EXPERIENCE IN CONDUCTING AN INCINERATOR TECHNOLOGY COURSE

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ABSTRACT

Modern municipal and industrial incinerators require qualified, technically trained men for their efficient operation and maintenance. The Incinerator Committee of the American Society of Mechanical Engineers organized and sponsored a fifteen lecture course in 1966 and 1967 for incinerator operators and others. The paper outlines the course and discusses enrollment and other factors which contributed to its success. The paper is intended to guide those who wish to organize and conduct similar courses in other areas.

THE NEED FOR A COURSE

The importance of incineration as a method of solid waste disposal is growing due to the increasing volume of solid waste being generated throughout the country and to the need for a disposal method that is as efficient and economical as possible but which produces a minimum of residue, nuisance and health hazards. These demands, and those of the public and air pollution control agencies, require that refuse incinerators be highly mechanized units incorporating expensive equipment. These complex plants must then be operated and maintained in a manner that will protect the investment of the taxpayer and ensure that they do the job they were meant to do.

All concerned with municipal incinerators should recognize that competent, qualified management and operating personnel are required to operate these modern plants. It is equally important that management and operating personnel understand their responsibilities, the limitations and the capabilities of the incinerator for which they are responsible, and at least most of the technical principles of incinerator operation. In 1965, a group of interested people recognized the need for trained, qualified operators of municipal incinerators and considered the possibility of establishing a training course to provide for upgrading the competence of incinerator personnel.

PLANNING THE EDUCATIONAL EFFORT

Early in 1966, representatives of the Incinerator Committee (now Incinerator Division) of the American Society of Mechanical Engineers met with representatives of the Westchester County Department of Health, the New York State Department of Health, and the City of White Plains Board of Education to pursue the matter further. Out of these meetings evolved the Incinerator Technology Course. An Education Committee of four members conferred on major decisions.

The course was designed to meet the needs of managers and operators of municipal refuse incinerator plants, public officials, designers, installation personnel, and others who desired information on the fundamentals of the incineration of solid waste. The basic philosophy was
to teach the underlying principles and basics that are not acquired by experience alone and to provide an understanding of plant phenomena to guide in decision making. Engineers in the area who were invited to speak all responded enthusiastically.

Through the excellent cooperation of the White Plains Board of Education and its Director of Adult Education, Dr. Clarence G. Noyce, classroom space was made available in a school in White Plans that is devoted entirely to Adult Education. A low registration fee to cover expenses was charged. The school district provided a modest honorarium for the lecturers and course moderator.

Selection of the day of the week and the time of day on which to offer the course was made on the basis of an information notice and questionnaire mailed to members of the Incinerator Committee and plant operators in the New York Metropolitan Area. The course was scheduled for 15 consecutive Wednesdays from 2 to 4 P.M. during the months of September through December.

Announcement of the course was made through an attractive and colorful, one-page flyer containing the course schedule, the name of the lecturer for each course, topics of each lecture, a brief statement of the purpose of the course, and a map giving directions to the course location. These were mailed by the Incinerator Committee to the membership of the committee in the New York Metropolitan Area, by the Westchester County Department of Health to local municipal officials and public health personnel, and by the New York State Department of Health to state public health personnel. Announcements of the course were carried in the mass media and a number of technical journals. Advanced registration was requested but registrations were also accepted after the classes began.

**ENROLLMENT**

Since this was the first experience with such training, the Committee could only hope for a successful course. After what seemed to be a slow but encouraging start, enrollment reached 90 persons from 5 states. These people represented incinerator plants, public works departments, public health agencies, manufacturers, consulting engineers and other disciplines interested in incineration of refuse. Seventy-two of the registrants completed the attendance requirements while the average attendance was 21 for each lecture.

At the time of registration, students in both courses were requested to complete student background information forms on their type of employment, education, etc.

**TABLE 1
STUDENT BACKGROUND**

<table>
<thead>
<tr>
<th></th>
<th>1966 Course</th>
<th>1967 Course</th>
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<tbody>
<tr>
<td>Total Registered:</td>
<td>90</td>
<td>30</td>
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<tr>
<td>Average class attendance</td>
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<td>22</td>
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<td>28</td>
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<tr>
<td>Employment Position:</td>
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<td></td>
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<tr>
<td>Incinerator operating personnel</td>
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<td>7</td>
</tr>
<tr>
<td>Other Public Works personnel</td>
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<td>Public Health personnel</td>
<td>19</td>
<td>9</td>
</tr>
<tr>
<td>Manufacturers representatives</td>
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<td>1</td>
</tr>
<tr>
<td>Consulting engineers</td>
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<td>6</td>
</tr>
<tr>
<td>Other</td>
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<td>8</td>
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<tr>
<td>College-undergraduate</td>
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<td>13</td>
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<td>Graduate School</td>
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<td>7</td>
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<tr>
<td>10 plus years</td>
<td>3</td>
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</tr>
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</table>
perience and professional background. The information obtained was tabulated and evaluated to provide the committee with a knowledge of student backgrounds, to assist lecturers and to help evaluate the course. Complete student background information can be found in Table 1.

**COURSE OUTLINE, LECTURES AND CERTIFICATE**

The course presented in 1967 consisted of a series of fifteen lectures on the subject of Incinerator Terminology; Refuse, Residue and Air; Combustion and Heat; Pressure, Draft and Flow of Gases; Maintenance and Inspection; Air Pollution Control; Instrumentation; Refractories and Metals; Hydraulics; Mechanical and Electrical Systems; Disposal of Flyash and Residue; Stokers and Grate Operation; Incineration of Bulky Refuse; Public Relations and Personnel; and Modern Concepts Here and Abroad. A general outline of the course can be found in the Appendix.

Lectures on the subject of Uses of Recovered Heat, Public Relations, and Record Keeping and Safety, presented during the first course were combined with other lectures in the second course and new topics substituted for them.

Lecturers were drawn from the Incinerator Committee, local regulatory agencies, and private industry and were selected on the basis of their specific knowledge and experience in the area of their assigned lectures.

Lecture outlines, prepared lecture material and other handouts were presented to the students to provide a permanent reference, together with their own class notes.

At the conclusion of each course, those who satisfactorily completed the attendance requirements received a certificate attesting to this accomplishment. In addition, specially prepared letters were mailed to their employers to recognize the students’ interest in the training and the employers’ interest in his attendance. A sample certificate is shown in Fig. 1.

**GENERAL COMMENT**

The course has received enthusiastic reception by the students and has gained the attention and the interest of the American Public Works Association, the United States Public Health Service, the Pennsylvania State Department of Health, the New York State Department of Health, officials from several major Canadian cities and many municipalities throughout the United States. Requests for information and for literature concerning the course, its operation and the lectures presented were received. Whenever possible the committee cooperated by furnishing this information.

We have briefly discussed our experience with the presentation of a course in Incinerator Technology. It is our hope that this first effort will serve as a guide for other groups in other geographical areas who might undertake such a venture.

**RECOMMENDATIONS FOR FUTURE COURSES**

We offer these recommendations to assist others in the planning of future courses.

1) Start planning early so that all aspects of the course can be properly thought out and be firmly established.

2) Contact your local or state health department, professional societies and colleges and solicit their assistance in planning, establishing, publicizing and presenting the course.

3) Contact the above agencies and your local Adult Education program staff for their assistance in providing classroom space and visual aid equipment.

4) Prepare an interesting and informative course format – if you wish, use the one discussed in this paper or a revision of it.

5) Select qualified, experienced and interesting lecturers for the presentation of the course. Use professional societies, governmental agencies and local colleges as source of lecturers.

6) Prepare an attractive and informative flyer describing the course and its format.
7) Charge a nominal registration fee to cover expenses. This may be required by the educational institution at which the course is presented.

8) Publicize the course sufficiently in advance to allow prospective students opportunity for adjusting schedules, obtaining approvals to attend, if needed, and to allow for the broadest spread of publicity possible. Use all means available. Do not limit publicity to a one-time effort.

9) During the course keep your students and lecturers informed of changes in schedule and of interesting and applicable sidelights.

10) Promote an exchange of ideas and experiences among students.

11) Use visual aids as much as possible.

12) Provide students with lecture notes and handout and encourage the compilation of a notebook for future reference.

13) Be prepared to spend considerable time toward making the course a success.

THE NEED FOR TRAINING

Most training in the past has been by a manufacturers' representative for his equipment in accordance with the requirements of a designing engineer's specifications. There is nothing wrong with this, but it only provides training in specific areas. An adequate training course integrating the fundamentals of incineration and incinerators, information on the whys and hows of operation and maintenance, and an understanding of what happens “inside” the plant units, is essential.

In the near future state governments may require certification of incinerator operators just as most states presently require certification of water and sewage treatment plant operators. Completion of a prescribed training course is generally required before certification. The course discussed here could serve this purpose.

Throughout the United States there are many incinera­tors that are being “run” by untrained or inadequately trained personnel. The emphasis is on “run”. Running a plant and operating a plant are not the same. To properly operate a plant personnel need training and experience. Experience can come after or during training but the importance of training must be stressed.

There is a need and demand for training of people responsible for incinerator design, operation and maintenance. Our experience indicates that sufficient interest exists to support training courses in Incinerator Technology. The number of people who completed our courses testifies to their success.

ACKNOWLEDGMENTS

Recognition is made here of the interest and foresight of James Gildersleeve, Superintendent of Incineration and Landfill for the Town of Oyster Bay, New York, and Elmer R. Kaiser, Senior Research Scientist at New York University who started this effort and kept it alive.

The author wishes to express appreciation to Dr. Clarence G. Noyce for his cooperation and guidance in procuring classroom space, to Frederick W. Trautwein for publicity and advice, to the co-sponsoring agencies for their support and to the Incinerator Committee for their support and the free rein they permitted the course committee in presenting the courses.


Classroom space was provided by the White Plains Board of Education.

APPENDIX

General Outline of Lectures

Lecture 1—Orientation and Terminology
  I. Course Purpose
  II. Course Content
  III. Film “The Third Pollution”
  IV. Definitions and Terminology

Lecture 2—Refuse, Residue and Air
  I. Refuse—its composition and characteristics
  II. Residue—its composition and characteristics
  III. Air—its characteristics and importance

Lecture 3—Combustion and Heat
  I. Basic Combustion Chemistry
  II. Combustion Air Requirements
  III. Heat Release
  IV. Heat Transfer
  V. Material and Heat Balances
  VI. Design Practices

Lecture 4—Pressure, Draft and Flow of Gases
  I. Draft
  II. Theoretical chimney draft
  III. Draft loss
  IV. Flow of gases
Lecture 5—Maintenance and Inspection
   I. Responsibilities of the Consulting Engineer
   II. Responsibilities of Management

Lecture 6—Air Pollution
   I. Air Pollution defined
   II. History and importance
   III. Pollutants from incinerators
   IV. Pollutant emission factors
   V. Air Pollution Control
   VI. Air Pollution Control Equipment

Lecture 7—Instrumentation
   I. Fundamentals of instrumentation
   II. Measurement of operating parameters
   III. Instrumentation for measurement
   IV. Final Control Elements

Lecture 8—Refractories and Metals
   I. Refractories
      A. Properties
      B. Classification
      C. Installation
      D. Maintenance
   II. Metals
      A. Effect of temperature and oxidation
      B. Effect of heat on strength of steel and cast iron
      C. Combined stresses and uneven heating
      D. Other effects

Lecture 9—Hydraulics
   I. Fundamentals
   II. Pumping equipment
   III. Fluid handling systems and proper fluid selections
   IV. Preventive maintenance
   V. Water Treatment

Lecture 10—Mechanical and Electrical Systems
   I. AC and DC circuits
   II. Motors and Motor Controllers
   III. Requirements for Heavy Duty Service
   IV. Standby Facilities
   V. Sound Systems
   VI. Maintenance

Lecture 11—Disposal of Fly Ash and Residue
   I. Definitions
   II. In Plant Handling
   III. Disposal
   IV. Incinerator Waste Water

Lecture 12—Stokers and Grate Operation
   I. Stokers
      A. Types
      B. Principle of operation
      C. Maintenance
   II. Grates
      A. Types
      B. Maintenance
   III. Fuel Bed Behavior

Lecture 13—Incineration of Bulky Refuse
   I. Bulky Refuse
   II. Air Requirements
   III. Types of Furnaces
   IV. Prior Developments
   V. NYU Test Furnace
   VI. Future developments

Lecture 14—Public Relations and Personnel
   I. Public Relations
   II. Personnel
   III. Budget
   IV. Safety

Lecture 15—Modern Concepts—Here and Abroad
   I. European incinerators
   II. Steam and power generation
   III. Air volume control for stoker zones
   IV. Slag-tap incinerators
   V. Incinerator test code
   VI. Metal salvage
   VII. Refuse/residue hills
   VIII. Rail haulage of refuse and residue
   IX. Composting
   X. Pyrolysis of refuse
   XI. Complete gasification of refuse
   XII. Utilization of residue
   XIII. Keeping up to date