DOCUMENT RESUME

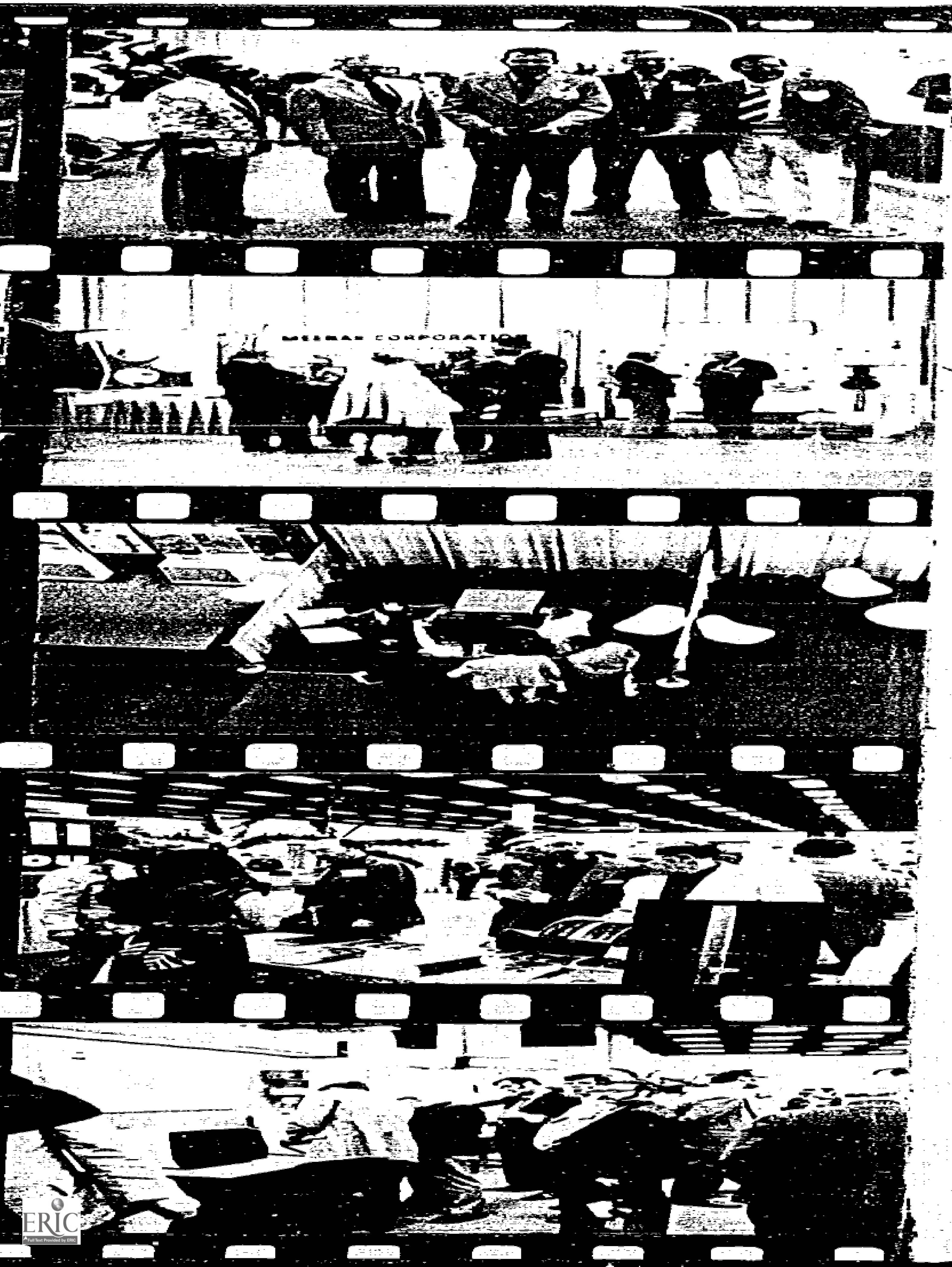
ED 073 560 EA 004 950

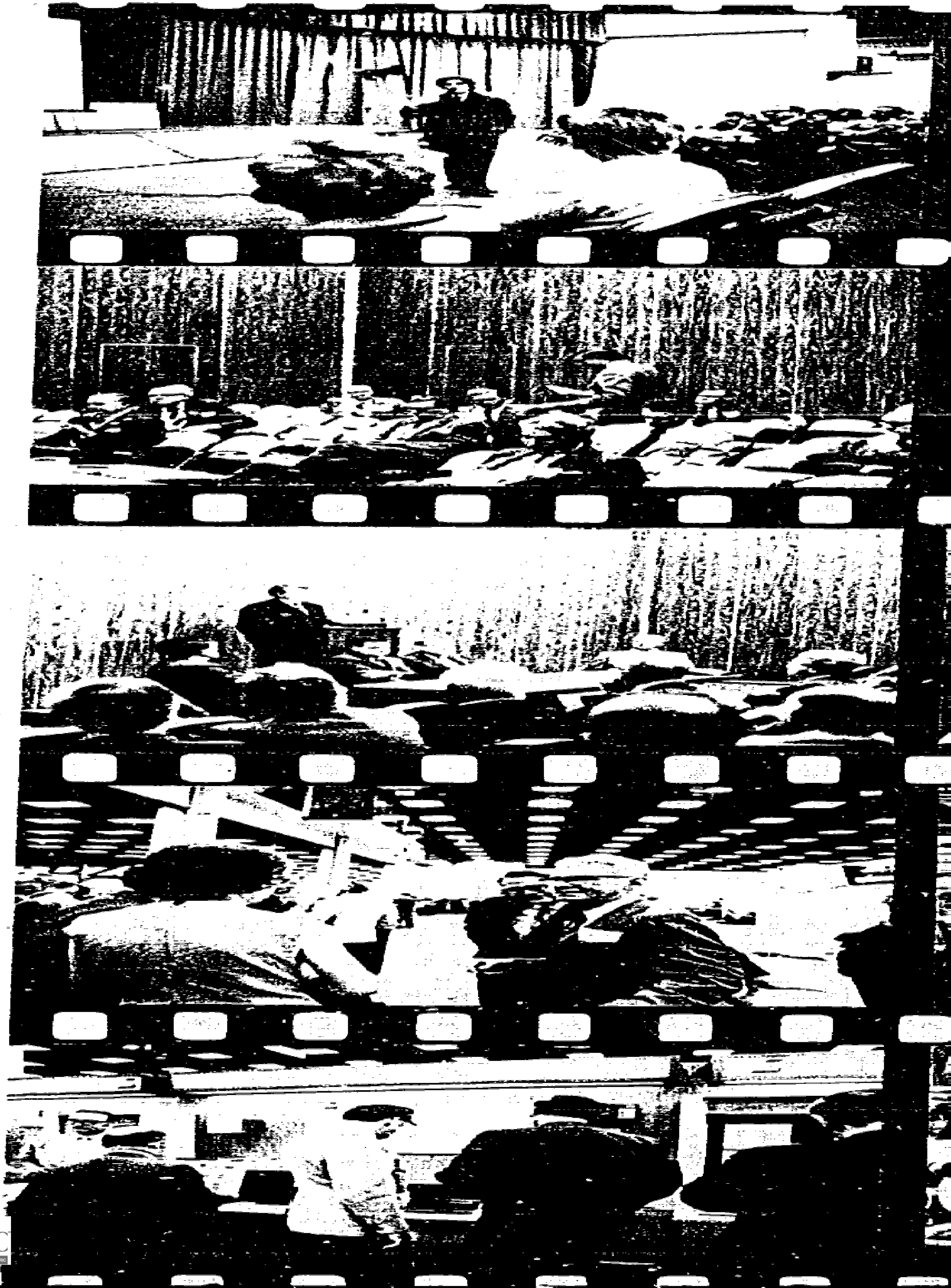
TITLE	Minutes 1972. Association of Physical Plant Administrators Annual Meeting. (59th, Cincinnati, Ohio, April 30-May 3, 1972).
INSTITUTION	Association of Physical Plant Administrators of Universities and Colleges, Washington, D.C.
PUB DATE	72
NOTE	292p.
AVAILABLE FROM	Association of Physical Plant Administrators of Universities and Colleges, Suite 510, One Dupont Circle, Washington, D.C. 20036 ($5.00)
EDRS PRICE	MF-$0.65 HC Not Available from EDRS.
DESCRIPTORS	*Administrative Personnel; *Annual Reports; *Building Operation; Campus Planning; Construction Management; Controlled Environment; Disadvantaged Groups; *Higher Education; Meetings; Planning (Facilities); Professional Associations; *School Maintenance; Speeches; Supervision; Turf Management; Work Environment

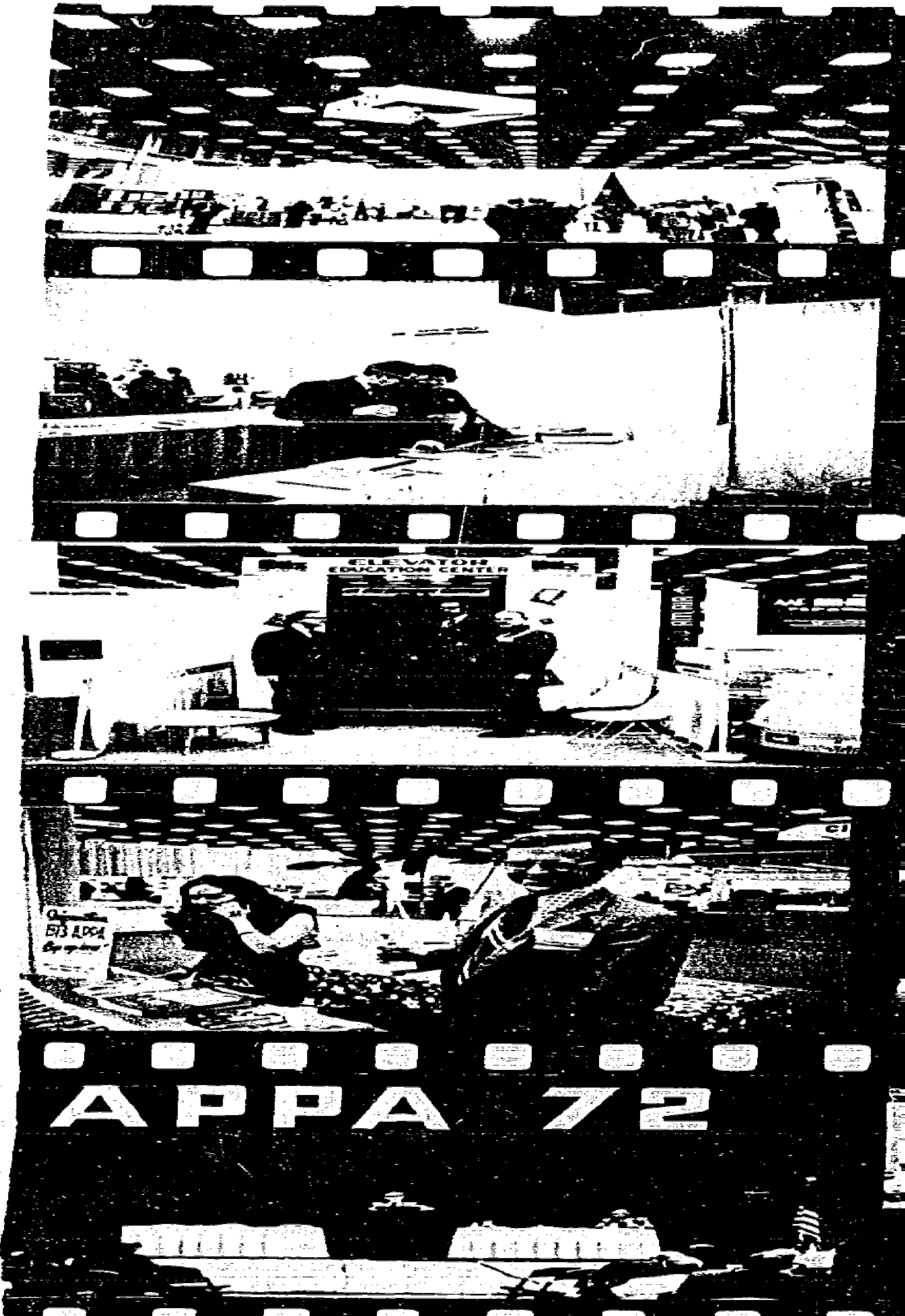
ABSTRACT

This presentation is comprised of 17 session papers and the transcripts of two group discussions all dealing with various aspects of campus physical plant maintenance. Among the subjects covered are: the post-traditional campus, central environmental control, contract management service, operational and maintenance planning, air handling systems, problems of and solutions to campus security, supervising the disadvantaged worker, and grounds care. (MLF)


SOC. OF PHYSICAL PLANT
ADMINISTRATORS
UNIVERSITIES & COLLEGES
APRIL 30- MAY 3, 1972
ST UNIV. OF CINCINNATI






ELEVATOR
EDUCATION CENTER
APPA 72


KOOLSHADE
HAWAII
Seward Sales


STADIUMS
UNLIMITED
APPA 72

ED 073560

EA 004 950

MINUTES 1972

FIFTY-NINTH ANNUAL MEETING
April 30 - May 3, 1972

Association of
Physical Plant Administrators
of
Universities and Colleges

HOST: University of Cincinnati

Cincinnati Convention and
Exposition Center
Cincinnati, Ohio

THE
ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES

APPA is an Association, international in scope, founded in 1914, whose purpose is to develop professional standards in the administration, care, operation, planning and development of physical plants used by colleges and universities.

TABLE OF CONTENTS

PROGRAM

59th ANNUAL MEETING

APPA '72

APPA-72 PROGRAM

April 30 — May 3, 1972

SUNDAY, APRIL 30

1:00 P.M. - 4:30 P.M. — Registration

5:00 P.M. — Exhibits open at Convention Center
Late Registration — Convention Center

6:00 P.M. — President's Reception
Exhibit Area — Convention Center
Sponsored by APPA Mid-West Region
(Ribbon - Cutting Ceremony)

7:00 P.M. — Buffet Dinner — Convention Center
Program: A short Presentation
"History of Cincinnati"
by Mr. Dan Ransohoff, Author and Historian
First Floor Assembly Hall

MONDAY, MAY 1

8:00 A.M. — Late Registration — Convention Center

9:00 A.M. — 4:30 P.M. Exhibits Open

9:00 A.M. (Promptly) — Morning Session -- First Floor Assembly Hall
Call to Order
Invocation
Presentation of Colors
Pledge of Allegiance
Announcements and Introductions

9:15 A.M. — Welcome Address
Mrs. Jane DeSerisy Earley
Chairman of the Board of Directors
University of Cincinnati

9:30 A.M. — Coffee Break, Door Prizes, Exhibits
Exhibit Area

10:30 A.M. — *SESSION No. 1*
Keynote Speaker — "Thrusters or Sleepers"
Dr. Roger E. Hawkins
Dept. Head/Business — East Michigan University
MONITOR: George C. Moore, University of Cincinnati

11:45 A.M. — Lunch in Exhibit Area

1:00 P.M. — *SESSIONS No. 2, 3, 4, and 5*
No. 2 —
"The Post-Traditional Campus"
"Old Faces, New Spaces" — Room 205
Mr. Philip C. Williams, Architect CRS
MONITOR: ~~Jeff Combe, Purdue Univ.~~ George C. Moore
No. 3 —
"Particulate and SO^2 Control Technology"
Room 203
Mr. Alvan V. Barron, Jr.
V. Pres. Zurn Industries, Inc.
Air Systems Division
MONITOR: Raymond D. Orlando, Youngstown State University

No. 4 —
"Central Environmental Control System"
Room 201
Mr. James J. Wenner, Utilities Coordinator
University of Cincinnati, APPA Member Emeritus
MONITOR: Harry T. Loveridge, Franklin College

No. 5 —
"Administrative Implementing"
First Floor Assembly Hall
Mr. William L. Holloway
Executive General Company
Cincinnati Management Consultant
MONITOR: Russell N. Giersch, University of Akron

2:15 P.M. — Coffee Break, Door Prizes, Exhibits
Exhibit Area

3:00 P.M. — *SESSIONS No. 6, 7, 8, and 9*
No. 6 —
"Things You Should Know About Contract Management Service"
Room 203
Mr. Edward M. Dorland
Dept. of H.E.W.
MONITOR: Stephen Springer, Lorain County Community College
No. 7 —
"Consulting Engineering Fees — and Things You Ought To Know, but Never Thought About"
Room 201
Mr. Otto L. Hilmer, P.E.
Cincinnati, Ohio
MONITOR: Thomas B. Smith, Ohio State University

No. 8 —
"Hardware and Its Relationship to Security"
Room 205 (Panel Discussion)
Mr. Robert J. Chabot, Hardware Consultant
(Discussion Leader)
Cincinnati, Ohio
MONITOR: Edwin V. Lyon, University of Notre Dame
No. 9 —
"Planning and Its Effect on Operation and Maintenance"
First Floor Assembly Hall
Mr. Clarence P. Lefler, APPA Member
Ohio University, Athens, Ohio
MONITOR: F. Eugene Beatty, Bowling Green University

4:15 P.M. — ADJOURN — Evening on your own

TUESDAY, MAY 2

9:00 A.M. - 1:00 P.M. — Exhibits Open

9:00 A.M. — Introduction to Annual Business Meeting

10:00 A.M. — Coffee Break, Door Prizes, Exhibits — Exhibit Area

10:30 A.M. — Annual Business Meeting
First Floor Assembly Hall

12:00 Noon — Lunch in the Exhibit Area

1:00 P.M. — Board Buses for tour of U.C. and SESSION No. 10

2:00 P.M. — *SESSION No. 10*
"Zimmer Lecture Theatre"
A discussion and demonstration of

Audio-visual Instructional Technology and an explanation of the Building
Mr. Russell C. Myers, Architect &
Mr. Roger Fransecky, Director U.C. Educational Media Center
MONITOR: Walter A. Hartman, Ohio State University

6:30 P.M. — SOCIAL HOUR — Sheraton Gibson Ballroom

7:30 P.M. — ANNUAL BANQUET — Sheraton Gibson Roof Garden

WEDNESDAY, MAY 3

9:00 A.M. - 2:00 P.M. — Exhibits Open

9:00 A.M. — *SESSIONS No. 11, 12, and Experience Exchange*
Experience Exchange Room 205
MONITOR: ~~TO BE SELECTED~~
No. 11 —
"Supervision and the Disadvantaged Worker"
Room 201 Bill Carruthers
Mr. ~~Walter W. Belman~~
Personnel Officer, University of Cincinnati
MONITOR: Harold R. Glaze, Cleveland State University

Cross: Utah
Stanton: Swarthmore

No. 12 —
"Physical Plants and Economic Transplants"
First Floor Assembly Hall
Dr. Meno Lovenstein
Ohio University, Athens, Ohio
MONITOR: Gerhardt J. Carlsen, Augustana College

10:00 A.M. — Coffee Break, Door Prizes, Exhibits
Exhibit Area

10:30 A.M. — *SESSIONS No. 13, 14, and Experience Exchange*
Experience Exchange — Room 201
MONITOR: ~~TO BE SELECTED~~
No. 13 —
Repeat of Session No. 5
First Floor Assembly Hall
Mr. William Holloway
MONITOR: Russell N. Giersch, University of Akron

Cross: Utah
Stanton: Swarthmore

No. 14 —
"Balancing Air Handling Systems"
Room 205
Mr. H. Taylor Kahoe, Consultant
MONITOR: Howard D. Walters, Ohio State University

12:00 Noon — Lunch in Exhibit Area

1:00 P.M. — *SESSIONS No. 15, 16, 17, and 18*
No. 15 —
"Problems and Solutions to Campus Security"
Room 205
Mr. Paul Steuer, Security Division
University of Cincinnati
MONITOR: Thomas Brennan, University of Dayton
No. 16 —
"Trends in Water Treatment for Steam Generation and Cooling Systems"
Room 201
Mr. J. F. Wilkes, Dearborn Chemical Division
Chemed Corporation, Lake Zurich, Ill.

MONITOR: Charles L. Codding, Bowling Green University
No. 17 —
"Grounds Care — Costs and Budgeting"
First Floor Assembly Hall
Mr. Cushing Phillips, Jr., APPA Member
Chief of Operations, Cornell Univ., N.Y.
MONITOR: Oneal Archer, Miami University
No. 18 —
"Corrosion on the Campus" —
Room 203
Mr. Lewis H. West, P.E.
President, The Hinchman Company
Corrosion Engineers, Detroit, Michigan
MONITOR: Cornelius C. Ackerman, University of Toledo

2:00 P.M. — ADJOURN

VISIT THE EXHIBITS

THE CINCINNATI TEAM . . . APPA '72

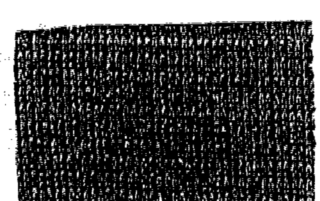
Front Row (L. to R.)
George Moore — *General Chairman*
Hank Rawlings — *Registration*
Virginia Woodburn — *Co-ordinator*

Back Row (L. to R.)
Dick Neidhard — *Exhibits*
Ray Smith — *Entertainment*
Jim Haberle — *Transportation*
Tom Dierkers — *Promotion & Publicity*
Paul Schmarr — *Finance*

A Final Message from the General Chairman--

Gentlemen: For the last time I want to say, hosting the annual national meeting in Cincinnati was a lot of fun and a lot of hard work. You can be sure the "Cincinnati Team" did much planning to assemble the program and exposition. The best count we have is 455 members, guests, and wives attended. 113 companies exhibited, the largest number ever at an APPA meeting. I think we can safely say, a good time was had by all! Oh yes, the lil' red "swatch" of material ...for those of you that missed the 59th meeting, the "Cincinnati Team" wore RED COATS and I mean red-- so we could be found easily and we could find each other --and it worked! The red patch may bring back fond memories. My last RED COAT reminder -- have a good year!

Very truly yours,
The Cincinnati Team



APPA BOARD OF DIRECTORS 1971-2

OFFICERS

PRESIDENT
Clyde B. Hill
U. South Florida

PRESIDENT-ELECT
T. B. Simon
Michigan State U.

PAST PRESIDENT
George O. Weber
U. of Maryland

FIRST VICE PRESIDENT
George C. Moore
U. of Cincinnati

SECOND VICE PRESIDENT
Philip W. Koehler
U. of Hawaii

V.P. FOR PROFESSIONAL AFFAIRS
L. Terry Suber
Colorado State U.

SECRETARY
John H. Sweitzer
Earlham College

ADMINISTRATIVE DIRECTOR
Gerald P. Hawk
Eastern New Mexico U.

EDITOR OF THE NEWSLETTER
Richard A. Adams
Oregon State U.

REGIONAL REPRESENTATIVES

EASTERN
P. Welanetz
Williams College
W. Stanton
Swarthmore College

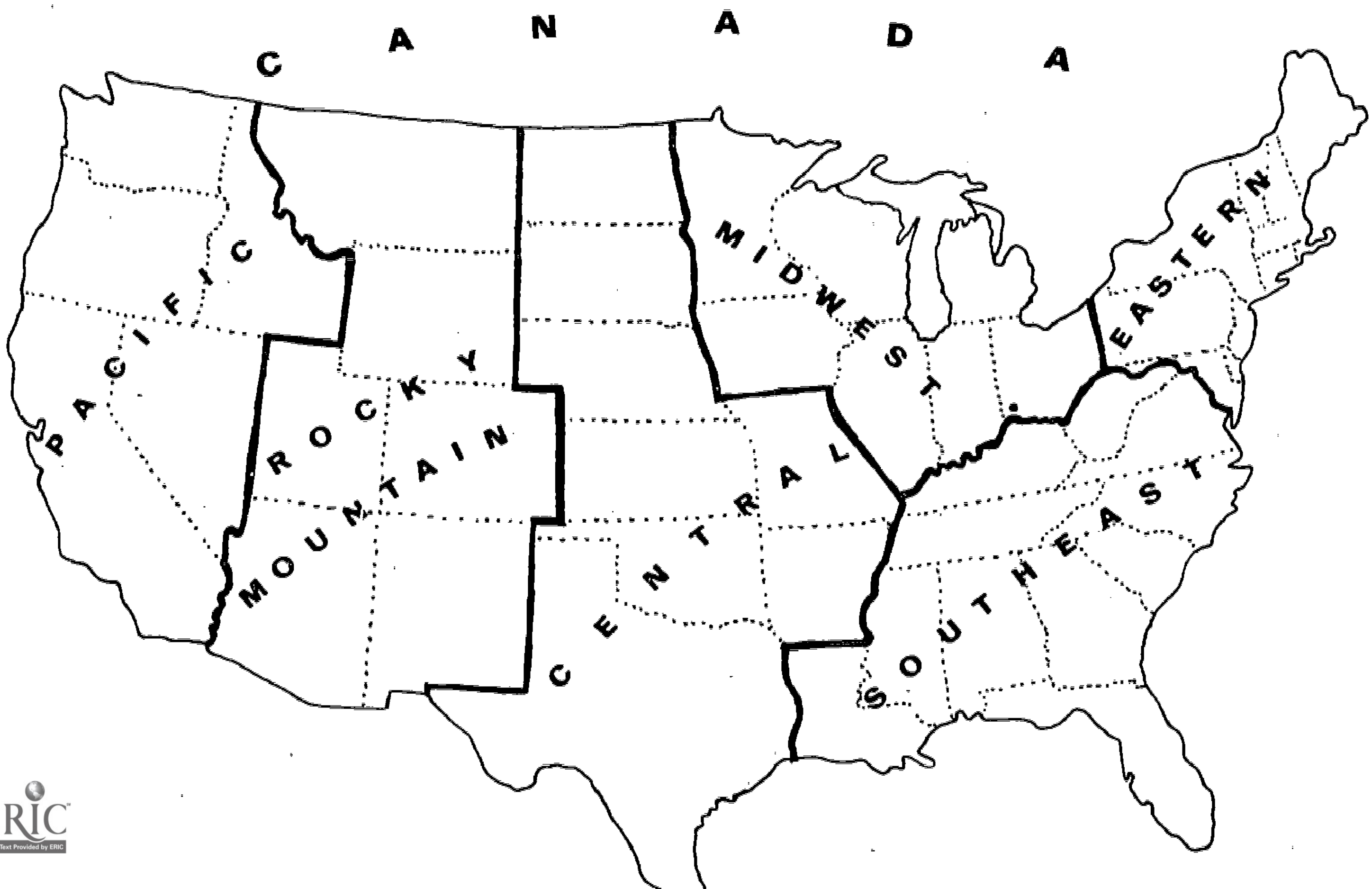
SOUTHEAST
W. Sterrett
Va.Poly.Tech.Inst.
C. Greene
U. of Florida

MIDWEST
D. Nollsch
U. of Iowa
H. Brooks
Indiana U.

CENTRAL
R. Halbert
U. of Missouri
G. Nixon
Kearney State College

ROCKY MT.
G. Cross
U. of Utah
A. Hall
Adams State College

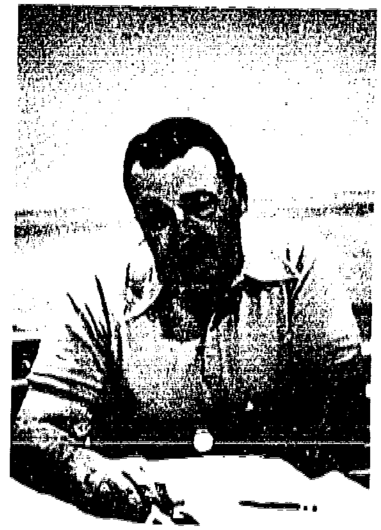
PACIFIC
B. Rutherford
Washington State U.
B. Cowman
U. C. L. A.



OFFICERS

HILL

SIMON



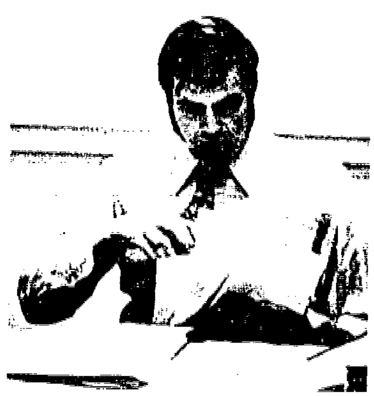
WEBER

MOORE

KOEHLER

SUBER

SWEITZER

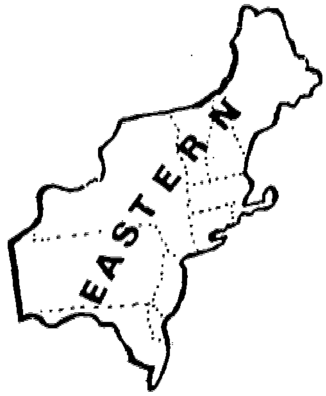


HAWK

ADAMS

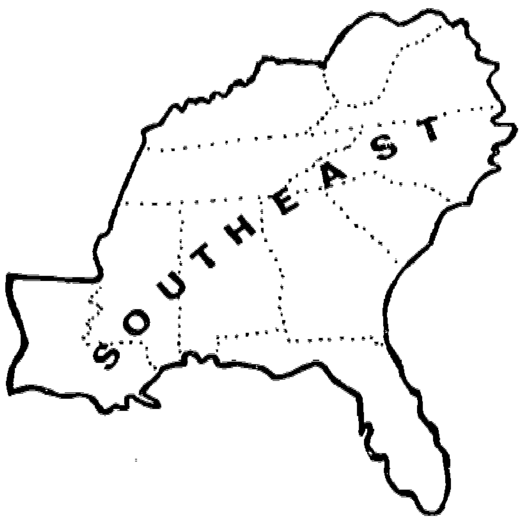
REGIONAL

WELANETZ



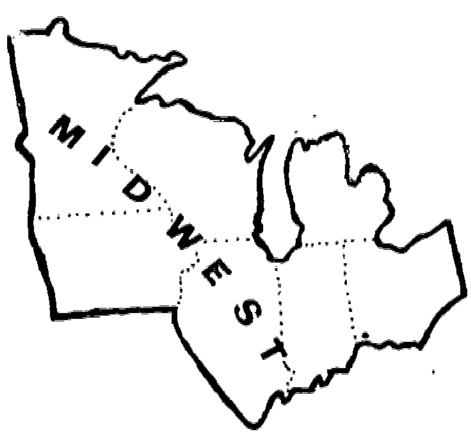
STANTON

STERRETT



GREENE

NOLLSCH



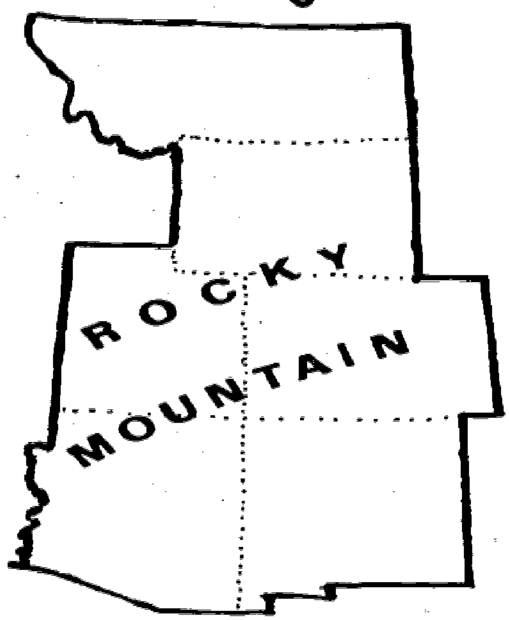
BROOKS

REPRESENTATIVES

HALBERT

CROSS

RUTHERFORD



D
(a

C

DAWSON
alternate)

HALL

OWMAN

.... introducing PAUL T. KN
(newly appointed Executive Di

ADDRESS:

One Dupont Circle

Washington, D.C. 20036

APP
rector)

ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
OF UNIVERSITIES AND COLLEGES

MINUTES OF THE FIFTY-NINTH ANNUAL BUSINESS MEETING

President Clyde Hill presided and opened the meeting at 10:30 a.m., May 2, 1972 in the Cincinnati Convention Center, Cincinnati, Ohio.

REPORTS OF OFFICERS

President

President Hill reported that the minutes of the last Annual Business Meeting were included in the bound volume, Minutes of the Fifty-Eighth Annual Meeting, which has been mailed to all members. Additions or corrections should be noted and sent to the Secretary.

He further reported as follows:

1. I was requested on behalf of APPA to provide a one hour and twenty minute program at the College and University Conference and Exposition in Chicago, March 14 through 16. Since we have been concerned about our public relations and pride in our profession, I readily agreed and selected three APPA members who I felt would represent us in an outstanding manner. Terry Suber agreed to participate and coordinate the efforts of the three. The other two participants were Clarence Lefler of Ohio University and Les Miller from the University of Chicago. From the reports I have heard on the performance of these three, it was probably the most outstanding program offered at the Conference and was very enthusiastically received. It certainly opened many eyes as to the value of good Physical Plant management.

2. NACUBO has received a grant to sponsor a Physical Plant Institute. This institute is geared to the black colleges and small colleges who need help in Physical Plant management. NACUBO has asked that APPA participate with them in this program. I readily agreed and ask that you concur in my decision. The grant sponsors the writing of a Physical Plant manual, a one week workshop, and consulting services after the workshop to the campuses who send representatives. The people who write chapters for the book, the instructors at the Workshop, and the consultants will all be paid a stipend for their services. Most of these people will be APPA members, however, some will be NACUBO members.

3. A membership campaign was started last May with the appointment of a membership chairman from each state and each Canadian Province. This campaign has been an

outstanding success. In a year when budgets have been cut throughout the education field, we managed to increase our membership from 703 last May to 835 to date. This amounts to an 18.8% increase. I am extremely proud of our members in this project.

4. You will recall that we agreed to participate with other university administrative oriented associations in the establishment of a personnel placement service. Eight associations have joined together and established the Higher Education Administrative Referral Service. A $30,000 grant has been secured to get this project underway. Mr. Steve Hychka has been appointed as Executive Director of HEARS and is progressing in that position.

5. This year I was able to attend three regional meetings. The Rocky Mountain Regional at the University of Wyoming with Bob Arnold as Host and A.J. Hall as President; the Southeastern Regional at the University of Mississippi with John White as Host and Hubert Jones as President; and the Eastern Regional at New York City with John Mueller as Program Chairman and Bill Stanton as President. Each of these meetings were excellent. I am only sorry it was impossible for me to attend the other three regional meetings.

I am very pleased with APPA's progress during the past year. APPA's accomplishments have only been possible through the efforts of so many of you. I wish to thank each of you for your support and cooperation that has been responsible for our progress.

President Elect

Ted Simon, who was elected to complete the term of President Elect upon the death of Bob Houston, spoke with appreciation for the many contributions which Bob Houston has made to this Association through the years.

One of the responsibilities of the President Elect is to work closely with the Workshop Committee, which is headed by George Berry. Ted Simon reported the 1971 Workshop was held at the University of Wisconsin - Milwaukee, with 70 participants, on August 2 through August 6, 1971. The Workshop was self-supporting financially.

In 1972, one Workshop will be held at Massachusetts Institute of Technology with William Dickson as host, August 6 through 11, 1972.

A second Workshop will be held on the west coast at the University of California, Santa Barbara, with John Gabe as host, August 20 through 25, 1972.

First Vice President

George Moore gave preliminary figures indicating that 496 people, including members, wives, children had registered for this Annual Meeting, plus 113 exhibitors.

Second Vice President

Philip Koehler welcomed the Association to Hawaii in 1973 and said they hope for a total registration of 1000.

Vice President for Professional Affairs

Terry Suber referred to A Plan for Progress for APPA, dated April 17, 1971, which was submitted by the Committee for Long Range Plans, and pointed out that most of the objectives have already been achieved.

He spoke of the recommendation to increase membership in APPA and announced 141 new members in the past year.

Regarding the goal of establishing a full-time Executive Director in a national headquarters, he announced the appointment of Paul Knapp to this position as well as the opening, August 1, of national headquarters at the Center for Higher Education, Suite 510, One Dupont Circle, Washington, D.C.

A personnel placement service has been established in cooperation with the National Association of College and University Business Officers (N.A.C.U.B.O.) This service is known as the Higher Education Administration Referral Service (HEARS).

Establishment of a formal workshop program was another objective and this is well under way, with a three-year program planned.

Ken Hayter presented a report on "APPA Career in Physical Plant Program", including the following highlights:

1. Under the leadership of Sam Brewster, Brigham Young University, Provo, Utah, is now offering a course leading to a B.S. Degree in Physical Plant Administration and will graduate the first student in this course on August 18, 1972.

2. Robert J. Hughes of William Rainey Harper College, Palatine, Illinois, reports that Malcom X Community College in Chicago, offers a Plant Engineering Program which leads to an Associate Degree in Science (or Applied Science). A committee representing the University of Illinois Circle Campus and Malcom X Community College is working toward a plan whereby all of the Plant Engineering credits will transfer and apply toward a Bachelors Degree in Industrial Education or Business Administration.

3. Ray Halbert, University of Missouri - Columbia - The University of Columbia does offer a program leading to a M.S. Degree in Civil Engineering with a major in Construction-Management. Twenty students are presently enrolled, the first of whom will graduate at the end of the current semester.

Regarding the APPA Memorial Scholarship Program, donations in excess of $1,100 have been received. It's recommended that a Scholarship Committee be appointed to recommend policies and procedures for implementing a scholarship program for APPA and to help coordinate such programs which may be developed at the regional level.

The Central States Regional Association last year awarded a $1,000 scholarship. The recipient will receive a Master's Degree in Civil Engineering, Construction and Management major, in May 1972 from the University of Missouri - Columbia.

C.S.R.A. plans to award a similar scholarship for the 1973-74 school year and is presently offering members of C.S.R.A. an opportunity to make personal contributions to help fund this scholarship program.

Up to the present time, major emphasis in this program has been as follows:

1. Through the use of posters and publicity, call attention to the opportunities in Physical Plant Administration.

2. Encourage colleges and universities to establish courses appropriate for training individuals interested in entering physical plant work.

3. Establish scholarship programs.

To provide more definitive direction to this program, it would appear desirable to try to determine the actual annual need for new professional people in the physical plant departments. It is therefore recommended that a survey be conducted to include the following:

1. The number of openings that developed during the past year.

2. A breakdown as to type of positions, that is, the management level, training and experience desired, etc.

3. The number of positions filled and the source from which obtained.

APPA has already received donations toward a memorial scholarship fund. It also seems reasonable to expect that the day will come when APPA or Regional Associations will wish to sponsor research in various aspects of physical plant or related operations.

Fund raising for such purposes is substantially enhanced if the donations are tax-deductible.

It is therefore suggested that APPA consider establishing a foundation for the purpose of receiving and disbursing funds for scholarships, research grants and other desirable activities that would qualify for tax exemption under IRS regulations. If possible, the foundation should also be in a position to receive and disburse funds for appropriate regional activities, thus eliminating the need for each region to obtain tax exempt status.

Furthermore, it is recommended that Ken Hayter, a member of long standing as well as a recipient of the Meritorious Service Award, be appointed by the President for a term of not less than three years as a Special Director of the APPA Scholarship and Career Program; that he prepare in writing semi-annual reports for the Board of Directors through the President with appropriate recommendations; that his name be listed on the stationary, in the Newsletter and other appropriate places as a single source for action and information; and that at his discretion can call upon any member of the Board of Directors for assistance and/or advice in promoting the Memorial Scholarship fund and the Career Development Program.

Secretary

John Sweitzer reported the Member Emeritus status may be granted to members who, upon retirement, have had a minimum of ten years of service in the Association. The following men have been elected to the status of Member Emeritus:

Dick Adams, Oregon State University
Alva Ahearn, University of Wisconsin
Ed Behler, Yale University
Charles Havens, University of Illinois
Harry Hepting, Colorado State University
Fred Palmer, Alfred University
Art Perry, DePauw University
Carl M.F. Peterson, M.I.T.
Robie Roscoe, Acadia University
John Shortreed, University of Western Ontario
Harold Wadsworth, Utah State University

Nominations for this honor should come through your Regional Representative. If you know of any member in your region who is retiring this year and who may eligible for this honor, please pass the information on to your Regional Representative.

The following members have passed on during the past year:

J.W. HALL, Jr. March, 1971
Southwest Texas State College

ROBERT HOUSTON University of Arizona	May 23, 1971
MAURICE E. EKBERG Northwestern University	September 7, 1971
C.K. BULLEN (Life) Oklahoma State University	September 15, 1971
HARRY WOOD (Life) Swarthmore University	October 25, 1971
THOMAS G. SWEARINGEN (Life) University of Montana	January 19, 1972

Persons outside of the Association who have rendered exceptional and meritorious service in promoting the purposes for which the Association stands, or persons of national stature, may be elected to Honorary Membership in the Association upon recommendation of the Board of Directors and by a majority of the votes cast by Members present and voting in any Annual Meeting.

Terry Suber moved and Howell Brooks seconded a motion that the status of Honorary Member be awarded to D. Francis Finn, Executive Vice President of the National Association of College and University Business Officers in recognition of his friendly cooperation and outstanding service to the Association. Motion carried.

Administrative Director

Gerald Hawk reported income from dues for the past year totaling $42,600, with expenses totaling $39,643.69 leaving a balance of over $100,000.

He further reported 141 new members during the past year, giving a total of 747 paying members, plus 90 Honorary, Emeritus, and Special.

Past President

George Weber worked closely with Ted Simon as co-chairman of the Selection Committee for the Executive Director. The committee screened 230 applications; narrowed the choice down to six finalists, who were personally interviewed, along with their wives; and announced the selection of the new Executive Director: Paul T. Knapp.

He also represented APPA on the Management Committee of the Higher Education Administrative Referral Service (HEARS). This is a joint venture with other business-related associations in the field of higher education and is being funded initially with the help of a $30,000 grant from the ESSO Foundation. The Director is Steven C. Hychka, Suite 510, One Dupont Circle, Washington,D.C. 20036. He urged members and member institutions to take advantage of this new placement service.

Newsletter Editor

Since Dick Adams was busy gathering news from the exhibitors, Clyde Hill read the following:

> This report covers briefly the activities of the editor in publishing of both the APPA Newsletter, Volume XIX, Issues numbered 1 through 9 inclusive, and the APPA Technical Papers 1972. This also concludes, officially, my nine years of publishing the Newsletter for you. The membership has grown from about 287 in 1961 to a figure well over 750, which represents a vigorous and healthy growth. This year, as an example of our growth, we sent out a ton and a quarter of Newsletters and about 600 lbs. of Technical Papers.
>
> As you go forward under the guidance of a new administrative leader, I wish you all success. If there remain areas where I can be of service to you, it will be a pleasure to assist you or your authorized personnel. The properties of APPA in my possession will be handled as your representative directs. It is my intention to retain P.O. Box 173 through the next few months in order to "wrap up" the tag ends which never seem to cut off on a specific date.
>
> This Board, as has all others before it, has never offered me anything but solid support. In addition, a responsive and tolerant membership has made it all very worthwhile. Many members have expressed a friendly satisfaction with my humble editorial efforts. When one's colleagues express themselves that way, that is about all the good one man can receive, and I am truly, most humbly grateful.
>
> In the words of an old-time entertainer, Groucho Marx, I say: "Hello, friends, I must be going!"
>
> Dick Adams,
>
> Editor

REPORTS OF COMMITTEES

Standards

Gene Cross announced his committee has laid the groundwork for a survey of general aspects of physical plant organizations, including numbers and kinds of employees.

Regional Associations have been requested to consider adoption of the APPA Classification of Accounts at their next meeting

The APPA Reference Manual is being updated by Henry Barbatti.

Constitution

Clyde Hill reported that certain changes in the Constitution and Bylaws were approved in principle at the last Annual Business Meeting as follows:

1. Provide for classification of members.
2. Correct inconsistencies regarding the title of Vice President for Professional Affairs and his committee.
3. Modify the process of site selection.
4. Modify the method of election of officers.
5. Change requirements for a quorum.

The details of these changes were given serious consideration by the Board of Directors and were reported in the Newsletter.

There being no discussion of the proposed changes, Howell Brooks moved and Walter Wade seconded a motion that the proposed changes in the Constitution and Bylaws, as presented in the April 1972 Newsletter, be approved. Motion carried unanimously.

Since Philip Koehler was elected to be Second Vice President last year and since, under provisions of the Constitution at that time, the Second Vice President automatically became First Vice President the following year, President Hill asked for a motion to continue the office of First Vice President for one more year and for Philip Koehler to fill that office. Tom Smith so moved and Martin Whalen seconded the motion. Motion carried.

Nominating

The Nominating Committee, chaired by Bruce Rutherford, presented the following slate of officers for the coming year:

President Elect -	George Moore, University of Cincinnati
Vice President for Professional Affairs -	Terry Suber, Colorado State University
Vice President for Membership-	Walter Wade, Purdue University
Vice President for Programs -	Harry Ebert, Duke University
Secretary -	John Sweitzer, Earlham College

The following officers are carried over automatically:

President - Ted Simon, Michigan State University
Past President - Clyde Hill, University of South Florida

All of the above officers were approved unanimously and with applause.

Site Selection

A secret ballot for site selection for the 1974 Annual Meeting produced the following results:

Houston, Texas	108
Wichita, Kansas	55
Lincoln, Nebraska	36

Therefore, the sixty first Annual Meeting will be held in Houston, Texas, in 1974.

President Clyde Hill announced that voting by mail may be tried for the election of officers and for site selection to get a broader base of voting by the total membership.

The meeting adjourned at noon.

Respectfully submitted,

John H. Sweitzer,
Secretary

ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS
of UNIVERSITIES and COLLEGES

ANNUAL FINANCIAL REPORT

(tentative)

INCOME:			
Dues (1971-72)	$42,600.00		
Dues (1972-73)	3,960.00		
1970 Meeting	16,610.45		
1971 Meeting	20,677.18		
		$83,847.63	
Total Assets Report April 1971		65,326.06	
Total			$149,172.69
EXPENSES:			
Salaries, Honorarium and taxes	8,300.00		
Equipment Rental	2,596.00		
Office Supplies	800.19		
Office Rent	840.00		
Office Expense	907.18		
Publishing			
Newsletter			
Technical Papers	5,510.00		
Manual	250.00		
Standards	2,154.20		
Meetings			
Board	5,744.00		
Workshop	1,261.00		
President's Office	500.00		
Adam's Office Adv.	300.00		
Annual Audit	387.40		
1973 Meeting Expense	1,000.00		
Travel	2,614.72		
Miscellaneous	303.00		
HEARS	1,000.00		
1972 Workshop	1,000.00		
Underwrite Workshop	935.00		
1968 Proceedings	3,241.00		
		39,643.69	
Certificates of Deposit		98,000.00	
Cash on Hand		11,529.00	
TOTAL			$149,172.69

59th ANNUAL MEETING

OPENING SESSION - MAY 1, 1972

Clyde Hill:

With the rapping of the official gavel of our organization, I would like to declare the 59th Annual Meeting of APPA in session.

At this time I would like to turn the gavel over to our genial host, George Moore.

George Moore:

Thank you, Clyde. Brother Matthew Kirwin from Maryknoll College will lead us in the invocation this morning.

Brother Kirwin:

Dear Father, God of space and time, as You know, these are the dimensions that this group usually has too little of. We are here, hopefully, to learn to make better use of Your space and Your time. Thus in our small way to use this knowledge to cooperate with You in building a better world. Help us. Amen.

George Moore:

The presentation of colors - Air Science ROTC of The University of Cincinnati

All: Pledge of Allegiance

George Moore:

President Clyde has a few things he wants to say here before we have our welcoming address, so I'll ask Clyde to take over again.

Clyde Hill:

First of all, it's always nice for all of us to get together. This is one place where our problems are always understood; whereas, it seems back home nobody understands our problems. As a matter of fact, when I come away from this meeting, I usually feel pretty good -- everybody else has more problems than I've got. So, if nothing else, and there always is a lot of else, I really get a lot out of these meetings, learning from you and learning from each other. I'm real pleased to see all of you here so I can pick your brains.

As you know, from the Newsletter, the Board and the Selection Committee have been working very diligently to secure our full time Director. This has been accomplished within the past week. At this time I'd like to ask Paul Knapp to come forward and be introduced. While he's coming I'd like to tell you a little bit about him. Paul is now the

Editor of Building Magazine. He will come with us on the 12th of June, within six weeks after that the full time office will be opened up. I'm sure Paul is going to do an outstanding job for us. Here's Paul.

Paul Knapp:

I would like to thank you gentlemen for your vote of confidence in me and I look forward to working with you throughout the conference and throughout many years ahead. I'm not coming to you as with a package of prosperity for all. At this point I hope we can contribute something like that in the years ahead and I look forward to working with you. Thank you again for your confidence.

Clyde Hill:

(a send off of the ladies to the Jubilee boat trip down the Ohio River)

During the past year we have increased our membership by 134. We want to welcome you to take advantage of our program and I'm sure you'll get a lot out of it, particularly if you participate.

So many of you don't know who our officers are, so I'd like to introduce them to you. (Introductions). And now I'd like to turn the meeting back to George Moore.

George Moore:

"The strong, steady pulse through the many branches of the University of Cincinnati is a sure sign of the school's health and growth. Put a stethoscope to its heart and, if you listen carefully, you just might hear a woman's voice at the base rumblings. That voice, of course, would be that of Mrs. Jane DeSerisy Earley right at the core as the new Chairman of the Board of Trustees and the first woman elected to such a post at a major American college." These are the words that were printed in the Cincinnati newspapers back in January when, in fact, Mrs. Earley was made the Chairman of the Board.

Mrs. Earley was originally named to the University Board in 1941 and was the first woman to hold that post. A victory for her sex perhaps, but just another step for Mrs. Dan Earley who has been at the heart of the University and she has had her heart in the University for well over 30 years. It was at U.C. where she inherited the job as the editor of the Bearcat Magazine -- sports editor at that, and it was at that time she met and later married Dan Earley who was a baseball player, I believe, and later became a great Cincinnati physician.

The Dan Earleys have two sons, who you might imagine were both U.C. graduates. Ladies and gentlemen, for Mrs. Earley it's been U.C. all the way. It's no doubt that it's this spirit that brings her to this lecturn to welcome you to the University and to the City of Cincinnati. Mrs. Earley.

Mrs. Earley:

How would you like to have been on a Board for 31 years when nobody's supposed to be over 30 years old? I'm delighted, on behalf of the University of Cincinnati, to welcome you here today. We are glad you came to Cincinnati. We're very proud of the job our Physical Plant people do at the University. They do a superb job and they know it, too, may I say. They'll tell you sometimes, too. But the one thing they have as an extra attribute that is of great value -- they do many, many things with the greatest of good humor.

Now it happens in Cincinnati - I don't think it ever happens any place else - that occasionally the Physical Plant Director will get a call from the Mayor, who had had a call from the neighbor with the dirtiest yard, and this guy says "why there's a piece of paper in the middle of the front yard on Clifton Avenue." Sometimes they call the President of the University and report such things and it's always the neighbor with the dirtiest yard who calls.

I remember, too, a few years ago when the Physical Plant Department framed a rubber dollar bill and a dollar bill stretcher - beautifully framed - and gave it to the Vice President for Business Affairs. This, I'm sure all of you can understand very well. But we need an awful lot of humor today and our Physical Plant Department does a good job with high good humor. You're familiar with today's parlance, the continuous dialogue, the participatory democracy, all about life styles. I know you read these in your campus newspapers. But I want to tell you where the Physical Plant squarely is (and squarely is probably the word, George,) you're surely improving the quality of life on the campus. Your ecological attitudes are highly correct. You're great at crises intervention, and in what they're now saying in gut language, you're highly meaningful.

People, you have a real good convention, and a really good time, and hurry back to see us. Thank you.

UNIVERSITY OF CINCINNATI
JUNCTA JUVANT
ALIA PETIT
1819

new faces and

President Clyde Hill (L.) turns the official gavel over to New President Ted Simon (R.)

APPA's Newest Member: Mr. Hayes M. Howard of North Carolina Central University, Durham, North Carolina.

New Vice Pres
Programs Harr

New Vice P
Membership

titles . . . .

New Executive Director...
Paul T. Knapp

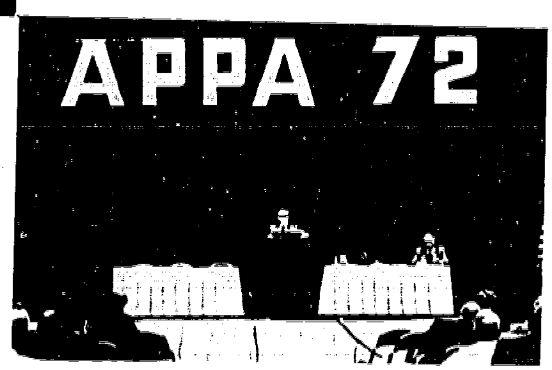
resident for
arry Ebert

e resident for
ni Valter Wade

session

papers

from:



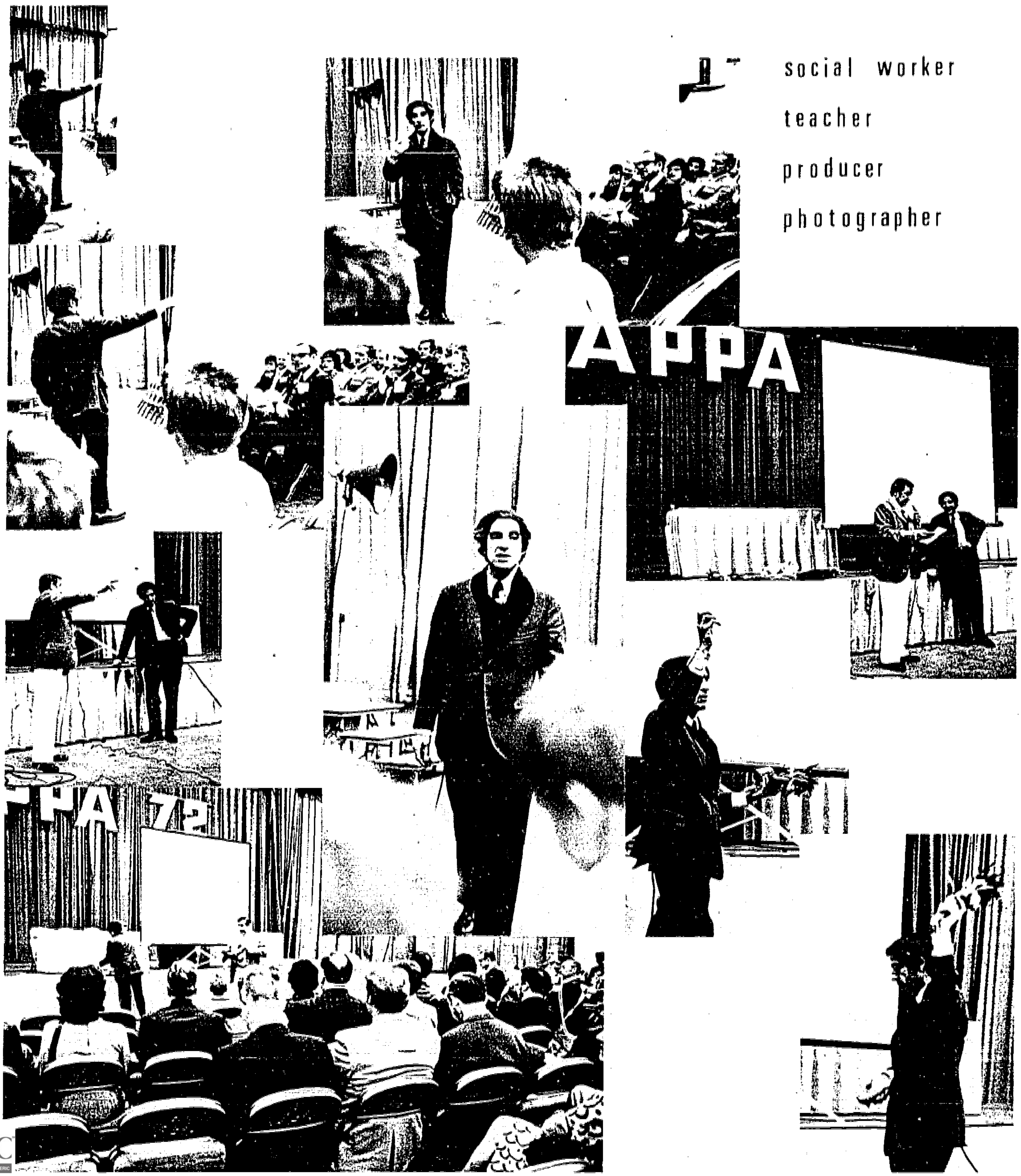
SUNDAY EVENING WITH DAN RANSOHOFF AND "The Best of Cincinnati"

social worker

teacher

producer

photographer



"SELF AND ORGANIZATION RENEWAL--A DETERRENT FOR MENTAL DRY ROT AMONG PHYSICAL PLANT PERSONNEL"

by Roger E. Hawkins

Biographical Sketch:

Dr. Roger E. Hawkins, Head of the Department of General Business and Executive Director of the Bureau of Business Services and Research, Eastern Michigan University, Ypsilanti, Michigan. Also, Chairman of the Board of Directors, Kenwood Homes, Inc., a multiplant manufacturer of low cost housing. He is a free-lance management consultant.

He earned a Bachelor's Degree at Western Michigan University, Kalamazoo, Michigan, a Master's Degree from the University of Akron, and a Ph. D. in Industrial Psychology from the Illinois Institute of Technology in Chicago, Illinois.

In the past Dr. Hawkins has been Senior Consultant at Ernst and Ernst (an international CPA firm in Chicago). He has taught at Purdue University and The University of Akron; Train Movement Supervisor for the Pennsylvania Railroad. He is a registered psychologist from the State of Illinois and a member of the American Psychological Association.

* * * * *

Many organizations suffer from individual and organization stagnation; many administrations are afflicted with myopia when it comes to anticipating problems and seeing the consequences of their decisions and programs. In the stagnant organization people seem to be in a sort of mental stupor and are incapable of regeneration. It is not unusual to identify individuals who have this particular malady; it is more difficult to see how entire organizations become stagnant. It's as though their mental batteries have run down.

The process of self-and organization-renewal is one of regenerating or recharging these run-down mental batteries. How do you get people turned on to the exhileration of new ideas and insights? What are the means for creating the quality of thought that enables individuals and the organization to succeed? I'd like to divide my discussion today into the symptoms, causes, and possible cure for stagnation. I want first to discuss how this condition can be identified. How can you tell if you or your organization are stagnant? Next, I would like to see us discuss how and why this situation comes about; and, lastly, I want to prescribe a treatment--a way to get your people turned on. As a bonus I hope to help you develop your organization in such a way that it is geared to renew itself regularly and automatically.

Our ultimate goal: find ways to reactivate the intellectual capabilities of the people who work for you. How do you get them to think, to use their heads?

SYMPTOMS OF CRANIAL DRY ROT

Let's take a look at some areas in which symptoms arise. Attitudes toward education, toward obsolescence, toward experience, toward change, and toward personal and organizational growth. These are the important dimensions which indicate the kind of attitudes, and hence, the degree of stagnation which may permeate your organization.

EDUCATION

In some organizations, the question arises, "Why don't our employees want to learn and want to deal with new concepts?" In most cases, this is exhibited by those who have never learned the value of life-long education because they simply have not tried it. How many people in your organization do you know of who are continually trying to upgrade what they know? Even professors, as I am sure you have all experienced, sometimes do not strive to improve professionally. The lectures too many are presenting today are the same lectures they have presented years ago.

Many ask what is the purpose of continued education? Presumably, the purpose of any education is to enable someone to anticipate what is going to occur and to try to deal with it effectively. Admitedly some formal education that takes place today prepares one to deal only with the past, or present, and not with the problems that will be occuring in the future. However, merely criticizing shortcomings of existing programs without appreciating, supporting and actively participating in the greater purpose of education is myopic and a tell-tale sign of stagnation.

OBSOLESCENCE

What is the general prevailing attitude of your people concerning the body of knowledge that they have at their disposal? Do they try to hide shortcomings in their background? Do they openly admit that they are becoming obsolescent and need additional training and education in order to be successful? Today the training of most people becomes obsolete in five to seven years, no matter what their level of education. Sometimes, the body of knowledge, the skills and training that they have becomes almost immediately useless in this rapidly changing, technological world. I need only to cite the experience of unemployed aerospace engineers on the West coast. Another example can be seen in the computer industry. We have experienced third and fourth generation computers in less than three years. At one time, we had one or two computer languages. Now we have dozens. In the past, university counselors needed to know the university catalogue. Today they have to be up to date on rapidly changing employment opportunities and a very different student body. An entire industry has emerged to provide condensation of research findings for various management and administrative groups. I am sure you are aware of the literally thousands of training programs and manpower development organizations which exist around the country today.

EXPERIENCE

Another good indicator of a stagnant organization is its attitude toward experience. Some say experience is the best education one can get. I reject this. I believe some experience is important, but it alone is not enough. One must also learn to cope with change, and instead of making such a task easier experience may interfere with it. It depends on what kind of experience people have. To have years of experience in doing the same tasks is surely different from years of experience in learning new tasks. Experience by itself is merely irrelavant. Experienced people, like inexperienced people, may or may not be able to deal with the future.

A serious symptom of this experience hang-up is the idea that the best way to learn a position is to watch someone else do it. That the best way to learn to be a Dean or Director of Physical Plant is to serve as an understudy for five or ten years. That's a good way of preventing people from learning from their own mistakes and stifling new ideas.

Somehow we tend to equate age with wisdom, that the two go hand-in-hand. The stagnant organization, the stagnant individual, both cling to the notion that slow ripening on the vine is preferred to the rapid accelerated rise. But in fruit farming, an overripe apple rarely contributes!

CHANGE

Attitude toward change is an important indicator of stagnancy. How receptive are the individuals to changes? For what purposes are changes introduced? How hard do the employees work to change the system that exists in order to press their own and the organization's capabilities even further? Is change ever introduced for sake of change?

GROWTH

Do most of your people in the organization seek added and increased responsibility? Do they have the opportunity for more and more authority? Are they able to develop more and more expertise, or are they stagnantly performing the same duties that they performed many years ago? One of the automotive companies conducted some research to determine the effect that increased responsibility and authority would have on their employees.

Briefly, they were responsible for mass assembly of carburetors. Waste and rejection cost were staggering. The highly trained machinest, who were then diverted back to earlier means of operating. They were given parts for carburetors and each man was responsible as a sole proprietor. He assembled his own carburetor, tested it, packaged it, tagged it with his name and sent it out. Complaints received on any product were handled by the individual. Management got a real scare, productivity diminished alarmingly. Within six months, however, the employees became accustomed to the new approach. Productivity returned to its former level. As a plus, waste and rejection were reduced by some 90 percent. Thereby, increasing the profitability of the company. These people were given the opportunity to use their heads, and it paid off.

ORGANIZATIONAL STAGNATION SYMPTOMS

An interesting line of research was pursued in 1965, conducted by a council of world economists. This study separated international companies and governmental organizations into two categories: the Thrusters and the Sleepers. The Thruster organizations were those in which attitudes were geared to the regeneration of the human mind and they were characterized by a spirit of as much concern about tomorrow, as today. They were openminded. They were aware of the various options available to them. They were optimistic about their ability to deal with the future. The Sleeper companies, on the other hand, held opposite attitudes; they were indifferent about tomorrow, secretive about their actions, concerned mostly with putting out fires, and short-sighted on personal development.

This study has since been replicated in the United States with similar findings. The general purpose of the original study was to determine why new production techniques and economic growth, characterized certain Common Market countries, the United States, Japan, Russia, West Germany, etc., but not England. The former countries' gross national product increased at a rate of 4 to 5 percent per year as compared to England's one percent. England, you remember, is the country which sparked the Industrial Revolution.

Why is England slower? The overall conclusion was that Britain held on to tradition, long after meaning and benefit had disappeared. The report said that bonedeep conservatism seemed to characterize the British industrial frame of mind as well as the British government.

Methods for this study as conducted with the top senior executives utilized a questionnaire somewhat similar to the one that you completed today, only it was much more comprehensive.

I would like to give you some of the results that relate to manpower development, growth, change, and planning.

MANPOWER DEVELOPMENT

The Thruster companies employ policies, and show attitudes that manpower must be continually retooled through education and training. Thruster top management personnel believed in and successfully implemented programs designed to develop capabilities of dealing with novel approaches and ideas. They sought training outside their own companies. They were able to make comparisons of themselves and competitors' industry. They knew the percentage of market they had captured. They had recent up-dated information on developments and new products in the field.

The Sleepers, on the other hand, had no planned program, depended primarily on the School of Hard Knocks, and, in general, seemed to be drifting pretty much asleep. There were limited opportunities for advancement in the Sleeper organizations. They tended to rely mostly on apprenticeship training.

Most of the Thruster organizations had conference rooms or a classroom where learning could take place. This was not true for the Sleeper organizations. The Thruster organizations could recite names and locations of specific training programs, which was not true in the Sleeper organization. The Thrusters have developed relationships with universities, consulting firms, and professors; this was not true with the Sleepers.

Young men in the Sleepers were dependant and unable to be self-reliant in many situations. Thruster personnel were making meaningful decisions at an earlier point in their careers.

THE CAUSES OF INDIVIDUAL AND ORGANIZATIONAL STAGNATION

In the late sixties a study was conducted at the University of California in an attempt to shed light on the underlying causes of Thruster vs. Sleeper attitudes. Three critical variable were identified. These were habits, specialization, and fear of failure.

<u>Habits</u> were described as rigid belief systems and fixed ideas. They guide behavior without much conscious attentiveness. Ritual behavior acquired over time. Habits simplify life; thus people fail to question the way that they do things.

<u>Specialization</u> refers to the characteristic of people to settle on a few acquaintances who are associated with their areas of competency. Thus, they develop a web of fixed relationships. Accountants talk to accountants, marketing people talk to marketing people talk to marketing people, and physical plant administrators talk only to physical plant administrators. Material read and studies applies directly to their specialty area. They

begin to loose sight of broader range and broader guage ideas.

Fear of Failure. As people grow older they develop images of competence. They garner reputations for the things that they do well. Subsequently, they only permit themselves to be tested in the areas that they have mastered in order to preserve their image of competence. The pitfall is highlighted when comparing this to a young child learning to walk. It is during this period that a young child experiences a phenomenal rate of failure. Once a child falls, he gets back up and tries and tries again until he learns to walk. However, somewhere between childhood and adulthood the price of learning--failure and risk of failure--is not paid.

ATTITUDE TOWARD COMPANY SPONSORED PROGRAMS

The University of California also studies the source of negative feelings toward company sponsored training programs. Sources revealed fear of the unknown, being uninformed on consequences of failure, unpleasant past academic experiences, reservations about moving someone around on the basis of education, and resentment for violation of individual rights. Thus, management's attempt to furnish recreative experiences jeopardize their firm because they were not appropriately administered. One subject in the California study previously mentioned had been asked to attend the senior management program at Harvard. He reported that he refused to get involved because he didn't know what the company's nomination meant. Did it mean that they thought highly of him, or that they believed him to be sub-standard. He was anxious about the possibility that Harvard might turn him down, or ask him to leave the program. What would a black mark such as this do to his record? He said, "even if I successfully complete the program, I know how the other managers feel about guys who go to school and then come back to make life miserable for their fellow managers. They are always afraid that the guy with the education will get the promotional nod. I guess overall, I just resent my company telling me I have to spend this time away from my family. I put enough time in on the job as it is."

THE INDIVIDUAL'S ATTITUDE TOWARD THEIR JOBS

As a general rule, people tend to become very possessive about their jobs. They resent anyone else performing their duties or making suggestions about how they can be accomplished. Moreover, they gravitate toward setting performance standards and determining how things should be done, irrespective of standards. In addition, if they are given small functional segments of a job, they tend to build it into a total responsibility, sometimes encroaching upon the duties of others. This is an area that the supervisor-manager must anticipate while maintaining a coordinated effort.

I am sure you have all heard the classic case reported by Dr. Pigors. It involves a situation where there were eight master mechanics on four different shifts who considered themselves one work group. One day one of them discovered a solution had made it possible to increase their efficiency by fifty percent. It was a problem that the methods department had been working on for some time. However, they kept their mouths shut so the brass wouldn't learn about their discovery. Therefore, they controlled productivity in their unit for a considerable period of time. They were about to control their earnings quite nicely. They even went so far as to leave false drawings around in order to run the methods department up blind alleys.

SOURCES OF STAGNATION IN THE ORGANIZATIONAL STRUCTURE

Organization structure delineates responsibility and authority. Research shows that no one plan of organization is suitable for all organizational objectives. A variety of communication networks can be very effective. I had an interesting experience once with a management game we played while I was at Aurora College. In this simulation we separated top executives into two groups based upon whether or not they were authoritarian leaders or democratic leaders. The participants were not aware of why they were separated into the groups they were. The product was greeting cards verse. The first two quarters of the game the authoritarian leaders were much more profitable than the democratic individuals. Before the third quarter commenced, I proceeded to fire both the company presidents. The democratic group eventually pulled ahead. The ensuing discussion centered around trying to determine how this could have happened. We had video tape sessions and we pointed out that the authoritarian people had established an organizational set up once that was quite rigid and highly structured. All communications had to flow through the organizational links, while the democratic participants communicated with each other. Once the chief link in the chain was removed, the communication process broke down and we concluded that the work center executives worked harder to preserve the system than they did to produce products.

People tend to develop rationale for perpetuating the existing organization structure, rather than viewing it as fluid and on-going. This means that we sometimes work harder to preserve the system than we do to change it to meet the organizational needs. Additionally, once organizational formats are achieved, people have a tendency to want to keep barriers between divisions of units in order to perserve their autonomy. Finally, if people are given the opportunity to select from various organizational formats, they will select the most efficient without regard to the importance of stablized work relationships which can seriously weaken performance.

TURNING PEOPLE ON: STIMULATING PERSONAL AND ORGANIZATIONAL RENEWAL

In order to set the stage for the stagnation cure, we must risk a glimpse of the future. I will turn to the theory of noted management theorist and social philosopher, Peter Drucker, for some hints. He discusses a dilemma in his book, The Age of Discontinuity, which describes basic changes that have taken place in the needs of people; the organizations they attempt to live and work in are described as inadequate. He describes the organizations as paramilitary structures, complete with unity of command, formal highly defined roles, etc. He says the characteristics of these organizations are incompatable with the very nature of people as they now approach their life experience. He disagrees with many who believe that our technology has outstripped our emotional capability to deal with it. On the contrary, Drucker says, we actually have become too emotionally mature to live happily and productively within the organizations that currently exist.

PEOPLE WANT MORE FROM THEIR JOBS THAN SECURITY OR MONEY

He also says that organizations must and will change. The very heart of the cure then, is managing the future. In order to aid in resolving the problems confronting our society and our organizations, we must all experience training to equip us to manage the future.

The point is, that unemployability for all of us is just around the corner. Many future shock theorists are forecasting the emergency of the knowledge organizations. Within these, survival depends upon the ability to collect, evaluate, emphasize and disseminate information and knowledge at a rate equal to the needs of a mature society and its members.

In the knowledge organization the following characteristics will be present:

1. Management teams will become teams of knowledge workers. Production workers, as we know them, will cease to exist.

2. Traditional organization relationships shall disappear; authority-obedience relationships will go the way of the dodo bird; and middle management positions will evaporate.

3. Management responsibility will be the management and production of ideas.

4. Interpersonal competence will rein, for example, knowledge workers will have to a) learn to develop deep human relationships quickly, b) learn to enter and leave groups with efficiency and smoothness, c) learn which roles are satisfying and how to achieve them.

Warren G. Bennis, the President of The University of Cincinnati, calls this phenomenon, "The Temporary Society." He says that we will hurdle through kaleidoscopic change. It is expected that in that world, all of us will become so involved in the application of our talents and training, that we will not need to focus on fighting; needs for self expression will be given their due. We will not have to substitute hair styles, drugs, self pity, professed love for humanity, sympathy for every underdog cause, protest of inequity of rewards, or worship of profit. Instead, people think and decide on their own fates, based on what they know and what they can do. This is the real American dream.

Now that we have peered into the future and examined the underlying philosophy of self and organization, it is important to summarize and conclude by pointing out some specifics that can be enacted to set the stage for personal growth and organizational renewal.

Help your subordinates recognize their habits and to introduce change for the sake of change. Encourage them to interact meaningfully with people outside their area of specialization. Develop policies and attitudes which convert failure to another step in the learning process rather than the end of the road.

Openly discuss the advantages and disadvantages of personal ownership of jobs and evaluate individual's real work standards with those set by the organization. Constantly examine positions to see how they can be whole-jobs, rather than part-jobs.

Openly discuss with your people the merits of loyalty to established organization practices, but encourage skepticism of uncritical attitudes about how things are done. Don't be intimidated by independence and autonomy among organizational units. However, keep constantly in front of your people the need for communication and coordination. And lastly, develop a comprehensive training schedule and manpower development program which clearly spells out the consequences of failure and accomplishment. This will clearly establish your expectations, the expectations that the individuals have for themselves and each other. I have three suggestions you may want to adopt as your guiding moral principles.

1) Make it a principle of yours not to squander human talent and ability. If you have talented capable people working for you, use them. Give them honest responsibility and direct them toward growth and development. They should be held accountable for more and more responsibility: permit them to develop expertise, or get rid of them. Force them not to waste their human abilities. Be committed to the proposition that every person has the right and the obligation to use what ever abilities or capabilities he has; the future

demands it.

2) Resist trying to buy cooperation and motivation of your people. Don't be intimidated and blackmailed by people coming to you and saying, "I want more money, because I am a part of the system." Because what they are really saying is I want my payoff, for having to put up with the squandering of my talents. If you can't motivate them through utilizing their talents eliminate them or their job.

3) Lastly, to ensure your own future success, develop your own expertise, and a capability to acquire knowledge which will make you employable in the future. A recent Dun's report described the current plight of fired executives. It was reported that executives, including middle management and top level people, were bitter because they were out of work and faced with personal financial problems they never dreamed possible. They were angry at the system they had worked in. The story is going around about one executive that was called in by his boss and told that it would be necessary for him to discharge twenty supervisors who were working for him. With great reluctance over several weeks of anguish and conflict, the man finally completed the job. He went back to his boss and said, "Well, boss, I've done what you've asked me." Then the boss said to him, "Good, now here are your termination papers." The point is none of us can be sure we won't be next and we must prepare for it.

If you establish the kind of environment I've described and adopt such a philosophy you will not only provide an atmosphere where recreative experiences can take place, but you can contribute toward the improvement of our entire socio-economic system. A system founded on the initiative resourcefulness and mental alertness of the individual. If we cannot sustain this, oblivion is around the corner. It is unacceptable for all of us as supervisors, citizens, and parents to ignore self and organizational renewal.

MAY 1, 1972

1:00 P.M.

SESSIONS 2- Mr. Williams
3- Mr. Barron
4- Mr. Wenner
5- Mr. Holloway

MERITORIOUS AWARD

presented to

YORK UNIVERSITY

Best Architect/Engineer Manual
submitted for judging
at the
Association of Physical Plant Administrators
59th Annual Meeting, April 30-May 3, 1972
Cincinnati, Ohio

"THE POST-TRADITIONAL CAMPUS: OLD FACES, NEW SPACES"

by Philip C. Williams AIA,
Senior Vice President
Caudill Rowlett Scott
Architects Planners Engineers

* * * * *

If I could explain the title of this talk I might go a long way toward making the points I want to make. This takes a little background -- George Moore heard somehow about a talk I gave a couple of years ago in Atlantic City and asked if I would give it here. I said yes, and a year later got a note reminding me of that obligation. Well, I hadn't recorded the other talk and didn't remember much of it by then, but George remembered the title and was about to use it -- "What the Space Age Campus Could Look Like". I thought it was a little far out at the time, and would have changed it anyway, but meanwhile, two years later I wasn't sure that either the title or the talk were still very relevant. So I asked for a change of title -- which brings us to

POINT ONE: Change comes fast in the Space Age, and a two year old talk is bound to be somewhat obsolete in certain respects.

Perhaps one approach to this assignment would be to analyze what seems valid and obsolete in our thinking of two years ago, relative to the campus physical plant. But that process wouldn't be complete without adding new ideas that have popped up since.

Now, back to the new title: "The Post-Traditional Campus: Old Faces, New Spaces". In the first place I soon had second thoughts about it, for a few days later my friend and partner Jonathan King, whom I greatly respect, was telling me how much distaste he has for titles with colons in them. Like"The Post-traditional Campus: Old Faces, New Spaces". If he knew mine had a hyphen and comma to boot, he'd disown me -- so let's not tell anyone. It would embarrass Jonathan anyway.

But I digress. Besides a colon, a hyphen, and a comma, what do we have? Three more points.

POINT TWO: We have entered the age of the Post-Traditional campus. Whether evolved from the traditional campus or created new, the post-traditional campus will differ conceptually from its predecessors. <u>The concept of communication is the dynamic force behind the design of the post-traditional campus.</u> Communication involves the mixing and moving of people, ideas and resources. Thus the new kind of campus will have a much more open and fluid character than those based on static compositions of buildings and landscape. If this is true, as I hope to show, then your jobs as physical plant administrators will also become less traditional as you take on a whole new set of challenges and opportunities.

POINT THREE: The faces I'm referring to are not those of the students -- they are our OLD FACES. Yours. Mine. Those of us who are in the business of serving students. Campuses may be changing a lot, but we Old Faces are still confronted with the job of providing and maintaining the places where the job of educating the new faces is done.

POINT FOUR: We Old Faces must learn new tricks to take care of the New Spaces of the post-traditional campuses.

To expand our horizons, I would like, with the help of some slides, to talk about some of these new campus spaces and the challenges and opportunites they present. Some of these examples will be from my earlier space age talk, accompanied with some "then and now" commentary. Some are new and will bring you some new, and I hope exciting,ideas.

We can begin by reviewing some precedents from the traditional campus. Even when reform is required, the first step is to decide what you need to keep. The precedents present a variety of images -- ivory tower images -- from the isolated country estate to the impacted (but still isolated) urban academic ghetto. In each area, we have progressed from an old formalism to a new formalism, each of which expresses a value system apart from, rather than part of, the "real world".

Of course, there are some outstanding exceptions to this general indictment, and on most campuses there are some spaces which reveal humane activities and values -- the ivory tower elitism may be overwhelming but not all-conquering.

Some of the delightful exceptions involve the interaction of the campus and the real world -- and most of these have occurred at the community college. Some of these have been the happy result of desperation -- the "storefront" operations, the makeshift occupation of scattered old structures, and, on the more rural scene, a new respect for nature in the form of preservation rather than replacement. It is partly the pragmatic purposes of these institutions that have de-institutionalized them -- vocational training, and more importantly, the attempts to reach the students who couldn't reach them by taking the school to the students. But whatever the cause, the effect of intimate physical contact with the real world has been more realistic and humane programs, and a refreshing mutual respect of town and gown.

In this evolution of attitude and purpose we are also seeing a physical manifestation. Campuses are beginning to look more like other parts of the world. This is not always for the best--there are important values to be preserved from the past sense of a campus as a community, but this discussion has at last brought us to another point. In the earlier space age talk this required another title shift -- from what the space age campus could look like to what it should look like.

POINT FIVE: The campus should look like what it should be Ideally, the campus should be a physical image of its time, setting and program -- it should evidence the teaching and research activities it houses, and express the human and social values it harbors. Unfortunately, the latter is too often true and our hastily constructed traditional but cheap copies of the '50's and '60's expressed a hell of an embarrasing set of values. Are these really monuments to education? To thought? To qualities of mind and spirit? To our culture? I hate to think of the observations the space age archeologists will make when they dig them up!

Now to be fair, we were to point out anachronisms in my earlier talk. One such is this: on the post-traditional campus, the architects' challenge is not simply to capture the requirements and essence of the current program and values.

POINT SIX: At the rate of space age change, we must also create the ENVIRONMENT FOR CHANGE, WHILE KEEPING WITH US THOSE QUALITIES PEOPLE MUST HAVE for mental and emotional well being. What do we need to retain from the traditional campus? How can we accommodate change? These are the difficult questions to answer in physical terms. The answers do not rest entirely in new building forms, for many old buildings are immense successes even for the post-tradional environment. The way buildings are furnished and maintained may be more important than the way they are built in the first place. Comfort is important; warmth (in textures and color) is a real human need; visual excitement is nice; changeability helps. But within the context of change there are basic permanent human needs to be served: the need for shelter; the need for security; for contact, visual and physical with other people; for materials that feel good to the touch as well as to the eye; for orientation, unity, variety. And the scale of these needs exists at the room, building, and campus levels.

In the search for valid constant values in the total campus environment one of the first steps has been to de-emphasize buildings, in themselves, as primary determinants of the campus plan. After all, on the changing campus it is buildings which are changing the most (not the old ones unfortunately -- they are usually too difficult to change). What is changing is our ability to forecast what future buildings should be like -- in fact our ability to do this has always been less adequate than we thought. Thus campus plans based on building form have usually been obsoleted before the campus was built, or soon after.

Yet the traditional campuses like Virginia and Duke, which were designed on a strong quadrangle or mall concept involving rigid building forms and associated landscape development obviously did incorporate many of the basic human needs, for they are still loved and respected, and make us feel comfortable and secure. Their order helps us remain oriented, their unity is peaceful, their scale is usually human, they have pleasant outdoor spaces, and lovely obsolete, expensive-to-maintain-or-reproduce buildings. They have values we must recapture, for our first departures from the traditional campus have given us chaos -- buildings; some good, more bad, scattered here and there with little regard for each other or the open space between.

So what can replace buildings as top dog in the campus hierarchy? One of the traditional aspects if collegiate life returning as an important part of institutional programming is the concept of the campus as a place for 2-way COMMUNICATION -- a place with spaces where discourse is fostered, within and without the classroom. Discourse finds outlets in the forms of various aspects of COMMUNICATION: interdisciplinary mix, increased opportunities for social contact, shifting emphasis from academic specialization to a broader education.

The concept of communication, then, leads to what happens <u>between</u> buildings -- the connectors and open spaces--movement and encounter. Perhaps we can design a non-building framework in the circulation and open spaces which has enough permanent order to create a campus out of chaos, yet flexible enough to accommodate unknown building requirements. Let me discuss some examples in the evolution of this idea.

At the University of Northern Iowa in Cedar Falls, our client wished to achieve balance between two objectives; to increase awareness and activity among the various colleges, and to reinforce the identity of each college. Working closely with the University planning committee we helped translate these program objectives into physical concepts -- the concepts of CORRIDORS and PLACES (never could come up with a better term than "place" to describe a "place"!) The CORRIDORS were designed to reinforce the program concept of Connection, and the PLACES were designed to reinforce the program concept of Identification. Together the CORRIDORS and PLACES form the basic development framework <u>within which</u> buildings and landscape projects occur.

Precepts were established for the design of Corridors as follows:

1. The design of the Corridor will be unique to the other pedestrian circulation elements in its pavement type, landscape, and activities which may take place thereon.

2. Corridors shall be located and designed to emphasize the connection between colleges and other major elements of the university.

3. Corridors shall be designed to give visual unity to the university.

4. Pedestrian sovereignty will be maintained on the Corridor, and the Corridor will express this sovereignty at any point where it is challenged by vehicular traffic. This may be accomplished by the separation of this traffic or continuance of the Corridor material across on interrupting element.

5. Corridors shall respond to the need for shelter from the elements by utilizing enclosed bridges, tunnels, and screening where suitable.

6. Service vehicles may use certain Corridors for access to facilities; however, the Corridor must be designed to make it clear that the vehicle is an intruder.

PLACES are essentially outdoor spaces formed by buildings and landscape features which identify and provide areas of activity. They provide centroids of visual and communicative activity which relate to certain programs, such as the colleges, university wide functions or social areas. Thus there are two roles to which these spaces must respond -- visual and functional. The visual response can be of three general forms; orientation, identification and termination.

A Place of Orientation is a space from which the individual has a sense of the university as a whole. Its function is to serve as a centroid of university life--socially, intellectually, and culturally.

A Place of Identification has a more limited visual and functional role. Its visual role is to identify it as a place of specific activity such as the Science College Courtyard. It is a space where someone not normally involved in that specific activity can enter and identify with it.

A Place of Termination relates more to a vista that suggests activity at a destination such as a residence hall. The plan identifies the general location and type of each Place with symbols.

Precepts were established for the design of Places as follows:

1. The design of a Place must establish a major visual and functional identity as seen from a pedestrian corridor. A Place should include some element representing its functional activity, such as an exhibit space, a unique sculpture or fountain, or another significant feature.

2. Places are the nodes for action. They are not merely to be viewed but are to incorporate some facilities for human activity. A snack bar, a classroom or study carrel is just as much a part of the Place as is the significant feature.

3. Places are not to be in themselves self-contained but should incorporate the total environment, including buildings and existing landscape features.

4. The environment within a place should be diverse -- that is to say there should be areas for individual activity as well as group activities.

Guidelines in the form of graphic sketches accompanied these precepts as shown on the slides.

The precepts for location and design of CORRIDORS and PLACES thus become the basis for campus development, rather than a drawing which showed the usual white buildings and green grass.

A recently completed campus plan at East Texas State University was shaped by three major forces. The first, again, was the communications concept, with special emphasis on integrating resident and commuter students. The other two are becoming more prevalent on many campuses. One is the desire to extend community and regional service. The other force was the shortage of funds, which demanded a plan which was not dependent on buildings for its success. The campus itself was rather disjointed, with housing areas separated from the academic core by both distance and a major highway.

The major concept of the plan is The Link (another imaginative name in the tradition of "The Place" and "The Corridor"), a highly developed pedestrian activity mall tying together the various parts of the campus, lending visibility to its activities and becoming the communication focus of the University. The Link is sort of an "external union" and along its brick paved and tree lined route one can find the arts court, recreation, the radio station and news kiosk, open air pavilions, outdoor classrooms, election campaigns, an amphitheatre on the lake, chess tables, fruit stands, a "walk-in" movie theatre, bookstore, sidewalk cafes, and mainly, people -- students, faculty, townspeople, visitors-- doing and being. The Link bridges the highway, and connects housing, P.E. center, arts center, Union, Library and the principal academic building. It enhances the visibility of the university's activities and environment, to encourage community participation. In pracical terms, for less than a million dollars, we can have a unifying environmental feature embodying the principal educational and social objectives of the ETSU program.

At Washington State University the rigors of climate and topography pushed the physical response to similar program goals of communication a step further in the concept of the CAMPUS CONTINUUM. The concept emphasises ease of pedestrian circulation and access by establishing the major paths uninterrupted by structures or topography. In fact, to be more positive about it, the pedestrian corridors utilize buildings and topography together to establish the Continuum. Outdoor corridors "seek their own level" on specified terraces to facilitate horizontal movement, for convenience and pleasure and to reduce hazards. Transitions between levels occur within buildings, utilizing elevators, escalators or stairs. This concept is further reinforced by development of "building clusters" formed by connecting existing buildings with new buildings. This goes beyond the idea of just bridging between buildings. The idea here is to incorporate program space--class and seminar rooms, study areas, offices, exhibit areas, lounges--with generous hallways to encourage awareness and communication, and (not so incidentally) to assure a means of financing the continuum. An added benefit of creating a continuum of building space, besides using buildings more effectively for circulation and communication, is to increase the flexibility of space assignment over that in isolated buildings representing departmental "turf".

The fourth example in the evolution of space for communication is at Governors State University in Park Forest South, near Chicago. This is an exciting new kind of institution, charged by its charter to be innovative and responsive to new needs. There are four interdisciplinary colleges and no departments. The "average" student is married, 27 to 28 years old and works. The fundamental program concepts are openness, humaneness, innovation, autonomy, efficiency, flexibility and experimentation. This is truly a "post-traditional" university, and its physical plant is truly a post-traditional campus.

All the enclosed space, 10 acres in the first phase, is contained in a single building, an "academic street" with an open plan and "office landscape" furnishings which maximize opportunities for interaction. To quote Frank Lawyer, the principal designer, "Our charge was to put this complex in a form, or series of forms that would have unity but still maintain some individuality. Each college required some highly specialized areas--like sculpture or painting studios, music rooms, or research labs. But we also needed a central concourse which was everyone's domain where things would happen that would be relevant to everyone. The program goals of openness and mix of people and activities evolved into the academic street concept. It's an educational shopping center mall where you can walk along and find the things you need. The idea of enclosing the street came as a response to climate and to the convenience and communication of students and faculty."

There is a maximum opportunity for mix, yet each college has a commons and specialized spaces for its students and activities. Every space in the 10 acre "campus" is accessible within a five minute walk indoors. Mobile labs will go to outlying schools, hospitals or forests to conduct research and instruction, and can "dock" at the campus to become an extension of the building between trips. The interior space can be re-arranged almost at will, and the exterior is covered with bolted-on steel panels which can be removed for expansion.

Although quite different in their particulars, these examples are similar in terms of their major concepts, which focus on providing an environment for COMMUNICATION.

In these four examples, buildings begin to reassert themselves in the Washington State Continuum, and at Governors State most of the new concepts became incorporated in a new kind of super building. So we do have to deal with buildings on the post-traditional campus. If buildings are to help establ sh the campus as a COMMUNITY FOR COMMUNICATION then they must appear to be part of the same family. There must be a degree of unity -- but not at the expense of vitality. Communication in the academic family can tolerate some lively discussion. (Sometimes it gets more than it can tolerate.) But prima donna buildings that scream out for attention tend to reinforce specialization and individuality rather than integration and communication. And buildings that all look alike can be deadly dull. In our traditional past, Gothic architecture embodied a wonderful balance of unity and variety and another important quality--human scale. Let me use an example from Duke University to illustrate one approach to evolving post-traditional architecture on a traditional campus.

At Duke University a lovely, well done(even though imitation) "Collegiate" Gothic campus was designed in the mid-1920's and constructed mainly during the depression years preceeding World War II. Following the war, under pressure from rising costs and new functional requirements, a series of red brick buildings were constructed a short distance from the Gothic quadrangle. Although screened from the quad by trees, it was quite evident that these buildings were a jarring departure from the campus environment. Nine years ago CRS was hired to analyze the campus architecture and establish design guidelines for future buildings which would be economical, functional, and continue the spirit of the original campus. The resulting report has been used as a guide for ensuing projects, and we have been involved in some of them as a team with local architects to "practice what we preached".

As part of the design study, precast concrete panels incorporating the same "Duke stone" of the Gothic buildings were developed. These were used in the Residence Halls which occupy a wooded site not quite out of sight of the Gothic quadrange, and the Chemistry Building which sits among the red brick outcasts to the west. The Library addition attaches to the quad, and therefore uses the laid up stone.

Although these three buildings are on three different kinds of sites, have three distinctly different functions and were designed in association with three different architectural firms I think you will agree that there is consistency, along with variety, and that they will live well with the Duke campus community. With this example we see an evolution of post-traditional spaces as a logical part of the post-traditional campus scene. Since we already have 2600 existing campuses, this may be the kind of situation most of you will experience.

In terms of functional requirements I think we are beginning to understand that the first priorities are not to design the campus as a conglomerate of special spaces for temporal programs, nor as hard shiny surfaces that are easy to clean and last forever.

Fortunately, some of the gifts of our post-traditional technology, such as systems building and fast track construction, have forced us to a generalizing of program requirements and thus to generalized rather than specific building space. This yields flexibility to adopt to changing programs, but more importantly, I believe, the building becomes a backdrop for human activities rather than a determinant of them, and people naturally get a chance to express and preserve those qualities which are important to them. THEY CAN AFFECT THEIR ENVIRONMENT, SO IT BECOMES RESPONSIVE TO THEIR NEEDS. I think we understand now, in this context, the failure of dormitories. It was not just inflexible rules that made them intolerable--it was unyielding space. Students could not imprint their personalities on their space and make it truly theirs.

Recognizing this problem, an attempt was made to maximize individual options in the Duke Residence Halls,(which are not systems buildings), by using movable furnishings, sizing the rooms to allow the greatest possible number of arrangements and providing adjustable shelf hardware on one wall of each room. Small refrigerators can be rented. You'd be surprised at the variety of environments that can be created in a hundred square feet.

Practically speaking, the fact that college buildings can be programmed, designed and built in nine months assures us that we will be seeing these new techniques employed on more and more campuses.

THE TRANSITIONAL CAMPUS

We have talked about some important human values and needs, and have seen some examples of the campus in transition. Another possible response is the campus as transition.

As more "new urban students", many of them from low income or minority areas, find opportunities to enter higher education, we find increasing uneasiness on many of our traditional campuses. I believe that part of this problem can be traced to the confusion caused by too abrupt a change in environment (both social and physical). Perhaps this is a form of "culture shock". Imagine the plight of a middle-aged businessman seeking to retread, instead of retire, being confronted with a radical love-in accompanied by 200 decibel acid rock upon his first venture into the Union cafeteria! Or the lady who got her degree from Vassar in 1930 seeking a parking place on the same side of the campus where her modern poetry study class meets. When a youngster from the ghetto is suddenly thrust into the high quality, sometimes pretentious surroundings of the ivory tower, can we wonder that there is disorientation, anxiety and alienation?

I'd like to suggest that an important function of the campus environment should be to create, by example, an aspiration level among its students for creating a better community environment after graduation. This brings me to

POINT SEVEN: The post-traditional campus should provide a TRANSITIONAL

ENVIRONMENT that replaces alienation with aspiration.

This requires a variety of environments so that from whatever level students enter, they can find a step up that they can negotiate. In such a campus there is a reasonable balance of essentials and amenities. Quality is evident but not ostentatious. Clear graphics direct strangers without embarrassing questions. New spaces include "home bases" where commuters can change from their work clothes or into their play clothes. Eating and study spaces vary in size, noise level and formality. Degrees of privacy are available. Above all, the people spaces are designed for enjoyment and vitality, with an "at home" casualness that encourages relaxed contemplation and mixing.

These new spaces are already present on many post-traditional campuses, and some of them can be found on most traditional campuses.

So where do we go from here?

Soon there will be a "campus under glass". Antioch College is building an experimental branch campus of Columbia, Maryland, entirely housed under a multi-acre plastic bubble. How is this for New Spaces: indoor-indoor spaces and indoor-outdoor spaces!

At the Tufts-New England Medical Center an eight story condiminium building will combine space under several owners for graduate student housing, Y.M.C.A., an elementary school, community recreation and commercial shops.

From here it is easy to predict education nodes appearing in downtown buildings and industrial plants--a decentralized campus, but not quite a non-campus. There is still a physical plant to maintain.

The nodes concept might be strung out into a Bead Campus, with facilities located along a transit line or expressway.

Or how about a system of mobile labs operating on the transit tracks with scheduled stops at key population centers?

Or, to turn this around, we could establish a Terminal Campus, located to capitalize on existing transit routes to bring students to an educational hub.

The Academic Street concept could be developed into a money-making campus, or at least a campus where education facilities have real world access to shops, services, day care for student mothers, entertainment--convenient support and employment opportunities.

We tried to launch a space age acacemic street in Arizona, but it never left the pad. (Sketch pad.) This was a linear subdivision of semi-autonomous colleges with a broad walk for mix, and parallel canal to unify and beautify. Within each college lot there was to be a consistent zoning pattern and considerable architectural freedom. The project was not funded.

Taking the linear concept a step further might produce an endless campus, anchored at one end growing at the other on an "educational right-of-way" through the city.

Leaving the campus scale and returning to new spaces in buildings, we might extend the commuter home base to include showers, and even rent-a-beds for those who make late use of the 24-hour study center.

Instead of massive gyms we will see more small scale health club type spaces in response to the program push toward individual physical development and lifetime sports.

What better place to achieve social and intellectual mix than in a combination student union and library?

Or, in institutions pursuing audio-tutorial programs we might find only carrels and offices. Then there are the new "temporaries". The historic quonset and portables will be replaced by special purpose air supported structures, and demountable systems buildings which can be leased and moved. These offer opportunities to assemble interdisciplinary projects in "non-turf" space for varying lengths of time.

How about flying language labs for on-the-spot-and-return foreign study?

And I hate to say it, but an obvious space age new space will be the hot and cold, wet and dry super carrel docked on the orbiting space platform.

By now I hope that by suggesting some ways in which the post-traditional campus will differ from what we are used to, we have demonstrated the need for developing some new approaches to planning and operating the physical plant. I don't know enough about your business to specify the new tricks you Old Faces must learn, so I'll just pass the buck back to you by summarizing some conclusions I consider important.

First I would like to dispel a current misconception held by some university administrators that because building funds are scarce, there is no need to plan. This is an excellent time to straighten our priorities, catch up on plans for utilities improvements, renovation and other neglected housekeeping chores, and above all, design a planning process for dealing with the needs of post-traditional education. In these times planning must be approached more as a process than as a product.

The first order of business is to straighten out the programming process. Whether developing the program for the campus plan, a building or a mall, this is the time to get a handle on the big picture, establish priorities, and determine what is really needed as well as a strategy for adjusting to later changes. As physical plant administrators and architects our part in this process is to offer our expertise, and at the same time put ourselves in perspective. We are her to support the program, not to distort it to make our jobs easier or our records look better. For example, there have been enough examples of what happens to dormitories that were programmed for maintenance efficiency rather than human habitation as the top priority.

Post-Traditional trends indicate that there will be new emphases in operations, budgets and methods. Some of these trends are:

A greater proportion of new construction and refinement of outdoor spaces-malls, plazas, walks, as well as vehicular facilities.

A greater variety of building materials and space types.

More large open spaces in buildings, and more extended hours of use.

Operating methods must become more flexible to deal with physical changes--more movable furnishings, movable partitions, even movable buildings.

Emphasis will shift from "whose space" to "what type of space", so space assignments will change more often. This means more picking up after moves, changing of phones, record changing--but hopefully improved utilization and less obsolescence--a shift from major to minor renovation.

There will be new interest in "people places" and people tend to be messy. They also like carpeting and soft furniture, a palette of colors and special lighting.

As larger areas of the campus are returned to pedestrians, new ways should be found to service buildings and collect trash. Dempsey dumpsters are not compatable with human beings, or the scale of quite courtyards. If smaller service vehicles and off-hours deliveries cost more, then this improvement should be accepted and the cost charged to implementing program goals. New environments will require new methods of allocating resources and measuring effectiveness.

This is a plea, once more, for a look at the big picture. We are members of service organizations. We must keep our roles in perspective. We must relate our objectives and processes to those of the institutions we serve.

Our jobs on the post-traditional campuses will be more complicated, but the results will be more rewarding. Be prepared. Stay loose!

1972 AWARDS FOR MERITORIOUS SERVICE ......

MERITORIOUS SERVICE AWARD

Active members of long standing who have performed particularly meritorious service for the success of the Association may be awarded a Certificate of Meritorious Service upon the recommendation of the Board of Directors and a majority of the votes cast by members present and voting in any Annual Meeting of this Association.

Recognition & Meritorious Awards Committee

M. Whalen, Chairman, Montana St. U.
B. Cowman, U.C.L.A.
G. Carlsen, Augustana College
J. Brush, Bowdoin College
C. Dawson, S.M.U.
G. Johnson, Tulane U.

RECIPIENTS

WALTER H. WIEGAND
Pennsylvania State Univ.

GEORGE C. MOORE
University of Cincinnati

CALVIN C. GREENE
University of Florida

PARTICULATE AND SO_2 CONTROL TECHNOLOGY FOR THE SMALL AND MEDIUM COAL-FIRED BOILER

By
A. V. Barron, Jr.
Zurn Industries, Inc.
Air Systems Division

ZURN
A Step Ahead of Tomorrow
AIR SYSTEMS DIV.
P. O. BOX 1883
BIRMINGHAM, AL 35201

PARTICULATE AND SO_2 CONTROL TECHNOLOGY FOR THE SMALL AND MEDIUM COAL-FIRED BOILER

Abstract

The proposed increase in energy demand of the United States over the next 30 years includes a 350 percent increase in the tonnage of coal burned. Already charged with growing particulate emission levels but unapplauded for significant emission reductions, the coal-burning industry is facing now a more difficult challenge in the control of sulfur oxides,which are inherent in emission of the combustion process.

This paper proposes that we fully evaluate the magnitude of the problem before us, evaluate the tools with which we have to work, and investigate the solutions that are available to control both the stack emission of particulates and sulfur oxides.

A review of electrostatic precipitators, bag filters, mechanical collectors, and scrubbers is included with the view that sulfur oxide control is destined to become the dominant gas-cleaning requirement of coal firing, particulates removal inherent in sulfur oxide scrubbing.

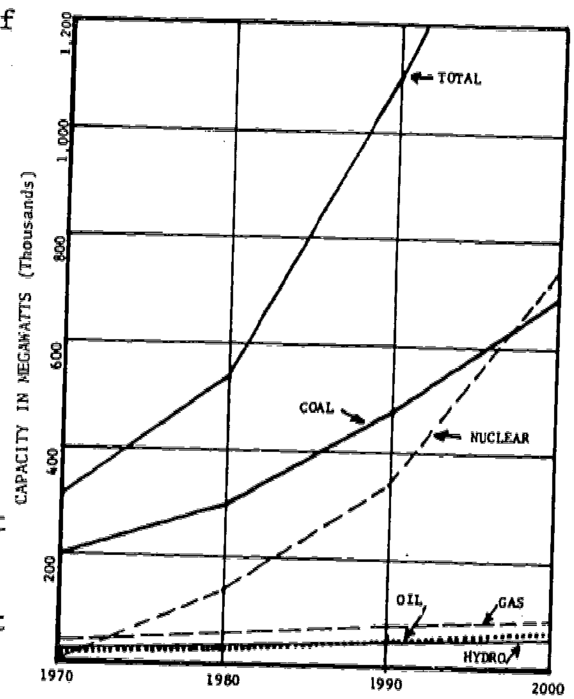
Discussion of several current SO_2 control systems, including limestone, sea water, and sodium hydroxide, as well as mobile pilot plants operation are detailed.

PARTICULATE AND SO_2 CONTROL TECHNOLOGY
FOR THE SMALL AND MEDIUM COAL-FIRED BOILER

It has been said that our civilization was forged in a crucible of fire. Combustion, burning of fossil fuels, has literally been the engine that propelled our human achievement. Prometheus, in offering mankind this precious gift, did not warn, nor were the ancients aware that an awesome responsibility would be required of modern man in controlling the by-products from this gift of fire and combustion that now radically affect the very future of man himself.

Today we are in the midst of the most massive public clamor ever faced by those of us involved in this business of burning coal. Starting over a hundred years ago, the fossil fuels of coal, oil, and natural gas that have accumulated over millions of years are being converted to flue gas and fly ash at a rate that, even with our understanding of the nature of our business, still can stagger our imagination.

In this country the total use of fossil fuels now doubles every 20 years. We have recognized that all this combustion - the internal combustion of transportation and the external combustion of industrial and utility requirements - is the principal contributor to manmade air pollution. While significant and even outstanding achievements have been recorded by this very group in cleaning our stacks, the rate effect is overcoming our previous achievements.



PROJECTED ELECTRICAL DEMAND FOR FUEL
FIGURE 1.

The best of intentions, the best of lauded achievements, and the very best of our prior accomplishments come up against the hard reality that we are but technicians serving a society which has an insatiable and ever-demanding appetite for the end products of our combustion of fossil fuel, particularly coal and petroleum. This insatiable hunger for energy is destined to increase, reaching eight times the present level during the next 40 years.

The only course left open would appear to be either major achievements in cleaning up the end result of the combustion process or substitution of noncombustion processes to produce energy. It is very likely that within the next 30 years coal consumption, not only an absolute necessity for the present energy requirements, will increase in tonnage used by some three and a half times over the present rate and usage still be increasing. Energy and steam is going to cost more to produce, and part of our job is to convince first ourselves and then our customers that this cost is part of the price society must pay.

Source	CO	Hydro-Carbons	NO_x	SO_x	Particulates	Total by Source
			Millions of Tons			
Transportation	64.5	17.6	7.6	0.4	1.2	91.3
Fuel combustion, stationary sources	1.9	0.7	6.7	22.9	9.2	41.4
Industrial processes	10.7	3.5	0.2	7.2	7.6	29.2
Garbage incineration	7.6	1.5	0.5	0.1	1.0	10.7
Miscellaneous	16.9	8.2	1.7	0.6	9.6	37.0
TOTAL BY TYPE	101.6	31.5	16.7	31.2	28.6	209.6

(Source: NAPCA, 1966 data)

TABLE I.

It is generally accepted today that by-products of the combustion process make up some 85 percent of the total tonnage burden of air pollution in the United States. Most of these emissions, both from internal and external combustion, classified as pollutants are not inherent in combustion itself but are rather the results of inefficient burning of fuels that are impure. The pollutants fall into two principle types, particulates and gases. The particulates include principally fly ash, which is the unburnable inert material in fuels; soot, which is the burnable unburned material left from the inefficient combustion; and lead, unburnable additive in gasoline. Less visible, but charged with being more damaging are the gaseous emissions from the combustion process. These include sulfur oxides, products of coal and oil burning which contain sulfur; carbon monoxide (CO), emitted when insufficient oxygen is present during combustion; and the various oxides of nitrogens, products of very high combustion temperature. Many complex hydrocarbon compounds, both particulates and gases, also result from incomplete combustion.

While the particulates or dirt particles are largely charged with the soiling and the general unpleasantness that we usually see, it is the gaseous emissions from the various industrial processes and combustion of fuels that are both less visible but now documented to be more damaging to human wellbeing. These gaseous emissions include sulfur dioxide (SO_2). Sulfur dioxide combines with oxygen and then with moisture to form sulfuric acid (H_2SO_4), resulting in a pungent, acrid, corrosive atmospheric contaminant.

The most serious threat to the environment, one of the most significant social issues coming forth, a major challenge to the entire coal industry and one of the most difficult jobs facing the manufacturers of control equipment, is this challenge of removing SO_2 from stack gases.

Typically the sulfur content of coal will run from 0.5 to 6.0 percent by weight, some of the highest sulfur content coal from right here in the Indiana-Illinois area.

In firing one ton of coal with 2 percent sulfur, some 40 pounds of sulfur is burned and released into the flue gas. This 40 pounds of sulfur combines with oxygen to form 80 pounds of sulfur dioxide. The sulfur oxides react with moisture resulting in sulfuric acid, eventually making some 125 pounds of sulfuric acid. The coal industry must recognize this issue it faces in the next 10 years. Along with fuel demands, shortages, new mines needed, transportation problems, labor problems, and the possibility of fuel allocations, SO_2 control is a major factor in deciding the future course of the coal industry.

While this paper was originally directed toward particulate removal systems, we cannot today dissociate particulate control from control of the sulfur oxides. There is much to gain in looking at particulate and SO_2 control as a problem with a common solution.

Let us review the individual tools we have available to control stack emissions and then attempt to tie all of these together in examining the total problem.

One of the realities we face today is that there are still only five basic devices for use in air pollution control - removing dust, dirt, ash, soot, odor, and gases from the stacks of coal - and oil-fired boilers. These are:

1. Electrostatic precipitators
2. Bag or fabric collectors
3. Mechanical dust collectors or multiple cyclones
4. Scrubbers or washers
5. Thermal or catalytic converters

While the newest of these tools, the precipitator, is now some 64 years old, each has been constantly improved in reliability, design, performance, and application knowledge, particularly within the last few years. It would be this author's opinion that developments have progressed at such a rate during these recent years that each should be fully re-evaluated by an engineer making a present-day application to small coal-fired boilers.

Particularly of value would be the consideration of using dual systems in combination with thorough engineering and economic studies of the cost and results. We are now at a time when we should consider the control of both the particulates and gaseous emissions, fly ash and SO_2, together.

There are two basic and different problems we face in providing truely clean smoke stacks for our industry: particulate control and gaseous emission. Particulates - dirt, ash, and soot - have been worked on a long time, and we have made substantial progress in their control. This industry has made more progress than the public recognizes and is even willing to acknowledge and has done it quietly, deliberately, and with great cost. We still have some distance, however, to go.

With any flue gas cleaning job, either particulate or gaseous, the first steps are easy and inexpensive. The closer we get to perfection, the more costly each incremental improvement step becomes. The costs rise exponentially, and perfection is actually beyond attainment.

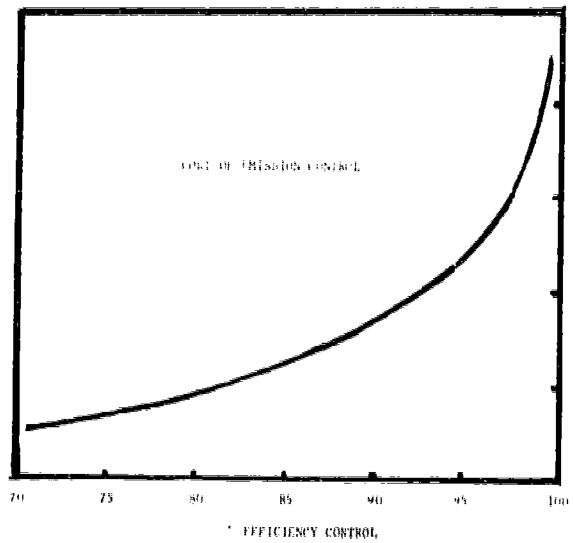


FIGURE 2.

ELECTROSTATIC PRECIPITATORS

The electrostatic precipitator has become the principal gas-cleaning device for pulverized coal-fired boilers as well as other industrial processes. The precipitator has the inherent characteristic of permitting dry collection and is high efficient on small particles. Electrostatic precipitators usually have the highest initial capital cost of all collecting systems, but operating costs are lower,so a true economic comparison must be thoroughly made to have a true cost picture.

The precipitator's principle of operation is to pass a gas slowly between a high voltage electrode and aggrounded plate. Dust particles are charged by the gas ions from the electrode and migrate to the grounded collecting plates where they adhere. Rapping of the collecting plates causes dust to slide downward in the hoppers.

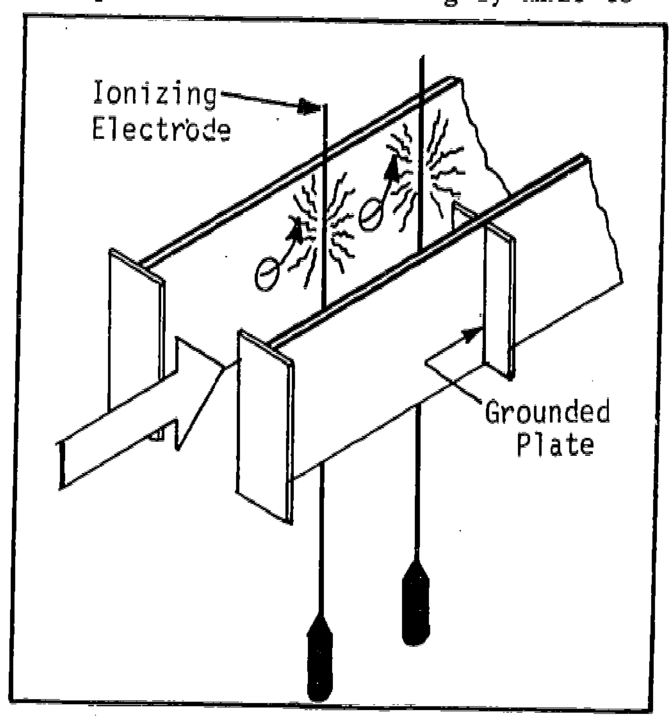


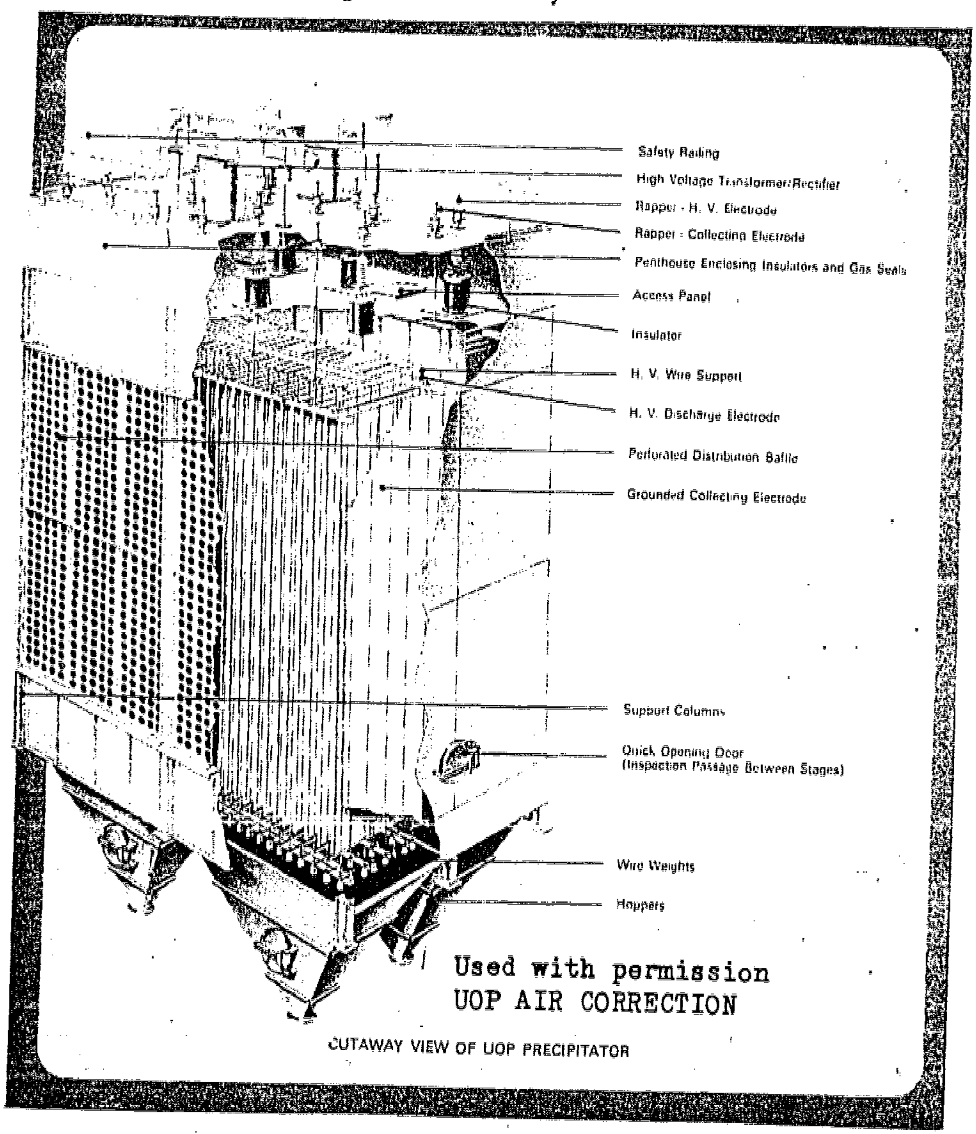
FIGURE 3. ELECTROSTATIC PRECIPITATOR

Precipitators are widely used and the fundamentals well developed since invention in 1906. Common applications other than pulverized coal-fired boilers include cement kiln dust, sulfuric acid mist, catalyst dust in oil refineries, and basic oxygen furnace dust.

Efficiencies are usually very high, and equipment design is not limited by temperatures to the 1,000° F. range. Pressure drop through the precipitator is very small, usually in the range of one-half inch because of the low gas velocities through the precipitator. Low gas velocity through the precipitator makes installations very large.

In applying electrostatic precipitators, even on similar installations, the most important single characteristic of the application is the electrical conductivity of the dust to be collected. The conductivity must be between that of a good conductor and a good insulator and not near either extreme. Dust particles with high conductivity readily lose their charge on the collecting plates and are re-entrained into the gas. Dust particles with low conductivity insulate the collecting plates, thereby reducing the grounding effect and causing poor collection.

Recent studies have indicated that present designed boiler exit temperatures can produce dust with high insulating values, 280° to 340° F., which adversely affect the ability of precipitators to operate at high efficiency. Reduction in sulfur content of the fired coal can have an adverse effect upon efficiency.



CUTAWAY VIEW OF UOP PRECIPITATOR

FIGURE 4.

BAG FILTERS

Application characteristics of the fabric bag collector are similar to the electrostatic precipitator in that the collected dust is caught dry and the bag filter is highly efficient on small particles. The cleaned gas is uncooled and unwetted. Temperature is limited by the fabrics available, with special fabrics today capable of handling about 600° F. Filters for industrial gas cleaning are usually a stocking bag type with woven or felted fabric made from a wide range of fiber materials. Dirty gas flows through this porous filter medium and deposits particles on the inner surface voids. As the voids fill and cake builds on the upstream fabric surface, the pressure drop increases to a point where the solids must be removed. Removal is accomplished by shaking or pulsing the bags.

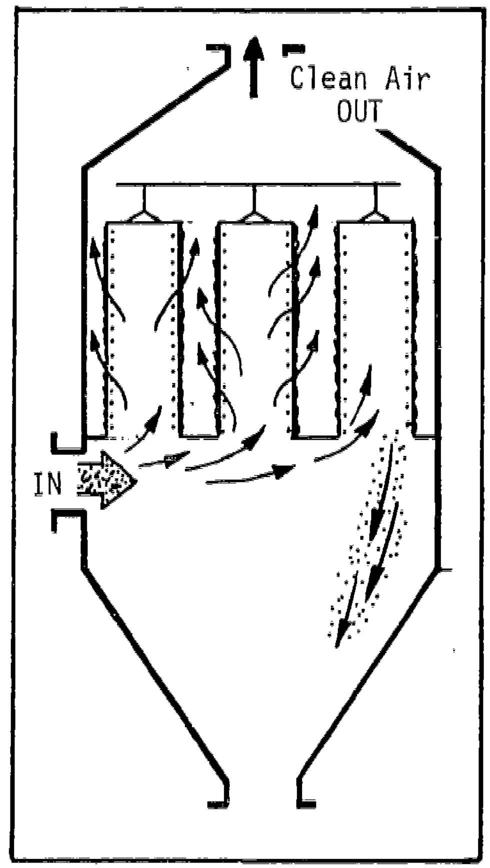


FIGURE 5. BAG FILTER

Bag filters are used for the high efficiency 99+ percent range on small particles well into the submicron range. Bag filters are not subject to characteristics of dust conductivity and temperature within limits. Because of low loading characteristics, bag filters are excellently applied when preceded by mechanical cyclones. Cost of bag filters falls within the moderate price range, and pressure drops indicate a moderate operating cost. Space requirement for bag filters is very large.

Temperature is the principal limitation of bag filters along with the inability to handle sticky dust or wet gases. Very hot gases can be cooled to allow the use of fabric, but if the gas is below the dewpoint, heating of the gas stream is required.

Traditionally, there have been very few installations of fabric filters on boilers. This is perhaps because of the moisture excursions encountered in startups and shutdowns and the possibility of blinding the fabric.

CYCLONES

The most basic tool in air pollution work, the most likely used, and yet the simplest of all is the mechanical dust collector, the cyclone. The cyclone is probably one of man's unique inventions in that it separates solids from a gas stream without moving parts, without the use of gravity, and in fact will work upside down.

Most cyclone systems used for coal-fired boiler applications are of multiple-tube type. Significant improvements in the multiple-tube collectors have been accomplished within the last five years. Overcoming the inherent deficiencies of the conventional multiple-tube collectors, these new designs give higher efficiencies, longer life, and elimination of maintenance problems.

There are three principle types of mechanical dust collectors in general use today on coal-fired boilers:

1. Large diameter cyclones
2. Conventional multiple cyclones
3. Totally accessible multiple cyclones

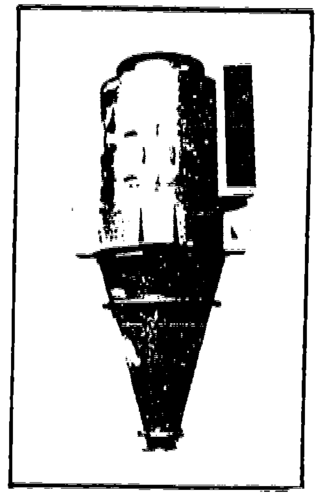


FIG. 6. LARGE DIAMETER CYCLONE

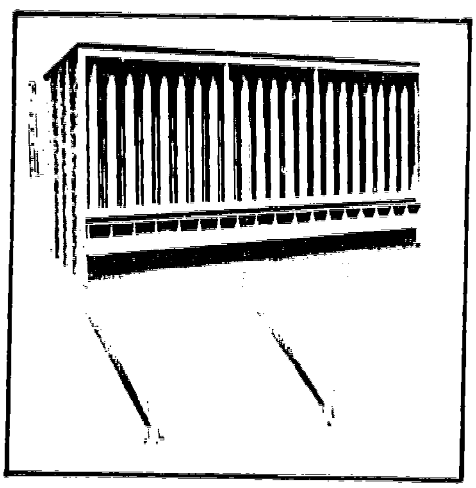


FIG. 7. CONVENTIONAL TUBULAR COLLECTOR

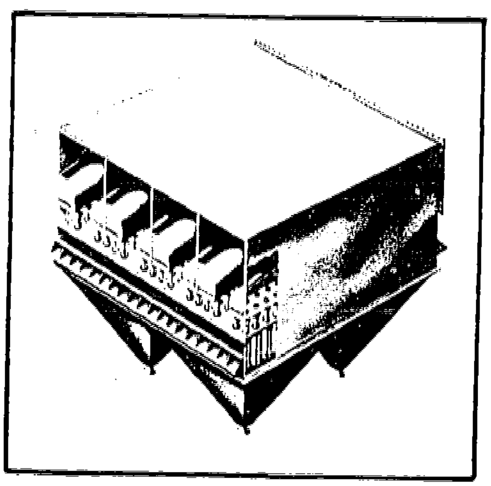


FIG. 8. TOTALLY ACCESSIBLE TUBULAR COLLECTOR

Each type has definite advantage that should be considered carefully in selection of a system.

The large diameter cyclone, from 30 to 80 inches in diameter, is ideal for handling materials that are sticky, tend to build up or operate at temperatures below the gas dewpoint, not usually considered practical for coal firing.

The multiple cyclone takes advantage of the increase in efficiency inherent in smaller diameter tubes. The forces of separation are increased with size reduction of the cyclones. The multiple cyclone system requires considerably less weight, height, and space requirement for a given installation. There are a number of features to construction and design of conventional collectors that prevent the normally high efficiency and long service from being obtained in coal-burning service. One of these is the lack of inspection, maintenance, and replacement capability within the unit.

The totally accessible design can permit entry into the collector and access to each vane and tube. Components can be easily inspected, cleaned, and replaced.

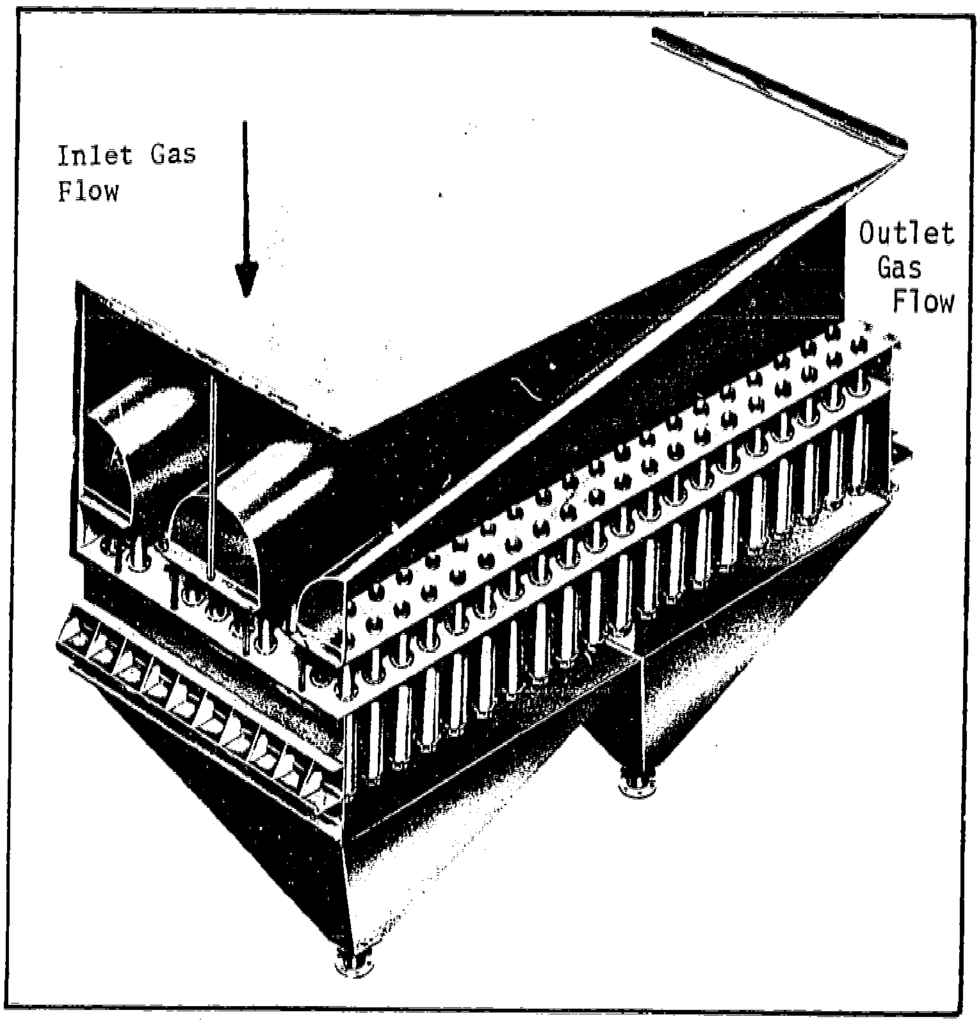


FIGURE 9. THE TOTALLY ACCESSIBLE DUST COLLECTOR

Conventional collector construction provides narrow passes between the rows of outlet tubes for gas to enter and make its way to the rear area of the collector. This gas velocity is in the order of 2,500 feet per minute through the tube area. This results in two factors that drastically affect performance of coal-burning collectors: 1) high wear rate from ash erosion and 2) through-put losses with hopper re-entrainment of small light particles.

Design of the totally accessible collector includes gas velocities into the collector and through the outlet tube area of less than 1,000 fpm. Erosion of the outlet tubes is reduced by some 10 to 20 times below the level encountered in conventional construction. This eliminates the need for wear shields and prevents the initial tube wear that once started progresses at a rapid rate.

Secondary Erosion

Several texts note erosion by dust-laden gases as a function of the fifth power of the gas velocity and of the third power of particle size.

One unique characteristic about erosion and wear in dust collectors is the secondary effect of initial wear. Once the incoming dust-laden gas has worn through the outlet tube wall, a condition exists similar to a pressure differential across an orfice.

A three-inch pressure at 500° F. will produce a velocity through the orfice of 10,000 feet per minute, causing wear to progress at a very rapid rate and contamination of the cleaned gas with char particles.

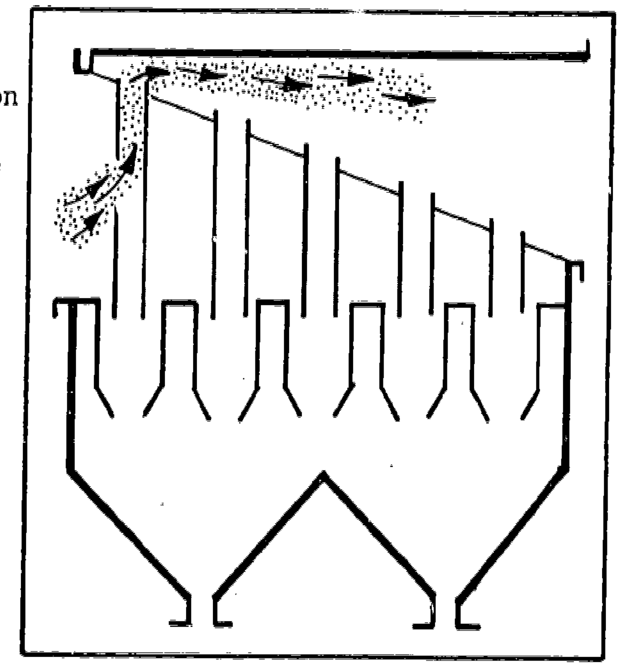


FIGURE 10. SECONDARY EROSION

Through-put Draft Loss

Standard designs of conventional collectors have a through-put draft loss in the order of 0.1 inch per row of tubes deep, resulting in losses in the range of 1.0 to 1.5 inches, just to distribute gas to the rear of the collector. The front area tubes match this loss in long outlet tubes.

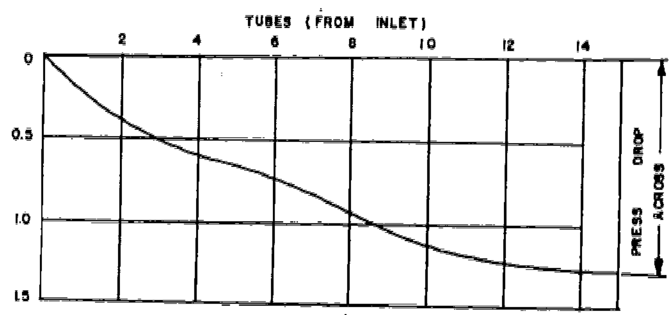


FIGURE 11. THROUGH-PUT DRAFT LOSS

Equally important in the TA design, with unlimited depth gas can find its way to the most remote tube, only passing a single tube row with virtually no through-put draft loss. Savings of 1.5 inches of through-put draft loss in a medium-sized collector is evaluated at:

$$\begin{aligned}\text{HP savings} &= (155{,}000 \text{ cfm})(1.5)(.000157)/.65 = 56 \text{ HP}\\ &= 56 \times \$50 \times 5 \text{ years}\\ &= \$14{,}000\end{aligned}$$

Hopper Circulation

Conventional collectors, with sloped tube sheets, varying tube length and through-put draft loss have pressure differential between the front rows of tubes and back rows. This differential causes gas to flow out of the front tubes down through the hopper and up through the tubes in the back rows.

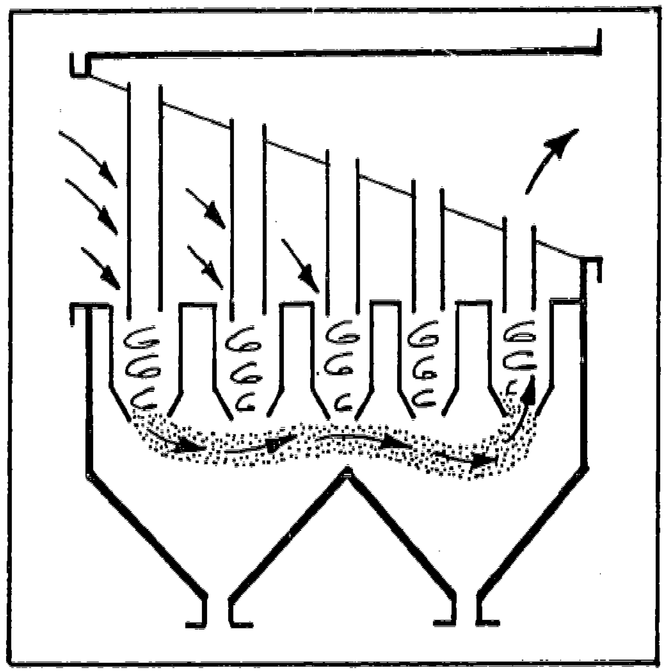


FIGURE 12. HOPPER CIRCULATION

This hopper circulation picks up light dust particles from the hopper and carries them up through the back-row tubes. Further, the small particles collected by the back-row tubes cannot be discharged into the hopper in the face of the gas flow coming up through the tubes. This re-entrainment of already collected material is of serious effect in conventional collectors.

Plugging

A gradual decline of satisfactory operation of a collector is usually an indication of plugging. This has been noted on high sulfur coal. There are a number of causes; however, each can easily be isolated and the problem corrected. There are generally three prime areas where collector plugging occurs. These are in inlet vanes, collection tube outlets, and at the recovery vane area in the outlet tubes.

Inlet vane plugging is rare because of the entrance velocity, but plugging does occur on occasion. Plugging of inlet is usually associated with material building up and falling off the walls of the collector into the vane area. Operating dust collectors without insulation, the outer walls will build dust. It is an excellent rule to insulate every boiler dust collector even though safety and heat recovery did not normally warrant such. Keeping temperatures well above the dewpoint in all areas makes good sense.

A plugged inlet vane or plugged outlet tube on a dust collecting system can easily pass ten times as much gas as is usually handled by the single tube. This gas is passed down through the hopper, re-entraining already collected dust and into the discharge of other tubes. A single plugged tube can reduce collection efficiency by 25 percent.

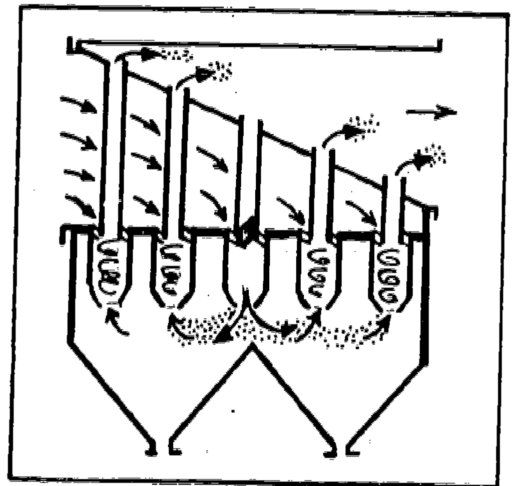


FIG. 13. PLUGGED OUTLET TUBES

The most common type of pluggage that occurs in mechanical dust collectors, however, is in the collecting tubes themselves. It is usually caused by allowing the hopper to fill, the level rising up to the collection tubes. The dust will fill up in the collection tube until equilibrium is reached. At this time the velocity inside the tube reaches a point to carry the new dust out the outlet tube.

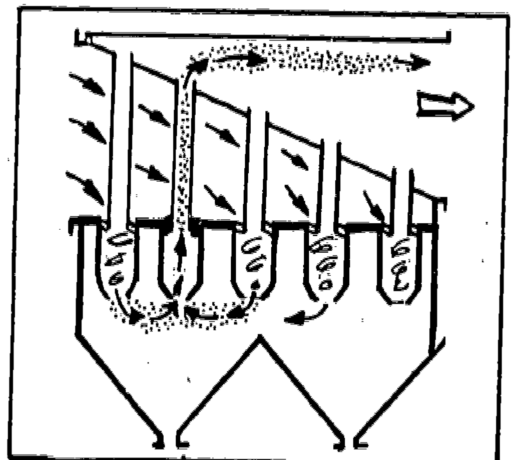


FIG. 14. PLUGGED INLET VANES

Emptying the hopper often fails to clear all the tubes, particularly on a dust such as coal ash, which will pack and bridge.

In these cases, not only is the tube letting dust-laden gas into the clean side of the collector, but the top layers of dust in the plugged tube is rotating at high velocity in one localized area causing serious wear.

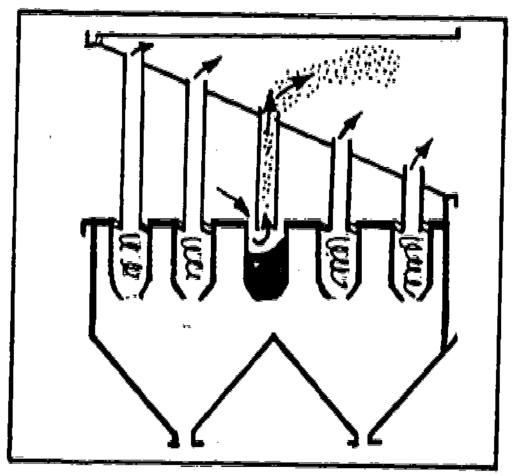


FIG. 15. PLUGGED COLLECTING TUBES

Leaking

Virtually all coal-burning boiler dust collectors operate on the negative side of the induced-draft fan. The hopper of these collectors operate at negative pressures and are subject to leaks which are both likely to occur and difficult to observe.

Leakage of air into the hopper or dust collector will reduce the collection efficiency of the system.

The various flanges of hopper assembly are serious leakage potential. They should be seam welded and all hopper seams welded both inside and outside.

If air leaks occur because of hopper leaks, worn or inadequate valves, or leaks between the tubes and the tube sheets, gas will enter and re-entrain hopper ash carrying it up through the collector tubes, seriously affecting collector efficiency.

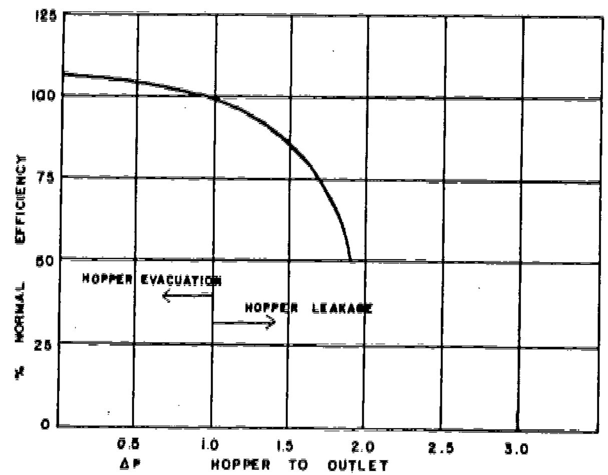


FIGURE 16. HOPPER LEAKAGE EFFECT

Collection Tubes

To capably evaluate dust collectors, the engineer must be aware that there are a wide range of collecting tube designs available, affecting volume of gas handled, draft loss, efficiency, operation, and price. The tube itself is usually of cast iron in a size range between 6 and 24 inches in diameter, nominally 9 inches in diameter for coal-burning boiler service. The smaller six-inch diameter tube is more efficient, but this is offset by the higher tendency to plug and the higher wear rate of smaller tubes.

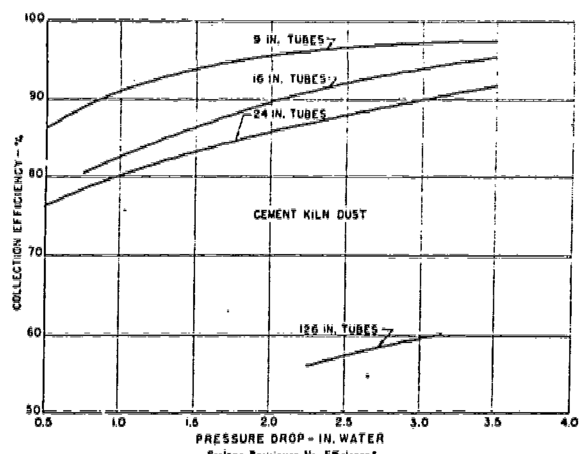


FIGURE 17.

The collecting tube described consists of the five basic parts: body, head, cone or boot, inlet vane or inlet volute, outlet tube.

The tube body is usually cast iron with thickness ranging from 3/16 inch in smaller sizes up to 7/8 inch in heavy-duty collectors.

Thickness of 1/4 inch is the usual practice in coal-fired boiler collectors.

The tube body is formed by either sand molding or by centrifugal spinning. Centrifugally spun tubes, like high-pressure pipe, is of completely uniform wall thickness and free from thin spots and holes but at extra cost.

The cast iron collection tubes can be obtained in various grades of hardness up to 600 Brinell. The harder tubes are more highly wear-resistant but are subject to both mechanical and thermal shock. Hardness of about 450 Brinell is a good compromise range for coal-burning service applications.

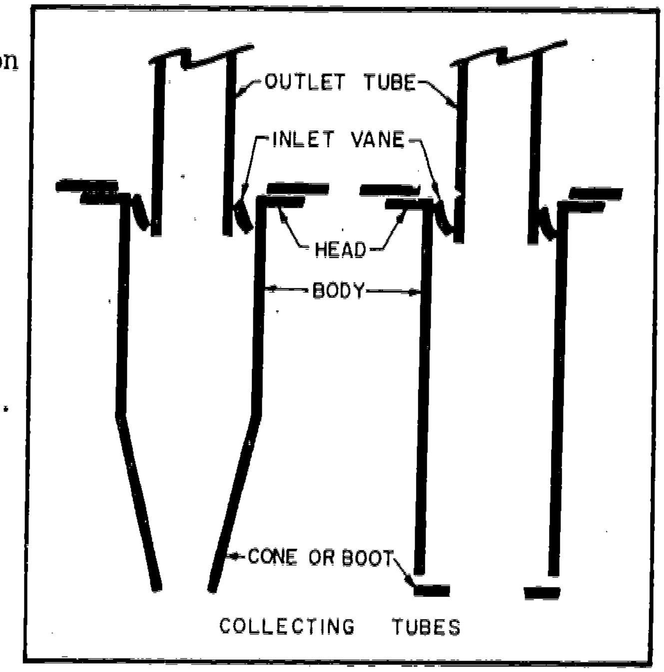


FIGURE 18.

Inlet Vanes

The inlet is the most prominet single factor determining efficiency and other operating parameters of a mechanical dust collector. There are two basic types of inlets: 1) the guided vane and 2) the volute inlet. Generally the guided vane is capable of much higher volumes, thus requiring fewer tubes and less cost and is the more prominently used. The volute entrance is capable of higher efficiency but at higher overall cost. The guided inlet is almost universally used on applications of coal-fired boilers.

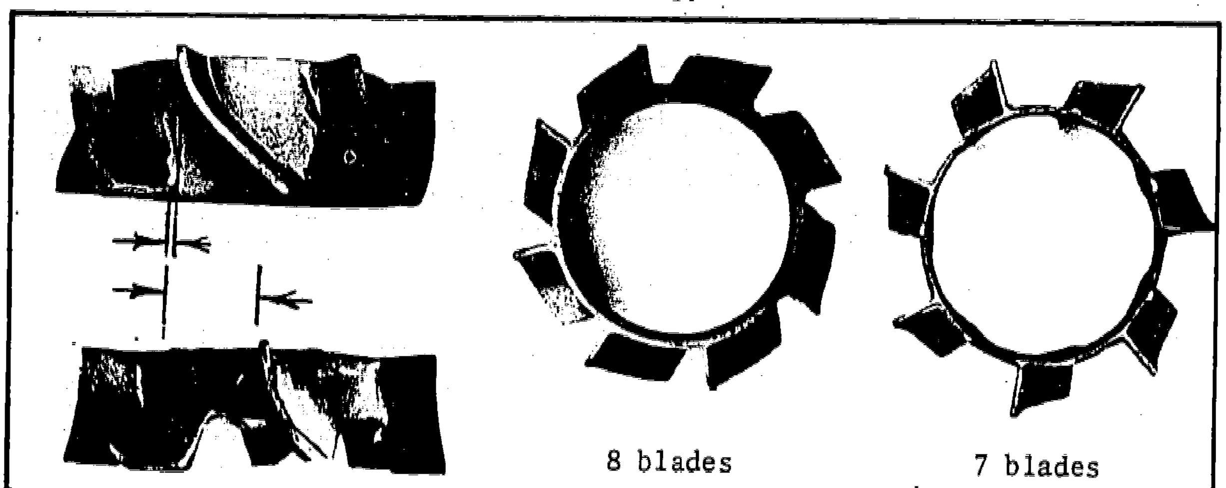


FIGURE 19. INLET VANES

The inlet vane itself can determine the amount of gas handled by a tube at a given draft loss. Steep pitch vanes handle more gas but at a decrease in efficiency. Shallow pitched vanes handle less gas but give higher efficiencies. The number of blades on a vane has a direct effect on efficiency; decreasing the number of blades allows the tube to handle more volume but does so with less efficiency.

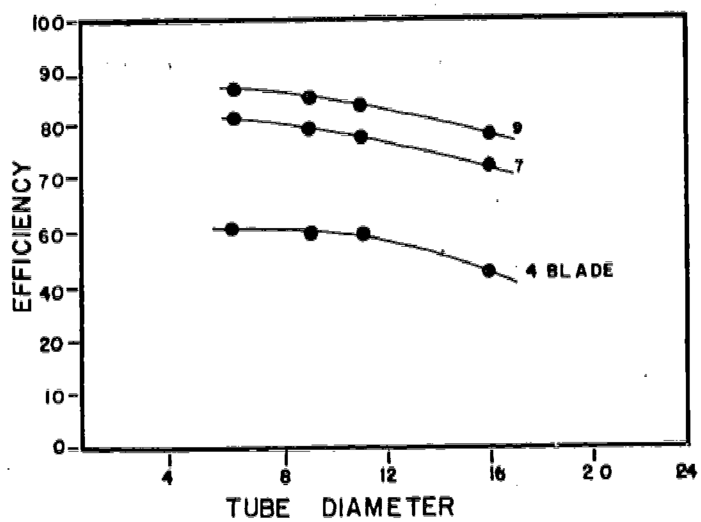


FIGURE 20.
EFFECT OF NUMBER OF BLADES VS. EFFICIENCY

Recovery Vanes

Recovery vanes are used in outlet tubes of dust collectors to recover the spiraling velocity energy of the outlet gas. In typical boiler applications, approximately .75 inch of draft loss is recovered by using an outlet vane.

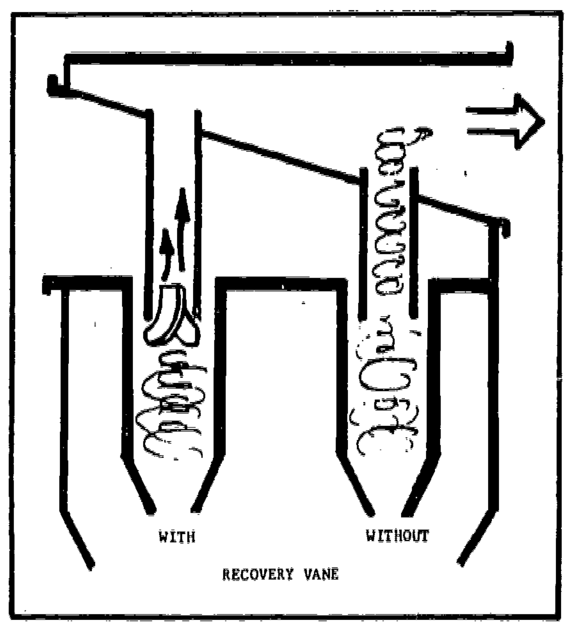


FIGURE 21.

There is serious doubt of any true value of the recovery vane because the use is accompanied by a reduction in efficiency of collection.

On any application where the finer particles of dust have any tendency to stick, such as oil firing in combination with bark, recovery vanes should never be used. There are apparently unburned oil fractions with dew-points above gas temperatures which, in combination with the fine char dust, cause a buildup on the recovery vanes. This buildup caus

Dust

the co
ventio
and ca
the tu
Where
being
are of
cific
periph
boot d
shown.
forman

auses outlet tube plugging and heavy

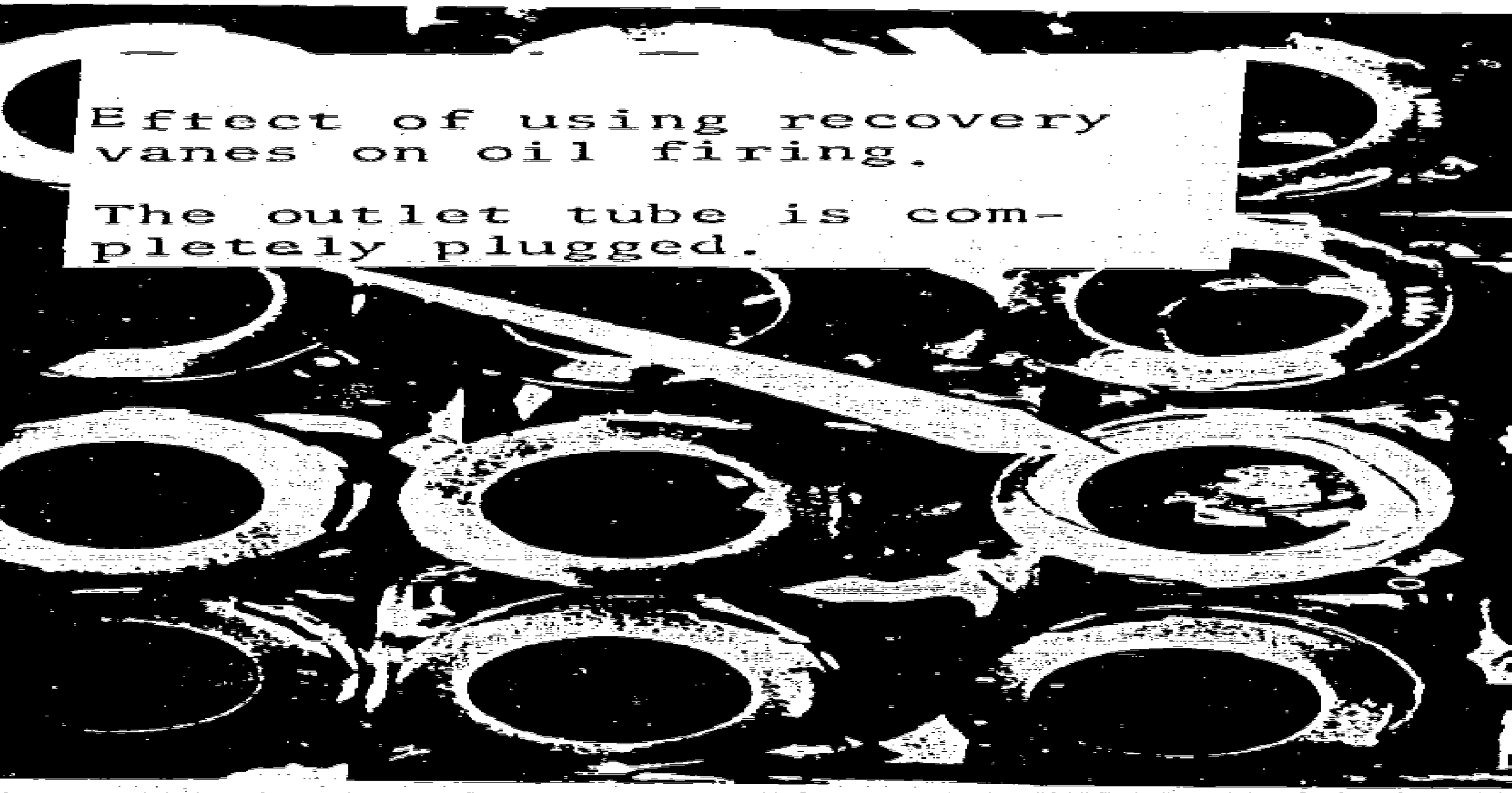


FIGURE 22.

st Discharge

There are two kinds of dust disch
e collecting tubes in multiple cyclo
ational collector tubes have a "cone
l cast as part of
e tube itself.
ere particles are
ng collected that
of very low spe-
fic gravity, a
ipheral discharge
t design has
wn superior per-
mance.

The peripheral discharge boot design has slots for dust ejection from the tube horizontally. In this manner the light and small particles are thrown out of the tube gas stream before the gas makes a reversing vortex. It is in the reversing vortex that the already collected paravane char particle can become re-entrained. Laboratory tests have shown that the use of a center hole in the peripheral discharge boot will not affect the operating efficiency of the collecting tube. The use of a center hole does provide, however, an entrance for gas in-flow to the tube if the collecting system does develop hopper leaks.

Areas of highest tube wear are in the cone of the cone tube and in the boot of a peripheral discharge boot. While the cone is a part of the tube itself, the peripheral boot can be made replaceable, extra heavy, extra hard, and be easier to replace or repair than an entire tube which must be unbolted from the tube sheet.

Collector Arrangements

The flexibility offered in new dust collector designs make fitting the collector into the boiler system and using the collector for duct much easier. The totally accessible design has allowed more than 50 tubes deep, providing long but narrow collectors, and top inlet provisions that are simple in construction.

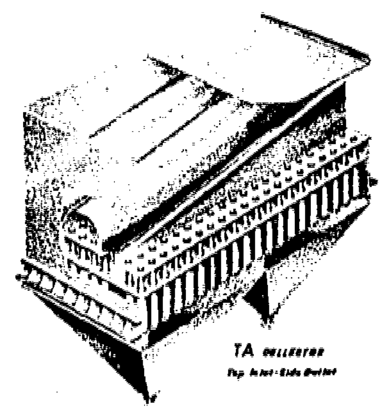


FIGURE 24.

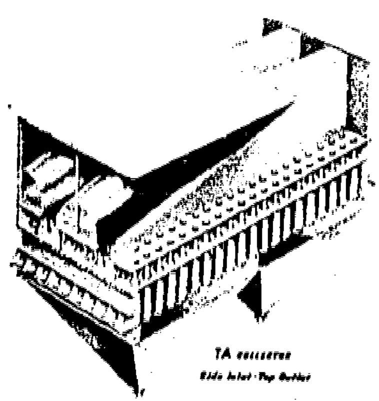


FIGURE 25.

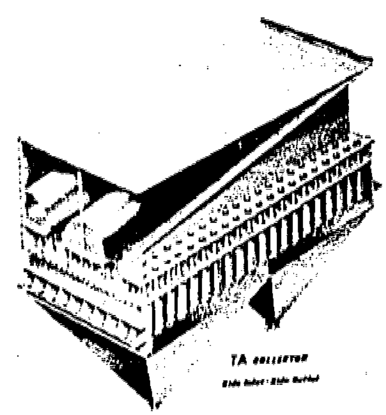


FIGURE 26.

Many new arrangements are possible. These new collectors can match the width of the boiler outlet exactly, fit within the boiler structure steel, and eliminate the need for wide and flaring ducts.

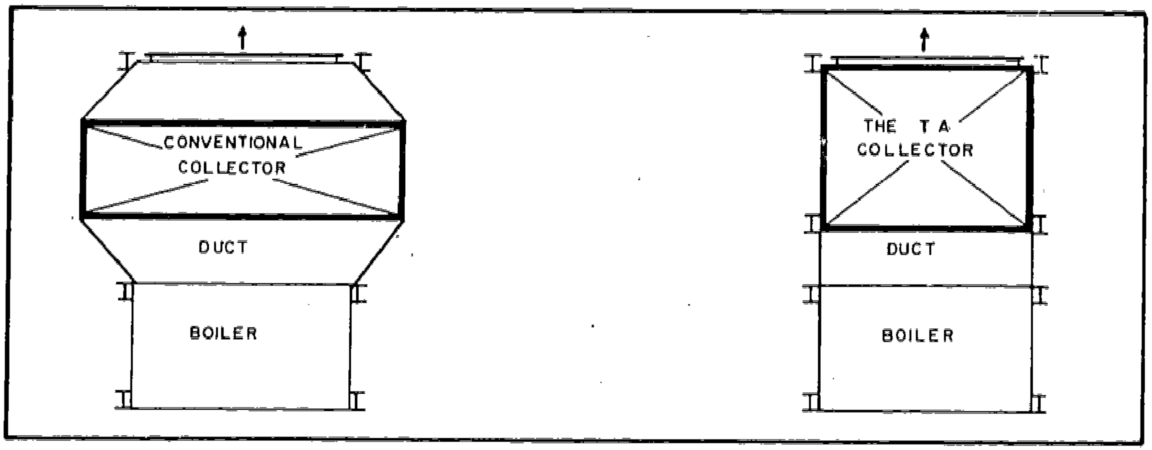


FIGURE 27.

Gas and Dust Distribution - Duct Design

Design of duct work has pronounced effects on the operation of dust collectors and the performance of fans. While this is a full subject in itself, there are several important points of general interest.

Poor design in collector entrance duct will reduce the collector efficiency and impose concentrated wear in areas. The gas distribution and the dust distribution should both be kept uniform as possible. Good gas distribution does not always mean good dust distribution. Frequently we find systems which produce uneven distribution of dust over a ten to one range. There should be provisions that would prevent the high wear in high dust loading.

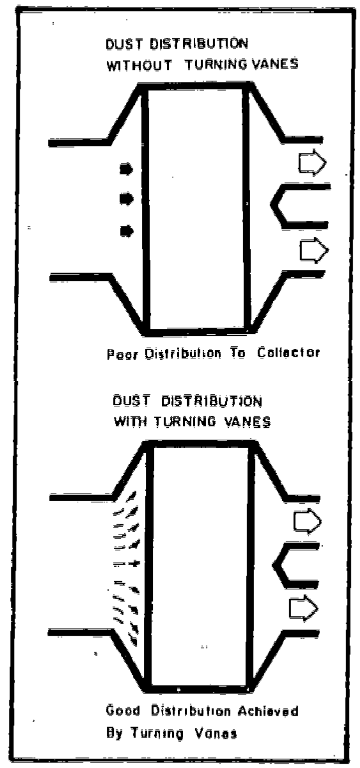


FIGURE 28.

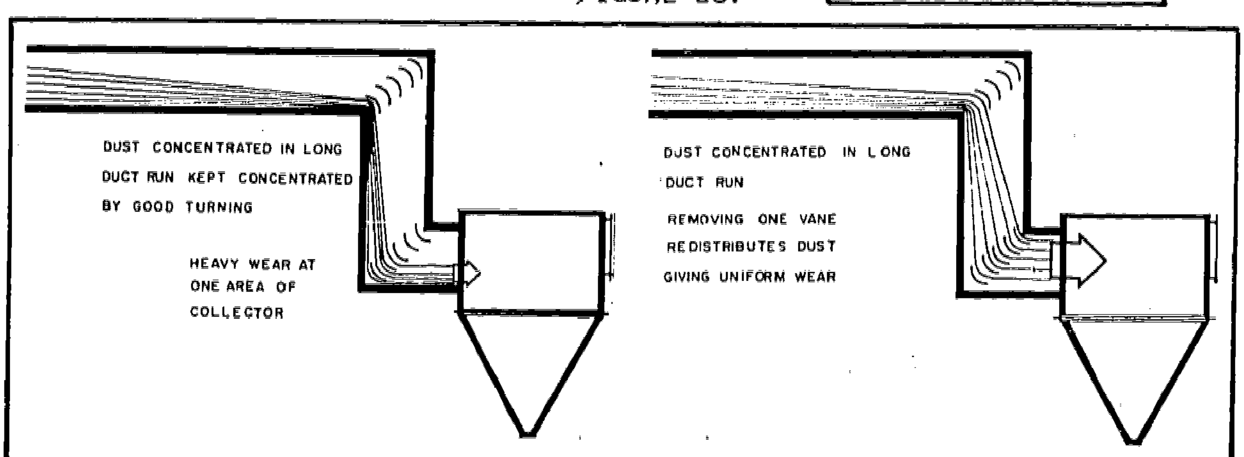


FIGURE 29.

Location of Dust Collectors

There are several schools of thought on location of dust collectors on boilers. The collector can be located immediately at the boiler outlet. Here the temperature is higher and the gas volume larger, resulting in a more costly dust collector. The boiler exit temperatures are not usually of any design problem. The principal argument is that the collector removes the ash and prevents erosion in the air heater and economizers which follow.

An opposing argument exists that the collector be located after the air heater so that the larger particles coming from the boiler will keep the air heater and the economizer clean. Locating a collector after the air heater makes it a smaller unit and less costly because it operates at lower temperatures and less gas volume.

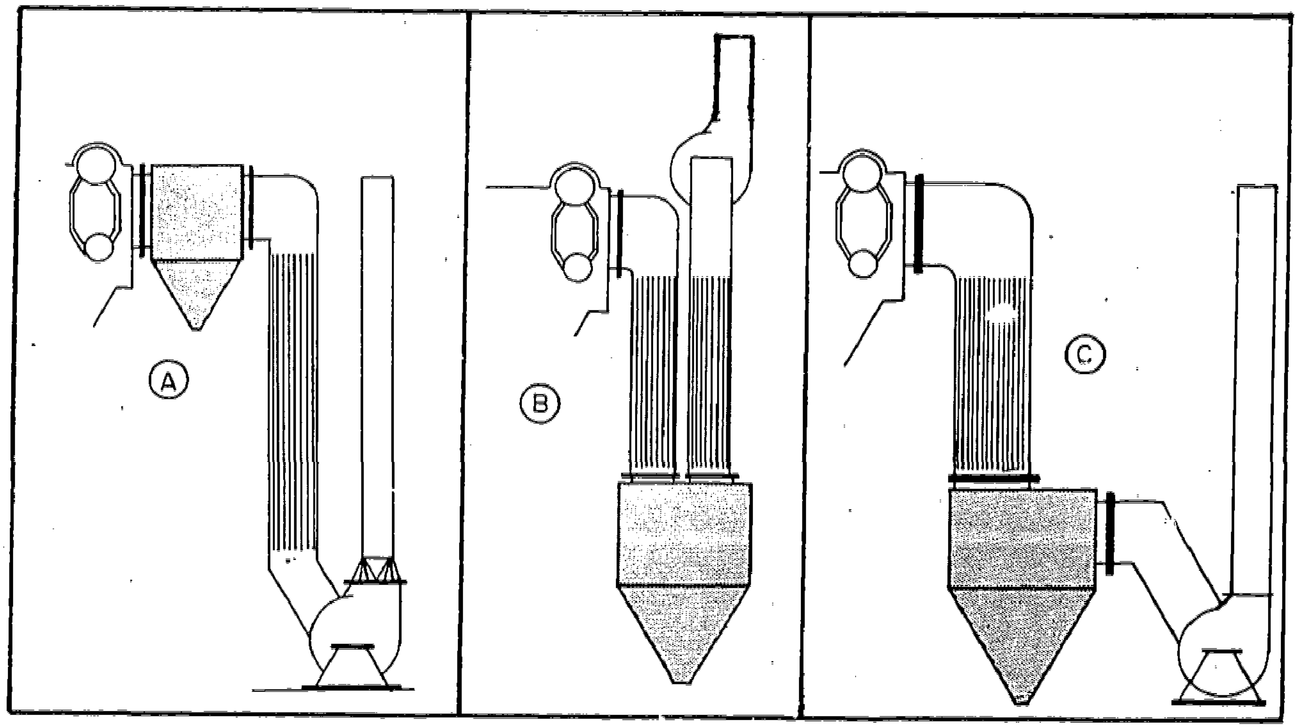


FIGURE 30.

The collector can also be fitted into the system between the air heater and economizer, perhaps at the bottom using the collector itself for turning duct. Certainly in every case, the collector should precede the induced-draft fan.

SPECIAL DAMPER USAGE

Sectionalizing for Low Load Operation

Many engineers prefer having a method of sectionalizing the dust collector during periods of operation at low loads. At lower gas volumes, partial closing will increase the resulting flow through the remaining section, keeping the pressure drop high and the efficiency high. While it is primarily a reduction in the heavier or larger particles, the collector can be sectionalized with dampers into two, three, or more parts. Separate hoppers and hopper discharge systems must be provided for each section.

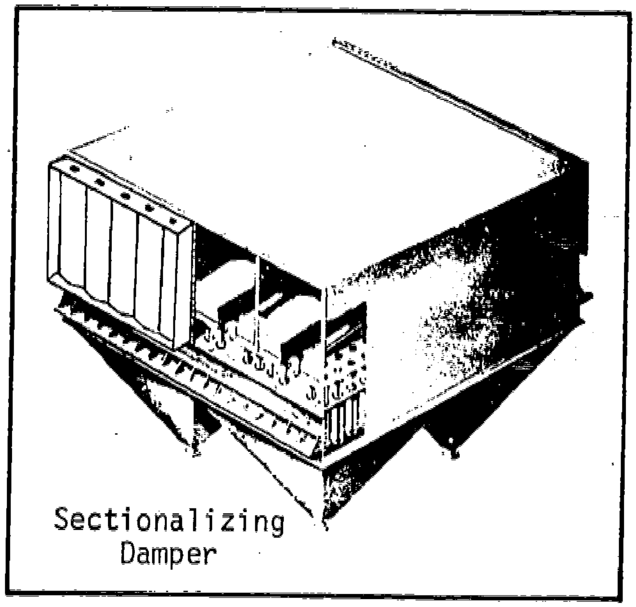


FIGURE 31.

Gas Firing

The totally accessible collector has inherent provisions for an integral bypass for use with gas firing. By opening the integral damper system, the collector tubes are bypassed, removing the collector loss from the system.

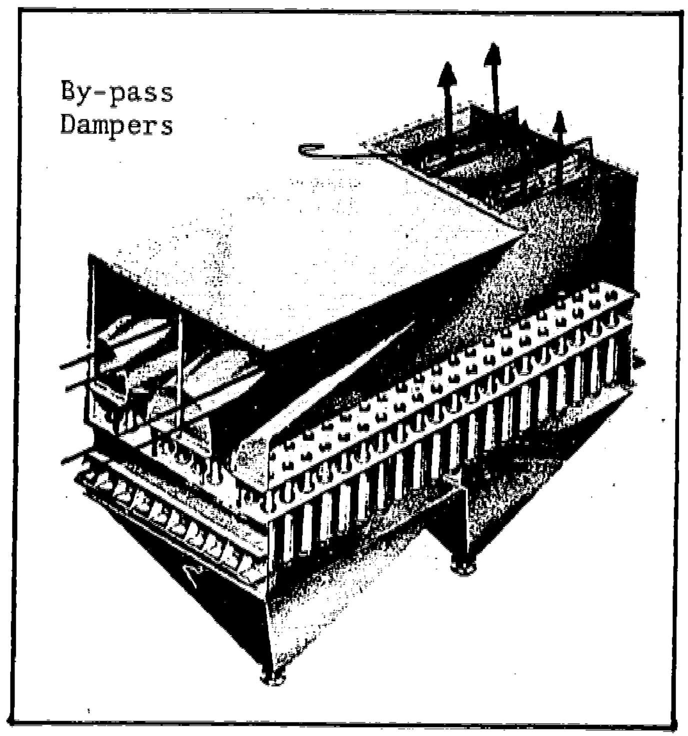


FIGURE 32.

Two-Stage Collection

Although controlled reinjection and good collector design are major steps in both improving collector performance and achieving that performance in actual field installation, there are a number of areas where work is under way to further reduce stack emission loadings from boilers.

At the Coosa River Newsprint mill of Kimberly-Clark, the new 300,000-pound boiler has two TA collectors which are installed in series or a two-stage collection system. The first collector is located at the boiler outlet with the second collector after the induced-draft fan.

	First Stage	Second Stage	Combined
Volume, cfm	245,960		
Inlet loading, gr/scf	2.806	.2345	
Pressure drop	2.0"	2.0"	4.0"
Outlet loading, gr/scf	.2345	.1097	
Efficiency	91.64%	53.21%	96.1%

Both collectors at Coosa River have nine-inch tubes using high-efficiency "A" vanes, totally accessible design, no recovery vanes, and use peripheral discharge boots. The boiler at Coosa River has a stack emission measured at 0.24 pounds per million BTU. While Alabama has no established code at present, this emission would fall well within the stringent codes of Georgia, South Carolina, Los Angeles, and Federal facilities.

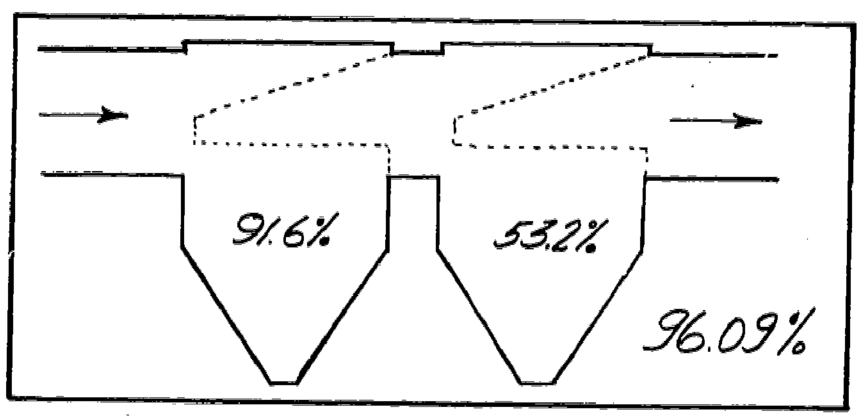


FIGURE 33. TWO-STAGE COLLECTION

Hopper Evacuation - Assisted Collection

A method of upgrading or assisting existing mechanical dust collectors or new collectors that are marginal in meeting air pollution code requirements, is the use of hopper evacuation. Allowing leakage into a hopper can reduce the efficiency. Similarly evacuation of the hopper can increase the efficiency. Evacuation is usually uniformly taken from the upper area o. the hopper and brings out very fine dust that is slow to settle. This fine dust must be cleaned from the evacuation stream by scrubbing. The effect of hopper conditions caused by leakage, hopper circulation, or hopper evacuation is illustrated. This is an effective technique for use on existing collectors, particularly to overcome losses traced to hopper circulation re-entrainment and general leakage.

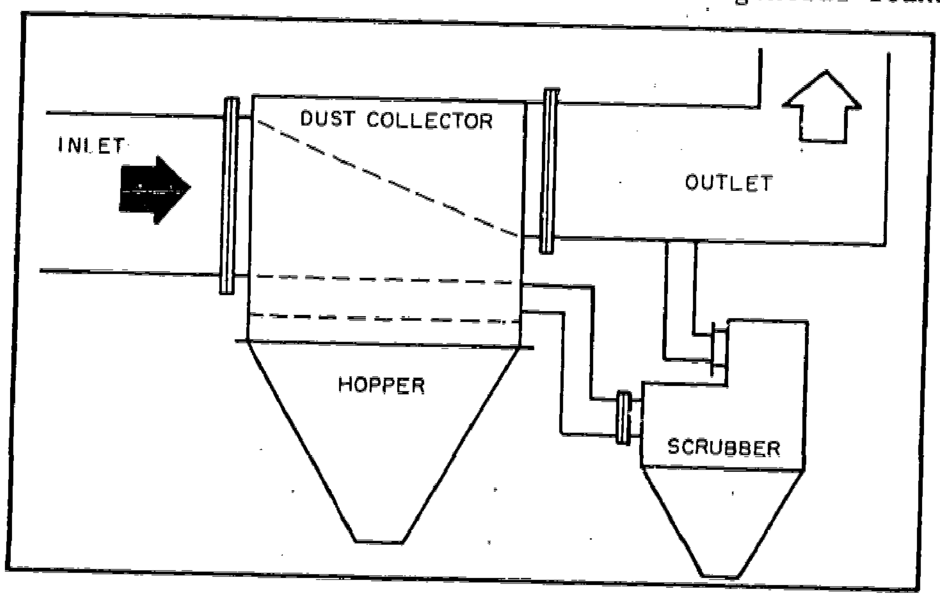


FIGURE 34.

Secondary Shave-off

The most promising approach to improving the basic mechanical collector beyond two-stage installations is with a secondary shave-off system. The gas from the main collecting tubes spiral up in the outlet tube at very high velocity. Normally this is where the recovery vane is inserted to regain some of this energy in the form of static pressure. The spiral up through the main tube and up through the outlet tube is of small radius and higher velocity than the original cyclone action. This high velocity spiral centrifuges that residual uncollected dust into an outer boundary area, making in effect a layer of gas that is "dust rich." This dust-rich gas is shaved off, allowing the main gas stream to continue on to the fan and the stack. The dus-rich gas from the boudary area, and possibly the gas from hopper evacuation is put through a small medium-energy wet scrubber where it is 100 percent cleaned of the fine particles. This wet gas from the scrubber is then returned to the main, cleaned, hot gas str am. Mixing the wet shave-off gas with the main hot gas stream provides a hot and dry stack without evidence of a plume.

Shave-off quantities can vary from medium to up to substantially half the main gas stream if necessary. With very small amounts of shave-off, the residual dust in the final stack discharge can be greatly reduced.

Several installations of secondary shave-off have been sold and are awaiting shipment, installation, or final testing. Other installations of totally accessible mechanical collectors for boilers are equipped with provisions for later adding secondary shave-off to the system.

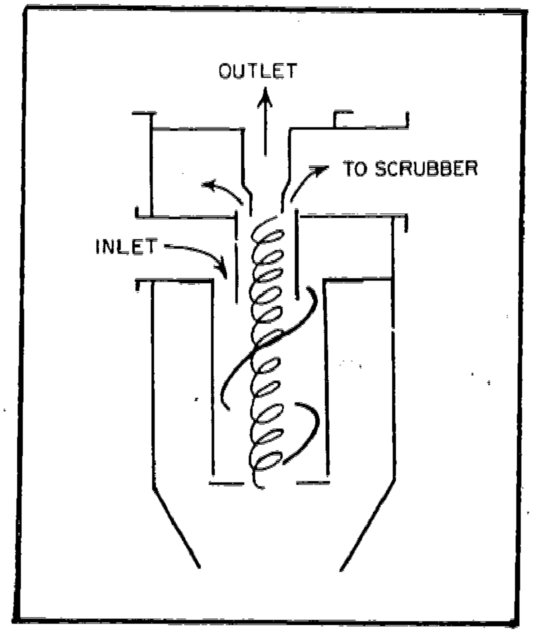


FIGURE 35.

SCRUBBERS

The wet scrubber uses water or other liquids to trap particulates or absorb the gaseous emission from a process. The liquid containing the entrapped material is then separated from the gas stream. There are many variations of scrubber designs, each with specific advantage.

For coal-fired boiler applications in controlling oxides of sulfur and nitrogen from the stack gases, scrubbers are alone among the air pollution control tools with the ability to control gaseous emission.

In general, scrubbers:

Collect the contaminant material as a slurry or a solution,

Cool the incoming gas and are virtually unlimited by high temperatures of the gas stream or moisture content,

Require minimum amounts of operating space, and

Are low in initial cost and size.

Scrubbers cover the very widest range of particle sizes and efficiencies - with power requirements determined by the pressure drop and efficiency requirement and

Are capable of very high efficiencies.

Scrubbers are available in a wide range of materials: steel, stainless, fiberglass, and others.

A wet plume is produced unless reheat, gas cooling or hot gas blending is used.

There are variations in scrubber designs; however, the three basic types generally used include the cyclonic, turbulent contact, and the high-energy venturi.

Cyclonic Scrubbers

Typically a cyclonic scrubber is a large tank with tangential inlet and a method of introducing the scrubbing liquid into the cyclone body. A spray system wets the dust particles inside the cyclonic scrubber. Centrifugal force separates the wetted particles from the gas stream. Pumps and piping are an integral part of the cyclonic system, and pump spray pressure determines efficiency and operating cost. Pressure drops across cyclonic scrubbers are in the order of one to six inches.

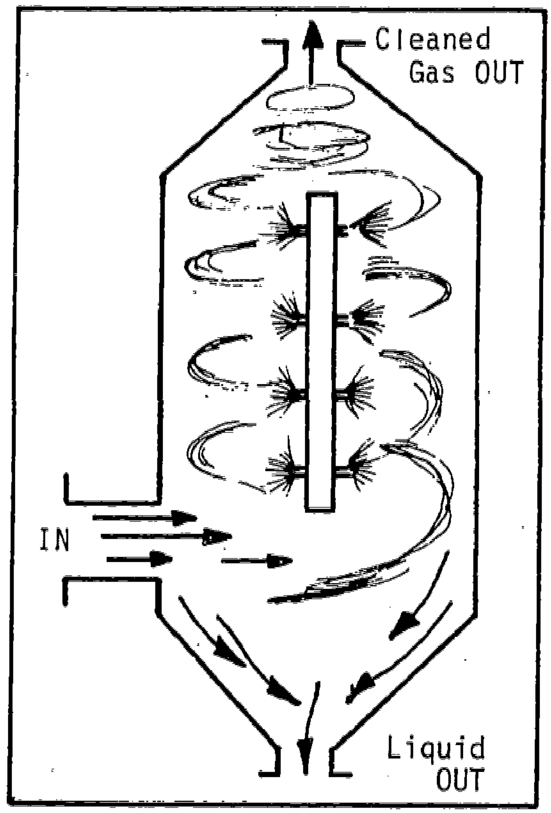


FIGURE 36.

Turbulent Contact Dustraxtor

The Dustraxtor design of turbulent contact scrubber uses the liquid level and inlet gas as a venturi to draw the water into the contact tube. Gas goes up the tube with violent mixing and is dewatered by deflectors in the upper area with the liquid returning directly to the hopper. Liquid from the dewatering area can be directed to drag type hoppers, flotation, or decantation vessels, or can be removed from the hopper itself at controlled solids content. The design shown uses no pumps and valves and can be operated with solids content of the scrubbing liquids above 30 percent.

The DX design is used for coal preparation dedusting, slurry scrubbing of SO_2, scrubbing of NO_2 in production of nitric acid, slaking, and a wide range of other power and chemical plant applications. This design can have varied tube lengths to allow a wide range of contact times, one of the important variables in gaseous emission scrubbing. Efficiencies are in the 95-99 percent efficiency range with pressure drops approximately six inches.

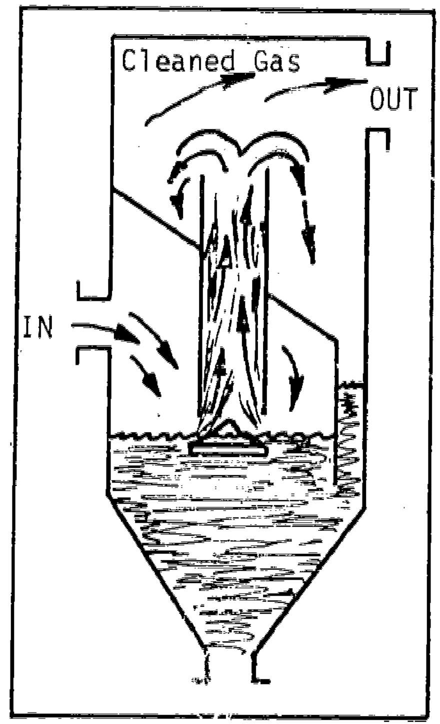


FIGURE 37.
DUSTRAXTOR
SCRUBBER

Venturi

The high-energy venturi has become the workhorse of scrubber application engineers. Dirty gases are passed through a duct loading down into the venturi throat where they make the transition from the hot duct to the wetted wall through the air preventing the problem of buildup, scaling and corrosion, which are important considerations in scrubber applications.

The narrow throat, completely wetted, develops a high gas velocity in the order of 200 to 600 feet per second, literally impacting the entrained dust with the slower moving water. The throats are made adjustable, or water rate control can maintain high efficiency over a wide variation in gas flow rates.

It is important to have even water distribution in the throat area to prevent "holes" in the impact area where dirty gas can escape through unwetted.

An expanding discharge section is utilized to regain some of the pressure drop before entering the cyclonic separator. A flooded elbow is often used to turn the high velocity gas/liquid to the separator without wear problems. Separators are large cyclonic tanks designed to allow centrifugal gas action with an upward velocity that is less than the terminal velocity of the water droplets formed. This allows the combination of "rain" and centrifugal separation to remove the liquid from the stack of gases.

The high-energy venturi requires piping and pumps to circulate the liquid, and it requires settling, drag, decantation, or clarifying equipment to remove the sludge so the effluent water can be returned to the scrubber for reuse. Makeup water on all scrubbers is usually that required for evaporation and that water carried away with the processing of sludge.

High-energy venturis operate in the 20- to 100-inch pressure drop range and have efficiencies in the 99.9 percent range.

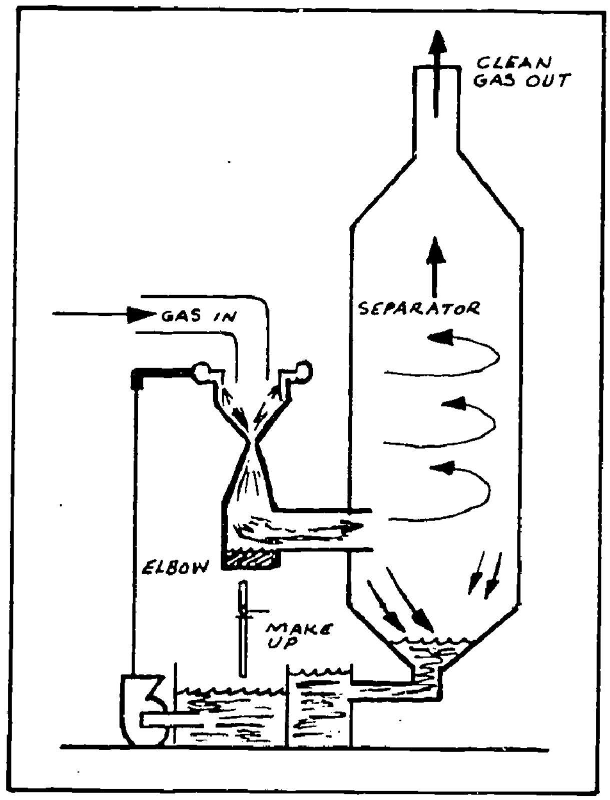


FIGURE 38.
HIGH-ENERGY VENTURI

CONTROL OF PARTICULATES AND SULFUR OXIDES

Several states and municipal areas today have already written codes which restrict the amount of sulfur dioxide emission to the atmosphere allowed from burning fossil fuels. Typical of these are areas like New York state where the SO_2 emission from a power plant must be controlled to that equivalent to burning fuel in the 0.3 to 0.6 percent sulfur range. Consolidated Edison has announced that possibly in 1973 their generating plants burning fossil fuels will have emission levels down to the equivalent of a fuel supply of a 0.37 percent fuel sulfur.

Some 32 million tons of sulfur dioxide is discharged into the atmosphere each year, representing 16 million tons of sulfur, or enough to make 50 million tons of sulfuric acid. Probably 60 percent of this sulfur dioxide comes from buring coal. With increasingly rigid air

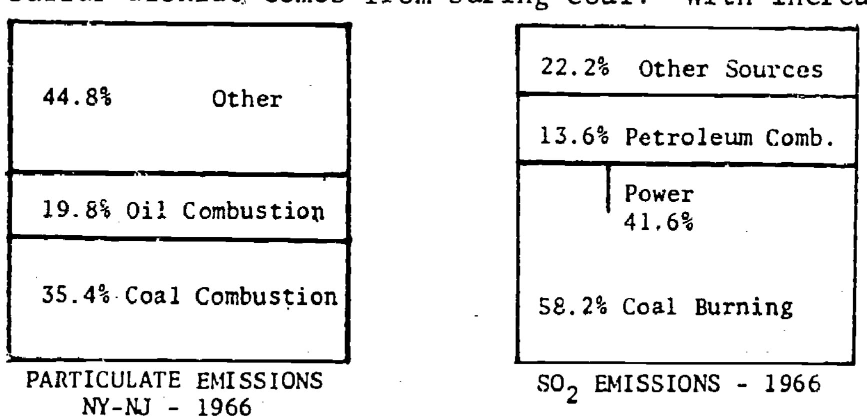


FIGURE 39.

pollution control ordinances, coal-firing operations are faced with either using low-sulfur coal or removing the sulfur compounds from their stack gases.

One approach is for the fossil fuel user to contract for the supply of a low-sulfur fuel on a long-term basis in order to comply with the air pollution requirements. This in itself must be self-defeating in the view that something like 10 percent of the available fuel supply will comply, and increasing demand for the scarce natural low-sulfur fuels will drive the cost higher. A few of the large utilities have virtually locked up all the available supply of low-sulfur oils. Consolidated Edison and Boston Edison have committed major contracts with Esso, Standard, and Hess Oil for a substantial amount of low-sulfur oil. Commonwealth Edison of Chicago has committed to burn some 2 million tons of low-sulfur Wyoming coal, with full recognition of complications from transportation, freight cost, and storage.

In recent years there has been an increasing interest in the desulfurization of fossil fuel. Second to coal, petroleum products produce the next largest amount of sulfur oxides. Fuel oil serves a wide variety of requirements, from heating homes to generating electricity, and some 20 percent of the SO_2 discharged into the atmosphere can be directly attributed to the petroleum products. The petroleum industry has done a good job, however, in reducing the sulfur content of its products. In the 15 years from 1950 to 1965, the residual sulfur in crude oil that remained in the end products was reduced by almost 50 percent. The petroleum people still have a long way to go because with the proposed and adopted regulations on SO_2, it is probable that the sulfur allowances will be in the order of 0.6 percent for heavy oils.

One of the areas that has been attractive to the petroleum people to reduce sulfur in the fuel oils has been the availability of raw sulfur market.

Within the last few years sulfur has been in short supply, and sulfur prices have been good. As a result, some of the expensive cost of desulfurization has been offset by the available market price of the sulfur and sulfuric acid by-products.

Sulfur can be reduced in coal by removing the iron pyrites from coal by beneficiation. This adds considerably to the cost of coal and does not do the complete job. Very few coals can be reduced down to one percent sulfur content by the removal of pyrite because of the higher organic sulfur content. Actually, about 2 percent minimum sulfur content is a general realistic goal, and even this cannot be achieved with some coals, and is expensive. To make a one percent reduction in sulfur costs between 5 and 10 cents per million BTU's with about a two percent minimum content achieved under the most optimistic desulfurization projections.

Although the removal of sulfur from coal prior to firing is an ideal objective, removal of sulfur dioxide from the stack gases holds more immediate promise. A number of feasibility studies have been undertaken examining treatment of flue gas to remove these oxides of sulfur. Some installations have already been put on the line. Others are in pilot stages, and many others are in laboratory stages today.

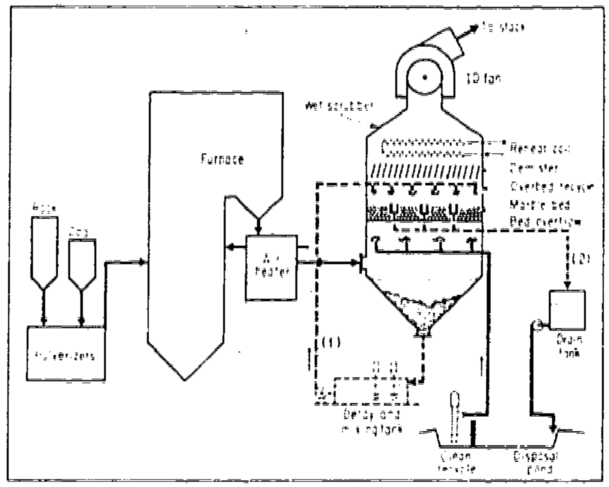
These processes include absorption of SO_2 in aqueous bases or slurries, oxidation of SO_2 with adsorption on activated char, catalytic oxidation with absorption in water, and absorption of the oxides of sulfur on alkalized solids. In some of these processes the sulfur is recovered. Recovery is either in the form of sulfuric acid, ammonium sulfate, or as elemental sulfur.

Substantially all the work under way leading to recovery of sulfur is keyed to the large tonnage fuel uses - the large central station utility coal- and oil-fired steam generating system.

If systems that recover sulfur from flue gases of power plants become economically feasible, they must pass two hurdles. First, the United States production of raw sulfur is some 12 million tons annually. Sulfur, while for the recent years has enjoyed a good market, is historically on erratic market. With some 16 million tons annual content of sulfur from combustion and industrial processes, this is one-third more again than all the commercially mined sulfur for all uses in this country. If recovery of substantial amounts of sulfur from fossil-fuel systems were achieved, this recovery could not help but depress the sulfur market and have serious effects on the projected value gained by the recovery. Secondly, recovery of sulfur from the flue gas will require large amounts of capital equipment, operating costs, and marketing expertise beyond the cost and capital investment for SO_2 control itself. If it becomes economically feasible in the foreseeable future to both control and recover sulfur from flue gases, this author believes it will be so only for the very large operators, and even then in the distant future. The operators of smaller boilers, 20,000 to 200,000 pounds of steam per hour, can look forward to simple SO_2 removal systems without recovery.

There are today some 25 different systems for SO_2 removal. Two of these are considered the most advanced and practical: the dry limestone or dolomite injection system and the wet limestone scrubbing process. The use of limestone or lime as an absorber for sulfur oxides has been studied for over a period of 36 years. Most of the work until recently has been small-scale pilot work, but now major tests and actual full-scale installations have been made.

Significant among the dry limestone injection processes is work by Combustion Engineering resulting in orders for complete systems supplied to Union Electric Company, Meramec Station, St. Louis, Missouri, and the Kansas Power & Light Company, Lawrence Station, Lawrence, Kansas. The Union Electric boiler is equipped with facilities to inject limestone through the top row of burners, treating the flue gases in a scrubber, reheating the exit gas and simple disposal of the wet solids. It is interesting to note that this system installed on an existing boiler bypasses the existing precipitators and the gas flow is diverted to scrubbers. This system was designed for removal of 82 percent of the sulfur dioxide and 99 percent of the particulates.



Modifications to increase sulfur removal include (1) recycling and retention of spray reject water and (2) direct discharge of bed overthrow to disposal pond, These changes will promote reactivity between sulfur oxides and calcined limestone

FIGURE 40.

The other dominant process, and the one that holds the most promise, does not include injecting dry limestone into the furnace but scrubbing the flue gases with a slurry of limestone. Introduction of the lime directly into the scrubber system eliminates potential boiler operating problems such as abnormal slagging and errosion.

Much experimental work has demonstrated that 90 percent or more of the sulfur dioxide can be removed from stack gases by scrubbing with a slurry of limestone. Good utilization of the absorbent is expected. Techniques have now been worked out to overcome the scaling problems.

A thorough discussion of all the available dust collection and scrubbing systems that are available and a look at the requirements we face in the future in the way of gas cleaning of coal-fired boilers certainly lead us to some new thinking about conventional gas-cleaning applications.

If SO_2 removal is a requisite, these are likely to be scrubbing systems. The scrubber, in obtaining 90 percent SO_2 removal, easily achieves 99+ percent particulates control. This leads us to question whether equipment to collect only solid particulates, at high efficiency, is necessary ahead of the scrubber.

There is merit in considering mechanical collectors as precleaners to the SO_2 scrubbing system to keep from fouling the limestone slurry and reduce the additional separation requirements of heavy fly ash solids from the slurry.

Zurn Air Systems is involved in SO_2 scrubbing system projects at this time, each unique and each applicable to the small coal-fired boiler application. One such project, funded by Zurn Industries and the National Air Pollution Control Administration, is being built to operate as a mobile pilot plant. This unit, on a trailer truck, will include a complete package of mechanical collector-scrubber combination of stainless steel, fans, complete with all the instrumentation, reactant vessels, tanks, and mixers, and SO_2 and NO_2 monitoring equipment. The mobile system will be made available to run plant sites using various reactants under controlled conditions.

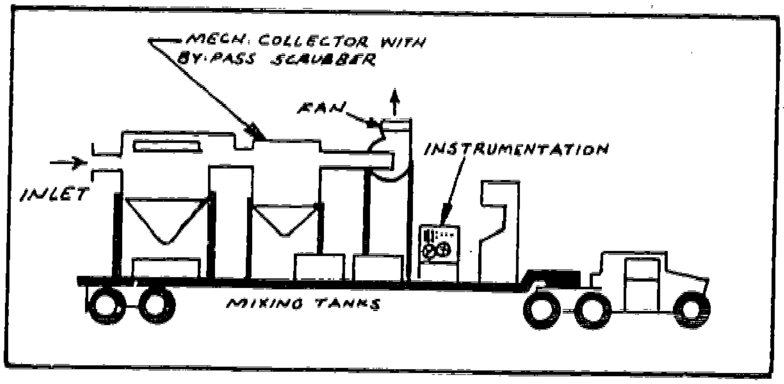


FIGURE 41.

This mobile unit has several prior commitments, including the Colbert steam plant at TVA, testing a pulverized coal boiler using a native limestone. The mobile test unit will be available for making on-site evaluations of various reactants. It can be rolled up to an existing boiler, and tests easily run on particulates and SO_2 control using locally available reactants to determine efficiency, foresee and correct problems, and determine best reactants combination.

Zurn Air Systems is supplying a complete particulate-SO_2 removal system for a 400,000-pound boiler for the City of Key West, Florida.

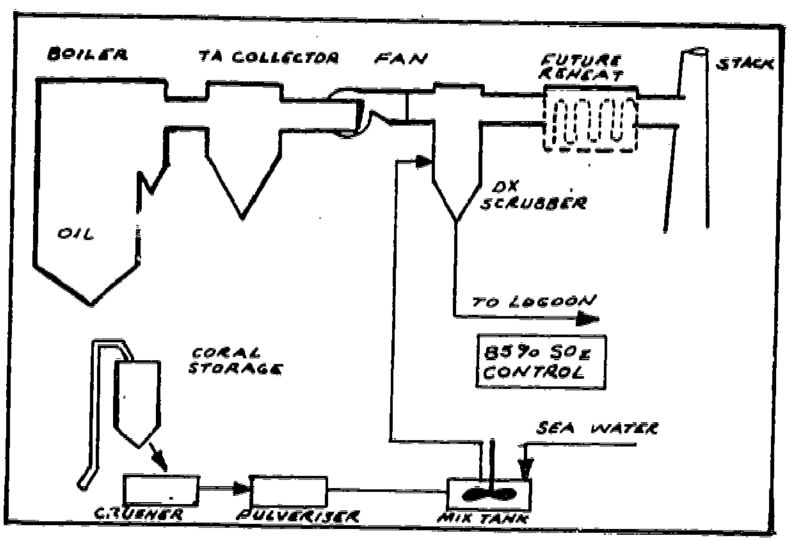


FIGURE 42.

This boiler will serve a 40-megawatt generator at the new Stock Island generating station. The boiler will fire bunker "C" oil from Venezuelan sources, having a sulfur content of 3.5 percent. The guarantee conditions are 98 percent particulate removal, 85 percent SO_2 control. Unique in the Zurn designed system for Key West, the scrubbing slurry will be a combination of sea water and pulverized native coral marl, from which the island is formed. Underflow from the scrubber will contain calcium sulfite piped to a lagoon where it settles and oxidizes to calcium sulfate, and inert material that will be used as landfill.

Zurn is offering one large midwestern utility and a major industry SO_2 scrubbing systems using sodium hydroxide (NaOH) as the reactant.

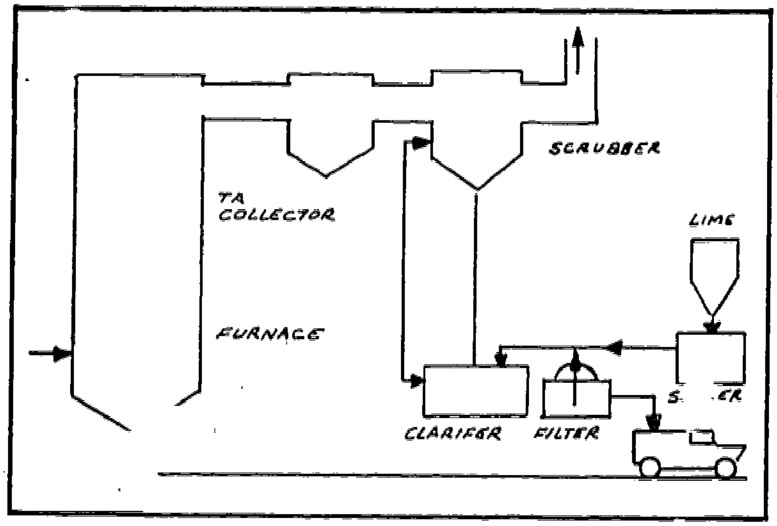


FIGURE 43.

The utility job involves 200 megawatts capacity and the industrial boiler is 200,000 pounds of steam per hour. The accompanying flow sheet describes the process and demonstrates two basic advantages of the NaOH process over the limestone or lime scrubbing. The scrubbing solution is a true solution and not a slurry. The NaOH is much more reactive with the sulfur oxides than lime slurry. Much higher efficiencies of SO_2 removal are obtained. Further, using sodium hydroxide prevents scaling within the scrubbing system. The sodium hydroxide is completely recovered in the process using a typical paper mill conversion system of slaker, filter, and clarifier. The only operating raw material that must be purchased is common lime as a convers on additive. This sytem does not need the investment in crushers, pulverizers, and storage capac y that is necessary for the limestone slurry process.

Sulfur dioxide can be controlled from coal-burning boilers. It will cost in added capital investment and in increased operating expense. The costs are reasonable, and the systems can be provided with reliability and performance consistent with the demands of the industry. A review of the costs expected include:

Coal firing - 200,000 # steam/hr.
90% SO_2 control (5% S x 10% emission - .5% S equivalent)
99+ % particulate control
Capital investment:
$250,000 to $500,000 (all total new system)
$125,000 to $250,000 (over present best particulate air pollution practice)
Operating cost:
2¢ to 4¢/million BTU

The coal-burning industry that is concerned with the 20,000 to 200,000-pound boiler can expect that the future will include requirements for SO_2 control, likely with the use of scrubbers and unlikely to include recovery of the sulfur.

QUESTIONS and ANSWERS

"PARTICULATE and SO_2 CONTROL TECHNOLOGY"

1. Ques: Have you considered Geothermal Energy?
   Ans: Barron - Will not have a great effect on the total requirements

2. Ques: Will the public accept the installation of reactors within cities?
   Ans: Barron - No - from what surveys indicate to me.

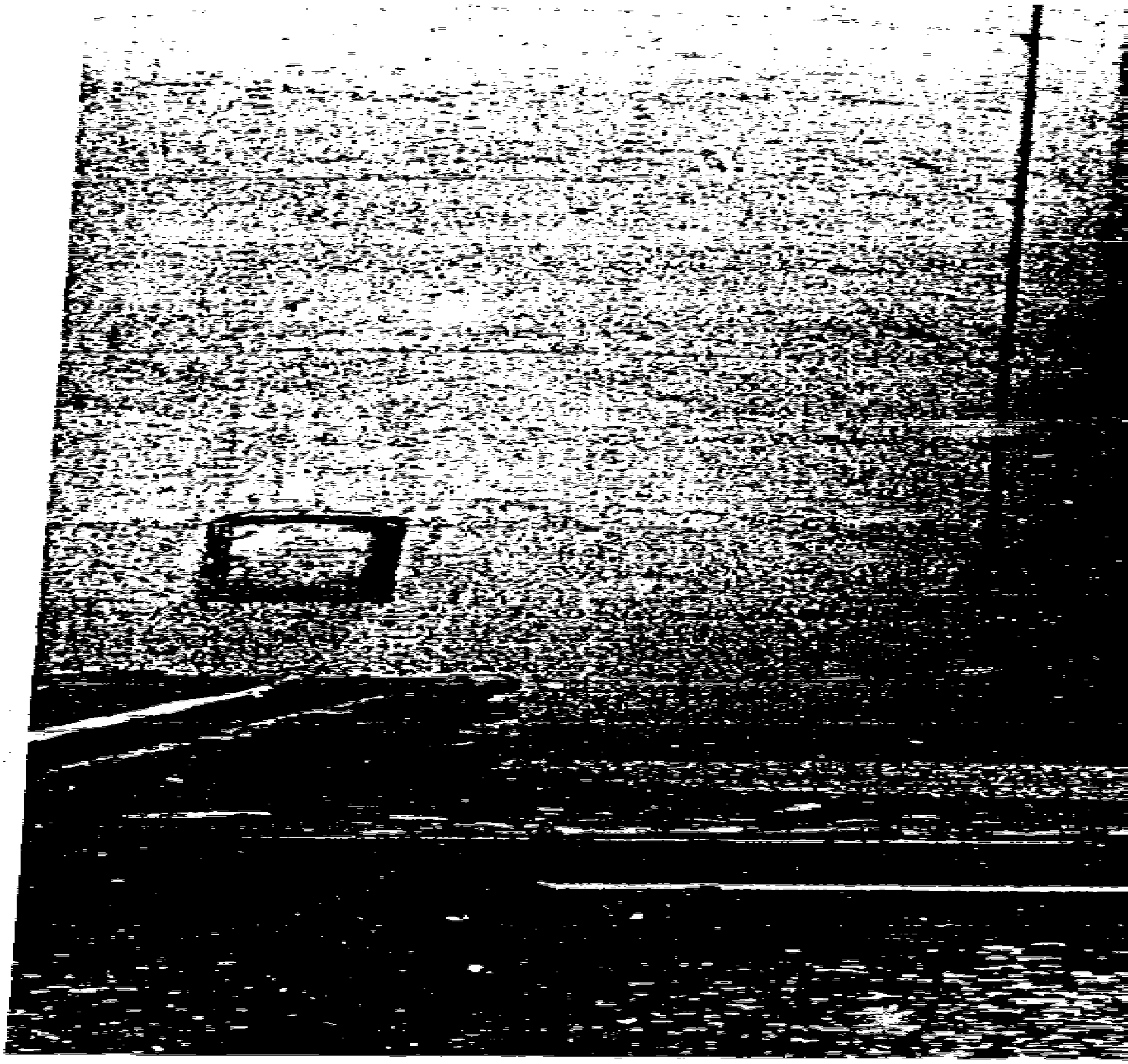
3. Ques: On double alkaline system, what is the operation cost?
   Ans: Barron - 3¢/ 1 million BTU

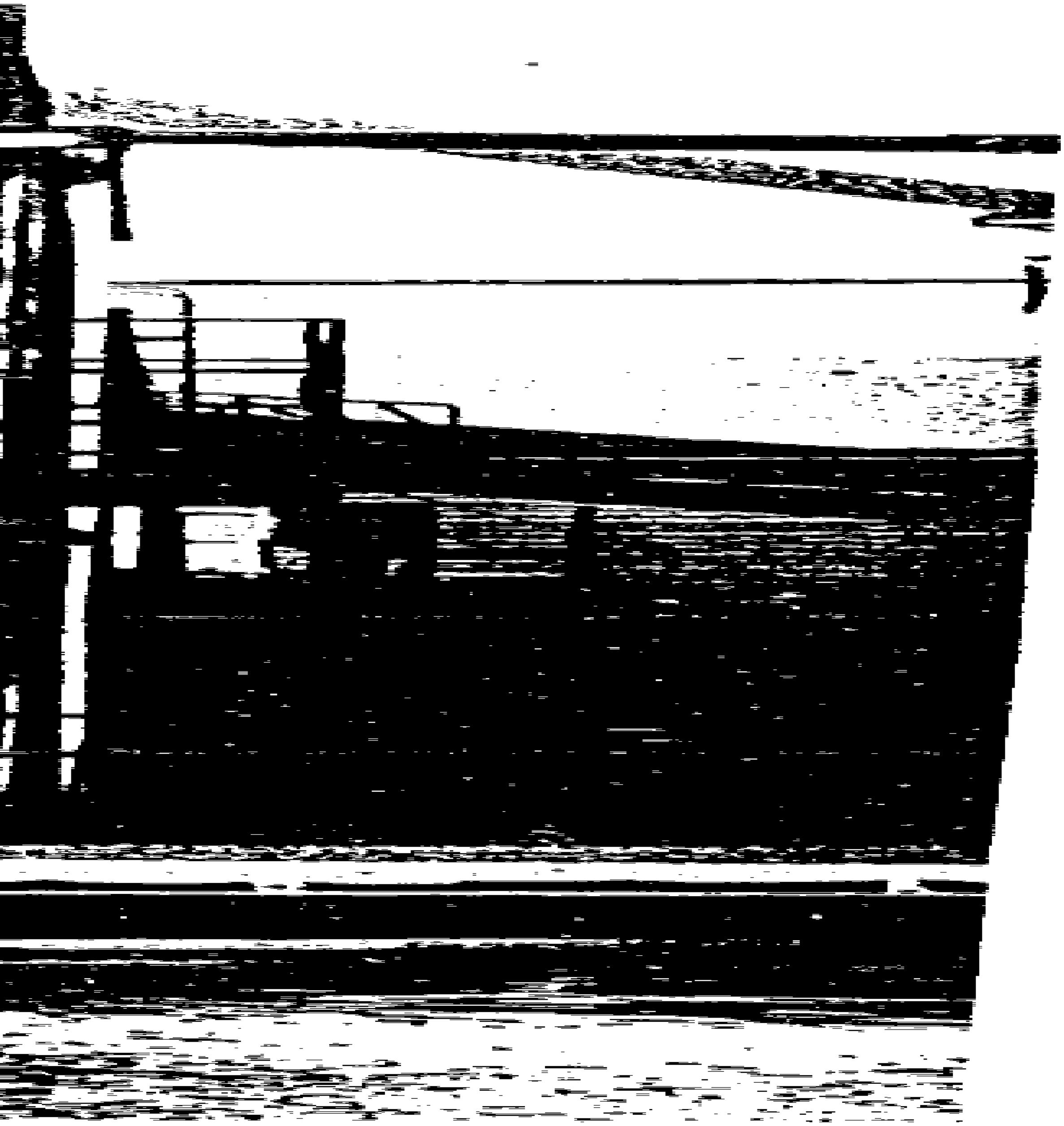
4. Ques: If you solve the SO_2 problem, do you get away from the Particulate Problem?
   Ans: Barron - Yes --you could end up with simple mechanical equipment.

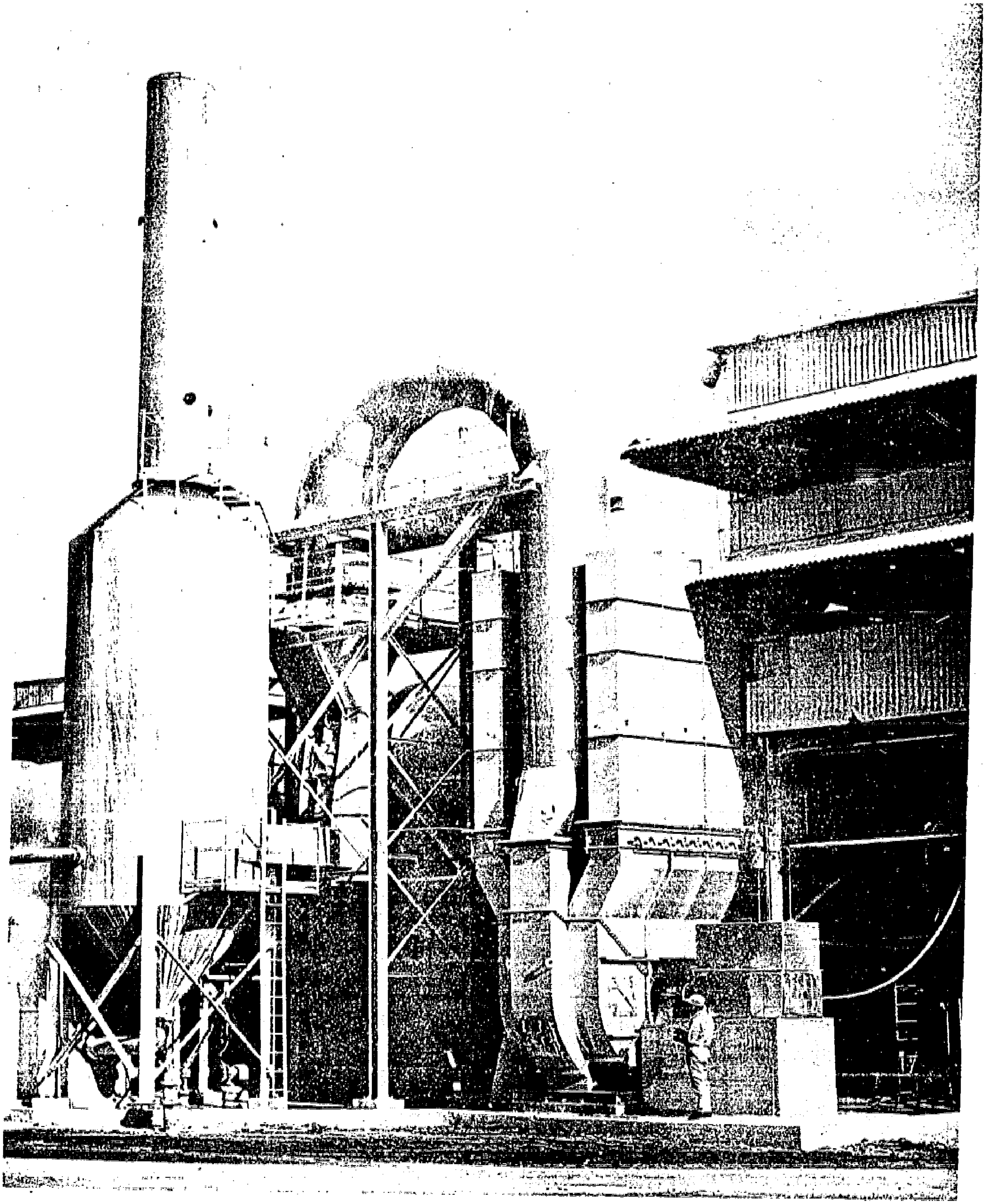
5. Ques: The Government has lowered the minimum on SO_2, what happens when you can get down to the minimum?
   Ans: Barron - You can get down to the minimum but the cost will be fantastic.

6. Ques: Is there in this country a working SO_2 scrubbing system?
   Ans: Barron - No.

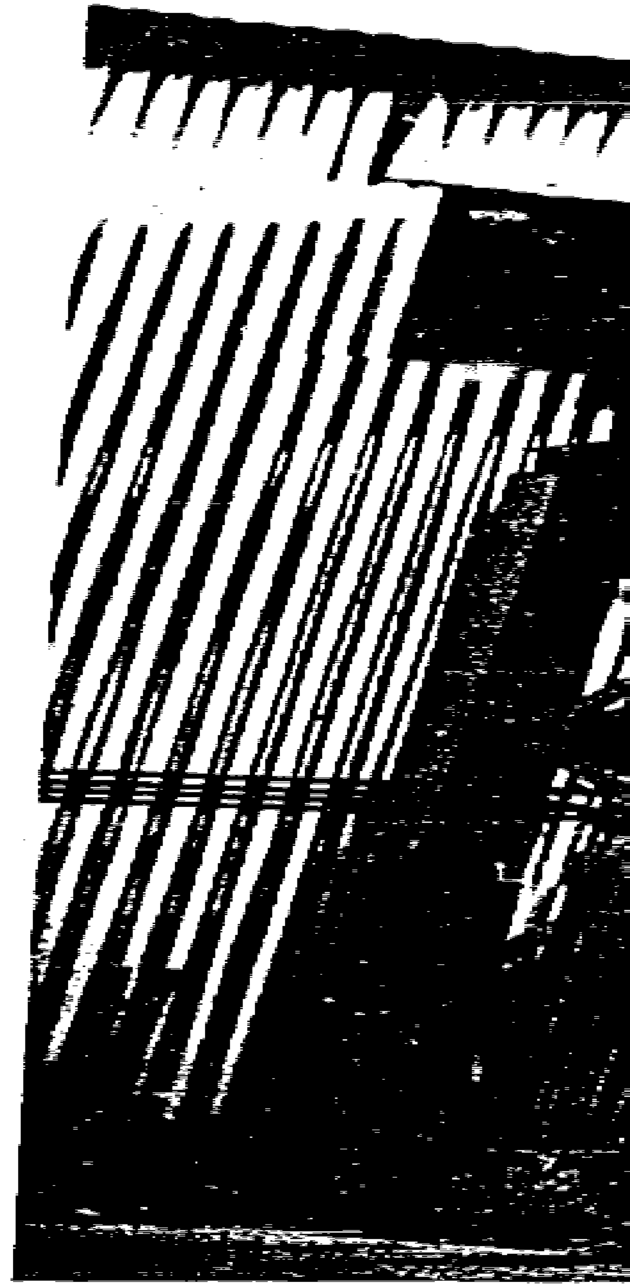
Ques: Won't the cost of Alaska Oil be expensive?
Ans: Barron - Yes

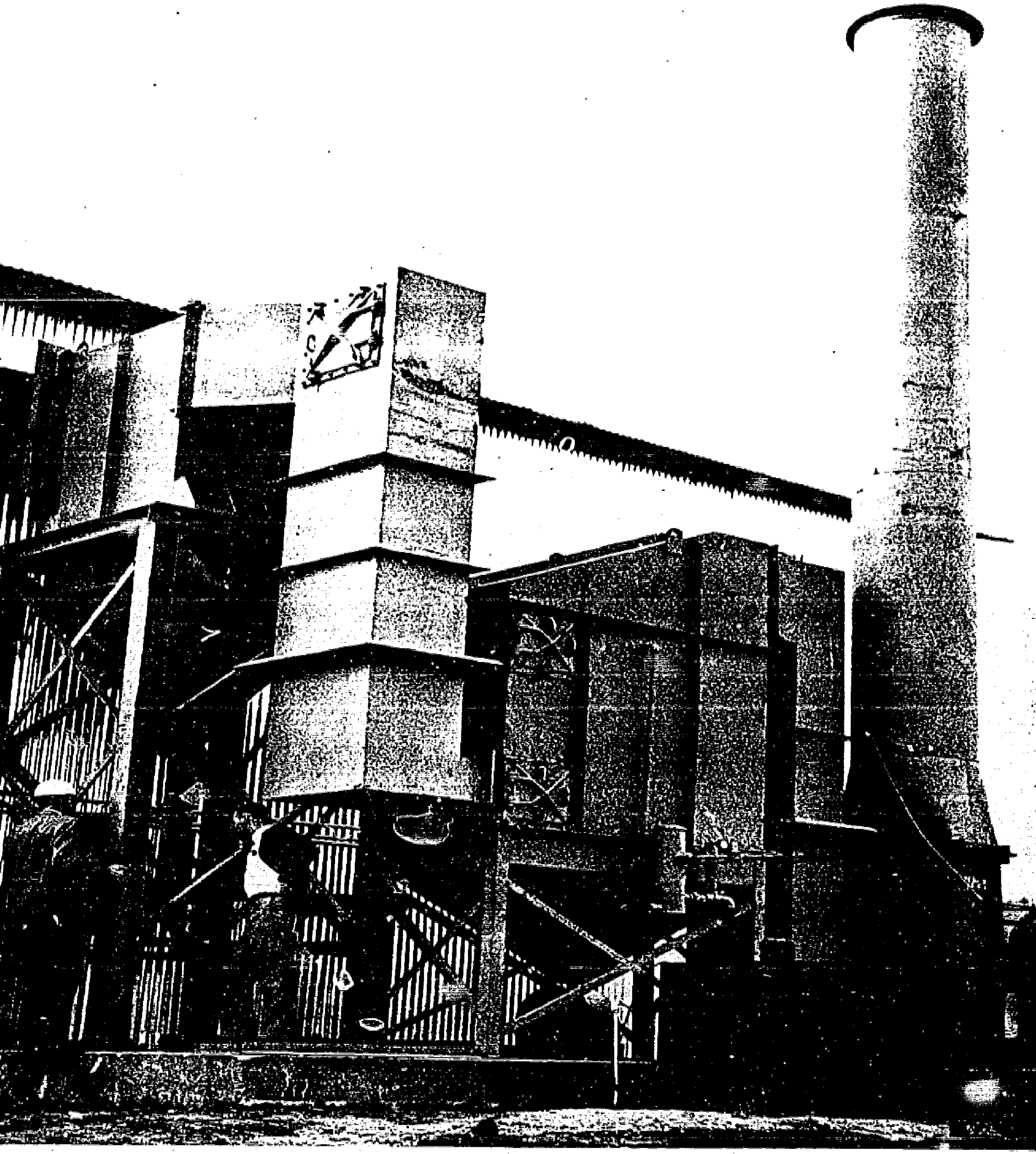






HIGH-ENERGY VENTURI SCRUBBER
ON LIMESTONE PROCESS





SMALL COAL-FIRED BOILER
WITH MECHANICAL-SCRUBBER COMBINATION

CENTRAL ENVIRONMENTAL CONTROL
at the
UNIVERSITY of CINCINNATI

by James J. Wenner

Biographical Sketch:

James J. Wenner, Utilities Coordinator, Physi al Plant Department, University of Cincinnati. He is a Professional Engineer and has over 25 years experience with the University of which 16 years he served as the Director. Mr. Wenner was President of APPA in 1968.

* * * * *

Introduction

Gentlemen: In some respects I wish I were addressing you in 1973 instead of 1972. Then we would have a year of operating experience on our Central Environmental Control system to draw upon and I could speak with more operating knowledge. As it is, we have been partially operating for less than two months and naturally still have a lot to learn.

As important as operating experience is, the programing, design, and education of all concerned with a C.E.C. system are probably even more important. If these are not properly done, the project will have two strikes against it before operations begin. The purpose of this paper is to briefly tell you of our experiences prior to start up of the C.E.C. system and, hopefully, pass along enough information to save you headaches, heartaches, and many dollars. My remarks pertain primarily to large systems and do not necessarily apply to small one building systems.

The Investigative Period

My first real contact with C.E.C. was in 1962 when I attended the APPA National Meeting at McMasters University, Hamilton, Ontario. The Honeywell Company had on display a van truck equipped with a working model of their C.E.C. equipment. With it they were able to show off its workings and hint at its possibilities. In subsequent years the Johnson Service Co. and the Powers Regulator Company offered similar exhibits at other APPA National Meetings, each of which we studied carefully and compared their various features.

Returning from McMasters University I was fired with enthusiasm and immediately started talking a C.E.C. system for U.C. Had I known then that I would still be "just talking" eight years later my enthusiasm might have been very short lived. A heavy construction program, an unconvinced administration, and tight budgets all contrived to delay any real action until 1966 when we finally got financial approval for an Engineering Study of C.E.C. and its application to this campus. What we needed most was a "Cook Book" to pass out to the many different engineering firms who were designing our new buildings and endeavoring to prepare for a C.E.C. system not yet in existence. An engineering office was selected and started work on such a "Cook Book." Now we could sit back with the smug thought that everything was under control, we were preparing for the future, and now could turn our attention elsewhere. Needless to say, we were in for a rude awakening!

We selected a consulting engineering office that had done similar work for another client, expecting to benefit from their experience thus gained. Sparing you all the gory details, 2½ years later we still had no "Cook Book," we found that provisions for C.E.C. in our new buildings were much too elaborate and, except for being sadder and wiser, were no further along than before. We finally severed relations with the engineers.

What's to be learned from this bad experience? First, the average Consulting Engineering Office does not make their money writing reports and making up "cook books." It takes too much of the principal's time. Accordingly, unless you are the exception, your study plays second fiddle to their other work.

Secondly, very few consultants are experienced in C.E.C. work and therefore "practice" at your expense. The picture has probably improved in the past 3 years with the increased interest in C.E.C. but as I see it, don't look for the small local engineering office to design your C.E.C. system. Rather look to offices that are designing very large office buildings or hospitals. These and college campuses represent the most users of large C.E.C. systems today.

After our disheartening experience of trying to get someone else to design our system, we did some hard thinking, trying to digest all we had learned to date. It boiled down to this:

1. C.E.C. systems have their own language, techniques, and hardware -- not at all like the many things that make up ordinary Physical Plant work. To understand them, you must learn the language.

2. Unless you can find the engineering office with at least a couple of successful large C.E.C. systems under their belt, beware.

3. C.E.C. systems are not a one shot deal. They will continue to grow over a long period of time and will cost real money.

4. Their potential profits are worth all the trouble it takes to get them.

Faced with these facts, our game plan developed along these lines:

1. Put together a project team of our own people so as to assure continuity and in-house knowledge over a long period of time.

2. With limited funds, develope a plan that can go in phases and easily build upon itself.

3. Learn all we can about C.E.C. so as to intelligently make our own decisions.

4. Write our own program

The team we put together is composed of Messers Lyle Clymer, Robert Brunst, Richard Neidhard, Arne Terkildsen, and myself. Together we are strong in electronics, HVAC, Building Operations, Central Plant operations, and Administrative Procedures.

Our next step was to learn all that we could about C.E.C. This we did with numerous visits to actual installations, the manufacturer's plants, phone calls, letters, manufacturers' brochures, magazine articles, etc. Out of this mass of information we filtered out some basic ideas. Two years later I believe most of them are still valid. They are:

1. C.E.C. is a complicated "tool", its use and potentials fully understood by only a few.

2. There have been very rapid changes in the "State of the Art." I might add that I think the big changes are now mostly behind us.

3. The system will fail or run at only half its potential, no matter how carefully designed or manufactured, unless the Owner really understands it and wants it to work.

4. Local manufacturer's service is most important to keep it going.

5. Most mechanical consulting engineers are weak in this field.

6. The system is not cheap, and the potential savings, while plentiful, don't come easily.

7. Much can be done without a computer tied into the system

8. Avoid mixed proprietary systems

9. Most systems are "over designed" costing more capital dollars than they should, increasing their complexity and not the pay-back.

Writing The Program

Now that we knew where we were going, we settled down to the hard work of writing a program. We had fine cooperation from both the Johnson Service Company and the Honeywell Company during this period. We worked closely with our Operations people because we were fully aware that their cooperation and understanding was vital. We started programming a couple of our dormitories but soon learned that they do not lend themselves to important savings as do the academic or office type buildings. This is because they are occupied most of the time, unlike other buildings. So we selected the Central Plant, Music Building, Engineering Building, and Auditorium Building for our Phase I program. These are all located relatively close together, have real money saving possibilities, and are all different in their use. Then building by building we put together their individual C.E.C. requirements. The program form we finally settled on is shown in the appendix.

I mentioned earlier that our investigation of other systems showed over design to be almost the rule. Instead of helping the operator, it merely added to his confusion. Jokingly, we had small signs made and fastened to our office doors. They said:

"When Working toward C.E.C.
Beware of the
Inundation of Obfuscation"

This play on words was not original. I believe it came from the University of Buffalo. I offer it to you as the best single piece of advice I can give.

Because we had a limited budget for Phase I, $220,000, we were careful in selecting the points to be tied into C.E.C. The following were our main guidelines:

1. How much money will it save?
2. Can we get basically the same information from another point?
3. Will its use lessen the time an operator must spend routinely inspecting the system?
4. If the equipment is low powered, under 1 H.P., forget it unless it is very critical.
5. Remote start/stop of larger motors is very desirable.

6. Don't try to control with C.E.C. that which can be automatically done locally.

We, knowingly, programmed far more equipment than we knew we could afford, but gave each point a priority of 1, 2, or 3. We asked for bids to be broken down according to priorities. In that way we could cut off when out of money, get the most important points, and have a feel for future costs when we could afford them.

An unexpected by-product of our programming was a much fuller understanding of our HVAC systems already installed and in operation for a number of years. We found uncorrected faults and inefficient operating methods that had gone un-noticed for a long time. A direct result of this was creation of a formal training program for building operators of HVAC systems. To date we have had 40 men go thru this 18 class hour program. We anticipate much improved operations and maintenance, together with good savings in our utilities, as a result.

BIDDING AND EVALUATION

With programming done we decided that writing specs suitable for public bidding was not our dish. So we employed a consulting engineer to take our program and put it into good specification form and at the same time look over our programming efforts. This proved to be a good and inexpensive arrangement for us.

Bids were taken and only two were received. These were from Johnson Service Company and the Honeywell Company. A very careful review was made of each bid submitted and this is where our hard earned knowledge of C.E.C. systems proved invaluable. After bids were opened we gave each company two hours of our time to explain their bid and answer our questions. Both companies had a lot to offer, are highly reliable, and have good service facilities in Cincinnati. The decision to award the Honeywell Company a contract was not an easy one to make.

A DESCRIPTION OF OUR SYSTEM

Our C.E.C. Equipment is located in the office area of our Central Plant, adjacent to our Work Control Center. We feel these two functions have a lot in common, hence their proximity. Space has been allowed for a future computer and a Central Security Systems tied into C.E.C. Arrangements have also been made to tie in our $52 million Medical Sciences Building when it is completed in about two years. Being located about 1 1/2 miles away, it will be connected via leased telephone lines.

Since our system is presently small, servicing only 4 buildings, we cannot afford full time coverage of the Control Center. We have settled for 8am to 5pm coverage, Monday thru Friday, with our Emergency Maintenance men checking the typewriters for alarms once every hour at all other times. When Medical Sciences Building is tied to our console we expect to provide 24 hrs. per day, 7 days per week coverage for it.

The selection of the chief C.E.C. operator is highly important if you expect to get the most out of the system. Ideally he should know the campus, have an above average knowledge of HVAC systems, be well versed in the technicalities of his equipment, and above all have the imagination and ambition to realize the full potentials of this tool. We found such a young man, Mr. Carl Ruther, in our own organization and started early to groom him for the job. He acted as our representative while the equipment was being installed, spent time with Honeywell Engineers, and studied up on HVAC systems. We are confident he will prove an outstanding choice. The selection of the other operators will be less important.

Our Central Plant is a rather special application of C.E.C. and worth a few comments. Several years ago we realized that lack of a Central Plant monitoring board was seriously hampering our Stationary Engineers. A detailed study was made and a good estimate showed that a hard wired electrical board would cost around $135,000 and a pneumatic board about $120,000. We got a much better package, but tied into C.E.C., for about $100,000. In addition we got all pertinent data printed out on a log sheet at any time required. The printers are located on the operating floor where the Engineers have ready access to them at all times. An alarm sounds whenever any point goes off normal and the Engineer goes to the typed log sheet to see what is wrong.

Separate communication channels have been assigned to buildings on this campus, Medical Center Buildings, and Central Plant. In this way, only alarms and logging originating in Central Plant are printed out on their own typewriters. However, all alarms and logging will be recorded on C.E.C. Center typewriters. No Stop/Start functions for Central Plant are controlled by the C.E.C. Center. In effect, Central Plant still runs its own show, but shares certain C.E.C. equipment with others.

PREPARING A NEW BUILDING FOR C.E.C.

Perhaps some of you are now in the position that we were six years ago. You haven't yet seen your way clear to having a C.E.C. system in being, but want to prepare for the day--especially in new buildings. I offer you some suggestions. They are:

1. Whenever installing underground electrical ducts between buildings add one or two more spares for communication lines, such as C.E.C. cables. Telephone lines and C.E.C. transmission lines are compatible so you can get double use from these ducts.

2. Inside a building it is wise to install empty conduits inter connecting separate mechanical rooms and the point of entrance of your C.E.C. cable. This will save considerable money later on.

3. If you like Building Services annunciator boards, located at one place in your building, be sure to provide auxiliary contacts on all alarms, start/stop buttons, etc. This will simplify hooking C.E.C. into the board in the future. Also, next to the annunciator board provide sufficient space for the Data Gathering Panel (DGP) an important part of the local C.E.C. hardware. Chances are that if your Mechanical Rooms are widely separated, you will need a DGP in each room. Therefore, provide space for it near to the center of equipment so as to minimize signal wire runs which should be in conduit.

4. Equip remote starter controls for all motors over 1 H.P. with auxiliary contacts. This permits remote start-stop via C.E.C. at minimum cost. Many sizable motors are left uselessly running because it costs too much in labor to shut off. Not so with C.E.C.

5. Thermo wells and pressure taps on steam, chilled water, domestic hot water, fire water, etc. lines are cheaply installed at time of construction. This same work later on can cost considerably more. Future draining of critical lines to do the work can really hurt.

6. Expensive machinery such as chillers, absorbers, etc. are naturals for C.E.C. The machinery manufacturer can provide thermo wells, pressure taps, auxiliary contacts, etc. initially built into the machines for later adaptation to C.E.C.

COSTS

The question in every one's mind when contemplating a new C.E.C. system -- How much will it cost? The only way to get an accurate answer is, of course, to have a complete set of plans and specs and then go out for bids. Even getting a preliminary estimate for budget purposes is difficult. There are so many variables.

Accordingly, rather than try to give unit costs I offer you comparative costs based upon an equal increment index of 1 to 1000. This will at least indicate which are the expensive and less expensive items.

It's up to you then to decide on how you wish to spend your budget dollars. Using index numbers also minimizes the influence of inflation, or possibly lowered costs due to greater production, upon the unit cost.

For what it is worth, here is my idea of comparative costs:

ITEM	INDEX NUMBER (Lowest No. - Lowest Cost)
1. Alarms for off-normal temperature,pressure, or humidity	2
2. Status of motors or other equipment (off/on) thru use of auxiliary contacts	2
3. Status of flow of air or water thru use of differential pressure or flow switch	2.5
4. Analog readout of temperature or pressure	2.5
5. Analog readout of humidity	3
6. Remote start/stop of motors	3
7. Remote re-set of temperatures, pressures or dampers	3
8. Analog readout of a totalizing meter - up to 6 digits	10-15
9. Co-ax cable, material and labor, conduit by others, per 1000 ft.	2
10. Console and two automatic typewriters, cost dependent upon options added to base unit. No computer.	300-600
11. Leased lines interface equipment for connecting a remote building complex to the central console	35

All of the above figures consider the cost of the added C.E.C. equipment only. Motor starters, automatic control systems, metering etc. has already been installed and paid for out of another budget.

POINTS REQUIRED - Before arriving at an approximate cost of a C.E.C. system, the number of points serviced must be roughly known.

This, too, is a difficult question to answer. HVAC systems can be as simple as a window unit all the way up to an elaborate multi-zone system serving many types of spaces with complete environmental control over temperature, humidity, and air quality. And, of course, the number of systems in a building varies as the function and size of the building.

As mentioned previously, we found that generally there is a tendency to install more points than necessary. Not only does this cost more capital dollars, but adds to C.E.C. maintenance costs and possibly adds to operator confusion.

To give you some ideas of the number of points we used, here are examples from actual buildings on our campus:

Building	Use	Gross Sq.Ft.	No.of HVAC Systems	Points Installed	Points to be Installed
Boiler & Chilled Water Central Plant	Supplies steam for entire campus & chilled water for 25 bldgs.	30,596	None	114	45
Rhodes Hall	Classrooms Offices & Labs for Engineering College	232,000	6	79	29
Zimmer Lecture Theatre Hall	Classrooms & 800 seat Lecture Hall	73,000	6	55	20
College Conservatory of Music	Classrooms, Offices, Music Studios 600 seat auditorium	147,164	8	34	51
Medical Sciences (now under construction)	Classrooms, Offices, Student Labs Research Labs Library Lecture Aud.	810,000	22		613
Remodeled Former Chemistry Bldg. (now under construction)	Offices, Classrooms, Speech labs Nuclear Engr. Labs.	143,428	10		46

THE FUTURE OF C.E.C.

We are firmly convinced that C.E.C. has a great future, especially for any large complex of buildings under a single administrative head. And the buildings need not be close together, although this will reduce capital and operating costs by eliminating interface equipment and leased telephone lines. Further, I believe that C.E.C. presently is about where computers were 15 years ago. Computers really then started to make themselves known, gradually taking over more and more of the routine work. In spite of the jokes about them they now occupy a position in many organizations where they are almost indispensable. I see the future of C.E.C. following the same pattern.

We have deliberately limited our C.E.C. program to Building Mechanical Systems, carefully avoiding anything connected with the academic or research areas. We did so to simplify our training, financial, and start-up problems. After a couple years experience we expect to actively relate to academic areas, at first limiting the service to 24 hr. per day surveilance of critical equipment, etc. However, I can visualize this being extended to all types of experimental data that can be changed into electrical impulses and stored in a computer memory. We, no doubt, would set up some type "use fee" for our services, helping to lessen our Capital and Operating Costs.

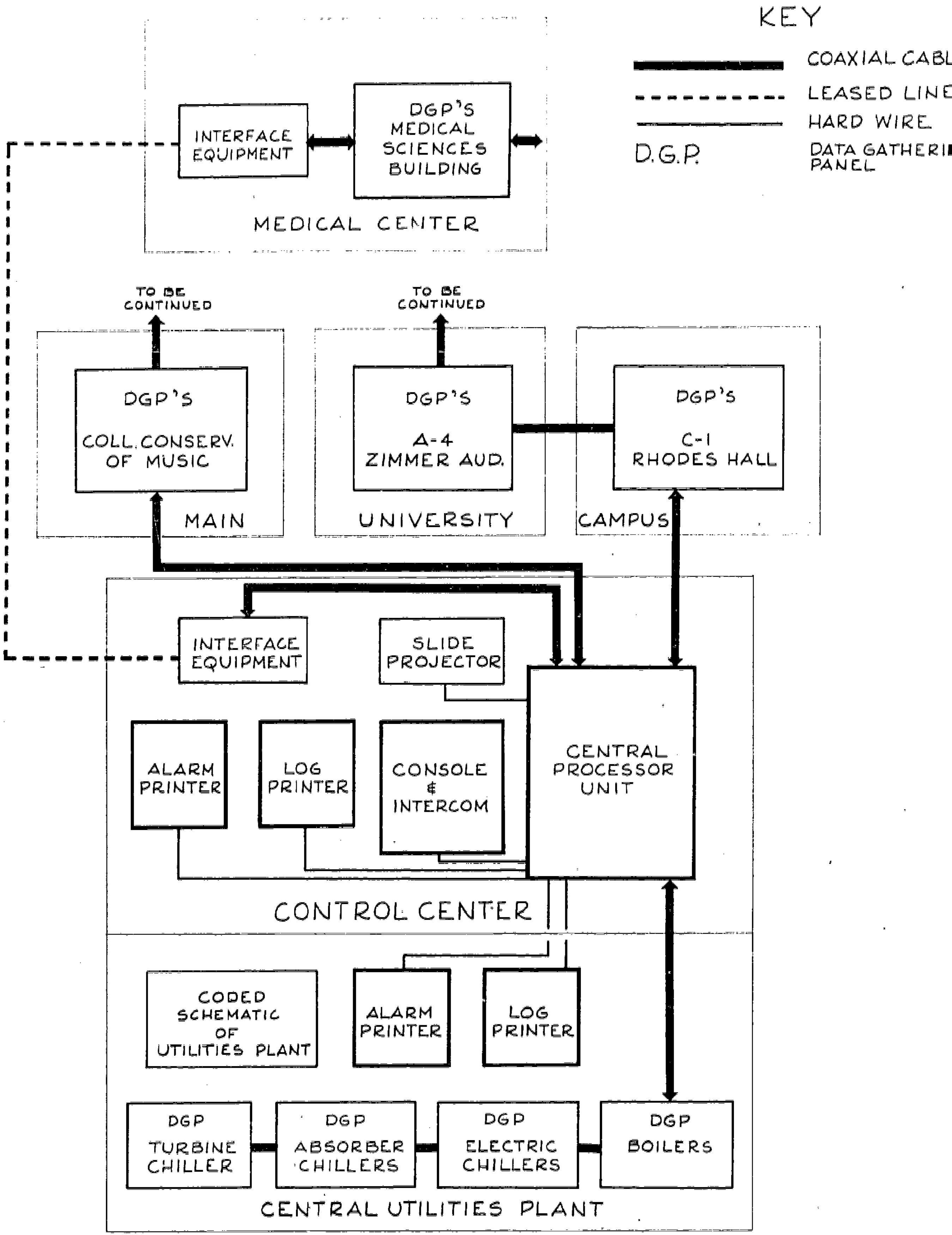
The Honeywell Company has had for over 5 years a service known as "Building Operations Service" (BOS). This C.E.C. service is for smaller organizations who don't want their own system. Under a contract arrangement, 24 hrs. per day C.E.C. service is provided to numerous private customers to any degree desired. For example, emergencies can be handled by the Customer's man or a Honeywell man. Specialized emergencies, like stuck elevators, would be handled by a direct call from C.E.C. operator to the Elevator Repair Company. It is not hard to visualize some version of BOS applied to a University with branch campuses many miles apart. Also, a small campus located near to an existing BOS center could contract for their C.E.C. Services.

Recently I heard of some really way out applications for C.E.C. as applied to Florida's Disneyland. It seems The RCA Company is interested in applying C.E.C. to other than Building Systems. By keeping continuous count of the pleasure seekers entering and leaving individual attractions, by means of lights, P.A. and other devices, the over crowded attractions are deemphasized and less popular ones played up. Doesn't this make sense for guiding the University family away from already full parking lots to the less used ones?

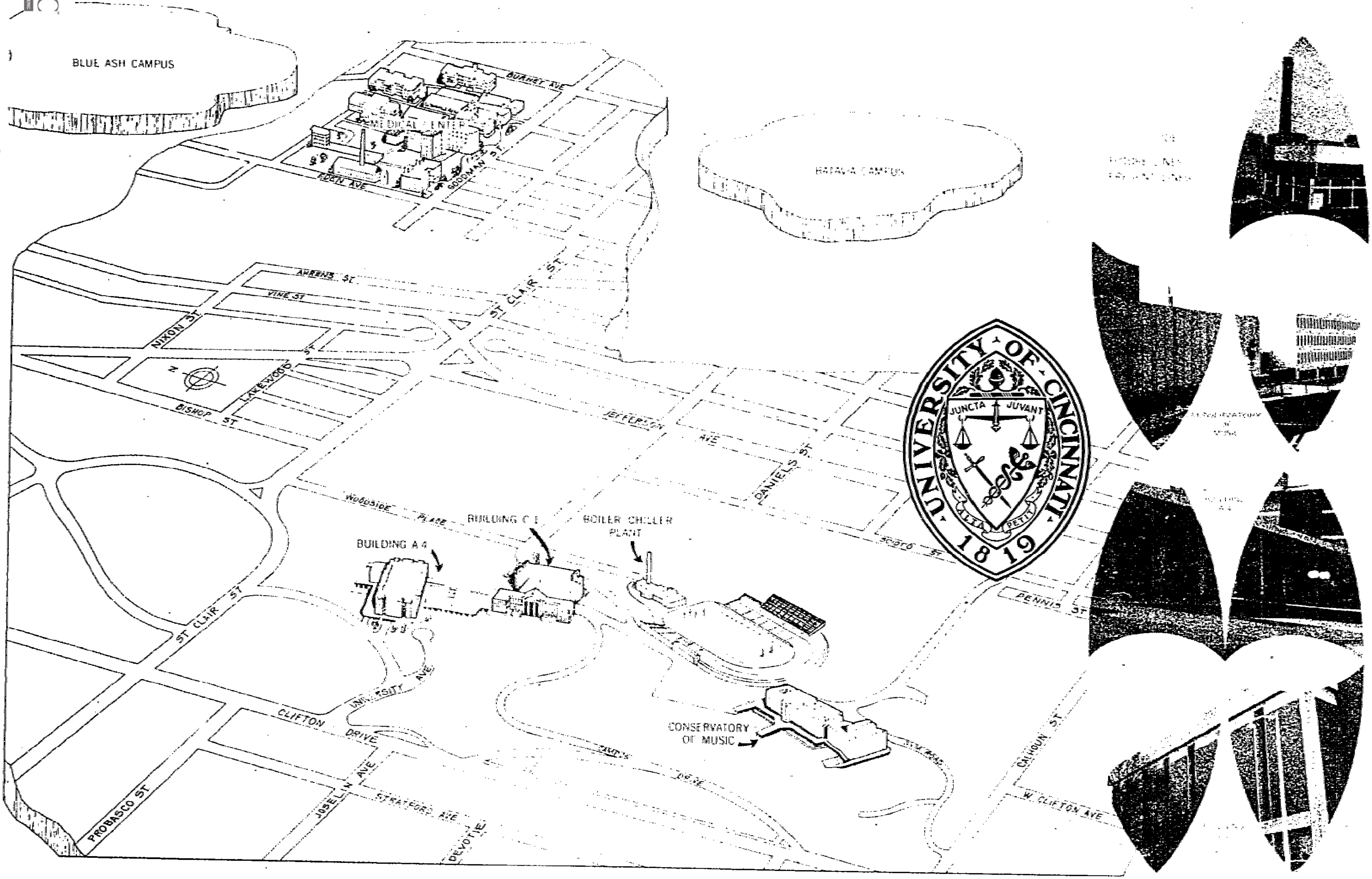
With the advent of automated security systems it is a natural to combine such a system with C.E.C. Again, you can reduce the cost of operating the Central Console by sharing this cost among several different activities. With this in mind, we have made our Control Center Space large enough for such future use.

Tieing a computer into a C.E.C. system opens up a whole new world of possibilities. We avoided the temptation of including one in our Phase I installation. Financially we couldn't afford it and also we felt it wise to learn to walk before starting to run. Our Phase II plan calls for further expansion of our system to include as many buildings as we can justify and afford. Phase III calls for still more expansion and the addition of a computer. By that time, around 1977, we feel that computer hardware will cost a lot less and software programs will be much more available than at present. I won't elaborate on what a computer combined with C.E.C. could do for you, but the sky is almost the limit. Your imagination, desire, and finances will determine how high is your sky.

Before opening this meeting to questions and answers I would like to show some slides illustrating some of the points about which I have talked. Some slides are reproduced in this paper, copies of which are available for the taking.



BLOCK DIAGRAM
CENTRAL ENVIRONMENTAL CONTROL
UNIV. OF CINCINNATI APRIL 1972


BLUE ASH CAMPUS
MEDICAL CENTER
BURNET AVE
EDEN AVE
GOODMAN ST
AHRENS ST
VINE ST
NIXON ST
LAKEWOOD ST
BISHOP ST
ST CLAIR ST
JEFFERSON AVE
DANIELS ST
WOODSIDE PLACE
SCIOTO ST
PENNIS ST
CALHOUN ST
W. CLIFTON AVE
BUILDING A 4
BOILER CHILLER PLANT
CONSERVATORY OF MUSIC
UNIVERSITY AVE
CLIFTON DRIVE
JOSELIN AVE
STRATFORD AVE
DEVOTIE
PROBASCO ST
UNIVERSITY OF CINCINNATI
JUNCTA JUVANT
ALTA PETIT
1819

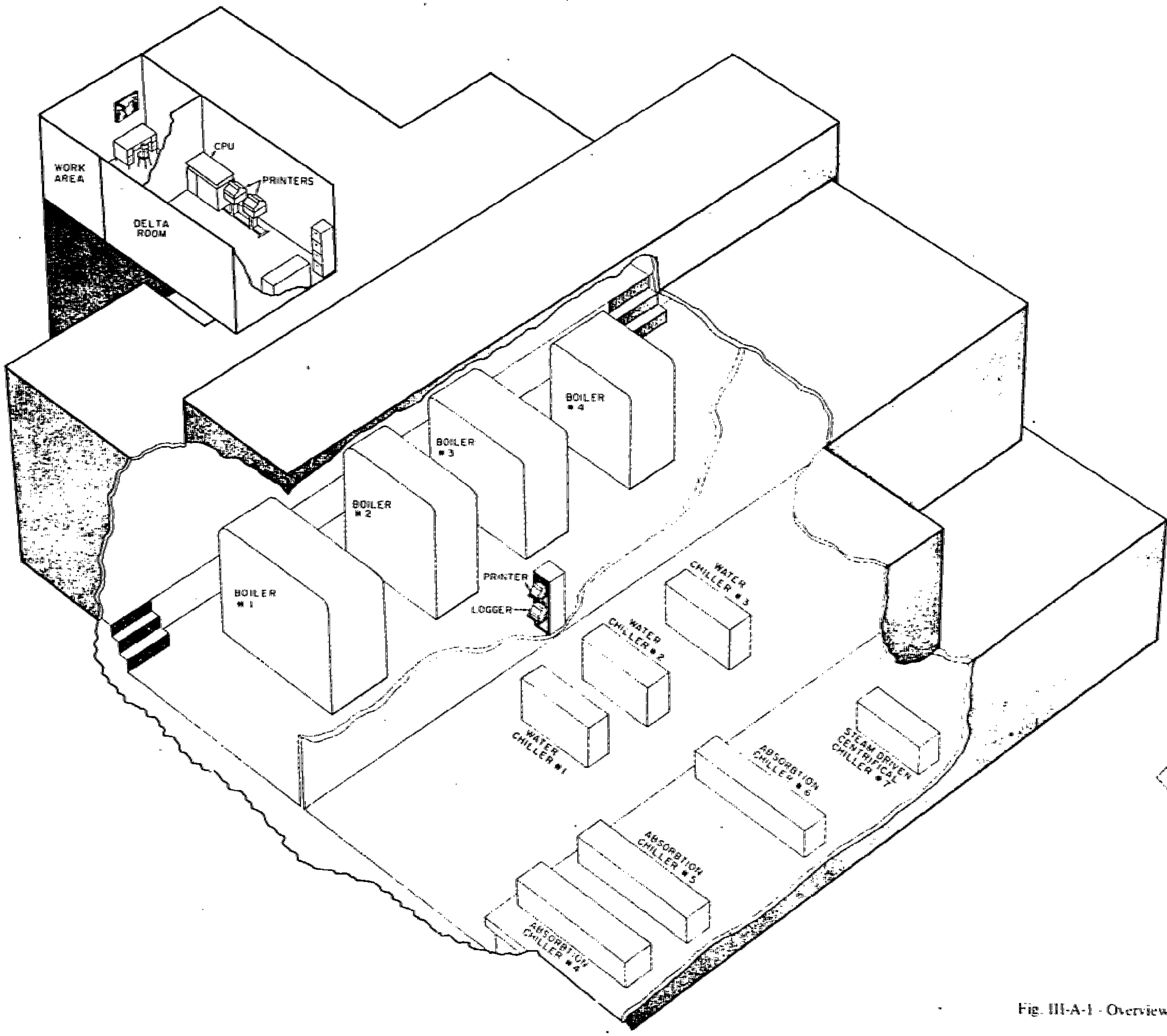


Fig. III-A-1 - Overview Showing Operations Center with Printers

I/O Address Points are coded as to priority: Priority 1 ; X Priority 2 ; o Priority 3 .

I/O SUMMARY – D-15

CHANNEL: 2		GROUP: 13			BUILDING: C1						SYSTEM: AC-6				
SLIDE DISPLAY Yes		INTERCOM: Same as Group 12									ROOM - 714				
	NO.	ADDRESS POINT	STATUS			ALARM			VALUE					COMMAND	PRIORITY
			SENSOR	BY	NOTE	SENSOR	BY	NOTE	UNIT	SENSOR	ALARM (L & H)	BY	NOTE		
	1	Supply Fan	DP	E		LDP	E							Start-Stop	1
	2	Filter				HDP	E	7							1
o	3	**Firestat**				FI	E								3
o	4	**Freezestat**				FR	E								3
o	5	**Humidifier**				LHU	C								3
	6	Preheat Coil							°F	T	L & H	C			1
x		**Preheat Coil**											13	**Temp. Reset**	2
	7	Cooling Coil							°F	T	H	C			1
X		**Cooling Coil**											5	**Temp. Reset**	2
	8	Reheat Coil							°F	T	L & H	C			1
X	9	**Space Temp.**							°F	T	L & H	C	14	**Temp. Reset**	2

SPECIAL AWARDS ....

DICK ADAMS - EDITOR of the NEWSLETTER

JERRY HAWK - ADMINISTRATIVE DIRECTOR (Interim Office)

"ADMINISTRATIVE IMPLEMENTING"

by William L. Holloway

Biographical Sketch:

William Holloway is a Lecturer on Management at the University of Cincinnati. He has been associated with Executive General since December of 1967, and serves in full time capacity as Vice President of the Corporation and President of the PDI Division.

Mr. Holloway is a graduate of Baker University and holds a Masters Degree in Business Administration from the University of Cincinnati. A member of Beta Gamma Sigma, National Scholastic honor society of Colleges of Business Administration.

His experience in Industry:

Turner Construction Company - Cincinnati, Ohio
Consulting role

Mississippi Valley Structural Steel - Flint,Michigan, St. Louis, Mo., Chicago, Ill.
Managerial Development program

Emery Industries
Behavioral Management Training Program - Specifically directed to research communications

"ADMINISTRATIVE IMPLEMENTING"

by William L. Holloway

The general purpose of this paper is to build a case for the importance of the process by which decision makers do (or do not) accomplish their goals. Some of the main ideas involved are the following:

1. Organizations have a sort of "life force" which is uniquely their own. It may have many facets which are similar to many other organizations of different types, but also certain individual characteristics.

   It is this individual character which provides the vitality to improve effectiveness.

   As Auren Uris * has described it, this is a "syntality" which may be compared to the "personality" of an individual. While it is not possible to directly compare a healthy person with a healthy organization, there is some comparison possible and not in the strictly "hygienic" or "organic" sense of management theory.

2. Individuals have shape form and substance which is directly visible to any observer. And some common definitions can be made which would be acceptable in meaning to all. Red hair, brown eyes, height, weight, and so on . . . all help to provide a common meaning to practically anyone. Organizations, too, show some similarly common attributes such as number of employees, physical location, types of outputs, services, etc. In neither case, however, do we find that these kinds of information bits necessarily aid the critical decisions made by either the individual or the organization. I use the term critical because if decisions must be made and can be made on readily observable things, "criticalness" is only relative and quickly becomes uncritical, the decisions are made and managers hurry on to something else. A manager does not devote too much time to those critical problems which are really difficult to deal with unless his priorities "box him in", or time runs out, or the boss demands it, or something else.

   This becomes habitual behavior. It is important to attempt to isolate some of the more common behavioral elements associated with organizational life and with the administrators responsible for the continuance of that life.

3. I am reasonably certain after attending or conducting literally hundreds of conferences, a certain commonality of concern is involved in all of them as group activity.

*Techniques of Leadership, Auren Uris.

The reason in part at least seems to be that members of organizations need and can't easily get, feedback on certain behavioral areas of concern. Communication, human relations, attitude, cooperation, team collaboration, and many more seem to be the behavioral themes of the concern, if not the actual agenda.

4. A manager does not go around all day thinking innovatively and creatively. If he did, not only would he tend to run down pretty fast physically, his staying power for daily activity would be shortened without the necessary amount of effective return on his efforts. So, as a result, we tend to develop shortcuts and habits (good and bad) to help us reach certain goals. In doing so we do not always recognize the price we pay in lowered efficiency. Nor do we recognize the price paid by our subordinates.

4. As managers it is important to first be effective (do the right things) and then to develop the efficiency (doing things right) to increase the net gain.

To illustrate these various notions and concepts certain process exercises have been employed very successfully to help not only explain the concept (structure) of an idea, but to also get actual behavior to support that concept (process). In the end it is the results that count not the intellectual understanding of how a thing is done.

Because all of these directly affect the management decision making process and because we do not always know exactly why, this paper will deal with trying to shed some light on why processes work as they do in behavioral terms.

Two "process exercises "follow, along with the end result to be obtained from each.

In the use of these exercises for staff meetings it is important to recognize that by themselves they are not as important as the transfer of the meanings and concepts in them to the actual work situations and problems that need attention. An exercise of this type is of little value by itself unless the manager gets his subordinates to utilize the concepts in their own work. This means that he must not only introduce and support but, as with all delegation, he must follow up to see if, in fact, any results are forthcoming from his people to improve on what has gone before. If no improvement or effort is indicated, find out why and correct, discard, or revise.

INSTRUCTIONS TO THE OBSERVER/JUDGE

Observer:

Your job is observer and evaluator. Do not interfere with what develops, but do your best to observe what happens.

1. No talking, pointing, or any other kind of communicating among the five people in your group is the instruction given.
2. Participants may give pieces to other participants but are not supposed to take pieces from other members.
3. Participants should not simply throw their pieces into the center for others to take; they are supposed to give the pieces directly to one individual.
4. It is permissible for a member to give away all the pieces to his puzzle, even if he has already formed a square.

As an observer, you may want to look for some of the following:

1. Who is willing to give away pieces of the puzzle?
2. Did anyone finish his puzzle and then somewhat divorce himself from the struggles of the rest of the group?
3. Is there anyone who continually struggles with his pieces but yet is unwilling to give any or all of them away?
4. How many people are actively engaged in mentally putting the pieces together?
5. Periodically check the level of frustration and anxiety-who's pulling his hair out?
6. Was there any critical turning point at which time the group began to cooperate?
7. Did anyone try to violate the rules by talking or pointing as a means of helping fellow members solve their puzzle?
8. Did "leadership" emerge?
9. To what degree did the group focus on the goal as <u>opposed to</u> observing the rules?

GROUP DECISION MAKING FORMAT

The group (consensus) decision making technique is used for group problem solving situations. It has its limitations in that it:

A. Lacks precision

B. May result in a series of compromises reflecting the points of view and personalities of the participants.

But it does:

A. Examine many points of view

B. Permit broad representation

C. Strengthen group commitment for results

FORMAT

I. <u>WHAT IS THE PROBLEM</u>:

Examine the cause vs. effect relationship.

II. <u>WHAT ARE THE PROBABLE CAUSES OF THE PROBLEM</u>?

These should be listed and then, through evaluation and discussion, eliminated until the causes are established.

III. <u>WHAT ARE THE POSSIBLE SOLUTIONS TO THE PROBLEM</u>?

These are to be listed only. There should be no criticism or defense of the solution permitted at this point.

IV. <u>WHAT IS THE BEST POSSIBLE SOLUTION</u>?

The possible solutions are discussed and evaluated and an optimum solution which is acceptable to the group obtained.

V. <u>ASSIGN ACTION RESPONSIBILITIES</u>

NASA EXERCISE: SEEKING CONSENSUS

Goals

I. To compare the results of individual decision-making with the results of group decision-making.

II. To diagnose the level of development in a task-oriented group.

Group Size

No less than five participants nor more than seven for best results. Several groups may be directed simultaneously.

Time Required

Approximately one hour.

Materials Utilized

I. Pencils

II. Individual work sheets

III. Group work sheets

IV. Answer sheets containing rationale for decisions.

V. Direction sheets for scoring.

Physical Setting

Participants should be seated around a square or round table. The dynamics of a group seated at a rectangular table are such that it gives too much control to persons seated at the ends.

Process

I. Each participant is given a copy of the <u>individual</u> work sheet and told that he has ten minutes to complete the exercise.

II. One <u>group</u> work sheet is handed to each group.

A. Individuals are not to change any answers on their individual sheets as a result of group discussion.

B. A member of the group is to record group consensus on this sheet.

C. The participants will have twenty minutes in which to complete the group work sheet.

III. Each participant is given a copy of the direction sheet for scoring. This phase of the experience should take seven to ten minutes.

A. They are to score their individual work sheets.

B. They will then give their score to a recorder in the group who will compute the average of the individual scores.

C. The recorder will then score the group work sheet.

IV. The group will compare the average score for individuals with the group score and discuss the implications of the experience. This phase of the experience should take seven to ten minutes.

V. Results are posted according to the chart and the facilitator directs a discussion of the outcomes of consensus - seeking and the experience of negotiating agreement.

Key points to discuss:

1. The level of quality in decision making can be raised by group effort given that certain limitations are recognized. (See group decision making format).

2. Individual high scorers can make a positive contribution and may make significant group contribution to net lowered group score.

3. Group decision making format.

4. Make immediate transfer in meeting to on-the-job situations where process can be applied to real life.

N A S A

DECISION BY CONSENSUS

Instructions: This is an exercise in group decision-making. Your group is to employ the method of Group Consensus in reaching its decision. This means that the prediction for each of the 15 survival items must be agreed upon by each group member before it becomes a part of the group decision. Consensus is difficult to reach. Therefore, not every rankingwill meet with everyone's complete approval. Try, as a group, to make each ranking one with which all group members can at least partially agree. Here are some guides to use in reaching consensus:

1. Avoid arguing for your own individual judgments. Approach the task on the basis of logic.
2. Avoid changing your mind only in order to reach agreement and avoid conflict. Support only solutions with which you are able to agree somewhat, at least.
3. Avoid "conflict-reducing" techniques such as majority vote, averaging or trading in reaching decisions.
4. View differences of opinion as helpful rather than as a hindrance in decision-making.

On the "Group Summary Sheet" place the individual rankings made earlier by each group member. Take as much time as you need in reaching your group decision.

N A S A E X E R C I S E
T A S K

Instructions: You are a member of a space crew originally scheduled to rendezvous with a mother ship on the lighted surface of the moon. Due to mechanical difficulties, however, your ship was forced to land at a spot some 200 miles from the rendezvous point. During re-entry and landing, much of the equipment aboard was damaged, and since survival depends on reaching the mother ship, the most critical items available must be chosen for the 200-mile trip. Below are listed the 15 items left intact and undamaged after landing. Your task is to rank order them in terms of their importance for your crew in allowing them to reach the rendezvous point. Place the number 1 by the most important item, the number 2 by the second most important, and so on through number 15, the least important.

______Box of matches
______Food concentrate
______50 feet of nylon rope
______Parachute silk
______Portable heating unit
______Two .45 calibre pistols
______One case dehydrated Pet milk
______Two 100 lb. tanks of oxygen
______Stellar map (of the moon's constellation)
______Life raft
______Magnetic compass
______5 gallons of water
______Signal flares
______First aid kit containing injection needles
______Solar-powered FM receiver-transmitter

NASA EXERCISE ANSWER SHEET

RATIONALE:	CORRECT NUMBER:	
No oxygen	15	Box of matches
Can live for some time without food	4	Food concentrate
For travel over rough terrain	6	50 feet of nylon rope
Carrying	8	Parachute silk
Lighted side of moon is hot	13	Portable heating unit
Some use for propulsion	11	Two .45 calibre pistols
Needs H_2O to work	12	One case dehydrated Pet milk
No air on moon	1	Two 100-lb. tanks of oxygen
Needed for navigation	3	Stellar map(of moon's constellation)
Some value for shelter or carrying	9	Life raft
Moon's magnetic field is different from earth's	14	Magnetic Compass
You can't live long without this	2	5 gallons of water
No oxygen	10	Signal flares
First aid kit might be needed but needles are useless	7	First aid kit containing injection needles
Communication	5	Solar-powered FM receiver-transmitter

NASA EXERCISE DIRECTION SHEET FOR SCORING

The group recorder will assume the responsibility for directing the scoring. Individuals will:

1. Score the net difference between their answers and correct answers. For example, if the answer was 9, and the correct answer was 12, the net difference is 3. Three becomes the score for that particular item.
2. Total these scores for an indivudual score.
3. Next, total all individual scores and divide by the number of participants to arrive at an average individual score.
4. Score the net difference between group worksheet answers and the correct answers.
5. Total these scores for a group score.
6. Compare the average individual score with the group score.

N A S A   E X E R C I S E
CHART

GROUP	Low Score	High Score	Average Score	Group Score
I				
II				
III				
IV				
V				

BROKEN SQUARES

Goals

I. To analyze certain aspects of cooperation in solving a group problem.

II. To sensitize the participants to some of their own behaviors which may contribute toward or obstruct the solving of a group problem.

Group Size

Any number of groups of six participants each. There will be five participants and an observer/judge.

Time Required

Fifteen minutes for the exercise and fifteen minutes for discussion.

Materials Utilized

1. Chalkboard, chalk, eraser

II. Tables that will seat five participants each.

III. One set of instructions for each group of five participants and one for the observer/judge.

IV. One set of broken squares for each group of five participants.

Physical Setting

Tables should be spaced far enough apart so that the various groups cannot observe the activities of other groups.

Process

The facilitator may wish to begin with a discussion of the meaning of cooperation; this should lead to suggestions by the groups of what is essential in successful group cooperation. These may be listed on the board, and the facilitator may introduce the exercise by indicating that the groups will conduct an experiment to test their suggestions. Basic suggestions which the facilitator may want to bring out of the groups are as follows:

1. Each individual must understand the total problem.
2. Each individual should understand how he can contribute toward solving the problem.
3. Each individual should be aware of the potential contributions of other individuals.
4. There is a need to recognize the problemsof other individuals, in order to aid them in making their maximum contribution.

Instructions are as follows:

A. When the preliminary discussion is finished, the facilitator chooses an observer/judge for each group of five participants. These observers are each given a copy of their instructions. The facilitator then asks each group to distribute the envelopes from the prepared packets. The envelopes are to remain unopened until the signal to work is given.

B. The facilitator distributes a copy of the instructions to each group.

C. The facilitator then reads the instructions to the group, calling for questions or questioning groups as to their understanding of the instructions. It will be necessary for the facilitator or his assistants to monitor the tables during the exercise to enforce the rules which have been established in the instructions.

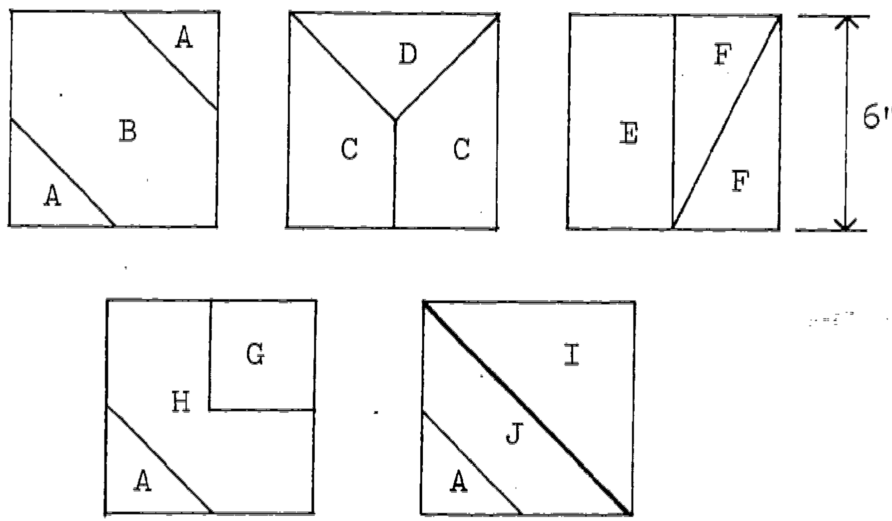
D. When all the groups have completed the task, the facilitator will engage the groups in a discussion of the experience. Discussion should focus on feelings more than merely relating experiences and general observations. Observations are solicited from the observer/judges. The facilitator may want the groups to relate this experience with their "back home" situations.

This exercise is adapted from Communication Patterns in Task-Oriented Groups, by Alex Bavelas

DIRECTIONS FOR MAKING A SET OF SQUARES

A set consists of five envelopes containing pieces of cardboard which have been cut into different patterns and which, when properly arranged, will form five squares of equal size. One set should be provided for each group of five persons.

To prepare a set, cut out five cardboard squares of equal size, approximately six-by-siz inches. Place the squares in a row and mark them as below, penciling the letters a,b,c, etc., lightly, so that they can later be erased.



The lines should be so drawn that, when cut out, all pieces marked a will be of exactly the same size, all pieces marked c of the same size, etc. By using multiples of three inches, several combinations will be possible that will enable participants to form one or two squares, but only one combination is possible that will form five squares six-by-six inches.

After drawing the lines on the six-by-six inch squares and labeling them with lower case letters, cut each square as marked into smaller pieces to make the parts of the puzzle.

Mark the five envelopes A, B, C, D, and E. Distribute the cardboard pieces in the five envelopes as follows:

Envelope	A has pieces	i, h, e
	B	a, a, a, c
	C	a, j
	D	d, f
	E	g, b, f, c

Erase the penciled letter from each piece and write, instead, the appropriate envelope letter. This will make it easy to return the pieces to the proper envelope for subsequent use when a group has completed the task.

INSTRUCTIONS TO THE GROUP

In this packet there are five envelopes, each of which contains colored pieces for forming squares. When the facilitator gives the signal to begin, the task of your group is to form five squares of equal size. The task will not be completed until each individual has before him a perfect square of the same size as that held by others.

Specific limitations are imposed upon your group during this exercise:

1. No member may speak
2. No member may ask another member for a card or in any way signal that another person is to give him a card.
3. Members may, however, give cards to other members.

Are the instructions clear? (Questions are answered).

Facilitator gives signal, "Begin working".

There is a need for each person to understand the total situation in which he is working.

There is a need for each person to see how he can contribute toward the solution of the organization problems and the fulfillment of organization goals.

There is a need for each person to be aware of the potential contribution of others.

There is a need to see each person's problems in order that he may be helped to make a maximum contribution

MAY 1, 1972

3:00 P.M.

SESSIONS 6- Mr. Dorland
7- Mr. Hilmer
8- Mr. Chabot
9- Mr. Lefler

BEST OF SHOW

awarded to

JOHNSON SERVICE CO.

for having exhibited what was judged to be the most attractive and informative booth at the Association of Physical Plant Administrators 59th Annual Meeting, April 30-May 3, 1972
Cincinnati, Ohio

"CONTRACT MANAGEMENT SERVICES"

by Edward M. Dorland

Biographical Sketch:

Edward Dorland is a Construction Management Engineer currently employed in the office of Federally Assisted Construction - Facilities Engineering and Construction Agency - The technical arm of the U.S. Department of Health, Education and Welfare.

Prior to his employment in the Federal Service in 1963, he had 12 years experience in the private sector of the construction industry as a manager of construction for several general contracting companies.

He managed construction projects at the National Institutes of Health in Bethesda, Maryland, from 1963 to 1965, taking an active part in the construction of the Surgical Wing of the 500 bed Clinical Center and Laboratory on the NIH Campus.

Mr. Dorland has been responsible for coordinating technical field services in HEW Construction Grant Programs since 1965 and joined the staff of the Facilities Engineering and Construction Agency two years ago, when that organization was first formed. A major portion of his time over the past year has been devoted to development of the Construction Management Process for the Department of Health, Education and Welfare.

* * * * *

INTRODUCTION:

The Department of HEW is giving its support to cost-saving procedures to be used in designing and constructing educational and health facilities. Particular emphasis is being given to those processes which will produce high quality structures at lower costs. The Construction Management process offers such potential.

At the present time the Facilities Engineering and Construction Agency and its 10 Regional Offices has an interest in approximately 3,000 projects for the construction of educational and health facilities valued at almost $10 billion dollars. Of this sum, we have 69 projects amounting to $500 million, employing construction managers.

The major credit for this increased interest in Construction Management Contracts must be given to our Director Dr. Gerrit Fremouw. His concern for promoting more efficient and cost-saving procedures in the construction of DHEW funded facilities has been directly responsible for many applicants selecting the CM process for their construction projects.

WHAT'S HAPPENING IN CM IN DHEW?

After getting Secretary Richardson's endorsement, Mr. Fremouw made it clear that he wanted to launch a positive program for reducing facility construction costs. It didn't take our office very long to learn that there has been little done in formalizing the CM procedure. Upon committing ourselves to using the procedure, a host of questions began to arise. What should be the responsibilities assigned to the CM? How does the CM get paid? What are his fees? How does the CM's intrusion into the Design Process change the liability of the Architect/Engineer? What form should the CM contract take? How is the CM selected? Who should be responsible for costs? On what types of projects can the CM procedure be used? What is the minimal size project on which CM should be used?

In this discussion I will set forth the Construction Manager's functions and responsibilities as we in HEW see them being applied to the Federally Assisted Construction Grant Projects -- That is, those projects which are funded in part by HEW with the rest of the money coming from State, County, or Private Sources. These are the projects in which the Federal Government has no contracting authority, the contract for construction is between the owner of the facility and the contractor performing the work.

The HEW procedures which will be applicable to direct Federal contracts for construction closely approximate the procedures being adopted by General Services Administration. These are the projects in which HEW or the Federal Government is the owner and has full contracting authority. This discussion will not apply to the Direct Federal Contracts.

First, I will briefly describe the methods of contracting which are being used in the grant programs of HEW, and then I will discuss the application of construction management to those methods.

SLIDE 1

Slide - Single lump sum contract.
Almost everyone understands the single lump sum contract method of construction. It is simple in its contractural relationships. Most parties involved, except perhaps the owner, have been through the process many times. Specification systems and contract forms have been developed, revised, and refined to a point where almost every conceivable condition of controversy has been covered.
Let's look at the single contract method.

SLIDE 2

The Owner desiring to construct a facility sets forth his requirements.

SLIDE 3

He hires an Architect who translates the program of requirements into a complete set of design documents ready for bidding to General Contractors.

SLIDE 4

The successful bidder, whom we in DHEW identify as the low responsive and responsible bidder, signs a contract for a fixed sum.

SLIDE 5

The General Contractor awards the necessary subcontracts and manages the project through completion of the work.

Somewhat over-simplified, but basically that's the process. It is a neat package and it has worked well on countless projects through a complete range of costs from the low thousands to multi-million dollar projects. We intend to continue to utilize this method of contracting on the major portion of federally assisted contracts.

Why then are we seeking other ways when we have such a reliable method - tried and proven?

Before we answer that question, let's complicate the situation a little more. Consider a project consisting of three major parts. The three parts may be elements of a single building, or they may be groups of buildings - We'll refer to these parts as phases.

SLIDE 7

Retaining the same arrangement of owner and architect, it is apparent that the control and management of the project becomes more difficult when we expand to three or more major contracts, with the resulting proliferation of

SLIDE 8

Subcontracts. The single contract method is still applicable on each of the phases, but the burden of management placed on the architect poses a workload of major proportion. The management of the project begins to dominate and he is diverted from his primary duty of design.

Now let's complicate the situation a little further by

SLIDE 10

Requiring that the phases be started and completed on separate accelerated schedules. Scheduling of the design as well as the construction takes on significant importance. The Architect's management burden is increased due to this additional requirement.

Finally, let's take a look at the ultimate in construction management problems.

SLIDE 12

The owner may become involved in a project requiring more than one architectural design firm, each having a part in the overall project.

In this case, the burden of responsibility for managing the separate architectural firms is that of the owner. If the owner does not have the necessary management skills on his staff, he must seek help; and, of course, any owner with a project of this magnitude will naturally contract for such services at the earliest possible time. Without such assistance, chaos will surely prevail.

Now let's back-track to the first example of contracting.

SLIDE 14

The single lump sum contract.

Where a single lump sum contract is anticipated, a construction manager may be employed to function only during the design phase as a consultant to the Owner.

SLIDE 15

He may assist in developing the budget and provide budget control during the design development; he may advise on construction methods, manpower availability, and work scheduling; and assist in developing the contract documents to preclude conflicts or areas that may result in expensive change orders. He may also assist the owner and architect in the solicitation of bids, preparation of the bidding documents, and holding the bid opening.

However, one of the basic concepts underlying the role of the construction manager is that THE DESIGN AND CONSTRUCTION PROCESS SHOULD BE MANAGED AS A SINGLE DEVELOPMENT EFFORT.

(Repeat Underlined)

SLIDE 16

This is the team approach, Owner-Architect-Construction Manager working together toward the same objective.

SLIDE 17

On larger complex projects, say $5 million or more where it is anticipated that the work will be phased or multiple contracts employed, the construction manager should also perform the management functions required to carry out and complete the work. The construction manager, having anticipated in the design development phase and development of the budget, should be completely indoctrinated as to the intent and desires of the owner and architect, and should be effective in coordinating the work to keep the project on schedule, and, of course, to keep costs within the available funds.

The construction manager can have a significant impact on the project in scheduling the work. Scheduling is closely coupled with development of the bid packages to place the work on the market in the proper increments and at the most beneficial time.

Accelerated scheduling of the work can be accomplished through bidding certain phases of the work while other phases are still in design.

To maintain competitive bidding on construction projects, we have established limits with respect to the construction manager's performance of work at the construction site and the award of construction contracts.

The construction manager may be requested to perform, on a reimburseable or fixed-fee basis, those non-construction contract services normally performed by a general contractor. (I'll come back to reimburseable items in a few minutes.)

Performance of construction work, specifically those items requiring skilled labor and materials of construction, shall not be included in the construction manager's contract.

All construction work shall be competitively bid and the award of contracts for construction shall be made to the responsible bidder submitting the lowest responsive bid. All qualified bidders must be allowed to bid on projects financed in whole or in part by Federal Funds. The owner shall be responsible for award of contracts after evaluation and recommendation by the construction manager and concurrence of the architect.

DHEW EXPERIENCES IN CM:

Of the CM projects we have approved, there are several that are particularly outstanding. I would like to give you a report on two of those projects, one of which is in the final stages of construction completion, the other is just going into the construction phase.

EXAMPLE NO. 1 SWRL

SLIDE

The Southwest Regional Laboratory for Educational Research is one of seven similar facilities being constructed under the Cooperative Educational Research Act - Public Law 89-10, The project is referred to as SWRL.

SLIDE ON SWRL STATISTICS

Here are some of the statistics:

The project contains 90,000 square feet of area. It is an air conditioned, two-story concrete frame structure with concrete slab floors, built-up flat roof, aluminum and glass exterior curtain walls and drywall interior partitions. As of March 15,1972, the project was 85% complete.

Initial Cost Estimate ------------$3,332,260-------$37.03/s.f.

Preset Cost Projection -----------$3,206,282-------$35.63/s.f.

Savings Limited to

Present Cost Projection --------   126,000

A/E fees were based on a percentage of estimated construction costs but were negotiated to a lump sum of $191,000 plus $13,000 maximum limit for extra services and travel. No adjustment of the fee will be made if the final costs are below the initial estimate. The A/E fee is 6%

The Construction Manager's fees were negotiated at $108,600 on the basis of 3 1/2% of the estimated construction cost, plus cost of payroll and out-of-pocket expenses limited to a maximum amount of $103,500. The basic fee is to be adjusted only in the event of a variance of 10% or more from the original estimate. The Construction Manager was not required to provide a guaranteed maximum price for the project because the building plans were completed and all construction contracts were awarded prior to start of construction.

The Date of the Grant Award was June 1970

The Date of Construction start was May 1971

SLIDE ON ED LABS

It is interesting to make a comparison of this project with the other six laboratory projects funded under the same Public Law. Although the SWRL project was in the last group to be funded, it will be the first to be completed. A total design and construction period of 23 months elapsed as compared to the other projects which will require from 39 to 50 months to complete

SLIDE ON COST SAVINGS (SWRL)

Cost savings which have been documented to date include

1. Reduction in bidding and awarding contracts	$126,000
2. Reduction in time for design and construction (Applicants operating costs for 5 months @ $100,000/month)	500,000
3. Avoidance of cost escalation (4 months @ 1% /month)	120,000
4. Savings by CM during design consultation (Value Engineering)	200,000
5. Cost savings suggestions during construction	40,000
6. Reduction in A/E fee compared with usual fee schedule	34,000
Total Savings documented	$1,020,000

The report on this project from the San Francisco Regional Office states the following: "In is the consensus of opinion that the Construction Management principal has been responsible for the documented savings. The early involvement of all concerned, including the field staff, on professional team basis has resulted in a feeling of pride and desire for accomplishment in the construction management organization. This has been a major contributing factor in providing a well managed effort and excellent community relations throughout the project."

EXAMPLE NO. 2 SADDLEBACK COMMUNITY HOSPITAL, LAGUNA HILLS, CALIFORNIA

The Saddleback Community Hospital Project, Laguna Hills, California, was one of our pioneering projects in Construction Management. It was important for FECA from the fact that it combined construction management with phased bidding and a guaranteed maximum price from the CM. Another unique feature was the taking of bids for the CM Services Contract.

SLIDE ON TIME AND COST COMPARISON

A comparison of the Saddleback Project with Good Samaritan Hospital, a project of similar type and scope, yields some interesting statistics.

1. The total square footage for each of the two projects is almost identical at 187,000 s.f.

2. The number of beds provided in each facility is also very close, i.e. 139 beds for Good Samaritan, 150 beds for Saddleback.

3. The similarity ends when a comparison is made of the estimated construction schedules (45 months vs. 37 months) and the total estimated project costs ($11,718,000 vs $10,439,600).

4. The estimated costs for the Saddleback project have held up through the design development stage. The guaranteed maximum price given by the CM was $9,198,000 within 7% of the initial cost estimate.

5. The project is on schedule and we have no factors to indicate that the projected date of occupancy will not be met.

The Construction Manager's Contract was divided into two parts identified as "Part A, Consultation Services During Design." To be compensated for according to the Bidder's proposed personnel per diem rate schedule, and "Part B, Services during the Construction Phase."
To be performed for the amount offered in his bid ($313,280).

Part A of the CM Contract provided for the following services:

1. Consultation related to systems, materials and components.
2. Coordination of the Critical Path Schedule
3. Preparation of cost estimates.
4. Analysis of construction techniques to realize full advantages of the building system design.
5. Development of an acceptable guaranteed maximum price, which price included:

   A. The CM's stipulated sum for services during construction.
   B. The estimated cost of field overhead items.
   C. The CM's estimate of the cost of the construction work to be performed by separate competitively bid contracts.

The fees for the Construction Management Services. Contracts were bid on March 2, 1971, and they ranged from a low of $313,280 to a high of $618,780 or from 3.4% to 6.7% of the estimated construction cost.

The fee $313,280 was for the provision of services during the construction period and included the following:

1. Obtaining segregated bids of all biddable portions of the Contract Documents.

2. Accepting assignment of contracts from the Owner for all biddable portions of the contract documents.
3. Accepting responsibility for all General and Supplementary conditions provisions.
4. Scheduling all construction activities
5. Accepting responsibility for the preparation of all cost estimates and budget control of the construction phases.

The General and Supplementary Conditions items are performed by the CM at actual cost of material and labor and include items such as layout and engineering, clean up, temporary utilities and their hook-up, field offices and sheds, sanitary facilities, and field transportation. Such items as material towers, hoists, motor cranes, general scaffolding, are furnished by competitive bidding procedures.

FECA CONSTRUCTION MANAGEMENT Guide Forms:

After several experiences with Construction Management Contracts, it became clear that uniform guides for the application of construction management procedures was necessary. We have developed two sets of documents for the use of applicants on Federally Funded Projects. They are simply identified as Type I and Type II CM Contract Forms.

<u>SLIDE OF TYPE I and TYPE II CONTRACTS</u>

TYPE I

Both types have been developed as two part contracts.

Part A --Construction Manager's Consultation Services Contract

Part B --Construction Manager's Fee plus Services Contract during Construction.

TYPE II

Part A --Construction Manager's Consultation Services Contract.

Part B --Construction Manager's Guaranteed Maximum Price Contract

The major differences between the two forms is the provision of the GMP in Type II. Type II also provides the necessary forms for taking competitive bids on the CM services.

While it is not a requirement that CM services be procured on a competitively bid basis it is recommended that several firms be asked to submit their qualifications and proposals. Both types of CM contract forms are now in the final draft stage and should be ready to go to the printer within the next several weeks. If you should want a copy of the documents when they are available, you may fill in the cards provided and you will be put on the mailing list.

SUMMARY

In all that we have discussed, there is one central theme -- The need for a Team approach.

REPEAT SLIDE 16

It is a management alternative which when properly applied in the correct setting, can produce unusual benefits to owners, architects, engineering, contractors, subcontractors, material suppliers, and manufacturers. What are the benefits?

Owners get their projects accomplished within established budgets and in a minimum time frame.

Architect/Engineers benefit from the cost information and construction technology provided during the design and are relieved of the burden of managing the project in the construction stage.

Contractors and subcontractors can bid sharper with less uncertainty regarding quality standards and manpower committments due to improved communication between owner, architect, and contractor, and closer coordination of work schedules.

Material suppliers and manufacturers can plan ahead more effectively in providing vital equipment to the project due to better scheduling and closer coordination of the work at the site.

Savings of significant proportions can flow from a project controlled and scheduled by a construction manager employed through the Team approach.

SESSION 6

QUESTIONS and ANSWERS

CONTRACT MANAGEMENT SERVICES

1. Ques: Is there a penalty for the construction manager if he does not perform?

   Ans: Dorland - He has to perform for a prescribed figure and the owner can incorporate a liquidated damage clause in the contract if he chooses.

2. Ques: Do you have a written qualification criteria for the construction manager?

   Ans: Dorland - No. Only the statement of responsibility I mentioned previously.

3. Ques: HEW work with both General Contractors and Consultant Management firms in this program. Who do they work mostly with?

   Ans: Dorland - Mostly with the General Contracting Firms as most consultant firms will not guarantee a fixed price

"CONSULTING ENGINEERING FEES"

Things You Ought To Know, But Never Thought About

by Otto L. Hilmer

Biographical Sketch:

Otto L. Hilmer born in Cincinnati September 27, 1913. Attended Cincinnati schools, graduated from Cornell University as M.E. in 1934. Worked as an engineer at Armco Steel Corporation prior to starting at Fosdick & Hilmer, Consulting Engineers, in 1937. Managing partner of this firm since 1951. Member of Consulting Engineers Council.

* * * * *

When George Moore of the University of Cincinnati contacted me about talking to you, I wondered what I might talk about, on what phase of engineering I was particularly well grounded that might be of interest to all of you. I didn't have any good ideas until I finally realized the thing I probably knew most about, or at least should know most about, was the operation of a consulting engineering office. I also decided I should stay away from the day to day operation of such a business as you are probably pretty familiar with this. So, I thought I would talk to you on several phases of our business with which you might not be so familiar.

In our office we have done a great deal of work for universities. Our office opened in 1905, and in those early years did work for Miami University and the University of Cincinnati. Since that date we have continually had university work in our office, and of course, since World War II, this volume has been quite sizeable.

Ninety-five per cent of the work our office does is in the State of Ohio, though much of it is for our out of state clients. So, what I am telling you is typical for Ohio. You will no doubt think of exceptions to what I may tell you and I know, in some areas work is handled considerably differently than in Ohio.

I have been working in consulting engineering in this same office since 1937, and since 1951 have done all the selling and overall office management of our firm.

On many occasions in talking to prospective clients, I have been told, we intend to hire an architect to design this project, or we have hired an architect, and it's up to him to select whichever engineer he wishes--it's his responsibility.

On further questioning it usually develops the Owner has not set up any standards as to what he expects from the engineer or what fee he might expect the engineer to be paid.

This continues to amaze me, and it was because of a discussion on this subject I had with several of the University of Cincinnati people that I decided to talk to you on this subject and one other on which no definite program seems to be established--that of professional liability.

Getting back to engineering services and fees. You have a 5 million dollar project. Of this, 60% is architectural and structural, 40% is mechanical and electrical. On a 6% fee basis, you are paying a total of $300,000 for design services, theoretically $180,000 for architectural and structural, $120,000 for mechanical and electrical.

We are talking now about the work being awarded to an architectural firm who in turn subcontracts the engineering. Who do you as an Owner get, and what do you get for your $120,000? Do you discuss this with your architect; do you establish any standards of performance? Do you specify the amount of on-site inspection services you expect from the subcontract engineer? The latter would also apply to a combined A-E firm. What mechanical and electrical inspection services should such a firm provide?

In talking to University of Cincinnati personnel on this subject, I was quite surprised to learn that they did not realize until I told them that architects as a whole do not pay the entire fee for engineering services to the engineering firm, and that the percentage that is paid varies considerably from architect to architect. In many cases it becomes a bargaining situation and the architect buys this for the lowest price he can.

As a sidelight on this, I think very few architects have an appreciation of the great variety of mechanical and electrical systems that can be provided in a building, and almost no understanding of the relationship of these systems to operating and maintenance costs in future years.

What fees do the architects pay? The only time the full fee is paid is when the engineer has been the major or at least equal force in selling the overall services for the project. When this is not the case, the highest fees paid I know about are 90% of the fee paid the architect on the engineering branches. Some architectural firms pay 85%, most 75%, and many as low as 50%.

What are your buying for your money? If you wonder at times why you are getting a relatively inexperienced firm on a complicated project, this is no doubt the answer. What are you buying in the way of inspection services from the engineer?

When you question an architect on these lower range fee payments to the engineer, he will tell you he has a sales cost on the project, he spends a great deal more time on the preliminary design than does the engineer, it costs him to handle all the administrative paper work, he spends a lot of time coordinating the work, the architect's higher cost of inspection services, and so on. Some of this is true, some is exaggerated.

The parts that are exaggerated are sales, paper work, coordination. We both have the same problems here. As to preliminary work, on the larger projects of an unusual or more complicated nature, in many cases the owner awards a separate contract for the very preliminary studies required to gather the basic data an develop a basic overall design scheme. If he doesn't, I think he should, because this can be very time consuming, mainly because more and more owner's representatives of all levels of competence and stature are becoming involved in these projects, and it is quite a problem to sift through and incorporate all their ideas and in the end arrive at a satisfactory solution.

The remaining, and to me the real problem, is the one of inspection services. The architect has costs here that are not covered by his standard contract (at least as it is understood in all of Ohio) and to make up for this, he is forced to cut down on what he pays the engineers, which in turn cuts down on the inspection services the engineer can provide on a job.

Our firm has four full time outside superintendents (or inspectors, as we are advised to call them) who spend all but a few hours each week outside on the projects. We try to give all of our projects what we think is adequate supervision based upon tradition, even though this is not spelled out in very many of our agreements with architects.

I was surprised to learn that the University of Cincinnati contracts with the architects do not include any stipulated amount of inspection services for the mechanical and electrical branches of the work, although the same contract may require full time architectural inspection.

On the other hand, on several what I will term low-fee contracts, we have only been required to make four visits to the job during the construction period, one of these being on a multi-million dollar project that took two years to construct.

Obviously there has to be a great difference in cost to the architect as between 50% of full time supervision by the engineer on such a project, and four visits in two years. Something like 2048 hrs., which at $15.00/hr. is $30,720.

Going back to the beginning of my talk, we start with a basic fee of $120,000 for mechanical and electrical engineering services on a five million dollar project. 90% of this is $108,000 or 5.4% for engineering services. Deduct $30,720 and you have left $77,280, or a 3.86% fee, which is 64% of the base fee for design services, checking of shop drawings, and four visits to the job during construction.

In my opinion, this is the principal difference in fees paid engineers. The remainder is the reduction a newer or younger firm is willing to accept to get started, hoping they won't run into slow times in the near future, so they won't need a little reserve to carry them forward.

The standard A.I.A. contract for architectural services allows 20% of the fee, after contracts have been awarded, for checking of shop drawings, administration of the contracts, and field inspection.

In our own office, on the more complex projects, we have found the time to be divided about 50-50 between office and field after award of contracts, and on the hospital projects in particular, we need one-third of our total fee, or 33-1/3%, to cover time after award of contracts.

Assuming the 50-50 split is true for an architectural office, it then has 10% of its fee available for field inspection, and in most cases in Ohio, the architect is agreeing to full time inspection on his part, plus an indefinite amount of engineering inspection on 2 and 3 million dollar projects, which just can't be done without losing money. I will proceed to show you why.

First, man-hour costs. We use 1920 hrs. per year, as the time a man works. This allows for three weeks vacation and one week (5 days) of holidays. The extra holidays, sick leave, etc., are considered overhead. In our office we use a 2.1 multiplier for sales charge, many offices use 2.5. Because I am going to use $15.00/hr. sales charge in my calculations, this would represent a man earning $13,714 per year on a 2.1 basis, or $11,520 on a 2.5 basis.

$$\text{Example: } \frac{\$15.00 \quad x \quad 1920}{2.1} = \$13.714.$$

Now take a three million dollar job at a 6% fee and allow 10% of this for field inspection at $15.00 per hour.

$$\frac{\$3,000,000 \quad x \quad 6\% \quad x \quad 10\%}{\$15.00} = 1200 \text{ hrs.}$$

If the project takes 18 months to construct to completion, this means an office can afford to man the project 800 hrs. per year for inspection services. This represents 38% of the working time and is a far cry from full-time inspection. This in turn must include all architectural and engineering inspection.

This is a major problem architects and engineers are faced with, and I don't believe either one has ever made a real factual attempt to explain this to a group like yourselves. The above is what you are buying, and to get what your contract calls for the architect to provide, full time inspection, only means that corners have to be cut somewhere else. One thing for sure, when an office has been in business for as many years as we and many of the architectural firms have been, we and they certainly are not losing money on every job.

Is this perhaps the real cause of indication to us at times that you feel you are being short changed on engineering design and inspection?

I was asked, are you really losing money in such a situation? The inference was, you are receiving more dollars than you are actually paying the man in the field. Well, any accountant will tell you, you can't analyze any cost problem in this manner. If you do, where do you stop?

In our own case, we provide each of our inspectors with a car, they have desk space in our office, they have the same insurance and profit sharing benefits as our other employees, much of the time of our bookkeeper is spent working on contractors' accounts which in turn come from the inspectors, we type their job reports, they are in constant touch with the men in our office. They can't be considered a separate entity--their overhead is just as high as our other employees.

Now to jolt you a bit, what size job does it take to provide full time architectural inspection and half time engineering inspection at $15.00/hr. on a project that takes 18 months to construct. We will assume two conditions of 20% and 30% of fees applied to work after award of contract, with half of each to field inspection.

<u>20% of Fee</u>:

$$\frac{78 \text{ weeks} \times 1.5 \text{ men} \times 40 \text{ hrs.} \times \$15.00}{6\% \times 10\%} = \$11{,}700{,}000$$

<u>30% of Fee</u>:

$$15\% \times 6\% = .009$$

$$\$11{,}700{,}000 \times \frac{.006}{.009} = \$7{,}800{,}000$$

This brings up another problem confronting the architect-engineer, at least in this area. How do you complete a 12 million dollar project, completely turned over to the owner, in 18 mos. time from award of contracts?

From the above, I believe you will agree that many of the contracts that have been written are very unrealistic. You can argue some of my points--the relation of inside to outside time--and granted, these vary. However, the only type jobs on which our inside time goes down considerably during construction are on dormitories, which are, let's say, 90% dormitory without a kitchen and dining hall or any other special areas.

In an office such as ours, we don't budget all of our jobs because we can tell from experience about what to expect and we run an overall operations record on the office every four months.

However, we do budget all the larger jobs. Since we know from experience the more complicated projects will run two-thirds plans and specifications through bidding and one-third checking of shop drawings and inspection, we start on this basis.

Going back to a \$108,000 fee (90% of \$120,000 - engineering on a 5 million dollar project), this would divide:

Plans and Specs. - $\frac{\$108{,}000 \times .667}{\$15.00} = $ 4802 hrs.
120 man weeks

Office hrs. during const. - $\frac{\$108{,}000 \times .333}{\$15.00 \times 2} = 1200$ hrs.

Field Inspection, same = 1200 hrs.

The 4800 hrs. is budgeted slightly differently for each job depending on the type job and the expected breakdown between branches. If a total of 6 men are working full time on the job on plans and specifications, then it must be completed in less than 5 months time.

If the construction program is expected to take 18 mos., we can then allow:

$$\frac{1200}{78} = 15.4 \text{ hrs./week for field inspection}$$

A small portion of the 1200 hrs. is actually reserved for calls back to the job after completion, but this would only be in the neighborhood of 60 hrs. on such a project.

The preceding discussion is background for another area in the construction field that is receiving considerable attention and promotion today. That is Construction Management.

Without going into all its ramifications, I will state that Construction Management is really what all professionals have tried to do in years past. I agree that some new facets have been added, but overall it's what engineers and architects have always felt was really their responsibility. I think design professionals can do everything in this field a contractor can. If this is so, then why aren't the design professionals accepting or living up to this responsibility?

It simply gets back to fees. The preliminary time required by the design professionals on both program and design is much greater than it used to be, and as shown above, the architect and engineer can't come out on inspection services under the present fee arrangement.

A fairly reasonable construction management fee on a five million dollar job is 2%. Why will owners pay a general contractor or a complete outsider an additional 2% for construction management services, but object strenuously to increasing a design professional's fee from 6% to 8% to do the same work?

On such a project, the management fee would be $100,000. Using very talented manpower at $20.00 per hour, this would provide 5000 man-hours of service. On a project that might take three years from conception to completion, a firm could allow 3000 hrs. for a manager and 2000 hrs. for field services. The latter figure plus the time already provided for inspection services would certainly provide adequate construction management in the field, and 1000 hrs. per year of office management time should be adequate to manage any five million dollar project; especially when you add this to the management work already being done by the design professional.

I feel very strongly about this because I think most architects and engineers have abdicated this field and responsibility to others, (1) because it's an easier way out for the present, and (2) because they haven't had the courage to sit down with an owner and show him just where his fees are going, sometimes for fear of losing the design contract.

Expanding a bit further on this theme, I would also like to add that because of the squeeze on engineering fees, I don't think nearly enough time is spent on these projects on overall planning and developing the best system for a project. This includes system, space allotted in building for major mechanical and electrical equipment, coordination of ductwork with other systems, construction costs, and future operating and maintenance costs.

All of you realize that today you are paying in the range of $13.00 to $15.00 per hour to contractors for their construction labor. This includes insurances, overhead and profit. How many hours a day do these men actually work on a job? In addition, how many times have you seen 6 or 8 men gathered around a foreman trying to decide what to do? How experienced and knowledgeable are the foremen? Even though you might say, that's the contractor's worry--if he pushes his men he will make money--if he doesn't push he won't make money, you are the one actually paying the tab, and any successful contractor has this waste time built into his bid.

On the other hand, you might say, that is why we want a construction management firm in the picture. There are no doubt exceptions, but in my experience, most contractor based management people understand general contract work only, and have no real ability in mechanical or electrical engineering design or construction.

Most engineering firms are also charging in the range of $13.00 to $15.00 per hour (some men less, full-fledged engineers more)for their men, and I'll guarantee you will save $2.00 for each dollar spent to have experienced engineers and designers take the time to engineer and properly lay-out your work.

Why an owner will give a blanket contract to a contractor and have him work out a system and install it in the field to save engineering fees is beyond my understanding. In anything other than a simple warehouse or factory building of the type the contractor has done many time over, the savings of the engineering fees can only result in a negative figure. When you talk to an owner who has done this, after the fact, and he is honest enough to give you all the facts, he will finally admit his square foot costs are considerably higher than he ever had reason to believe they would be.

How can any reasonable person think that a foreman working at a table out in a half-finished building with six men standing around him can work out problems as quickly, economically, and correctly as an experienced designer can in an engineering office?

One other area I would like to discuss is that of professional liability and the responsibility of engineers or architects for their so-called errors and omissions.

This is a very broad field and has as many ramifications as there are clients. However, I think your group is different from most and some definite guidelines can be established.

I say this because most all of you represent owners who have had a great deal of building experience, you do not expect the impossible, and the work being done at one university to a great extent is very similar to that done at many others, so you have a good basis of comparison.

The most difficult client to work for is the one job client who has not built anything previously and expects far more than is reasonable. Beyond this is the client who continually wants something additional or a revision at no extra cost.

Each architect and engineer has to be somewhat selective in securing clients to avoid the above. As a whole, you are a very reasonable group, you are knowledgeable as to what to expect.

Most firms carry professional liability insurance to protect them on a serious errors, but there is no protection against the smaller errors because of the large deductible that must be met before the insurance applies. In our own case, the deductible is $7,000.

The fee structure as it is set up today does not provide sufficient cushion that an engineer can guarantee he will assume the responsibility for all extras due to errors or poor judgment on his part. What would it take to make such a guarantee? Probably an increase in fees of one per cent of the job costs.

In our own office we have never had a claim that was handled through our professional liability insurance, nor have we ever had an owner threaten to sue us. We have had owners say, "Don't you think this is your responsibility, we'd appreciate your taking care of this."

We have not had over 6 or 7 such cases in the 35 years I have been with our firm, and the largest amount we have ever paid was $2,000. So to date, this has not been a serious problem.

This does not mean we have not made other errors and that we have not caused some extras on work. We have, but in 99 per cent of the cases, the Owner has taken a very reasonable attitude on these and paid for our errors.

Should he pay or shouldn't he? My attitude to you on this is this: In general, all of you are employing from several to many architects and engineers on your work. You have a history of this, as do all members of your organization, so you should be able to establish some standards of performance.

If the extras due to errors and poor judgment are above the standard you have set on a project and you have had this same experience previously, or you know of another university who has had the same experience with this particular professional, then don't hire that professional for another project, and so advise him as to your reasons.

It certainly seems to me there are plenty of firms available who can meet reasonable standards on job after job.

I have never thought a professional should be responsible for an extra where an item was inadvertently omitted and then had to be added during construction, unless considerable work which has been completed had to be dismantled to make the new installation. Here, I think, the professional, if he has had unreasonable extras on the project, should be responsible for the dismantling, but the owner should pay for the added work even though we know the owner is paying more for the added work than if it had been included originally.

I realize, as do you, that there are extremes in such cases, and it is not possible to set up an explicit program on this that will apply to all situations.

Similarly, you have changes resulting from, I'll term it relatively poor judgment on the professional's part. He had designed something that will work or that will serve a purpose as outlined by the owner, the job is under construction, the owner and the engineer realize some changes should be made to provide a desired improvement in design, and the only thing to do is---go ahead with the changes. How much should you penalize the professional for this?

My own thought on this is the professional should do all the design, specification, and change order work necessary to process any change that is necessary. Assuming this is a case where you aren't pressing a major claim against him that would involve his professional liability insurance, I would think:

1. If the changes are clearly the result of relatively poor judgment and not an actual error on his part, the only compensation he would receive on the change order would be the portion of the fee that applied even though it might end up as a credit.

2. If the changes are due to a change in thinking on the owner's part, and this is very clear, then I think the professional should be paid on a time basis for the work, as it is seldom the fee received on a change order will cover the time spent on this.

A professional is continually making changes on his own during the design of a project because of improved judgment on his part. Each owner has done the same thing many times prior to start of final design in attempting to establish his program. So it should not be surprising that several additional desired changes should come to the minds on both sides of the project during the construction period.

It seems to be the nature of this business that we are always meeting deadlines and pushing to finish our design work. Decisions have to be made quickly and on bid type work there is no chance for putting off a decision till next week or saying, we will figure that out when we get to that point in the construction program.

All of us are accepting risks on every job, and part of our pride is based on the fact that we can solve unusual problems on a one time basis--our clients aren't too willing to accept programs on a trial basis. Naturally errors arise and things sometimes don't work out as well as we have planned.

The other area where an engineer or architect has to protect himself is from a liability suit arising from an injury or death as a result of an accident at the construction site where the professional had no part in the accident.

The lawyer representing the plaintiff sues everyone connected with the project and his claim against the professional is that he has been negligent in supervising the work, and in this capacity failed to act to prevent the accident that happened.

Ludicrous as this may seem, it does demonstrate the wide gulf in understanding that exists between the design professional and the general public.

There have been many claims of this type filed throughout the country. The usual contention is that because of a design failure or failure in construction review (supervision and inspection) by the professional, a workman has been injured.

These suits have been responsible for two changes in our work. One is we are advised to use the term inspection instead of supervision. Inspection means examination of construction to insure that it conforms to the design concept expressed in the plans and specifications. Supervision is now used only in connection with those having direction and control over the performance of the work.

The second change is the use of the "hold harmless clause" in our general conditions making the contractor responsible for the injury of his employees or any subcontractors' employees except if the injury is caused by the sole negligence of the owner or the professional. As an adjunct to this, we as professionals cannot accept the liability which some owners try and thrust upon us that we hold him harmless or indemnify him for any loss he may suffer.

Most all of us are involved in checking shop drawings, and we attempt to do a very thorough job on this, because this is really the time to pick up any errors or changes that should be made. However, if you read the words on the stamps we use when we return these drawings you may wonder what kind of hedging men you have employed to do your work. Here again, this is done to prevent legal claims against the professional on matters over which he has no control and no responsibility. In truth though, a good job of checking is being done.

I have tried to cover several areas in the operation of a consulting engineering office which you may have wondered about in the past, and which may have caused you problems. These are areas where a great difference of opinion exists and I imagine each of you can come up with a situation to refute what I have told you.

In conclusion, I think I should like to restate what I think is the most important point in my talk. When you are buying engineering services, have a thorough understanding with your architect or engineer on just what you are getting for your money. Going back to our original example of $120,000 for engineering services, what other item of work that costs $120,000 on a five million dollar construction project are you buying without complete specifications on design and performance standards? This becomes doubly important when you consider how much engineering design can affect your future operating and maintenance costs.

I have enjoyed being here and talking to you, and will be pleased to attempt to answer any questions you might have.

SESSION 7

QUESTIONS and ANSWERS

"CONSULTING ENGINEERING FEES"

1. Ques: Eugene Richter - Connecticut College
As the prime consultant hired by an owner for a study and plans on specification for bidding inspection, what fee is normal for $500,000 job?
Ans: Hilmer - On jobs of this size fees start at 6% up, on smaller jobs. Remodeling projects, fees go up to 9% including inspection.

2. Ques: Cushing Phillips - Cornell University
What is your reaction to a study investigation conducted on an hourly fee basis and how is it controlled?
Ans: Hilmer - Before starting an estimate is established and a review is conducted when approximately 75% of the estimate is committed. These are generally undertaken in the belief that they will end up in a job.

3. Ques: Maurice Wilson - Consultant
At the completion of a job, who is required to "tune up" a system and provide maintenance and operating manuals?
Ans: Hilmer - It is normally a specification item for the contractor to provide qualified people for "tune up" and manuals.

4. Ques: Kenneth Hayter - South Dakota State University
Do you normally include movable equipment?
Ans: Hilmer - Owner normally specifies and buys movable equipment

5. Ques: Kenneth Hayter - South Dakota State University
What methods are used to check change order prices?
Ans: Hilmer - We check and review change order prices. Individual change order prices are higher than bid prices. Goal of 1 1/4% of maximum change orders on job.

6. Ques: William Sharp - Denison University
Should a consulting engineer pre qualify potential bidders?
Ans: Hilmer - We can and do perform this service in private work but cannot successfully do it in public work.

7. Ques: Harry Loveridge - Franklin College
What steps can be taken if equipment is not according to specifications?
Ans: Hilmer - This review must be made at the shop drawing stage and proper design detail assists this review.

8. Ques: A. J. Hall - Adams State College
Do you recommend an independent air balance firm?
Ans: Hilmer - Yes. Usually included as a sub contract to the HVAC contractor, but may be a separate prime contract.

9. Ques: Walter Hartman - Ohio State University
What responsibility does the engineer have for compliance with OSHA?
Ans: Hilmer - Presently compliance is made a responsibility of the contractor by the specifications.

10. Ques: James Wessels - University of Kentucky
Do you furnish final design data including calculations?
Ans: Hilmer - On request. File data is organized for future reference.

11. Ques: Walter Wade - Purdue University
What factor do you apply to direct payroll costs in charging hourly fees for consultation?
Ans: Hilmer - Fosdick and Hilmer use 2.1. Most A & E firms use 2.5

12. Ques: Are you legally required to design to OSHA standards?(Unknown)
Ans: Hilmer - Yes, pending clarification of requirements.

HARDWARE AND ITS RELATIONSHIP TO SECURITY

MODERATOR:

Robert J. Chabot, A.H.C.
President, Norwood Hardware and Supply Company
Cincinnati, Ohio

Boston University, B.S. Degree 1952
Member: Construction Specifications Institute
American Society of Architectural Hardware Consultants

PANEL MEMBERS:

James A. Merriam, A.H.C.
Sargent and Company; Security Products Manager

Twenty-five years experience, serving in a variety of managerial positions with manufacturers of Builders' Hardware and Locksmith Supplies.
Member of the American Society of Architectural Hardware Consultants and the Security Equipment Manufacturers Association.
A graduate of Tufts University

W. S. Adams
Sales Manager, LCN Closers, Princeton, Ill.

Washburn College, Topeka, Kansas- BA Degree 1934
Graduate Work - Northwestern University 1935
1949 to Present - Sales Manager, LCN Closers
Associates Member - National Builders Hardware Assoc.
Alternate National Representative - Producers' Council
Alternate Representative - Construction Specification Institute

Carl Happersberger, Von Duprin Division, Vice President Sales

Joined the Von Duprin Division of Vannegut Hardware Company in the Assembly Department in July 1936, as an inspector of mortise locks and the assembly of various locks, outside trim, strikes and cylinders for completion of orders and preparation for shipment. In 1943 joined Armed Forces. Rejoined Von Duprin in December of 1945, 1946 was transferred to Sales Department. In 1968 was named Vice President-Sales for Von Duprin, Inc. Member of Construction Specifications Institute and Sales and Marketing Executive of Indianapolis. Served as an instructor for the Corp of Engineers Architectural Hardware School for the past seven years.

Art Campbell
Hager Hinge Company, Vice-President Customer Affairs

Served as Eastern Sales Manager in territories of Mountain States and New York
In recent years specialized in architectural and engineering sales. In contact with several thousand architects throughout the United States and Canada with involvement in research, architectural specifications, and the introduction of new products.
Member of Construction Specifications Institute
Vice President of Architectural Services in 1967
Duties expanded to Vice President of Customer Affairs in 1971.

* * * * *

HINGE SECURITY

1. TERMINOLOGY
   - A. Types of hinges
   - B. Door and frame construction and determination of proper hinge
   - C. Security features of the different types of hinges

2. HINGES
   - A. Ferrous versus non ferrous base metal
   - B. Finishes
   - C. Size and weight of hinge
   - D. Style of hinge - 5-3-2 knuckle type of hinges

3. HINGE REQUIREMENTS
   - A. Underwriters
   - B. Selection of appropriate type hinges dependent on:
     1. door width
     2. door height
     3. door thickness
     4. door and frame material
     5. usage

4. SUMMARY

LOCK SECURITY

A. Security Check List

1. Environment
2. Value of property and assets
3. Physical design of installation
4. Door opening construction
    a. wall
    b. frame
    c. door

B. Determine Level of Security Required

1. Convenience vs security

C. Two Basic Levels of Lock Security

1. Mortise
    a. large parts designed for heavy duty usage
    b. separate cylinder for added security
    c. separate deadbolt available with 1" throw
    d. separate anti-friction guard bolts for independent action
    e. separate spindle hub, heat treated for extra strength to retard forced entry
2. Key-in-knob
    a. easy installation
    b. smooth operation
    c. long life
    d. contemporary appearance

D. Cylinder Security

1. Standard pin tumbler
2. Removable core
3. High security cylinders
4. Security collars

E. Summary:

1. Determine security requirements
2. Consider the opening
3. Select the lock and cylinder
4. Consider convenience vs security

DOOR CLOSERS

Security Against Trespass

A. Certain locks must re-latch after operation to provide security

1. Panic devices
2. Night latches of various types
3. Electric releases

B. Closing Power at the latch

1. Selection of proper size and type
2. Efficiencies
3. Power adjustment

Security Against Fire and Smoke

A. Closers on fire doors - need to latch

B. Closers on Smoke-Stop Doors - need to stay closed even under fire draft conditions

C. Magnetic holders and closers

D. Early warning devices and closers

E. Fusible link closers

Sum Up

"EXIT THE DOOR"

A. History

1. Event leading to the development and promotion of exit devices

B. Responsibility of building owners for propery equipped doors

1. Coconut Grove, Boston

a. Owner
b. Fire Inspector

C. NFPA National Fire Code

D. Types of Devices

1. Rim

a. Application and security value on single doors and pairs with mullion

b. Selection of outside trim functions and their relation to security

2. Surface Vertical Rod

a. Application and security value
b. Selection of outside trim functions

3. Mortise Lock

a. Application and security value
b. Deadlocking latchbolt

4. Concealed Vertical Rod

a. Application and security value

E. Summary

"PLANNING AND ITS EFFECT ON MAINTENANCE"

CLARENCE P. LEFLER
Director, Physical Plant Division
Ohio University

Title............. Director.

Affiliation....... Physical Plant Division, Ohio University.

Background........ Bachelor of Science in Electrical Engineering, University of Nebraska at Omaha.

Mr. Lefler is a member of the Midwest Regional Association of Plant Administrators, a past member of the Central States Regional and Eastern States Regional Association of Plant Administrators. He also served as a member of the committee to write the book entitled WHAT WENT WRONG for the Council of Educational Facility Planners.

He has presented numerous papers and several of his articles have been published in a number of the trade journals.

Mr. Lefler has served as a faculty member of the Workshop for Physical Plant Administrators and is currently a faculty member of the College Business Management Short Course at the University of Nebraska at Omaha.

Mr. Lefler has been in maintenance for the past twenty years, beginning as a Maintenance and Utilities Officer in the United States Navy. He then served as Maintenance Engineer for the Elgin National Watch Company and as Plant Administrator for the University of Nebraska at Omaha, Nebraska and Fordham University, Bronx, New York. He is currently the Director of Physical Plant at Ohio University in Athens, Ohio.

Planning and Its Affect on Maintenance

Clarence P. Lefler

There is a very direct relationship between the planning of a facility and the resulting operating costs, a relationship not always given the attention it deserves. This may be because the battle for the dollar is fought on two different fronts. The first front is that of obtaining an appropriation for the construction of a facility which is usually a fixed dollar amount based on current construction cost estimates. The second front involves the requesting of funds to operate existing and proposed facilities for a given fiscal period.

In the first instance, from the time the appropriation is requested until it becomes a reality, frequently inflation has already taken a sizable bite from what originally may have been an adequate request. Also, during the same period, technological developments may dictate the need for a more sophisticated facility than had been originally conceived, resulting in another substantial bite from the original dollar. These two considerations alone can impose an undue burden on the planning dollar resulting in compromise decisions being made during the planning process without due consideration being given to the impact they may have on the long-term operating costs. In the second instance, the battle to obtain physical plant's fair share of available funds for operations usually must be based on historical data developed from experience with facilities which already exist. This data, whether it results from square footage costs or some other criterion, is projected in the hope that it will provide for the new facilities that will be placed in operation during the fiscal period in question.

Unfortunately, the processes involved in submitting a request for either a construction appropriation or for operating funds is so involved and time consuming that often there may not be an opportunity to evaluate the impact one has on the other. Because of the time constraints, we may be forced to ignore planning problems which if considered would substantially improve the accuracy of the operating requests. Because of the affect which planning has on maintenance, my theme will be one of exploring problems which each of us should consider in an effort to insure the best possible facility without placing an undue burden on future maintenance costs.

There is yet another relationship between planning and operation costs about which we should be cognizant. The operating costs for a facility having a designed useful life of fifty to one hundred years can easily surpass the original construction costs several times during its lifetime. This suggests that planning decisions should give as much or more emphasis to the resulting operating costs than to the initial cost. One thing which recognition of long-term costs does is to preclude some predetermined construction estimate from being the primary criterion for facility design.

I will not take the time to discuss all of the people who should be involved on a planning team. There is one person, though, who has faced the problems of operating facilities and who can help avoid many problems associated with the use of certain types of equipment, systems and materials -- the plant administrator. He should be a member of this team from its inception and since decisions are continually being made throughout the planning process which affect the long-term operation, it is essential that he participate during the entire planning process. For him to be used only as a reviewing agency at various stages of the project is a bit like asking him to read one or two chapters of a book and expect him to report on the entire book. We would not think of asking an architect to draw the plans for a building and an engineer to provide the necessary systems without first giving them a good idea of the end result desired. By the same token, a plant administrator should not be asked to sit on his hands while a facility is being developed and then be expected to operate it effectively with little or no concept of the needs it must meet. Most architects and engineers would welcome the opportunity of working with a competent plant administrator who is willing to share his experience, knowledge and time. Even though the plant administrator may have a greater long term interest in the project than most of the other members of the planning team, he should not expect to dictate his wishes to the exclusion of the suggestions made by other participants. It is still the mutual contribution of the total planning team that results in the best possible facility.

There is one hazard for the plant administrator if he is included as a member of this team; when errors or omissions occur, he does have a commitment to work them out. Personally, I would rather face this problem than have all of the enjoyment of griping about the mistakes that others make because I was not asked for comments. I do not feel it is the responsibility of any institution to automatically recognize the valuable contribution that a plant administrator can make to the planning process. Rather, it is the responsibility of the plant administrator to establish himself as a competent member of his college or university's administrative team so that his inclusion will be automatic.

It is not altogether uncommon to hear a plant administrator berate the architects and engineers who designed the facilities he must maintain. There may be instances where this criticism is justified, however, the criticism should come only after the administrator has made every effort to provide these professional planning people with information as to how he would like to see the design and construction proceed. As a party in the planning effort he should make available to all members of the planning team a list of his desires both general and specific. For the purpose of identification, let us call his requirements "construction guidelines". They should reflect the plant department's thinking in considerable detail and cover special requirements for all aspects of the project from start to finish. They should be in writing so that all members of the planning team can use them as a ready reference during the planning process. They should be all inclusive and reflect his thinking on items such as steps at grade changes, where glass should not be installed in entryways, where thresholds and doorways are unacceptable, why changes in floor levels are undesirable, his thinking on landscape planting, etc. The construction guidelines should not preclude changes or substitutions in the development of a new facility. Remember, their primary purpose is to provide a working base which will assist the planning team in making important decisions and should not be thought of as the last word in any given situation. If the plant administrator has done his homework by preparing the construction guidelines he substantially enhances his bargaining position since it places the burden of proof, when alternates are suggested, on those who would challenge his recommendations.

Closely akin to preparing construction guidelines is the preparation of a plan and specification review checklist. We can recognize the appropriateness of having the plant department make a detailed plan and specification review but to do this without a review checklist provides too many opportunities for important considerations to be overlooked. If you are not able to steal somebody else's list as a starting point, it is really not too difficult to prepare one of your own. The one that we have at Ohio University is simply a compilation of all the errors that we have found on our building plans over a period of the last three years. It may interest you to know that this list now includes over two hundred items. It has proven extremely helpful to us particularly in our more recent reviews.

An institution may need to be made aware of the value of having plant department review its plans and specifications. I recall on one occasion I was given a set of plans and specifications for a 3.5 million dollar science building less than twenty-four hours before it was released for bidding. They were given to me then only because I asked when I was going to receive a set for review. The response was one of surprise because my boss did not understand why I was concerned since the plant department would not be maintaining the building for at least two years. It was pointed out that any errors discovered before the construction was completed would obviate the necessity of correcting them after the building was turned over to us. A set of plans and specifications were then given to me with the stipulation that they be back in his office by eight o'clock the next morning. This did not give me nearly enough time to make a detailed review, however, the list turned in was eighty-five items long and most of them represented general conditions throughout the building. Unfortunately, all of the items had to be corrected by addendums which is not a good procedure during bidding. I can assure you from that point on all plans and specifications were received well in advance of the bidding date so that all changes could be incorporated in the bidding documents without having to resort to use of addendums.

When the plans have been received by physical plant in sufficient time to make detailed review and it is put off until the last minute, making the effort at best a cursory one, they have no one but themselves to blame for the mistakes that result. The excuse that the plant department is too busy to make a review is not good enough in this case. The long range impact that these plans have on maintenance cost is sufficient to mandate that time be made available to properly perform this important job. It is just possible that if the plant administrator does not take advantage of this opportunity, others may consider him responsible for the mistakes which result.

In connection with the facility construction, I feel that the plant department should make regular inspections of all facilities while they are being constructed. Here, I am referring to inspections by all supervisory personnel who will be involved in maintaining the building after it is completed. This, obviously, should include the department directors and all of the shop foremen. There are two good reasons for doing this: first, it provides an excellent opportunity for them to become familiar with the systems as they are being constructed and second, any problems which are identified can be reported to the appropriate authority for correction. To maintain a building, you must not only know how it is intended to function but must also know where the system components are located. This information, to a large degree, can be obtained through regular inspections during construction. Any problems uncovered during these inspections can be corrected more readily and usually at less cost during construction than it can after the facility has been completed. Both the location of system components and identification of problem areas can serve to reduce future maintenance costs. Our goal is to plan, design, and build a building ready to serve the purpose for which it was intended and I know of no better way to promote this effort than by having the plant personnel make these informal inspections.

While I feel it is extremely important for the operating personnel to make informal inspections, it is recommended that physical plant have in its employ an inspector professionally trained in the field to protect their interests. This is in no way intended as a criticism or a reflection of the state inspector or the architect's representative on the job. Their training and orientation, generally speaking, is to see that the plans and specifications that are developed are strictly adhered to. Since they have not, generally speaking, been involved in the operation of a facility after it has been completed, they may have little or no knowledge of the problems which physical plant will face once they take over the operation and maintenance of the building. We have such an individual at Ohio University who, I might add, worked as a building superintendent for seven years and fifteen years as an architect's representative on many, many projects. In the three years since he has been with our department he has come to learn that understanding the intent of the plans and specifications is quite different from understanding the problems these documents create. He would be the first to say that, without considerable experience in plant maintenance, no person could expect to understand the maintenance operation and effectively represent physical plant as an inspector. One of the primary advantages of having such a position is that the man works for physical plant and owes loyalty only to his department. A professional inspector gives the added dimension of recognizing other problem areas that would not be identified by somebody purely oriented to maintenance. There have been no construction jobs on our campus where our director of inspection has not more than saved us his salary. As a result, I am firmly convinced that construction of even a relatively small job can more than justify the cost of a plant inspector even if it is only for the period of the construction project.

Most of us recognize the importance of holding regular progress meetings during a construction period. We should also give consideration to holding a post-mortem meeting after a facility has been in operation for a period of time, say after a year, to assess our planning effectiveness. Call it, revisiting the scene of the crime. Again, all members of the planning team should participate and as much or more time should be spent identifying the good features of the facility as is spent in discussing its failures. Every member of the team would benefit since they would be assessing earlier decisions in light of actual performance. Field testing determines the suitability of an automobile for production and sale. Why should we not employ a similiar technique such as the post-mortem meeting in measuring our planning efforts so that we can avoid repeating our mistakes and more importantly take fullest possible advantage of our successes in future planning.

Let us consider a specific problem which often causes plant departments a great deal of difficulty. It is the use of new materials, new techniques and new processes which have not proven themselves in actual practice. An institution should not shy away from new ideas, neither should they be used as a testing ground for designers who desire to do something because it is new and different. The architect or engineer who is genuinely interested in developing a facility which will serve the function for which it is being planned will never intentionally experiment. Unfortunately, there appears to be those who dwell in the world of gimmickery and feel compelled to try every new idea they come across without regard to what it will do to the operating costs. As I mentioned earlier, the operating costs easily exceed the initial costs several times during the life of a facility and experimentation with new products which may increase these costs should be avoided.

Just as employing every new idea in a building should be avoided, if it is merely for the sake of having something new, so should we avoid status quo in our planning and design. New educational processes demand that we continually incorporate new concepts and ideas. Planning should, in fact, incorporate the flexibility to support the programs of the future. These programs in many instances are unknown, but in most cases some of the demands can be anticipated. Failure to anticipate future demands is what can be referred to as "instant obsolescence". The planning process must represent a balance of the tried and true with the new in developing the needed flexibility.

In developing a new facility, the operating costs of each component should be considered since each will have a direct bearing on the total operating costs. I am aware of instances where buildings exceeded the initial project cost estimate and the flooring material was compromised to bring it within the funds available. Unfortunately, the individuals making this decision were not aware that floors represent one of the largest single maintenance cost items. As a result, the building was expensive, if not almost impossible, to maintain. Casual compromises such as this could be well considered among my pet peeves.

Deliberate over-design is another serious problem and I go on record as being unalterably opposed to edifices to individuals, monuments for the sake of monuments, economies for the sake of construction savings, sophisticated systems for the sake of environment and equipment and materials purely for the sake of good maintenance. They in themselves, never result in a good facility but all of these factors play a role and should be carefully weighed to insure the proper balance of each. An example of this might be environment which has become a household word for everyone even indirectly related to the educational process. I am not certain that anyone has satisfactorily defined the word, however, it is with us and deserves attention. It introduces problems for designers, planners, contractors and maintenance personnel because it may force compromises since it results in making decisions between what we would like to have and what we can afford to maintain. Creating special environments often brings about competition between the various members of the planning team who vie for their plum in the pudding. Such competition, unless carefully weighed, can result in compromises which in the long haul may prove to have not been wise ones. Compromise is often necessary but should always reflect a balance between the program needs, the environment desired and the initial cost as well as to the future operating costs.

Environment whether it is related to landscaping, the materials used in the building or the mechanical equipment should be designed so that it can be maintained within the prevailing limitations of the locality where the facility is to be constructed. For example, if the locality has a dearth of competent mechanics, it seems absurd to design a highly sophisticated mechanical system unless funds are made available to recruit and bring in the necessary technical skills. It may be possible to develop a training school to overcome such a handicap but this, too, can be an expensive proposition and must be recognized as adding to future operating costs. Contracted maintenance services might, in some instances, represent an answer to this problem. However, it is not a remedy in all situations as some would have us believe. Contract services are not available in all localities and the cost of bringing them into some areas would make the service prohibitive. These are not in· .mountable problems, but in order to solve them each member of the planning team may be called upon to demonstrate more ingenuity in contributing to the planning effort.

My comments concerning overdesign may sound negative, however, they are not intended as such. We need sophisticated facilities to meet the demands of the ever increasing sophistication in our educational programs. We should strive for no less than the ideal environmental condition until every avenue has been explored which might provide the necessary skilled and financial support in the plant department. We must remember that sophisticated facilities require sophisticated maintenance. Unless the support is provided, the system should not be designed.

Casual or arbitrary compromises, not those made after careful study taking into account all factors, certainly represent my pet peeve. My reason for feeling this way is that so many of the buildings we have inherited have housed an abundance of these compromises. Often we learn that the reason for the compromise is to hold down the initial construction cost. While we are in this area, why are the custodial closets which are often no larger than a mail cubicle, located in the most remote area of the building? This makes it necessary for the custodial personnel to walk hundreds of unnecessary miles each year simply because location was not considered as an important factor during the planning process. Why are mechanical equipment rooms so cramped and poorly located that efficient and effective maintenance is impossible? Why is equipment often located in areas so inaccessible that maintenance personnel visit them only when they are forced to? Why are so many utility systems installed without valves in branch lines, making it necessary to shut down an entire building to repair a simple leak? Why should all occupants be inconvenienced when a little thought and a valve could have prevented it? Where such practices are permitted in the interest of keeping down the initial cost, it raises a fundamental question: Is it more important to have a slightly smaller building that is well maintained or to have more net assignable area, very expensive if not possible to maintain? Usually this occurs when no thought is given to the possible impact of these omissions on long-term operating costs. The scales of justice may be blind, but the balance of initial cost to the long-term maintenance cost can clearly be seen. Both should be considered carefully before eliminating any portion of the system which will add to future maintenance costs.

Standardization is another problem that should be realistically faced during the planning process. It has a value, however, I feel that all too often outdated equipment and materials are employed and re-employed under this flag. Even though it is often justified, it is by no stretch of the imagination a panacea for all of the plant man's woes. Standardization on certain items may be advisable if there are only a few on campus. It concerns me though when this philosophy is expanded to literally hundreds of similar items. In such instances, the initial cost may be increased without resulting in a corresponding reduction in operating expenses. For example, using a particular brand of temperature control device under the guise of standardization is like buying a fleet of vehicles from the Ford Motor Company without letting General Motors or Chrysler submit bids. This practice virtually insures that the cost of the vehicles will be excessive and it is doubtful that operating costs will be reduced.

Standardization is encouraged by architects and engineers who incorporate manufacturer-prepared-specifications within their specifications. A single word or phrase which appears in itself unimportant, can actually restrict a major manufacturer from submitting a bid. This defeats the purpose of bidding and no responsible architect or engineer will intentionally condone this practice.

Standardization sometimes creeps in because, in the interest of insuring specification completeness, some designers fall back on their so-called standard specifications. This should not happen since our educational programs are in a constant state of change and the facilities and environment we create to support them must also constantly change to meet the new demands. Standard specifications in themselves are not bad, but they must be continually updated to reflect the needs of the project.

Standardization can be as wrong for an institution as it is right. It must be considered in the light of the restriction it places on planning versus the value derived and is but one factor deserving consideration which should never be allowed to impose itself on the project as a controlling condition.

Perhaps the most important consideration during planning is the service a manufacturer provides in support of his product. It is not uncommon for an architect to have an excellent rapport with a manufacturer's representative and the service provided by that same company in support of its products is totally unsatisfactory. As a plant administrator, I have objected to the use of a certain type of equipment because of the poor service support provided by its manufacturer. The most important thing that any firm sells is the service that backs up its product -- not the product itself. While I am opposed to the use of restrictive specifications, I have been forced to employ them to prevent companies with a poor service record from bidding on a project. It is a simple matter of dollars and cents to me. It is the plant administrator's responsibility to see that all components installed in a facility are properly maintained and function as designed. If they do not because a manufacturer's service is consistently poor or slow, he should not be given the opportunity to bid on future facilities.

A case in point involved a research animal house which was designed to operate within a temperature variation of plus or minus one degree Fahrenheit. This requirement made the control system extremely critical. We were notified that the temperature in the building was rising. It was an extremely hot day and a quick check indicated that a control was defective. We contacted the service representative and requested prompt service. They advised us that it would be at least four days before they could attend to our problem. This was totally unacceptable to our department and would have been a tragedy for the research personnel using the facility. We immediately contacted a competitor and asked if he had a control in stock which would work in the system. After a few minutes of checking, he advised us that they did and said it would be delivered immediately. It was installed and operating in a matter of two hours. While the temperature did rise beyond the one plus degree limitation for which the system was designed, the researchers were not unhappy since in this particular case, no harm was done to their experiments. They reported, however, that had the temperature risen three more degrees, they would have had to abandon and start over, on research projects which had then been in process for more than six months. To their research program, this would have been catastrophic.

Wouldn't you know, four days later the service representative arrived, control in hand, and asked where the problem was. Since I felt that the firm's failure to recognize the urgency of our request was determined by the local service manager, a conference was set up with their regional service manager to register our disappointment. After listening to the report of this incident, he advised that our complaint about their service was unreasonable. After all, emergency service was difficult to provide and having to wait only four days did not seem at all unreasonable to him. The impact that such a delay would have had on the research program was then restated, which I regret, fell on deaf ears. He gave me no alternative but to assume that this instance was representative of service we could expect to receive in the future and needless to say, no more of their controls were used at that particular institution during my tenure there. My objections were not registered against the quality of their control. It was a good one. Rather, the complaint was directed at the support service which the company provided.

We should not leave this area without recognizing that good or poor service by any company is generally a local condition at a given point in time. It is not reasonable to assume that because the service is found to be poor in a particular locality that it would not be excellent in another section of the country under the supervision of a different service manager. It does, though, point out the importance of balancing the rapport which an architect may have with a supplier and the service the plant administrator receives from the same supplier. Again we relate initial to operating costs.

As professionals, I feel when there is a complaint about product service, we have an obligation to advise the firm of our dissatisfaction. On several occasions where there was a difficulty, communicating this fact to a responsible member of the firm brought about the desired change. What we desire is good service to support our operations and not to black-list manufacturers. It may cost more to buy the product from a supplier who provides service but when weighed in terms of our ability to provide service it may be cheaper in the long run.

From its title you may have expected this talk would deal with the hundreds of mistakes that somehow creep into building plans and result in increased operating costs. Instead, I chose to direct my remarks to a few areas where some of our on-going problems occur during the planning process. There are obviously many other areas that deserve similar attention. My desire has been, by the examples used, to point out the importance of giving appropriate consideration to operating costs throughout the process of planning a facility.

SESSION 9

QUESTIONS and ANSWERS

"PLANNING and ITS EFFECT ON MAINTENANCE"

1. Ques: J.R. Smith - Defiance College
Do you think that contract mechanical maintenance is more efficient and/or economical than in-house mechanical maintenance?

Ans: Lefler - I really don't know a definite answer for this question. It depends on the labor market involved in the area.

2. Ques: B.P. McKay - University of Tennessee Medical Units
How does a Plant Administrator influence the Mechanical Team more than the aggressive equipment salesman does? (i.e. how can you contracturally enforce this requirement in your Architect's and/or Engineer's Contract?)

Ans: Lefler - One way is to be powerful. Best is to justify your position with facts. If you have the facts as well as the salesman, you will win.

3. Ques: R. B. Long - Central Michigan University
Aren't you jeopardizing the legally accepted Contractor-Inspector (one) relationship by adding a "second" official inspector?

Ans: Lefler - We are not in the State of Ohio. Our inspector is from the State of Ohio and we are protected.

4. Ques: R. B. Long - Central Michigan University
Aren't you risking "Claims" by the Contractor based on this second inspector?

Ans: Lefler - No. This would be worked thru the inspector and regular channels.

5. Ques: Roger Allen, University of Wisconsin - Parkside
What are your recommendations as regards the use of equipment, boilers, pumps, etc. during construction, before acceptance by the university?

Ans: Lefler - In our state we must accept such things as elevators, etc. when they are completed, however, we seldom permit the use of boilers, etc. prior to our complete acceptance.

6. Ques: W. N. Sloan - St. Petersburg Community College
Do you know of any instances where projected operating costs have been identified and included in consideration of total costs for new construction?

Ans: Lefler - No. In most cases they are not considered. Although in the State of Ohio we do prepare operating costs estimates prior to construction.

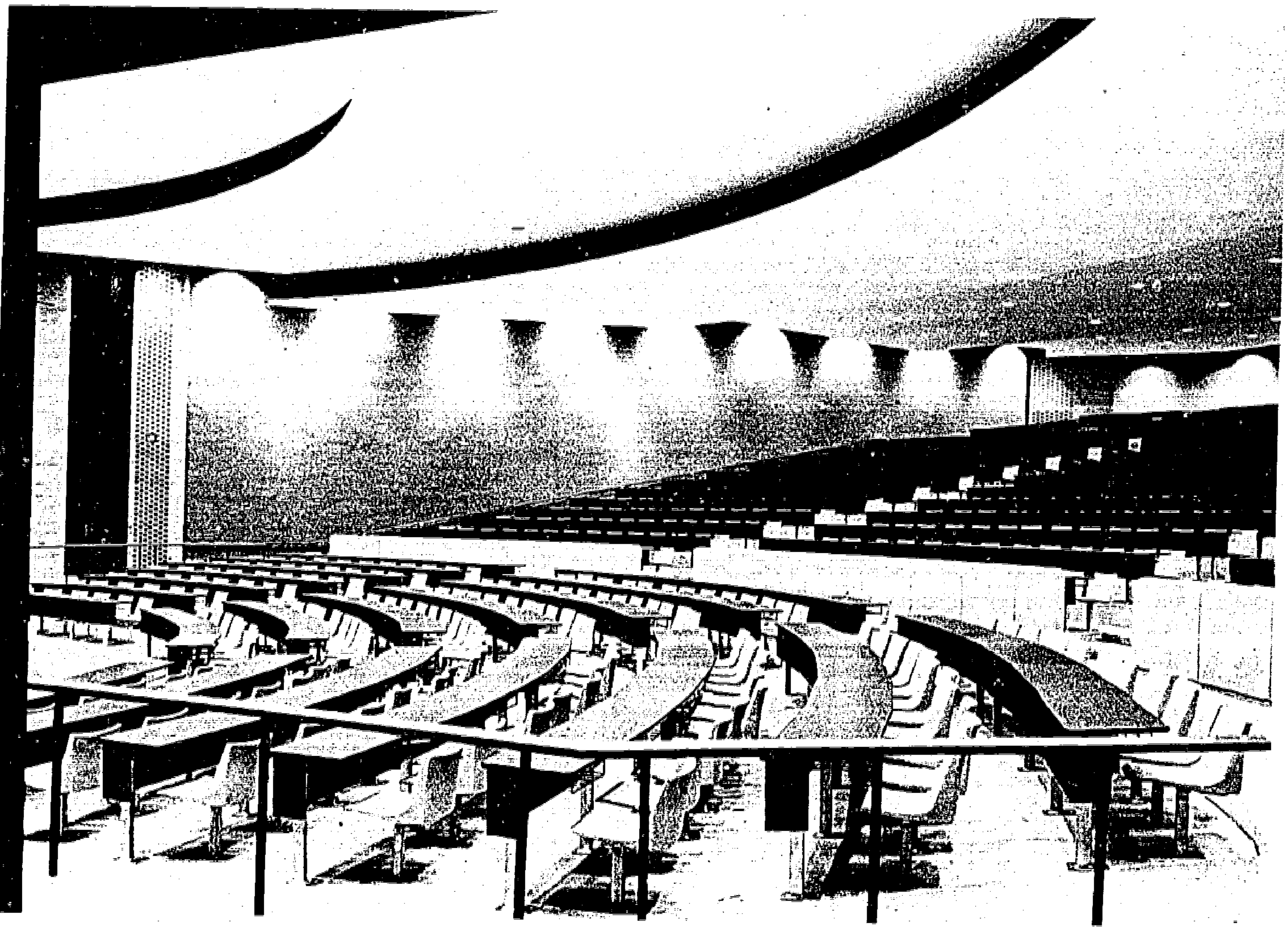

APPA

SSION 10

ZIMMER LECTURE THEATRE

..... a discussion and demonstration of Audio-Visual instruction technology and an explanation of the building.

by Mr. Russell C. Myers, Architect



JLTI-MEDIA LECTURE HALL

iversity of Cincinnati

aser & Myers and Associates, Inc., Architects

ncinnati, Ohio

Reprinted from COLLEGE & UNIVERSITY BUSINESS, May, 1971

U of Cincinnati Lecture Theater Is an Audiovisual Experience

"The impact of television on our culture is just indescribable. There's a certain sense in which it is nearly as important as the invention of the printed word."

Carl Sandburg's observation has become a fact of life at the University of Cincinnati, where a unique multimedia lecture theater is using television and other audiovisual aids to change the entire concept of large-group instruction. Conceived and designed by Glaser & Myers and Associates, Cincinnati architectural and planning firm, the building provides what architectural partner Russell C. Myers describes as "an individualized approach to communicating with large audiences."

By utilizing the concept of "instant magnification" through the use of large-screen audiovisual aids, the architect created nearly the same visual relationship between the student and instructor in a large group situation as the student would have in a conventional class setting.

Focal point of the $2,700,000 theater is a fore thrust lecture platform, above which are located three screens, each 10 by 14 feet. The screens are designed to handle color television, slides, motion pictures, film strips, or, if needed, all of these simultaneously. Images are projected by cameras from a rear projection room and can be magnified to any size desirable to fit the needs of the instructor. The presentation may be controlled either from the lectern or off-stage from a master control room adjacent to the lecture platform. For more complex presentations, the instructor has both visual and audio contact with the master control room and has available a battery of elec-

Focal point of the lecture hall is the fore thrust lecture platform and the three large screens, designed to handle, via rear projection, color television, slides, film or, if needed, all three simultaneously.

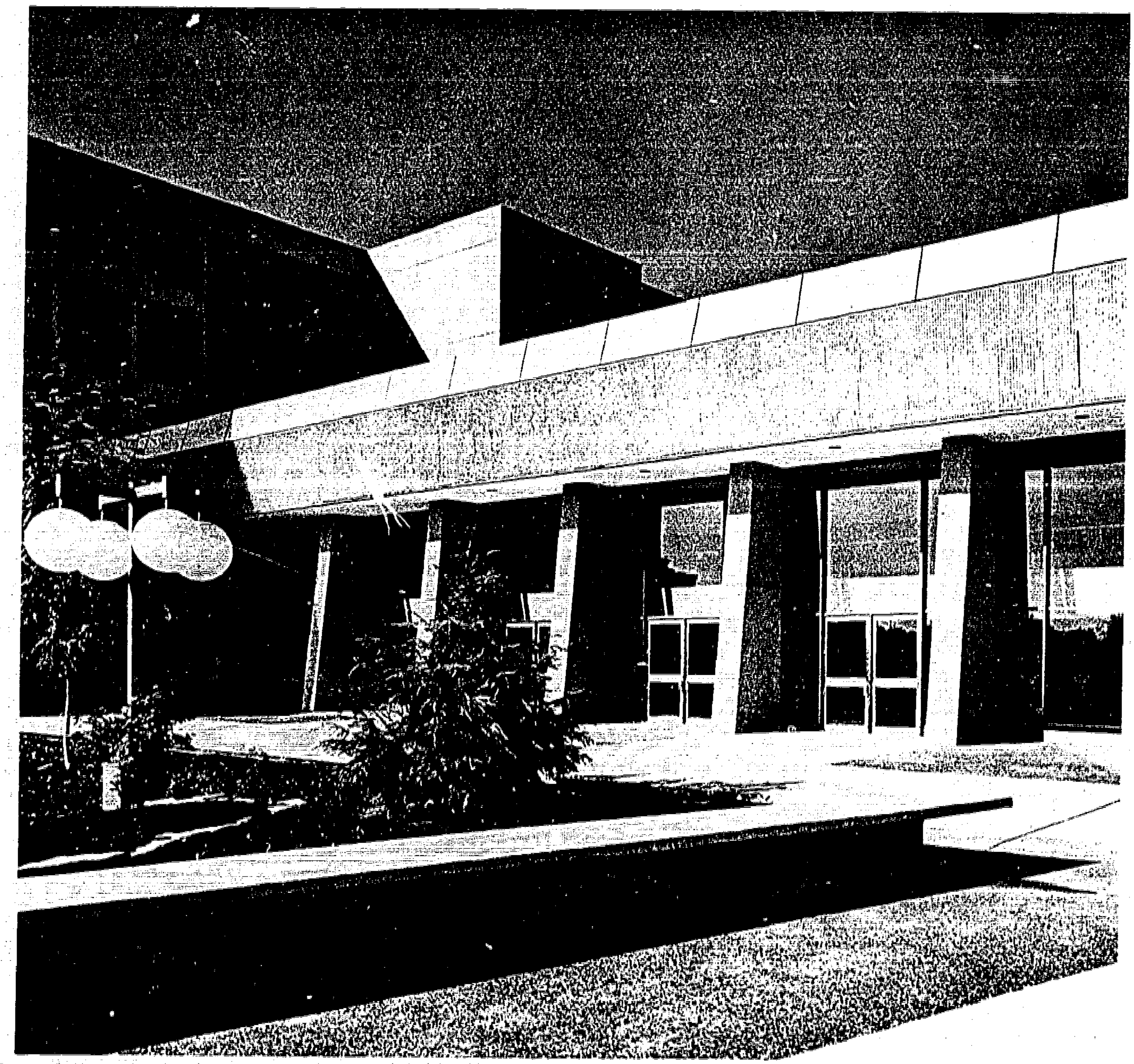
tronic equipment, including television projectors, motion picture and slide projectors, audio contols, lighting controls, and recorders.

The theater seats 850 students in swivel chairs mounted on continually tiered platforms, which are equipped with continuous desk tops. The elevation of the last two tiers is 18 feet higher than the first, giving all students an unobstructed view of both platform and screens.

Sound in the theater is enhanced by a rich gold carpet, extending from floor to ceiling on the side and rear walls, as well as the main and side aisles. The theater is also separated acoustically from the rest of the building, preventing outside noises from penetrating the lecture hall.

Seven classrooms, which can seat up to 60 students each, are interconnected to the lecture theater by closed-circuit television. With the closed-circuit system, the theater can instruct up to 1,200 students at any one time. Adjacent and connected to the building is the Educational Media Center, where media materials for lecture theater presentations are prepared.

The lecture hall is equipped with recessed incandescent lights controlled by motorized dimmers. Desired lighting levels may be preset



From a lower landscaped plaza, access to the multimedia lecture theater is provided directly into the main lobby. Students also use the plaza as a gathering place.

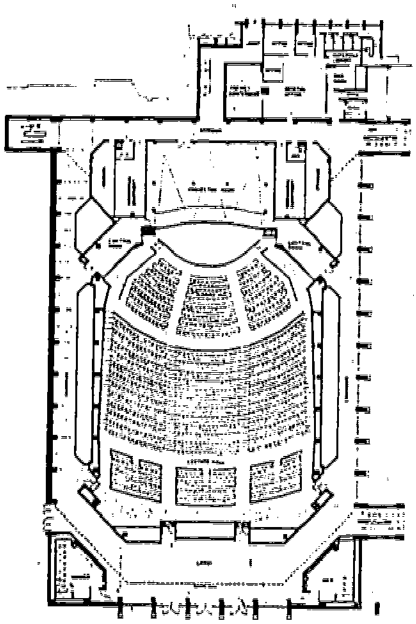
or altered during the presentation. Lighting for public areas of the building is provided by a combination of fluorescent and mercury vapor recessed fixtures.

Although its primary purpose is to serve as a multimedia auditorium, the building also is the principal connector between other campus buildings making up the university's science complex. Large concourses on two levels encircle the lecture area and serve as passageways through which thousands of students pass from building to building for hourly classes. Nearly 9,000 students attend classes in the building daily. The roof serves as a tree-lined plaza over which students have access to five additional buildings. Since the building is located on a natural hillside, its access on one side is at grade level to the rest of the campus. ☐

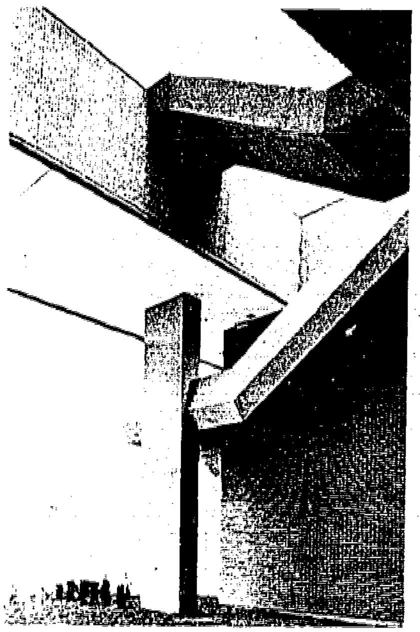
CONSTRUCTION DETAILS

Gross floor area: sq. ft.	80,000
Cost per sq. ft.	$33.75
Cost of equipment	$150,000
Total construction cost ..	$2,850,000

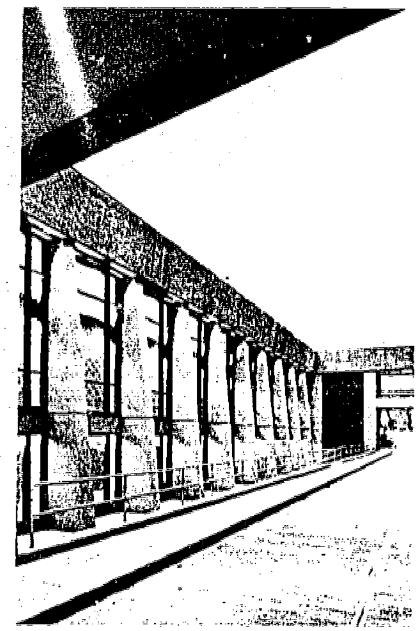
This building has been selected as the College Building of the Month, and award certificates have been presented to the president of the university and to the architect.



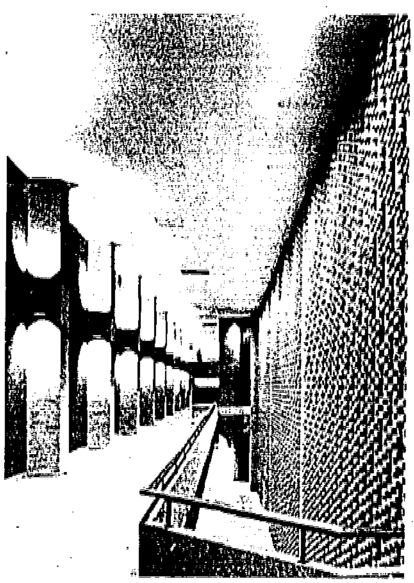
Continually tiered platforms in the theater provide seating for 850 students.



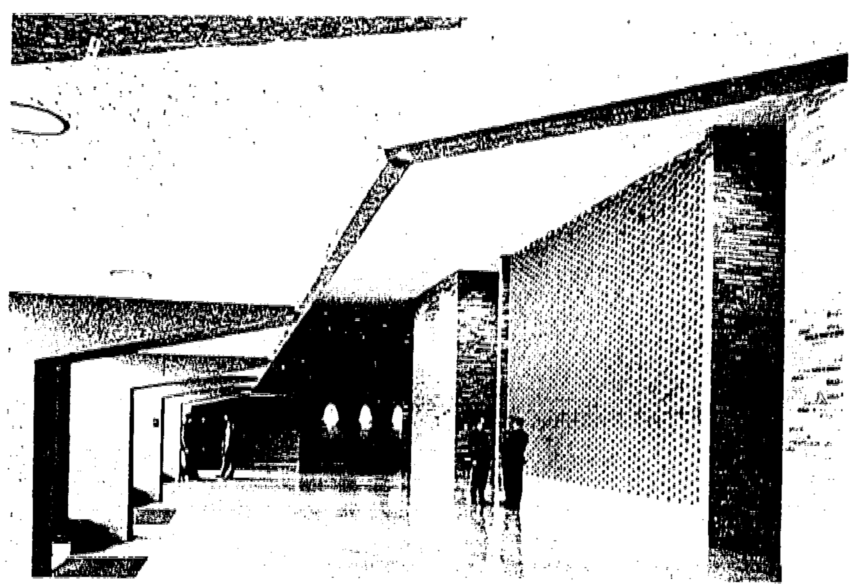
Exterior stairs provide access from roof plaza and one interconnecting bridge to lower plaza.



Post tensioned beams span the lecture theater and support the esplanade rooftop.



Concourse on second level encircles lecture area and provides easy access to other buildings.



Corridors, stairs, lounges and all other public areas of the building have terrazzo flooring, face brick, acoustic tile ceilings and sandblasted concrete surfaces.

MAY 3, 1972

9:00 A.M.

SESSIONS

Experience Exchange

11- Mr. Beinhart

12- Mr. Lovenstein

APPA MEMBERSHIP INFORMATION

Total Paying Members as of April 26, 1972	747
New Members since May 1, 1971 through November 30, 1971...	71
New Members December 1, 1971 through April 26, 1972	70
Total New Members since May 1, 1971	141
HONORARY: Emeritus, Life & Special	90
TOTAL APPA MEMBERSHIP as of April 26, 1972	837

EXPERIENCE EXCHANGE No. 1

William Stanton, Swarthmore College
Gene Cross, University of Utah
William Sterrett, Virginia Polytechnic Institute and State University

Good morning, ladies and gentlemen. We are Session No. 1 of the Experience Exchange. I'm Bill Stanton, this is Gene Cross and Bill Sterrett. We are up here, not because we are the experts, you are the experts. We will try and give the questions here. We have a good bunch. We have two sessions; one at 9:00 and then one at 10:30. Some of you have requested that your questions come in this 9:00 session and we will try to get them aside so that we can take them up while you are here because, after all, that is the fun of it. The person who asks the question may want to amplify on these put down here on the paper and then we will all take a crack at giving the answer. If there is any theme to these questions that we have, in general, let me say that we do cover a wide range of things that we have to worry with, but four if not five of you put down, and I'm sure that each of you thought about OSHA. And we have three or four questions on OSHA. We thought maybe we would start off this morning by having some discussions on OSHA. Gene Cross has spent some time worrying with it, as I am sure each of us has, and I thought we might start with asking Gene how he has attacked this thick set of government rules on the <u>Occupational Safety and Health Act of 1971.</u>

<u>Gene Cross</u>: It's kind of coincidental, but I have been writing a report for our school, the University of Utah, on Environmental Health and Safety programs at the University, and as soon as I got into this, got involved in the OSHA Act, and we are having seminars, orientation seminars in the Salt Lake area for the past few weeks and I attended one of these, put on by our State Industrial Commission there. For those of you who may not be familiar with what OSHA stands for, it is Occupational Safety and Health Act. It was passed in December of 1970 and was implemented in April of 1971.

We have been sitting around fat, dumb and happy for a year, even though it applies to all of us. Just as a matter of interest, how many people have had any implication of it or had any inkling of it. How many have? It looks like about 70% to 80% have. How many of you have done anything about it at this point? Looks like maybe about 40% to 50%. Some of the questions pertaining to it are, this particular one I am looking at, says 'what impact of OSHA' and others have asked, 'what implications does it have for state institutions, etc?'

Let me continue to run down then a little bit about the things that I have found and then we will throw it out for any questions or amplifications that you may have. The Act itself exempts Federal and State Agencies right off the bat. Now, you might say that we are all, in the most part, unless you are private institutions, a state agency, therefore, we are exempted. Well, that is true, but it's like most governmental documents -- it exempts you in one paragraph and the very next paragraph says 'however'. States must develope their own program, and if states do not develope their own program, then the Federal program will come in and enforce the Federal regulations. So, it is this 'you do it or we will do it' type of thing.

The program also says the states will be equal to or exceed the Federal standards so I think what is happening in our state is what's happening -- the State Industrial Commission is adopting the Federal program Carte Blanche and all they are doing is proposing now the routine they have to go through to propose a program back to the Secretary of Labor and, in our case, they just propose the Federal program. Then there is a six month interim period in which the Secretary of Labor has to evaluate the state program and then, after that six month period, the state then picks it up with the monitoring of the Federal people for a three year period. After that three year period, if the state program is acceptable to the Federal people, then they will give the state permission to continue on enforcing the program, but audit them at least every year to insure that they are maintaining these standards. So, in essence, what it amounts to is the Federal will say the states are exempt, however, the states have to have a program as good or better than the one we have. We will keep watching them all the time to make sure that they do.

Now, to show you the type of implications this thing has: the fines for noncompliance are - fines for not keeping the proper records, there are fines for not posting the proper reports and you have to past everything. You have to have an annual history of all accidents and this had to be posted publicly for all of your employees to see. Just by show of hands, how many of you have posted this record? You see, some of you that have said you are aware of it haven't even posted it. And you can be fined for this. You can be fined for any amount, I think for non-posting, it is about \$50 to \$100, in that range, and that is per day. They can knock you per day. These are the minimum fines of about \$50 to \$100 a day for non-posting of these reports. For a citation for noncompliance you can be fined a minimum for small industries or institutions, of \$500.

Now this is for noncompliance, when you are not complying with the law. And for a large industry or institution, you can be fined a minimum of \$600 per day. The maximum fine, under the OSHA program, is \$10,000 per day, for noncompliance. During the second six months of 1971 there was \$730,000 worth of noncompliance fines assessed in the nation. Now, of those, I think about 50% to 60% of them have been contested, so when they are contested, everything is held in a state of equilibrium until such time as there is a ruling on them. But, nevertheless, these fines are not where they come around and say 'you're in noncompliance. We will give you thirty days and then we will fine you'. These fines are just like traffic tickets. If, any time they come around your institution, they fine you, you have to pay. There's no warning or anything involved. One thing that is very critical in this is that -- don't ever invite a Federal State Inspector on your campus for any reason whatsoever. I don't say that in jest either because if they come on your campus for any reason, they are required to inspect. They are required by law to inspect.

Now, if you want to know anything about the law, you go to them. They are very co-operative and will give you anyinformation they can. But under no circumstances, absolutely no circumstances, invite them to your campus, because if they come they are required by law to inspect, and if they see you in violation, then they must fine you and there's no way that you can get out of it except if you contest it, then it goes into a state of arbitration and you still might get nipped. And if you are in a situation where it is a construction situation, where you have to make repairs and so on, then you are fined so much a day until such time as that is corrected.

Stanton: Booker Conley - Tuskegee Institute wants to know if any college represented here has been inspected by OSHA? Has anybody been inspected? Looks like none of us have been.

Cross: There is another aspect of this act. Anybody can get into an argument with you, I can write your Federal inspectors that you people have a violation and to get out there and check you out, and they are required by law to keep my name in confidence and to go and inspect you. Any one of your employees can initiate this; anyone, anywhere can initiate this to these people and the confidence of the informant are, by law, to be kept in confidence. So this, needless to say, is a labor-sponsored bill when it was pushed through. This has pretty well incorporated all the safety laws and acts, up to this time; is very omnibus and very all encompassing, and if it is enforced to the degree that it can be enforced, we would have a major recession in our economy because it would put a great majority of small companies completely out of business, and virtually paralyze a lot of our industries, because it is so all encompassing, and it is spelled out, too; it has pictures, diagrams. and everything. Any of you who do not have this act can get it by writing to the Federal Bureau of Documents for about $1.80 or something like this. I would strongly recommend that you write and get it. I would strongly recommend to you that you contact your State Industrial Commissions and go to them, don't invite them to come to you. You go to them. I emphasize -- do not ask them to come to your campus.

Tom Long: Southern Methodist University - Beware of insurance people. We had a man, I'm not sure if he was ours or somebody else's, he came in and toured various places and said we were in violation of so on and so forth.

Cross: Anybody can turn you in for concompliance or ask for an inspection, and they have to keep the informant anonymous and if this is initiated and they want to they can come in and inspect you. This is the ominous thing about this. Here again, just as our State Industrial Commission indicated, they are going to have to implement this thing with extreme prudence because if they enforced this thing to the degree that they can, it can cause an extreme paralyzing affect on our economy. Because it could literally put all kinds of companies out of business and you could close your eyes on any one of our campuses and grab in all directions and find yourself in noncompliance.

We had Federal people at this seminar, along with our State Industrial people and we asked them about these kinds of things and the basic atmosphere was "as long as you are doing something to correct and move toward compliance, they will try to stay away from you as long as they can." However, if you have a major accident, or fatality, you're going down the tube because as soon as that happens, they are going to be in there, crawling all over you everywhere, and they are going to cite the devil out of you.

John Hector: University of Chicago - This law does not include the students, only employees. The law is going to be enforced by the state and the state is supposed to put out certain documents. Everyone should be getting them from their own state. We are using the Federal law as a guidance. The next three years will be a grace period. Once the state gets into it and starts putting out their inspectors, they have a couple of very good deal~. They have what they call a "red tag." If they find a machine that is dangerously operating, they "red tag" it. You can't operate it again until you correct it and everything is approved.

Stanton: The grace period you speak of is only for state institutions. The private institutions have no grace period.

Cross: I'd like to clarify that, though, that is not a grace period for enforcement. All of you sitting here now are under the law right now. The only grace period is in adopting the state enforcement of that and for the state to take it over completely. But the Federal people can walk on your campuses today and cite you. What this says is 'anybody involved in interstate commerce', but let me show you the degree that they have stretched this thing. There was an apartment house that rented to people locally. They had a telephone switchboard within that apartment house that accepted out-of-state calls and therefore, they were interstate commerce and that is how they defined it. Everybody is involved in this. Everyone in the nation is under it who is engaged in interstate commerce and they are extremely liberal in defining what interstate commerce is, even telephone calls. The law specifically says that those who are engaged in interstate commerce and that has been defined down to the point of even long distance telephone calls. If you have any activity whatsoever over state lines, then you are defined as falling within the jurisdiction of this law. You are not exempt from the law during that three year period. You are still under the law. All that three year period is, is a trial period for your states to assume the enforcement of their program, which must be equal to or exceed the Federal program. But the state people could walk in and inspect you one day and the Federal people could come in the next day; because the Federal people have a blanket over this whole program and can enforce it any and all times, but the states can come in and set up their own program, underneath that umbrella, and the Feds will back away from it, as long as the state program is equal to or exceeds the Federal program.

Stanton: Is there anyone who has a good plan or a way they are going to tackle this?

Tom Noe: University of North Carolina - You shouldn't inform contractors that an inspector is coming.

Q. Robert Williams (W. Michigan Univ.): We are recently completing a preliminary feasibility study with an outside consultant which indicates a substantial saving could be affected by owning, operating, and maintaining our own telephone system, as compared with purchasing service from a public telephone company. Are there any universities who have their own systems? What are their experiences? We would like to have their names.

A. Stanton: Anybody owning their own telephone systems? Berea College does and Duke may own their own. It is leased at Purdue.

Q. Joel Hemsley (Univ. of California): What administrative policies do other universities have with regard to when major repairs are contracted out?

A. Sterrett: From the point of view of Virginia Tech, there is no firm policy; it depends on the work load of the maintenance people and the size of the job and the time of the year.

Q. Joel Hemsley: We have another problem, defining what is construction and what is maintenance. Does any other campus have a definition? The fact that we are unionized precipitates this.

A. Young Moore (Univ. of South Dakota): We are changing our job descriptions so we don't have five trades involved in driving the same nail. Dollar value is not involved in determining what is maintenance or work to be contracted.

Cross: How many have a dollar limit differentiation between construction and maintenance? Six have a differentiation.

Charles Braswell (Appalachian State Univ.): We have $25,000

Iowa State has $10,000, Purdue has $30,000, State of Washington is $10,000, State of Utah is $8,000.

Q. Jack Harmon (Univ. of Maryland-Baltimore County): We would like to have a list of all colleges with satellite-type student union buildings, that is, buildings around various parts of the campus.

A. University of Wisconsin at Madison has two.

Q. Kenneth Eyre (Oklahoma Baptist Univ.): Has anyone had any experience with the four day work week? Ten hours per day for all plant employees?

A. University of California at Irvine: Tried it for a few months and found that they did not get the work out of their men. The work hours were too long, production dropped.

A. Young Moore (Univ. of South Dakota): They are trying it and seems to be working so far for custodians only.

A. Harry Loveridge (Franklin College): We have a couple of people working Sunday through Wednesday. Workers agreed to scheduling.

A. Wayland Slayton (Florida International Univ.):We are working our maintenance crew with the Monday-Thursday, Tuesday-Friday schedule and are quite pleased with the results.

Q. Young Moore (Univ. of South Dakota): Given a central control system what kind of monitoring provides the most significant savings in operating costs?

A. Virginia Tech: Is in the process of building one.

A. Gene Cross: By the control system, I would assume they are talking about the Johnson-Honeywell Systems and the Powers System. We went through an extensive evaluation and finally adopted a Honeywell System a few years back. We have a central high temperature hot water heating plant. In our evaluation we found all three to be very satisfactory, however, each of them build up in a different way so that at certain development points and their growth seem to be the main criterion as to which you may choose. We found in our build up that we were going to want it about a 12,000 point system. We found that about 2,800 points there was a cross-over on cost. Johnson was low, up to 2,800 points and over, then Honeywell was low and this is purely because of the engineering design.

It was our decision that any of the three would do a good job. It depended on what you wanted to accomplish and the maximum development you were going to have. No matter how you go, it is powerfully expensive initially, but it will save you hundreds of thousands of dollars in the long range picture.

Q. Case Bonebrake (Kansas State Univ.): I would like to hear a discussion of policies and practices regarding dogs on the campus. How are strays and dogs not on leash handled? Are dogs on leash allowed and, if so, what are the restrictions?

A. Santa Barbara University: Adopted the Santa Barbara Leash Law, allowing students to tie their dogs to a tree.

A. Gene Cross (Utah): This campus has a problem because of such a great number of dogs. They found the students harrassed the male dog catcher, thereby employed female (co-eds) dog catcher, and have no more problems.

A. William Stanton (Swathmore): Local dog catcher will come on campus, but insists on both the area policeman and campus policeman to come with him. This scares the dogs off pretty well. We have started this year a program run by the students whereby any student who wishes to have a pet, make a $35 deposit. A red tag indicates a deposit was made. This deposit paid for any damage made by the pet. Because this policy encouraged more pets, they are abandoning it for next year.

Q. John Trimble (Univ. of Arizona at Tucson): I would like to know how many of the large universities, over 20,000 students, have the following departments under their Physical Plant and are these departments recorded as part of their budget?

A. Stanton: There are 8 large universities represented. 4 Universities have police under the jurisdiction and in budget of their Physical Plant. Three universities of 8 have the telephone system within their budget. No universities had the student housing and maintenance in their departments. 4 have a central motor pool. One of 4 is self-supporting. 3 have a planning department.

What is the large university's average operating budget per square foot per year? One has cost of a range of $ .75 to $1.00 per square foot per year. 5 universitites range between $1.00 and $1.25.

A. Robert Russell (Marquette Univ.): Perhaps we could share our cost cutting ideas since budgets are being cut.

A. Harry Loveridge (Franklin Univ.): Cut down on week-end work and did not replace employees who resigned.

A. Young Moore (Univ. of South Dakota): Cut down on cleaning significantly.

A. Bob Walters (Eastern Montana Univ.): Picked up 13 people under the Emergency Employment Act (Federal Government pays salary).

Q. Robert Russell (Marquette Univ.): Would like to hear a discussion on the use of compacters for garbage disposal?

A. Lawrence University: Wants to know how many are using a re-cycling program -- cans, bottles, and paper.

A. Stanton: 7 universities are employing a re-cycling program. How are they doing it?

A. Martin Whalen (Montana State Univ.): Project in the student union to collect paper once a week. Strictly a student project and money goes to the Boy Scouts.

Q. Gene Cross (Univ. of Utah): Are any of these operations financial self-supporting?

A. Oregon State: Yes. Labor - students

A. Southwestern Medical University: It is all donated labor.

A. Virginia Tech: We have initiated a trial program in one of our dining halls where there is a compactor, not for the purpose of saving money but it does eliminate the demands on our refuse collectors and our incinerators. It looks like it has good possibilities.

A. Wayland Slayton (Florida International Univ.): We are re-cycling all of our office waste. We think we are in a good position to do this because we will then have no bottles or cans on campus, so these won't contaminate the material. We are buying a bailer rather than a compactor. We'll bale this material and sell it to a local paper merchant. This is in regard to eliminating all bottles and cans on campus in regard to paper in all our buildings and we'll bale them and sell them commercially. We are hoping that this will be economically feasible as well as contributing to recycling.

A. Tom Long (Southern Methodist Univ.): In the city of University Park, 23,000, are picking up newspapers every Wednesday. It's a loosing proposition. They make $85 and spend $150 doing it.

A. Stanton (Swathmore): The local community is collecting papers but it's a money-loosing proposition.

A. Robert Williams (Western Michigan Univ.): The labor has been too high with incinerators in dormatories and running balers. The countdown is they spend a lot of money on incinerators when they could use something else. We change around and purchased a 30 yard compactor truck. Fortunately the county operates the land filled dump. It takes care of all the refuge from the entire college and then we put in containers that the compactor truck can pick up. Where we got into trouble is some of the large trash generating areas like the university would get 6 or 8 containers over a week-end and the dock space just wouldn't take care of it. Now we tend to pick up the trash from one point with no more than 2 containers on a daily pick up basis or 2 containers over a weekend. We are using stationary compactors at heavy generating areas.

Q. Speaker to Gene Cross: You had Dempster Dumpster for quite some time but not the portable or stationary compactors. Are you aware you can get those containers up to 6 yards?

A. Gene Cross (Univ. of Utah): Yes. When we got ours, $4\frac{1}{2}$ or 5 was the largest. I believe 6.5 is now the largest. We have 6 in operation and they dump from the front. The only problems we've had are we have a few places where the incinerators are in the basement and the ashes are taken out on sidewalk elevators, and getting the trash out to the street by a sidewalk elevator that will accommodate about a 2 yard container isn't really that difficult.

A. Stanton: "Load-All" has them up to 8,and 8 is for trash that's dumped in on the side and therefore you can get about the same amount in the 6 - top load.

Q. Martin Whalen (Montana State Univ.): I was asking more about the ones like they have in demonstration out here to use in the dormatories where you get so much paper, aerosol cans, and this sort of thing in your trash chutes and if you used a compactor within the building with any success.

A. Bowling Green University: Has a stationary compactor in the building.

Q. Jack Harmon (Univ. of Maryland): How are physical setups - stage, tables, chairs, etc. handled for dances, concerts, etc.? Are they done by the sponsoring student groups or by the Physical Plant personnel?

A. Stanton: This I gather are the informal kinds of things. Does anybody insist that buildings and grounds do the setups for everything?

A. Harry Loveridge (Franklin College): Campus center operates seven days a week, practically 24 hours a day and we charge each organization for the hourly rate, not the number of chairs and the number of tables, just like this type of setup here. Franklin College does it all and charges for it.

A. Paul McNichol (McMaster Univ.): We Have charged student groups quite a bit of money for years and this year they asked to do it themselves so they do it with one supervisor and a custodial crew. The first two occurrences were pretty poor. They set up, but they didn't clean up after. Got together with the student union; since then it's worked pretty well.

A. A.C. Biggs (Univ. of Evansville): We use the space and registration form similar to the University of Maryland and we give them a chance to sign either that they want to pay for it whether we'll do it on this space and reservation forms.

A. Stanton: But you charge for it as you do it.

A. A. C. Biggs: We charge for it if we do it. But we will let them do it if they want to and save money.

Q. Robert Burch (George Washington Univ.): Charging auxiliary enterprises for solid waste collection and disposal. Do any others have experience in charging on a unit cost basis such as by the yard, by the ton, etc.? If so, is it difficult to develop cost accounting procedures and supporting reports for this?

A. Stanton: Let's first, by a show of hands, for charging auxiliaries for solid waste collection. How many do charge for solid waste collection to auxiliaries, by a show of hands? Looks like about 25. How many do not? Looks like about 10 do not. Those of you that do charge, do you charge them by the yard or by the weight? How many charge by the yard? (3) How many charge by the weight? (2). What are some of the other ways that you charge? Flat monthly rate based on the time involved. Pretty much of a flat rate.

Q. Robert Burch (George Washington Univ.): Do any have experience in charging auxiliary enterprises for utilities operations, heating plants, and central air conditioning installations on a unit cost basis? If so, what units are used - BTU's, tons, etc.?

A. How many charge for utilites by a show of hands? Looks like about 30 or 35. How many do not charge for utilities? About 6. Those that do charge, what do you base it on? Do you base it on meter readings, BTU's, tonage, pretty much, or do you have anything other than that? Some charge by cost per square foot on the total average on the campus, some by meter.

Q. Robert Burch (George Washington Univ.): Do any have experience in setting up accounts to provide for major repair and replacement of equipment other than as a direct charge to the fiscal plant? Do any have experience in setting up accounts to provide for major repair and replacement of HVAC, heating, ventilating, and air conditioning equipment other than as a direct charge for a Physical Plant Department or auxiliary equipment?

A. Stanton: Any of you care to respond to that?

We are reaching the end of our time. Is Owen A. Lawson, Jr. here from Western Kentucky University here? He has sent in a solution instead of a problem. It's entitled "How to unroll a tree." With University students many new problems occur, such as rolling trees with toilet paper out of reach with ladder and general defying removal. We solved this problem with a torch, rags, and kerosene which, when lighted, burned out the paper. No damage to the tree. So there is a solution for you.

Stanton: Gentlemen, I think we have come to the end of our first session. We will have session No. 2 starting at 10:30AM in Room 201 and we still have a good stack of questions here. Thank you very much.

"SUPERVISION AND THE DISADVANTAGED WORKER"

by ~~Walter W. Beinhart~~ Bill Carruthers

Biographical Sketch:

Walter W. Beinhart born and raised in Cincinnati, Ohio. Graduate of Walnut Hills High School. Graduate of Dartmouth College--B.A.; graduate of Chase College of Law--J.D.; formerly with Globe-Wernicke, F.B.I., and Cincinnati Milacron. With Formica Corporation 28 years as Director of Employee Relations. Past President of Cincinnati Personnel Association. Former Lecturer at University of Cincinnati Evening College in "Personnel Administration" and "Industrial Management".

Former Trustee, Deacon, and Sunday School Superintendent. Speaker on "Human Relations" to various civic and professional groups. Recipient of Silver Knight award from National Management Association - 1967; Director of Personnel, University of Cincinnati since January 1, 1970.

* * * * *

Ten to fifteen years ago employers were proud of the fact that their hiring and other Personnel policies were non-discriminatory, and that equal consideration was given to all applicants and employees regardless of race, creed, color, or national origin. If only few minority people applied and even fewer were hired because of lack of qualifications the employer had done his duty.

Today the mere offer of equal opportunity is not enough. Various Federal, State and local laws as well as executive orders have made it necessary to do more by means of an aggressive Affirmative Action Program. Not only do the various regulations require such action, but all employers should look upon such a program as an opportunity to carry out his social responsibility.

Supervisors must realize that top management not only of the Physical Plant but of the entire University is behind this program. It does not make good sense merely to go through the motions and have no results to show for the time and money spent.

Recruitment

We can no longer depend on help wanted ads in the regular press or on "walk-ins" at the employment office. Too many times these disadvantaged workers have been turned down when answering ads and at employment offices to have much faith in this system. It is essential, therefore, that these people are made fully aware of opportunities available to them.

Help wanted ads in the minority press (and there are many fine publications of this kind) can go a long way in dispelling the myth that only lip service is being given to equal opportunity.

Visits to such groups as the Urban League, NAACP, Opportunity Industrialization Centers, NYC, and local high schools with a high percentage of minority students can build up the source of disadvantaged applicants. Many of these groups will not only refer such applicants but will also give pre-employment job training and counseling to these people thereby eliminating or at least minimizing the problems that arise when the disadvantaged come into a totally new environment.

Another source of applicants are friends and relatives of minority employees currently on your payroll. These employees can serve as excellent examples of opportunities offered by your University.

Lowering Standards

The question has often been raised: "How much do you lower your standards?" Essentially your standards should not be lowered. Too often, however, many standards for jobs -- particularly those at the entry level -- are unrealisticly high and have no bearing on the positions to be filled. How ridiculous it is to require a high school education or even two years of high school for jobs such as cleaners, laborers, maintenance helpers and so forth. If the standards are realistic, they should not have to be lowered.

The EEOC and Courts have thrown out many pre-employment tests because they have no relationship to the positions to be filled and no validation to back up such requirements. The objective of any employment program should be to screen-in--not screen-out potential employees.

Many employers have had a policy of not hiring people with records of arrest regardless of whether such arrests resulted in convictions. Such a standard is also being thrown out by courts because a much higher percentage of blacks have arrest records, and such records have no bearing on the ability to do a job.

Even convictions of crimes should not automatically eliminate applicants. Consideration should be given to the nature of the crime, how many convictions an individual has had, is there evidence of rehabilitation, and so forth.

It must be remembered that the hard core or disadvantaged unemployed have many handicaps to overcome, and these handicaps have been forced on them through no fault of their own. (A disadvantaged person is considered as one who is a school drop out, has never earned more than $3,000 annually, has a poor work history, and has no primary work skills.) As Mr. Nichols Oganovic, retired Director of the U.S. Civil Service Commission, said, "the poor results on tests and employment history of these people has been caused by their environment--not their lack of intelligence. They have been unable to receive what society is sending, despite equal opportunity."

Orientation ---Training

Orientation of disadvantaged employees can make or break the program. There will, of course, be differences even between one disadvantaged person and another; and the amount of orientation and training will vary from one to the other. I most cases such training will be more intensive although as pointed out earlier, many agencies stand ready to help in this area. If a new employee is having trouble, the agency will be glad to work with you to help overcome any problems you encounter.

It is easy for a supervisor to become discouraged and frustrated in the early stages of training these people, and persistence will be required to overcome the problems encountered. These people will often have poor work habits, if any, since they have never in most cases been exposed to a working environment. Many will not know what an alarm clock is, much less have one. In many instances transportation to work can be a problem. Most will be in financial difficulties because they have had no income and, therefore, have no financial resources. Supervisors and fellow workers must have plenty empathy for disadvantaged personnel if such a program is to be successful.

Morale

The problem of morale must be closely watched to avoid losing disadvantaged personnel before they really get started. Again the full and empathic cooperation of all supervision toward these people is necessary. With proper preparation of your old employees, the buddy system can be a big factor in helping the disadvantaged off to a good start. A good buddy system can eliminate feelings on the part of the minority worker that he is being discriminated against either openly or in more subtle manners. Above all, patience and perseverance must be maintained, and supervisors must not give up because some fail and others do not seem to progress as fast as desirable. Also don't be condescending or paternalistic. Trainees do not want to feel like - "special cases" - you might make him think he's less capable than others and lose him before he has a chance to get started.

The most important principle to get across to these people is the importance of their jobs to the University. We have heard too often that disadvantaged people are relegated only to "menial!" or "coolie"jobs. In my opinion there is no such thing as a menial, coolie, or unimportant job. If any job is unimportant, it should be eliminated because it obviously is not needed. The President of the University, a Dean, Director of the Physical Plant or even an entire academic department can be absent for a week or longer and the University will continue to operate with no noticeable trouble. If these employees, however, who are filling the so called unimportant jobs are absent, the University could come to a grinding halt in a hurry. The communication of this philosophy is particularly important where for those employees who are limited in their ability to move up the ladder.

Disadvantaged employees, however, who have the potential should certainly be encouraged to get what training is needed to prepare themselves for better jobs.

Discipline

Discipline is always a delicate matter and is especially difficult with disadvantaged trainees. Too often these employees, because of their background, are not aware that they are not performing as expected. If an employee is late or absent, it may be because he does not know any better and has not learned the importance of regular attendance. Even what might seem like insubordination may be merely a defense mechanism or inexperience in taking orders. Some of these problems can be overcome through pre-employment counseling by the various groups mentioned earlier. Such counseling, however, is not always available, and it is up to the supervisor to be sensitive to these reactions and the reasons behind them. The employee must be made aware of what is expected of him and the necessity for various rules and regulations. Constructive criticism can go a long way in overcoming these problems and praise when due can help in building the employees morale.

Once these initial problems have been overcome, discipline should be administered in the same manner as to other employees.

Other Employees

One danger must be guarded against, namely that of other employees thinking that you are being more lenient with disadvantaged people than with them. These employees should be informed that the disadvantaged will be respected and treated fairly, but will not receive any advantages over other employees. They should be informed that their own job security, promotional opportunities, and other job benefits are as good as ever. With proper preparation these employees can be a help in improving the opportunities for the disadvantaged and for improving race relations within your plant.

When you tend to get discouraged, remember that those who remain on the job quickly acquire "middle-class" attitude and habits and are no longer disadvantaged. When that position is reached you have made a contribution to society, lent a helping hand, developed a loyal employee, and in the long run made your own job a lot easier.

PHYSICAL PLANTS and ECONOMIC TRANSPLANTS

by Dr. Meno Lovenstein

The Charles G. O'Bleness
Professor of Economics
Ohio University

Economists should be flattered these days when they are invited to comment on economics, considering the seeming contradiction of inflation and unemployment and the conflicting advice and policies which emerge from the economists' analyses. Yet there is no reason to be defensive, since the little we do know has come from the responsible and competent use of the best of economic reasoning. Moreover, if we are ever to do better in understanding and influencing our economy, the improvement will come from economic analysis and its effective employment will depend upon the public's ability to follow such analysis and apply it.

One of the demands most frequently placed upon the economist is to predict the future, a mystical power which is made to sound technical by calling it forecasting. In its most familiar form, the forecast is supposed to pin-point the figure for next year's Gross National Product, or more recently, the percentage of unemployment and price rises. It is never done perfectly, and seldom well done, but for those who know the nature of the task, it is a near miracle that it can be done at all. Fortunately, the process of prediction must contain an analysis and the analysis provides insight to the variables which influence the results. So even in erring about the future, we acquire the power to understand the inputs and relationships out of which an economic future may be constructed.

Only the professionals in any endeavor are privileged to appreciate the arduous journey from confusion to less confusion and now and then to a high ledge of perspective and clarity. Capitalism is a familiar word, and familiarity breeds the illusion of understanding, but for those who know something of the story, the emergence of the market economy out of the practices and institutions of the Middle Ages occurred long before the nature of the change was appreciated and analyzed. At this very moment, enormous changes are taking place, quite a few of them, as we shall see, affecting the administration of the world's physical plant. No doubt bit-by-bit responses will be made to the pressures for accommodation, but a thoughtful and adequate analysis will lag behind the modified behavior. Of course, there is always a heavy cost in not knowing what one is really doing. The pity is that we find out the cost just about the time that we discover what we have been doing wrong.

We may illustrate our continuous learning experience by remembering that, in 1965 and on, we imposed a heavy war burden on an economy which was already rather fully employed. It was clear to those who understood the situation that we would establish an inflationary process if we did not recognize the need for paying the proper amount of taxes, in a word, making the proper allocation of our resources for such a war effort. Moreover, the relationship of a rising domestic price level to our international economic position was understood, at least by economists, but not by the public and hence was not a part of governmental and private economic policies.

There are many sources of blindness, but surely one of the most ironic comes from focusing on an immediate and respectable challenge. Such a concentration is all-too-human, necessary, fruitful - and very costly. Summarizing the history of economics and economic policy, economists at first sought to explain how a society could increase its material wealth, then how income is distributed. After the Great Depression, attention was directed towards analysis and policies which would stimulate the economy to higher levels of output and employment. The federal government accepted the responsibility for assuring stability (in prices and employment) and growth. The term, The Gross National Product, expressing the output of the nation in a givn year, became a basic indicator of the country's economic position and progress. Still, this powerful tool of analysis and the policies derived from it left many fundamental structures and processes obscured or neglected.

The Gross National Product, for example, measuring the annual output, could not be regarded as a measure of the nation's welfare. One would need to stretch the concept of welfare to include defense expenditures as a contribution to a country's well being; even if protection is thought of as a public good and military research and development spill over into civilian technology, it is questionable that the massive money and real costs should be regarded as making everybody better off. At any rate, defense and war are a special case of the wasteful use of resources. The general case is that for a variety of reasons, the economy has not made the most efficient use of its scarce resources.

The word "efficiency" is another of those magical economic terms supposedly made clear by frequent repetition. One is attempting to measure the output compared with the inputs of materials, labor, etc. Always a difficult computation, but the really important difficulties are not in its calculation. Rather it is that in measuring efficiency in a particular enterprise or output, so much may be omitted. For example, one can measure the product and not include the pollution involved in the process of production. We have recently become more and more aware of what the economists call the social costs, that is, the long-run depletion of a resource base, the deterioration of the environment, the possible impairment of health. The older word was conservation; the newer one is ecology. The fundamental concern is what man is doing to nature, to his endowment of resources. In creating a flow of goods and services, what is he doing to his stock of resources, particularly to those exhaustible ones? Depreciation and investment in capital goods may maintain or increase these assets, but one cannot replenish an exhausted mine by moving to another area. The point is that we have been so concerned with creating a flow of goods and services, that is, the income of the nation, that we have neglected the concept of the stock of resources. To draw an analogy - and more than an analogy - from your world, we have been so occupied in operating the plant, we have lost sight of the plant itself. Maintenance is interpreted as a current outlay rather than the preservation of the plant-in-being. More needs to be said - and will be later - about this point of view.

Not only does the Gross National Product fail to reflect social costs, it also does not reveal the existence of social revenue. The economists use that term to mean the expenditures in the current year which add to the productivity in subsequent years, for example, outlays for education, for research and development, for health. The importance of recognizing both social costs and social revenue is that together they serve the larger notion of the long run conservation of resources or the possibility of actually protecting and enlarging the resource base. The more clearly and pointedly one thinks about the accumulated endowment, the more responsible is the policy which uses the present with an eye to the future. A nation which thinks that way about what it has -- and has to preserve- is closer to the concept of the administration of the "physical plant," using the concept of the physical plant as a symbol for the productive assets of the economy.

Quite often such assets are thought of as factories, machines and equipment. But their solid presence is misleading. Actually a machine is the embodiment of a technology and its value is determined by present and future yields. It is only incidentally a thing. More exactly it is an accountant's nightmare. Once it is appreciated that buildings and tools are really intangible, one may be prompted to recognize that many other intangible inputs - the skills of the workers and management, the structure of markets, financial and other economic institutions - are just as real, and if one will, as "physical" as a furnace. If one reasons deeply and long enough, it is hard to distinguish the janitor from his mop. Assuming one has thought himself into such a philosophical view of things, then it is clear that economic relationships are equally as real and solid as pick and shovel. To illustrate, the market may be defined as a meeting of supply and demand, but such a meeting can take place in a highly competitive situation or under a monopoly. The consequences may be quite different with regard to prices, the quantities produced, the role of government, etc. The predictable behavior and outcomes of such relationships enables us to speak of economic institutions as inputs into the creation of goods and services. These institutions total to the entire economy, which can be thought of as the "physical plant" for the nation. It is understandable and appropriate that economists refer to the various supply and demand situations as the "structure" of markets.

Indeed, as the markets work, they are often thought of as mechanisms relating supply and demand. So, for example, we want to know how effectively supply and demand may operate to keep the economy fully employed - say, at 4% unemployment - and still provide price stability. One obviously does not have to be an economist to realize that in Phase I and II the market system was judged to work ineffectively and unsatisfactorily, at least in the presence of the market forces which now exist. Nevertheless, this comprehensive mistrust was not always so. We did make exceptions with regard to public utilities and brought into existence an array of regulatory agencies, e.g. The Interstate Commerce Commission, The Federal Trade Commission, etc. And in World War I and II, we did substitute an administrative state for a market economy in the direction of the war effort.

What can one conclude from the activities of government with regard to growth and stability and the modification of our acceptance of the operation of the market economy? One could become alarmed and seek to stigmatize these developments by calling them a name, say, socialism. A calmer and more sensible reaction is to acknowledge that technology and the institutions which serve it must face changes and that it is the sign of a good and healthy democratic society that we may contomplate these challenges,always mindful that we chiefly wish to preserve the structure of our way of life, its values, its freedoms, its basic institutions. The property we are really defending, the physical plant we are maintaining, the long run custodial responsibility, these are all expressions for the conservation of our stock of resources, our accumulated sacred endowment of know-how, the protective processes of the law, the freedom of choices. Your responsibilities in administering physical plants are, in spirit and practice, closely allied with the nation's concern for its most essential assets.

Admittedly, it will not be easy or automatic, this fitting of an ever-changing world into the framework of our traditions. It must be obvious from the actions in Phase I and II that we cannot separate the domestic economy from our international economic relations, e.g. the domestic price level and the value of the dollar in international trade and investment. Our corporations have become multinational, so one cannot any longer separate economic from political considerations, if indeed we ever could! At least, many Americans with a naive view of American self-sufficiency convinced themselves that the American economy was bounded by two oceans and wriggly borders north and south. So here we are, running out the century, by recognizing, begrudgingly of course, that we are in the world with an astonishing number of non-Americans.

Finally, an honest and profound self-examination of our economic institutions should persuade us that we cannot easily distinguish private from public institutions, at least, not so comfortably as we once thought we could. With more than a fifth of the Gross National Product representing government expenditures for goods and services and one out of seven working for government, federal, state, and local; with the not-for-profit sector, including mutual insurance companies, estimated to be about 30% of the Gross National Product; and with the presence of large corporations, mindful about profits but not totally stimulated or directed by them, run by professional management and not by stockholders, with all these institutional considerations before us, it is obviously not clear or meaningful to speak of our economy as a private, market system. The point of this summary is not to raise an alarm but emphasize that one must look behind and beneath the scene to appreciate that our institutions are changing. In many ways our economic analysis is not abreast of these changes, meaning we cannot give a theoretical explanation of the effects of technology on our decisions about prices and output. But we are aware of the changes calling for thought and reconsideration. Again, thinking of our institutions as the "physical plant", we must ponder deeply how their maintenance is relating to operational demands.

Hopefully enough has been said to make it clear that we are approaching a great turn in our thinking about our economy and its institutions, the turn being an increasing awareness and emphasis on the maintenance of our resources, those in nature, those embodied in existing physical plant, those incorporated into living persons, those conserved in our market system and in our fiscal and monetary policies. Of course, the bulk of our concerns have to do with the short-run: high levels of employment and stabilized prices. But pressing forward for more attention is our concern for the long-run, for what must be done to preserve our stock of assets, if you will, our stock of economic wealth, not just the annual income.

The concept of the ratio of capital to output is one mainly used in devising policies for developing economies. The question is, how much additional capital will be required to increase the output of the economy by a certain percentage. It is then possible to consider where the funds needed will come from, perhaps from outside investment, perhaps from forced internal savings. But we may also ask the same question of a developed economy, such as ours. Although we chiefly emphasize the nation's income, we have studies exploring and summarizing the nation's wealth. The nation's wealth, in 1967, was $2.8 trillion dollars, so with subsequent price increases, it could be approximately $3.4 trillion now, that is, about three times the current GNP. Of that amount, 82% consisted of reproducible assets, such as structures, durables and inventories, and 16% were nonreproducible for example, agricultural and residential land. The rest was net foreign assets.

Assuming that debt may be regarded as an approximate measure of existing assets, we note that net public and private debt, in 1970, was $1.8 trillion, of which 27% was public debt, 75% corporate debt and 32% individual and noncorporate indebtedness. But one does not need such figures to know what a massive war destruction could do to the enormous collection of buildings and equipment. Even if there were some fantastically rich country, unspoiled by war damage, it could not reconstitute the stock accumulated through the years, even as the United States with its foreign aid could do no more than merely help in the restoration of economies and the slow improvement in developing economies.

We do not have currently reported data for the increase in real investment in the American economy. We can estimate the increase by subtracting from the gross private domestic investment the amount which went for depreciation or replacement. But it is not possible to discover from the federal budget, for example, the amount of current expenditures which went for capital improvement, since we do not include a capital budget figure. But one needs only to think about the structures owned by the federal, state and local governments to realize how large a figure it must be. In 1968, the federal government owned 33% of the land and had over 400,000 buildings.

The net stock of residential structures, in 1970, amounted to $804 billion. The mean age of all types was almost 19 years, but farm structures averaged 35 years. Obviously we all have to care for old houses and even mobile homes average a little less than 3 years old. One of the illusions of the magazines, that we all live in spanking new housing units, gives way to a grim world of plumbing repairs and the deceptive freshness of paint.

Whether they appreciate it or not, Americans are custodians of a fantastic accumulation of wealth, not only in buildings and equipment but in their economic institutions, not only in what they have but in the knowledge which made it possible. The creation and preservation of achievement are not identical processes and responsibilities but they are tightly intertwined. The flight to the moon combined the daring of astronauts with the conservation of what we know, a brotherhood of flight and formulae. And everything we know and do must be contained in people. Acknowledged or not, we all are custodians. Even those who know not what they do are negative custodians when they destroy.

A less dramatic expression of the inescapable custodianship is to regard everybody who is in the labor force as being in the "service" industries. Of course, that is not the way we look at the division in economic activities and gather statistics. The conventional conception is to think of the goods-producing industries as manufacturing, construction, mining and agriculture, and all of the other employments as service-producing, for example, retail, wholesale, government, and other services. Over half of the labor force is employed in producing services; moreover, the service-producing employment trend is upward. These distinctions are helpful in the production of goods, the imputs are directly and ultimately the knowledge and skills of human beings.

In our measurement of productivity, the familiar formula is to estimate the output per man-hour, more easily computed when the output can be determined quantitatively. Not so easily reckoned is the quantity and quality of the labor input. And not included in the estimate of productivity is the contribution of the other factors of production, e.g. management, equipment, and the entire direct and indirect contributions of the economy itself, its attitude and reqponses to technological development, the appropriateness of fiscal and monetary policy, in a word, the contribution of the whole to the productivity of a part.

Yet even keeping with the limited formula for the measurement of productivity, there has been much concern about the possibility of increased productivity in the service-producing sector. A majority view is that lagging productivity in the service sector will slow up our economic progress, but some feel that the service sector is on the threshold of an advance in productivity comparable to the previous achievements in the production of goods. Supporting such optimism is the hope of increased efficiency under the new postal arrangement, more specific accountability in government operations, reduction of paper work in our payments systems, better health delivery, and extensive expansion in manpower development and training programs.

Through habit and conventional orientation, nearly all of these looked-and-hoped-for improvements focus on economic activity at the point of production. But it should be obvious that there are efficiencies which arise from the effective coordination of all economic activity. When the economy operates below its estimated potential, it can never recover in the future what was not produced in the present. Inflation which redistributes income, security and opportunity is a historic and irrecoverable loss. The enlightened citizen should be included in the service industry, along with the lawyers, doctors, and Indian chiefs. Being an informed citizen is a profession. His work and contribution are to seek to understand the economy and to influence its short and long run performance. To be actively concerned makes him a custodian of its present and future. In a sense, we are only indirectly parental when we care for our children; we are directly parental when we care about the world they must live in.

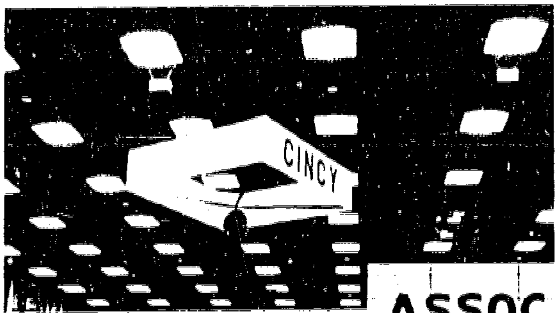
Given all these reasons for being adequate custodians of our wealth and institutions, why have we so largely failed to appreciate our responsibilities as caretakers? Some of the answers have already been suggested, namely, the emphasis on current output and employment and our assumptions that our economic institutions and the values embodied are God-given and God-protected. Perhaps the latter emphasis is more revealing than the former, since there is always a deep theology buried in a nation's economic philosophy. For most Americans a trust in providence seem justified by the belief in our inexhaustible resources, in the powers of Yankee ingenuity, in the last-minute miraculous escape through new technology. Just to help the Lord along, an enlarged role for the federal government was accepted by both parties, more or less, in the form of regulatory agencies and in the charge to the Council of Economic Advisers, the purposes of which were to keep the market system alive and provide for economic growth and stability. The prayerful word was "progress", assured to the living while it could still be enjoyed.

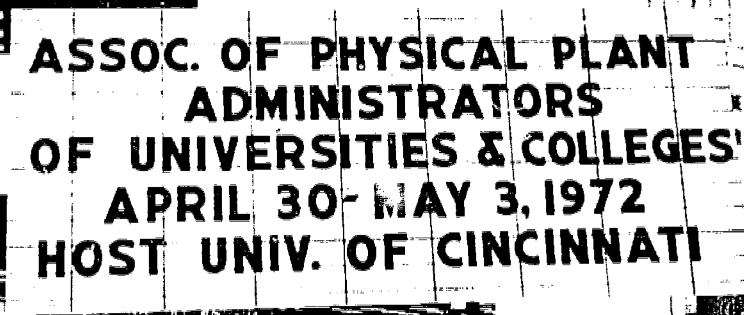
Providence not only took care of tomorrow, it guaranteed that the future would be more comfortable and exciting. Conveniences and novelties would put us to sleep and keep us awake, both at once. The grand effect of an uncritical faith in contemporary providence was to make us personally and nationally improvident. The present concern about the environment and ecology may seem to contradict our historic disposition towards innocent hope, but I fear we will only give a begrudging recognition to the consequences of our behavior. We may actually make use of ecological concerns to ease our consciences as we gaily exploit the sweet moment of being alive now.

Economists, who should know better, have often referred to the American economy as an economy of abundance, an affluent society. Comparing our Gross National Product per person with the rest of the world, and accepting that crude comparison, we do have more. Of course, comparisons per capita do not tell us about the distribution of income and opportunity, but one cannot avoid feeling rich in a rich country, even if one's commonsense reminds us that feeling rich and being rich are quite different. Nontheless, the sense of wealth, of more to come, of annual models in clothing and automobiles, of a throw-away economy, these are hardly likely to create an appreciation of maintenance or establish firmly the good habits of a custodian. Although we are far from having an economy of abundance, we act as though we have one. Even if the abundance in the department stores is an illusion, the phantasy of apparent abundance sustains the illusion that only money keeps all of it from being free.

The Garden of Eden illusion is also maintained by the overwhelming presence of public buildings, the endless highways, the defense establishment. Whenever the pitch of the ceiling is high and the doors are solid aluminum, when you are awed and know you could not afford it yourself, you are in a public structure. In spite of taxes, it has the appearance of being free. Moreover, the vast holdings of corporations are likewise public, owned by the stockholders in point of law, owned by management in point of fact, owned actually by no one. In the beginning, it would appear, God created 1972-America. But on the seventh day, He was not allowed to rest.

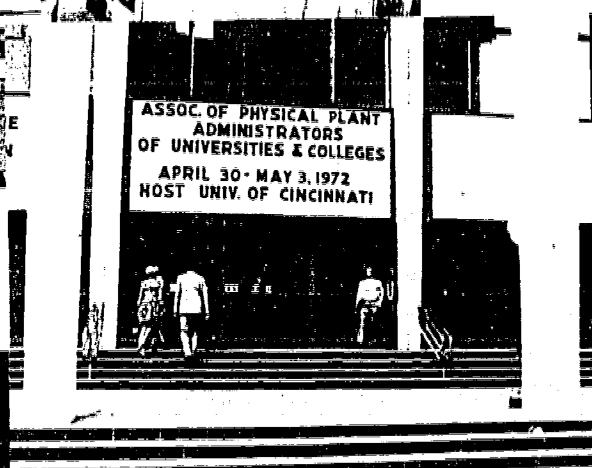
Nor can we! We must stand back from the illusions and the appearances, from the familiar conceptions and orientations, and think clearly and hard about our real possessions. We must know that we are custodians of the achievements of man, now expressed in a formula, now in a work of art, now in the idea of machine, now in economic processes and institutions, now in physical plants. These are the vital organs inherited from those who preceded us. They are transplants to keep vital and creative the living reality of man's existence. Your responsibility in the administration of physical plants is to dramatize the concept of maintenance, to symbolize the custodian duties, to sustain the future by a vivid respect for the embodied achievements of man's efforts.

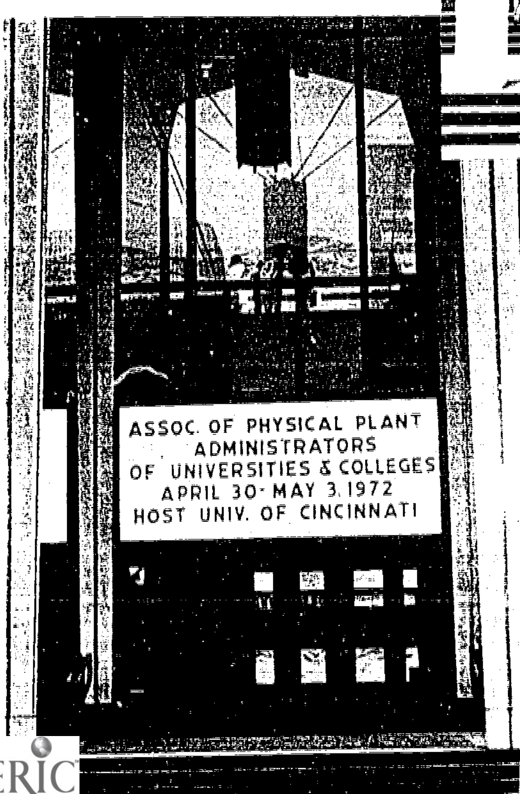

CINCY


ASSOC. OF PHYSICAL PLANT
ADMINISTRATORS
OF UNIVERSITIES & COLLEGES
APRIL 30- MAY 3, 1972
HOST UNIV. OF CINCINNATI


ASSOC OF PHYSICAL PLANT
ADMINISTRATORS
OF UNIVERSITIES & COLLEGES
APRIL 30- MAY 3, 1972
HOST UNIV. OF CINCINNATI


CINCY


ASSOC. OF PHYSICAL PLANT
ADMINISTRATORS
OF UNIVERSITIES & COLLEGES
APRIL 30- MAY 3, 1972
HOST UNIV. OF CINCINNATI


ASSOC. OF PHYSICAL PLANT
ADMINISTRATORS
OF UNIVERSITIES & COLLEGES
APRIL 30- MAY 3. 1972
HOST UNIV. OF CINCINNATI

MAY 3, 1972

10:30 A.M.

SESSIONS 13- Experience Exchange
Repeat of Session NO. 5
Mr. Holloway

14- Mr. Kahoe

The Cincinnati Post
Wednesday, May 3, 1972

On being trapped by stagnation

BY SUSAN YOHE

Roger E. Hawkins talked to about 350 administrators of physical plant from colleges and universities throughout the nation this week but what he said could have been taken to heart by anyone.

He talked about stagnation and how individuals and groups are trapped by it. He warned about the dangers of standing still and offered some suggestions on how to avoid it.

HAWKINS IS head of the business department at East Michigan University. He is in Cincinnati for the 59th annual meeting at the Convention Center of the Assn. of Physical Plant Administrators of Universities and Colleges. The University of Cincinnati and its director of physical plant, George Moore, are hosting the meeting.

Physical plant personnel at colleges and universities are in charge of maintaining a safe and attractive campus for students to live and work in—and of doing it at the lowest cost. Their biggest responsibility today is to direct all new construction on campus.

APPA

The AAUP was founded in 1914 ~~and~~ has grown to encompass 555 institutions both here and abroad. It will hire this year its first full-time executive director, Paul Knapp, former editor of "Buildings" magazine. He will direct the group's activities from a Washington base.

AT TIMES Hawkins sounded almost like a science fiction writer, warning that civilization will advance as much in the next five years as it has done in the past 500 and predicting that survival in the job market of the future will depend on what you know and not what you do.

The blue-collar worker will be engineered out of existence, he predicted, and the traditional authority-obedience relationship between an employe and employer will disappear.

STAGNATION—or what the administrator termed "mental-dry rot"—will become all the more dangerous then, he said.

You are stagnated, Hawkins said, if you think experience is the only way to get to the top; if you are not constantly at the business of upgrading your education; if you don't realize you are obsolescent and aren't trying to do something about it or if you're working harder at preserving the status quo than changing it.

THE PHYSICAL PLANT administrators will hear three days of presentations on ecology, administration, contract management, campus security and water treatment. The meeting adjourns tomorrow.

The administrators also have about 300 exhibits to see set up by more than 110 businesses.

113

300 exhibitors

EXPERIENCE EXCHANGE No. 2

William Stanton, Swarthmore College
Gene Cross, University of Utah

Gentlemen, let's get started on the second session of the Experience Exchange. I'm Bill Stanton from Swarthmore and this is Gene Cross from the University of Utah. But you're the participants. We're just going to shuffle the yellow papers here. George Moore has asked that we record this so we're asking each of you each time you speak to give your name and the name of your institution. Could I see a show of hands -- how many of you were in the first session? A majority -- so we will try not to duplicate the questions we used this morning because we have plenty of them.

We had a lengthy discussion on OSHA this morning, which I think is one of the questions that all of us need to be talking about. Shuffling through my papers I wasn't able to come up with the ad from last night's Cincinnati paper. I don't know how many of you saw it. The odds are four to one that your business is breaking the law and, if you read, it says that the chances are four to one that you break OSHA's rules. I think the odds were a heck of a lot better than that. I'd like to meet those (ones), I know who the other four are. Alright, we'll go ahead with your questions.

Q. James Simpson(Indiana Central College): What jobs are included in your IBM scheduled work tapes and how often do you have the job lists run?

A. Stanton: Let's ask first how many of you use IBM Work Tapes for your scheduling? Anybody? I assume that this means scheduling by computer?

A. Stan Palmer (Colby College): Just recently, I think within the last few years, we had a very expensive orientated planning system and we asked the computer to print 4 weeks in advance on the work order schedule weekly, and we would print out once a week a brief resume of the status of the conditions. Simply, the number issued and the number of complete. Once a month we print out a complete list of the individual orders that were not finished.

Stanton: I asked what jobs you included. Did you include everything?

A. Stan Palmer (Colby College): No, only in mechanical, heating, ventilating, air conditioning and utilities areas and not to do anything with custodial work and not to do anything with grounds. Simply with the utilities system, heating, ventilating, and air conditioning which is all the mechanical trades.

Q. Martin Whalen (Montana State University): How are you coping with HEW regulations as per paying maids the same salary as custodians? Does anyone have a classification system approved by HEW and the U.S. Labor Department that allows a reasonable work assignment with some overlap of duties recognizing light duties such as dusting, bed making, etc. should not command as high a salary as heavy cleaning? Preferably such assignment would allow assignment by building rather than cleaning crews.

A. Gene Cross: Does anyone still have a differential between the custodian classification and salaries and the maid? How many? Looks about 8. Have any of you been challenged on that as yet? Have you been able to overcome a challenge? Let's give some response then.

A. Joe Spedowski (Ferris State College): Applied by the first of July and we feel as though that we can change the classification of the man enough or change the work duties so that we will have these things.

Q. How are you going to change this?

A. Joe Spedowski (Ferris Tate College): Well, right now we are using a lot of student labor and they are the ones that are doing the heavy cleaning and actually our custodial people are more or less doing the light cleaning. So we're going to change them around and have the students do the light cleaning and the custodial people do the scrubbing. That will change work assignments to comply.

A. Harry Loveridge (Franklin College): We have maids only in the dormitories. We don't have them in the educational buildings where they can not do any moping or any use of floor equipment, washing windows, or using an industrial wet pick-up vacuum. They strictly do the hand cleaning. This works so that there is a differential between the two.

Q. Has HEW approved that?

A. Harry Loveridge (Franklin College): Yes

Stanton: Any other discussion on that?

A. Gene Cross (University of Utah): I just might make one comment. The only place this has been over ruled. It doesn't make any difference how fancy your job descriptions are, but it does depend on what the actual work performed by the individuals are. You can write up the most fancy differential job descriptions that you want, but when they look it over they will actually audit what the daily routine and work assignments of those people are. Like in you case, where you indicated that you actually have the maids do light work every day and restrict them to that and don't allow them to do the other work, and then the men are actually doing heavy work and they don't overlap on the maid's work then you could have a differential, but if in fact they kind of slush back and forth, I can guarantee you that they'll cite you and they'll knock you down in a minute because they've done it time and time again and they make you go back and pay back wages and they'll hit you real hard financially.

A. Harry Loveridge (Franklin College): Normally I've found it's the maids who were strict themselves.

A. Gene Cross: Well that doesn't make any difference though. When you get with these guys it's what they are doing.

A. Robert Walter (Eastern Montana College): We had the unfortunate experience of being the first public college to be charged by the Department of Labor. We went to court and lost. We set the precedent for the nation, unfortunately, on this and I can tell you it's a lot tougher than it seems on the surface. The main point is that all they have to do is find one man on campus who is doing work that is equivalent to what the ladies are doing and you are paying this one man more, you are guilty of discrimination across the entire campus. Just one person in this category, you're in bad shape. But, I would suggest that if you have pay grades now, they're not against this.

A. Gene Cross: HEW is not against pay grade differential.

A. Robert Walter (Eastern Montana College): So when they filed against us everyone was boosted up one pay level. No one can loose or be dropped in pay because of one of these actions. All of a sudden you have no pay raise. In other words, we're going to have to start at $510 a month, which is what everyone gets now on our campus in the custodial area. And in order to get a range we are going to have to go up from there. Well, it's really boosted our costs. So what I would suggest is that you get at least one man on that crew with the women and from that point on this could work in reverse. This one man, I think, could establish you are discriminate. From that point on I think you would be safe and you could maintain these various grades and tables, etc., but if you wait you could have the same experience we have had, and it's difficult.

Q. James J. Thorne (Oklahoma State Univ.): Do they distinguish any difference in their tenure service, men or women in their pay rate?

A. Gene Cross: Longevity. Longevity I think you're talking about. In other words, you can pay them if a man's been there longer than a woman, you can pay a different salary. Is that what we are talking about? I think that is recognized everywhere.

A. James J. Thorne: But do you know if this is a hit or miss thing?

A. Gene Cross: I think the main thing to remember, though, is to look at what actual work they do and, irrespective of what your job descriptions are, if you see one thing on the description and the person is doing something else again, as long as the man and woman are actually performing like functions, then they will require you to pay them a like pay irrespective of whatever your job descriptions are. So you constantly have to keep auditing this work performance of your people if you do have a differential, because if they start coming together they'll cite you and you'll have to comply and once you comply,as Bob Walter said here, then you're locked in from that time on. You can never drop back. Are there any other questions about that?

A. Harry Loveridge (Franklin College): We do make jobs available to women on the same basis if she can perform a man's duties and use the floor machine and vacuum, etc.; she can take the job. But, we have yet to have a woman accept it.

A. Gene Cross: We've actually been pushed to the point by the Denver office where we can no longer advertise in the paper under men and women listings. Everything is just advertised as job openings. You can no longer catagorize them in the paper as men and women. And, if they can qualify and do the job, you hire them.

Q. Eugene Richter (Connecticut College): Would like to hear from members who have installed recording demand meters, switch gear, and other devices or methods to reduce peak electrical demands. Who has been successful in combating peak electrical demands?

A. Erb Roberts (Vanderbilt Univ.): We have just finished installment of equipment, could write to our electrical engineer for more information.

A. William Stanton: We had a speaker from one of the electrical companies at the Eastern Regional Meetings and he explained how they would give copies of the demand charts to any of their customers who wanted them. Several of us went home and reported this and it took me 5 months, but I finally was given a copy of the demand chart for each of the previous 12 months. This helped us to determine whether it was just one peak during that month or whether we were actually getting up there daily, what day of the week it was, etc. We have been able to keep our demand down, but we're not sure whether there's been good planning or just happenstance.

A. Charles Dawson (Southern Methodist Univ.): Our company has a demand chart and demand meters in our plant that were under the operator's watching.

A. William Stanton: This is done by the man watching the chart. Does anybody have any automatic equipment that rings bells or does anything when the demand gets up to a certain point? Apparently not.

A. Gene Cross (Univ. of Utah): We've worked on this utility manager for the second half of last year and we have two sub-stations on the campus which zones the campus and then, as we determine that we had peak periods in there, started having this person work with various areas on large pumps, large motors, things like this and we cut our demand very quickly. Our peak demand leveled out. However, if your system is similar to ours, our rates are determined by peak and our rate is determined by a given load factor and as we start cuting that peak down then the power company starts looking at us as to the rates because the rate was structured on our load factor that we would draw from them and, as we go under that load factor, then they start looking for reasons that may be increasing the rates. So this has kind of a back lash, too, and you want to keep aware of that. That, just because you become more efficient, it may end up costing you more money as they raise your rates on a lower use factor.

Q. Charles Dawson (Southern Methodist Univ.): What is your use factor?

A. Gene Cross: Just off hand I don't know, Charles. If you would drop me a note I'd be happy to get it for you.

A. Charles Dawson (Southern Methodist Univ.): We are running 66% to 69% on ours. It's well worth it.

A. William Stanton: This utility company did give a figure. He said you can save yourself $4 for every kilowatt you can knock off your demand; just to give you some idea what kind of money you are working on. Now I suppose that varies from different parts of the country, but this is a rule of thumb he gave us.

Q. Robert Kirk (Illinois State University): Has anyone had any experience with elasta guard roofing system?

A. William Stanton: By a show of hands -- anybody? I guess, no comments pro or con on surface coating of weathered asbestos roofing felts. Anybody had any experience with surface coating of weathered asbestos roofing felts? I guess you're on your own then. You find out and let us know. Kirk, I've talked to all the experts and each expert gives me a different opinion.

Q. Don Zuck (Des Moines Area Community College): wants to know what is considered to be a reasonable fiscal plant budget in terms of percent of the total institutional budget?

A. William Stanton: How many run between 5 and 10 percent? Looks like about 15. How many between 10 and 15 percent? Looks about 15-20. Any above 15 percent? A couple. Any below 5 percent? 2.

A. Gene Cross: Usually it runs around 7 to 10 percent, about an average. Here again there is a lot of factors you have to take into consideration, but the range 7 to 10 percent is a fairly average range, on your percent of your total installment budget. How about community colleges? How many community colleges are represented here? What are yours running? 14, 10, 8, 12. So we're all in the same boat.

Q. John Lane (Washington and Jefferson College): Would like to receive from other small colleges in the Western Pennsylvania area a safety program or manual. Would like to have information on how the storeroom and tool checkout systems are handled?

A. William Stanton: Well, let's just put that out. Those of you small colleges in Western Pennsylvania please drop John Lane at Washington and Jefferson College a note if you have something along the lines of a safety program or manual on a storeroom and tool checkout system.

Q. Harold Ingram (Rhode Island School of Design): What controls have been found successful for utility costs, gas, electricity, etc.?

A. William Stanton: We have just talked about the demand meters. Anybody have any good ways of controlling use of electricity or gas?

A. Speaker: President came up with a good idea - put stickers on every light switch on campus.

Q. Speaker: Did it work?

A. Speaker: The kids are having a lot of fun writing notes on them. The decal says, "please turn out lights." Most of them now read, please turn off -- (President's name)

A. William Stanton: This does keep them from writing on the walls, though.

A. Gene Cross (University of Utah): We have gone into this, got going fairly well then lost the man on this utility management part. We started working on a program of financial kick back to a department.

We felt that we had to get a real motivation or incentive for the academic people to be responsive to our needs of cost so we had this man working with a department or a building if you will. Maybe there are more departments in a building and he would evaluate what the cost is a month or quarter of say electricity that was in that building, and then we would say to the departments in that building, "We will give you 25 percent of any reduction in cost of electricity in your building, as soon as we can show evidence that that amount is cut back." So, say that in one month they got busy and implemented things and cut back $1,000 electricity cost in a large complex, then we would give them $250 back. We just send them a transfer of funds. We found this to be very motivational.

Q. Speaker: For instance, this can't backfire, can it? For every hour on the hour they turn fluorescents off, they claim it costs you more in the long run to turn them back on because you wear out your bulb that much faster.

A. Gene Cross (Univ. of Utah): We have found that 15 minutes is about the cross-over factor and you can get any answer you want from whoever you talk to. We have found, and we put this information out, that if you're going to not use a fluorescent for more than 15 minutes to turn it off and incandescent, turn it off and on each time you use it. But we have found the 15 minute period to be fairly realistic.

In our library, in which the light bill runs between $6,000 and $7,000 a month, that once we started working with these people it immediately dropped down about $400 or $500 and it has been going down since then, and they have come up with things, innovations, such as "well let's start taking out bulbs." We had four-bank fluorescents. They said "well, let's take out all of those and see how it works." And in some areas they said "let's take out 2 of those and see how it works." In other words, once they started working to save themselves some money it's amazing how many new ideas these departments can come up with. When we are trying to do it they could care less. But once you give them a motivation and incentive it seems like they keep coming up with all kinds of things. It seems like everybody wants money so they'll work with you on that. We have individual meters on all of our buildings on electrical.

A. Philip Rector (Calif. Institute of Technology): We did some of what you did, too. We made the individual departments aware of what it cost, in fact I worked out an hourly cost, in the buildings and we were able to convince the academic department to cut down the demand on ventilation and air conditioning to a point where we picked up $70,000 from our utilities budget in a year. Voluntary cooperation -- when you make them aware of what really is the cost to them, they can see the dollars and cents and we really don't have to go to that extent.

A. Gene Cross: Another big important factor here is that you know that sometimes you'll go into a building and there'll be one professor in that whole building, yet it will be totally operational. Well, the Physical Plant comes and says you have to close that building down, the academic freedom. But if the department head or dean with their academic people, say, "Look, it's costing $7,000 or $8,000 to keep this building open. Let's see if we can schedule our time better so we can close this building down so it won't cost that much." Once you start working with them, when they're working to help you and if they're going to get something out of it, it creates some kind of motivation for them. It's amazing what they can come up with and your talking, like Phil said, tens of thousands of dollars that you can come up within a given year.

If it's self-amoritizing, whereas if you get some motivational factor or you say, "We will give you a percentage, whatever you come up with, of what you save", then you have got a hard dollar savings, something that will motivate them to get interested in the problem. Without it we seem to be shouting into the wind all the time. You have to come up with something to get them working with you.

A. Martin Whalen (Montana State Univ.): We have been doing a little experiment in our library and we took one floor and the designing conditions on that was 120 foot candles and we took out every other bulb besides trip lighting in an egg crate ceiling style. We took out every other row of bulbs on it. We cut down to about 55 foot candles in the area, which made it a softer light, a lot less glare on it. It's just a more pleasant place to be and every table in this area for the past two months has been filled all the time. On the other floors we still aren't getting the utilization. The students seem to like it and I think its partially because they don't like the harshness of too bright a light.

We started this because we noticed that in our student union they would go over and do all their studying. I checked the light level and it was 10 or 12 foot candles in the student union. But this is where they wanted to be. We wondered if there was any correlation between it and it seems to be working out that there is a real correlation between them. They don't want it as bright as the IES says it ought to be, and I think that all of us should look a little bit at these standards of lighting that are put out because they are just too bright.

I've got 120 foot candles in my office, so I cut that in half and boy it's so much easier to read and cuts that glare down, a more safer light, a more pleasant place to be, and I think they've gone overboard on the IES standards. We're seriously considering cutting back in every place that we can.

A. Gene Cross: Makes one think that some of these lighting engineers have stock in some of the lighting corporations.

A. Speaker: I'd like to get a raise of hands on how many people here think that lighting standards are too high today? The vast majority.

Q. Howell Brooks (Indiana Univ.): How do you dispose of paint thinner, chemicals, radio active material, and acids?

Gene Cross: Would anybody like to respond to that? Radio active material and the chemicals and other things probably would come separate. Would anyone like to respond to this? Someone said -- throw it down the sewer.

A. Noel Desch (Cornell Univ.): The state of New York is getting touchier and touchier, and what they are going to be insisting on very soon in incineration.

A. Frank Rice (Univ. of Wisconsin-Madison): We did throw it down the sewer, closed the sewer, and they did get kind of excited about it. We now have monitoring of sewers to make sure we don't throw any material down there. We collect it, then bring it to a land fill. It is put in a big pile; not the radio active stuff, though, and all the bottles and other trash. Then we get a large torch, we stand back and, poof, it's called instant incineration. That's not too acceptable either even though we have been doing it. We are in the process of having a safe design and construction of an incinerator for these liquid bottles of waste. This should be operational in about a year.

Radio active waste are taken to Illinois under a contract basis and they bury it out there. There are 19 animal waste incinerators on campus and we propose to close them down and build one Central incinerator under our control, probably.

Q. Gene Cross: Does anybody have any other means of doing it other than down the sewers or incineration?

A. James Thorne (Oklahoma State Univ.): We have a burial ground, one for radio active material and one for chemicals, pesticides and insecticides. All under our university safety rules.

Q. Gene Cross: What experience have you had with synthetic piping materials for condensate and/or chilled water systems under ground?

A. Elbridge Bacon(Stanford Univ.): We had a bad experience with the Johns-Manville Temptite. If you've used it I know you'll agree with me on this. It is totally unacceptable for condensate returns. Those longitudinal splits, and it happens we had one installation, we thought we had something great going and we found out differently. However, this Temptite is a very good product for chilled water systems.

A. Gene Cross: Temptite is a good product for chilled water systems. The Johns-Mansville product is not satisfactory in that it splits.

A. Elbridge Bacon (Stanford Univ.): On condensate return we have also had experience with Johns-Mansville super Temptite, which is excellent.

Q. Gene Cross: What ground problems have been experienced with central control and monitoring systems or computer installaations in a campus wide system and what solutions were found? Evidently they have had some problems with their control systems grounding out and not being functional. Have you had any experience with that? These low voltage indicators or transmittal systems are highly susceptible if they're not properly insulated.

Q. Harold Buddenbohm(Art Institute of Chicago): I am experiencing fish odors from 2 air handling units that have different sources of make-up air. The odors come in the air on our 8-row sprayed cooling coils. Has anyone else had this problem and if so what was done to correct it?

This odor has defeated about three different chemical companies. The only thing we can do is use hydrochloride and finally we wind up giving them a new odor. Hydrochloride. We can't seem to get rid of this, particularly in the spring of the year when the air is more moist than you need and your sprays will shut down to keep from over humidifying and your clogs tend to dry out. That's when the odor occurs.

Q. Gene Cross: When it dries out like this, does the algae dry?

A. Harold Buddenbohm (Art Institute of Chicago): No, it is internal.

A. Gene Cross: We had a problem with a smell in some of our cooling towers and we found it was the algae. That when it started to dry it created an odor. We put chemicals in there to keep all the algae off and once we did this, we had no more odor.

A. Harold Buddenbohm: Your saying tower. I'm saying air handling.

A. Gene Cross: In the unit itself?

A. Harold Buddenbohm: Yes

A. Gene Cross: You might check for an algae of some kind in there; when the algae starts to dry, it will create all kind of odors.

Q. James Thorne (Oklahoma State Univ.): Twice a year we have that smell in the water. No matter how we endeavor to treat it you still have the smell, even though you're making coffee. We just endure it for another couple of weeks in the spring and in the fall.

A. Harold Buddenbohm: I'd just like to say one thing further. This is only 2 units out of 65. I have no trouble with the others.

Q. Harold Buddenbohm (Art Institute of Chicago): I've been approached on the subject of water treatment with the application of an item called Ultra Stat or Electrastatic Water Treater. This looks to me as evasive and as illusive as it has been in the past. However, has anyone had any experience with Ultra Stat?

A. William Stanton: Apparently not.

Q. Harry Loveridge (Franklin College): What reaction, cost, or limitations, at institutions who are allowing students to break down beds and sleeping on mattressed on floors, doing to combat the overhead costs of not only taking furniture to storage but also returning it to the room for the next semester?

A. William Stanton (Swarthmore): We are having this problem. We give them one warning to put the bed back together again or we'll do it at their expense and then if they don't we come in and put it together and charge for $5 for putting the bed back together again.

A. Harry Loveridge (Franklin College): That's at the end of the semester?

A. William Stanton: No, that's as soon as the maid reports it. If they have a good maid, we never hear about it, but that's as soon as the maid reports it, we do it immediately.

A. Earlham College: Has the same problem. Our Dean of Students is the one who has caused this problem by the permissiveness of saying that they want to do their thing and they can do it. We have 90% of our male students now sleeping on the floor.

Q. Gene Cross(Univ. of Utah): Do you have a financial problem?

A. Harry Loveridge (Franklin College): Yes, I've already instituted a $5 charge for next year, but I want to know whether other institutions have started this for a labor charge for up and down of beds.

A. Gene Cross: A financial squeeze is always a good out and you can just go to the Dean and explain you just don't have the financial capability to do this. Therefore, they can do it but you'll have to charge for it. Usually when you hit them in the pocketbook, you can still allow it, but they have to pay, and usually they don't have the money and usually it will correct itself. If you can get the financial impact on it, it seems to have a deterring factor. You can still say you can do it, you can be permissive, but it still hits them where it hurts.

A. Harry Loveridge (Franklin College): This is a real problem because if you don't allow them, the janitor comes the next morning and there are 5 or 6 bed frames and a half dozen springs stacking in the hall. Even though you put the room number on them, they say, Joe down the street took it out. It's a real problem and the rest of you will have it.

Q. William Stanton(Swarthmore): I expected some questions on water bed problems. Is there anyone who allows water beds?

A. Harry Loveridge (Franklin College): Our floors aren't strong enough to hold them.

A. Univ. of Maryland speaker: We had a problem down in Maryland last year. Our structural engineers at the University made a study. It won't be permitted and we won't be responsible for the structural frames to hold them.

A. William Stanton: How about the guy who has a basement room? We have a general rule (Swarthmore) but a guy comes in and says, "I'm in the basement on a concrete slab, what are you talking about structural?" We said that it's a college-wide rule.

Q. William Stanton: Does anyone else allow water beds?

A. Alphonse Zabor (Lake Forest College): We allow them, but this is only in areas where we have concrete floors. In the older buildings they are not allowed.

A. William Stanton: Our problems are emptying them, rather than structural. The first one we had, the girl had the room right over the main entrance to the dormitory. She dumped it on commencement morning when everybody was trying to get in and out. Anyone else allow it?
That's comforting to know that so many of you are saying no.

Q. Gene Cross: What institutions in the central area have built new field houses with Tartan floors in the past three years?

A. Midwestern Texas; University of Dayton; Augustana,

Q. Gene Cross: How many institutions now have students serving on their Physical Plant Committees? Show of hands - looks like about 20. How many have students sitting on their Board of Trustees Physical Facilities Committee? looks like about 15.

Q. Gene Cross: How many institutions have already done so or will discontinue any summer school activities due to overall rising Physical Plant costs? This will include labor, utilities, and maintenance. Show of hands - none.

A. William Stanton: Many institutions are thinking about summer activities because of unemployment insurance, so I think the trend would be just the opposite.

A. Gene Cross: So it's a continuous year rather than doing away with the summer program and pay those 9 months people.

Q. Howard Schultze (Ursinus College): At the fall meeting of the Association of College and Research Libraries, the Assistant Director for Preservation of Libraries of Congress outlined the necessity of certain temperatures and humidity levels required to keep library books from deteriorating. Has anyone any thoughts or data concerning the costs of book damage vs. the operating costs of controlled humidity?

A. Harold Buddenbohm (Art Institute of Chicago): We made a study of this about 10 years ago which predicated our awareness but I don't have the figures with me, but I'll be glad to reply to a letter.

Q. William Stanton: How about fluorescent lighting on damaging books? Our people are trying to get us to buy something to slide on the fluorescent tube to cut down the ultraviolet light. There's a company that sells them and we're getting a few of them, a glass shield.

A. Speaker: Any piece of glass takes care of that problem.

A. Speaker: You could kill two birds with one stone if you could cut down on the amount of electricity that's being used in that tube.

A. William Stanton: We suggested that and didn't get away with it. We got to these people through Rohm & Haas. It turned out that their plant was about 10 miles from us. It seems to to me that it was Westlake Products in Glen Riddle, Pa.

Q. Speaker: Will plastic do it?

A. Speaker: No, plastic won't do it -- it has to be glass.

A. William Stanton: And yet the thing they sell you to put right around the tube is plastic.

A. Speaker: No, it's glass.

A. William Stanton: The one I'm talking about is a plastic sleeve that you slide on - it looks like it's ready for bologna. You slide it right on the fluorescent tube.

Q. Floyd Miller (Univ. of Illinois - Chicago): What is your experience with Buyers Laboratory, Inc., plant and sanitary maintenance test reports? Did they have a booth this year? I know they had one in Tampa. Who subscribes to Buyers Laboratory Test Service? Nobody! Maybe that's the reason they weren't here this year.

A. Gerhardt Carlsen(Augustana College): We did, and I cancelled it. Our Purchasing Agent bought it for us and I told him after a year to save his money because so often the things reported on by it weren't material to our area anyway.

A. William Stanton: OK, maybe Floyd Miller can get in touch with you.

Q. William Stanton: Do you have a programmed or computer prepared maintenance system and, if so, was it developed by a consultant or "in-house". We talked a little bit about that, but those of you who had them, did you develope them? By show of hands -- how many have them - a computerized or machine planned maintenance program? 3. Did you develope it yourself or did you get an outside expert to come in?

A. Bob Arnold (Univ. of Wyoming): We couldn't find an expert in our area so we hired our own people to do it and I think that's the way to go. Gene Cross has one of the best machine oriented preventive maintenance programs in our area.

A. Bob Hughes (Harper College): We did our own test analysis.

A. Speaker: M.I.T. has one.

A. William Stanton: Looks like it's in-house unanimously.

A. Cushing Phillips (Cornell Univ.): We didn't find that the computer helped us at all. We find it far cheaper to run it manually for what we got out of it.

Q. William Stanton: How long did you put up with the computer before you came to that decision?

A. Cushing Phillips (Cornell Univ.): We went through a cost analysis, we never did actually go into computer, but the machine time and programming time, etc., just didn't bear it out.

A. Gene Cross (Univ. of Utah): We found that you have to go through a staging period to get a planned maintenance program and the first stage you have to go through is a manual one. You have to take a survey manually, find out what equipment you want to put on and what equipment you don't want to put on and then lay out a program on each piece of equipment -- how often you need to service it and how.

Then you take the manual program and put it on a key punch card system and that is probably adequate for any amount of budget money most of us will have. Now, if at any time you could get many thousands of dollars, and I mean many thousands, to have a 4.0 maintenance program you possibly then would need a computer. You can imagine the number of motors, switches, and everything else, plus fans, etc. you would have to go to computer to keep track of it. But, I think, basically our budgets won't warrant it as evidenced by some of the other comments here.

You can't go beyond the stage of development of a key punch machine operated system. The one we use--we put everything on the cards and then go through and sort them each week and then pass out each deck of cards each day to the workmen. They do the work and put on there what they have done and we punch it back in. We have a history of each piece of equipment -- what was done and how often, and that kind of thing so that you have a running history. You can get a cost for your piece of equipment and it comes up automatically. Every time you just throw the deck in and sort it, they drop out on what week it should be done and each day you just pass them out to the people. It's very simple and inexpensive. It's very comprehensive, too. We have our own equipment and it's very basic equipment and we have two key punches, a sorter, a print out machine with a totalizer Machine.

This equipment is some of the most basic of the business machines you can get and you can lease them for somewhere around $6 - $8,000 a year. They're very basic and really make money for you.

A. Gene Cross: These types of business machines can do more for less money than you can hire a girl to do it. If any of you are doing it manually you can look into these - it's a IBM-402, and Burroughs and some of the others may have comparable stuff, but it can do possibly 100 times more than what you are doing manually now at what a girl will cost you - say $4 - $6,000 and you can lease this equipment for around $6 - $8,000. So if you're taking more than one girl you can do it with these machines cheaper.

A. M.I.T.: The main advantage of this program is you don't ask the computer to do any thinking in this kind of program. You only ask it to keep score. It will reduce paper work. But the main thing is that it frees your people in the supervisory level. They're not tied up doing a lot of paper work.

Another thing it does, as you've pointed out, it gives you the kind of management control information that you really want. The supervisor can take the print out and sit right down and go over it with his immediate area foreman, which saves a fantastic amount of time and gives a degree of control you just can't get any other way. It's well worth the expense.

Q. Tom Smith (Ohio State Univ.): To get the job done do you have a master file or a duplicate card?

A. Gene Cross: It's a duplicate card. You always keep the master file.

A. Phil Rector (Calif. Institute of Tech.): Of those who have preventive planned maintenance programs, are you doing it with a separate group or are you doing it with your own shops?

Q. Gene Cross: How many are doing it with separate organizations, say 2 or 3 people that handle all your maintenance scheduling? About 10.

How many are doing it by every supervisor or superintendent in every shop-separated out everywhere?
Looks like about 30 or 40.

Q. Bert Merril (Memphis State Univ.): I'm wondering how many control it from a central organization, whether they do it by shop or separate organization? The one where you keep your cards and make sure they do it on time and follow-up. We have ours centrally coordinated up there in my office but it's done by each shop.

A. Gene Cross: Now since you say it's done, you mean the work actually performed. I think that's what Phil was asking as to the administrative -- who does the paper work and the scheduling, keeping the records? How many of you that have maintenance programs do the paper work in a central place?

A. Gene Cross: Looks like the vast majority.

Q. Gene Cross: How many of you have a special work force that does just your planned maintenance programs?
Looks like about 15.

Q. Gene Cross: How many of you disperse the paper work out so that every shop does their own paper work?
Looks like about 20.

Q. Gene Cross: How many of you have each of your shops do their own maintenance then along with all the other construction and work.
Looks like about 30 or 40.

A. Don Wiston (Mass. Institute of Technology): One of the failures we've had initially was the inability of the supervisor to communicate with the computer system. We found it necessary to set up a procedure of program change so that the individual supervisor in the shop could put in changes to directly change the basic bank of information in the computer. This is an essential part of the program.

A. Gene Cross (Univ. of Utah): I might just add that any of you that are doing it dispersed now, it is a very difficult thing to go to a central system where you do your central paper work and have them control it all, not from the mechanics of doing it, but for the reason that was just mentioned of getting your supervisory people, your foremen and supervisors, as well as your workmen, to go with an increased -- to use their terms "paperwork system, or red tape factory" that they perceive this to be.

It's been our conclusion that it's much more efficient, however, to go to a central system and much more accurate and you can get better information when you have a central administrative or paper work control. You get a better overall picture and you're able to use people that are more knowledgeable in the area with the automation, as well as with the record keeping, etc. They can read this data and come up with better management information. Whereas, if you keep it down at the workmen level, your supervisory level, these people are more mechanical and they don't understand or have the depth of knowledge to get all the benefit out of the paperwork and the things that you're doing and the record keeping you're doing. It's a very difficult thing to make that transition - to have them adopt it -- because more paperwork is foreign to them and they don't know how to use it.

Q. Jim McChesney (Bennett College): Well, he wants to know how many people do their own mechanical work on their vehicles?

How many of them farm it out to dealerships and garages?
Looks like 5 or 6.

A. Speaker: It depends on how bad it is. In other words, changing tires or incidentals - we don't just send everything out. Our used cars we send back to the dealers for service, but if it's some little minor thing, we take care of it ourselves.

Q. William Stanton: Is that if there's a warranty still on it you send it back? Yes, major overhaul and body work we send out -- the rest we do in.

A. Randolph Twycross(Whittier College): We have one full time mechanic and 23 vehicles. We are a very small college and we do 100% of our work. If we have a complete boring job, we send that out to be done on a machine and then our mechanic assembles and pieces everything together. Transmission repairs and everything like that we do ourselves. We get our one man help as he needs help from any mechanical man who is able to help.

Q. Speaker: How much to you pay your machanic?

A. Randolph Twycross (Whittier College): We pay our mechanic $650 a month.

A. Harry Loveridge (Franklin College): This same question came up at the business meeting. The Business Managers have come to the conclusion that on automobiles they can come out financially ahead by trading every year, not every 2 years or every 3 years. This is actual statistics. You'll argue this, I know, but the Business Managers did too, but they actually showed figures and if you wish to have them, write to John Sweitzer, Earlham College, Richmond, Indiana, and I think he can give them to you.

Q. Gene Cross: This is on vehicle replacement, on buying new cars?

A. Harry Loveridge: Yes, on new cars and trucks.

Q. Gerhardt Carlsen (Augustana College): I bet the Business Managers don't approve buying new trucks every year? They never have.

A. Illinois State Univ.: Illinois State is trading every 18 months and operating at 6¢ a mile - fleet cars - not maintenance vehicles.

Q. Speaker: Are you trading in or are you outright selling?

A. Illinois State: We have to trade

A. Gene Cross: I think in the past it's been 2 years or 50,000 miles, whichever occurs first, is what some of the big leasing companies have been using--Hertz, Avis, etc.

A. Harry Loveridge (Franklin College): They have found that most of these types have been averaging more than 50,000 miles a year.

Q. Robert Butler (Univ. of California-San Diego): What ratio of supervision is optium in custodial operations? Assume this is probably on the foreman level.

A. <u>Gene Cross</u>: How many have a ratio of 1 to 5 - 1 supervisor to 5 custodians? - 1; 1 to 10? - About 20; 1 to 15? about 15 or 20; 1 to 20? - About 6; 1 to 25? - 1 Over 1 to 25? - 1 OK, that gives us a pretty good spectrum.

Q. <u>H. E. Sire</u> (Sir George Williams Univ.): How many universities have a planned maintenance service contract with Carrier Air Conditioning? In case of breakdowns, did Carrier pay all expenses - labor, materials, drying out of motor or, if necessary, rewinding motor?
Extra explanation: My problem was a breakdown which cost $50,000 of which insurance paid $34,000 and I paid the rest, and Carrier is after me to take this planned maintenance contract with them for $18,000 a year. I have two 2,000 ton machines. Now I paid the first $18,000; so in 5 years that comes up to $60,000 paid to them, which is about the repair cost I had, and I wondered if anybody had experience with a real major breakdown on these machines and how Carrier handled them -- if they push the responsibility back to operating personnel and say that they were sleeping and not paying attention?

Unfortunately, I'm stuck with the insurance that Martel and the Board of Governors who are probably involved there, and they insured us after this affair with $5,000 deductible and they won't pay freon replacement, they won't pay anything but exactly a split tube regardless of how the rest of the machine might have been deteriorated. We had one tube split and that contaminated both of the machines and I had to replace 220 tubes, we checked the thickness of the corrosion on the tubes. We had to replace that and we lost all our freon because both machines were inter-connected and then we had to send the motor down to Ohio because locally they couldn't dry it out (this 2000 HP motor) and all this we had a bad time with insurance to get at least a portion of $4,000 out of them -- but I'm sure I won't get it the second time.

A. <u>Gene Cross</u>: Why don't we take a survey to see how many have maintenance contracts on their cooling systems irrespective of their make - by show of hands -- about 10 to 12. That kind of gives us an idea of how many maintenance contracts there are.

A. Bob Davis (Univ. of Guelph): Similar failures on Carrier equipment $12,000 and $4,000. OK, so the insurance company paid, but they want the $5,000 deductible. We've taken similar maintenance contracts with Carrier but not the parts contract because they wanted between $18,000 and $20,000 a year. They do all service and we pay all parts and so far the insurance company rate is relatively low, but if we continue to have failures, it's obvious we'll have to pay higher insurance premiums.

A. Gene Cross: How many of you have insurance on your cooling systems? It looks about the same -- 10 to 12, so it looks like you'll have to make up your own minds.

Q. Gerhardt Carlsen(Augustana College): Could you find out who is writing the insurance?

Q. Gene Cross: What companies are writing the insurance on the cooling systems?

Hartford - Continental - Mutual

William Stanton: I have a confidential letter here on the missuse of men's rooms by deviates. This is a solution -- not a problem. They were having problems with persons tearing toilet paper rolls off to make holes in the partition so they had a great discussion of all the possibilities and solutions and finally they simply removed the stall door on every other toilet. How do you like that for simplicity!

Comments - William Stanton: We have used up all of the questions which you have sent in. Before we ask for questions from the floor, let me remind you that in your blue notebook, the APPA Reference Manual, there are listed in the back by decades, I believe, all of the papers which have been given at these annual meetings by subject. As soon as we get the Washington office set up it will be possible for you to write in asking for a Xerox of any of these papers that are listed here. Now I'm not so sure about the old, old ones, but certainly any of the recent ones. There may be a charge for this, but I'm not sure. This service is to be something that will help get the kind of information that we have been exchanging today and digging into this gold mine of papers that have been offered to us over the years at our national meetings.

Q. Speaker: I'm interested in how many of you have developed a specification for obtaining open competitive bids on cooling water treatment processes or is this all on a negotiated basis?

A. Gene Cross: How many do it yourself? Looks like everybody does it.

Q. Stan Palmer (Colby College): I'm interested in knowing if anyone has had a good experience with an architectural or planning firm in broad campus area planning, not just a big building design, but in working with the planning committee of the college and designing uses and functions of certain areas, general locations of buildings, placement, and operations of buildings?

A. University of Maryland: We are working on a master plan at Maryland right now. We are using Richards, Zimmer, Shield, of Urbana, Ill. They are real cooperative. We like them.

Q. Cushing Phillips (Cornell Univ.): Does anyone have, or are under pressure to have, a crew of student painters?

A. Robert Hafer (Univ. of Maryland): Yes, I'll tell you what we did, and it worked. We have to do some of these things once in a while. A kid classified as a radical, the President of the Resident Dorm, and through George Weber, my boss, he came down to see me and we picked a dorm and let them paint it. But this student was kind of loose and I said, "Look, you're going to be responsible." He said, "Oh no, I won't do that, this is for the students." I said, "well it's your idea, you're pushing it. You're responsible and you're going to get paid for it." Believe it or not, they did a good job. In this dorm, if we had put it out for bid, it would have run about $7,000 to paint it. Those kids did it, I guess, for about $2 - $3,000 less, but you have to keep them honest, and you've got to show them what to do and how to do it. Don't let them go, to do it by themselves. Now we let them believe they did the whole thing. As a matter of fact, they didn't because we were right over their shoulders.

Q. Cushing Phillips (Cornell Univ.): You didn't run into any flack with the union?

A. Robert Hafer (Univ. of Maryland): No, we're not union and when we put out a bid it's to non-union.

Q. Speaker: How did you handle brushes, rollers, etc.

A. Robert Hafer: Here's what we did. We set up a program and had a foreman go up and actually spend half a day instructing them on the proper application of paint, how to use the brush, how to cut in a window, and how to use a roller. Then we had him stop by every day. I didn't have him check with the rest of the kids, just "the boss," because that was the kid I was going to pin to the wall if he didn't do the job. So, when you put the responsibility on, make sure they realize they have it, you are going to get results. But don't be wishy-washy about it.

Q. Speaker: Do the students select their own colors in their own rooms?

A. Robert Hafer: No, we have a group of pastel colors that we let them select from.

Q. William Stanton: How did you get them to finish up? You can always get them to start, but how do you get them to finish?

A. Robert Hafer: We said to them, if you do a good job, and we figured it would take about 6 weeks, and if you're doing a good job, and you can prove it to us that you want to work the rest of the summer - after the 6 weeks is over, we'll put you with the paint crew and let you work the rest of the summer. Well, about 4 of them did this. So we just sort of dangled a carrot - played both ends against the middle. And they got paid for it. This kid didn't want to get paid for it, but we told him, you're the foreman and you get 20¢ more an hour.

Q. Speaker: How much did you pay them?

A. Robert Hafer: We called them brush hands and they got $2.10. The foreman got $2.30 - $2.40.

A. Speaker: We did this on a private contract. I had five of them come into the office and they wanted to do our outside rental property and they wanted to work the summer. I had one experience the previous summer where they were working for me and it was just no good. So one man was the foreman, and let them give me a bid. We supplied the material, all they did was supply the labor. They painted 8 houses for me and I had not one bit of trouble. My painting foreman, or I, would go over there and check them out and if they had problems, we would work them out -- and this one kid was a whip.

Q. Lawrence Ehinger(Adrian College): Do any of your deans use the Physical Plant Department as a penal institution for people who have fines, and if so, what are the results?

No Answers

Q. Pennsylvania Univ.: Are there any small schools in recent years that have gone to contract custodial services, and if so, what are the results?

A. William Stanton: Ursinus College has one. University of Dayton has one. Have they been successful?

Q. Have they been national or local firms?

A. National. Have been most successful.

Q. Young Moore (Univ. of South Dakota): We are in the situation where we do not have unions as yet. We're a little concerned about it. Has anyone had the experience of broadening the guidelines for job descriptions to make more general, yet valid, for people that you can substantiate in front of the union? We would be very interested if someone has done something in this area to make a broader use of the people you have at your disposal.

A. Don Perry (Evergreen State College): I have had the opportunity to initiate a new college this year. We have one classification, except for custodians. This is called Maintenance Technicians. In essence this qualifies a man to do anything he qualifies to do.

Q. Gene Cross: Have you been challenged by the union?

A. Don Perry: No, we hired someone from the State Personnel Board, which is the Civil Service of higher education and we received approval without any objections.

Martin Whalen (Montana State): I might make a statement about this painting deal. We were going through our own dorms painting our dorms, and a group of students came in. They were primarily our students, and they said we would like to do some mural work on the walls of the dorm corridors. We said "Well, fellas, you are supposed to be experts. Can you put in something that will be pleasing to the better amount of students and not be offensive to the rest of us?" They insisted they could, so we finally made a deal with them. OK, you take one floor and we will see what it looks like when you get done. Well, they did a beautiful job, so we turned them loose, and they went through the entire dorm, and it's spectacular - it's really something.

They did all the corridors and have everything under the sun and have quite a variety of colors, as you could imagine- all types of designs, nothing obscene, but it really worked out to be something. They're just tickled to death with it. It's one of the best things for public relations we've done in that dorm in my history.

William Stanton: I'm so glad that this session has said a great many things positive about students. I think we often get together and say what a terrible bunch of students they are, but from all over the country here we have heard some good things to say about students. That must mean they are getting somewhat better, or we're getting easier. It's about 11:55 am. Meeting adjourned.

"BALANCING AIR HANDLING SYSTEMS"

by H. Taylor Kahoe

Biographical Sketch:

H. Taylor Kahoe, President of Kahoe Air Balancing Company, Cleveland, Ohio. Is a member of ASHRAE Cleveland Chapter. Mr. Kahoe is a graduate of John Huntington Polytechnic Institute of Cleveland, Mechanical Engineer.

He was employed by the John Paul Jones, Cary & Millar, Consulting Engineers, Cleveland for 23 years as Design and Chief Mechanical Engineer. For 2½ years served with the "Seabees" on the Admiral's staff as a Mechanical Engineer. Spent 1956 in Europe for Richard Hawley Cutting & Associates as Chief Mechanical Engineer designing many U.S. Military installations.

Mr. Kahoe is a member of "ASHRAE" Technical Committee TC4-1 and a member of Task Force Committee on Air Balance for the Guide. Consulting editor on testing and balancing for The Air Conditioning & Refrigeration Business magazine. At present is President of AABC-Associated Air Balance Council.

* * * * *

The final System Balance for an A.C. System, H & V System, or an exhaust system is a problem that has plagued our industry for years.

It is no secret that a System Balance to the mechanical contractor is a bothersome problem that occurs at the end of every job.

Likewise to the Engineer, it is a bothersome problem that will result in an unhappy client if not accomplished successfully, plus untold hours and expense trying to protect his design.

What is a definition for a System Balance? It depends on your vantage point. To the Engineer - It ususally means -- get the system working to meet my design and if the components fall short of specified performance, the balancer must either explain why or be prepared to lab test the component to prove the field findings.

To the Owner - it covers that period during which it is his privilege to discover justifiable complaints and, also, any subterfuge for delaying final payment.

Our definition for a System Balance is somewhat more lengthy which I hope this paper will explain.

The process is not, as I have sometimes heard, a trial and error method, but rather a planned detailed procedure.

There is no question as to the necessity for a good System Balance. All the components of a system are related to air volume. Fans, coils, filters, pumps, compressors, cooling towers, ducts, and pipe sizes are only a few.

The Engineer determines his load requirements by heat loss or heat gain calculations in B.T.U.'s at the final occupied areas, and all his calculations for sizing his equipment are directly related to air volumes.

Therefore, without a proper System Balance, his design does not have a chance to perform satisfactorily, <u>no matter how well it was installed</u>.

Now, how do we accomplish this most important phase of a modern mechanical system?

Three basic items are required before a System Balance Team starts work.

1. The Engineer's design drawings and specifications.
2. The shop drawings of all equipment -- fans, air outlet, pump curves, and temperature control diagrams. From these you get the design fan R.P.M.'s, B.H.P., outlet flow factors and percentage of fresh air, etc.
3. And the last, but most important, is a good basic knowledge of the fundamentals of air and water flow thru fans, ducts, outlets, pumps, pipes, etc.

Now, in addition to these three basic requirements, several checks must be made on the system before the actual System Balance is started.

1. Check the fan rotation (tell antidote)
2. Check Air Filters for Cleaness
3. Check all dampers on the system and secure in an open position.

   (This includes splitter dampers, balancing dampers, outlet dampers, and let's not forget the fire dampers.) Please no 160° linkage, use 220° fuseable linkage.
4. Now set the system for a given set of operating conditions, say at minimum F.A. with face dampers open, and secure so the conditions will not change during your tests.
5. Now turn on all systems in the building as they will affect each other, such as toilet exhaust and general exhaust systems.

We are now ready to start the actual testing of a system, and you start at the fan. May I say here that 50% of the work on System Balance is done at the fan, and the main ducts to and from the equipment room.

First - take a speed reading of the fan.

Second - take a power reading of the fan motor.

(a) Voltage

(b) Amp. 3 phase

(c) Correct for actual voltage and motor no-load and calculate BHP approx.

Now compare your readings with the fan curve, or performance chart. This will tell you the approximate total air and the system's total resistance. If speed and power readings compare with the listed design condition, then a velocity traverse is made on the main duct system.

Cut test holes on 6" centers on all ducts to and from the fan, and using a pitot tube and manometer or some other direct velocity reading instrument such as an Anemotherm, take a careful velocity traverse of the duct.

These test holes must be cut at a reasonable location on a straight run of duct. An average duct velocity is establish and the cross section of the duct in sq. ft. is used to calculate the C.F.M.

Often, this procedure must be carried out at a number of points, each zone of a multi-zone system or on the hot and cold duct of a constant volume mixing box system. Occasionally, the duct system is such that duct traverses can only be made on the suction side of the fan, or perhaps, it is impossible to get any duct traverse. Then velocity reading over coils or filters should be taken.

Field testing is not 100% accurate and it is important to constantly prove yourself by another method.

Now, if our velocity test agrees with our speed and power test (in relation to total air) and we have two methods that indicate total air, we can then move out to the main branch ducts and set the secondary dampers. The velocity traverse method should also be used here.

With all main ducts, branch ducts, zone ducts set for design air, then and only then are the individual outlets tested and adjusted.

The method for testing individual outlets is as varied as there are manufacturers. However, the manufacturer's method should be used as this gives you a third method to prove total air.

Individual outlets are not only adjusted for air volumne, but must be set for air pattern.

With the system now balanced under this set of operating conditions say minimum F.A., it must be rechecked at the fan for 100% F.A. If it is a fixed min. F.A. system, of course, you are done with this system. But in the case of an Economizer type system, the automatic damper should now be set for 100% F.A. and power and velocity traverse readings retaken. If they agree with the min. F.A. reading, then the system is balanced. This is hardly ever the case, however. Due to the difference in resistance of the return duct system as opposed to the fresh air intake resistance, it is usually required that the automatic fresh air dampers be stopped down. In the case of a return air exhaust fan on the system, then resistance must be added between the two fans to match the conditions when they are operating as spearate systems as opposed to one system with two fans in series.

You will note that no mention has been made to S.P. test. S.P.'s, or rather fan pressure on a fan system are very difficult to read accurately in the field and should not be relied on for determing total air volumes.

This does not mean that you should not use S.P. readings for in the case of trouble in the system, S.P. reading will pinpoint the problem quickly.

Also, pressure readings are used to balance certain types of systems, such as a constant volume mixing box where a minimum of 3/4" to 1" is required at the last box on the longest run for the box to function properly. Certain manufacturers calibrate their induction units on a wind box pressure, and for a perforated ceiling type installation, the manufacturer requires a given pressure above the ceiling for correct penetrations.

So you see, S.P. readings are used but not for establishing total air.

There are other advantages to an air balance which are not generally thought of.

It is a check on the temperature control as all components of the system must be functional. We all know of the problem of setting of the min. F.A. A 25% min. F.A. System is almost never 25% of the F.A. intake opening, yet I have seen many systems where the fresh air intake is divided by four-leaf damper with one of the leafs being the min. F.A. damper.

The min. F.A. should be set by velocity method, return air being deducted from total air to determine the volume of F.A. Another good check on min. F.A. is the temperature method where you measure the return air temperature and the F.A. temperature and by proportion, you determine what the mixed air temperature should be. The problem here is getting a good mixed air temperature due to stratification of air thru the unit.

Another advantage of good air balance is that it will discover errors by the contractor and his subs. Wrong thermostats controlling the wrong zone, omission of outlets due to architectural changes; incorrect piping of Chilled Water coils.

Architectural changes without the knowledge of the Engineer is a real problem. The changes are made during the construction and may affect the mechanical design. They are done at the request of the owner thru the architect and no one thinks to check with the Engineer.

Occasionally, a design error is discovered during the balance. Engineers are, after all, only human and do sometimes make errors. When this occurs, the problem should immediately be brought to the attention of the Design Engineer. Almost without exception, a solution to the problem can be accomplished when he has field facts to guide him.

There is a final part to a good air balance, and this is the comfort adjustment for the occupants, or as we like to call it, the psychological balance.

This can sometimes be nigh impossible in the case of individual requirement of temperatures. However, if these adjustments are made with the total system in mind, then most of the individuals can be satisfied.

Very quickly, a system can be unbalanced by promiscuous setting of volume dampers by untrained personnel to satisfy individuals.

As to instruments used for this work, you will find the pitot tube and manometer are the most versatile field instruments. These are used for duct velocity traverses. Also, an anemotherm, which is a hot wire anemometer, direct velocity reading type instrument is useable for velocity traverses. The rotating vane Anemometer and Velometer are used for reading grilles and diffusers. Of course, a combination Amp/Volt clamp-on meter and a tachometer or speed counter are essential.

Field practice in the use of these instruments is most important, and the same person should read and reread all outlets so they will be relative, as no two people will get the same field readings.

Now, as to the Water Balance of a system.

The same general procedure is followed and reported.

1. Fix water temperature during test.
2. Set all elements to full flow.
3. Check pump motor amps to determine approximate motor B.H.P.
4. Check pump heads at full flow and at no flow.
5. Tabulate all elements for location and design conditions.
6. Adjust balancing fittings of all elements to proper required temperature drop.
7. After all elements are adjusted, recheck circulating pump for final operating conditions.

If at all possible, use the pressure drop method on elements, such as chilled water coils on a chilled water system. This does require pressure tap (gage cocks) across the coils, but the cost of a few gage cocks properly placed will save you time on the balance and will give you a positive method of testing.

Common pressure gages can be used, however, a good set of calibrated gages, reused on each element is desirable. Better yet, a differential pressure gage will read the drops direct.

More and more the engineers are designing into their system the installation of calibrated orifice or venturi flow fitting. The differential pressure gage can be used here and this is a positive method for determining valume.

1. Unit measured with Surface Pyrometer.
2. Must be related to the design drops for test conditions.
3. From the final pump volume, the temperature can be reset for the conditions required.
4. Be sure all is tabulated in the report.

Thank you for your attention.

"PROBLEMS AND SOLUTIONS TO CAMPUS SECURITY"

by Paul Steuer

Biographical Sketch:

Paul Steuer, University of Cincinnati Campus Police. 30 years with Cincinnati Police - served as patrolman, detective, Det. Lieutenant and Acting Night Chief. Introduced the first two way radio to motorcycle patrol. Prepared and initiated the first Human Relations Course in Police Academy in 1950. Designed and taught first Defense tactics course in Police Academy in 1948. Set up and commanded the first tactical unit in Cincinnati Police Department. Set up and commanded first down-town shopping detail (Christmas shoplifting program).

* * * * *

I know you have heard the expression "A rose is a rose is a rose" -- well, "A police is a police is a police", and it means just that!

Police means to control; hold within bounds. The law is a written prescribed boundary, and there can be little or no abridgement to law enforcement.

Law, what is it? Law is a rule of civil conduct as directed by the supreme governing authority commanding what is right and prohibiting what is wrong.

Criminal law is a branch of the written or statutory law which deals with an act or omission which is forbidden by law and to which a punishment is annexed and which the governing authority prosecutes in its own name.

We hear of independent youth culture and conflict over changing values or general drug dependence, mental anxiety, emotional stress, culture lagall are problems and symptoms of our contemporary society but none alter or change basic law enforcement.

There are as many types of police departments as there are agencies who sponsor them. Actually a police department may be nothing more than a group of politicians in uniform and just about as effective.

When I talk about a good basic police system, I allude not only to the organizational set-up but the men who make it functional and effective.

By the very nature of our position I am talking about University Police which is not and cannot be far removed from the city police concept. Except for realignment of attitudes and priorities, there remains the responsibility of equal importance to the basic business techniques and principles of police protection.

The organization for and the application concept for "campus cops" must be innovative from their inception. The University Police must recognize and relate to the unique concepts of university policing to cope with and combat a major crime problem and to relate to and function within the unique structure of the institution (community) it serves.

University Police, much more than municipal, are and have to be educators in their own field and contribute materially to the educational climate and total educational effort within the university compound. The educative process is initiated in many and varied ways. The foremost is probably by example; others are by operating techniques and procedures, job knowledge, and a professional performance running the entire span of police functions and expertise.

How Do We Achieve This -- Selection and Training

The primary feature in acquiring the professional image is education, training and retraining in all the sensitive relationships which develop in human inter-personal contacts.

A policeman can never know too much, so educate is the key word. O. S. Sims* said "The development of a model law enforcement agency on campus, the institution, can teach by example", which reenforces the very concept which I propose. He continues by saying the sworn public safety officers are so professionally competent and service oriented, that the impression which they leave on students during their campus period will be carried with them following graduation. "These students can be so convinced and impressed by a professional campus police that they will reflect their thinking and images in their communities as our future judges, councilmen, representatives, and just 'good ole citizen Joe' who can propose and develop the same metamorphosis and eventual upgrading of city and county police.

The welfare and development of the student is the primary goal of the University Police so the upgrading of police and policing and the realignment of attitudes and priorities should bridge the hiatus between student, faculty, public, and police.

The University community, like any community (town, village, your home town), is a concentration of all the types, colors, and creeds which constitute the human race, and it is a race-- a race to fame, fortune, success, havoc, doom, and all the interpersonal relationships which develop or evolve from the weekly, daily, hourly contacts and conflicts of human to human.

---

*Sims, O. Suthern, Jr. A Handbook for Administrators, Editor of New Directions in Campus Law Enforcement

The campus is a city. It responds to all the same emotional and influence factors; the same give and take; the in and out groups: the accepted and rejected, the genius and the psychotic. It is also the depository of the most learned and educated people in the community. It is the center of many research projects. It is the womb of many of our future leaders. It is complex, concentrated, cosmopolitan. Like any concentrated group, it needs direction and control. That direction must be skilled, experienced, sensitive, firm.

The members of the university have the same rights and responsibilities as those of any community. They also enjoy no special immunities.

The more we discuss the structure and functions of the university, the more we re-enforce the proposition that we need just a good, efficient educated police agency.

The police are not the complete answer. Always we balance out with legislature and judicial controls. The police are not the judge and jury.

Several factors influence law enforcement concept and efficiency.

1. Laws, rules, regulations are only going to be observed so long as a majority population chooses to do so.

2. The basic concept of the administration of criminal justice is based on the swiftness and the sureness of punishment from fair and impartial trial.

The law enforcement administrator has two responsibilities:

1. The enforcement of the rules and regulations as defined by society.

2. Fair and impartial enforcement leads to and re-enforces public support of the enforcement program and thus to voluntary compliance.

No law enforcement program can survive with political or permissive policing.

<u>There Are Some Unresolved Problems</u>

The joint role of enforcement agency and the university community at large in crime prevention and crime control must determine the best balance between individual rights and the rights of the community. They have to reach, to tune into that segment outside the main stream of society who are usually apathetic, or afraid, or hostile.

The relations between minorities and law agencies - not academic- but immediately and violently influencing community life at many levels: civic endeavor, crime prevention, public order, safety, equal and impartial enforcement and justice.

The police many times expend more effort, ingenuity and persistence in proving someone right than as they exert in developing a case and proving someone wrong.

The university complex needs a university police; men hired to do a specific job. Universally, the job description follows these requirements:

1. Protect life and property
2. Must enforce city and state ordinances and laws
3. Must enforce school regulations
4. Must investigate and follow through
5. Must preserve and collect evidence
6. Must prosecute offenders
7. Must prevent crime
8. Must direct student action
9. Must instruct in proper student behavior
    a. work with office of the Deans
    b. work with all departments
10. Must co-ordinate and cooperate with other police agencies
11. Must have power of arrest

The foregoing at first glance, seems to indicate 10 simple steps to campus policing. Really, it delineates 10 simple commands which encompass all the contemporary and sophisticated police methods and techniques with their supernumerary ramifications of applications.

Law enforcement is much more than just making an arrest. That is just one small facet on the gem of professional policing.

Primarily and most importantly, we need an educated, well-trained, sensitive, sophisticated, flexible, firm, student-faculty and community oriented police agency. They must be adaptive. They must be part of the educative system. They must be exemplary, sophisticated, contemporary, dedicated, career police. They must be investigative and inquisitive and not be offensive or nosey. They must be understanding and sensitive to sociological and psychological aspects of the man on the street and group concepts and reactions and be firm and fair in applying police techniques and in executing an arrest. They must be well indoctrinated in the law - constitutional law, criminal law, civil rights, court procedure - and have sufficient knowledge, experience, and expertise to effect instant application.

How Do We Do This?

(You don't turn to the yellow pages!)

Organizing and training a University Police is part of the answer.

Selection and training of personnel is part of the answer

Constant supervision is part of the answer

Selection of personnel is of major importance. There are some types of people who could never or should never be policemen. Some become dictatorial when they have authority. They seem to lack the ability or judgement to perceive the tremendous responsibilities that accompany authority. Others recognize all the responsibilities and lack the self confidence to abide by them. These rather distinctive but deleterious applicants must be separated and rejected. Even the most subtle, perceptive and thorough screening misses one occasionally and he then must be recognized and separated during the probationary term. Scrutinizing supervision during the probationary period is an absolute.

Who Do We Get?

We get good, stable men and train - train - train ad infinitum.

We recruit in the same manner as a football coach. You are going to be just as good as the team you develop. Get the word out. Let other police agencies and groups know that you are recruiting and what kind of man you want. You just may find the one gem who didn't make the city because he lacked an inch in height or had to have corrected vision, and thus you inherit a good man. We just got lucky; a Washington D.C. policeman and a Seattle policeman, each fully qualified, trained, and experienced (I checked with their training officers and supervisors), had married Cincinnati residents who wanted to return home. We scored!

A few of the wise old sayings score here:

. . . . Those upon whom we depend must be the most dependable

. . . . Those who dare to control or lead others must be able to control themselves

. . . . Those who lead or control must never cease to learn

Our men qualify through Civil Service. There are certain basic specifications.

1. Age: 21 to 50 - don't exclude the good retired man. Some retirees are looking for a plum; they want to get good money while depositing all their dead weight on their dead posterior. Look carefully and you can find a good, active, capable, ex-policeman and really make an acquisition.

2. At least a high school education; try to escalate to Associate in Police Science.

3. Must have a police commission or satisfactorily complete a training course approved by the Ohio Peace Officers Training Council (est. by Chap. 109 Ohio Revised Code)

4. Must meet the physical requirements. (examined) 5'8" and a reasonably proportionate physique and clear speaking voice, who has the ability to deal with the public courteously, yet firmly, when necessary. A person with a speech defect or physical defect would be subject to ridicule and harassment which could only compound the volumnous verbal abuse so prevalent in current confrontations.

5. He must be able to accept and follow orders and analyze situations

6. He must be able to prepare accurate and concise reports.

7. He must be willing and able to work day or night shifts, weekends, and holidays, and in all kinds of weather.

8. Must have or qualify for a drivers license.

9. Must be capable of working with emergency conditions: excessive damage - massive injury, agonizing pain - death.

10. Qualify through oral interview. This is a knock down drag out brawl. We don't ask the nice questions: temperment, alertness, composure, appearance, attitudes, prejudices. Satisfy you; not him!

After You Get Him You Mold Him

Too many agencies accept and abide by the minimum requirements threshold. That has the connotation of marginal, fringe, inadequate to me. That is the first step in a long staircase to competency and adequacy. It is an endless program of training - in-service training, special selected courses - all reenforced by review at roll call, research and development in in-service ventures. All our men have attended a human inter-personal relations class (sensitivity training) at Xavier University. We have completed programs at Case Western, Eastern Kentucky, various police institutes and the Cincinnati Police Academy.

They have basic training in the role of law enforcement. It is necessary to recognize the vital importance of and manner in which sound relations with the community may be encouraged and developed and to live with the fact that only efficient performance of duty demands respect and acceptance of the public.

A basic program may include:

1. Role of law enforcement
2. Laws of arrest, search, seizure (civil rights, civil liberties, and constitutional guarantees)
3. Criminal Law
4. Vehicle and traffic laws and traffic control methods and techniques
5. Rules of evidence, court procedure and testimony
6. Interview or interrogation principles and techniques - admissions, statements, crime scene notations
7. Civil complaints
8. Crowd control; confrontation; management
9. Patrol function - duties and techniques
10. Techniques and mechanics of arrest
11. Juvenile methods; procedures
12. Reporting and report writing
13. First aid
14. Tactical operations
15. Investigation techniques
    a. homicide, assault
    b. burglary
    c. larceny
    d. vice control
    e. undercover
    f. narcotic

Notice, please, I said basic program. This is only the beginning.

Equally important is administrative, supervisorial training. This starts with the sergeants and escalates all the way to the top. Again, a few basics:

1. Role of supervisor
2. Leadership development

3. Supervisory planning
4. Staff conferences for supervisors
5. Supervisors subordinate relationships
6. Evaluation of police personnel and work performance
7. Effective communication
8. Supervisorial training responsibilities
9. Employee complaints and grievances
10. Motivation, discipline, morale
11. Police/campus relations

There are books, volumes, written on each of the subjects mentioned. My only comment is read them all, analyze them, and use the best of each as it best applies to you and your situation.

We have written rules and regulations. Each has to be exact and positive. You can't tolerate or abide by ambiguous and supernumerary orders. I would rather refer to them as unifying guides. I am convinced that written procedures for every thought and act stifles and prohibits ingenuity, self assertion, and innovation. If your men need a million orders and a million procedures detailed to minutiae and trivia, 'fire yours and hire ours.' Robert Towsend, author of Up the Organization, stated my thinking beautifully when he wrote "The only people who read policy manuals are goldbricks and martinets. The goldbricks memorize them so they can say: 1) That's not in this department or 2) It's against our policy. The martinets use policy manuals to confine, frustrate, punish and eventually drive out of the organization every imaginative, creative adventuresome woman and man. If you have a policy manual, publish the Ten Commandments."

You need some, but be careful what you dictate and how you dictate it.

I could choose any one subject or function of policing and talk for hours. I think each has its own important niche in the overall operation or the attainment of police goals.

A "Fer Instance"

Report writing is much more than writing something on a form. It precedes, predetermines and initiates many police activities. It isn't sufficient to include report writing as a part of policing or a necessary evil. It is not an insignificient task.

A report must be factual, accurate, pictorial, concise, accumulative,directional, accessible and should evolve into many responses. Reports should develop a crime panorama, etch out a spot map, develop a time, area, location pattern, predict behavior problems or possible incidents and progressively determine the selective assignment of personnel. Good reporting should furnish statistics and facts by which we develop a pattern for a crime prevention program. An ounce of prevention is better than any kind of cure (not just a pound). The prevention program based on reporting and intelligence, often a dirty word, must coincide and progress in intensity step by step with the enforcement program and be so integrated and contemporary that it is as much as contributory effort or factor in resolving a problem as the effort methods and techniques which effect an arrest. This is a public relations, a selling the police, approach.

We use the reports to tell us what, when, where, and how offenses are happening. We contact the victims and develop the why and then work for the who. We talk to related groups in related areas, jobs, conditions, etc. We tell what is happening. We tell them how to prevent a like incident. We solicit their information and observation working on the principle that nothing is insignificant. Enough people assisting the police in looking for the same thing, in the same place, at the same time is a sure winner.

Patrol is a very important function. Area, concentration of activities, concentration of residence halls, high risk areas and many related factors combine to determine the type of patrol most appropo to your unique conditions. The walking patrolman equipped with a handi-talki is probably the best police contact. A sharp man walking among the people at the right time and in the right places is in a key position to develop the best image, serve the most people and become most involved in the accepted way. The telephone, the large expanses to cover, and the mobility of the population compels the use of the motor vehicle. Mobility may be accomplished by car, scooter, motor cycle or even bicycle. We use 3 cars; 2 sedans and one station wagon. They are convenient for hauling prisoners. The importance of removing the arrested from the scene promptly cannot be over emphasized and is accomplished expeditiously with the cars. Also troops are easily transported hither and thither as conditions dictate. The station wagon is especially equipped for emergency conditions. Each car has radio contact with Cincinnati Police. Each U.C. policeman has handi-talkie. This gives instant and constant communication. We divided the U.C. area into 3 beats or zones and have an over riding supervisor on each shift. The man assigned to a beat is responsible for anything and everything that happens in his area and only leaves that area when summoned for an emergency assist. He responds to all the radio requests in his area and is held accountable for the report, the initial investigation (a very important function), and the referral for follow up. Each car is equipped with emergency first aid, masks, fingerprint kits, recorder, camera, flares, and chemical repellents so that we provide the beatman with the necessary equipment to service people and fulfill his police duties. He not only takes reports but preserves the scene for additional investigation, preserves and prepares evidence, secures witnesses and statements, takes pictures of victims or crime scenes, and contacts our investigators, the Cincinnati Police or whatever agency is involved.

Each patrolman, in addition to foregoing, must know all the buildings.

1. Entrances and exits
2. When they open and close
3. Who and what is in each building
4. Who is in charge - the evacuation plan
5. Where are fire extinguishers, shut offs, fire hydrants, fire doors, etc.
6. Who parks where
7. Storage areas
8. The research projects

I mention one item, crime scene preservation. This means that the patrolman must recognize, analyze and preserve anything which might lead to the identification or arrest of the perpetrator of a crime or anything which may explain the manner in which a crime was committed. He must recognize and preserve physical evidence.

A recent U.S. Supreme Court decision on evidence and admissibility shifted the responsibility and burden of crime investigation more toward the technical aspects. The police must rely on physical evidence to prove cases. Photos are silent witnesses; pictorial testimony. Each photo must be relevant and material to the case.

We have constant contact and liason with Cincinnati Police and have written procedures relating to various activities which may involve them. We use their facilities such as identification section, records section, intelligence unit, vice control unit and in no way could divorce ourselves from them.

We are always conscious of the police image. I think every patrolman and officer is responsible for polishing or tarnishing that image.

Each patrolman has to be well chosen, well trained, and a complete policeman in himself.

I think each policeman is his own and the department's public relations representative. We put him in a uniform to make him conspicuous; readily identifiable. He is, and so is every act, word, and deed.

The department is just as good as each man. He reflects himself and the department.

Actions speak louder than words. He better be good!

How Do We Become Part of the Educative System

We work directly and intimately with the wonderful people working with the Dean of Men and Dean of Women.

Every infraction of a school regulation or a city ordinance does not require or merit instant arrest. Many times on a first offense involvement, we think that the student is better handled by referral to the Dean. Working with the Dean or one of his representatives, allows the student to become involved with the right people who can instruct and direct the errant one toward the right thinking or attitude or approach.

Many times a minor offense is committed by one student against another student or member of the University Family and the person victimized, who always has the right to prosecute or petition through a warrant, declines to do so. This may be construed as a charitable or philanthropic act but may also reenforce anti-social behavior. We refer the student to the Dean and impress upon him that there are no double standards, the University does not condone illegal or objectional behavior and that you adhere to the straight and narrow voluntarily or with a bit of guidance. The students may receive a lecture, be referred for help and probation, or be ordered before the Judiciary Council. This is a beautiful, effective and efficient process. Each step is student-oriented, student attuned, and student and faculty directed. To me, it is a very competent, intermediate step.

We have prepared bulletins and flyers on the Do's and Don'ts of security. We suggest that security is somewhat a personal responsibility and that each person has to develop an awareness of contemporary social conditions along with a conscious protective attitude. We meet with members of the News Record, the school paper, and exchange news, views, and ideas. We have to be honest and accurate in all contacts with the reporters. The Press is part of the action. They are omnipresent. You better accept them and work with them. There are enough headaches without fighting the press. We have a reporter procedure which we use in criminal investigation incidents. Our men do not report to the reporters. We have a Public Information Office. The policeman gathers all the facts and then notifies the Information Office. All reporters are referred to them.

A special student contact is our student monitor program. We enlist students, male and female, to observe in certain sensitive areas and high incident areas: note that I said observe, not patrol. The student works with us as an observer. He is not a policeman, makes no arrests, and does not get physically involved.

We ask him to work areas like the dorm lobbies, specialized areas and parking lots and notify the campus police if they see something that needs our attention. They are informed of the incidents occuring in their areas. They are instructed in what to look for, to differentiate between prank and trouble. They submit a daily performance sheet listing not only their hour by hour activities, but suggestions and ideas which we acknowledge and employ whenever we have one practical and applicable. We not only have met and worked with some very fine people (students) but some who developed into very competent, effective aides. They observe our actions, become aware of our problems, learn our attitudes, philosophy, interest, and dedication and become our best boosters.

The most important thing about people contact,any people relations concept, is not the open door, but the open mind.

1972 APPA WORKSHOPS.........

Eastern

DICKSON

LOCATION: Massachusetts Institute of Technology

DATES: August 6 through August 11, 1972

HOST: William Dickson

Western

GABE

LOCATION: University of California, Santa Barbara

DATES: August 20 through August 25, 1972

HOST: John Gabe

WORKSHOP COMMITTEE

George Berry, Chairman, Univ. of Wisconsin/Mil.
William Dickson, M.I.T.
Lloyd Durow, Washburn University
John Gabe, University of California, Santa Barbara
Henry Barbatti, University of Tenn. at Chatt.
A. J. Hall, Adams State College

TRENDS IN WATER TREATMENT FOR

STEAM GENERATION AND COOLING SYSTEMS

J. F. Wilkes

DEARBORN CHEMICAL DIVISION

CHEMED CORPORATION

LAKE ZURICH, ILLINOIS 60047

Session 16

ASSOCIATION OF PHYSICAL PLANT ADMINISTRATORS

Cincinnati, Ohio

May 3, 1972

ABSTRACT

Day to day problems of maintaining essential services (heating, cooling, air conditioning, humidification, etc.) at universities, hospitals and other major institutions continue to increase in complexity and cost. Contributing factors include rising costs of manpower; reduced quality and experience level of available labor; increased costs of maintenance materials; complex new designs and critical ratings of modern steam generators and total energy systems; expanded demand for cooling, air conditioning and humidification; and concern over problems of occupational safety and health, toxicity, pollution and other environmental factors.

Water treatment engineers are finding ways to minimize such problems, while continuing to provide maximum protection and increased life for expensive capital equipment. They have designed new chemical products and control systems offering versatility, simplicity in use, improved toxicity and safety characteristics, and reduced pollution hazards. Several of these new approaches in boiler and cooling water treatment will be discussed, as will the special requirements of humidification applications.

TRENDS IN WATER TREATMENT FOR STEAM GENERATION AND COOLING SYSTEMS

Physical plant administrators are well aware that problems involved in providing and maintaining essential utilities (heating, cooling air conditioning and humidification) at universities, hospitals and other major institutions continue to increase in complexity and cost. Already hard hit by shortages of operating funds because of budget cutbacks and decreased endowment income, administrators now must deal with sharply rising manpower costs, often coupled with reduced productivity and experience level of available labor. Costs of maintenance materials and services also have risen sharply.

The complex designs and critical ratings of modern steam generators and total energy systems demand closer attention to water conditioning parameters and preventive maintenance schedules. Modernization programs have brought expanded demands for cooling, air conditioning and humidification of new and existing buildings, laboratories, computer installations and research centers, further increasing work load on maintenance personnel. Another major factor requiring increased consideration is public concern over problems of toxicity, pollution, occupational safety and health, and related environmental factors.

In the face of budget limitations, there often is a tendency to omit essential preventive maintenance services, or to defer vital maintenance. These practices endanger performance and service life of costly capital equipment; eventually they lead to serious mechanical breakdowns, resulting in heavy maintenance expense, even requiring total replacement of failed heating, cooling and steam generating facilities.

To assist in minimizing maintenance problems, increase operating efficiency of utility installations, and make possible continued operation with reduced manpower, Dearborn researchers and engineers have developed new water treatment approaches, with modern automated systems to simplify application and control of essential chemical agents. The new chemical products embody improved safety characteristics, lower toxicity, and reduced pollution hazards.

The Dearborn philosophy has been termed ECOMATION™, to highlight considerations of economy, automation, and ecology. It provides positive water treatment results through economical, easy-to-use, scientifically controlled additives designed with maximum protection of the environment in mind. The objectives of this approach are maximum protection and increased life for expensive capital equipment, at minimum operating cost and maximum protection to personnel and to the ecology.

NEW APPROACHES TO BOILER WATER TREATMENT

To reduce labor, minimize handling problems and facilitate feeding of chemicals, multi-purpose liquid boiler water treatments have been developed. These additives combine essential features of scale control, corrosion inhibition, sludge conditioning, and prevention of carryover in precisely controlled, versatile products.

Automated Feed-Control Systems - The new liquid treatments are ideally designed for application and dosage regulation thru automated chemical feed and control systems. These electronically-controlled and automated systems regulate chemical feed in exact proportion to steam production or boiler makeup, while controlling system blowdown on the basis of boiler water conductivity. Automation of feed and blowdown systems, in combination with multi-purpose liquid treatments which can be pumped direct from the shipping container, eliminate man-failure and error possibilities, and substantially reduce previous labor costs of chemical application thru standard mixing tank-feeder combinations. Automatic control of blowdown on the basis of conductivity or other concentration factors allows boiler water quality to be maintained at a uniform level, while reducing losses of chemicals, water and heat. Modern boiler water antifoams incorporated in multi-purpose liquid treatments guarantee production of high quality steam, and also help minimize blowdown water and heat losses.

Synthetic Polymer Dispersants - A major forward step in boiler water treatment was the development of synthetic polymer dispersants to replace older vegetable tannin compounds and other natural organic sludge conditioners. The new polymers are highly effective as sludge conditioners and dispersants, and are not subject to decomposition or charring on high temperature boiler tube surfaces. The synthetic polymers are specifically designed for maximum performance, and rigidly controlled at constant quality level, which could not be guaranteed with vegetable tannins and other natural organic additives.

Sequestrants - Also available now are modern sequestrants and complexing agents which produce deposit-free steam generating surfaces, permit operation of boilers at lower chemical additive levels, and offer other advantages in environmental preservation. Chelating agents and sequestrants require very careful control to prevent boiler corrosion problems and generally are economical and appropriate only where very high quality makeup and feedwater are provided.

Steam-using equipment and condensate return line systems also must receive careful attention. Improved corrosion control additives have been developed and are in use to protect steam-condensing surfaces and condensate return systems against the aggresive action of dissolved oxygen and corrosive carbonic acid. The improved filming amine additives now being utilized are resistant to degradation, and help maintain deposit-free return lines. Combinations of neutralizing and filming amines also are available, combining the advantages of both types of additives.

Ion exchange pretreatment systems such as sodium zeolite softeners and demineralizers frequently experience capacity loss or flow reduction problems caused by iron oxides and other metallic residues which coat or foul ion exchange resins and interfere with unit performance. New resin cleaner compositions have been developed which efficiently remove iron oxides and similar foulants from surfaces of the ion exchange resin beads, and restore softener or demineralizer units to normal efficiency.

MODERN TRENDS IN COOLING WATER TREATMENT

The modern approach to cooling water treatment can best be described as the clean system concept. This concept recognizes that when metallic surfaces in cooling towers and related heat exchange equipment can be kept free from scale deposition, corrosion deposits and microbiological foulants, efficiency of water treatment programs will improve, while treatment costs will decrease. This new approach has been made possible by the development of synthetic polymer dispersants and antifoulants which keep fouling substances in suspension, so that they can be removed with cooling tower bleedoff. These antifoulants, along with modern sequestrants, also help minimize deposition of scaling matter and corrosion products on heat transfer surfaces, thereby providing improved heat transfer efficiency and rendering the entire system less subject to localized corrosion.

In a clean system, any corrosion attack which occurs is likely to be uniformly distributed and therefore lower in penetration rate, as contrasted with deep pitting and concentrated localized attack often encountered in areas of spotty, irregular scale and foulant layers. Since the clean system is less subject to localized corrosion, because of the elimination of adjacent anodic and cathodic areas, reduced dosages of corrosion inhibitors are effective. In addition, heat transfer systems are kept free from localized overheating which accelerates corrosion attack.

Multi-functional cooling water treatment products now are available for use in cooling towers and air conditioning systems. These are somewhat analagous to multi-purpose additives developed for boiler use. They combine (in single products) polymeric dispersants and antifoulants, corrosion inhibitor agents and scale control additives. Supplementing these products, modern microbicides have been developed to prevent fouling by microbiological growths.

Fouling layers caused by slime-forming bacteria, algal and fungal growth, and other microorganisms are major contributors to cooling tower and heat exchanger problems! If slime layers are allowed to form, they will interfere with heat transfer throughout the system and handicap cooling tower performance. Moreover, they prevent free contact of corrosion inhibitors with metal surfaces to be protected, reducing efficiency of corrosion control. Beneath slime layers, sulfate-reducer bacteria and other microorganisms may contribute to accelerated, localized corrosion attack. Accordingly, high potency microbicides for control of microbiological slimes play an important part in the maintenance of clean systems.

Microbicide products are not fed continuously; typically, they are applied intermittently, once or twice per week by shock dosage techniques. For maximum effectiveness, cooling systems should be cleaned mechanically to remove major accumulations of bacterial slime and algal growth, before starting microbicide treatment. Otherwise, a large proportion of the additive will be exhausted on surface growths, without penetrating down to metal or wood surfaces, to kill or control active cells and bacterial spores existing in the mass of the slime growth. If the system is maintained clean, the intermittent microbicide dosages necessary to control active growth will be smaller, reducing treatment costs and minimizing residual microbicide concentrations in waste water discharged to streams or to public sewer systems. This is important with respect to pollution control, to prevent damage to fish and aquatic growth downstream from the point of discharge of cooling tower bleedoff.

Cooling Water Treatment Methods - Several methods of cooling water treatment have been employed effectively in the past for control of scale deposition in cooling towers, and for prevention of corrosion. One method, still used in major industrial installations, employs controlled acid feed to reduce alkalinity of makeup water, and to maintain circulating water in the general pH range of 6.5 - 7.5. The amount of acid to be fed is regulated automatically in modern feeding systems, by pH control on recirculating cooling water. Acid also may be added manually, or by intermittent pumping systems, based on alkalinity and pH determinations in periodic control tests. The automated pH control system is preferred in view of labor savings, freedom from man failures, and flexible response to load variations.

Corrosion Control - Along with alkalinity control, efficient corrosion inhibitors must be included to offset increased corrosivity resulting from reduced pH of the cooling water. Chromates are highly effective corrosion inhibitors and have been used industrially for many years. Because of pollution considerations and potential skin irritation properties, chromate treatments largely have been supplanted by less objectionable inhibitors. Combinations such as zinc-chromate or zinc-chromate-phosphate are effective at lower dosage levels, and therefore contribute reduced pollution potential in bleedoff water which must be discharged to surface streams.

New Cooling Water Treatment Technology - A major forward step in recent years has been development of new, low toxicity, multi-purpose cooling water treatments to replace older, more hazardous combinations of acid feed plus chromate corrosion inhibitors. The new products incorporate low toxicity corrosion inhibitors, sequestrants to minimize scale deposition, and synthetic polymer antifoulants to help maintain clean cooling systems.

In larger installations where an automated treatment approach is feasible, modified alkalinity control procedures may be adopted, alkalinity being adjusted to maintain pH within the general range of 7.5 - 8.5, so as to maintain a favorable Langelier Saturation Index in the recirculated water. In these plants, combination treatments incorporating new multi-functional corrosion inhibitors together with complexing agents and polymeric dispersants may be utilized effectively. In other installations, where cooling tower bleedoff is discharged to a waste treatment plant or municipal sewers, low level zinc-chromate treatments may be completely practical, especially when used in combination with polymeric dispersants and the new complexing agents.

The newest system of treatment, one which is especially appropriate for smaller cooling tower installations, does not use acid feed for alkalinity reduction and pH control. Instead, the cooling system is allowed to stabilize at a natural pH, determined only by alkalinity present in makeup water, and concentration effects in the tower. Such systems obviously need controlled bleedoff and special scale-control additives, to prevent deposit problems when high hardness, high alkalinity makeup water is allowed to concentrate by evaporation. In these systems, the multi-purpose treatments recommended combine modern sequestering agents with polymeric antifoulants for scale control, together with anti-nucleating agents and corrosion inhibitors to maintain clean, corrosion free surfaces.

Automation for Small Towers - Treatment concentration and necessary bleedoff in small towers are readily controlled by new automated systems of several types. One such system uses conductivity control on the concentrated recirculating water to regulate bleedoff, and to control chemical feed in proportion to makeup water. Another system employs conductivity for control of bleedoff, but uses a water meter equipped with electrical contacts to start the chemical feed pump at regular intervals, (as determined by consumption of makeup water), and causes the chemical pump to operate for a preset length of time. These automated units are simple and relatively trouble-free; they effectively reduce labor required for supervision, maintenance and operation of treatment systems. They are designed to apply liquid treatments direct from shipping containers, without necessity of weighing out chemicals and making up solutions in mixing tanks.

Microbicide Problems - Treatment methods which do not employ acid feed for alkalinity reduction-pH control, and which allow cooling water pH to stabilize in a relatively alkaline range, (pH 8.5 - 9.5), impose special demands on microbicide agents selected. Many commonly used microbicides are ineffective, or may be totally neutralized and precipitated at high pH and alkalinity levels. It has been necessary to design special new microbicides which will give effective control of slime and microbiological foulants in the elevated pH zone just described. In spite of this problem, the new cooling water treatment approach offers definite advantages, such as reduced hazards in handling toxic chemicals, and elimination of need for transporting or feeding acid to cooling tower systems.

AUTOMATION OF CHEMICAL FEED AND CONTROLS

We previously mentioned the advantages of automated systems for treatment application and control in boilers and cooling systems. These automated systems permit definite labor savings, and minimize problems caused by failure of assigned personnel to follow operating instructions on manually controlled systems. They offer added major advantages in the conservation of water, ability to operate efficiently at lower controlled treatment dosages, and consequent reduction of pollution caused by discharge of treated water.

Automated analytical systems also are available to monitor specific control parameters in boiler and cooling water, and to regulate inhibitor dosages accordingly. These systems also can be adapted and used to monitor cooling water effluents or boiler water blowdown, for control of pollution. The main advantages of automated feed and control systems, however, are those of economics and reliability.

POLLUTION AND ECOLOGICAL CONSIDERATIONS

Where boiler water blowdown or cooling tower bleedoff can be discharged to an efficient waste treatment plant, or accepted by municipal sewage systems, pollution and ecological problems are largely eliminated. It will be necessary to insure that shock dosages of cooling tower microbicides are maintained within recommended limits, to avoid upsetting biological processes in sewage treatment plants by massive discharges of these potential toxicants.

Waste treatment techniques have been developed to remove chromates, zinc and similar toxic ions or pollutants from cooling tower bleed-off prior to discharge to surface water supplies. Ion exchange techniques can be used for removal and recovery of chromate, and for removal of zinc from cooling tower waste waters. Precipitation techniques also are available for removal of chromate and zinc. In these latter processes no useful recovery is possible. The metallic ions are precipitated as sludges which must be removed for disposal thru qualified scavenger services, or in approved landfill areas.

Phosphates in bleedoff from cooling towers and boiler blowdown can be removed in carefully controlled activated sludge sewage treatment plants, or in separate treatment facilities where lime or alum are added as precipitants. The newer organo-phosphorous sequestrants used for scale control and for control of metallic oxide deposition are low in toxicity, and resistant to oxidative degradation. When discharged with waste waters, they are slowly utilized by aquatic growths, but do not contribute to algal bloom. Polyphosphates and orthophosphates, previously used extensively in cooling water treatment as well as in household detergents, can contribute to algal bloom under certain conditions, and therefore, are limited to very low residual concentrations by Federal and state water quality regulations.

The discharge of treated cooling tower bleedoff containing microbicides to surface water sources must be carefully regulated to prevent damage to fish, shellfish and other aquatic life. These problems are eliminated where bleedoff water can be discharged to city sewers or waste treatment plants. Where cooling tower bleedoff must be discharged to a surface water supply, cooling tower waste waters containing microbicides must be adequately diluted to reduce residual concentrations below levels which would cause damage to fish and aquatic growth.

STEAM AND WATER FOR HUMIDIFICATION

Recently questions have been raised concerning potential effects of amine-type corrosion inhibitors in treated steam used for humidification, on horticultural research; laboratory studies involving enzyme, bacterial or tissue culture; food processing; or hospital and medical activities where autoclaving or sterilization operations are involved. Since the amount of steam required for humidification in air-conditioning installations is relatively small, it can readily be shown that problems of human toxicity do not exist. Likewise, unless neutralizing amines applied for corrosion control are added in large slug dosages, odor problems in humidified air are unlikely to be created.

Neutralizing amines and filming amine corrosion inhibitor additives have been accepted by the U.S. Food and Drug Administration for many years, for use in production of steam which contacts food products. Allowable concentrations and limitations on the use of these materials are spelled out in Food Additive Regulations, 21 CFR 121.1088.(1) The amines likewise have been authorized for use in steam for sterilization and autoclaving of gauze, surgical instruments, etc., in pharmaceutical or hospital installations.(2)

The effect of amine additives in steam used to sterilize media for culturing of enzymes, tissues and microorganisms has received little study to date. Problems have been reported in a few instances. Macheak and co-workers called attention to inhibition of Clostridium chauvoei 7320 growth, when solutions were prepared in distilled water obtained by condensing octadecylamine-treated steam, and when media used for culturing operations were exposed to treated steam during sterilization.(3)

George E. Gifford, Department of Immunology and Medical Microbiology, University of Florida, College of Medicine, studied the effect of morpholine in treated steam on the cultivation of Hela cells, and found no adverse effects from morpholine in steam or in autoclaved water in concentrations below 50 ppm. He also examined several common bacterial species and concluded that amine concentrations as high as 1% in solution had no obvious inhibiting effect.(4) The major concern expressed by Dr. Gifford is that microbiologists and medical researchers using treated steam for autoclaving, or using condensate as makeup for laboratory stills, may not be aware that amines and other water treatment additives are present in the steam. The presence of such additives could effect research in progress.

No data are available on potential effects on horticultural research and greenhouse operations of volatile corrosion inhibitor additives in humidification steam. In the absence of specific data, the use of treated steam for humidification in these operations is not recommended.

The use of amine-treated steam in dairy and fluid milk processing operations where steam contacts milk products is prohibited by the Food and Drug Administration. This application is specifically excepted in the Boiler Water Additives section of Food Additive Regulations, 21 CFR 121.1088.

Clean room operations requiring humidification should encounter no adverse effects from the use of steam containing neutralizing amines. Minor 'sticky dust' problems may be possible when using steam treated with filming amines. Both filming and neutralizing amines can be removed from condensate by passing it thru activated carbon or ion exchange columns. Activated carbon is particularly effective in removal of octadecylamine and similar filming amines.

Where sensitive microbiological cultures or enzymes are being grown in laboratory research, every effort must be made to exclude traces of amines and similar organic contaminants from water used to make up media. Demineralized water frequently will not be acceptable because of amine traces released from ion exchange resins. Treated condensate should not be used as makeup for media, or to supply laboratory stills. Where steam free from amines and other contaminants is essential for humidification or other sensitive processes, an unfired auxiliary steam generator may be used to produce it. Treated steam may be used on the tube side of heat exchangers as the heat source in these units, with untreated makeup water being supplied to the steam generator.

OCCUPATIONAL HEALTH AND ENVIRONMENTAL FACTORS

It is appropriate to call attention to the potential impact of occupational health and safety legislation on the responsibilities of physical plant administrators. The Williams-Steiger Occupational Safety and Health Act of 1970 has been responsible for a massive compilation of Occupational Safety and Health Standards(5) which may effect every aspect of physical plant or industrial plant operations in coming years.

The Occupational Safety and Health Standards already promulated establish detailed regulations concerning working areas; occupational health and environmental control; hazardous materials; personal protective equipment; fire protection; compressed gas and compressed air equipment; materials handling and storage; electrical facilities; powered work equipment, hand and portable powered tools; welding, cutting and brazing; and all other operations involved in new construction or day-to-day maintenance of existing physical plant facilities.

Under these regulations, stiff penalties may be incurred because of violations uncovered either by EPA or Labor Department inspectors, or those disclosed in complaints lodged by individual workers. A serious accident or fatality may lead to immediate and massive invasion by inspectors from state and Federal agencies, followed by imposition of severe penalties for violations found. Such investigations may uncover other violations for which the employer also is subject to penalties. These health and safety considerations clearly indicate the potential value of automated chemical feed systems, which save on labor, minimize handling, and reduce personnel exposure to potentially hazardous chemicals.

The stringent pollution controls imposed by state and Federal regulatory authorities also call attention to intrinsic values of the new low-toxicity, minimum pollution-potential water treatment products now available for use in physical plant systems. Logical adjuncts to these scientifically designed water treatments are the simple, automated feed control systems emphasized in the ECOMATION™ approach.

References:

(1) Food Additive Amendments 21 CFR 121.1088 - Boiler Water Additives; (last amended 34 F. R. 15842, October 15, 1969).

(2) Title 21 - Food and Drugs Statements of Policy - Octadecylamine. 21 CFR 3.506 - Use of Octadecylamine in Steam Lines of Drug Establishments. (34 F. R. 8704, June 3, 1969).

(3) Macheak, M. E. and Claus, K. D., Effects of Certain Anticorrosives in Steam on Clostridia, Am. J. Vet. Res., Vol. 31, No. 12, pp. 2301-2304, (December 1970).

(4) Gifford, George E., Occurrence of Morpholine in Steam and Its Solution During Autoclaving, Journal of Bacteriology, Vol. 80, No. 2, pp. 278-279, (August 1960).

(5) Title 29 - LABOR, Chapter XVII, Part 1910, Occupational Safety and Health Standards, 36 F. R. 10466-10714, May 29, 1971.

"GROUNDS CARE - COSTS AND BUDGETING"

by Cushing Phillips, Jr.

Biographical Sketch:

Cushing Phillips, Jr., Chief of Operations, Department of Buildings and Properties - Cornell University. He attended Cornell University as an undergraduate, receiving the Bachelor of Civil Engineering degree in 1943. He subsequently has undertaken post graduate studies which led to the award of the degrees of Bachelor of Management Engineering in 1953 from Rensselaer, and Master of Business Administration in 1965 from California State College at Fullerton.

From 1944 until 1965 Mr. Phillips was an officer in the Navy Civil Engineer Corps, from which he retired, as a Commander, in 1965. All of his Navy service after World War II involved some aspect of facilities management. His last duty was that of Public Works Officer and Officer-in-Charge of Construction for the Marine Corps Air Station, El Toro, California.

Since leaving the Navy Mr. Phillips has been employed by Cornell University, as Staff Engineer, Director of Construction, and Chief of Operations of the Department of Buildings and Properties.

* * * * *

I want to talk today about a problem which most of us share, with the possible exception of those fortunate souls who take care of downtown campuses -- this is the problem of controlling the cost of grounds care. The events of the last few years have increased the importance of this topic considerably. There are very few schools now who are not suffering from financial strictures of one sort or another, and, when the competition for the buck gets hot, the plant maintenance budget is the loser more often than not.

Even if you have not felt the axe on your operating budget, I am sure there is no college or university whose administration is not insisting on quantitative justification for all major budget items. With the information available to us now, grounds care costs are very hard to substantiate, to compare with other needs, or to evaluate on the basis of those of other institutions. Actually, who knows how much grounds care should cost?

And if you are a conscientious physical plant man, you are obliged to battle for enough dollars to insure that your grounds program doesn't fall too far behind. We know we can all squeeze something out of our grounds budgets, but, here, as much as anywhere, maintenance deferred too long produces ruin. And a dust bowl, or a forest of dead trees, impresses neither the trustees nor the students.

How can we solve this problem? Here is an answer right out of the textbook: we must insure that our grounds care budget is large enough to pay for the necessary work, but no larger. We must also insure that each item in our grounds care budget can be substantiated in objective terms, and that the budget is a recapitulation of "hard" estimates, each one of which can be proved. Very good. This is the policy, but we, like the centipede with sore feet in the old story, are faced with a very sticky administrative job.

Let's try to decide first what we are buying with our grounds care appropriation. Traditionally, the grounds division has consisted of a fairly constant work force, sometimes augmented by temporary summer help, whose mission has been to "take care of the grounds." The core staffing level of this component has been reached by a number of routes. Some organizations have formulae, based on acreage or dollars or some other aspect of the campus, which have been used to reach a staffing figure. However, most staffing decisions have been made on the basis of who could shout or cajole more effectively; in other words, the "squeaking wheel" concept. Even though more recent management has recognized that staffing in certain areas was excessive, significant reductions have been hard to make because there has been no method available to determine accurately the work load. Those institutions following the practice of assigning areas to individuals or groups of groundsmen have discovered that in such a situation the personnel are always busy because their work load is self-perpetuating.

The first break-through which must be made if we are to achieve our administrative goal is to establish a functional basis for the work of the grounds division. Instead of dealing in terms of a force of men, and budgeting for their salaries and the material they will use, our budget and our chart of accounts should identify and price functions. This way we can separate major jobs from recurring work, and distinguish between repetitive and one-time items. Above all, we must educate our supervision that labor is a commodity. We must budget and schedule man-days, not people.

We have talked about breaking down the grounds care program into functions and jobs, but we still have to know how much work we are actually doing in other terms than the labor or dollars required to do it. In other words, we need some system of work measurement. Let's look for a moment at work measurement and work measurement systems. Most of us think of work measurement in terms of the production line or at least of a product-oriented activity. It's not too difficult to evaluate costs if output is measured in numbers of "widgets" or some other produced or manufactured item. Also, it's quite easy to compare costs with selling prices so we know whether we're making or losing money. Work measurement also has been applied to office work, construction, and many other types of activity. Getting a little closer to our subject area, a good many physical plant people have had to become familiar with work measurement techniques in evaluating custodial work. Here, of course, is the situation where we are repeating, daily or weekly, operations which are similar enough to be treated as essentially standardized. Nonetheless, there is a lot of work that goes into developing a good custodial standards program. When we get into the area of grounds care we are dealing with work that is far less repetitive than custodial work and consequently more difficult to evaluate to determine staffing requirements.

At Cornell, we decided that the easiest and fastest way to a usable set of work units was the statistical route. If we could collect costs for the principal grounds care functions (mowing grass, seeding, etc.) for each of the different types of grounds (open lawn, formal gardens, wooded areas, etc.) and relate these costs to the measured areas in which the work was done, we would have a set of unit maintenance costs which reflected present practice. This is a long first step toward the development of standard costs for grounds maintenance.

Here are the steps we went through to derive our unit maintenance costs. First, we examined the campus and identified and labeled zones of apparently homogenous (from the grounds care point of view) segments of the campus. (Exhibit 1). We assigned a code number to each zone to permit the accumulation of cost date related to it. Then we classified each zone in terms, we hoped, of the relative difficulty and cost of grounds maintenance, and measured the area of each zone. We grouped, for reporting purposes, the zones falling into each classification. We set up our cost recording and reporting system, which is on an IBM 360 system, so that we were able to identify costs with zones and functions and, eventually, have the computer produce summarized date for our program. What we now receive is a recapitulation of grounds care dollar costs for each season(and we are using calendar quarters to delineate seasons), by group and zone, and by function.

We calculate unit costs; that is, cost per unit area, for each element of our matrix of zones and functions. When the unit costs vary between zones classified in a single group we want to know why. Perhaps the answer is that our classification left something to be desired. Perhaps, on the other hand, our supervision leaves something to be desired. Where the trouble is apparently in our classification, we attempt to reclassify the zone into a more appropriate group. We will publish, for our own education, unit costs for each season, for each function and group (or grounds type). This we will use for comparing our costs with those of other institutions using the same basis for cost data calculation.

This is where I hope you all come in. Although we can learn a lot from examination and analysis of our own unit costs. evaluating one area against another and one year against another, the real payoff in a program of this sort comes from comparisons between different groups and different institutions, all or part of whose work and situations are similar. If I am successful today, it will be because I have persuaded at least a few of you to participate in exchanging this type of information, to the end that we are all able to compare our costs in this area with those of other institutions. We will discuss this more later.

To get down to specifics regarding our reporting and coding framework, the grounds classifications which we came up with at Cornell are shown in Exhibit 2.

This may seem too simple, but in analyzing our campus, we came to the conclusion that density of obstructions was the principle determinant in the nature of the grounds care function. Also, to use more precise categories would involve us in hundreds and thousands, even, of very small separate zones. By the time a foreman had decided precisely which zone each of his men was working in at each hour of the day, he would have little time left for supervision. We determined the areas of grass, trees, plantings, and pavement in each zone.

Exhibit 3 lists the functions, or work categories, into which we broke down grounds care, and their identifying account numbers.

Exhibit 4 shows the results we got when we measured up our "zones". (These zones are maintained by Buildings and Properties appropriations. The grounds around the dormitories, and other areas supported by non-B and P funds are <u>not</u> included). The photographs which follow give you an idea of what we meant by the assigned classifications.

(Slides of typical campus areas).

As is often the case when one is extracting statistical information from a going enterprise, we encountered difficulties in obtaining cost data broken down into the zone and function categories. Inserting the necessary codes into our cost-collection system was no problem. The function breakdown was provided by adding a couple of extra items to our list of standing job orders. The zone code fitted into a formerly unused field in the computer input. The problem, and the delay, came when we tried to get a computer program written to extract the data in a usable report. We were competing with too many other elements of the university for priority. Without boring you with detail, I suggest early and close liaison with the data processing group to avoid unnecesssry difficulty in this area.

Obviously, the more work the computer will do for you, the less effort (and cost) will be required to "massage" data and prepare meaningful reports. For this reason our programmers and I tried to anticipate the principal calculations which would be required to develop unit cost data, and to write these into the computer programs. To some extent we were successful, but some "second-guessing" was required.

The principal computer-prepared report, which accumulates costs by zone and by job category, and shows total and unit (per square foot) costs, has the form shown in Exhibit 5. The computer also gives us a summary of total and unit costs by group, or classification, and by work category.

In order to facilitate the comparison of our results, to identify abnormalities, I used the format of Exhibit 6. This, while somewhat time consuming, showed up some interesting situations. For example, some Buildings and Properties areas adjacent to dormitories appear to get mowed without cost to B and P. Then there are the step-child or orphan areas, that receive very little attention. On the other hand, the grounds around the B & P Office cost almost twice as much to maintain as those around the Department of Mathematics building. Of course, the legitimate reasons for high or low maintenance cost will show up, too, in an area by area analysis.

Incidentally, although we have used the computer at Cornell in extracting and compiling cost information, there is no reason why the same data can't be collected manually. For a large institution it would be quite time-consuming, but for the smaller schools would present no serious problems.

Exhibit 7 is a summary of the unit costs for the several "groups," or classifications, of grounds zones, for each of the grounds maintenance functions, for the period from June 16, 1971 to December 15, 1971. Although the interval is too short for firm conclusions, the unit costs show sufficient consistency to provide an indication of our experience, and the beginnings of a basis for estimating and evaluating grounds maintenance costs. You will notice that grass cutting is the large item in each group. This is no surprise, but the amount required for leaf removal in the larger zones surprised me. Over-all, the average unit costs are consistent enough to provide a basis for budgeting, which we haven't had before.

Obviously, there are fallacies in projecting 6 months' experience and assuming that the result will be an accurate picture of future operating costs. It will take two years or so of collecting and refining cost information before we will have reliable unit costs. The real pay-off will come if and when a number of institutions are collecting and exchanging comparable unit cost data, and following up with analysis of variances to determine the reasons for high cost areas.

We will use the information we are gathering in a number of ways. With our present, hard-nosed, administration, we need unit costs to substantiate our budgets, to show cost reductions or identify requirements for increased spending, and to use as a basis for budgeting for new or enlarged facilities. We are establishing a datum from which we can measure and evaluate cost increases or decreases due to maintenance program changes, new techniques, or new equipment, and from which we can project the effects of such changes. We hope to be able to exchange information with other institutions, so cost level data are not limited to the local situations. We hope also, by this exchange, to share improvements in management and field techniques with other organizations. After all, no one outfit has all the ideas.

Thus far, we have been developing what might be called statistical standards. One out-growth of this program can be the development of measured work standards for many of the repetitive functions involved in grounds care. We would select the more expensive and repetitive jobs (such as grass-cutting) for this sort of treatment. We would use work-simplification techniques, if appropriate, to improve and standardize the procedures being used by our personnel. If, for example, we wish to set standards for grass-cutting, we should insure that the groundsmen are using appropriate equipment, that the sequence of work permits maximum efficiency for moving equipment from area to area, and that the moving pattern and cutting height are proper. We will then by observations(operation sampling) and cost collection, determine the actual unit costs for the improved operations, and the level of performance of the operators, for each category of grounds. Once we have developed unit performance standards for each category of grounds on campus, a meaningful annual budget can be assembled for this function.

Here, then, is the point of the program. We have designed a system for statistically comparing costs in a field where there now are few reliable standards. If I can persuade a few of you to use this system, and to compare costs with one another, I believe we will all benefit. In order to make this as easy as possible I'm prepared to act as the "clearing-house" for such information. You'll find cards at the exit which you can mail if you are interested in participating in such a program. I'll send any institution interested in participating the results of our initial year's cost data collection, and copies of forms for collecting cost data for next year. At the end of another year I'll assemble the data sent to me and distribute copies to all participating institutions.

I hope you'll join me in this venture. The cost is low, and the return can be high. Comparing our performance with that of others may sometimes deflate the ego, but it's always educational, and education, after all, is our business.

EXHIBIT 2

GROUNDS CLASSIFICATIONS

Classification	Description
A	Unobstructed - Less than 1 Acre
B	Moderate Obstruction - Less than 1 Acre
C	Dense Obstruction - Less than 1 Acre
D	Unobstructed - Greater than 1 Acre
E	Moderate Obstruction - Greater than 1 Acre
F	Dense Obstruction - Greater than 1 Acre

EXHIBIT 3

GROUNDS MAINTENANCE FUNCTIONS

Account Number	Function
76050	Lawns - Weed and Grub Control
76051	Lawns - Seeding and Renovation
76052	Lawns - Fertilization
76053	Lawns - Irrigation
76054	Lawns - Grass Cutting
76060	Trees and Shrubs - Spraying
76061	Trees and Shrubs - Cabling, Pruning, and Feeding
76062	Trees and Shrubs - Vine Trimming
76063	Trees and Shrubs - Tree Removal
76064	Trees and Shrubs - Tree Planting
76065	Trees and Shrubs - Shrub Removal and Replacement

EXHIBIT 4

GROUNDS MAINTENANCE GROUPS AND ZONES - AREAS BY TYPE OF GROUNDS

Group and Zone	Description	Areas - Square Feet: Grounds: Grass	Trees	Plantings	Total	Pavements: Walks	Pkg.Lots	Buildings
Group A	Unobstructed-Less than 1 Acre							
5931	Anna Comstock Parking	3,600			3,600	600	20,400	
Group B	Mod. Obstruction-Less than 1 Acre							
5901	Baldwin Memorial					2,400		
5907	515 Stewart	25,300			25,300	600	10,200	
5908	102 West	4,600		400	5,000	400	1,000	3,200
5912	Cascadilla Parking	31,360			31,360	4,640	10,400	
5925	Upper Campus Rd.	20,000		15,760	35,760	6,760		
5933	109 Dearborn	31,500	6,500		38,000	900	3,100	1,800
5955	Lynah Rink	25,715			25,715	5,340	20,570	44,975
5956	Kite Hill Parking	22,600			22,600	11,330	220,000	
5962	Hi-Volt Lab	12,000	11,275		23,275		12,000	16,475
5987	B&P Storage	2,000			2,000			
Group B	Totals	175,075	17,775	16,160	209,010	32,370	277,270	66,450
Group C	Dense Obstruction-Less than 1 Acre							
5910	Heller House	4,400		10,500	14,900	700		2,000
5917	225 Fall Creek Dr.	7,150		3,500	10,650	450	900	2,300
5942	308 Wait	27,400	4,000		31,400	2,500	4,600	3,700
5943	626 Thurston	13,360	2,000		15,360	840	5,300	2,500
5957	104-110 Maple	1,000		500	1,500	400	4,000	8,000
5988	726 University	3,800		400	4,200	1,200	4,900	4,600
* 5953	Toboggan Lodge - Hyd. Lab.	28,000	118,225		146,225	500	36,550	6.175
* 5958	Service Building Area	30,100	66,550		96,650	3,200	75,150	45,000
Group C	Totals	115,210	190,775	14,900	320,885	9,790	131,400	74,275

* Special Areas

EXHIBIT 4

GROUNDS MAINTENANCE GROUPS AND ZONES - AREAS BY TYPE OF GROUNDS

Group and Zone	Description	Areas - Square Feet						
		Grounds				Pavements		Buildings
		Grass	Trees	Plantings	Total	Walks	Pkg.Lots	
Group D	Unobstructed-Greater than 1 Acre							
5916	Library Slope	975,000		13,100	988,100	43,600		
5937	Jessup Playing Fields	1,390,000	741,000		2,131,000			
5939	Country Club Parking	62,080	9,500		71,580	1,020	165,000	
5965	Observatory Area	142,150	9,500		151,650	1,000	7,350	2,250
5968	Judd Falls Road Bank	54,900	10,000		64,900			
Group D	Totals	2,624,130	770,000	13,100	3,407,230	45,620	172,350	2,250
Group E	Mod. Obstruction-Greater than 1 Acre							
5913	Taylor-Hughes Halls Area	187,620	15,000	10,000	212,620	27,160	43,100	62,000
5920	Arts Quad	680,000		39,200	719,200	113,000	61,000	217,800
5923	Engineering Quad	401,690		20,000	421,690	53,215	119,770	137,425
5928	Clark Hall Area	266,210	16,500	10,000	292,710	38,255	96,585	182,400
5935	310 Triphammer	108,900	23,500		132,400	1,200	20,200	4,920
5944	"A" Parking	366,775	95,000		461,775	800	283,585	500
5950	Helen Newman Hall Area	44,500	267,480		311,980	3,170	26,850	32,200
5964	Wilson Laboratory Area	103,840	135,000	25,000	263,840	5,760	31,300	35,500
5969	"B" Parking	264,720	10,000		274,720	800	342,180	1,500
5971	Research Park	184,000		800	184,800	3,000	175,000	83,000
Group E	Totals	2,608,255	562,480	105,000	3,275,735	246,360	1,199,570	757,245
Group F	Dense Obstruction-Greater than 1 Acre							
5904	West Dorms Parking and Bank	28,000	60,000		88,000		46,900	
5909	Lower Campus Road	35,880	50,000		85,880	8,620		
5921	Campus Store Quad	269,185	10,000	15,000	294,185	48,530	40,225	68,360
5927	Malott-White Museum Area	83,885	35,100	25,000	143,985	13,810	43,080	27,125
Group F	Totals	416,950	155,100	40,000	612,050	70,960	130,205	95,485
	Total -- All Groups	5,943,220	1,696,130	189,160	7,828,510	405,700	1,931,195	995,705

CORNELL UNIVERSITY
DEPARTMENT OF BUILDINGS AND PROPERTIES
GROUNDS CARE COST REPORT BY ZONE FROM 06/16/71 TO 12/15/71

ZONE 5921 LOCATION F CAMPUS STORE QUAD SQUARE FOOTAGE 294185

JOB NUMBER	DIVISION-TRADE	LABOR	MATERIAL	TOTAL
76061	440 GROUNDSMAN	44.24	.00	44.24
76061	465 TRUCK RENTL	.00	8.00	8.00
TOTAL FOR JOB NUMBER 76061		44.24	8.00	52.24
TOTAL COST FOR JOB NUMBER 76061 PER SQUARE FOOT				.0002
76062	440 GROUNDSMAN	168.79	.00	168.79
TOTAL FOR JOB NUMBER 76062		168.79	.00	168.79
TOTAL COST FOR JOB NUMBER 76062 PER SQUARE FOOT				.0006
76108	440 GROUNDSMAN	1,004.22	.00	1,004.22
76108	465 TRUCK RENTL	.00	72.50	72.50
76108	466 EQUIP RENTL	.00	24.00	24.00
TOTAL FOR JOB NUMBER 76108		1,004.22	96.5[illegible]	1,1[illegible].7[illegible]
TOTAL COST FOR JOB NUMBER 76108 PER SQUARE FOOT				.0037

TOTALS FOR ZONE 5921:

LABOR	8,457.89
MATERIAL	973.50
TOTAL	9,431.39

TOTAL COST PER SQUARE FOOT .0321
ZONE 5921 LOCATION F. CAMPUS STORE QUAD SQUARE FOOTAGE 294185

.0321

EXHIBIT F

Exhibit 6

Costs and Unit Costs by Group and Zone - 1st & 2nd Qtrs. FY '71-72

Account / Job Order Number and Function

Group, Zone, & Area		76050 Weed Cont.	76051 Seed	76052 Fertil.	76053 Irrig.	76054 Grass Ctg.	76060 Spray.	76061 Prun.	76062 Vine Trim	76063 Tree Rem.	76064 Tree Pltg.	76065 Shrub R/c	76108 Leaf Rem.	Total
Grp F 5904 88,000#	$					168.57								168.57
	$/#					0.0019								0.0019
5909 85,880#	$					291.32								291.32
	$/#					0.0034								0.0034
5921 294,185#	$		1,145.11		670.44	2,878.22		52.24	168.79	899.13	26.16		1,100.72	6,940.81
	$/#		0.0039		0.0023	0.0098		0.0002	0.0006	0.0031	0.0001		0.0037	0.0236
5927 143,985#	$		47.58			1,384.26		129.57	78.04	29.45			380.49	2,049.39
	$/#		0.0003			0.0096		0.0009	0.0005	0.0002			0.0026	0.0142
Grp F Totals 612,050#	$	–	1,192.69	–	670.44	4,722.37	–	181.81	246.83	928.58	26.16	–	1,481.21	9450.09
	$/#	–	0.0019	–	0.0011	0.0077	–	0.0003	0.0004	0.0015	0	–	0.0024	0.0154

EXHIBIT 7

Costs and Unit Costs by Group - 1st and 2nd Quarters - FY 1971-72

Group		76050 Weed Cont.	76051 Seed	76052 Fertil.	76053 Irrig.	76054 Grass Ctg.	76060 Spray	76061 Pruning	76062 Vine Trim.	76063 Tree Rem.	76064 Tree Pltg.	76065 Shrub R/R	76108 Leaf Rem.	Total
A	$													
	Sq.ft.	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
	$/sq.ft.													
B	$		262.21			2,373.41		274.82		20.35			91.40	3,022.19
	Sq.ft.	209,010	209,010	209,010	209,010	209,010	209,010	209,010	209,010	209,010	209,010	209,010	209,010	209,010
	$/sq.ft.		0.0013			0.0114		0.0013		0.0001			0.0004	0.0145
C	$		11.62			1,371.15		392.49					482.49	2,257.75
	Sq.ft.	136,110	136,110	136,110	136,110	136,110	136,110	136,110	136,110	136,110	136,110	136,110	136,110	136,110
	$/sq.ft.		0.0001			0.0101		0.0029					0.0035	0.0166
D	$					2,989.20							149.28	3,138.48
	Sq.ft.	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230	3,407,230
	$/sq.ft.					0.0009							0	0.0009
E	$		988.53		95.65	20,050.85		1,080.03	18.00	167.57	161.49		3,711.40	26,273.52
	Sq.ft.	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735	3,275,735
	$/sq.ft.		0.0003		0	0.0061		0.0003	0	0.0001	0		0.0011	0.0080
F	$		1,192.69		670.44	4,722.37		181.81	246.83	928.58	26.16		1,481.21	9,450.09
	Sq.ft.	612,050	612,050	612,050	612,050	612,050	612,050	612,050	612,050	612,050	612,050	612,050	612,050	612,050
	$/sq.ft.		0.0019		0.0011	0.0077		0.0003	0.0004	0.0015	0		0.0024	0.0154

THANKS!

PRESIDENT & MRS. CLYDE B. HILL

"CORROSION ON THE CAMPUS"

by Lewis H. West, P.E.
Lloyd A. Ramseyer

Biographical Sketch:

Lewis H. West, P.E., Owner and President of The Hinchman Company - Mr. West, graduated from Cornell University, has designed and supervised several million dollars worth of corrosion control systems for operating companies such as Standard Oil of Ohio and Texas Eastern Transmission for over twenty five years. He is a National Director of NACE, Secretary of the Michigan Corrosion Committee; Past Secretary-Treasurer of the North Central Region, NACE; Past Chairman of N.W. Ohio Corrosion Committee; and Past General Chairman of the Appalachian Underground Corrosion Short Course. He has authored many published papers on corrosion and regularly lectures at conferences and short course.

Mr. Ramseyer, a Project Manager for the Hinchman Company, graduated from Lawrence Institute of Technology. He has worked for The Hinchman Company for the past four years designing and testing corrosion control systems for industrial plants,utilities companies, and many school and college campuses. His speciality is corrosion testing and control for educational institutions. Some of his recent major projects in the Midwest have been the power distribution system at Purdue University and the heating lines at Indiana University. He is an active member of NACE.

The Hinchman Company
Corrosion Engineers
Francis Palms Building
Detroit, Michigan 48201

CORROSION ON THE CAMPUS

I. Introduction

Elevators drop, power fails, heating systems do not operate, and communications are inoperative.

These occurrences are regularly experienced on campuses everywhere, even without militant student activities.

They all have one thing in common -- CORROSION. When metals are exposed to moisture, they corrode at some rate. Careful design, construction practices, and special corrosion control measures control CORROSION to any desired rate. CORROSION ENGINEERING accomplishes this.

Corrosion is an electrochemical phenomenon caused either by natural (galvanic) or stray (man-made) currents leaving metal surfaces to enter moisture.

Corrosion control is an important part of designing, building, and maintaining physical plant. It makes the difference between an economical and unoconomical operation. Safety, ecology, and aesthetic campus beauty are involved.

II. The Corrosion Problem and Its Costs

A. What is the Problem?

Campus structures most commonly affected by corrosion include:

Lead Sheath Power and Communications Cables

Piping

FIGURE 1: 12 KV Lead Sheath Cables. Note that one is not properly cradled.

FIGURE 2: Corroded Steam and Condensate Piping.

FIGURE 3: Steam and Condensate Piping in Pit.

FIGURE 4: Repairing Buried Condensate Lines.

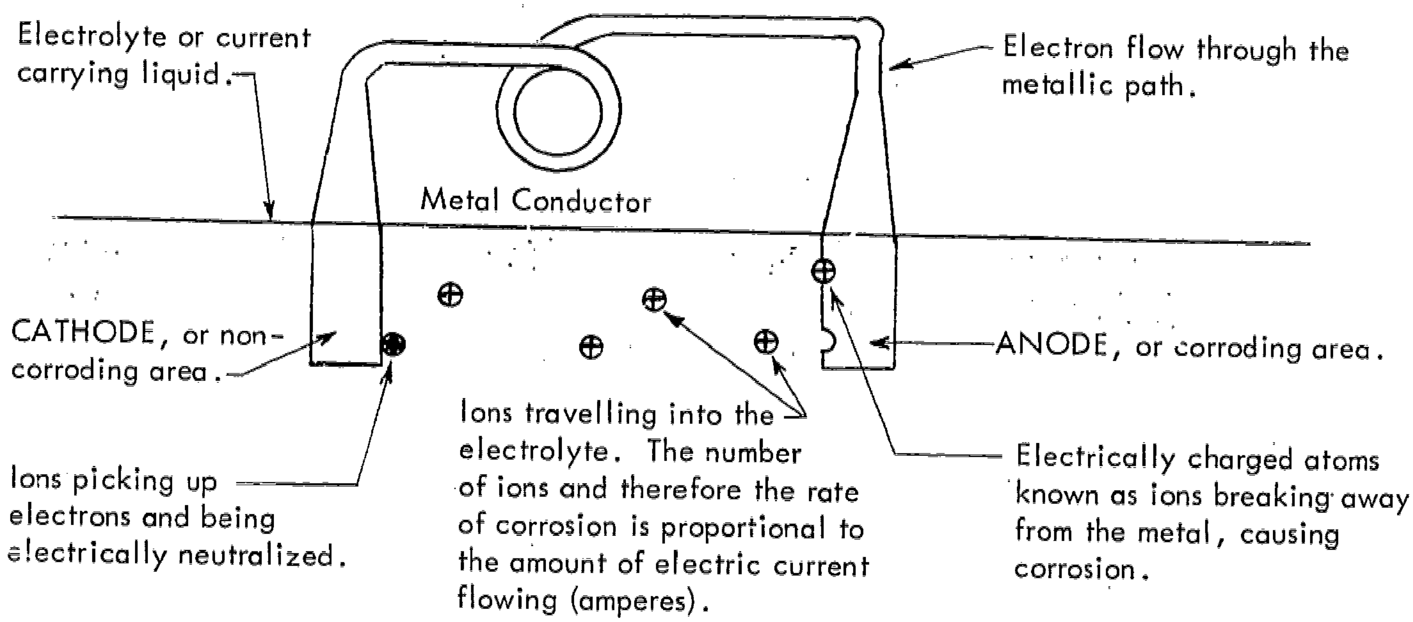


FIGURE 5: THE BASIC CORROSION CELL

Underground and On-Ground Storage Tanks

Hydraulic Elevators

Elevated Water Storage Tanks

Electrical Grounding Systems (Rods and Connecting Cables)

Poles and Posts

Piling

All types of lead sheath cables are affected. They might be bare, neoprene jacketed, jute wrapped, or tape armored. These will deteriorate whether directly buried in soil, inside ducts, or inside conduit.

Buried piping (especially pressure piping) is often a major campus problem. This usually includes gas lines, heating lines, water lines, and sometimes sewer lines.

Heating lines can be a problem whether or not in conduit or insulated backfill. In steam systems, condensate return lines are the most common problem. However, steam lines themselves are sometimes affected.

In high temperature hot water systems, both supply and return piping deteriorate. Domestic water lines, sewer force lines, and special gas lines (as hospital and laboratory facilities) often corrode. Water systems, particularly heating lines, can be affected by both internal and external corrosion.

At Purdue University, numerous failures occurred in 12 KV triplexed lead sheath cable inside ducts. (Corrosion control facilities are now being installed.) We have seen heating line problems at Yale, University of Michigan, U.S. Air Force Academy, Indiana University, Oakland University, Michigan Tech., and Ohio State. Cathodic protection

FIGURE 6: Insulating Backfill Type Coating Being Applied to Heating Piping. Coatings, alone, should not be relied upon to control corrosion.

has been successfully applied at these institutions.

Fires, explosions, personal injuries, and equipment shutdowns caused by corrosion can be a serious safety problem. Gas line and hydraulic elevator failures are usually the most serious (injuries and loss of life). Power and communications line failures are probably second. Loss of security and fire alarm systems create serious problems during times of student unrest. Control of heating systems, air handling equipment, pumps, etc. can be lost. The seriousness of corrosion leaks in water and heating systems, storage tanks, sewer force mains depends upon each individual situation and importance placed upon pollution control.

B. How Much Does Corrosion Cost?

Corrosion is expensive as well as a hazard and inconvenience. Hydraulic elevator cylinders cost $8,000. to $10,000. for each replacement. Power cables cost $5,000. to $8,000. for typical runs. Water tanks average $500. to $2,000. per repair. (In addition, water in tank is usually wasted.) Underground tank replacements average $500. to $1,500. each. Pressure piping repairs (water, gas, heating, etc.) usually cost between $250. and $1,000.

Some specific examples are:

A Midwestern University spent $8,300. (labor and materials) to replace one 500-foot lead sheath cable run.

Another School spent $1,600., last winter, to renew 70 feet of corroded condensate piping.

A Florida University replaced two hydraulic elevator cylinders at a cost of $12,000.

Both had failed from corrosion. No one was hurt, but we have seen serious injury result from similar failures.

C. Why Do Facilities Corrode?

Designers often give no consideration to corrosion. If they do, they often do not understand its causes. We see materials used in incompatible environmental conditions. Coatings may not be used at all, or relied upon as "cure alls" for all corrosion on all materials. A coating is usually not the total solution, and coating on a buried or submerged structure without cathodic protection will accelerate its corrosion failure rate.

Construction practices should be carefully specified and monitored. Even with excellent design and intent, insufficient or deleted construction inspection can result in:

1. Improper use of materials.
2. Improper backfilling.
3. Promiscuous substitution by contractors.
4. Structures installed with damaged coating.

Maintenance practices are also important. Inspection should not be neglected. Repairs should be made with materials (backfill, coating, etc.) as used, or compatible with those in the original installation. When corrosion failures occur, knowledgeable advice should be obtained. Maintenance personnel, or their advisors, should be able to identify corrosion failures.

Basically, campus facilities are corroded by:

1. Soil or water conditions.
2. Stray currents (usually DC).

FIGURE 7: Bare Copper 4/0 Cable shown here in a manhole is buried beside lead cable ducts. This creates a serious galvanic corrosion problem.

FIGURE 8: Anodes are being placed in ducts parallel to ducts containing lead cables. These emit current for cathodic protection. (See also Figure 13)

3. Dissimilar metals connected together.

4. Combinations of 1, 2 and 3.

Extremely low resistivity soils (as saline conditions in coastal areas) are nearly always corrosive. Widely varying soil resistivities, even though high resistant, are often equally severe. Corrosive soils are found most everywhere, and often result from contamination (de-icing salts, chemical "dumps", etc.).

Sources of significant stray currents include:

1. Campus lab equipment, controls, or appliances.

2. Cathodic protection systems - operated by utility industrial companies.

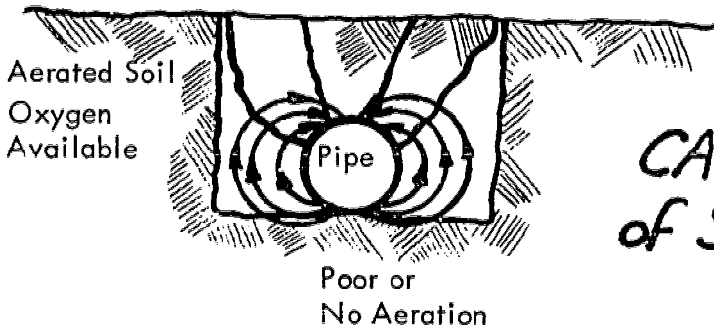
3. Adjacent industrial plant equipment.

4. Electrified railways and transit systems.

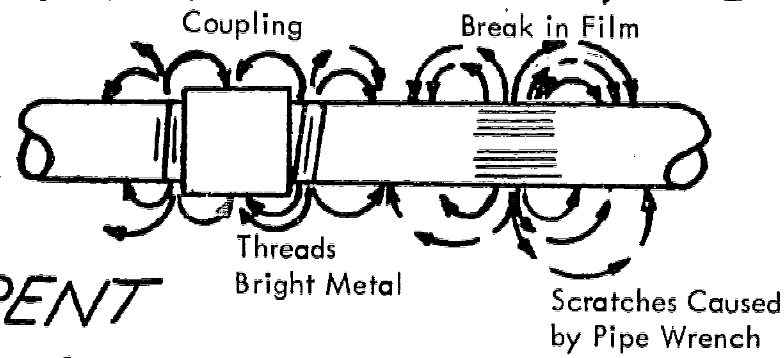
Dissimilar metals are connected together at every campus building because utilities are connected there. This causes galvanic corrosion out in the soil. Copper grounding systems are the worst offenders here. Large quantities of bare copper are normally used. Most all other metal structures (lead, steel, iron, etc.) are tied in and copper is noble to them, causing them to corrode.

Corrosion failures are usually caused by combinations of those discussed. Elimination of only one or two factors seldom significantly alleviates corrosion. Example: A bare copper counterpoise, paralleling lead cable ducts, was the major cause of high voltage lead sheath cable failures. The copper was disconnected. However, this did not stop corrosion failures. Obviously, soil conditions had not been changed, but tests also indicated some stray current. Cathodic protection was effectively applied to counteract this combination situation.

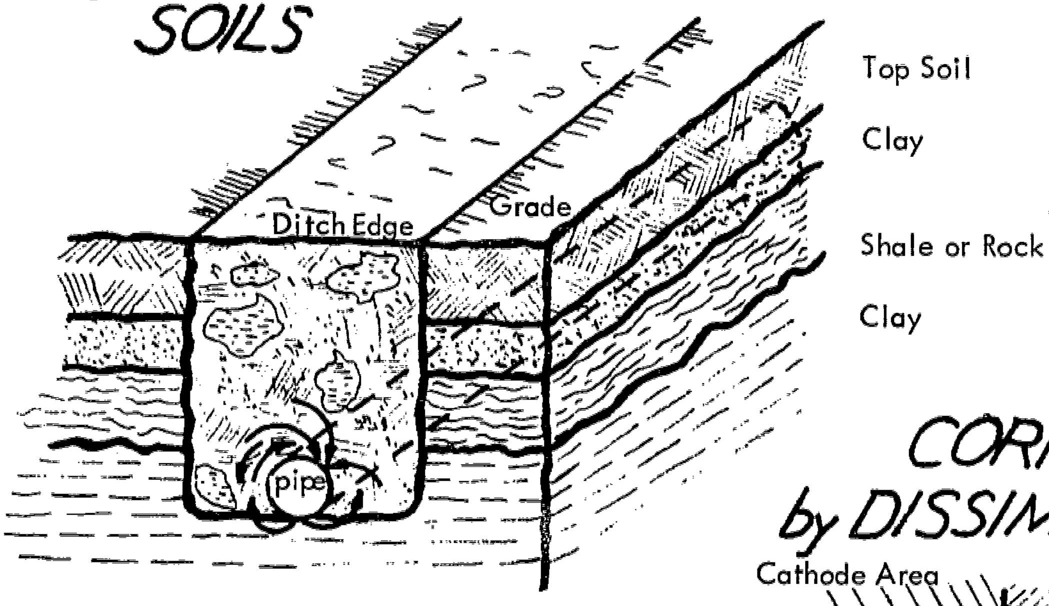
CORROSION CAUSED by DIFFERENTIAL AERATION of SOIL



CORROSION CAUSED by DISSIMILARITY of SURFACE CONDITIONS



CORROSION CAUSED by MIXTURE of DIFFERENT SOILS



CORROSION CAUSED by DISSIMILAR SOILS

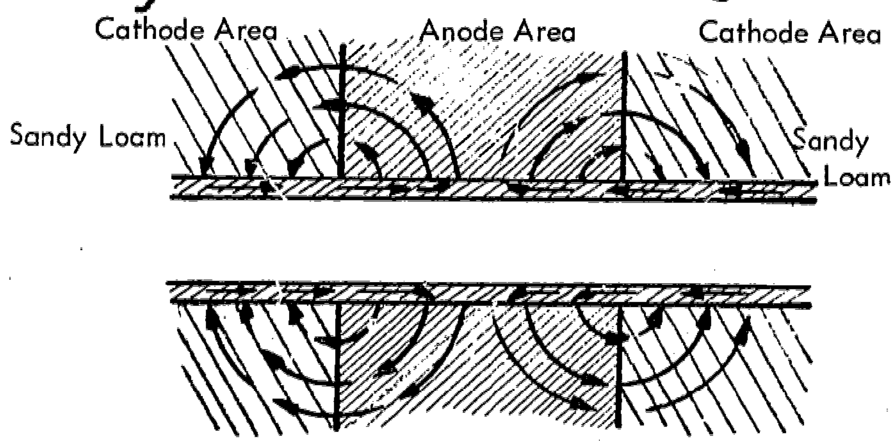
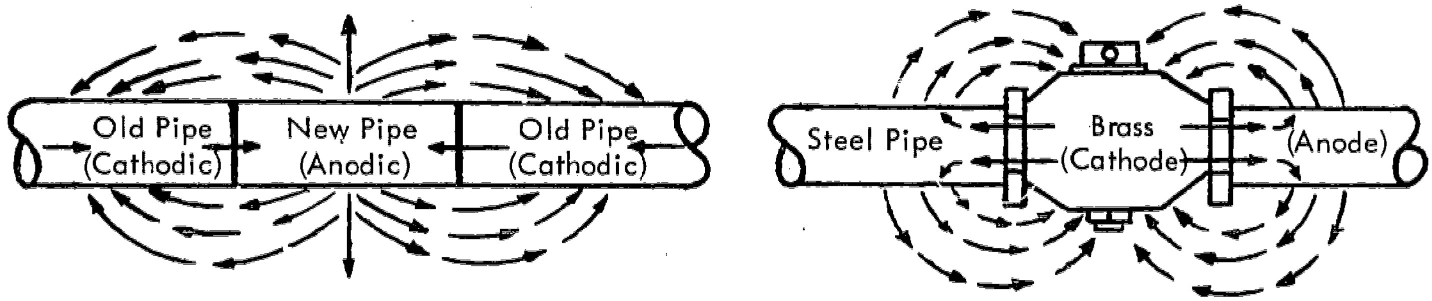
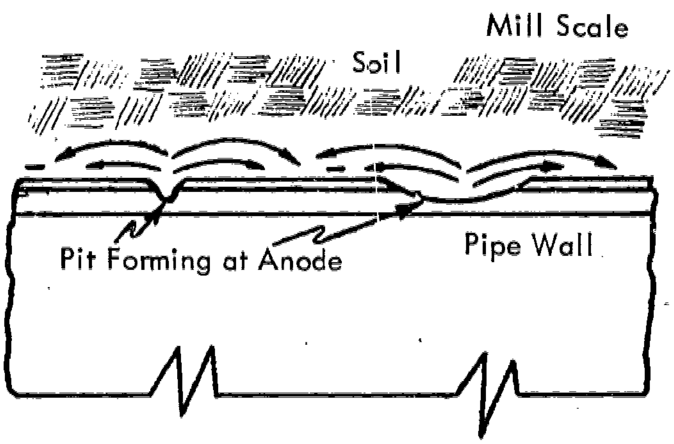


FIGURE 9: GALVANIC CORROSION

DISSIMILAR METAL CORROSION



PITTING DUE TO MILL SCALE



CORROSION DUE TO CINDERS

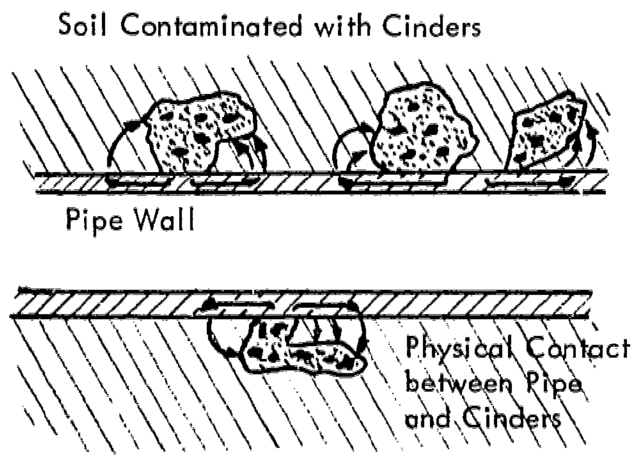


FIGURE 10: GALVANIC CORROSION

D. How Does Corrosion Affect Metals?

1. Galvanic Corrosion

Galvanic corrosion occurs when different metals are connected together or when surface or environmental conditions differ along the same metal. (Moisture must, of course, be present.)

With dissimilar metals connected together, the more noble metal is cathodically protected and the other corrodes. (Noble as referred to the electrochemical series.)

One metal can have a variety of conditions in its surrounding environment which affect different areas of its surface. One area becomes the anode (corrodes) while the other is the cathode. Examples of these environmental differences are:

1. Clay to sand.
2. Rock to clay or sand.
3. Soil to concrete (manhole or building wall).
4. Oxygen concentration differences (top-to-bottom of a buried tank or pipe).

Similarly, surface conditions on the same metal can vary. Examples are:

1. New, uncorroded metal connected to that which has corroded to some extent. (New metal suffers accelerated corrosion.)
2. Scratches on surfaces or breaks in mill scale of new metals. (Bright, scratched areas are anodic.)

Bacteriological corrosion is a variety of galvanic corrosion, resulting from by-products of bacteria feeding on organic materials in soils or water. (Acid attack.)

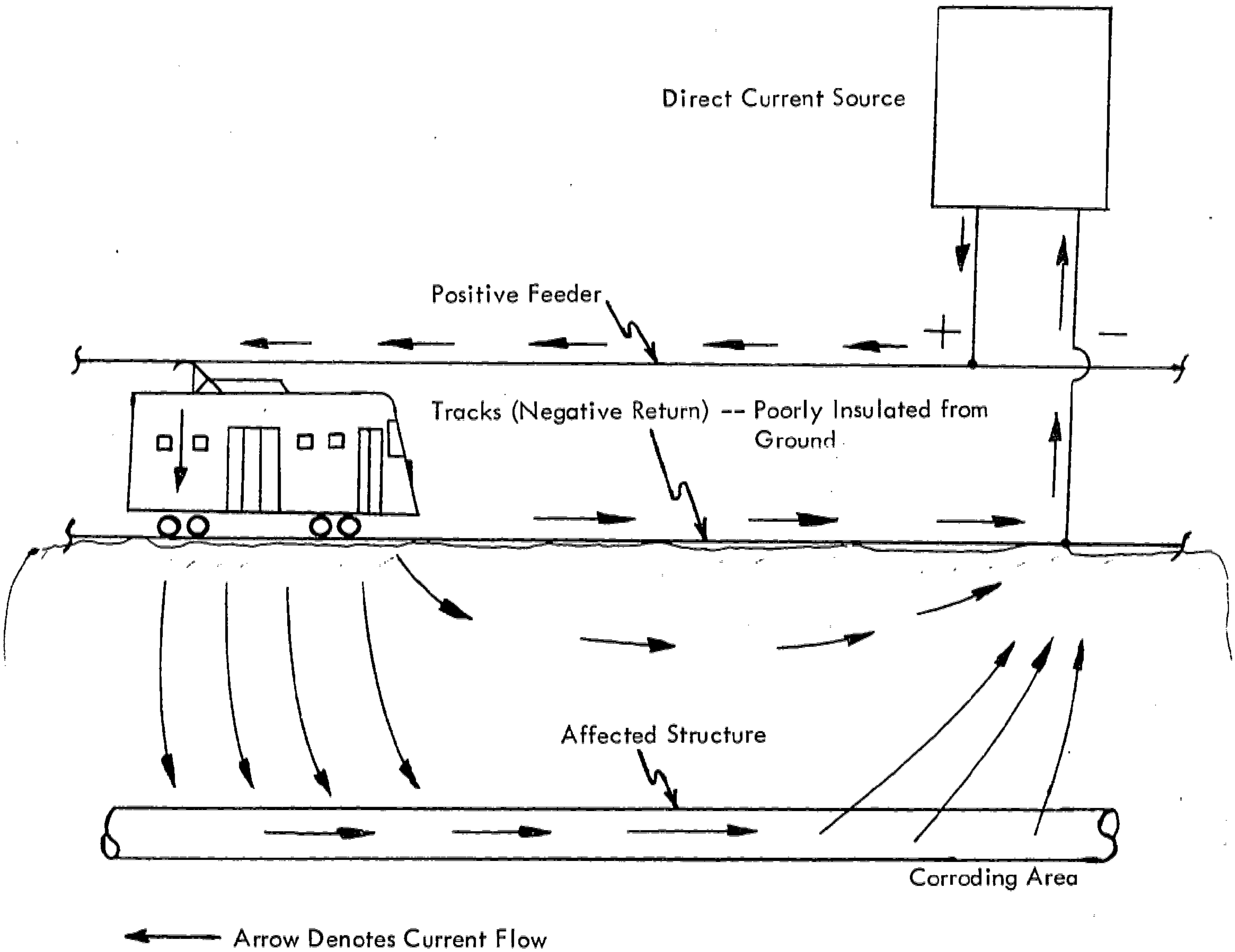


FIGURE 11: STRAY CURRENT CORROSION

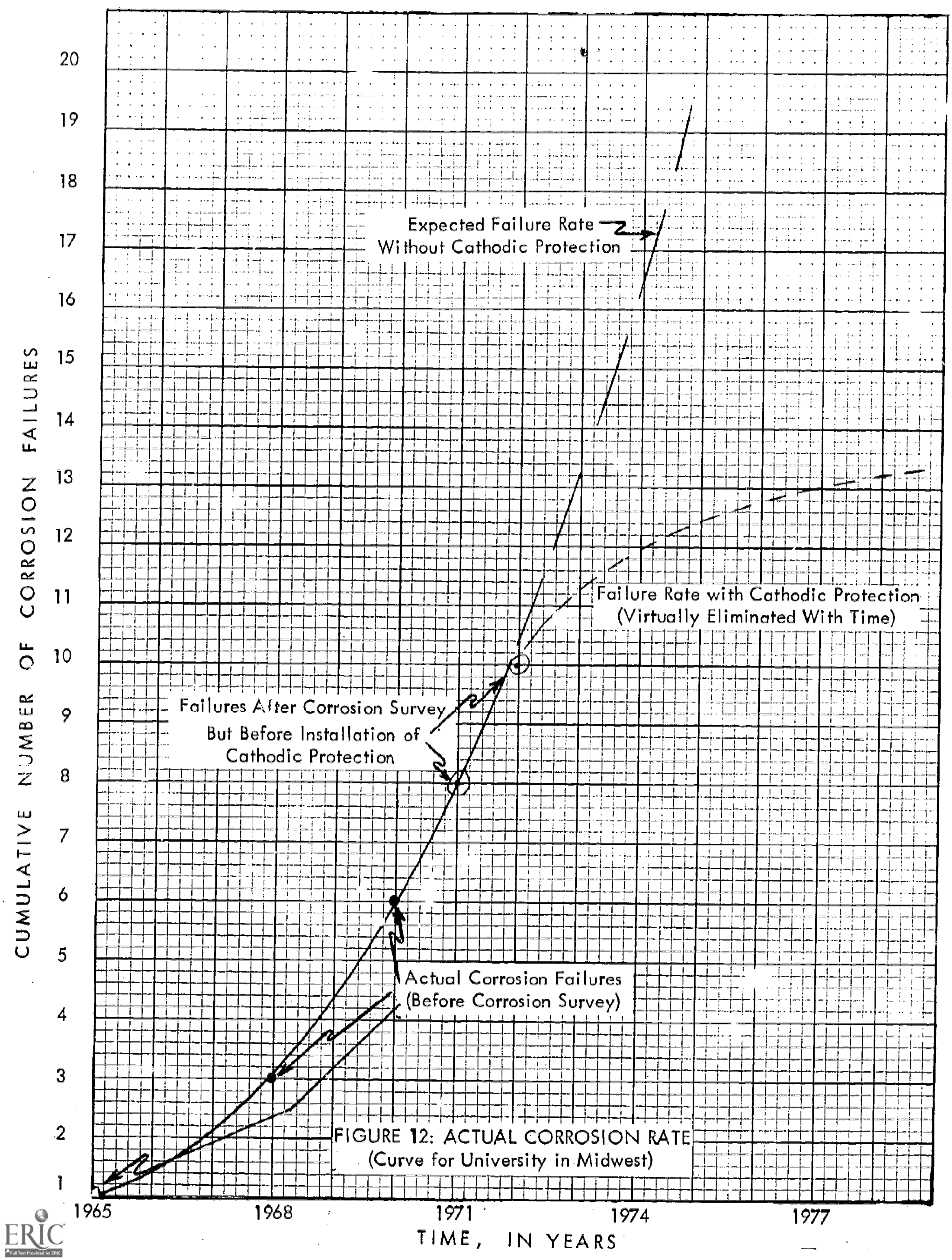


FIGURE 12: ACTUAL CORROSION RATE
(Curve for University in Midwest)

2. Stray Current Corrosion

Stray current is some portion of the total current from someone's cathodic protection system or other electrical equipment, using an external metal structure as a part of its circuit. If this current is DC and passes from metal into soil or water, the metal corrodes. AC has a 4% DC effect, and can also be rectified if metals such as lead and copper are involved. Corrosion rates, for DC at 100% efficiency, are 20 #/ampere-year for steel and cast iron, 42 #/ampere-year for copper and 75 #/ampere-year for lead.

Once corrosion failures begin, they increase logarthmically with time. If failures are plotted vs. dates of occurrence, the projected curve yields expected future corrosion rates. By knowing unit failure costs, such predictions can be used to estimate repair costs and justify corrosion control expenditures. Once repairs are made, and/or corrosion control measures taken, the slope of any leak expectancy curve changes.

III. Solutions to the Corrosion Problem

A. New Construction

Preconstruction surveys should be conducted before designs are finalized, and certainly before bid specifications are issued. This permits inclusion of detailed corrosion control considerations in original designs so they do not have to be added as costly "extras".

These initial investigations should include soil and water tests (resistivity, pH, and sulfides) and stray current tests. In addition, practices and experiences of those operating facilities in the area should be analyzed.

From these data, the best materials are selected for the environment. Corrosion

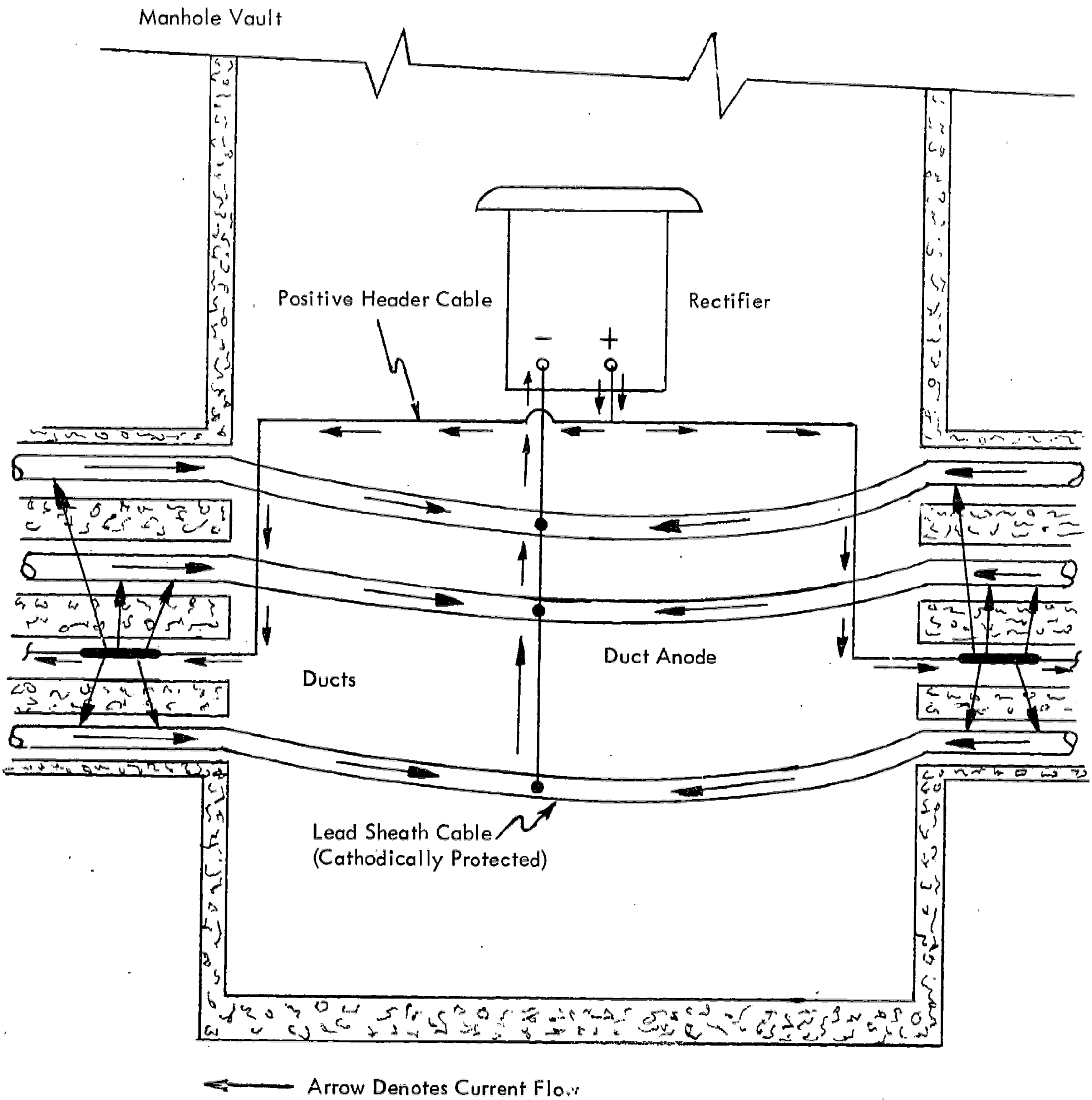


FIGURE 13: BASIC CATHODIC PROTECTION CIRCUIT (DUCT ANODES)

control items, if necessary to get life expectancy, are designed and specified. These could include coatings, insulation, bonds (metallic connections between structures or across non-conducting joints), test wires, and cathodic protection.

During construction, contractors' work should be thoroughly inspected. Specified materials are to be installed using approved techniques.

B. Existing Facilities

Record complete data on all failures. These should be frequently analyzed. Dates, locations, appearance, and type of repair are among pertinent information to keep. Personnel should be trained to recognize corrosion failures, and if possible, types of corrosion failures.

Surveys should be conducted to locate corroding areas and determine corrosion rates before failures actually occur. Data from these will yield methods and costs for mitigation. If a severe major problem exists throughout the campus, long-range plans and budgets can be established. Corrosion control is preventative maintenance.

Work on campus facilities should be coordinated with that done by local utilities. If other groups are installing cathodic protection, or draining stray currents, cooperative tests should be conducted to determine whether or not there is an effect. A maintenance engineer should attend coordinating committee meetings, if an active one meets locally.

Maintenance and repair procedures should be studied and standardized. Work should be inspected. Water and heating lines should be pressure tested before backfilling. Manholes should be cleaned periodically. (Remove soil and sewage.) All alternates should be considered for repairs and replacements. Coatings, insulation, cathodic protection, and bonds should be properly applied, as needed, in repair areas.

Cathodic protection is an economical approach to reduction or elimination of corrosion failures for many older structures. Metal is not replaced, but that remaining is held "as-is". This usually involves "putting up with" some additional corrosion failures, even after cathodic protection is energized. Repair costs must be balanced against corrosion control expenses. Engineering studies may reveal cathodic protection applicable only for selected structures in limited campus areas or not at all feasible. Widespread problems may require complete cathodic protection for all structures throughout the campus. Such major projects are often developed as five or ten year programs.

IV. Summary

All metallic structures can be affected by corrosion. Those most critical from the safety standpoint are not always the most expensive to repair. However, safety usually takes precedence for corrosion control. Repair costs range from $250. for a piping leak to over $10,000. per elevator cylinder replacement.

Corrosion is a major problem and expense because it is often ignored on new projects as well as in maintenance. Site conditions should be investigated (but are often not) before designs are finalized. Soil, water, and adjacent structures affect corrosion rates.

Corrosion occurs when direct current flows from metal surface into an electrolyte. The two basic causes of this current flow are:

1. Galvanic, and
2. Stray Current

Corrosion rates increase logarthmically with time, and costs are directly related.

Preconstruction surveys are recommended for all new facilities. Since conditions are known, materials, methods of construction, and corrosion control measures can be included in initial bid documents. Adequate construction inspection is always necessary.

When working with existing plant, use good maintenance practices -- repairs and changes should be carefully made to planned standards with careful inspection. Failures should be monitored and tests should be made to determine actual conditions. Corrosion can be minimized and sometimes eliminated through judicious use of coatings, insulation, bonds, and cathodic protection. Experienced corrosion engineers should be called in for advice.

The University Singers