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ABSTRACT

Eight conference papers on miscellaneous campus safety topics are included in this conference report: "The Safe Use of Mutigens and Carcinogens in the Laboratory" by Leo K. Bustad; "Planning for Laboratory Animal Care" by Sigmund Rich; "Testing Breathing Apparatus" by Henry McDermott; "Earthquake Damage Prevention at Lawrence Livermore Laboratory" by George Mackinic; "Management of Risk in the University Setting" by Irvin Nicholas; "The Fume Hood Controversy" by Lawrence Schmeltzer; "Current Fire Protection Topics" by John Morris; and "Manpower Needs for Campus Health and Safety Programs" by Harold Brown. Also included in the report are conference participant lists (individual names and by institution), the conference program, and minutes of the annual meeting of the Campus Safety Association. (JT)

SAFETY MONOGRAPHS FOR SCHOOLS AND COLLEGES

MONOGRAPH NO. 34

TWENTY-FIRST NATIONAL CONFERENCE on CAMPUS SAFETY

1974

A joint project of
University of California—Davis
Davis, California
Campus Safety Association
of the National Safety Council
425 North Michigan, Chicago, Illinois 60611

Twenty-first National Conference on Campus Safety

THE UNIVERSITY OF CALIFORNIA
LET THERE BE LIGHT
DAVIS

University of California-Davis

Davis, California
June 24-28, 1974

GREEN CROSS FOR SAFETY
NATIONAL SAFETY COUNCIL

Editor . . .
Jack N. Green
Assistant Manager
School and College Department
National Safety Council

CHANCELLOR JAMES H. MEYER

UNIVERSITY OF CALIFORNIA, DAVIS

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

CHARLES J. HITCH
President of the University

JAMES H. MEYER
Chancellor at Davis

OFFICE OF THE CHANCELLOR
DAVIS, CALIFORNIA 95616

November 8, 1973

Members and Associates of the Campus Safety Association

TWENTY-FIRST NATIONAL CONFERENCE

ON CAMPUS SAFETY

The Davis campus of the University of California is pleased to act as host for the Twenty-first National Conference on Campus Safety to be held June 26 to June 28, 1974.

Like many campuses throughout this country, we have experienced expansion and shifting program emphasis in the past few years. Changes in research methods, in the make-up of our student body and in local, state, and federal regulations and standards provide continuing challenges to our Environmental Health and Safety programs. The opportunity to exchange our ideas with other campuses throughout the country will be a valuable asset to our policy of providing a safe environment for our students, faculty, and staff.

We are honored to host your conference and look forward to a productive and enjoyable meeting.

Sincerely yours,

J. H. Meyer

James H. Meyer
Chancellor

Campus Safety Association

THE CAMPUS SAFETY ASSOCIATION

Originally formed in 1949, the Association was affiliated with the National Safety Council in 1956 and became a division of the College and University Section formed in 1957. The Association makes a sincere effort to be of service to the members and others interested in Campus Safety.

OBJECTIVE

The objective of the Association is to promote safety on college and university campuses by exchange of information on prevention of accidents to faculty, staff and students.

MEMBERSHIP

Membership is open to any person whose activities are related to college and university safety programs. Besides campus safety administrators, present membership also includes radiation safety officers, security personnel, physical plant superintendents, insurance personnel, residence hall directors and many more. Membership in the Association automatically provides membership in the College and University Section.

MEMBERSHIP APPLICATIONS

Application blanks may be obtained from the Staff Representative; there are no dues. Members are entitled to voting privileges and are eligible to serve as officers or as members of committees.

OFFICERS

The Association officers are chairman, vice chairman, corresponding secretary, recording secretary and treasurer. The vice chairman automatically succeeds to the chairmanship.

STANDING COMMITTEES

The permanent committees of the Association are Nominating, Membership, National Conference on Campus Safety Planning and Congress Program Planning.

NATIONAL CONFERENCE ON CAMPUS SAFETY

The primary activity of the Campus Safety Association is an annual National Conference on Campus Safety held in the early summer on the campus of a member college or university. An effort is made to present successive conferences at as wide spaced geographical locations as possible.

The annual conference, of several days duration, is a combination of education, training and discussion of specific problems. The proceedings of the National Conference on Campus Safety are published in a Monograph. Copies are available from the National Safety Council for a small charge.

NATIONAL SAFETY CONGRESS

A mid-year business meeting is held in October of each year in conjunction with the National Safety Congress in Chicago. Informal get-togethers, workshops and sessions of interest to campus safety members are scheduled during the Congress. Oftentimes arrangements are made to hold joint meetings with other divisions and sections of the Council.

NATIONAL COLLEGE & UNIVERSITY SAFETY AWARDS

This program is designed to provide initiative for programming and achievement in campus safety programs along standard lines, and also to recognize novel or original safety efforts by colleges and universities.

Each entry is evaluated by the members of the Judges Committee and rated as follows: President's Letter, Certificate of Commendation, Award of Merit, Award of Honor (top award). Entry blanks and information about the program may be obtained from the College and University Section, National Safety Council.

ACCIDENT REPORTING

The Association believes that an important ingredient of a campus safety program is an accident reporting system. Assistance and materials for initiating an accident reporting program can be obtained from the College and University Section, National Safety Council.

At the end of each academic year, the Association requests that colleges and universities send their accident statistics to the Council. In this way, special in-depth studies can be made and published in the Council's annual publication of ACCIDENT FACTS.

PUBLICATIONS

The Association contributes to the *College and University Safety Newsletter*, the official organ of the College and University Section. It is published five times a year by the Council and is distributed to Campus Safety Association members.

OFFICERS AND COMMITTEE MEMBERS

Campus Safety Association
Officers 1974-1975

Chairman-Eric Spencer, Brown University
Vice Chairman-William H. Watson, Florida State University
Corresponding Secretary-Oliver K. Halderson, Southern Illinois University
Recording Secretary-Raymond C. Hall, University of Colorado
Treasurer-James N. Knock, University of Wisconsin

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Past Chairman-Ray Ketchmark, University of Illinois at Chicago Circle
Edward W. Simpson, University of Nebraska
Nicholas Ozaruk, University of Waterloo, Ontario, Canada
Frederick Thomas, Howard University, Washington, D.C.

Dick Yamaichi
Host Chairman
Univ. of California
Davis

Richard Holdstock
Program Chairman
Univ. of California
Davis

Eric N. Spencer
Chairman

William A. Watson
Vice-Chairman

Oliver Halderson
Corresponding
Secretary

Raymond C. Hall
Recording
Secretary

James N. Knocke
Treasurer

Executive Committee

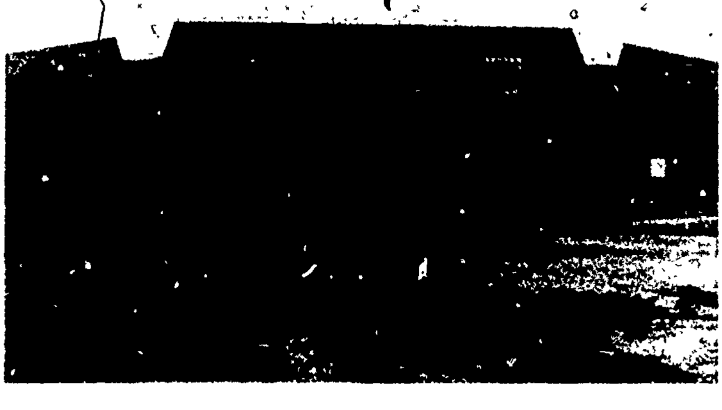
Ray Ketchmark

Edward Simpson

Nicholas Ozaruk

Frederick Thomas

CAMPUS SCENES
UNIVERSITY OF CALIFORNIA-DAVIS



COLLEGES REPRESENTED BY STATES AT THE TWENTY-FIRST NATIONAL CONFERENCE ON CAMPUS SAFETY

ALASKA

University of Alaska, College Alaska

ARIZONA

Arizona State University, Tempe
University of Arizona, Tucson

CALIFORNIA

Biola College, La Mirada
California Institute of Technology, Pasadena
California State University, Chico
California State University, Fresno
California State University, Fullerton.
California State University, Long Beach
California State University, Sacramento
Fullerton College, Anaheim
Grossmont College, El Cajon
Humbolt State University, Arcata
Loma Linda University, Riverside
Lone Mountain College, San Francisco
Los Angeles Trade-Tech College, Los Angeles
Pacific Union College, Angwin
San Diego State University, San Diego
San Jose State University, San Jose
Santa Barbara City College, Santa Barbara
Stanford University, Stanford
The California State & University Colleges, Los Angeles
University of California, Berkeley
University of California, Irvine
University of California, Los Angeles
University of California, San Diego, LaJolla.
University of California, San Diego
University of California, Santa Barbara
University of California, Santa Cruz

COLORADO

Colorado State University, Ft. Collins
University of Colorado, Boulder
University of Denver, Denver

CONNECTICUT

Yale University, New Haven

FLORIDA

Florida State University, Tallahassee
University of Florida, Gainesville
University of Southern Florida, Tampa

GEORGIA

Medical College of Georgia, Augusta
University of Georgia, Anthens

HAWAII

University of Hawaii, Honolulu

ILLINOIS

Illinois State University, Normal
Northwestern University, Evanston
Southern Illinois University, Carbondale
Southern Illinois University, Edwardsville
University of Illinois, Chicago
University of Illinois, Urbana

INDIANA

Prdde University, West LaFayette

IOWA

Iowa State University, Ames
University of Iowa, Iowa City

KANSAS

Kansas State University, Manhattan
University of Kansas, Lawrence

MASSACHUSETTS

Harvard Medical School, Boston
Massachusetts Institute of Technology, Cambridge

MICHIGAN

Michigan State University, E. Lansing
Western Michigan University, Kalamazoo

MINNESOTA

University of Minnesota, Minneapolis

MISSISSIPPI

Mississippi State University, College State

MISSOURI

Florissant Valley Community College, St. Louis

Conference Participants

Kneeling Row: (All names are listed left to right) Dick Yamaichi, Jack Green Sr., Joe Uyeminami, Jack Sidlow, James A. Williams, Hank McDermott, Al Livingstone, Ed Bradley, Cal Williams, Daniel R. Holling, Carl Eigenauer, Frank T. Rivera, Joe S. Warner, Dave Crockett, Rod Waterman, Peter Boyle, James Presswood (Dave Keller and John C. Marsden--Not Shown).
Second Row: W. M. Newton, John F. Burké, Chuck Seymour, Mary Lou Vorce, Carroll L. Mann Jr., Ben Clements, Dick Giles, Stephen A. Fredette, M. G. Syracuse, L. A. Blackwell, Eric Spencer, Bill Steinmetz, Edgar Amacker, Chuck Robinson, Jimmy D. Matthews, Earl V. Rupp, Luther "C" Guynes, Mary Mellein, Nancy Taylor (Karen MacMillan, Leo Bustad and Wayne Littrell--Not Shown).
Third Row: Art Stringfellow, John B. Connor, George A. Hayworht, Hubert J. Hayes, Lewis L. Legg, Kenneth J. Steen, Robert E. Eyre, Louis D. Severau, Samuel Espinosa, Philip Lapish, John Clemons, Charles L. McKinney, John J. Guzzetti, Adolph Torres, Tom Partridge, Larry Blake, Emery E. Sobottka, J. Patrick Eaker, T. DeWitt Birch and James Lang.
Fourth Row: J. Warren Cordermann, Billy G. Dunavant, Sigmund T. Rich, Kenneth D. Conn, Thomas A. Selders, Sidney M. Waldrop, Robert Sturdevant, Howard Huskey, Gus L. Scheffler, Thomas R. Jones, Harold V. Brown, T. Carl Shelton, Bill Hoeye, Phil Koehler, Anna Provencial, Dick Holdstock, Larry Thomas and Gene Sikes.
Fifth Row: Charles B. Wingstrom, A. J. Hubert, Jr., James Knocke, Robert H. Sudmann, Lawrence F. Knauff, Ken C. Fay, Dale S. Partridge, Warren H. Munroe, W. H. Watson, Lawrence L. Schmelzer, Frank A. Gohr, G. S. Michaelsen, Jerry Hopkins, Charles W. Hailes, Richard L. Meihos, Gerald L. Matthews, John S. Campbell, Jack Tarnava, Robert L. Jones and J. S. Young.
Sixth Row: Victor Osborne, Ray Stephens, John Lambert, Willard Whitaker, Harry Mandt, Ray Hall, Alvin Williams, Frank Bellracula, Oliver K. Halderson, George O'Hara, John Morris, Robert Wirbel, J. S. Coogan, Albert W. Errick, W. W. Simpson, Jr., Ed. Roddy, Evelyn Campbell, Bill Smirl and Ben Baptiste.

MISSOURI (Continued)

University of Missouri, Columbia

NEBRASKA

University of Nebraska, Lincoln

NEW YORK

State University of New York, Binghamton
State University of New York, Buffalo
The Rockefeller University, New York

NORTH CAROLINA

Duke University, Durham
North Carolina State University, Raleigh

OHIO

Case Western Reserve University, Cleveland
University of Ohio, Athens
University of Toledo, Toledo

OKLAHOMA

Oklahoma State University, Stillwater

OREGON

Oregon State University, Corvallis
University of Oregon, Eugene

RHODE ISLAND

Brown University, Providence

TEXAS

Rice University, Houston
San Jacinto College, Pasadena
Texas A & M University, College Station
University of Houston, Houston
University of Texas, Austin
University of Texas, El Paso
University of Texas, Houston
University of Texas Health Science Center, San Antonio

UTAH

Brigham Young University, Provo
University of Utah, Salt Lake City
Utah State University, Logan

VIRGINIA STATE UNIVERSITY,

Virginia State University, Blacksburg

WASHINGTON

University of Washington, Seattle

WISCONSIN

University of Wisconsin, Madison
University of Wisconsin, Milwaukee

CANADA

The University of Calgary, Calgary, Alberta
University of Guelph, Guelph, Ontario
University of Manitoba, Winnipeg, Manitoba
University of Sask, Saskatoon, Sask

1. Conference planning committee meet to discuss Davis program.

2. The Davis Campus is very strong in agricultural education as this scene indicates.

3. Mexican Band entertaines participants and guests at Mexican dinner.

4. Dick Yamichi (left) gives Ken Fay pointers for conducting National Conference on Campus Safety. Mr. Fay, University of Calgary will be holding the 1975 Conference.

5. Several participants engage in conversation during coffee break.

6. Reaction panel listens attentively during Wednesday morning session.

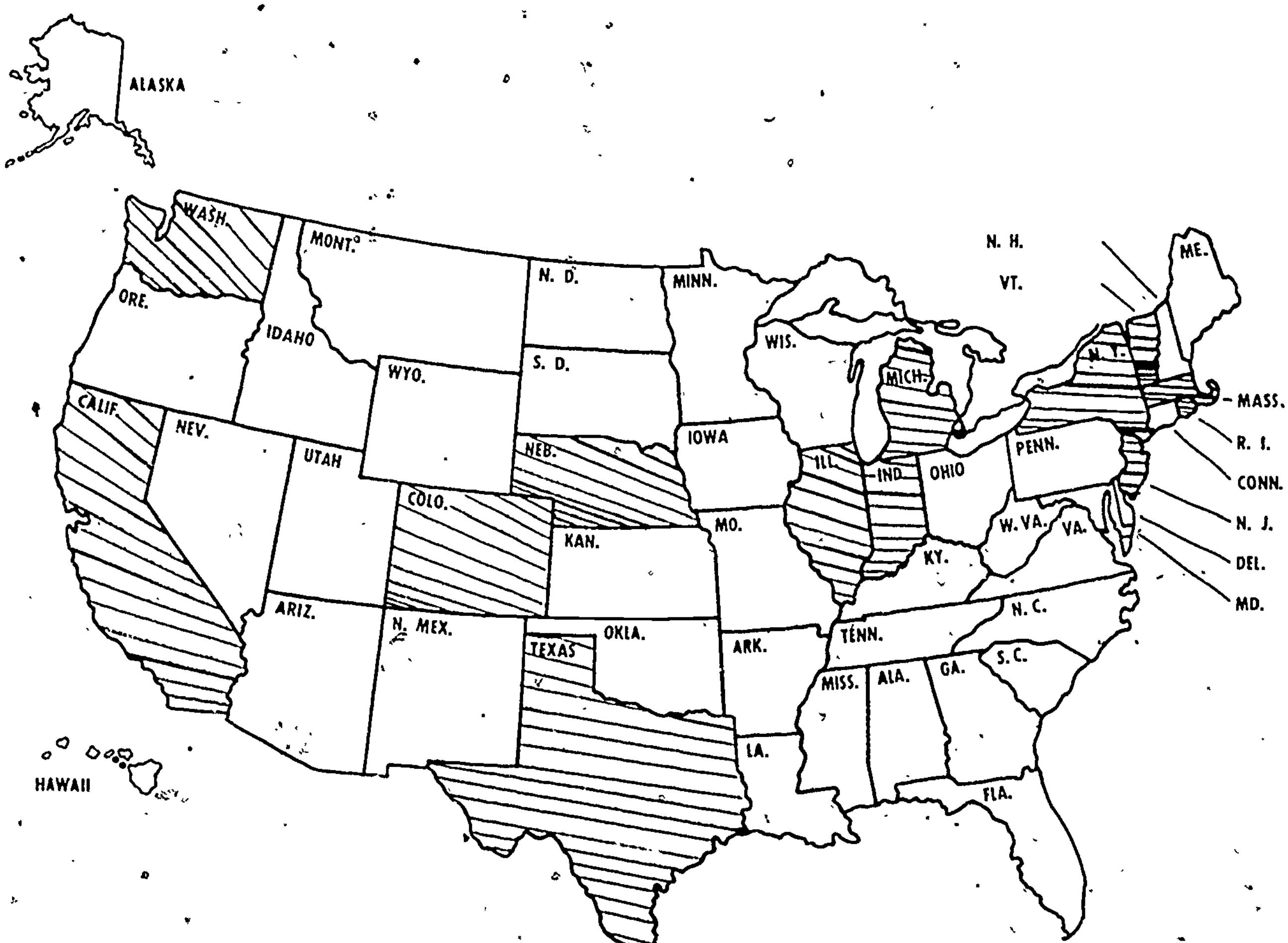
7. CSA Chairman-elect, Bill Watson and Bob Wirbel discuss events of the day.

8. One of the many beautiful campus scenes of the University of California-Davis.

9. Ken Fay models typical attire for the Calgary Stampede. This event will be a part of the 1975 Conference.

NATIONAL CONFERENCE ON CAMPUS SAFETY
1954-1974

Sponsored by: Campus Safety Association,
College and University Section,
School and College Conference
National Safety Council



States and Campus Location

Illinois	(Univ. of Ill.)	1954	Michigan	(Cent. Mich. U.)	1965
Minnesota	(Univ. of Minn.)	1955	Washington	(Univ. of Wash.)	1966
Massachusetts	(MIT)	1956	Nebraska	(Univ. of Nebr.)	1967
Indiana	(Purdue)	1957	Vermont	(Univ. of Vt.)	1968
California	(Cal Tech)	1958	Texas	(Texas A&M)	1969
Michigan	(MSU)	1959	California	(Univ. of Calif.)	1970
New York	(Cornell)	1960	Illinois	(U. of I. Circle)	1971
Illinois	(SIU)	1961	Rhode Island	(Brown University)	1972
California	(U. of C.)	1962	Colorado	(Colorado State U.)	1973
Indiana	(Univ. of Ind.)	1963	California	(U. of C.-Davis)	1974
New Jersey	(Rutgers)	1964			

ROSTER OF TWENTY-FIRST NATIONAL CONFERENCE ON CAMPUS SAFETY

Amacker, Edgar	California State University, Sacramento, Sacramento, California
Androff, Carl T.	California State University, Long Beach, Long Beach, California
Bachelor, Jim	University of California, Davis, Davis, California
Baptiste, Benjamine	University of California, Santa Barbara, Santa Barbara, California
Bellncula, Frank	University of Texas, El Paso, El Paso, Texas
Benzel, Mildred	University of California, Davis, Davis, California
Birch, T. DeWitt	Utah State University, Logan, Utah
Blackwell, L. A.	Rice University, Houston, Texas
Blake, Larry	Duke University, Durham, North Carolina
Boyle, Peter J.	Johns Hopkins Medical Institutions, Baltimore, Maryland
Bradley, Edward	University of California, Davis, Davis, California
Brown, Harold V.	University of California. Los Angeles, Los Angeles, California
Buckley, Patricia	University of California, Davis, Davis, California
Burke, John F.	San Jose State University, San Jose, California
Butterfield, Ken	University of California, Berkeley, Berkeley, California
Cadwell, George	Contamination Control, Incorporated, Houston, Texas
Campbell, Evelyn W.	Los Alamos Scientific Laboratory, Los Alamos, New Mexico
Campbell, John S.	University of Guelph, Guelph, Ontario, Canada
Chamberlin, Richard I.	Massachusetts Institute of Technology, Cambridge, Massachusetts
Clements, Ben R.	University of Texas Health Science Center, San Antonio, Texas
Clemons, John F.	Harvard Medical School, Boston, Massachusetts
Conn, Kenneth D.	California Institute of Technology, Pasadena, California
Connor, John B.	Medical College of Georgia, Augusta, Georgia
Coogan, John S.	EPA, National Environmental Research Center, Las Vegas, Nevada
Corderman, Warren J.	State University of New York, Binghamton, New York
Crockett, Dave	University of California, San Diego, La Jolla, California
DeBoer, Harvey	Santa Clara County Health Department, San Jose, California
Decker, Donald	University of Texas, Austin, Texas
Dunavant, Billy G.	University of Florida, Gainesville, Fla.
Eaker, Patrick	University of Wisconsin, Milwaukee, Wisconsin
Eigenaver, Carl	Michigan State University, E. Lansing, Michigan
Errick, Albert W.	University of California, Santa Cruz, California
Espana, Carlos	University of California, Davis, California
Espinosa, Samuel	Loma Linda University, Riverside, California
Eyra, Robert	Santa Barbara City College, Santa Barbara, California
Fay, Ken C.	The University of Calgary, Calgary, Alberta, Canada
Fenton, James A.	Biola College, LaMirada, California
Fierrero, Dennis	Yolo County Health Department, Woodland, California
Galligan, Sylvia	University of California, Davis, Davis, California
Gates, Joseph	University of California, Berkeley, Berkeley, California
Giles, Richard W.	Oklahoma State University, Stillwater, Oklahoma
Gohr, Frank A.	University of California, San Francisco, San Francisco, California
Gonzales, Ben	University of California, Berkeley, Berkeley, California
Green, Jack N., Sr.	National Safety Council, Chicago, Illinois
Guynes, Luther "C"	Los Angeles Trade-Tech College, Los Angeles, California
Guzzetti, John	University of California, Los Angeles, Los Angeles, California
Hailes, Charles W.	Utah State University, Logan, Utah

Halderson, Oliver K.	Southern Illinois University, Carbondale, Illinois
Hale, John	Sacramento Medical Center, Sacramento, California
Haley, James T.	University of California, Berkeley, Berkeley, California
Hall, Ray	University of Colorado, Boulder, Colorado
Handler, Larry	University of Houston, Houston, Texas
Hargis, Suzanne M.	LBLU of California, Berkeley, California
Harrold, Boyd	University of California, Davis, Davis, California
Hayes, H. J.	Southern Illinois University, Edwardsville, Edwardsville, Illinois
Hayworth, George	University of Missouri, Columbia, Missouri
Herrera, Josephina	University of California, Berkeley, Berkeley, California
Hertig, Bruce	University of Illinois, Urbana, Illinois
Hickman, John	University of California, Davis, California
Hoeye, W. D.	Oregon State University, Corvallis, Oregon
Holdstock Richard S.	University of California, Davis, Davis, California
Holling, Daniel R.	University of California, Los Angeles, Los Angeles, California
Holloway, Grant	University of California, Davis, Davis, California
Hopkins, Jerry	Humbolt State University, Arcata, California
Hubert, A. J., Jr.	University of Illinois, Urbana, Illinois
Huskay, Howard S.	University of Missouri, Columbia, Missouri
Jelonek, Harry	University of California, Berkeley, Berkeley, California
John, Sharon	University of California, Davis, Davis, California
Johnson, Deedra	University of California, Davis, Davis, California
Johnson, Kenneth	University of Illinois, Chicago, Illinois
Johnson, Marilyn	University of California, Davis, Davis, California
Jones, Robert L.	University of Arizona, Tucson, Arizona
Jones, Thomas R.	Prude University, West LaFayette, Indiana
Kahane, Stephen	University of California, Los Angeles, Los Angeles, California
Keller, David C.	University of Missouri, Columbia, Missouri
Ketchmark, Ray	University of Illinois, Chicago Circle Campus, Chicago, Illinois
Knauff, Lawrence F.	University of Illinois, Chicago, Illinois
Knocke, James N.	University of Wisconsin, Madison, Wisconsin
Koehler, Phil	University of Hawaii, Honolulu, Hawaii
Lambert, John P.	Kansas State University, Manhattan, Kansas
Lang, James	University of California, Santa Cruz, Santa Cruz, California
Lapish, A. Phillip	Case Western Reserve University, Cleveland, Ohio
Laszcz, Chris	United States Atomic Energy Commission, Oakland, California
Lee, Harold H.	University of Toledo, Toledo, Ohio
Legg, Lewis L.	Illinois State University, Normal, Illinois
Little, Gordon	University of California, Berkeley, Berkeley, California
Littrell, Wayne O.	Northwestern University, Evanston, Illinois
Livingston, A. E.	University of Sask, Saskatoon, Sask, Canada
MacMillan, Karon	University of California, Davis, Davis, California
McDermott, Henry	Lawrence Livermore Laboratory, Livermore, California
McKinney, Charles	University of California, Davis, Davis, California
McNeill, Caroline	University of California, Davis, Davis, California
Mandt, Harry	University of Texas, Austin, Texas
Mann, Carroll, Jr.	North Carolina State University, Raleigh, North Carolina
Marceau, David	The California State and University Colleges, Los Angeles, California
Marsden, John C.	Florissant Valley Community College, St. Louis, Missouri
Mathews, Gerald L.	Brigham Young University, Provo, Utah
Matthews, Jim	University of Ohio, Athens, Ohio
Meibos, Richard	Brigham Young University, Provo, Utah
Mellein, Mary Rose	Southern Illinois University, Edwardsville, Edwardsville, Illinois

Michaelsen, G. S.	University of Minnesota, Minneapolis, Minnesota
Mills, William E.	University of Southern Florida, Tampa, Florida
Morris, John	Fred S. James and Company, Berkeley, California
Mortimer, Rand	National Institute of Health, Rockville, Maryland
Munn, Susan	University of California, Davis, Davis, California
Munroe, Warren H.	The Rockefeller University, New York, New York
Newton, W. M.	San Jacinto College, Pasadena, Texas
O'Hara, George E.	Southern Illinois University, Carbondale, Illinois
Osborne, Victor	Yale University, New Haven, Connecticut
Palmer, John	University of California, Los Angeles, Los Angeles, California
Pappagianis, Demosthenes	University of California, Davis, Davis, California
Partridge, Dale S.	Arizona State University, Tempe, Arizona
Partridge, Thomas	Duke University, Durham, North Carolina
Phifer, Richard	University of California, Davis, Davis, California
Presswood, James	Texas A & M University, College Station, Texas
Provencial, Anna	Sacramento Medical Center, Sacramento, California
Rivera, Frank T.	University of Denver, Denver, Colorado
Robinson, Charles	California State University, Fullerton, California
Roddy, Edward	California State University, Fresno, Fresno, California
Rupp, Earl V.	University of Wisconsin, Madison, Wisconsin
Scheffler, Gustavel	University of Minnesota, Minneapolis, Minnesota
Schleth, Don	Stanford University, Stanford, California
Schmelzer, Lawrence L.	University of California, Berkeley, Berkeley, California
Selders, Thomas A.	University of Iowa, Iowa City, Iowa
Seto, George	Stanford University, Stanford, California
Sevehau, Louis D.	Lone Mountain College, San Francisco, California
Seymout, Charles T.	Grossmont College, El Cajon, California
Shelton, Carl T., Jr.	Virginia State University, Blacksburg, Virginia
Shriner, Larry	Mississippi State University, College State, Mississippi
Sidlow, Anthony J.	Stanford, University, Stanford, California
Sikes, E. E.	University of Texas, Houston, Texas
Simpson, E. W., Jr.	University of Nebraska, Lincoln, Nebraska
Smirl, William	University of California, Irvine, Irvine, California
Smith, James R.	University of California, Davis, Davis, California
Sobottka, Emery E.	Iowa State University, Ames, Iowa
Spencer, Eric W.	Brown University, Providence, Rhode Island
Steen, Kenneth	University of Washington, Seattle, Washington
Steinmetz, Bill	University of California, Santa Barbara, Santa Barbara, California
Stephen, Fredette	Fullerton College, Anaheim, California
Stephens, Ray	University of Illinois, Chicago, Illinois
Sterling, Claude B.	Pacific Union College, Angwin, California
Stone, J. Michael	University of California, Davis, Davis, California
Stott, John A.	Mississippi State University, College State, Mississippi
Stringfellow, Arthur K.	University of Georgia, Anthens, Georgia
Sudmann, Robert H.	University of Oregon, Eugene, Oregon
Syracuse, Michael G.	State University of New York, Buffalo, New York
Syracuse, Patricia	State University of New York, Buffalo, New York
Takata, Kenneth	Sacramento Public Health Laboratory, Sacramento, California
Taloff, Paul	University of California, Davis, Davis, California
Tarnava, Jack	University of Manitoba, Winnipeg, Manitoba, Canada
Taylor, Nancy	University of California, Davis, Davis, California
Thomas, James L.	Stanford Research Institute, Menlo Park, California
Thomas, Larry W.	Contamination Control, Incorporated, Houston, Texas

Torres, Adolph	University of California, Los Angeles, Los Angeles, California
Uyeminami, Joe M.	University of California, Davis, Davis, California
Vorce, Mary Lou	San Diego State University, San Diego, California
Waldrop, Sidney M.	Colorado State University, Ft. Collins, Colorado
Warner, Joe	University of California, San Diego, La Jolla, California
Waterman, Rod	University of California, Berkeley, Berkeley, California
Watson, William H.	Florida State University, Tallahassee, Florida
Wheadon, John	University of California, Davis, Davis, California
Whitaker, Willard C.	University of Alaska, College, Alaska
Williams, Alvin S.	University of Texas, Houston, Texas
Williams, Calvin	University of Kansas, Lawrence, Kansas
Williams, James A.	California State University, Chico, California
Wingstrom, Charles B.	University of Illinois, Urbana, Illinois
Wirbel, Robert S.	Western Michigan University, Kalamazoo, Michigan
Wolf, Henry	University of California, Davis, Davis, California
Yamichi, Richard	University of California, Davis, Davis, California
Young, Jensen	University of California, Berkeley, Berkeley, California
Young, J. S.	University of Utah, Salt Lake City, Utah

SPEAKERS, MODERATORS, AND PRESIDERS

Aldrich, Franklin D.	Massachusetts Institute of Technology, Cambridge, Massachusetts
Baptiste, Benjamine	University of California, Santa Barbara, California
Brown, Harold	University of California, Los Angeles, California
Bustad, Leo K.	Washington State University, Pullman, Washington
Butterfield, Kenneth	University of California, Berkeley, California
Chamberlin, Richard I.	Massachusetts Institute of Technology, Cambridge, Massachusetts
Conn, Kenneth	California Institute of Technology, Pasadena, California
Coogan, John S.	EPA, National Environmental Research Center, Las Vegas, Nevada
Crockett, David A.	University of California, San Diego, La Jolla, California
Espinosa, Samuel	Loma Linda University, La Sierra Campus, Riverside, California
Fay, Ken	University of Calgary, Calgary, Alberta, Canada
Giles, R.	Oklahoma State University, Stillwater, Oklahoma
Gohr, Frank	University of California, San Francisco, California
Halderson, Oliver	Southern Illinois University, Carbondale, Illinois
Hailes, Charles W.	Utah State University, Logan, Utah
Hall, Raymond	University of Colorado, Boulder, Colorado
Hayworth, George A.	University of Missouri, Columbia, Missouri
Holdstock, Richard	University of California, Davis, Davis, California
Jones, Gary	California Workmen's Compensation Insurance Fund, Sacramento, California
Knauff, Lawrence F.	University of Illinois at the Medical Center, Chicago, Illinois
Lang, James	University of California, Santa Cruz, California
MacKanic, George	Lawrence Livermore Laboratory, Livermore, California
McCapes, Richard H.	University of California, Davis, California
McDermott, Henry	Lawrence Livermore Laboratory, Livermore, California
Mandt, Harry	University of Texas System, Austin, Texas
Marceau, David	State University & College System, Los Angeles, California
Michaelson, George	University of Minnesota, Minneapolis, Minnesota
Morris, John	Fred S. James and Company, Berkeley, California
Nicholas, Irvin	University of California, Berkeley, California
Rich, Sigmund	Consultant on Laboratory Animal Care, Santa Cruz, California
Scheffler, Gus L.	University of Minnesota, Minneapolis, Minnesota
Schmeltzer, Lawrence	University of California, Berkeley, California
Shelton, T. Carl, Jr.	Virginia Polytechnic Institute, Blacksburg, Virginia

SPEAKERS, MODERATORS, AND PRESIDERS (Continued)

Small, Arthur C.	University of California, Davis, Davis, California
Spencer, Eric	Brown University, Providence, Rhode Island
Steen, Kenneth	University of Washington, Seattle, Washington
Steinmetz, William	University of California, Santa Barbara, California
Sudmann, Robert H.	University of Oregon, Eugene, Oregon
Warner, Joe	University of California, San Diego, La Jolla, California
Watson, William	Florida State University, Tallahassee, Florida
Whitaker, Willard C.	University of Alaska, College, Alaska
Williams, James A.	California State University, Chico, California
Wirhel, Robert S.	Western Michigan University, Kalamazoo, Michigan

PROGRAM

WORKSHOP ON BIOHAZARD CONTROL IN BIOMEDICAL LABORATORY

Monday, June 24

Kleiber Hall

8:30-9.00 a.m.	Registration
9:00-9:15	**Welcome, Logistics, Objectives** Dr. Donald Vesley. Assistant Professor. University of Minnesota
9:15-10:15	**Introductory Lecture — Epidemiology of Laboratory Acquired Infections** Dr. Jess F. Kraus, Associate Professor of Community Health, School of Medicine. UC Davis
10:15-10:45	Coffee
10:45-11:30	**Risk Assessment** Dr. Arnold G. Wedum, Safety Director. Fort Detrick.
11:30-12:15 p.m	**Basic Principles of Contamination Control** Dr. Donald Vesley. Assistant Professor. University of Minnesota
12:15-1.15	Lunch
1:15-1 45	**Dissemination of Aerosols** Mr. Mark Chatigny, Chairman. Environmental Biology Department. Naval Supply Center
1.45-2:30	**Primary Barriers and Film** Mr. Mark Chatigny. Chairman. Environmental Biology Department. Naval Supply Center
2:30-3:00	Coffee
3:00-3:45	**Secondary Barriers** Professor George S. Michaelsen, Professor and Director, University of Minnesota
3:45-4:30	**Personnel Practices** Dr. Donald Vesley. Assistant Professor, University of Minnesota
4:30-5:00	**Slide Presentation and Discussion**

Tuesday, June 25

Kleiber Hall

8:30-9:30 a.m.	**Sterilization and Disinfection Principles** Dr. Velvl W. Greene, Professor, University of Minnesota
9:30-10:15	**Animal Containment and Control**
10:15-10:45	Coffee
10:45-12:00	**Personnel Motivation and Control** Dr. Joan C. Martin. Associate Professor. University of Washington
12:00-1:00 p.m.	Lunch
1:00-2:00	**Physical Safety Programs, Discussion, OSHA** Professor Gustave L. Scheifler, Assistant Professor and Safety Engineer, University of Minnesota
2:00-2:45	**Radiation Safety Programs, Discussion** Professor Ralph O. Wollan, Assistant Professor and Health Physicist. University of Minnesota
2:45-3:15	Coffee
3:15-4:00	**NCI Programs** Dr. W. Emmett Barkley, Head. Environmental Control Section, Etiology. National Institutes of Health
4:00-5:00	**Open Discussion** Staff

PROGRAM

Philosophy and Theme

The conference will feature maximum participation by the membership. We have scheduled a minimum number of featured speakers and a maximum number of implementors of environmental health and safety programs.

Each subject will be reviewed in depth by a featured speaker and four panel members. The panel members will discuss methods of implementing programs to meet the needs outlined by the featured speaker.

Rap Sessions

There will be a convenient sign-up board for rap sessions by topic. Participants can sign up for the round table rap session of their choice. Space will be made available for each group.

Special Events

Tuesday Evening Reception — 6:30 p m
TERCERO DINING COMMONS
Hosted Beer Party and Buffet

Wednesday Evening Reception — 6:00 p.m
MEMORIAL UNION DINING COMMONS
Hosted Wine Tasting Party and Banquet

Thursday Evening Reception — 6:00 p.m
PUTAH CREEK LODGE
Traditional Mexican Tardeada featuring Mariachis and Mexican food and Hosted Cocktails

Wednesday, June 26
Roessler Hall

8:30 a.m. - Noon — Registration and Coffee

MORNING CHAIRMAN
RICHARD S. HOLDSTOCK, Program Chairman

9:30 — **Welcome to the Davis Campus**
Vice Chancellor Arthur C. Small, University of California, Davis

Opening Remarks

Eric W. Spencer, Chairman, Campus Safety Association

10:00 — Coffee and View Exhibits

10:30 — **The Safe Use of Mutigens and Carcinogens in the Laboratory**

Leo K. Bustad, D.V.M., Dean, School of Veterinary Medicine, Washington State University

Reaction Panel

Franklin D. Aldrich, Massachusetts Institute of Technology
James A. Williams, California State University, Chico
David A. Crockett, University of California, San Diego
Robert H. Sudmann, University of Oregon

General Discussion

12 Noon — Luncheon and View Exhibits

AFTERNOON CHAIRMAN
RAYMOND HALL, Recording Secretary, Campus Safety Association

1:30 p.m — **Planning for Laboratory-Animal Care**
Sigmund Rich, D.V.M., Consultant on Laboratory Animal Care and former Campus Veterinarian, UCLA

Reaction Panel

James Lang, University of California, Santa Cruz
Richard I. Chamberlin, Massachusetts Institute of Technology
Richard A. McCapes, University of California, Davis
George S. Michaelsen, University of Minnesota

General Discussion

3:00 — Coffee and View Exhibits

3:30 — **Testing of Breathing Apparatus.**
Henry McDermott, Industrial Hygienist, Lawrence Livermore Laboratory

Reaction Panel

Lawrence Knauff, University of Illinois Medical Center
Charles Hailes, Utah State University
Benjamin Baptiste, University of California, Santa Barbara
Kenneth Butterfield, University of California, Berkeley

General Discussion

5:00 Adjournment

6:00 Wine tasting and Dinner

THURSDAY, JUNE 27
Roessler Hall

MORNING CHAIRMAN
ERIC W. SPENCER, Chairman, Campus Safety Association

9 a.m. **Planning for Earthquakes**
George MacKanic, Deputy Department Head, Hazards Control Department, Lawrence Livermore Laboratory

Reaction Panel

Willard C. Whitaker, University of Alaska
William Steinmetz, University of California, Santa Barbara
Kenneth Steen, University of Washington, Seattle
Frank Gohr, University of California, San Francisco

10:15 Coffee and View Exhibits

10:30 Annual Campus Safety Association Business Meeting

12 Noon Luncheon and View Exhibits
AFTERNOON CHAIRMAN
OLIVER HALDERSON, Corresponding Secretary, Campus Safety Association

1:30 p.m. **Management of Risk in the University Setting** Irvin Nicholas, Risk Manager, University of California

Reaction Panel

Raymond Hall, University of Colorado
George Hayworth, University of Missouri
Gary Jones, California Workmen's Compensation Insurance Fund
To be Announced

General Discussion

3:00 Coffee and View Exhibits

3:30 **The Fume Hood Controversy** Lawrence Schmeltzer, Environmental Health and Safety Officer, University of California, Berkeley

Reaction Panel

Harry Mandt, University of Texas
Gus Scheffler, University of Minnesota
Kenneth Fay, University of Calgary
G.S. Michaelsen, University of Minnesota

General Discussion

5:00 Adjournment

6:00 Cocktails and Tardeada

Friday, June 28
Roessler Hall

MORNING CHAIRMAN
WILLIAM WATSON, Vice Chairman, Campus Safety Association

9 a.m. **Current Fire Protection Topics** John Morris, Loss Consultant for Fred S. James and Company

Reaction Panel

Richard Giles, Oklahoma State University
Robert Wirbel, Western Michigan University
Joe Warner, University of California, San Diego
Kenneth Conn, California Institute of Technology

General Discussion

10:15 Coffee and View Exhibits

10:30 **Manpower needs for Campus Health and Safety Programs** Harold Brown, D.P.H., Environmental Health and Safety Officer, University of California, Los Angeles

Reaction Panel

Samuel Espinosa, Loma Linda University
Carl Shelton, Virginia Polytechnic University
John Coogan, National Environmental Research Center, Las Vegas
David Marceau, California State University System

General Discussion

12 Noon Luncheon and View Exhibits

1:30 **Committee Meetings; Special Reports and Selected Rap Sessions**

Conference Speakers

Arthur C. Small

Leo K. Bustad

Sigmund Rich

Henry McDermott

George Mackanic

Irvin Nicholas

Lawrence Schmeltzer

John Morris

MODERATORS

Richard Holdstock

Ray Hall

Eric Spencer

Oliver Halderson

William Watson

George Michaelson

WIVES AND CHILDREN OF CONFEREES

First Row: (left to right) Brent Livingstone, Daraw Baptiste, Kenny Baptiste, Jackie Lamber, Gerry Hopkins, Kay Stephens, Andrew Campbell, Jeff Livingstone, Scott Livingstone.

Second Row: Arlene Livingstone, Julie Stephens, Bill Stephens, Elaine Stephens, Lucille Hopkins, Rae Rivera, Peggy Steen, Pat Jones, Belle Hayworth, Grace Hayes, Sarah Waldrop, Fern Eyre, Laurie Campbell, John Green.

Third Row: Marge Ketchmark, Pat Tarnava, Edna Hall, Linda Baptiste, Jill Stephens, Jeri Hopkins, David Steen, Beulah Bayle, Gina Wirbel, Jane Jones, Marion Simpson, Arloa Wirbel, Zenia Munroe, Gloria, Mandt, Beverly Young, Gordon Shelton, Mrs. Campbell, Diane Osborne, Pat Syracuse.

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THE SAFE USE OF MUTAGENS AND CARCINOGENS IN THE LABORATORY

Leo K. Bustad
Dean, School of Veterinary Medicine
Washington State University
(presented at the Twenty-First National Conference
on Campus Safety, University of California, Davis, June 26, 1974)

By way of introduction I have a poem to read with due apology to Marvin Goldman, Danny Kay, and Anatole of Paris.

"It all began when I was born, too soon.
My ma was frightened by a run-away basoon.
Pa was forced to be a hobo.
'Cause he blew the oboe.
And the oboe, it is clearly understood
Is an ill wind which no one blows good.
I shan't forget the morning
When Grandpa ate the awning
To impress a pretty lady
Who went for men that were shady.
And I am the result of this long long line
Of inbred eugenic schizophrenics.
And I have come to talk about mutagenics
And also carcinogenics."

It is appropriate perhaps that we should discuss this timely item of mutagens and carcinogens. To impress upon you the timeliness of the subject, one need only refer to last night's paper. On the stock market page was an item entitled, "Employers Claim Ruling On Air Would Cut Jobs." This article went on to point out that in hearings before the Department of Labor that workers and employers stated that if the Department of Labor were going to utilize the new Occupational Safety and Health Standards for cancer causing chemicals there would be a reduction in 1.6 million jobs in the U.S. The chemical under discussion was vinyl chloride. The limits for it were scheduled to be cut from 50ppm to less than 1 part per million. Vinyl chloride is the foundation for much of the plastic industry's production of polyvinyl chloride. There are over 6,500 workers actively involved in this industry and this chemical has been incriminated in the induction of a tumor of the liver, i.e., angiosarcoma. There are over 700,000 workers that may be exposed to this danger.

Before I go any further, it is well to point out something about mutagens and carcinogens. Carcinogenesis and mutagenesis are very complex cellular processes which have some growth similarity in that each produce phenotypic heritable changes. Mutagens are an assortment of chemicals that are in widespread use today, whose mutagenesis is well known. These include caffeine, nitrites and nitrates, insecticides and herbicides, and anti-malarial, chemotherapeutic and certain antibiotic agents. The experimental mutagenesis by a pure chemical agent was achieved about thirty years ago. The mechanism of action by these mutagens is fairly well understood and consists of heritable changes being produced in the molecular structure of the genetic material. Most of the work on the chemical mutagenesis has taken place during the last few decades and has concentrated on insects, plants, and bacteria.

The induction of cancer by chemical agents was discovered about two hundred years ago. However, the first experimental induction of cancer by a pure chemical agent was achieved only a little over four decades ago. In the Federal Register of

Thursday, May 3rd, 1973, Safety and Health Standards stated that a carcinogen is any of the following substances and then they went on to list 14 chemical agents: 2-Acetylaminofluorene, 4-Aminodiphenyl, Benzidine, 3,3'-Dichlorobenzidine (and its salts), 4-Dimethylaminoazobenzene, alpha-Haphthylamine, beta-Napthylamine, 4-Nitrobiphenyl, N-Nitrosodimethylamine, beta-Proplolactone, bis-Chloromethyl Ether, Methyl-Chloromethyl Ether, 4,4'-Methylene(bis)-2-chloroaniline, Ethyleneimine. Their mechanism of action is not well understood relative to the molecular event. There are probably many here in this audience today who know a great deal more about mutagens and carcinogens than I do. I certainly hope so. My intention here today is to impart a philosophy, a philosophy on the safe use of these agents based on my experience over more than two decades with the safe use of an agent that is both potentially carcinogenic and mutagenic and that is radiation. It is on the basis of this that I will try to suggest some things that will help you use mutagens and carcinogens safely in your laboratories or in the laboratories for which you have responsibility for surveillance.

On entering the field of radiation in the late 1940's I had a great advantage over many of you with chemical mutagens and carcinogens. We had a backlog of almost a half of a century of experience, some of it unfortunate; however, out of this experience there were commissions established to evaluate the risk and to develop "permissible" limits. There were two agencies, the International Commission for Radiation Protection and in the United States the National Council for Radiation Protection and Measurements. These bodies continue to sit in council to continually evaluate new data and to make recommendations relative to the safe handling of these radiation hazards and to evaluate the risks from them. This has been very useful and probably contributes to the remarkable safety record of the nuclear industry.

We have, with radiation exposure, the difficult problem of delayed injuries and late effects, notably cancer, which complicates the establishment of criteria. We cannot use clinical criteria with confidence often times because by the time the clinical symptoms are manifest the degree of damage may be irreparable. What we seek is a biological indicator in people which signals a change short of injury of serious or permanent nature and which could be used for controlling radiation exposure. In the absence of this indicator we resort to indirect means for measurement of the material and that is what you have to do with mutagens and carcinogens.

The latency, the long period between exposure and the eventual manifestation of some disease is certainly a perplexing one and a real one. One has only to refer to your literature in this regard. I call to your attention an article from "Chemicals and the Future of Man" by M. H. C. Williams of Imperial Chemical Industries. A table from his presentation appears below and shows the progressive increase in bladder tumors from aromatic amine distillers. There were 78 of these involved and for those workers who were exposed for five years or more the incidence of tumors observed in thirty years was 94 per cent. These are very sobering statistics indeed.

Progressive Increase of Bladder Tumors Among 78 Aromatic Amine Distillers With Increasing Length of Exposure

Length of latent period in years	Length of exposure in years: Up to 1	1	2	3	4	5 and over
	Percentage of workers with tumors					
Up to 5	0	0	0	0	0	0
10	0	0	0	0	0	1
15	0	17	22	0	10	45
20	4	17	22	40	30	69
25	9	17	22	70	70	88
30	9	17	48	70	80	94

From: M. H. C. Williams[3], 1958

In radiation work we have learned several things that may be helpful to you. In this regard I list some material below.

1. Mouth pipetting must be strictly forbidden. Mouth pipetting should be restricted to the soda fountain, milk bars and other bars. It has no place in the laboratory. There is no good or sufficient reason to allow mouth pipetting and there have been none since simple means for applying suction was invented and that was a long time ago. I have heard all of the reasons why one would like to continue mouth pipetting, but none of them make any sense worthy of serious consideration.

2. Syringes and needles and aerosols are the greatest potential and actual source of contamination. Syringes and needles are lethal weapons and we have not yet learned how to use them well. Also we still suffer the delusion that if we cannot see a material or smell it it isn't around, but aerosols, whether they contain radioactive or other material may not be seen but may still be hazardous.

3. Data obtained from experiments involving high doses at high dose rates may not be applicable to low dose rates. With certain chemical agents as with radiation at variable levels, we do not know the exact shape of the dose response curve at very low levels of exposure, but there are some indications that it is not linear.

In carefully controlled radiation-effect studies in animals we note considerable variation in the response within a given population. This is a signal to look for the constitutionally most susceptible subpopulation. The susceptible members of the population are however, not easily detected and one can perhaps eliminate some of these people by careful screening via physical examinations prior to employment. This is to be highly recommended in your work. Related to this issue of sensitivity within a given population there are certain situations in which a special sensitivity can be recognized.

Early on in radiation work it was recognized that the fetus at certain stages of development is especially sensitive. Therefore, women of reproductive capacity have special maximum permissible doses applied to them. When pregnancy is diagnosed, special limitations are applied. Furthermore, those who are under 18 years of age are not allowed to work with radioactive material or to enter a radiation zone. This philosophy may also be a good one to follow in your work to reduce risk.

Physical examinations and wholebody counts, as well as instruction on working with radioactive materials, are required before a new employee is allowed to work in a radiation zone. This we find has avoided many accidents. It has also eliminated certain high risk people from employment as well as preventing legal action from people who were entering employment with a considerable radioactive material of body burden obtained from some other site. A strong safety program at work directed towards avoiding or minimizing risks makes for a much safer community and home life. I was disturbed when I first began working in the radiation industry that we were required to have a safety meeting of 20 minutes every three or four weeks. I realized, however, that after some time that the habits of safe work did extend to the community and that the town in which we resided was probably the safest town of any of its size in the country. Safety is only maintained with continued vigilance and constant reminders of varying nature. What we found in radiation, I know, is also applicable to your situations. Related to this, is that work with hazardous material requires outside surveillance. In radiation work health physicists are trained and engaged to perform this surveillance and see that the proper rules are established and maintained. This has minimized the number of serious accidents and overexposures that marked the early years of radiation technology development.

Detailed investigations of accidents, which includes an establishment of cause and also future prevention are important in any safety program. The investigation is made a matter of record and a public disclosure of the more serious ones are made. This is a very educational method for preventing accidents and by their wide dissemination they are instructive to other organizations which have similar hazards. On entering the field of radiation, I was impressed that in each of the organizations in which I was a member I noted the initial accident report would always assign the risk to someone other than the victim. God usually got the blame. It always took a little time to show that the victim was usually more often to blame than God. Safety rules and mechanical devices will not in themselves prevent radiation accidents or other accidents. The rules have to be enforced and safety devices used.

We often talk of balancing the benefit and cost versus the risk. In certain diagnostic and therapeutic procedures this analysis is somewhat reasonable; however, in many other areas the balancing of benefit and risk is largely intuitive since there is inadequate biological information to assess the level of risk from very low levels of radiation. At the same time, it is difficult to express in quantitative terms the benefit that will accrue. A further complication is in some cases the exposure is to one group and the benefit to a different group. This in a way is a problem not too dissimilar to the problems you face. It is not enough to assert that the hazard is negligible or permissible or undetectable. It is essential to have at least a rough estimate of the scale and type of risks involved and their type and maximum frequency. In this regard it might be well to discuss risk briefly.

In determining negligible individual risk levels, Otway (H. J. Otway, "The Application of Risk Allocations to Radiation Safety and Design" Univ. Microfilm 1969. - (Los Alamos, N.M.), made some interesting observations.

1. With an accident annual risk level for death of 10^{-3} immediate action is taken to reduce the hazard. It is a level that is unacceptable to about everyone.

2. With an annual risk level of 10^{-4} people are very willing to spend money (especially public money) to control the hazard (for example, put up traffic signs, fences to prevent falls) and to develop slogans "the life you save may be your own."

3. At the 10^{-5} level people still recognize the hazard, as mothers warn their children about these hazards (drowning, firearms, poisoning, air travel hesitation) and slogans are precautionary "never swim alone," "never point a gun," and "keep medicine out of reach of children."

4. A risk of 10^{-6} is not of great concern to the average person. The person feels it just can't happen to him or her and these accidents are often referred to as an "Act of God." The attached table might be helpful:

ACCIDENTAL DEATH STATISTICS FOR 1966

TYPE OF ACCIDENT	TOTAL DEATHS	PROBABILITY DEATH/PERSON/YR
Motor Vehicle	53,041	2.7×10^{-4}
Falls	20,066	1.0×10^{-4}
Fire and Explosion	8,804	4.0×10^{-5}
Firearms	2,558	1.3×10^{-5}
Poisoning (Solids & Liquids)	2,283	1.1×10^{-5}
Poisoning (Gases & Vapors)	1,648	8.2×10^{-6}
Aircraft	1,510	7.5×10^{-6}
Electric Current	1,026	5.1×10^{-6}
Lightning	110	5.5×10^{-7}

Of great concern is the matter of waste storage. We're running out of "aways." Not many years ago, we disposed of most of what we didn't want by throwing it away, but we're fast running out of "aways." In nuclear industry this is very important and also a controversial problem. We have, however, established procedures for waste disposal and established waste disposal sites.

In the case of carcinogens and mutagens, the problem is in some ways more difficult. The nature and level of chemical material on contaminated parts is difficult to quantitate. Storage sites to my knowledge have not been well studied and widely established for carcinogens and mutagens; in the least if they are established they are not well known. It is of paramount importance to establish procedures and find sites for waste disposal that are advertised and well regulated.

In order to support our technology we may have to compromise with the desire of the geneticist for no increase in mutation rates and the oncologist for no increase in cancer. But we owe it to our offspring to see that the compromise is based on knowledge rather than a guess we may deeply regret in our leisure. There is much research that needs to be done to erase our ignorance. We must also give serious consideration to changing our technology and our life style.

NOTE: Many references were used in preparing this presentation. Three articles were especially useful.

1. Chemicals and the Future of Man. Hearings before the Subcommittee on Executive Reorganization and Government Research of the Committee on Government Operations - United States Senate, Ap 6 & 7, 1971.

2. World Health Organization. Technical Report Series No. 341, 1966.

3. E. C. Miller and J. A. Miller. The Mutagenicity of Chemical Carcinogens: Correlations, Problems and Interpretations. pg. 83 - 119 in Chemical Mutagens Volume 1 (A. Hollander ed.). Plenum Press, London 1971.

PLANNING FOR LABORATORY ANIMAL CARE

Sigmund Rich
Consultant on Laboratory Animal Care
University of California-Los Angeles

When we come to an important national conference, especially when it is held at a prestigious institution like this, we have high expectations of learning a great deal about a given subject. Reading, observing, and listening, which is all we do here, constitute only sixty percent of the learning process. These are typically the major modes of learning in a university. (Most of the talking is usually nonproductive!) Another twenty percent is learned by doing, usually after we leave the halls of academia. An additional ten percent is learned by doing it wrong! (Not really hard to do!) The last ten percent, and the most painful, is doing it wrong and getting caught at it!

In looking over the program, the predominant emphasis is on the safety of people! That is wrong -- and I hope you feel you've been caught at it!

There are usually more animals than people on most campuses. Moreover, in some respects animals deserve more consideration than people. They provide mankind with many, many benefits and ask very little in return -- decent housing, nourishing food, rewarding activity, and good medical care. Nobody dare say that they're not entitled to these minimal requirements.

The naked truth is that the Department of Health, Education, and Welfare (DHEW) is not going to provide funds to your respective institutions to conduct research involving the use of animals unless we do think in terms of the well being and safety of the animals -- as well as the people.

How many have copies of the following?

1. Rules and Regulations of the Animal Welfare Act (PL 91-579) of 1970.

2. Guide for the Care and Use of Laboratory Animals (DHEW Publication 73-23, 1972 edition).

3. DHEW Policy (May 14, 1973) on the Care and Treatment of Laboratory Animals.

Each of you should have a copy of these three documents since they are the basis of understanding the current very complicated scene in which biomedical research is conducted.

In essence, the traditional responsibility of the research worker for the care of his experimental animals has become interwoven with institutional obligations and requirements of regulatory and granting agencies to meet increasingly demanding standards of animal care and use.

Institutions must now recognize that their animal facilities and animal care programs require professional direction apart from, and in addition to, that provided by the investigator. You should be part of that professional direction.

Since 1971, institutions have to furnish written assurance to the DHEW granting agency that they are either accredited "by a nationally recognized professional laboratory animal accrediting body" (in this instance the American Association for Accreditation of Laboratory Animal Care (AAALAC) or have established "an institutional committee to evaluate on a continuing basis the care of all animals held or used by or for the grantee or contractor institution for use in research, teaching, or other activities supported by DHEW grants or contracts. Where the institution uses significant numbers of animals in DHEW supported activities, the committee will consist of at least three members, at least one of whom must be a Doctor of Veterinary Medicine." In addition, "as part of the continuing evaluation process, awardees will keep a record of committee activities, including its recommendations and determinations."

DHEW shows all signs of <u>enforcing</u> their policy, part of which states, "...institutions using animals....shall assure DHEW in writing that they will evaluate on a continuing basis their animal facilities in regard to the care, use, and treatment of such animals...." Again, I believe that the Safety Officer should be a member of the committee because of his broad training and the perspective he can bring to bear.

We could spend the entire session talking about how the accreditation process developed and how it's working now. It is a peer group review and in universities you know what a serious process that is. The standards have been developed by the Institute of Laboratory Animal Resources, National Academy of Sciences/National Research Council (ILAR, NAS/NRC) and published in the <u>Guide</u>. A step by step outline describing the accreditation process is available from AAALAC.

Even if you have all the right ingredients for meeting the standards, the institution is advised to do its homework carefully. Not only will the veterinarian, his staff, the facilities, the animal health program, <u>and</u> the animals be examined carefully, <u>but</u> the <u>institutional policies</u> and how they're implemented will also be subject to evaluation. That means the administration and faculty should be involved in the process and be present to meet with the site visitors. Since the DHEW policies have been spelled out it should be easier to get them involved and concerned.

It is increasingly evident that the quality of the animal care and use portion of grant requests will be examined as carefully as any other portion of the research proposal. Some otherwise meritorious scientific proposals will <u>not</u> be funded because the investigator has not given this aspect of his work the careful attention it deserves, and some institutions will <u>not</u> get some institutional funding it might obtain for the same reason!

So much for accreditation, now let's talk about SAFETY. One of the questions is -- safety for whom? The Occupational Safety and Health Act (OSHA) is designed "to assure safe and healthful working conditions for working men and women."

As a veterinarian, one of my obligations is to be spokesman for the animal. In laboratory animal medicine, as well as in all other phases of veterinary medicine, we have to develop our own brand of OSHA uniquely designed for the benefit of the animals -- and we would welcome your help to accomplish this mission.

When you become a member of a working committee, you should examine such things as the cages for sharp or rough edges that can cause injury to both animals and man; check the temperature of the cage washing water to see if it is hot enough to kill pathogenic organisms that may affect both animals and man. Is the animal facility clean? An analysis of deficiencies encountered in inspections which resulted in withheld accreditation or provisional accreditation revealed that cleanliness was the most common deficiency! Is there space to separate healthy from sick animals? Are there enough people to get the job done 365 days a year? These are other frequently cited deficiencies.

The double standard (one for people and one for all other animals) has no place in the teaching and research setting. All this effort in high standards to comply with legal and moral requirements (although they are in themselves good and adequate reasons) are being emphasized because it's also good science!

Biological research has gradually been changing from examining single cause-and-effect relationships to the study of increasingly complex, interrelated phenomena. Finely developed techniques, devices, and materials, accurate and sensitive electronic instruments, and more precise definitions of chemical reagents are required to measure the tiny changes that take place in the test tube and in the experimental animal.

Today, the quality of the research animal must match the quality of the instrument and reagents selected for experiments. It is evident that the experimental animal is <u>the</u> most sensitive and delicate "instrument" the biologist uses in his research. In order to achieve reliable and replicable results, the animals must be defined and equilibrated to laboratory conditions. This means that the animal facility becomes more than a structure to house animals--it is an instrument for research.

The design and construction of the facility determines the animals' environment which, in turn, controls the quality of the animal so it is capable of uniform and predictable responses. In short, successful research is as dependent on high quality laboratory animals, properly maintained, as it is dependent upon the creativity of the scientist and the adequacy of his mechanical equipment and supplies.

Several years ago the American Association of Laboratory Animal Science (AALAS) sent out a questionnaire on safety programs in animal care facilities. Some of the questions are posed again here for the purpose of providing you with a partial check list to help you with your activities.

Has your laboratory (facility, institution) an established safety program, safety committee, or safety regulations manual? If so, which?

Are new employees formally indoctrinated on biological safety as well as on industrial safety procedures and regulations? By whom?

Have refresher training programs been incorporated in your safety program for your personnel?

What provisions have been or will be made to cover the applicable requirements of the Williams-Steiger Occupational Safety and Health Act (OSHA) of 1970?

Are procedures in effect for prompt reporting and written follow-up of laboratory accidents, even including minor cuts in risk areas, to appropriate management and medical personnel and subsequent evaluation of the accident?

Do you have pre-employment physical examinations?

Does your institution provide a medical program which specifically includes applicable vaccinations for personnel working in infectious-disease risk areas?

Have any major emergency or disaster plans been prepared to minimize personnel and animal colony damage and escape of experimental animals as in case of hurricane, flood, earthquake, or fire?

Do you have any areas for isolation and quarantine of clean or "defined" animals? If so, are these areas operated in a "barrier" fashion or are laminar air flow devices of any type used in the facility?

Is standby power available in case of a primary power failure in risk areas?

What animal caging system is used in your facility for infectious-disease or cross-contamination control, i.e., ventilated cages; filter-top cages; individual caging of animals?

Are animal cadavers incinerated? If yes, has any agency (EPA) or air pollution inspectors monitored your equipment within the past year; with what results?

How are biological contaminated liquid wastes disposed?

What methods are used to clean infectious-disease and experimental animal husbanding areas?

Are changes of clothing required and personnel protection equipment and emergency shower facilities provided for operating personnel?

Is instruction provided to supervisory personnel in basic aspects of first-aid to be applied in cases of physical injury or impairment to personnel (fainting, electric shock, lacerations, animal bites)?

Are special training lessons provided for personnel involved or working with high voltage electrical instrumentation?

In biohazard areas, have all personnel been instructed as to exactly what remedial action must be taken in case of a "spill" i.e., accidental release of pathogenic organisms or toxic materials?

If working with radiological (X-rays) equipment or radioactive chemicals, what provisions have been made to periodically check out equipment in work area for radiation leakage during operations?

If ultra-violet lamps are used for microbial airborne contamination control, how often are lamps cleaned and checked for germicidal wave-length emissions?

Have you conducted or requested any aerobiological monitoring (air-sampling) of animal room or laboratory atmospheres for determining, at least qualitatively, the type and concentration of airborne biological contaminants?

Have any occupational illnesses (laboratory-acquired infections) been reported for your institution? If yes, have they been traced to any specific operations in the laboratory?

There are sizable bodies of literature on specific areas of safety such as handling of radioisotopes; hazardous chemicals; infectious agents; personnel health programs; viral zoonoses; facility design; equipment design; employee education; biological monitoring of the environment; personnel monitoring; cleaning, disinfection and sterilization procedures; necropsy procedures; waste and carcass disposal; and even such mundane but important matters as safe handling of animals; and identification of animals.

We could spend an entire session talking about the recent outbreaks of lymphocytic choriomeningitis (LCM), or the special precautions to be taken in nonhuman primate colonies, measles in new world monkeys, Q-fever as an occupational hazard when sheep are used in research, acquired hypersensitivity to animal dander, etc. etc.

When one stops to think about how much is known already, one wonders why some of these same problems keep recurring. It reminds me of the story of the old farmer who was fixing an ancient tractor on a country road. He was approached by a young man from University Extension who was making farm calls for the purpose of disseminating information on soil conservation, pest control, crop rotation, and other new farming techniques. After a polite and well presented speech the young man asked the farmer if he would order some of these new pamphlets, to which the old man replied, "Son, I don't farm half as good as I know how already."

It seems to me college safety programs are at this very same stage. Go back to your school and do your thing as you know it can be done!

TESTING OF BREATHING APPARATUS

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Many jobs involve potential breathing hazards due to airborne contaminants, or even a lack of oxygen in the working atmosphere. For routine operations ventilation or process enclosure often can be used to control the potential hazard. As a last resort, if engineering controls are not feasible, respiratory protective devices can be used. However, there is one application where respiratory protection is a necessity rather than a last resort. During emergencies firemen or other response personnel must enter atmospheres containing unknown levels of possibly lethal contaminants and perhaps atmospheres with too little oxygen to support life. These personnel must be provided with proper breathing equipment in good working condition.

Probably most of your campuses have an established emergency respirator program. Equipment has been purchased and potential wearers selected and trained. But of course that is not the end of the story. The respirator program must include procedures to guarantee that both the equipment and the wearers will be ready to go whenever an emergency occurs.

Types of Respiratory Equipment

Respirators are divided into two main classes depending on whether they are air purifying or atmosphere supplying. Characteristics of each class include:

- Air purifying respirators remove contaminants from the ambient air through the use of filters or chemical sorbent elements. Their use is limited by the efficiency of the air purifying elements in removing the specific contaminant in the air. Another major limitation is that these units add no oxygen to the breathing air and so are unsafe for use in an area where an oxygen deficiency may exist.

- Atmosphere supplying respiratory equipment provides a safe breathing environment that is independent of the ambient atmosphere. One type is an airline respirator that consists of a facemask or hood connected by high pressure hose to an air compressor, bank of air cylinders or other air source. The use of airline equipment is limited to atmospheres that are not immediately dangerous to life or health since the wearer must be able to escape safely if the air supply is interrupted.

  Self contained breathing apparatus is another major type of atmosphere supplying respirator. With these units the wearer carries his own supply of breathing air and so is independent of the ambient atmosphere and external air sources such as compressors. The air supply is either a cylinder of compressed oxygen or air, or a chemical canister which evolves oxygen and removes exhaled carbon dioxide as the wearer breathes.

Because of the inherent advantages of providing emergency personnel with an independent supply of breathing air, self contained breathing apparatus is recommended for emergency use. The most popular self contained units are those with compressed air cylinders lasting about 30 minutes such as the Scott Air Pak, MSA Air Mask, and Survivair.

Until several years ago air purifying respirators equipped with the "Universal," "All-Service," or Type "N" canister were widely used for emergency entry. This large red canister was the only air purifying device that could remove carbon monoxide (CO). However, as with all air purifying units, it was unsafe in oxygen deficient atmospheres and its purifying efficiency for all contaminants, including CO, was limited by the type and amount of sorbent chemicals in the canister. I am describing it in the past tense because its misuse caused several tragic accidents involving firefighters and as a result its use in fires is prohibited in several states. Most manufacturers do not make them anymore.

"Testing" Can Mean Several Things

The topic for discussion today is the testing of breathing equipment. However, the term "testing" can have several other meanings in a respiratory protection program that should be mentioned briefly. They include:

- Testing the employee's medical qualification for wearing respiratory equipment in hazardous atmospheres. For example most self contained units weigh about 35 pounds and so persons with back problems, bad knees or lifting restrictions should be excluded. Some lung or respiratory system problems may exclude a potential wearer as may other general health problems. In addition, eyeglass temple bars interfere with the seal of a full face mask and so employees wearing glasses need an extra pair to be installed in a face mask. Federal OSHA standards require a periodic reevaluation of the workers physical condition.

- Testing the fit of the face mask to assure that there are no leaks. Each manufacturer uses face piece molds that are designed to fit a high percentage of human face shapes. However, no one brand mask can fit everybody. Special problems such as eyeglasses and facial hair also can prevent a good face seal. What you should do is test each wearer to assure that he has a mask that fits properly to prevent leakage of contaminants into the mask.

- Testing the employee's skill in donning the equipment and using it safely. Wearer proficiency should not be a problem with fire services that train regularly, but it is a potential weak spot in a program with infrequent wearers.

- Testing the equipment for defects. This is really what this presentation is about so the rest of the paper will deal with this topic.

Testing Breathing Equipment

Why is a testing program needed if good quality equipment is purchased and properly stored? As a reply let me describe some defects uncovered during our routine inspections that could have hampered our emergency response capability if not corrected. At Lawrence Livermore Laboratory we have about 175 Scott Air Paks. Our defect rate is very low but here are some things we occasionally find:

- Loose hose connections. Cylinder air hoses are hand tightened only, to allow rapid changing of used air cylinders. These connections can loosen with time as gaskets set and the units are handled.

- Deterioration of face masks and other rubber parts. Rubber deterioration can probably be correlated directly with the level of ozone and other oxidant air pollutants. So more problems can be expected in polluted areas if masks are not stored in plastic bags or other airtight containers:

- Low air pressure in cylinders due to slow leaks, prior use, etc.

Once the need for a periodic testing program is recognized, the next question is how often to test? The U. S. Department of Labor answered that question in their Occupational Safety and Health Administration Standards. These standards require testing on a monthly basis for emergency use respiratory equipment. OSHA also outlines how much detail is required during these tests:

- Are air cylinders fully charged?

- Do regulators and warning devices function properly?

- Are hose connections tight?

- Are headbands, valves, facepieces, connecting tubes and other parts free of defects?

Monthly inspections in this much detail may seem unusually stringent but OSHA adopted almost verbatim parts of the American National Standards Institute (ANSI) Standard Z88.2-1969 on "Practices for Respiratory Protection." The ANSI Standard is a concensus of many groups interested in respiratory protection and contains recommendations on all facets of a respirator program. It probably should be required reading for anyone with a major role in a respirator program.

LLL Testing Program

The breathing equipment testing program at Lawrence Livermore Laboratory reflects our overall health and safety organization, as will be the case with the other speakers on the panel. The LLL Hazards Control Department contains three distinct groups with major responsibilities in testing emergency breathing equipment:

- The Fire Department frequently inspects and tests the 40 Scott Air Paks located at the fire stations. The firemen respond to all emergency calls at the Laboratory and always wear Air Paks when a breathing hazard might exist. Because of the frequent use for emergency response and training, few units go for more than a month without being used and tested.

- The Field Support Section, made up of safety professionals and technicians assigned to specific buildings and areas at the Laboratory, tests most of the emergency use respirators stored in high hazard buildings. The technicians follow a written field instruction procedure for the monthly inspection and keep a record of their findings.

- The Industrial Hygiene Respiratory Protection Service has overall responsibility for maintaining all respirators used at the Laboratory and for testing them prior to issue. The Scott Air Paks used by the Fire Department and stored in field support areas are inspected before delivery to these groups, and any defective equipment found during inspections is returned to the Industrial Hygiene group for repairs. An additional 50 Scott Air Paks are stored in the Respirator Facility for use during extended emergency operations or as replacements for units returned for servicing. These stored units are tested monthly by Respirator Technicians.

The actual procedure follows the OSHA requirements but, of course, is specific for the Scott apparatus. It includes:

- Checking air cylinder pressure.

- Checking for loose hose connections.

- Pressurizing the regulator to check for leaks and to assure that it delivers air during operation.

- Checking the low pressure alarm bell, making sure that it sounds when air pressure reaches a preset level.

- Checking face masks and breathing hoses for deterioration and proper exhalation valve operation. Then the mask and hose are rebagged in a plastic bag.

- Checking all valves to assure that the unit is stored properly for rapid use.

- Sealing the carrying case.

- Recording test dates and findings.

In addition to these monthly tests, air cylinders are hydrostatically tested every five years and the Air Pak regulators are overhauled on a five year interval.

Probably more interesting than the "nuts and bolts" of testing Scott Air Paks is the quality control steps in our program designed to make sure that the equipment is ready for use when needed. These include:

- Maintaining a written record of test dates and findings. The inspector must initial the inspection record so he can be identified. The responsibility for testing the equipment at least monthly is assigned to individuals in written operating procedures.

- Each Scott Air Pak carrying case stored for emergency use is sealed after testing with a dated label or a lead and wire seal. The label or seal must be broken to open the case. This helps to visually identify equipment that has been used or tampered with since the last inspection for immediate servicing.

- Enough extra equipment is available in the Respirator Facility so defective or used equipment can be replaced during cleaning or servicing operations. Because of the extra equipment there is no need to cut corners by using marginal equipment to maintain an adequate emergency capability.

Implementing a Testing Program

Perhaps some of you will be motivated to improve your emergency respirator testing program. Here are some tips that might help to organize such an effort:

- Identify the respiratory equipment to be used in emergencies, and separate it from routine use equipment.

- Delegate responsibility for testing.

- Maintain records of testing dates and findings.

- Establish a method to periodically evaluate the effectiveness of the testing program.

Summary

I have described the OSHA and ANSI requirements for testing emergency breathing equipment. The standards require monthly testing to assure that the equipment will perform properly when needed. Although the requirements may seem too stringent and time consuming, all safety and health personnel will agree that the reliability of emergency breathing equipment, and hence the wearer's safety, cannot be compromised.

EARTHQUAKE DAMAGE PREVENTION AT LAWRENCE LIVERMORE LABORATORY

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This presentation describes the earthquake damage prevention program at Lawrence Livermore Laboratory (LLL). The Laboratory is operated by the University of California for the Atomic Energy Commission. It is located in Livermore, California approximately 50 miles southeast of San Francisco. The Laboratory covers 1 mi^2 and employs about 5500 people.

The Laboratory is located in a relatively active seismic area. Those attendees from east of the Rockies may well have the attitude that Californians experience earthquakes continually. However, the chances are remote that this gathering will experience an earthquake. In the 22 years that the Laboratory has been in existence, there has never been earthquake damage to any research operations. But earthquakes do occur frequently enough in this area to warrant attention and concern.

In the last 10 years, the coastal portions of central California have experienced 30 earthquakes that caused some damage. The 1971 San Fernando-Sylmar quake in the Los Angeles area was in this decade, and to go back a little earlier, other major quakes were the 1952 Tehachapi quake near Bakersfield and the 1906 San Francisco earthquake.

The earthquake statistics are convincing. The resulting damage is also convincing. However, the day-to-day reality lulls one into a feeling that there is no problem. It was the San Fernando earthquake that caught the interest of the Laboratory and led to the start of our program. At that time, the Laboratory was becoming increasingly concerned with the environment and potential situations where radioactive and/or toxic materials could be released to the environment. The timing was right for us, and our program started.

People usually look at earthquakes in terms of total devastation. In reality, this is not what usually happens. A moderate ground movement can leave a structure basically undamaged, but cause significant damage to equipment and utilities within. As an example, there is a high probability of significant stock loss in a liquor store even in a minor earth tremor. The contents of the store may well be ruined while the structure is basically unharmed. It is from the perspective of internal damage that I want to approach the earthquake problem and its impact on a campus. I want to explore some of the things we can do to cut down the internal damage to our facilities. These can be done now for a modest dollar expenditure, which will not only save large sums later but also maintain the continuity of our operations if an earthquake does occur.

The following slides will show some of the effects of the San Fernando earthquake. The quake occurred shortly after 6:00 a.m. on February 9, 1971. It had a Richter magnitude of 6.4 and was felt over a 200-mi^2 area. Casualties included 58 people killed and 2400 injured, 1500 buildings damaged extensively and costs of over 500 million dollars. The emphasis of the slide presentation is to point out equipment loss and utility damage.

Slides Showing Effects of San Fernando Earthquake

- Roadway/freeway destruction
- Structural damage to industrial buildings
- Structural damage to a hospital
- Utility disruption at the hospital
- Equipment damage at the hospital
- Municipal electrical distribution system damage

LLL Program

As we looked around the Laboratory, potential problems became quite apparent. We were able to relate many of the Sylmar-San Fernando earthquake conditions to our own facilities. Let me expand somewhat on the Laboratory and its facilities to help you visualize our conditions.

We have a heavy program emphasis on nuclear research as well as basic energy research. We have a reactor, accelerators, precision shop facilities, chemistry laboratories, computers and lasers. We handle radioactive, toxic, and other hazardous materials. As we looked around, this is what we saw.

Slides of Operational Areas at the Laboratory

The slides depict many operational areas at the Laboratory. Special emphasis is placed on showing those areas where obviously high-value equipment is poorly installed from an earthquake ground shock viewpoint. Electrical utilities, piped gas systems and fire protection systems are also depicted.

As I previously stated, the Laboratory management was receptive to starting an earthquake damage prevention program. It was decided to initially look at five buildings from both the structural and internal equipment standpoint. The critical question rapidly became clear. The engineers needed a design number - they needed to know what the estimated peak ground acceleration was. This was vital for any structural analysis and for determining deficiencies. Significant changes in dollar requirements can occur, depending on the design number.

The Laboratory contracted with a private firm to conduct a seismic study of the area. This was accomplished, and indicated that a potential earthquake would have a magnitude of 5.7 with an epicenter 2-1/2 miles away giving a peak ground acceleration of 0.5 g. (A similar study would make an excellent project for your school's Engineering Department.)

With our design number in hand, we were ready to go. We embarked upon a two-part program as follows:

- Part I involved our Plant Engineering Department in a seismic analysis of all buildings and plant utilities.

- Part II was a program of analyzing the internal aspects of our buildings including experiments, equipment, utilities, and personnel hazards.

We chose a team approach to deal with this part of the problem. Our teams were composed of personnel representing three areas: Engineering, Safety, and Correction.

Engineering

Mechanical Engineers were responsible for evaluating equipment, upgrading design, cost estimates, and correction requests.

Safety

Safety Personnel were responsible for identifying and placing hazardous operations in their proper perspective, particularly where radioactive and/or toxic materials are involved.

Correction

Correction Personnel (Mechanical Technicians) are responsible for immediate corrective action where feasible. Some situations are corrected with a minor structural change, e.g. bolt, strap, brace, etc. Where significant design is not needed, the technicians make the correction.

We are presently completing our first six months of the program and are finishing our fifth building.

Slides Showing Preventive Earthquake Damage at LLL

The slides show some of the earthquake damage preventive steps taken at the Laboratory. They include the following:

- Tiedown of: electrical distribution panels,
  air filtration systems,
  storage vessels for liquified gases,
  machine tools, and
  experimental apparatus.
- Modification of chemical storage
- Storage of electronics gear

We have determined that an earthquake is a credible risk to the Laboratory. We have undertaken a program of modest expenditure of funds which should significantly reduce the damage of an earthquake and help assure continued operation of the facility.

RISK MANAGEMENT

Irvin Nicholas
EH&S Officers Conference
Davis Campus
June 27 and 28, 1974

As respects to this risk management part of the program, don't be misled by your host, Dick Holdstock, who has selected a speaker who is too young to have any wisdom because I am under 45 and too old to be trusted because I am over 30. Let me caution you that the thoughts that I will express during this talk are my own and don't necessarily represent the views of the University of California. That is a good risk management statement. To make maximum use of the format of this discussion on risk management, my talk will be limited to 15 or 20 minutes. I will turn to the panel and you for what will probably be a very rewarding discussion of problems and topics that are of specific interest to you and your area of risk management. Hopefully, I have couched several of the points in terms that should produce challenge by members of the panel and the audience and agree ahead of time that there is plenty of room for another viewpoint of the subject matter.

The University of California started to develop a Risk Management Program over seven years ago. When I was assigned the task to review University procedures for the purchase of insurance, like any good financial analyst, I started by defining the areas that were part of or associated with insurance management. Four basic areas were involved in varying degrees:

1. Insurance Companies: Their objectives were to collect enough premiums to pay all losses and expenses plus a profit.

2. Insurance Brokers: Their objectives were to put firms and institutions with uncertainty to sell together with insurance companies who wanted to buy uncertainty and make a profit.

3. Loss Control Officers: Their objective was to create an optimal environment satisfying moral and legal requirements no matter what the cost.

4. General Management: Their objective was transferring uncertainty to others, often without consideration of the cost effectiveness of their action.

It was clear that insurance companies were performing a needed service, insurance brokers were performing a needed service, loss control officers were performing a needed service, and general management was performing a needed service but in the majority of cases, including University and other firms and institutions studied, what was lacking was a coordinated effort with an overall objective under which decisions in the interest of the institution could be made so that the objective could be reached. In other words, what was lacking was a function to put it all together. The common objectives require that all risk management functions assure that:

1. Decisions are to the maximum benefit to the institution, and

2. Resources are allocated with cost effectiveness in mind.

Risk management, then, is a financial management effort. It is supportive of the four major areas in risk management and in basic conflict with none. In other words, there are no wheels to be invented in risk management, just goals and objectives to be determined and resources coordinated to assure that objectives are reached. Risk management is now widely defined as the minimization of four cost elements:

1. Management of the program

2. Assumption of loss

3. Control of loss

4. Transfer of loss

Risk management then deals with pure risk, where there is a chance of loss, not with speculative risk where potential profit is involved. On the other hand, as will be further developed later, risk management has the potential of freeing dollars normally used to fund losses for other programs and from that standpoint has the characteristics of a profit center operation.

Looking back, we can be satisfied that the technology of risk management has come a long way in the past ten years. But it is still better classified as an art rather than a science and much needs to be developed before its full potential is realized. Insurance purchase, loss control, claims management and loss funding are all generally treated as individual functions rather than as a coordinated effort designed to minimize over-all cost of losses. But as the cost of the risk increases, and we have seen remarkable increases in several areas over the past five years, institutional management will allocate more resources to this area and more will be getting it all together because of a general need to maximize the effectiveness of every higher education dollar expended, including its risk dollar.

I mentioned that I view risk management as a coordinative function but it has financial flavor. The need for coordination in this area in universities and colleges is more important because of what is currently happening in higher education.. Growth is no longer the challenge of higher education today. Rather, maintenance of what we have and increased effectiveness and utilization are the challenge of higher education. Marginal educational institutions are closing.

In your own particular area, with the new Occupational Safety and Health Program, you are being called on to perform at a level never asked of you before. Our own EH&S Officers at the University of California advise that their voices are carrying even more weight in University management decisions. I submit to you that this is occurring because loss control is a cost effective function. Like all functions it is worthwhile to remember that it has its limits and you should anticipate difficulty in achieving your goals and objectives if they are unrealistic and not cost effective over time. Loss control, traditionally viewed as an institutional expense, is viewed as an investment in the risk management formula. Remember the cost of risk is defined as the total cost of four elements.

1. Management

2. Loss Control

3. Assumed Risk

4. Insured Risk

The risk management concept of considering the total cost of risk adds new depth to the loss control function and to each of the other three factors in the formula and creates more alternatives for program design than the traditional method of viewing each function as an expense. As an example, we would ask ourselves what happens to the other three factors in the risk management formula if we buy less insurance.

Certainly our cost of assumed risk will go up because assumption does not stop losses. Additionally, by investing either in management or loss control the cost of assumed risk can be reduced or perhaps good loss control can be the key to making assuming risk financially feasible. The goal here is to reduce the overall cost, not necessarily to reduce the cost in any single function included in the formula.

If the total cost of risk is reduced, have we produced a profit? Well, I am not really ready to go that far but I think that it is clear that if an institution pays less to manage its risk, someone somewhere is going to have extra dollars to spend for other purposes as a result of investing in management of risk.

THE FUME HOOD CONTROVERSY

by
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The fume hood controversy has probably existed since the first laboratory technician elected not to breathe the effluvium from his experiments. The controversy then was probably similar to the present one, i.e., how is it done properly and how does one reduce and/or justify the cost. During the coming decade, the cost controversy will probably become less important as OSHA fines are levied for inadequate laboratory ventilation. The current state of the art in laboratory ventilation is well advanced. Almost any problem can be adequately and economically handled. The issue is one of selection of the more effective of many choices rather than insistence on blanket application of one method.

A brief historical review of fume hood development shows that in a relatively short time, sophisticated and effective ventilation techniques have evolved. Hoods built in the late 19th or early 20th centuries usually relied on thermal currents to provide ventilation. During the decade before World War II, fume hoods were usually provided with common mechanical exhaust ventilation but no positive make-up air system. The pressure gradients throughout the building fluctuated widely as windows were opened or closed and fumes often were transferred from one room to another through the exhaust ventilation system.

Following World War II fume hood design and ventilation was given the attention it needed. This was probably due to the urgent need to control radiological hazards and to the investigative resources available in the several National Laboratories.

Among the first to recognize the need for design standards was the American Conference of Governmental Industrial Hygienists. The Industrial Ventilation Guide published by ACGIH in 1951 included recommended designs for radioactive material hoods and for a glove box.[1] The recommended design included a requirement for 100 feet per minute face velocity, a highly controversial issue at the time.

In 1954 the industrial hygiene group at the Los Alamos Scientific Laboratory reported the results of a definitive and exhaustive study of the many types of fume hoods installed in their laboratories.[2] Their nine conclusions are as valid today as then and are the basis for current laboratory ventilation recommendations of the ACGIH.[3]

The demand for air conditioned laboratories has heightened the fume hood controversy and led to the recommendation of some unworkable schemes to reduce the cost of throwing away conditioned air.

In consequence of these economic pressures much attention has been paid to the ventilation of laboratory fume hoods since these typically discharge large quantities of air. The approach has largely been to substitute untreated air to make up the air exhausted through the fume hood, thereby eliminating costs of conditioning this large volume of air. No system has yet been devised that completely answers all the demands of adequate fume hood ventilation and of economy in air conditioning systems.

The ACGIH recommends several schemes, all of which are workable if used with imagination and with recognition of the specific needs of the application at hand.(3,4) These recommendations are: (a) use horizontally sliding sash to reduce maximum hood face opening, (b) supply outside air up to 50 per cent of exhaust volume through opening outside of hood face, and (c) use local exhaust ventilation for fixed apparatus.

The use of horizontally sliding sash to reduce hood face area is one of the more economical ways of reducing costs of laboratory ventilation whether air conditioned or not. Ventilation of a chemical laboratory should be at the rate of about 10 - 12 air changes per hour. In an average chemical laboratory the amount of air moved to achieve this rate of ventilation is sufficient to ventilate adequately a chemical fume hood of realistic proportions. Figure 1 shows a typical research laboratory in a Chemistry building at the University of California. This is a two-man laboratory, has a reaction rack in the center of the room, and work benches on either side. The room is approximately 20 x 15 feet in area and has a 10 foot high ceiling; the volume of the room is 3,000 cubic feet. A ventilation rate of 10 - 12 air changes per hour would require 500 to 600 cubic feet of air per minute. Assuming 100 linear feet per minute face velocity for the fume hood, this amount of air would be sufficient to ventilate a fume hood that has a face opening of 6 square feet. Typical fume hoods with vertically sliding sashes would be restricted to approximately 30 inches in length if the required face velocity were maintained. This size is obviously too small to be practical. A reasonably sized fume hood, however, can be constructed and properly ventilated if the face of the hood is restricted so that it can be no larger than 6 square feet.

Figure 2 shows such a fume hood. The glass panels on either side are hung on the overhead track and slide horizontally. Moving the glass panels permits access to any portion of the hood, in effect moving the opening, which is 6 square feet, from one side to the other as needed to service equipment within the hood. Behind the glass panels as shown at either end of the fume hood are two additional panels which can be moved independently so that, as shown in Figure 3, the fume hood can be completely enclosed. Air to ventilate the laboratory is drawn into the hood through slots at both sides of the hood face. There is no need to introduce untreated, outside air since the rate of ventilation needed for the fume hood is equal to that needed for general laboratory ventilation. The fume hood then becomes the exhaust part of the laboratory ventilation system and runs continuously.

The need for permanent balance of the laboratory ventilation requires that laboratory users be prevented from shutting off or adjusting the fume hood ventilation. Consequently no motor controller is placed in the laboratory and the fume hood itself has no ventilation adjustments as shown in Figure 4.

This fume hood design has additional advantages in that the horizontally sliding glass panels, which are made of safety glass, can be placed between the experimenter and his work so that in the event of run-away reactions or explosions, he is protected. This is of considerable importance since most hazardous part of operations in a chemical fume hood is when the experimenter is adding reactants to his system or otherwise manipulating his apparatus. A 6 foot chemical fume hood to serve two researchers may seem insufficient; however, if the experimenters are careful to plan their work this is adequate.

The second method of conserving air is illustrated in Figure 5. The untreated air is introduced outside but close to the fume hood in an amount not more than 50 per cent of exhaust volume. Experience has shown that introducing air inside the hood face destroys the effectiveness of the hood in capturing and removing contaminants. Clearly the balance between supply and exhaust must be carefully maintained. The hood is useful in locations where more general purpose hood area is needed than would fulfill the essential exhaust requirements in a laboratory.

The third method of conserving air is local exhaust ventilation. This is the type usually used in industrial processes because of its inherent economy in both installation and operation. The technique is equally applicable to laboratory ventilation. Figure 6 shows two illustrations of local exhaust ventilation for permanent laboratory apparatus. At the near end of the work bench is a muffle furnace with local exhaust ventilation affixed to the top and a short length of flexible hose connecting it to the exhaust duct. Exhaust volume is about 20 cubic feet of air per minute. This is ample ventilation for the muffle furnace - it removes all the products of combustion which rise quite rapidly because of the temperature differential. Similar ventilation can be provided for drying ovens. The hood in the center contains a steam bath and hot plate. These two pieces of apparatus are often installed in a chemical fume hood with a large face opening resulting in the exhausting of far more air than is necessary. The opening on the fume hood serving the hot plate and steam bath is approximately 10 inches high and three feet long. Consequently, less than 300 cubic feet of air per minute is necessary to ventilate this hood adequately. If the steam bath, hot plate and muffle furnace were placed in a chemical fume hood the ventilation requirements would increase threefold to about 900 cubic feet of air per minute. Figure 7 shows local exhaust ventilation on an atomic absorption spectrometer. The emission of toxic vapors is only from a burner directly under the inverted funnel exhaust hood. The air flow necessary to control completely the products of combustion from the burner is about 50 cubic feet per minute. The thermal up-draft of the hot gases aids in the ventilation in this instance. If this piece of apparatus were to be placed in a chemical fume hood the amount of ventilation necessary would be approximately 600 cubic feet of air per minute. These three special local exhaust ventilation facilities require, then, approximately 350 cubic feet of air per minute to control adequately the hazards connected with the operations normally carried out. This is in contrast with approximately 1500 cubic feet of air per minute which would be necessary to ventilate the usual type of chemical fume hood were these operations carried out in such a facility.

Figure 8 shows a different type of local exhaust ventilation that is considerably more flexible and can be used in practically any type of chemical operations. The local exhaust hood on the left is designed to remove the fumes from various types of baths used to heat reaction flasks. Were this type of ventilation not provided the operation would have to be carried out in a chemical fume hood which would need 400 cubic feet of air per minute contrasted to the 20 cubic feet of air per minute which is needed for this local exhaust facility. The hood in the center is at the top of the reflux column and removes any vapors that might get this far up the condenser. Its design permits adding materials through the condenser without interrupting control ventilation. For this operation the amount of air exhausted for control can be limited to approximately 40 to 50 cubic feet per minute rather than the 500 - 600 cubic feet per minute that would be necessary in the usual type of chemical fume hood. The hood on the right is simply an inverted funnel and can be used to remove the fumes from any open faced vessel.

It is clear, however, that this type of ventilation is only defensible in experiments where the level of hazard is relatively low. There is no protection in the case of breakage of equipment or leaks in the system at points not controlled by local exhaust facilities. This does not mean, however, that one needs a full chemical fume hood with the attendant large air flow to control the hazards adequately. Figure 9 shows a so-called ventilated reaction cabinet. It is 7 feet tall, has a concrete curb at the floor, a floor drain inside sliding doors and a reaction rack with the necessary utilities. In normal operations the amount of air exhausted through this hood is about 250 cubic feet per minute. Flexible ducts may be used to carry this exhaust to points where toxic fumes are released, much in the manner as is shown in Figure 8. Figure 10 shows the stubs coming from the overhead plenum chamber to which the flexible ducts may be connected. Shown also are the vapor-proof electrical fixtures to prevent entry of explosive vapors in the electrical system.

The relatively low ventilation rate will normally control the fumes generated by reactions taking place within the cabinet because they are normally in totally enclosed systems. It is this trend in modern chemical experimentation that makes local exhaust ventilation effective and acceptable. Most modern chemical research is being conducted in closed systems, usually under vacuum, and ventilation of the exhaust from the vacuum pump is often the only continuing need. However, should the system in which the experiment is being conducted fail in any way, the toxic materials could then be released to the atmosphere inside this reaction cabinet and not be collected by the local exhaust system. Should this happen, an auxiliary ventilation system can be activated which will move about 2000 cubic feet of air per minute through the reaction cabinet. This is sufficient to maintain a face velocity of 100 feet per minute over the maximum possible opening of the cabinet. There is no need for conditioning the make-up air to replace that exhausted by this emergency system. The toxic materials can be flushed down the floor drain, the hood can be cleaned and the emergency ventilation system shut down in a matter of a few minutes - at the most a half hour. In the meantime, it seems reasonable to ask the people working in the laboratory to put up with either cold or hot air.

Economies can also be achieved in classroom laboratories where large numbers of students may be working with toxic or odoriferous materials. In general, planning of the academic program can eliminate many of the hazards or reduce them to levels where highly sophisticated ventilation is not really needed. If, however, standard chemical fume hoods were provided, to control what toxic and odoriferous problems do arise, the cost of conditioning the air removed by these hoods would be unreasonably high. Figure 11 shows one method of overcoming this problem, a down draft hood mounted on a workbench in a freshmen Chemistry laboratory. Four students use this hood which has a rod at each of the four corners to support beaker holders and bunsen burners and all are within the captured pattern of the hood. The amount of air exhausted is approximately 50 cubic feet per minute. There are 8 such hoods in the laboratory serving 32 students. If typical chemical fume hoods were used instead of these local hoods the amount of exhaust needed would be approximately 5,000 cubic feet per minute instead of the 400 which is now being moved. Local exhaust hoods are augmented by a chemical fume hood of special design as shown in Figure 11. This hood has fixed glass above the opening which is approximately 10 inches high and 4 feet long. This hood is used for bubbling hydrogen sulfide through the test solutions being examined by the students. Again, by providing special designs which match the technological needs of the processes, a fume hood is provided that requires only 400 cubic feet of air per minute for ventilation rather than 1200 cubic feet per minute which would be necessary for the typical chemical fume hood. In this particular laboratory, which is used for teaching freshmen Chemistry, the local exhaust ventilation for controlling fumes and odors is only half of the ventilation necessary to provide 10 air changes per hour in the laboratory. The hazard control ventilation, then, adds very little to the cost of the ventilation system needed.

With proper attention to the processes involved and the technological needs of the researcher, it is possible to design effective hazard control systems that do not add significantly to the cost of laboratory ventilation or air conditioning. This requires a considerable degree of ingenuity and cooperation on the part of the laboratory designer and the researcher, and above all, an unusual depth of communication. The alternatives are unreasonable economic demands or ineffective hazard controls.

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CURRENT FIRE PROTECTION TOPICS
by
John Morris
Fred. S. James & Co.

The Federal Government, having entered the worker protection field with the Occupational Health and Safety Act (Williams-Steiger Act, 1970) and into the protection of the consumer with the Consumer Product Safety Act of 1972, is now entering the Fire Safety field with further legislation. The President's National Commission on Fire Prevention and Control spent nearly 2 years in studies of fire in all parts of the nation and produced a final report in March 1973. It was published under the title "AMERICA BURNING." A television program by ABC-TV first shown in November and again a few days ago parallels the published report.

The principal recommendations of the 177-page report:

1. Congress should establish a fire administration;
2. NIH should enter the field of research into burns and other fire injuries and also supervise programs pursued by others;
3. Federal Fire Administration would upgrade fire prevention to the same importance as fire fighting;
4. Research in both of these sciences would be stimulated;
5. A national fire academy to be established for training fire officers and for upgrading local and state fire training programs; fire investigation would be taught, for example;
6. Fire research assignments would be made to many governmental and private bodies, e.g. Bureau of Standards, Dept. of Agriculture, American Institute of Architects;
7. Automatic fire detection may be recommended for every dwelling unit and every public building, and automatic suppression systems for all high-rise buildings.

The two houses of Congress are approaching implementation of the Commission's recommendations by two different routes. The House of Representatives would put 5-1/2 million dollars into programs for one year, much of it into existing programs, and would set up a director working in the Bureau of Standards.

A Senate bill places the program on a very differnt plane, headed by a new assistant secretary in Dept. of Commerce, with 167-1/2 million dollars for a 3-year program, with emphasis on sponsoring master plan developments in local fire jurisdictions. (Information from Chief C. W. Prather, member of the State Board of Fire Services appointed by Governor Reagan.) I recommend that you locate a copy of "AMERICA BURNING" - you will find it stimulating.

One of the problems singled out in the Commission's study is that of high-rise building fires, which more than any other single aspect of the fire problem has highlighted the need for changes. High-rise is the term given to any building more than 7 stories high, or more than 75 feet high, or any building so high that fires have to be fought from the interior. According to the story in "New York" magazine for May 1974 "What Are Your Chances of Surviving a High-Rise Fire?," there are 800 such buildings in New York city alone.

Because of the incidence in recent years of fires in tall buildings and the difficulty of fighting fire in these buildings, there is a very general movement in all parts of the country and abroad to establish rules improving the safety of persons from fire. We are prompted to ask, why not buildings less than 7 stories as well? The speed of fire in modern materials, whether in old construction or new, makes the advantage of persons on the 6th floor over those on the 8th a dubious one.

Chicago's fire in Hawthorne House apartments in 1970 was a shocking event, and the first fire in Chicago in which a modern apartment house meeting all the rules of the building code sustained a fatal fire that exposed occupants of an entire floor to fatal heat and smoke. Since then Chicago has also experienced the record high fire in the 95th, 96th and 97th stories of the John Hancock building.

New York city's new life safety code demands smoke detectors, pressurized stairwells and superior compartmentation of floors against the spready of fire, plus other features short of complete automatic sprinkler protection. Canada will demand automatic sprinkler systems for all new government high-rises, and next will seek legislation to improve all such buildings.

California's Senate Bill 941, the Moscone bill, sets requirements for all new construction commencing July 1, 1974, and calls for new rules to be written for existing buildings by January 1, 1975. There will be a 3-year grace period for compliance. The rules for new buildings call for: (a) fully automatic smoke and fire detection systems; (b) fully automatic, hydraulically designed fire suppression units; (c) an intrastructure communications system for the fire department; (d) provision of maximum safety for both occupants and fire fighters. Many other fire jurisdictions have now set up new rules. Wisconsin demands sprinklers on all floors above the 7th. Rochester provides a garden hose on all floors in apartments.

Incidentally, high rise fires have sparked some original thinking about devices for rescue. One is the air safety cushion, a vinyl-coated nylon bag which can be inflated to size in 30 seconds, and is supposed to be suitable to receive a person jumping from 10 stories up.

Other devices for rescue are those invented by engineering students from universities competing in the SCORE program (Student Competition on Relevant Engineering), in the 1974 program called "Students Against Fire." Two university teams submitted inventions for lowering oneself from a burning building. One team had a cannon for firing the rescue kit from the ground into the upper floors of a building. The UC Berkeley team converted a VEGA car to protect the gas tank from rupture and fitted with fire suppression systems.

The U.S. General Services Administration, under the leadership of Arthur F. Sampson, has undertaken to make its own Federal Office Building in Seattle a prototype of fire safety systems, including prevention, containment, extinguishment and life safety. It will include automatic sprinklers, a smoke migration control network and 2-way voice communications with the various floors. A central control center will manage building operations, security functions, fire prevention systems and elevator ontrol.

Other high-rise construction has incorporated many of these systems in such outstanding new buildings as the Transamerica Building in San Francisco and the Sears Tower in Chicago.

Elevator discipline and emergency routines for elevators have emerged as possibly the most essential factors in building fire safety after the enclosure of stairs and other vertical openings between floors. Most of the victims of New York high-rise fires have died in elevator cars that stopped at the fire floor, causing car and hoistway doors to open on the fire, killing the occupants. Firemen have been trapped in several fires the same way.

There is a saying that library offices have about automatic sprinkler protection--"I'd rather have the fire than the water on the books." In recent years they have been joined by computer managers, some of them, who have not kept up with their reading and like to say "I'd sooner have fire than water in the computer room." The real water damage comes when the good librarian, having been afflicted with one of the really rare fires that strike libraries, has to see the fire department attack such a fire with hose streams that carry several hundred gallons per minute of water to knock out the fire and incidentally, soak down many books that aren't burning, the hose is just not as discriminating as the sprinkler head, which opens over the fire while the fire is small, and keeps it that way.

A refinement on the conventional sprinkler system, the fire cycle pre-action system, maintains a piping system without water in it. When fire occurs, the system is charged with water on the action of detectors that function at 140°F; ready to discharge water over the fire when the sprinkler head temperature goes to 160°F. The added virtue of this system is that when the fire is reduced or put out the sprinkler shuts off, and no more water is discharged unless the fire rekindles. Automatic alarms have meanwhile brought the fire department to the scene.

Another stop-and-go system is that created with the use of another new development, the aquamatic sprinkler head which has the virtue of stopping the flow of water when the fire is put down, and reopening if the fire starts up again. These systems have become important to colleges and universities which own irreplaceable collections. University libraries are now being protected against fire, some with combined systems of fire and smoke detection and sprinklers, with improvements in compartmentation, and some with total automatic fire suppression systems. In areas where values are very high, as in rare books, Halon systems may be a good investment.

Books and records damaged by hose streams have proved very difficult to restore. However, where the value of the materials is sufficiently high to justify a substantial outlay for restoration, it can be done. Soaked books and records are placed immediately into a deep freeze. In this condition they can be preserved for as long as necessary without further deterioration or damage progressing.

Then they are taken and put in vacuum chambers, the air is exhausted, the temperature raised to 100°F and held for several days after which time the books are clean, dry and unwrinkled. Bindings and covers damaged by water sometimes need to be replaced. Costs in one such salvage operation averaged about $4 per book against a replacement cost of $25.00 each for many books, while others could not have been replaced at all.

This process was worked out by Insurance Company of North America (INA) when the Klein Law Library burned at Temple University. Thermal vacuum space stimulation chambers at General Electric Space Division, Valley Forge, Pennsylvania, were the site of processing.

A similar procedure was used to restore soaked vital records from the Veterans Administrative record center after a very destructive fire. Vacuum chambers at McDonald Aircraft Company were used. Similar facilities with a wide range of capabilities exist across the nation. On the west coast there are a number of vacuum chambers but the most numerous and versatile are probably those of Lockheed Missiles and Space Company at Sunnyvale, California.

There is another development of considerable importance in the automatic suppression field. This is the Life Safety sprinkler system--invented by Fire Protection Engineer Richard Patton and promoted by him persistently for several years. It is a plan for hydraulically engineered systems and differing from the conventional sprinkler system in these details:

1. Function primarily safety to life rather than property;

2. Acts to protect property also to the extent that it controls incipient fires, and sends an alarm automatically calling the fire department for backup protection;

3. Depends on available water in some instances;

4. Obtains more efficient water flow through use of copper pipe and tubing, and is easily installed in existing buildings because of the ease in working tubing into the building structure;

5. Engineered on the theory that with light or moderate fuel loading, a fire will be contained with one or two heads in many occupancies.

Patton has for several years attacked the establishment represented by the manufacturers of automatic sprinkler equipment and the code writing organizations with something resembling bitterness at times, and has lately been rewarded by seeing his concepts accepted by various code writing groups and his plans acted upon favorably by rating authorities. On a single such job his plan produced a cost of $140,000 less than the quotation on a conventional system.

There is also the introduction of plastic pipe into sprinkler systems, and the claim of the plastics industry that it is appropriate for small-buildings systems; extensive testing of a plastic pipe system at Mountain View, California supports their claims. They are now looking for building code rules that would demand retrofitting of sprinkler systems in frame buildings of 3 stories and less, and permitting plastic pipe for the procedure.

Security vs. safety: There is now a conflict being brought about by the desire for greater security against vandals and thieves, and the demand that traditional ready exit facilities be locked against exit so as to facilitate that security. The chain and padlock through panic hardware bars is an example of this; so are vertical slide bolts and all manner of deadlocks. One authority having jurisdiction over places of assembly has endorsed an electrical locking system that simultaneously locks all exits against travel in either direction, in or out. This system has failed to get the endorsement of the Safety to Life Committee of N.PA.

It is wise to remember disasters that have resulted from inadequate exits and improper doors and door hardware. The security problem is a real one, but the proper answer is not to fit all doors with deadlocks. To emphasize this point consider the number of disasters in recent years in which occupied places of assembly have been fire-bombed while occupied. A few were those in Chicago, Los Angeles, Montreal, New Orleans, Detroit, Allentown, Pennsylvania, and Miami Beach. In nearly every one of these places secondary means of exit were devious or concealed and not known to the patrons. The requirements are clearly stated in the Life Safety Code. Fatal fires in student residences from incendiarism have occurred on three university campuses in recent years, possibly more. Although it was the custom in some college residence halls only a few years back to lock the women in at night, presumably this threat to life safety has gone with the changing winds of women's liberation. New ordinances designed to reduce burglary and theft in cities by requiring special locking devices are creating a real fire trap hazard for the people living there. The intent is to foil the thieves who specialize in stripping your apartment clean of everything worth stealing while the neighbors watch and wonder why you have decided to move without telling them about it.

Cheap and versatile automatic alarm devices are being manufactured and invented at a great rate, and the public is buying. You can buy a plug-in fire detector from a mail order house for a few dollars, a UL listed products of combustion detector alarm for $70 or less. No wiring is necessary. At somewhat higher cost an individual can provide himself or his place of work with a warning system that will sense heat or smoke, detect an intruder, sound a siren to scare him off, and notify a paid watch service at a central station that any or all of these things are taking place.

A typical low cost system is set up to do all these things, and makes a print-out record of everything that happens at the central station. They call the owner's place and confirm the emergency, then dispatch the police, fire, ambulance, doctor or whatever else may be called for. There is a provision for aborting false alarms, for testing the 6 channels, for voice communications with central station, for preventing tampering, and for standby power in case the main supply fails.

At this campus (Davis, University of California), a similar multiplex system has a capability for ten different indications for each location. For example, the computer center can experience and report automatically an attempt at intrusion by a burglar, smoke or fire, water moving in the sprinkler system indicating an accident of some kind, or the release of halon in the fire quenching system, or water collecting in the computer room. A bank of 60 locations with 10 indicators for each location gives a potential of 600 signals for each cabinet, and more cabinets will be added as the campus expands its automatic systems of protection.

Improvements will be required in many campus buildings in the next few years. The pressure from federal fire and work safety programs is already strengthening the hand of regional authorities in the fire and life safety fields. Typical of university problems is a very large laboratory building built in a hollow square with open stairways and continuous corridors, not broken at any point by a fire wall or a smoke barrier. How to improve life safety? A partial sprinkler system has been installed covering corridor ceilings, and with another head inside labs.

Laboratory design will be closer to standardization as the new code, NFPA 45-T (T for tentative) becomes better known. Adopted May 1974 at the annual meeting of NFPA, 45-T relates primarily to school, college and university teaching and research chemical laboratories, as contrasted to manufacturing process labs. Chemical laboratories are classified low hazard, ordinary hazard or high hazard, in accordance with (a) quantities of flammables maintained, and (b) construction, and protection is specified for various combinations of these factors. We can predict that code will be useful in obtaining a reduction in quantities of solvents stored in a lab.

The NFPA Committee most concerned with university fire protection is the Sectional Committee on Assembly and Educational Occupancies. The Committee now wants to determine what rules in the Life Safety Code should be rewritten to recognize the differences between public schools and college or university buildings.

Of all available ways of killing a fire, we have come to accept the DuPont Freon family as the finest agents for putting out fires quickly and cleanly, if not cheaply. Halon 1301 is now accepted as the ideal agent for automatic protection of electronic assemblies, rare books and objects of art and other high values. Thousands of installations have now been made and the full potential for this agent has yet to be realized. Some of the more important considerations on Halon 1301:

1. Paired with special fast-acting detection and release systems it can suppress a fire bomb in less than two seconds.

2. Used in explosion suppression, it can cut off and suppress an explosion in a fraction of a second, the whole detection-suppression cycle lasting less than 40 milliseconds.

3. Far more efficient than CO_2 and almost wholly non-toxic in dilute atmospheres which will not support combustion.

4. Fairly expensive, it can nevertheless be competitive with other forms of automatic extinguishment in some applications.

5. Can be used in manual extinguishers backed up by water systems in areas where computers or electronic systems are at risk.

A few of the new developments which seem to have real promise in fire protection include:

... a pillow of noncumbustible materials for stuffing floor and wall openings against the spread of fire, particularly during the dangerous construction period.

... a shear pin of plastic for use in pressurized fire extinguishers which permits the proper functioning of such a weapon when the person using it fails to remove the pin; also a neat and cheap plastic cord and tag for recording inspection and recharging of extinguishers.

... an electrical testing device for measuring the tension on the inner parts of a wall receptacle against the prongs of an electric plug; this is a companion device to the famılar "safety yellow" plug-in tester with neon lamps which indicates by various combinations of lights correct wiring, reversed polarity, open ground, etc.

... a chemically impregnated fibreboard of great strength, light in weight and having UL fire listings of 10, 10 and 0.

... improved door holding devices that operate to detect smoke (or products of combustion) passing through a doorway and automatically close the door, an arrangement permitting a fire door in a place of heavy traffic to stand open until needed.

Speakers at the 1974 NFPA meetings in Miami Beach last month covered a wide range of topics. Here are some of the points they made:

... The assistant Secretary for Science and Technology, Dept. of Commerce, Betty Ancker-Johnson, called for a systems management approach to the fire problem, and said that an advisory committee of knowledgeable professionals should serve the fire administration and that losses could be cut in half in a single generation.

... Wallace E. Johnson of the Federal Communications Commission said radio and TV stations should be doing more to educate the public on fire safety to fulfill their public service commitments.

... Allen Gomberg, manager, NFPA Projects Development, reported that NFPA is producing a training course on fire for business and industry, and NFPA will not only provide materials but supervise courses as well.

... Miles Woodworth, NFPA Flammable Liquids Field Specialist, said the metal jerry can with screw top may be the best solution to the spare gasoline problem. To put an ordinary safety can in the trunk of your car may be inviting disaster, since the spring loaded cap will permit flammable vapors to leak out as the liquid expands. Safety can makers have now recognized this with a special warning label.

... George Webb of Johns Hopkins Hospital said that grounding of portable electric equipment in hospitals with a portable ground wire is creating a tripping hazard somewhat more dangerous than the shock hazard; a 3-wire cable should be used.

... Bert Cohn of Gage-Babcock talked about trade-offs for automatic sprinkler protection in buildings, and said rules are too liberal in sprinklered buildings and too restrictive in non-sprinklered buildings. Total dependence on sprinklers means that on the occasion of a sprinkler failure the loss will be far greater than in an unsprinklered building of the same occupancy and contents.

... A plan for safety in high-rise buildings based on sanctuaries was outlined by Norman Alvares of Stanford Research Institute. Using data derived from fallout shelter studies, he said that a 1000°F fire burning five hours on one side of a concrete 12-inch wall would raise the temperature on the other side only 25 degrees, from 75 to 100°F. Six hours is the maximum burning time in high-rise fire theory.

Any attempt to list the various fire protection developments now emerging in areas of legislation, code writing, manufacturing, construction, automatic detection and extinguishment, new materials and devices must lead to the conclusion that the fire sciences are in a period of unprecedented growth, and none too soon to keep ahead of the fire threat, which for various reasons has been growing almost as rapidly.

MANPOWER NEEDS FOR CAMPUS HEALTH AND SAFETY PROGRAMS

by
Harold Brown
University of California, Los Angeles

There is little point in attempting to justify the need for campus Health and Safety programs to this particular group. The fact that you are here demonstrates that there has been recognition by the campus administration that a Health and Safety program is necessary. A rough estimate of the extent of hazards at a university or college can be made by looking at the lost-time injury frequency rate. A few years ago the National Safety Council reported industrial rates ranging from 1.6 for the auto industry to 34.7 for coal mining with an overall average of about 7.4. Figures I've seen for colleges and universities run from about 3.5 to 10, and teaching hospitals have lost time injury frequency rates that may be twice as high. The point is that these rates are comparable to those in industry. It is evident that a campus has its share of hazards.

The hazards, which cover the entire spectrum of possibilities - chemical, mechanical, biological, and even psychological (fairly high suicide rate around final exam time) are found in nearly every department. Before I came to the University I had the feeling that the biggest hazards might be the inhalation of chalk dust while writing on the blackboard or development of writer's cramp from preparing papers for publication. We all know better, though. If a gadget, device or chemical is available, it will be found somewhere on campus, and if it isn't available, it will be built or synthesized there. The attempt to extend the frontiers of knowledge requires people to work in unknown territory - with forces, chemicals and stresses that have not been experienced before.

In 1952 a very crude survey was done of exposures to a list of 41 different chemicals used at the University of California. We found that the average person had potential exposures to about 6.7 different materials from the list of 41. We know we have lasers, microwaves, infectious agents, and various kinds of ionizing and non-ionizing radiation. People work under and on the sea and at high altitude stations.

But what is really occuring, is that instead of all of these exotic, glamorous, frightening, unknown potential hazards injuring our university people, they are injured by common everyday causes such as falls, strains, and being struck by objects. The "exotic" agents are involved in less than 3 per cent of the total injuries reported.

It can be demonstrated that an EH&S program can result in reduction in the number of injuries, but there are other reasons for such programs. For example, to comply with a law such as OSHA, or to qualify for an AEC or a hospital license, or an AAALAC certification. You can think of other reasons ranging from humanitarian ones to purely mercenary ones involved with saving workmen's compensation or liability insurance costs or qualifying for a grant.

There is a need for Health and Safety programs on a campus, but what, briefly, is involved? For the sake of simplicity I've divided the EH&S program into four major areas: Sanitation, Safety, Industrial Hygiene, and Radiation Safety. Since there is little published on this subject I looked at the University of California because I had relatively easy access to the information by means of the intercampus telephone line.

Here is what I found (Chart I: Effort expended in General Phases of EH&S). The numbers refer to the percent of total effort assigned to programs - not to the number of FTE. These percentages are just guesses, but if you "eye ball" the columns you can see that we expend about 45 per cent of our effort on Radiation Safety, about 30 per cent on Safety, about 12-13 per cent on Sanitation, and 12-13 per cent on Industrial Hygiene. With the developments pertaining to control of hazardous chemicals that are rapidly appearing, I am guessing that industrial hygiene will require about the same effort as the radiation safety program within a very few years.

I've mentioned four major programs, but before I get into manpower needs to carry them out I want to list some of the general things that are done in varying proportions by all the EH&S programs - yours and ours. Surveillance (audit) - Consultation (advice) - Training (staff, faculty, students) - Service - Research - Etc. (dogs, drug registry, sewage disposal). The mix or proportions will depend on funding and manpower availability. In my opinion, in order to achieve maximum effectiveness with our usually limited means we should emphasize training and surveillance. A few people can't do all that needs doing, but if we can train others to take care of needs in the various departments, and then provide surveillance to see that the job is done, plus some technical back-up when needed, I think we can have effective programs.

About 1969 or 1970 I tried to find out how many people were needed to carry out EH&S programs. I found no good answer, but what I discovered was that on some campuses there was no identifiable safety entity, on others the safety function was added to the "regular" duties of a physical plant superintendent, or a police chief or someone in the personnel or insurance office. At the other extreme I found institutions like the UC Lawrence Berkeley Lab which had in 1970 an EH&S staff of 82 persons serving a population of 2600 (1 to 32), Los Alamos and National Institutes of Health in 1963 had a ratio of 1 to 200. Last week I was told that NIH now has an EH&S staff of 63 serving a population of about 10,500 or 1 for 167.

It is apparent, after looking into the functions, that a great deal of service and research can be provided by these heavily staffed institutions. But before you feel sorry for yourselves, remember that some of the potentials are greater at NIH and Los Alamos than at the usual campus. We can view our potential hazards as caged animals, but most of us have pussycats where they have tigers.

I have taken the liberty on this next chart of tossing out the extremes and picking only the numbers that seemed reasonable to me. Not very scientific, I'll admit. I also found a couple of recommendations in the literature (Steere in 1962, Ferris in 1964). (Chart II: Approximate ratios recommended or in use.) This chart shows staff ratios ranging from about 500 to 3700.

A study for the USPHS was begun several years ago to survey accurately the Health and Safety staffing patterns on campuses in the United States, but the job was never completed, so, for the time being, these are about the only numbers available.

Here is what the staffing ratio has looked like for a few years at the University of California. Note that the ratios range from 1200 to 1 to 3600 to 1 (Chart II: Ratio Stud., Fac. and Staff UC 1966-1970).

Chart IV shows figures only a couple of months old for the University of California (Chart IV: UC EH&S Staffing 1973-1974). Average for the campuses was about 2400 to 1 and salary costs were about $5.84 per person on campus. We actually have a somewhat lower ratio, because I did not include any temporary staff. These figures are for the "permanent" or "career" employees including clerical help.

For those of you who try to justify staff increases to your administration, a good, easily understood, workload measure that is independent of your own manipulation is useful. I've shown total campus population in previous charts, but other relationships can also be used. Figures like those on Chart V (UCLA Campus Workload Indicators) are more useful to show how your work load changes from year to year, than to compare one university to another.

After all of this, can a number be derived to show the "correct" size of EH&S staff for your institution? I think we can come up with an approximate range that, while not very defensible, may prove useful. Based on the very rough fragmentary information previously shown, plus subjective feelings about how hard I work and how little everyone else with a larger staff works, I would guess that if we have one Health and Safety staff member for each 1500 to 2500 students, faculty and staff (FTE), we would be able to provide some, though minimal, service, and adequate consultation, surveillance, and training. The larger loading would be about right for a humanities and arts campus, the smaller loading for a campus with lots of science, engineering, medical, and research activity. For an average mixture perhaps 1:2300 would do. There usually are lots of ways to do things and what works in one place won't necessarily be right for another.

What is the overall implication of this suggested 1:2300 ratio? Chart VI (Approximate EH&S needs in U.S.) shows that with a population "at risk" of 11 million, there would be at present a requirement for 3800 EH&S technical staff (safety engineers, industrial hygienists, sanitarians, etc.). This is about one-fourth of the total supply in the U.S., and more than we have in the whole state of California. A study done in 1972 estimated that California would need 300 more such people by 1974 (Chart VII: Technicians needed in the future, etc.).

What are the chances of universities and colleges acquiring this staff, assuming they decided to do some hiring? In 1970 this association did a salary survey which showed that the median salary was about $11,000 per year (see Chart VIII: Campus Safety Personnel Annual Income). If we add about 6 per cent per year for four years to get us up to the present, the figure would be about $14,000 per year. The salaries paid EH&S people in California in 1972 were about $14,000 (Chart IX: Average Salaries in California) so if we add another 10 to 12 per cent the 1974 figure might run to about $15,500.

I mentioned earlier that I thought that the need for industrial hygiene surveillance would increase as more details on air-sampling, record keeping, etc. appear in the OSHA and state-plan requirements. A salary survey of Industrial Hygienists was reported in May of this year at the American Industrial Hygiene Association meeting. The histogram (Chart X: Salary Distribution Industrial Hygienists) indicates that Industrial Hygienists have a median salary of about $21,000 at present. Are salaries on your campus competitive?

Most of what I have presented will leave you unsatisfied. The data is incomplete, and there is no "right" answer. If you have a staffing ratio of more than about 2300 population served to each of your EH&S staff, you have my permission to complain to your administration to try to get more staff. If your loading is less than about 1500 to 1, I think you should be quiet, unless you can show that you have tigers and not pussycats on your campus, or perform services and research that make your organization different than at most campuses.

MINUTES

ANNUAL MEETING OF THE CAMPUS SAFETY ASSOCIATION
21ST NATIONAL CONFERENCE ON CAMPUS SAFETY
UNIVERSITY OF CALIFORNIA AT DAVIS, CALIFORNIA
June 27, 1974

Opening: The annual business meeting of the Campus Safety Association was convened at 10:50 a.m., Thursday, June 27, 1974, in conjunction with the Twenty-First National Conference on Campus Safety at the University of California at Davis, California, with Chairman Eric Spencer presiding.

Secretary's Report: The Secretary's report of the fall meeting of CSA in Chicago, Illinois on Wednesday, October 31, 1973, was not read since a vast majority of members had received copies. It was moved, seconded and approved that the minutes of the fall CSA meeting be accepted as printed.

Treasurer's Report: Jim Knocke, Treasurer, reported a cash balance of $2,278.28 on hand as of May 31, 1974. He also submitted an auditor's report confirming the correctness of statement of cash receipts and disbursements. It was moved, seconded and approved to accept the treasurer's report and auditor's statement as read.

Chairman's Comments: Chairman Spencer reported that CSA relationship with NACUBO was steadily improving. Fred Thomas (Howard University) has been attending meetings regularly and it is anticipated that this relationship will continue to improve, as it should. Fred Thomas is also active with the NACUBO Committee working with government agencies, thus CSA is obtaining additional input. Eric also reported that APPA is conducting seminars in various U.S. locations concerning facility repair and remodeling. He also reported that CSA is cooperating with the NACUBO "HEARS" program (Higher Education Academic Referral Service).

Committee Reports: Chem. Safety Handbook - Ray Hall reported that he had received 10,000 copies of the "Guide for Safety in the Chemical Laboratory." Southern Illinois University had purchased the first 50 books in May. Cost to members is 25¢ and to non-members 50¢, plus mailing charges. Also available were sample copies of the handbook, which Ray asked members to take back and talk over the purchase with Chemistry Department chairmen and/or bookstore managers.

Conference Site Committee - Ed Simpson announced that the 1975 CSA Conference will be held at the University of Calgary, Calgary, Canada. He also reported that the results of a recent questionnaire had indicated the following site locations to 1980:

University of Maine, Orono, MA	1976
University of Hawaii, Honolulu, HA	1977
University of Illinois, Urbana, IL (25th Anniversary Meeting)	1978
University of Michigan, Ann Arbor, MI	1979
Auburn University, Auburn, AL	1980

Fire Safety Committee - Dick Giles reported that the new fire reporting forms seemed to be working out very well. He had received excellent support and information, however, problems with printing schedules had been delaying published fire reports. Dick hoped that the printing problem would soon be resolved.

Membership Committee - George Hayworth reported that the Committee was active, was working and with continued support from the existing membership we will continue to grow. CSA membership is now about 1200.

Awards Committee - Eric Spencer requested the three members of the committee to stand and be recognized and he thanked them for their efforts in behalf of the CSA and the Award Winners. The committee members are: Steve Logan, Chairman; John Marsden and Orville Briscoe.

State Activity Reports:

Michigan - The most recent meeting held at Western Michigan University in April 1974 was well attended. Viable programs are improving campus safety.

Illinois - An April 1974 meeting was held at Western Illinois University. Lou Legg reported that the Illinois Association meets quarterly.

Colorado - Ray Hall and Frank Rivera reported that the Campus Safety Association meeting held in conjunction with the first Colorado Safety Congress and Exposition was successful even though attendance wasn't as great as expected.

Ohio -- The Ohio Association meets quarterly and in conjunction with the State Safety Association.

Upon request of Eric Spencer, Jack Green replied to comments concerning printing delays of the CSA Monograph. If completed papers are provided soon after the conference, the monographs can be printed early and mailed sooner.

Chairman Spencer requested a 10 minute adjournment to permit the nominating committee (Ketchmark, Rupp and Morris) to finalize the 1974-75 executive committee.

The meeting was re-convened at 11:40 a.m. and Committee Chairman Ray Ketchmark announced the following officers for the 1974-75 year:

Chairman - William Watson
Vice Chairman-- Ollie Halderson
Corresponding Secretary - Ray Hall
Recording Secretary - William Steinmetz
Treasurer - James Knocke

Secretary Ray Hall re-read the 1974-75 slate to the assembled membership and Chairman Spencer requested the motion. It was moved, seconded and approved ~~to~~ accept the 1974-75 slate of officers as read.

Prior to handing control of the organization over to the incoming Chairman, Eric thanked the officers and membership for the unqualified support that he had been given during the past year. He also asked the entire membership to offer Dick Holdstock, Dick Yamichi and the Environmental Health and Safety Staff a standing ovation for a very excellent conference site and program.

Chairman Watson thanked Eric for the past year's work and activities and commented on improvements gained in our relationship with NACUBO.

The first order of new business concerned the progression of the Treasurer who usually holds the job for a three year term to permit better financial and budgeting control of CSA resources. After an explanation by Chairman Watson and Ray Hall, it was moved to permit the Treasurer to progress to Vice Chairman at the completion of the three year term. A discussion resulted and it was decided to refer the question to John Fresina (MIT) Chairman, Laws and Regulations Committee for review and recommendations. The motion was withdrawn.

Ken Fay was then asked to provide information concerning the 1975 CSA Conference Program at Calgary. Ken reported that he had prepared a list of eleven technical areas and he would be most appreciative of receiving comments from the membership. The areas are:

1. Hi-rise fire safety.
2. Total loss control programming.
3. Analyzing chemical hazards.
4. NSC services available to institutions of higher education. (Ken Licht - NSC.)
5. Fire detection applications on campuses.
6. Uses and abuses of HALON BO1.
7. Fleet and motor pool safety.
8. The "Safety hot seat" program.
9. Noise terminology and hazards.
10. Gas detection - hazards.
11. Audio-visual uses for campus safety programs.

In closing Ken again requested comments and input from the membership.

Chairman Watson commented that he had appointed Pat Eaker Chairman of the Publications Committee and that he was most desirous of publishing additional "safety guides" to assist institutional safety officers and college business officers. Pat was introduced to the members and he requested that copies of all papers written by CSA members be sent directly to him for future handbook development and publishing.

The discussion then changed to conference fee charges. Generally it was felt that the $25.00 conference fee was not representative of the value of the conference nor could it be maintained in the present inflationary period. A motion was made and seconded to increase the fees from the present $25.00 to $35.00 for members and $50.00 for non-members. Additional discussion resulted in the motion and second being withdrawn and the decision returned to the Executive Committee for resolution before the 1975 Calgary Conference.

The question concerning the Chairman's coordinating trip to Calgary in September or October, 1974 was discussed and it was decided that the trip need would be left to the Chairman's discretion.

A discussion concerning the mounting problem of mutigens and carcinogens in university laboratories resulted in the formation of a committee composed of George Michaelson and the Executive Committee. The committee will prepare a CSA position paper concerning the problem and forward it to the Department of Labor and NIOSH.

In closing, Chairman Watson thanked everyone for their participation and support and recommended that each member present seriously attempt to consolidate the Environmental Health and Safety activities into a single viable department adequately staffed and funded tc meet the mounting hazards of university campuses.

The meeting was adjourned at 12:25 p.m.

Respectfully submitted,

Ray Hall
Secretary

OTHER SAFETY MONOGRAPHS FOR SCHOOLS AND COLLEGES

(Monographs No. 1,2,3,5,6,13 and 16 are out of print and are available by loan only from the NSC Library.)

NO. 1 1952	EXPERIENCING SAFETY IN COLLEGE AND UNIVERSITY LIVING CENTERS. Personnel Section, American Association of Colleges for Teacher Education and the Higher Education Committee, National Safety Council.
NO. 2 1954	FIRST NATIONAL CONFERENCE ON CAMPUS SAFETY. University of Illinois and the National Safety Council.
NO. 3 1955	SURVEY OF ACCIDENTS TO COLLEGE STUDENTS. American College Health Association and the National Safety Council.
NO. 4 1955	SECOND NATIONAL CONFERENCE ON CAMPUS SAFETY. University of Minnesota and the National Safety Council. $1.80.* Stock No. 429.50-4.
NO. 5 1956	ACCIDENTS TO COLLEGE STUDENTS. American College Health Association and the National Safety Council.
NO. 6 1956	THIRD NATIONAL CONFERENCE ON CAMPUS SAFETY. Massachusetts Institute of Technology and the National Safety Council.
NO. 7 1957	FOURTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Purdue University and the National Safety Council. $1.80.* Stock No. 429.50-7.
NO. 8 1958	FIFTH NATIONAL CONFERENCE ON CAMPUS SAFETY. California Institute of Technology and the National Safety Council. $1.80.* Stock No. 429.50-8.
NO. 9 1959	SIXTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Michigan State University and the National Safety Council. $1.80.* Stock No. 429.50-9.
NO. 10 1960	SEVENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Cornell University and the National Safety Council. $1.80.* Stock No. 429.50-10.
NO. 11 1961	THE BICYCLE AND THE MOTOR SCOOTER ON THE COLLEGE CAMPUS. Michigan State University, the University of Washington and the National Safety Council. $1.25.* Stock No. 429.50-11.
NO. 12 1961	EIGHTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Southern Illinois University and the National Safety Council. $1.80.* Stock No. 429.50-12.
NO. 13 1962	ORGANIZATIONAL STATUS AND DUTIES OF CAMPUS SAFETY PERSONNEL. Los Angeles City School System and the National Safety Council.
NO. 14 1962	INJURIES IN MEN'S PHYSICAL EDUCATION AND INTRAMURAL SPORTS. Michigan State University and the National Safety Council. $1.80.* Stock No. 429.50-14.
NO. 15 1962	SAFETY EDUCATION LAWS AND REGULATIONS. State University of New York and the National Safety Council. $1.25.* Stock No. 429.50-15.
NO. 16 1962	NINTH NATIONAL CONFERENCE ON CAMPUS SAFETY. University of California at Berkeley and the National Safety Council.
NO. 17 1963	TEACHER PREPARATION AND CERTIFICATION IN DRIVER EDUCATION. Illinois State University, Iowa State University and the National Safety Council. $1.25.* Stock No. 429.50-17.

NO. 18 1963 TENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Indiana University and the National Safety Council. $1.80.* Stock No. 429.50-18.

NO. 19 1964 ELEVENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Rutgers University and the National Safety Council. $1.80.* Stock No. 429.50-19.

NO. 20 1965 TWELFTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Central Michigan University and the National Safety Council. $1.80.* Stock No. 429.50-20.

NO. 21 1966 THIRTEENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. University of Washington and the National Safety Council. $1.80.* Stock No. 429.50-21.

NO. 22 1966 SEMINAR FOR SAFETY EDUCATION SUPERVISORS. Indiana University, Insurance Institute for Highway Safety and the National Safety Council. $1.25. Stock No. 429.50-22.

NO. 23 1967 FOURTEENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. University of Nebraska and the National Safety Council. $1.80.* Stock No. 429.50-23.

NO. 24 1967 COLLEGES AND UNIVERSITIES HIGHWAY TRAFFIC AND SAFETY CENTERS. College and University Safety Centers, Division of Higher Education Section, National Safety Council. $1.25.* Stock No. 429.50-24.

NO. 25 1968 FIFTEENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. University of Vermont and the National Safety Council. $1.80.* Stock No. 429.50-25.

NO. 26 1969 SIXTEENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Texas A & M University and the National Safety Council. $1.80.* Stock No. 429.50-26.

NO. 27 1970 SEVENTEENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. University of California at Santa Barbara and the National Safety Council. $1.80.* Stock No. 429.50-27.

NO. 28 1971 EIGHTEENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. University of Illinois at Chicago Circle Campus and the National Safety Council. $3.50.* Stock No. 429.50-28.

NO. 29 1971 NATIONAL SAFETY EDUCATION CURRICULUM GUIDELINES (K-6). Indiana University at Bloomington and the Elementary School Section of the National Safety Council. $3.50.* Stock No. 429.50-29.

NO. 30 1972 A HISTORY OF NATIONAL SAFETY COUNCIL SCHOOL SAFETY ACTIVITIES. Author, Dr. Vivian Weedon. $3.50.* Stock No. 429.50-30. (Available late 1975.)

NO. 31 1972 SAFETY IN K-6 STUNTS AND TUMBLING. Author, Miss Victoria Benedict. $3.50.* Stock No. 429.50-31.

NO. 32 1972 NINETEENTH NATIONAL CONFERENCE ON CAMPUS SAFETY. Brown University and the National Safety Council. $3.50.* Stock No. 429.50-32.**

NO. 33 1973 TWENTIETH NATIONAL CONFERENCE ON CAMPUS SAFETY. Colorado State University and the National Safety Council. $3.50.* Stock No. 429.50-33.

NO. 34 1974 TWENTY-FIRST NATIONAL CONFERENCE ON CAMPUS SAFETY. University of California-Davis and the National Safety Council. $3.70.* Stock No. 429.50-34.

* Beginning with Monograph (1971) No. 28, the series was renamed to include Schools--Safety Monographs for School and Colleges.

** Except for sale items (all Monographs-1966 and prior-$1.00 ea.) Prices subject to 20% discount to NSC members. For quantity prices write Order Dept.,National Safety Council. Specify complete title and Stock No. Payment must accompany orders for $5.00 or less.