

# Instrumentation Maintenance - A Major Problem

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One of the foremost problems facing the incinerator industry today is that of Instrument Maintenance. One does not have to look very far today to find incinerators no more than 2 or 3 years old where the instrumentation systems are functioning improperly, if at all. If incinerators are to continue to operate in accordance with more and more stringent air-pollution regulations, instrumentation systems of considerable complexion become a necessity. If an expensive instrumentation system is allowed to deteriorate owing to lack of maintenance then the purchase cost of the instrumentation has been wasted and the incinerator faces the possibility of being closed down by air pollution authorities.

Therefore, it seems obvious that municipal officials involved with the operation of incinerators must solve the problem of instrument maintenance. The purpose of this paper is to outline some possible solutions to this problem.

Each possible solution will be examined to determine the advantages, disadvantages, and insofar as possible, the relative cost.

For purposes of definition, this paper is devoted to that equipment normally used for measurement and control and does not include that equipment normally designated as electrical switchgear.

## CONTRACT MAINTENANCE

It is possible for a municipality to contract with an outside service organization for a complete

instrumentation maintenance program. Under this type of contract, the municipality, for one lump-sum payment per year, will receive from the contractor a complete maintenance program including all necessary labor, parts, charts, ink, and if desired, replacement thermocouples and thermocouple wire.

The effectiveness of such a contract maintenance program depends on several things. First, the instrumentation maintenance contractor must be selected for integrity, dependability, and technical capabilities. Second, the maintenance contractor must operate from a location close enough to the municipality to guarantee rapid and dependable emergency service. Third, the municipality must be certain that unauthorized tampering with the instruments by plant personnel is eliminated. The unauthorized tampering with instruments by itinerant knob twisters has upset more maintenance programs than any other single cause.

The cost of contract maintenance will vary somewhat depending on the age and condition of the instruments at the time the contract is issued, the distance of the plant from the contractor's nearest office, and local labor rates. Based on instruments which are relatively new and in good condition, the annual cost of contract maintenance will be approximately 10 percent of the original cost of the instruments. Thus, if the instrumentation system equipment was originally \$50,000, excluding installation, the annual cost of contract maintenance will be approximately \$5,000.

There are several advantages to contract maintenance. The first and most obvious advantage is the fact that the instrumentation system will be properly maintained. A second advantage to the municipality is the fact that exact maintenance costs will be known and can be budgeted accurately.

There are few if any disadvantages to contract maintenance providing that the maintenance contractor is selected carefully so that the municipality is assured of competent continuous maintenance and readily available emergency service.

#### **PREVENTATIVE MAINTENANCE CONTRACT PLUS IN-PLANT MAINTENANCE**

Many instrument companies offer maintenance on a periodic preventative maintenance basis. Under this type of agreement, the instrument company service personnel will visit the plant at periodic, pre-arranged times to perform such preventative maintenance functions as cleaning, oiling, and adjusting of the instrumentation system. Such visits are usually arranged on a monthly, bimonthly, or quarterly basis. Under such an agreement, the instrument company is not responsible for the total maintenance of the system and it is normally expected that plant personnel will take care of the day-to-day maintenance functions as well as maintain an inventory of parts, accessories, and so on.

The cost of such periodic preventative maintenance depends on a great many factors, including the distance from the nearest service office, the frequency of visits, and the capabilities of in-plant maintenance personnel. Based on an instrumentation investment of \$50,000, excluding installation, a periodic maintenance contract of this type will cost a minimum of \$2,500 annually. In addition to this cost, the municipality must anticipate other costs relating to instrument maintenance. These include the costs of operating and maintaining an instrument shop, including work benches and stock room; the costs of purchasing and maintaining shop equipment, including hand tools, test instruments, and calibration standards; the cost of training plant personnel to carry out maintenance procedures from day to day; and the cost of labor for carrying out day-to-day maintenance. In addition to these costs, the municipality must anticipate the possibility of emergency service performed by the instrument company when emergency instrument breakdowns are beyond the capabilities of plant personnel. Such emergency service calls are usually charged on an hourly or daily basis and will average \$19 to \$25 per hour including travel time plus expenses.

Since, under this type of maintenance plan, parts and accessories are not included, the municipality must maintain an inventory of parts, charts, and accessories, and the costs of maintaining such an inventory must be considered.

The advantage of this type of maintenance plan is the assurance of a proper preventative maintenance program. In addition, if selected plant personnel are assigned to assist the instrument company service engineer during his visits, this plan can become a form of on-the-job training program which will continually update the capabilities of the plant personnel.

The major disadvantage is the possibility that little or no maintenance will be performed between the periodic visits of the instrument company service engineer.

#### **MAINTENANCE BY PLANT PERSONNEL**

The municipality may elect to select and train one or more competent instrument maintenance men to maintain the instrumentation system, on a full-time basis. As an alternative, the municipality may elect to hire a competent experienced instrument maintenance man to perform the maintenance function. Such a plan is completely satisfactory providing: a) The plant has enough instrumentation to justify a full-time maintenance man; b) the maintenance man selected is a competent, well-trained and conscientious technician; and c) the salary plus fringe benefits are high enough to prevent losing the maintenance man to the surrounding industrial labor market.

The initial cost to be considered under this plan is the basic salary. If the municipality is to compete with surrounding industry, prevailing labor rates indicate that a qualified instrument maintenance man will cost the municipality approximately \$10,000 per year. In addition to the basic salary, the cost of such factors as paid holidays, sick leave, paid vacation, social security, workman's compensation, unemployment compensation, group insurance, and the like, must be considered. If the municipality operates more than one incinerator facility, the cost of transportation must also be considered. In addition, the cost of furnishing and maintaining an instrument shop, shop tools and calibrating standards, and parts inventory must be considered in the overall costs.

The primary advantage of a municipality maintaining an instrument repair department is the fact that the municipality has complete control over the maintenance functions and has an instrument maintenance man in the plant at all times. Disadvantages include costs and the necessity of competing with

surrounding industrial labor markets for skilled instrument technicians.

### TRAINING

Unless maintenance is performed on a contract basis, at least partial or complete maintenance must be performed by plant personnel. Therefore, the municipality must give consideration to the proper training of plant personnel to perform instrument maintenance functions.

Most instrument companies operate instrument maintenance schools. Plant personnel can be sent to these schools for periods varying from several days to several weeks for training in instrument maintenance techniques.

The cost to the municipality for such training is no longer generally limited to transportation, salary, and expenses for the trainee during this training period, the cost of the school itself must be borne by the municipality also.

Trainees should be selected with due regard to intelligence, mechanical aptitude, interest, and manual dexterity.

### SELECTING A MAINTENANCE PLAN

Although there are many factors which must be considered in the selection of a maintenance program, practicality dictates that costs becomes the dominant factor.

The following is an example of cost analysis of the three aforementioned plans. The example is fictitious and serves to illustrate some of the costs which must be considered. This example is based on a new incinerator installation with instrumentation valued at \$50,000, excluding installation.

#### CONTRACT MAINTENANCE

The cost of contract maintenance is estimated at 10 percent of the initial value of the instrumentation  
 $\$50,000 \times 0.10 = \$5,000$  annually

### CONTRACT PREVENTATIVE MAINTENANCE PLUS IN-PLANT MAINTENANCE

Preventative Maintenance	24 days at \$140	=	\$ 3,360
Plant Personnel	500 hours at \$3.50	=	\$ 1,750
Paid Vacation	20 hours at \$3.50	=	\$ 70
Social Security	5.85 percent of \$1,750	=	\$ 103
Parts, Charts, and so on	Estimated (15 yr avg)	=	\$ 1,650
Shop Space, Tools, and so on	Estimated	=	\$ 450
Total Annual Cost			<u>\$ 7,383</u>

### MAINTENANCE BY PLANT PERSONNEL

This estimate is based on the use of a full time, qualified, instrument technician:

Salary	2000 hours at \$5.25/hour	=	\$10,500
Paid Vacation	80 hours at \$5.25/hour	=	\$ 420
Social Security		=	\$ 640
Workman's Compensation	(Varies by State)	=	
Unemployment Compensation	(Varies by State)	=	
Parts, Charts, and so on	Estimated (15 yr avg)	=	\$ 1,650
Shop Space, Tools, and so on	Estimated	=	\$ 450
Total Annual Cost			<u>\$13,660</u>

The preceding example indicates that, for the example selected, contract maintenance is the least expensive method of properly maintaining the instruments in this particular incinerator. It should not be concluded from this example that in every instance contract maintenance will prove to be best. Since costs will vary from plant to plant it is recommended that a cost analysis be made to fit the particular incinerator in question.

### **CONCLUSIONS**

Because the amount of combustible waste is increasing from year to year, incinerators must be operated at optimum efficiency. More stringent laws

in regard to air pollution make it necessary that incinerators be operated to keep air-pollution loading to a minimum. Both of the foregoing requirements call for more sophisticated instrumentation systems. These instrumentation systems must be maintained if the incinerator is to operate properly.

There are a variety of maintenance plans available. Each plan should be examined carefully to determine which plan offers the best possible maintenance at the lowest possible cost. Municipal management must recognize the need and appropriate the funds for a proper instrumentation maintenance program. Instrumentation maintenance is a major problem in an incinerator operation. It must be solved.

**(This paper was presented by Mr. Stickley a number of years ago, and has been updated 1974 and modified by Carl Garcia, Maintenance Consultant of Honeywell, Inc., Cleveland, Ohio.)**