Air Pollution Control Training in Colleges and Universities in the United States

S-11 Education and Training Committee Survey Report No. 2

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A nationwide survey of air pollution control training efforts in the United States at colleges and universities was carried out for the S-11 Education and Training Committee, Air Pollution Control Association. Information from 91 schools having four year or graduate programs and five community colleges was received. Questions include type of course work, backgrounds of participating faculty and students, and eventual placement. At the present time about 70% of those in training are graduate students. It was found that most students taking initial employment in air pollution control activities had the M.S. degree. Recommendations for updating this information are made.

This paper was prepared to provide an overview of current air pollution training in the United States for the S-11 Education and Training Committee, APCA. An earlier report by Sholtes[1] reviewed the wide range of training going on in 1966. The number of programs has significantly increased; therefore, the present study has been focused on training efforts at colleges and universities leading to academic degrees.

Statements indicating a need for manpower trained in air pollution control are frequently cited. To meet this challenge, many schools now offer training in air pollution control. Federal programs partially support some of these efforts. The objective of this study was to determine the extent of the training now going on in the United States. Of particular concern was the (a) type of program, (b) background experience of students in the program, and (c) eventual placement of the students.

Questionnaires were sent to all schools listed in the Journal of Engineering Education Directory or with faculty members in APCA or listed in data obtained from the Air Pollution Control Office-EPA. Response from 96 schools that had programs identified with air pollution control training was received.

Academic Programs

Complete lists of all schools with instructional effort in air pollution control are given in Appendix I and II, respectively. To determine the scope and particular direction of each program requires a detailed study of each specific curriculum. For the purposes of this study, certain key factors were used instead to characterize the work offered. Most programs were centered in departments of Civil, Chemical, Environmental, or Mechanical Engineering. Sixty-three percent of 466 faculty involved in air pollution training in 72 schools responding are identified with these four departments. The remaining participating faculty are distributed as follows: Biological Sciences—11%, Meteorology-8.7%, Chemistry—6.6%, Public Health—5.7%, Public Administration—1.8%, and others- 3.2%.

The courses taken by students in these programs covered a wide range of subject matter. The types of courses offered were reported by 67 schools and are shown in Table I.

In 63 out of 72 programs, non-degree candidates may enroll in air pollution courses. The five community colleges

Reprinted from APCA JOURNAL, *Vol. 21, No. 9, September, 1971*

Table I. Courses offered in training programs in 67 schools.

Course	Number of schools
Introduction to Air Pollution	56
Sampling and Analysis	44
Meteorology	46
Control Technology	40
Legal Aspects	24
Community Planning	21
Administrative Procedures	12
Public Information—Community Relations	11
Statistics	44
Other	23

who completed questionnaires are not included in the above statistics.

Financial assistance was reportedly available at 33 schools from several sources. This information is summarized in Table II.

Students

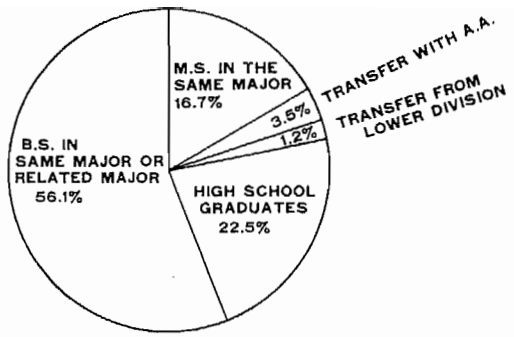
The academic background of students entering the air pollution programs varied. An overall distribution of background is presented in Figure 1. Of these students, many had some experience relevant to air pollution control. Up to 25% of the students had experience with NAPCA, (now APCO-EPA), up to 40% with control agencies, and up to 50% with industry, depending on the school. Apparently over 70% of those in the programs that furnished data are graduate students.

Table II. Number of students with various types of financial assistance.

Source of assistance	Number of students and degree		
	BS	MS	PhD
Part-time A.P.C. agency	1	5	1
Summer A.P.C. agency	11	7	3
Summer work with industry in A.P.C. areas	18	9	4
Fellowships (Industry)	6	10	13
Assistantships	4	50	27
Fellowships (Foundation)	1	9	9
PHS Traineeships		113	21
Total	41	203	78

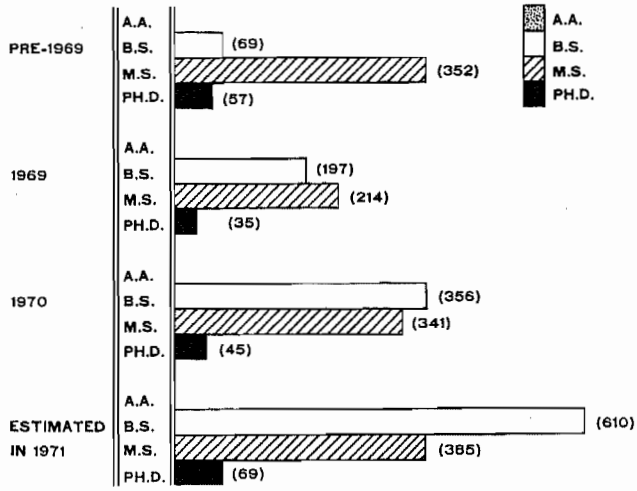
Table III. Geographical distribution of air pollution control jobs accepted.

Location	Degree Obtained		
	BS	MS	PhD
On West Coast	26	28	5
On East Coast	2	84	17
In Central States	1	98	11



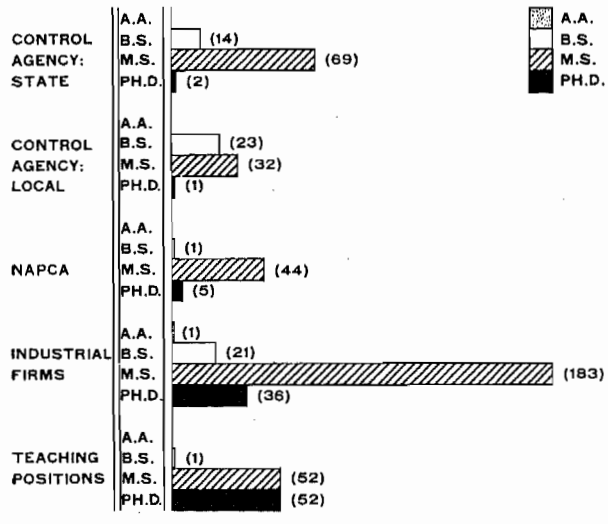
57 SCHOOLS REPORTING

Figure 1. Distribution of academic background of students entering air pollution programs.



57 SCHOOLS REPORTING

Figure 2. Number of students graduated with training in air pollution control.



41 SCHOOLS REPORTING

Figure 3. Number of students completing an air pollution program and placed in related work.

Graduates

Although a total of 2456 students were reported taking course work in air pollution control, the number getting in-depth training and later working as professionals or semi-professionals is much less. The number of students graduating in recent years is an indicator of the latter. Figure 2 shows how the number of graduates at all levels has grown since 1969 at 57 schools.

Figure 2 does not include 308 graduates classified as receiving a degree other than the B.S., M.S., or Ph.D.

Of considerable interest is where the various graduates are now working. Figure 3 correlates the total number of graduates taking initial employment in the air pollution field at 41 schools. Figure 3 does not include 113 who were placed but did not have the degrees mentioned above.

Information on the geographical location of air pollution control jobs was limited. The data from 28 schools reporting are included in Table III.

Conclusions

1. This study reveals that more than 96 schools in the United States are currently involved in air pollution control training. Faculty involvement was estimated at 466 by 73 schools reporting.
2. It was estimated that 610 BS, 385 MS, and 69 PhD students would graduate in 1971 with some training in air pollution control from 57 schools. The interpretation of training was taken broadly.
3. At this time, there are more students with Masters Degrees taking initial employment in the air pollution control field.
4. The level of support is small and needs to be encouraged at all levels from many sources.

The data on which the above conclusions were based are not complete. All schools with programs were not able to complete the questionnaire. Often the information desired was not available. Based on the experience gained in this report, the Education and Training Committee, S-11, is encouraged to update these estimates on a regular basis. In addition, community college and specialized training programs should be followed. The author invites comments on this report.

Studies have been made to estimate manpower needs in the governmental and private sectors.[2] One conclusion from these estimates as well as observation is that there is a growing need for manpower committed to working toward the solution of air pollution problems. This has been the basis for a significant commitment of faculty, students, and resources. Determining what the manpower needs actually are is another area where some effort must be placed.

References

1. Sholtes, R. S., "Report of Education and Training Committee, S-11," *J. Air Poll. Control Assoc.* **16** (11), 610 (1966).
2. "Manpower and Training Needs for Air Pollution Control," Report to the President and Congress by the Secretary of Health, Education, and Welfare, June 1970.

Appendix I. Air pollution control training at colleges and universities in the United States.

State	College or University	Program Concerned In	# Courses	Degrees
Alabama	Samford U.	None	5	None
	U. of Alabama	ChE	4	BS, MS
Arizona	U. of Arizona	CE	5	BS, MS, PhD
Arkansas	U. of Arkansas		2	MS
California	Calif. Inst. of Tech.	EnvE, ChE	18	Post-Doc, PhD
	Cal. State—Long Beach		1	
	Cal. St. Poly-San Luis Obispo	EnvE	6	BS, MEngr.
	Sacramento State	CE, ME		BS, MS
	San Jose State	Grad	8	MS
	Stanford U.	ME		BS, MS, PhD
	U. of Calif.—Berkeley	ME	2	MS, PhD
	U. of Calif.—Davis	CE	5	MS, PhD
	U. of Calif—Irvine	EnvE	5	
	U. of Calif.—Los Angeles	Engr	10	MS, PhD
	U. of Calif.—Riverside[1]			
	U. of Southern Calif.	APC Inst	8	M.P.A.
Colorado	Adams State College[2]			
	Colorado State U.		1	
	U. of Colorado	Chem		
	U. of Denver	Engr		
Connecticut	Yale U.	PH	8	M.P.H.
Delaware	U. of Delaware			
Florida	U. of Florida	Engr	10	MS, PhD
Georgia	Columbus College			BS
	Georgia Inst. of Tech.	ChE	6	
	U. of Georgia	AgE	1	
Hawaii	U. of Hawaii	PH	6	MS, PhD
Illinois	Bradley U.		1	
	Northwestern U.	Engr	3	MS, PhD
	Southern Illinois U.	Engr		BS, MS
	U. of Illinois—Chicago Circle	Energy E	18	BS
	U. of Illinois—Urbana	Engr		BS, MS
Indiana	Purdue U.	CE	10	MS, PhD
	Rose Polytechnic Inst.	Bio, CE ChE	2	BS
	U. of Notre Dame	CE	9	BS, MS, PhD
Iowa	Iowa State U.	CE	2	BS, MS
	U. of Iowa	EnvE	1	
Kansas	Kansas State U.	ME, ChE	3	MS, PhD
	U. of Kansas	Env H	1	MS, PhD
Kentucky	U. of Kentucky	Engr, ChE	7	BS, MS, PhD
	Western Kentucky U.	E Tech	3	BS
Louisiana	Lousiana State U.	Chem		
	Louisiana Tech. U.	CE	1	
	LSU—Baton Rouge	EnvE	4	
	Tulane U.			

Appendix I. (*cont.*)

Maine	U. of Maine	Engr	1	MS
Maryland	Johns Hopkins U.	EnvE	5	MS, PhD
	U. of Maryland	CE, ChE, Met	7	BS, MS, PhD
Massachusetts	Harvard U.	PH	10	BS, MS, PhD
	Mass. Inst. of Tech.	Engr		MS, PhD
	Northeastern U.	CE	6	BS, MS
	U. of Massachusetts	ME, CE, ChE PH	4	
Michigan	Ferris State College	EnvH	7	BS
	U. of Detroit	Engr	6	
	U. of Michigan	Engr, PH	5	MS, PhD
Minnesota	Bemidji College			
	U. of Minnesota	PH	4	MS, PhD
Mississippi	Mississippi State U.	CE	1	
Missouri	St. Louis U.[3]			
	U. of Missouri—Rolla	CE	2	BS, MS, PhD
	Washington U.	Engr Sci	7	MS, PhD
New Hampshire	U. of New Hampshire	ChE	2	BS, MS, PhD
New Jersey	Newark College of Engr.	CE, EnvE	3	MS
	Rutgers CAES	Bio		
New Mexico	N. M. Inst. Mining & Tech.	EnvE		
New York	Cooper Union	Grad	5	MS, PhD
	Cornell U.	Engr	3	
	New York U.	Engr, Sci	5	
	Rensselaer Poly. Inst.—Troy	EnvE	5	MS, PhD
	SUNY—Potsdam	CE, ChE	4	BS, MS
	Union College	ME	4	BS
North Carolina	North Carolina State U.	ChE	4	BS, MS
	U. of N. C.—Chapel Hill	PH, EnvE	10	MS, PhD
Ohio	Bowling Green State U.[4]	IT		
	U. of Cincinnati	Engr	9	MS, PhD
Oklahoma	Oklahoma State U.	CE	1	
	Tulsa U.	ME, ChE	1	
	U. of Oklahoma	CE, EnvH	7	MS, PhD
Oregon	Oregon State U.	ME	9	BS, MS, PhD
	Oregon Tech. Inst.	EnvH	4	AA, BS
	Portland State U.	Engr, Sci	6	BS, MS
Pennsylvania	Carnegie Mellon U.			
	Drexel U.	EnvE-Sci	8	MS, PhD
	U. of Pittsburgh	PH	7	MS, PhD
	Pennsylvania State U.	Air Env	10	AA, BS, MS, PhD
Utah	U. of Utah	Bio	6	MS, PhD
Virginia	U. of Virginia	Engr, Sci		MS
	Virginia Poly. Inst. & St. U	CE		BS, MS, PhD
Washington	U. of Washington—Seattle	CE		
	Washington State U.	CE, Env Sci	9	
West Virginia	West Virginia U.	CE	5	MS, PhD
Wisconsin	Marquette U.	CE, Med	2	
	U. of Wisconsin—Madison	Met, ME ChE, CE	1	
Wyoming	U. of Wyoming	EnvH	3	

[1] The Statewide Air Pollution Center provides instructors for several air pollution related courses in other departments and frequently has graduate students conduct their research at the center.
[2] Currently in final stages of having Environmental Science curriculum approved.
[3] Currently working on programs that involve air pollution meteorology.
[4] In planning stage.

Abbreviations Used in Appendix I and II

Air Env	Air Environ. Studies Center
AgE	Agriculture Engineering
APC Inst	Air Pollution Control Institute
Bio	Biology
CE	Civil Engineering
ChE	Chemical Engineering
Chem	Chemistry
Engr	Engineering
EnvE	Environmental Engineering
EnvH	Environmental Health
EnvR	Environ. Resource Engr.
EnvSci	Environmental Science
E. Tech	Engineering Technology
Grad	Graduate School
IT	Industrial Technology
ME	Mechanical Engineering
MEngr	Master of Engineering
Med	Medicine
M.P.A.	Master of Public Admin.
M.P.H.	Master of Public Health
Met	Meteorology
NatSci	Natural Science
PH	Public Health

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Appendix II. Air pollution control training at community colleges in the United States.

State	College or University	Program Concerned In	# Courses	Degree
California	El Camino College	Nat Sci	2	AA
Florida	Santa Fe Junior College	Engr	5	AA
Maryland	Charles County Com. College		4	AA
Michigan	Genesee Community Col.—Flint	EnvCont Tech. AP	3	AA
New York	Broome Tech. Com. Col.	EnvH	1	AA
	Corning Com. College	Bio, Chem		