

**CURRICULUM GUIDE**



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**FOR**

**OCCUPATIONAL  
SAFETY AND HEALTH  
TECHNICIANS**

**CHANCELLOR'S OFFICE  
CALIFORNIA  
COMMUNITY COLLEGES  
1972**



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**CURRICULUM GUIDE**  
**FOR**  
**OCCUPATIONAL**  
**SAFETY AND HEALTH**  
**TECHNICIANS**

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SACRAMENTO, CALIFORNIA

1972

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## FOREWORD

The Community Colleges of California recognize the obligation to provide vocational and technical education programs to meet the needs of business and industry. The Colleges seek means continually to serve their respective communities better.

The Occupational Safety and Health Act of 1970 places new responsibilities on employers. These responsibilities require extensive improvement and updating in techniques and, consequently, the training of additional personnel for the administration and enforcement of safety and health standards. The enactment of this Act provided funds for research and development. Under a grant from the National Institute for Occupational Safety and Health, an agency created by the Act, this survey and curriculum guide have been developed.

With the guidance of a statewide advisory committee, a team of safety and health professionals was engaged to develop a curriculum for training occupational safety and health technicians.

Some of the Community Colleges already offer one or more occupational safety and health courses. The survey undertaken as part of this grant indicates that a broader program is needed. I hope this publication will help Community Colleges implement such a program.



Sidney W. Brossman, Chancellor  
California Community Colleges

## PREFACE

The Chancellor's Office of the California Community Colleges has provided the direction and coordinated the development of this curriculum guide. The consulting firm of Gilbert L. Rhodes and Associates, safety, professionals, was engaged to develop the curriculum guide under a grant from the National Institute for Occupational Safety and Health.

The Occupational Safety and Health Act of 1970, by placing requirements on employers to provide safe and healthful working conditions, increases the need for trained safety and health personnel in federal, state, and local government, private industry, and labor. Formal programs for training such personnel are limited in California.

The Chancellor's Office recognized the potential service the California Community Colleges could offer and applied to the National Institute for Occupational Safety and Health for a planning grant to develop a curriculum for technical training in occupational safety and health. The objective of this study was to determine the needs for technicians and the scope of training that would be required.

It is our hope that this publication will assist California Community Colleges in the implementation of programs to provide trained safety and health technicians to meet the needs of their respective communities.



Leland P. Baldwin, Assistant Chancellor  
Occupational Education  
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## ACKNOWLEDGEMENTS

Every project must have individuals with analytical and perceptive talent to serve as the starting force towards the ultimate goal. The citizens of California should appreciate the effort of the Board of Governors, the Chancellor's Office and the people in the Division of Occupational Education, California Community Colleges, for their roles in beginning a program in Occupational Safety and Health for Technicians.

The assistance of the National Institute for Occupational Safety and Health, without which this work would undoubtedly have been delayed, is appreciated.

William Anderson, Specialist in Technical Education and California Community College's director for this project, has been a constant help.

The interest and help of many members of the Advisory Committee is prominently reflected herein. They will continue to be essential elements to the ultimate program.

The project staff of Gilbert L. Rhodes & Associates who, because of their dedication to the field of safety and health, were anxious to participate in this curriculum guide development. These persons are: Alfred Barnes, M.S., C.S.P., Director of Educational Services, California Trucking Association, George Mac-kanic, Jr., M.P.H., C.S.P., Deputy Department Head, Hazards Control Department, Lawrence Livermore Laboratory and Foster Rinefort, Jr. M.B.A., C.S.P., Loss Control Consultant.

All are grateful to the 220 individuals who took time to reply to our survey questionnaire as their generous input has provided a great deal of the sustenance for the staff and for the development of this guide.



Gilbert L. Rhodes

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# INTRODUCTION

Concern for the health and safety of workers has existed at least from Biblical times. There was an acknowledged responsibility of the master for his servants and also an obligation for what is now called "public liability".

In the 19th Century B.C. the Babylonian Code of Hammurabi stated, "If a man strikes another, he shall be responsible for the physician." Moses also proclaimed that battlements shall be placed upon the roofs of houses to prevent falls. In the 5th Century B.C. Hippocrates first described occupational diseases.

Modern activities and concern have their origin with the advent of the factory system. New sources of power, new machines and new processes, combined with the concentration of people in one work location, compounded the injury and health problems that existed in the dingy, unhealthy craft and cottage workshops.

With the factory system the concept of responsibility for diseased and injured workers became an issue. The alleviation of the suffering took two courses: The struggle for laws to compensate injured workers and their families, and laws to regulate working conditions. Along with these efforts arose the volunteer attempts by some industries to prevent those injuries from occurring.

As laws became more stringent, costs became a more important consideration. It became provident to prevent injuries rather than pay for their consequences. Thus the safety profession was born.

Along with the recognition that injuries from mechanical sources could be prevented came the recognition that exposure to toxicants was an equally and perhaps more insidious cause of harm to the worker. Fire losses also came to be recognized as preventable. From these came the development of safety engineering, industrial hygiene and fire protection engineering as cooperative disciplines. All are encompassed in the Williams-Steiger Occupational Safety and Health Act of 1970 (OSHAAct).

Early safety practitioners had little formal safety training and were usually engineers, production men, or personnel men. These volunteer efforts did make substantial reductions in injury rates, particularly from the late 1920's to the 1960's. In general safety engineers received their knowledge by experience though a few colleges did offer safety engineering courses.

In the 1960's a leveling off of the rate of reduction of injury frequency rates occurred. As a matter of fact there has been a slight increase in the injury rate since that time in the United States. Many groups, and in particular organized labor, sought increased legislation to control the work environment. There have been many Federal and State laws, but the Williams-Steiger Act is the most comprehensive and stringent and imposes vastly increased responsibility on employers, government agencies at all levels, and upon the safety professions.

For the purposes of this study the occupational safety and health professional is defined as a person engaged in safety engineering, industrial hygiene, or fire protection who has had responsible experience in these fields and who possesses a baccalaureate or higher degree.

In California it has been estimated that there are approximately 3,000 full time occupational safety and health personnel.

With over 400,000 work places in the State of California there are not enough trained professionals nor para-professionals available to adequately serve the objectives of the Occupational Safety and Health Act or the humanitarian and economic objectives of occupational safety and health.

Some of the tasks currently being performed by the professional and some of the job openings brought about by the Occupational Safety and Health Act need not be performed by a highly skilled professional. A person trained to the technician level could satisfactorily serve in many capacities.

For the purpose of this study a Safety and Health Technician is defined as a person who possesses basic scientific knowledge and technical skills that allow them to support the activities of safety and health professionals. The technician will be primarily concerned with the application of attained knowledge in such tasks as monitoring, surveying and inspecting the safety and health aspects of a work place. The formal education is normally less than a baccalaureate and, with proper training, the technician may perform many duties that are now done by some professionals.

The training of these technicians is the objective of this study and curriculum guide.

# THE COMMUNITY COLLEGE AND SAFETY AND HEALTH TECHNICIAN TRAINING

The California Community Colleges are uniquely qualified to provide the necessary training of safety and health technicians. Each is located in a population center and has as its objective the serving of the educational needs of that community.

Students usually enter the community college for one of four objectives:

1. To prepare for entry into an occupational field. Vocational and technical education have become increasingly important curricula for community colleges. Business and industry are demanding higher levels of knowledge and skills because the increasing complexity of our society requires not only greater knowledge, but depth of knowledge for entry into some occupations and certainly for individual growth in most endeavors. The community colleges are geared for this type of program and the safety and health field, which fits this category, is growing in scope, opportunity and challenge.
2. To prepare for upgrading or re-training while gainfully employed. This segment of the student population is the most likely source for the program at the beginning. Most of those currently enrolled in safety courses fit in this category.
3. To prepare for transfer to a four-year institution. It can be hoped that some percentage of beginning students in the Safety and Health Technician Program will wish to pursue their studies to the professional level. With the advent of OSHA it is hoped that more four year colleges will offer baccalaureate degrees in the field.
4. To pursue general education goals for their own self-satisfaction. It can be hoped that some of these students will become interested in the health and safety field. In fact, in those few colleges offering safety courses, this has happened.

The occupational safety and health field should prove appealing to the young and those with contemporary youthful values. The field is and always has been concerned with people and their problems in relationship to the work environment. In this sense it has a definite relationship to the ecological and humanistic interests of today.

In addition to humanitarian concerns, today's youth also seems to desire challenge, opportunity and more rapid assignment of responsibility. The occupational safety and health field offers ample opportunity for individual approaches to problem solving and certainly ample challenge to talent and imagination.

To meet the challenges of the training and successful application of that training, the students must have certain basic attitudes and interests:

1. They should be people oriented. Their work will primarily be that of working with people to solve people problems or problems that affect people. The reserved or introverted person will have greater difficulty in influencing others. They must be able to communicate well orally and in written form.
2. They should be persuasive. The principal tool the Occupational Safety and Health Technicians will need in their work is ability to encourage, advise and sell workers and supervision on the principles of safety and environmental health.

3. They should be imaginative. The formal training will provide principles and general practices, but work environments vary to such extent that practical application frequently requires unique and resourceful judgements.
4. They should be mechanically interested. They will be involved in preliminary evaluation of mechanical hazards and the development of safeguards. They will be working with equipment and instruments which will require some understanding of the underlying principles. With these instruments they will be making preliminary evaluations of environmental stresses affecting the workers.
5. They should be curious and inquisitive. They will be seeking practical solutions to environmental problems and will be seeking causes of those problems. They must be interested in looking deeper than the initial or obvious appearances.
6. They should be determined. Frustrations are frequent and problems are often complex. Persistence is often a major determinant in this field.

With these requisites, the curriculum has been directed to practical knowledge and skills. For a more comprehensive and technical career, additional training is necessary.

Although the able student should be encouraged to continue through the baccalaureate, special counseling will be required. Not only will acceptable college transfer courses be needed for the general education requirements, some of the safety and health courses may not be acceptable for credit in a four-year safety curriculum. The counselor will have to evaluate new information from the four-year institutions in the light of OSHA developments.

For best program results close liaison with representative industry members should be maintained so the program can closely meet the needs and expectations of those organizations which will employ the graduates of the program.

# JOB DESCRIPTIONS

Until recent years the job of those engaged in occupational safety and health varied with the industry, the company, and even the personality of the individual filling the position. Titles ranged as widely. Some were called safety managers, safety directors, safety officers, safety men, or safety assistants. Only those more directly concerned with occupational health had more descriptive titles, that of Industrial Hygienist.

The American Society of Safety Engineers in October, 1965 attempted to bring order to the job titles and job descriptions. What has evolved is a higher degree of professionalism in response to the increasing complexity of modern industry. Today the top professionals may have varying titles, but his responsibility is managerial, technical and evaluative.

The technician on the other hand will, in general, work under supervision performing the more routine tasks such as record keeping, conducting regular inspections, safety training, or accident investigation.

As with many professional fields, there are too few qualified professional safety and health personnel to meet the needs. As with other fields, trained technicians can capably perform many of the tasks, thus freeing the professional to serve more fully. The needs and the emerging recognition of the potential of the technician make prospects for employment encouraging.

Sample job descriptions were received from many respondents to the survey. Titles ranged widely as did the industry. Replies were received from the chemical industry, construction, aero-space, publishing, electronics, insurance companies, utilities, Federal agencies, State agencies, and various cities and counties. The common threads running through all were working under supervision, routine tasks, and training.

A composite job description of the safety and health technician is as follows:

## **SAFETY AND HEALTH TECHNICIAN**

**BASIC FUNCTION:** Under the general direction and with the assistance of the safety professional carries out the organization's safety program for safety training, accident investigation, inspection for hazards, and related work.

**TYPICAL TASKS:** Inspects facilities and work processes for compliance with organization's, State and Federal regulations; recommends physical changes or work practice changes to improve safety performance; investigates accidents and makes recommendations as to corrective actions necessary; keeps accident reports and records in accordance with organization's and State and Federal requirements; analyzes accident data for trends, special problems or special reports; prepares and conducts safety meetings and safety training sessions for employees and supervision.

- SPECIAL TASKS:** With guidance of professional may monitor work environment for health hazards using standard testing instruments, may make preliminary evaluation and recommendations.
- May serve as first aider at jobsites or smaller facilities, responsible for liason with medical personnel and medical records.
- May be responsible for maintenance, repair and issue of personal protective equipment. Must be able to recommend appropriate equipment for task involved.
- May be responsible for the development of safety posters or visual aids for training programs.
- COLLATERAL DUTIES:** Reviews literature for new developments in techniques, legislation, or regulations; may administer driving or other tests to vehicle operators; may be responsible for inspection and maintenance of fire protection equipment and for fire training; may be required to conduct first aid training.
- ENTRY REQUIREMENTS:** High school diploma and two years employment in industrial safety and/or training. College courses may be substituted for experience. First Aid Certificate may be required.

The above composite job description is based upon criteria as it has existed. Technology, work environment and the law have changed the requirements substantially. The criteria will be updated to meet the new requirements and the suggested curriculum in this guide is designed to meet the new needs.

### **TYPICAL FUTURE WORK SITUATIONS FOR THE SAFETY AND HEALTH TECHNICIAN**

The Community College graduate will most likely be employed in government as an enforcement officer, in insurance as a field loss control representative, as an inspector in the construction industry, or as junior safety and health assistant in a variety of manufacturing or service industries.

# CALIFORNIA COMMUNITY COLLEGES OFFERING OCCUPATIONAL SAFETY AND HEALTH COURSES

As reported in *Occupational Programs in California Community Colleges, 1971 - 1972*,<sup>1</sup> only two colleges offer degree programs in Industrial Safety. Of the two only San Diego Evening College currently schedules the courses. Merritt College in Oakland has offered both an Associate degree and a Certificate Program. Neither is available at this time.

However, many of the colleges have one or more courses in safety and related fields. The Bureau of Labor Statistics<sup>2</sup> surveyed community colleges and found that in California 28 of the 94 colleges offer one or more courses in fire science, 12 offer one or more courses in occupational safety, and three have courses in radiation safety. There are 26 giving Associate degrees in fire science and one, Canada College in Redwood City, has offered an Associate degree in sanitation and safety as part of the food and lodging technician training. Chabot College in Hayward has both a degree and a certificate program in radiation technology.

Until OSHA interest in a degree program was primarily a matter of dedicated individuals using every means available to promote the courses. The one course offerings were usually adequately filled by requiring the course as part of a supervision or management certificate.

Increased voluntary effort as well as OSHA are bringing new responsibilities to management, supervision and employers. These all make more intensive knowledge of occupational safety and health principles mandatory. The increased efforts also creates more positions in the field. With modest promotion the new programs should be well attended.

1. Chancellor's Office, *Occupational Programs in California Community Colleges 1971 - 1972*, Sacramento: California Community Colleges, 1971.

2. *Survey of Safety Education Opportunities at the Junior College Level*, Office of Training, Bureau of Labor Standards, U.S. Department of Labor, 1971.

# EMPLOYMENT OPPORTUNITIES & TRENDS IN CALIFORNIA

(A more detailed description of survey data is in the Appendix.)

Currently there are approximately 15,000 people employed full-time in the occupational safety and health field in the United States according to 1971 estimates by the U.S. Department of Labor and by the American Society of Safety Engineers. Approximately 10,000 of these persons work principally in the area of occupational injury prevention or casualty loss control. About 2,000 are in industrial hygiene or occupational health, about 2,000 work primarily to control fires or other property losses and about 1,000 work to control boiler and machinery losses principally by means of inspections.

In California, based on memberships in various professional societies, it is estimated that there are approximately 3,000 full-time occupational safety and health professionals and technicians.

The 257 organizations surveyed by questionnaire or interview represent a small portion of the estimated 12,000 organizations in California which employ more than 100 people.<sup>1</sup> However, because of the response of many larger organizations in the State these 257 respondents do employ a sizeable proportion of the work force in the State. These firms employ 1,286,000 people or 16% of the 7,994,000 employees in the State.<sup>2</sup>

These organizations surveyed currently employ 313 full-time occupational safety and health technicians. They indicated that if they were available, they would hire an additional 79 occupational safety and health technicians during 1972, a total of 200 by 1973, a total of 299 by 1974 and that a total of 607 additional people were needed by 1982. In other words these employers indicated they needed a 25% increase to existing staff by 1972, a 64% increase by 1973, a 96% increase by 1974 and a 194% increase by 1982.

A review of estimated needs by geographic area may be helpful. In the Greater San Francisco-Oakland Area the 110 organizations surveyed employ 231 full-time technicians and see a need for an additional 20 or 9% during 1972, 64 additional or 28% more by 1973, and a total of 105 by 1974 or a 45% addition to current staff. In Greater Los Angeles-Long Beach firms surveyed employed 58 technicians and needed an additional 22 technicians or 38% more during 1972, an additional 60 or an additional 103% by 1973 and an estimated 96 or 165% more by 1974. In Sacramento and the San Joaquin Valley survey respondents employ 14 full-time technicians and need 34 more or 243% additional personnel during 1972, 68 additional or 485% more staff by 1973 and 84 or 600% more technicians by 1974. In San Diego surveyed firms employed 10 full-time technicians and indicated they needed 2 or 20% more by 1972, 7 or 70% additional personnel by 1973 and 13 or 130% more by 1974.

A review by type of industry may also be helpful in evaluating needs. Surveyed governmental agencies employ 45 technicians and indicated they would need an additional 12 technicians or a 27% increase during 1972, a total of 45 or a 100% addition to staff by 1973 and 67 or 149% more by 1974. Surveyed manufacturing, mining and construction firms employ 43 technicians and indicated a need for an additional 18 or 42% more during 1972, 49 more or 114% more technicians by 1973 and 89 total additional or 207% additional by 1974. Service, trade, transportation and utility firms surveyed employ 44 technicians and estimated a need for 9 more in 1972 or 21% additional, estimated they would need a total of 22 or 50% additional by 1973 and by 1974 an additional 35 or 80% more. Surveyed insurance and finance organizations, principally casualty and property insurance carriers, employ 159 full-time technicians. They indicated they need 12 more technicians or 7% additional during 1972, 28 or 18% more by 1973 and 46 or a 29% addition to current staff by 1974. All other organizations

surveyed, principally trade associations, consultants, labor organizations and agricultural establishments employ 15 full-time technicians and estimate they will need an additional 28 or 187% more during 1972, 56 more or 373% more by 1973 and 62 or 413% additional by 1974.

In summary and conclusion, based on reasonably extensive survey data, there is a significant immediate need for additional occupational safety and health technicians both in all major metropolitan areas surveyed and in each of the various sectors of the economy in the State.

1. State of California, **California Statistical Abstract, 1970.**
2. *ibid.*

# SURVEY PROCEDURES

The development of the curriculum guide required the determination of job entry requirements in terms of skills and knowledge, the educational experiences necessary to meet those requirements, and the present utilization and future needs for safety and health technicians who may receive training under such a program.

Two approaches were used. A questionnaire for a mail survey was developed and reviewed with the Advisory Committee. This questionnaire and a cover letter were mailed to 1,014 organizations in California. (See letter and questionnaire in Appendices A and B).

In order to obtain more detailed information 37 patterned interviews were conducted throughout the State. The pattern consisted of probes for in depth responses to questions of the mailed survey form.

## THE MAIL SURVEY:

The questionnaire was developed after extensive review by the contractor's staff and was reviewed and pre-tested by the Advisory Committee on December 7, 1971. After further revision the form was printed and mailed to 1,014 organizations in California on January 25, 1972.

Mailing lists were obtained from Chambers of Commerce, professional organizations, insurance companies, state agencies and a commercial mailing service. From these lists a sample was drawn to correspond on a proportional basis with each major population center of the State and each major section of the economy.

The economic sectors sampled were:

- Governmental Agencies
- Manufacturing, Mining, Construction
- Service, Trade, Transportation and Utilities
- Insurance and Finance
- Agriculture
- Labor Organizations
- Professional Organizations (Consultants, Trade Associates and Educational Institutions)

The geographic areas were:

- Greater San Francisco-Oakland
- Greater Los Angeles-Long Beach
- Sacramento and San Joaquin Valley
- Greater San Diego
- All Other

Each addressee was mailed a questionnaire, a cover letter and a postage paid return envelope. In one month 186 replies had been received. On February 24, 1972 a follow-up reminder was mailed to the 400 largest organizations not replying to the first inquiry. (See Post Card Appendix C.) An additional 34 replies were received for a total of 220 replies.

## THE PATTERNED INTERVIEWS:

In the planning stages it was recognized that questionnaires, no matter how carefully designed, cannot provide the breadth and depth of information desired. To provide more detailed information 37 patterned interviews were conducted throughout the State in January, February and March 1972.

The basic framework of the interviews was the questionnaire. The respondents were asked to answer the questions while the interviewer recorded the answers. Probes such as, "In what way?" "Please amplify " were used to elicit more detail. In questions from the respondent regarding definition, the interviewers asked, "What does it mean to you?"

The interviewees provided excellent comments. Samples of these statements are located in Appendix J.

# SUMMARY OF SURVEY RESULTS

A total of 1,014 questionnaires were mailed and 220 were returned by the deadline date. This is a 22% response, good in terms of mailed surveys, but very good in terms of the restricted interest of the subject matter. Additional replies have been received since the analysis, but review of these indicates no significant differences from those included in the analysis.

The mailings and interviews were made to sample the economic sectors and the major population centers of the State. The distribution of responses is as follows:

## ECONOMIC SECTOR

Federal, State and Local Government	15%
Manufacturing, Mining and Construction	48
Service, Trade, Transportation and Utilities	14
Insurance and Finance	11
Agriculture	1
Labor Organizations	1
Professional-Consultants and Trade Associations	5
Educational Institutions	<u>5</u>
	100%

## GEOGRAPHIC AREA

Greater Los Angeles - Long Beach	39%
Greater San Francisco - Oakland	43
Sacramento and San Joaquin Valley	10
Greater San Diego	6
All Other	<u>2</u>
	100%

It was not surprising that 96% of the respondents were familiar with the Occupational Safety and Health Act of 1970. Although 3% indicated they were not familiar with the Act, many of these indicated they were unfamiliar with the details. There were 1% of the respondents which gave no answers to this question.

Since the number of employees is an indication of the number of safety and health people needed, we asked each respondent for the number of employees in his organization. The total employees represented by the sample was 1,286,000. If, as expected, OSHA begins to affect more and more establishments, the opportunities will be there for trained technicians.

The organizations sampled employ a total of 818 full-time professional safety and health personnel and 313 full-time technicians. In addition 151 part-time professionals and 727 part-time technicians are employed.

In these organizations 119 technicians have advanced to the professional level of safety and health employment, 77 to other positions, 16 to production positions, 5 to sales, 36 to management and 7 to other unspecified positions. In other words, in the last five years, 260 safety and health technicians have advanced. Opportunity is there.

The average annual salary of full-time occupational safety and health professionals is \$14,337. The average annual salary of the technician is \$11,156.

The principal duties of the professional are, in decreasing ranking by the respondents:

- Safety Program Administration
- Safety Training
- Fire Protection
- Safety Inspection
- Accident Investigation
- Industrial Hygiene
- First Aid and Medical
- Claim Settlement

For the technician level the rankings in decreasing order are:

- Safety Training
- Safety Inspection
- Safety Program Administration
- Fire Protection
- Accident Investigation
- First Aid and Medical
- Industrial Hygiene
- Claim Settlement

The balance of the questions dealt with the college program. With respect to the need for a program such as proposed, 63% agreed, 28% did not see a need, 1% did not know, and 8% did not respond.

The organizations clearly preferred degree programs for both current and potential employees. The preferences in decreasing rank order are:

For currently employed technicians:

- Evening Degree Programs
- Evening Certificate Programs
- Day Degree Programs
- Occasional Evening Courses
- Day Certificate Courses
- Occasional Day Courses

For potential employees:

- Day Degree Programs
- Evening Degree Programs
- Evening Certificate Programs
- Day Certificate Programs
- Occasional Evening Courses
- Occasional Day Courses

In relation to the type of program preferred is the employment opportunity at the end of the program. 61% of the sample indicated they would employ graduates of a program as it is proposed. On the other hand 25% said they would not and 14% made no response. Those who said no and those who did not respond frequently indicated one of five alternative means of meeting their needs: Training within the organization, experienced new hires, training current employees by evening courses, outside consultants, none needed, and government inspectors. (In order of preference.)

The respondents stating they would hire graduates of a program would employ 79 if available in 1972, 121 in 1973 and 99 in 1974. In the next 10 years 308 additional graduates would be needed.

The suggested program content was in two areas – topics or knowledge areas felt most important, and activities the technician must be able to perform. The proposed curriculum guide was developed from these suggestions. In decreasing rank order the choices were:

#### **TOPICS**

- Safety Engineering
- Human Relations
- Industrial Hygiene
- Fire Protection
- Government Laws & Regulations
- Psychology
- Motor Vehicle Safety
- Chemistry
- Statistics
- Business Administration
- Physics
- Mathematics
- Physiology
- Claim Settlement

#### **ACTIVITIES**

- Safety Inspection
- Safety Engineering
- Safety Training
- Accident Investigation
- Safety Program Administration
- Industrial Hygiene
- Fire Protection
- Record Maintenance & Analysis
- Motor Vehicle Safety
- First Aid and Medical
- Claim Settlement

Detailed tabulation of the questionnaire results and discussion of the interview data are located in the Appendix.

# **SUGGESTED CURRICULUM PATTERN OCCUPATIONAL SAFETY & HEALTH**

The questionnaire survey and interview data provided a substantial base upon which a curriculum could be designed. The local industry needs and the student's needs and interests will significantly affect the curriculum and course content. The patterns which follow should be considered suggestions. Four levels were considered in the design of the curriculum guide.

At the base are those potential students currently employed in the field who wish further knowledge in particular areas. Each course can, with proper experience or educational background, be taken for its own merit. Also, supervision or management majors may be required to take one or more of the safety and health courses.

The next level is the certificate program for those either possessing a degree or who do not wish to pursue the requirements of an Associate degree. These students would take only Occupational Safety and Health courses specified for the certificate.

The third level of students are those who are pursuing the Associate degree in Occupational Safety and Health. The general education requirements may vary, but the survey indicated definite recommendations for related courses. These are included in the curriculum plan.

At the final level will be those wishing to transfer to a four-year institution. Certainly the general education, science and mathematics courses will have to be college transfer level. In addition the counselors must recognize that at the outset at least, few of the Occupational Safety and Health courses will be acceptable for transfer credit. It can be hoped that a fully functional program will gain acceptance at least by those colleges offering bachelor's degrees in the field.

## **REQUIREMENTS FOR OCCUPATIONAL SAFETY & HEALTH CERTIFICATE**

A certificate will be awarded for satisfactory completion of six of the ten courses.

### **Required Courses:**

**OSH 11 - INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH**  
**OSH 12 - SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS**  
**OSH 13 and 15 - PHYSICAL HAZARDS CONTROL I & II**  
**OSH 16 - ELEMENTS OF INDUSTRIAL HYGIENE**

### **And at least One Additional Course Selected from the Following:**

**OSH 14 - MOTOR FLEET SAFETY**  
**OSH 17 - INDUSTRIAL FIRE PROTECTION**  
**OSH 18 - TECHNIQUES OF INDUSTRIAL HYGIENE**  
**OSH 19 - HUMAN FACTORS IN SAFETY**  
**OSH 20 - SAFETY PROGRAM MANAGEMENT**

## REQUIREMENTS FOR ASSOCIATE DEGREE

Course Major (10 OSH courses)	30 Units
General Education Courses	17
Physical Education	2
Recommended Courses	
Physics and Chemistry	8
Mathematics	3
Psychology (Human Relations)	<u>3</u>
	63 Units

## SUGGESTED ASSOCIATE DEGREE PROGRAM

### First Semester

OSH 11 - Introduction	3 Units
OSH 12 - Codes and Standards	3
Written Communications	3
History or Political Science	3
Health Education	2
Physical Education	<u>½</u>
	14½ Units

### Second Semester

OSH 13 - Physical Hazards I	3 Units
OSH 14 - Motor Fleet Safety	3
Oral Communications	3
History or Political Science	3
Mathematics	3
Physical Education	<u>½</u>
	15½

### Third Semester

OSH 15 - Physical Hazards II	3 Units
OSH 16 - Elem. Industrial Hygiene	3
OSH 17 - Fire Protection	3
Chemistry or Physics	4
Human Relations (Psychology)	3
Physical Education	<u>½</u>
	16½

### Fourth Semester

OSH 18 - Tech. of Industrial Hygiene	3
OSH 19 - Human Factors	3
OSH 20 - Management Safety	3
Electives*	3
Chemistry or Physics	4
Physical Education	<u>½</u>
	16½

#### \*Suggested Electives

- Blueprint Reading and Sketching
- Manufacturing Processes
- Statistics

#### NOTE:

Every effort should be made to obtain work experience or cooperative education opportunities for students. In cases where students are obtaining on-the-job experience, allowable work experience credit should be given and the OSH course that has corresponding educational value can be waived.

## RELATED COURSE DESCRIPTIONS

The following are typical of related courses to supplement the technical curriculum. Some will be required for the Associate Degree. For balanced education and to better qualify the student for his career they are recommended.

- ENGLISH: Written Communication** **3 units**  
Development of writing skills. Sentence structure; style. Business correspondence and form; techniques in writing technical reports.
- SPEECH: Oral Communication** **3 units**  
Theory of speech composition. Principles of organization and delivery. Development of competency of expression. Individual speech analysis; business and social conversation; informative talks; group speaking.
- MATHEMATICS** **3 units**  
Emphasis on application of mathematics for technology. Fundamental mathematical operations; fractions; decimals; percentage; logarithms; slide rule and table usage; elements of algebra, trigonometry and analytic geometry; empirical equations.
- CHEMISTRY (with laboratory)** **4 units**  
Basic principles of inorganic chemistry, nomenclature, major elements and compounds, chemical calculations, chemical reactions, atomic and nuclear structure, chemical bonding, laboratory techniques.
- PHYSICS (with laboratory)** **4 units**  
Principles of physics; mensuration; properties of matter; mechanics; heat; light; atomic and molecular structure; electricity; magnetism; sound; radiation; optics; with laboratory to develop skills in making physical measurements.
- HISTORY, POLITICAL SCIENCE, OR SOCIAL SCIENCE (two, 3 unit courses)** **6 units**  
Principles and problems in government; the political process, democracy as practiced in the United States; Constitution; United States History; State and local government.
- PSYCHOLOGY: Human Relations** **3 units**  
The general processes and principles of behavior and methods used in studying them. Social determinants of behavior including childhood socialization, group decision making, attitudes and opinions. Learning; motivation; perception; emotion; personality.
- HEALTH EDUCATION** **2 units**  
Factors of physical and mental health; personal health; community health.  
Associate degree requirement.
- PHYSICAL EDUCATION (four, ½ unit courses)** **2 units**  
Associate degree requirement unless the student is exempt.
- BLUEPRINT READING AND SKETCHING** **3 units**  
Fundamentals of blueprint reading, including the alphabet of lines, orthographic projection, print numbering systems, title blocks, engineering orders, engineering changes and sketching.
- MANUFACTURING PROCESSES** **3 units**  
Operation of conventional machine tools; industrial production techniques; materials selection; tool selection; precision measurement techniques; equipment care and maintenance; shop safety. Basic principles of chemical and physical properties of industrial materials.
- STATISTICS** **3 units**  
Introduction to methods of analyzing numerical data including sampling and probability distributions, expected value, statistical inference, reliability and validity, correlations.

**COURSE TITLE: OSH 11 - Introduction to  
Occupational Safety and Health**

**UNITS: 3**

**COURSE PREREQUISITES:** Consent of Instructor

**CATALOGUE DESCRIPTION:**

An introduction to the principles of occupational safety and health. A survey course covering the basic principles and techniques. Required for OSH majors and suitable for management and supervisory certificate students.

**COURSE OBJECTIVES:**

To develop interest in and appreciation for careers in the field. To develop ability to perform investigation of simple accident events; to develop ability to inspect facilities and equipment of simple construction for compliance with safety codes; to develop capability to compile and compute the standard measures of accident experience.

This is an introductory course designed to familiarize the student with the Occupational Safety and Health Field. Although intended as the basic course for OSH majors, others will find it useful, particularly supervision or management majors. Students with work experience in a factory or construction environment will find the course easier to follow.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	ORIENTATION - Introduction to occupational safety, its principles, scope and concerns.
2	HISTORICAL PERSPECTIVES - A review of the early records from the ancients to the emergence of the factory system. The conditions which led to concerns for occupational safety and health.
3	THE EMERGENCE OF THE SAFETY MOVEMENT - A study of early efforts and problems in relation to the contemporary programs.
4	THE DEVELOPMENT OF WORKMAN'S COMPENSATION - A review of the early laws, their principles in relation to current law and practice.
5	THE DEVELOPMENT OF CODES AND STANDARDS - Landmark disasters in relationship to the codes that evolved as compared with current standards including the Occupational Safety and Health Act of 1970.
6	OCCUPATIONAL INJURIES AND ILLNESSES - A review of the scope of the problem, the types of losses, cost factors and causal factors.
7	BASIC ELEMENTS OF A LOSS PREVENTION PROGRAM - A review of the nature of loss prevention and the techniques of risk management.
8	LOSS CONTROL POLICY AND RESPONSIBILITY - A study of organizational policy requirements for the successful implementation of a loss control program.
9	LOSS CONTROL TECHNIQUES - A survey of the techniques of environmental controls for mechanical, electrical and fire hazards.
10	OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE - An examination of the scope of concerns of occupational health, the more common problems and protection measures.

<b>Week</b>	<b>Units of Instruction</b>
11	HUMAN FACTORS IN SAFETY - An examination of the psychological contributions to accident prevention, motivation, attitudes, and psychological and physiological capabilities and limitations of man.
12	BIOMECHANICS - Man in relationship to machines with respect to design for ergonomics and function in a man-machine system.
13	ACCIDENT INVESTIGATION - A review of the requirements for investigation and the causal factors in accidents.
14	FACT FINDING AND ACCIDENT REPORTS - A case study approach to determine facts in accident events and in accurate reporting.
15	SAFETY REPORTS AND RECORDS - A survey of contemporary law and practices in records, reports and statistical measurement.
16	THE SAFETY ORGANIZATION - A survey of the typical organization and the role of the organization; the use of the organization to accomplish safety objectives.
17	SAFETY AND THE FUTURE - A review of contemporary literature indicating trends, prospects and new developments as well as challenges.

**RECOMMENDED TEXT:**

**Accident Prevention Manual for Industrial Operation**, 6th Edition , Chicago: National Safety Council, 1967.

De Reamer, R., **Modern Safety Practices**, New York: John Wiley & Sons.

**COURSE PREREQUISITES:**

Consent of Instructor; OSH 11 may be taken concurrently.

**CATALOGUE DESCRIPTION:**

A review of the important occupational safety and health standards and codes with particular emphasis on application of these codes to typical work situations.

**COURSE OBJECTIVES:**

To develop understanding of the importance and scope of occupational safety and health codes, to develop ability to interpret the codes in terms of practical application.

This course will be appropriate for business management, supervision, and engineering technology majors.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	HISTORY OF CODES AND STANDARDS - From the beginning of recorded history man has had a relationship with others that appears to have required safety and health laws. Chronologically this history will be reviewed.
2	CALIFORNIA LABOR CODE - A review of the State agencies operating in the safety and health field and their enabling legislation including the role of the California Inspection Rating Bureau.
3	THE CALIFORNIA HEALTH AND SAFETY CODE - A review of the public codes i.e., sanitation, air, water, pest control. The State Fire Marshal's responsibilities and the Building Standards and Earthquake Protection.
4	CALIFORNIA VEHICLE CODE - A review of vehicle accidents and reports, equipment and loads, hazardous cargo. Included will be Safety Orders of the Public Utilities Commission.
5	DIVISION OF INDUSTRIAL SAFETY ORDERS - A review of pressure vessels and the Construction Safety Orders.
6	DIVISION OF INDUSTRIAL SAFETY ORDERS - A review of the General Industry Safety Orders i.e. general plant equipment, power transmission equipment, prime movers, machines and machine parts.
7	DIVISION OF INDUSTRIAL SAFETY ORDERS - General Industrial Safety Orders continued. Review of point of operation, cranes, gas systems for welding and cutting, control of hazardous substances and the highlights of specialized safety orders.
8	FEDERAL REGULATORY BODIES AND THEIR OCCUPATIONAL INFLUENCE - Describing the responsibilities in safety and health by various Federal Departments and Agencies i.e. Department of Labor, Department of Health, Education and Welfare, Department of Transportation.

<b>Week</b>	<b>Units of Instruction</b>
9	FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 - Explanation of the Law and how it works, penalties and how violations are processed. Judicial review of orders, relation to State Law.
10	OCCUPATIONAL SAFETY AND HEALTH STANDARDS - FEDERAL - Review of building and Construction, Mining, Federal Service Contracts Act, Walsh Healy Public Contracts Act.
11	OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of standards for walking and working surfaces, means of egress and powered platforms, manlifts and vehicle mounted platforms.
12	OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of standards for occupational health, environmental controls, hazardous materials, personal protective equipment and medical and first aid.
13	OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of standards for compressed gases and equipment, materials handling and storage, powered industrial trucks, cranes and derricks.
14	OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of standards for machines and machine guarding, hand and portable powered tools and special industries.
15	OCCUPATIONAL SAFETY AND HEALTH STANDARDS - Review of the electrical standards including overcurrent protection, grounding, cords, cables, transformers, appliances and hazardous locations.
16	ADVISORY OR CONSENSUS STANDARDS - A review of other standards and codes promulgated by organizations like the National Fire Protection Association, American National Standards Institute, Uniform Building Code, Underwriters Laboratory and Factory Mutual Engineering Corporation.
17	FIELD EXERCISE - A plant visit to inspect for violations of safety and health standards, codes and regulations.

**RECOMMENDED TEXT:**

**State of California Labor Code**  
**State of California Administrative Codes**  
 title 8. Industrial Relations  
 title 13. Motor Vehicles  
 title 17. Public Health  
 title 19. Public Safety

**Federal Occupational Safety and Health Standards**  
**National Fire Protection Association Standards and Codes**  
**American National Standards Institute**  
**American National Standards**

**COURSE TITLE: OSH 13 - Physical Hazards Control I**

**UNITS: 3**

**COURSE PREREQUISITES:** Satisfactory completion of OSH 11 or consent of Instructor.

OSH 12 Safety and Health Standards, Codes & Regulations would be helpful.  
Familiarity with industrial work environment would also be helpful.

**CATALOGUE DESCRIPTION:**

An examination of physical hazards in the work environment and methods of control.

**COURSE OBJECTIVES:**

To explain and illustrate methods of control of hazards with particular reference to regulatory standards. To develop ability to recognize and recommend corrective measures for most common hazards found in industry.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	FUNDAMENTALS OF SYSTEMS SAFETY - Definition of system safety terms. A review of the "factory" as a system and the significant "system" interfaces.
2	FUNDAMENTALS OF HUMAN FACTORS ENGINEERING - A review of the capabilities and limitations of man, man machine relationships and the design requirements necessary to fit man.
3	DESIGN AND LAYOUT - The significant considerations in site and facility planning are developed including transportation facilities, traffic control, waste disposal and lighting.
4	PLANNING CONSIDERATIONS - A study of the significant aspects of exits, floors, walkways, storage facilities, process flow and equipment layout in planning.
5	PLANNING CONSIDERATIONS - A continuation of planning consideration including floor loading, color & safety and principles of material handling.
6	PRINCIPLES OF GUARDING - A study of the types of mechanical motion and the basic types of mechanical hazards.
7	DESIGN AND CONSTRUCTION OF GUARDS - A review of Federal and State standards and their application to guard design. Design principles are developed in relation to the basic machine mechanisms.
8	MACHINE GUARDING APPLICATIONS - A practical study of specific machine problems covering machine tools, woodworking machines and power transmission equipment.
9	ELECTRICAL SAFETY - PRINCIPLES - A review of elementary electricity emphasizing its effects on man and the selection and installation of electrical equipment.
10	ELECTRICAL SAFETY - EMPLOYEE TRAINING AND SAFETY PROCEDURES - The role and value of employee training and development of safety procedures. Emergency procedures, lockout systems and grounding protection is emphasized.
11	MANUAL MATERIALS HANDLING - An examination of manual lifting techniques, accessories used in lifting and safe storage techniques.

<b>Week</b>	<b>Units of Instruction</b>
12	<b>WAREHOUSING AND MATERIALS HANDLING EQUIPMENT</b> A review of warehouse arrangement, traffic flow, lift truck operation and fire considerations. General types of hoisting apparatus are examined.
13	<b>RIGGING EQUIPMENT AND PROCEDURES</b> - A study of wire rope construction and use. Rigging methods and accessories are examined.
14	<b>CONVEYORS AND ELEVATORS</b> - Types of equipment and guarding techniques are studied. The principles of elevator operation, maintenance and inspection are examined.
15	<b>WELDING AND CUTTING OPERATIONS</b> - The hazards and use of oxygen, acetylene and hydrogen are studied. The principles of regulators and welding equipment are reviewed.
16	<b>RESISTANCE WELDING</b> - The principle and safety considerations of resistance and arc welding are examined.
17	<b>GENERAL SAFETY CONSIDERATIONS</b> - Miscellaneous hazards of welding are studied including ultra violet light, fire potential and working on closed containers. The role of protective clothing is reviewed.

**RECOMMENDED TEXT:**

**Accident Prevention Manual for Industrial Operations**, 6th Edit., Chicago: National Safety Council, 1967.

Public Law 91-596, December 29, 1970, "Occupational Safety and Health Act of 1970".

**COURSE TITLE: OSH 14 - Motor Fleet Safety**

**UNITS: 3**

**COURSE PREREQUISITES:**

OSH 11 - Introduction to Occupational Safety and Health or current assignment in safety work or driver supervision.

**CATALOGUE DESCRIPTION:**

A basic introduction to problems and practices of Motor Fleet Safety Programming with emphasis on regulatory requirements.

**COURSE OBJECTIVES:**

To develop ability to plan and administer safety program of small fleet or provide assistance in administration of large fleet program.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	THE COMMERCIAL MOTOR FLEET - An overview of the types of motor fleets and the kinds of loss experience and their costs.
2	THE TYPICAL FUNCTIONAL ORGANIZATION - A description of management organization and typical operating functions and their interrelationships.
3	SAFETY AS A LOSS PREVENTION ACTIVITY - The operating ratios of typical commercial motor fleets and the costs of accidents or losses of all types. Loss control potential in total operations.
4	DRIVER SELECTION - The need and purpose of good job descriptions and qualifications needed for professional performance, common industry practice.
5	FEDERAL AND STATE REGULATIONS - Department of Transportation and Department of Motor Vehicles requirements to driver qualification and requirements for driver certification.
6	DRIVER RECORDS AND PHYSICAL REQUIREMENTS - DOT requirements for driver's records, standard practices, DOT and DMV physical certification.
7	PSYCHO-PHYSICAL TESTING - Review of standard and required tests, their uses and limitations.
8	EXPERIENCE WITH TESTS - Each student will take and each student will administer standard tests under the supervision of the instructor.
9	THE TRAINING OF DRIVERS - An explanation of the factors affecting learning, determining the need for training, and typical training methods and new developments. Pre-trip and post-trip procedures.
10	PLANNING THE TRAINING PROGRAM - Planning instructional sequence, resources available, evaluating the instruction.
11	DRIVER SUPERVISION - Communicating with the driver, driver meetings, road patrols, dispatch control.
12	MECHANICAL RECORDING DEVICES - Types available, selling the driver, using the information effectively.

<b>Week</b>	<b>Units of Instruction</b>
13	MOTOR VEHICLE ACCIDENTS - A review of the techniques of accident investigation with particular emphasis on information required.
14	DETERMINING PREVENTABILITY - A study of accident causation using case studies and typical accident reports.
15	ACCIDENT REPORTS AND RECORDS - A description of DOT requirements and the needs of an internal system, examination of typical record-keeping systems. Accident reconstruction field exercises.
16	HANDLING OF DANGEROUS ARTICLES - A review of the special requirements for the classification, labeling, handling, placarding, loading and transport of dangerous articles. Description of control systems.
17	MANAGING A FLEET SAFETY PROGRAM - An overview of the principles of management as they would apply to a fleet safety program.

**RECOMMENDED TEXT:**

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1967.

**Motor Fleet Safety Supervision**, Institute of Public Safety, Penn. State University.

**COURSE TITLE:** OSH 15 - Physical Hazards Control II

**UNITS:** 3

**COURSE PREREQUISITES:** Satisfactory completion of OSH 13

**CATALOGUE DESCRIPTION:**

Continuation of OSH 13 - An examination of the control of physical hazards in the work environment.

**COURSE OBJECTIVES:** Same as OSH 13

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	HAND AND PORTABLE POWER TOOLS - A review of injury statistics and the control of accidents from this source. An examination of the maintenance, repair and use of specific tools.
2	POWER TOOLS - The techniques of inspection, repair, guarding and use. A general review of the operation of specific tools including pneumatic and powder activated tools.
3	PERSONAL PROTECTIVE EQUIPMENT - HEAD, EAR, EYE - An examination of the role of personal protective equipment in injury prevention emphasizing standard and specific equipment for head, ear and eye protection.
4	PERSONAL PROTECTIVE EQUIPMENT - FOOTWEAR, RESPIRATORY - A continuation of the examination of personal protective equipment emphasizing footwear and respiratory protection.
5	SAFETY BELTS AND PROTECTIVE CLOTHING - Conclusion of the examination of personal protective equipment covering clothing for protection from heat, electrical protection, and the inspection, testing and maintenance of safety belts and lifelines.
6	CHEMICAL HAZARDS - INJURY CAUSES, RESPONSIBILITY - A review of the causes of chemical accidents. The role of labeling, waste disposal and transportation in chemical accidents is discussed.
7	CHEMICAL HAZARDS - CONTROL METHODS - A review of typical hazardous chemical reaction and their control is presented. Protective equipment and biological hazards are studied.
8	HIGH PRESSURE SAFETY - A review of the physical properties of gases as related to accidents. Safe testing and installation of gauges, lines and equipment are studied.
9	COMPRESSED GAS CYLINDERS - GENERAL - A review of cylinder handling and storage. The use of manifolds, regulators and color coding for safe usage.
10	COMPRESSED GAS SYSTEMS - OPERATION AND MAINTENANCE - A review of the proper design, assembly operations, and maintenance of pressure systems.
11	ILLUMINATION - The role of lighting and safety are studied. Measurements, standards, quality, quantity, light sources are covered. The proper conduct of lighting surveys is reviewed.

<b>Week</b>	<b>Units of Instruction</b>
12	SLIPS, TRIPS AND FALLS - Slips, trips and falls as accident sources are studied. The construction consideration of floors, stairs, ladders and scaffolds are reviewed.
13	WORKING AT ELEVATIONS - A review of the inspection, testing and safety rules for ladders and scaffolds. The types and specifications for scaffolds.
14	INSPECTION TECHNIQUES - Inspections as a control technique are studied emphasizing types of inspections and inspection techniques.
15	SAFETY OBSERVER PLAN - The use of the observer program and safety sampling as accident control techniques is studied.
16	ACCIDENT INVESTIGATION - The techniques of accident investigation are developed emphasizing cause determination, system failure, and fact collection. Case study techniques are used.
17	ACCIDENT ANALYSIS - The analysis of investigation data considering automatic data processing systems, cost analysis and information utilization.

**RECOMMENDED TEXT:**

**Accident Prevention Manual for Industrial Operations**, (6th Edit.). Chicago: National Safety Council, 1967.

Public Law 91-596, December 29, 1970, "Occupational Safety and Health Act of 1970".

**COURSE TITLE:** OSH 16 - Elements of Industrial Hygiene

**UNITS:** 3

**COURSE PREREQUISITES:** Consent of Instructor

It is preferable that OSH 11 - Introduction to Occupational Safety and Health be completed prior to enrollment.

**CATALOGUE DESCRIPTION:**

A basic introduction to the field of Industrial Hygiene. A survey of the effects of toxic agents on the body and general methods of control.

**COURSE OBJECTIVES:**

To develop understanding of broad concepts of Industrial Hygiene and to develop ability to recognize potentially hazardous environmental conditions.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	HISTORY, RESPONSE TO TOXIC MATERIAL - The history of man's exposure to toxic materials from the ancients to the OSH Act of 1970. A review of the acute and chronic response of the body to toxic material.
2	ROUTES OF ENTRY INTO BODY - LUNGS - An anatomical review of the lungs. The relation of breathing rate, lung capacity, particle size and retention to toxic inhalants is studied.
3	ROUTES OF ENTRY INTO BODY - SKIN - An anatomical review of the skin covering the epidermis, dermis and subcutaneous tissue. Dermatitis and its cause is studied in depth.
4	ROUTES OF ENTRY INTO BODY - INGESTION - An anatomical review of the digestive tract with emphasis on the resultant damage on the liver and kidney. The specific effects of selected materials are studied.
5	THRESHOLD LIMIT VALUES - The concept of threshold values is studied emphasizing the source of values, use and misuse and units of expression. Record keeping is emphasized.
6	TOXIC AGENTS - SOLVENTS, GASES AND VAPORS - The effects of these materials is studied. Routes of entry - inhalation, ingestion, and skin absorption are reviewed. The effect of inert gases and oxygen deficiency are studied.
7	TOXIC AGENTS - DUSTS, MISTS - An examination of the effects on man. The relation of particle size to and effect on the body is studied.
8	TOXIC AGENTS - DUSTS, FUMES, SMOKE - An examination of the effects on man.
9	IONIZING RADIATION - An examination of ionizing radiation and its effects on man.
10	NON-IONIZING RADIATION - Light, ultra violet, infra red, lasers and radio frequency are studied emphasizing unit of measurement, effects on man and exposure standards.

<b>Week</b>	<b>Units of Instruction</b>
11	TEMPERATURES; PRESSURE: NOISE AND VIBRATION - Temperature and pressure measurement and effects on man are studied. Anatomy of the ear, hearing physiology and units of noise measurement are studied.
12	NOISE - The exposure standards, measurement and control techniques are studied.
13	CONTROL MEASURES - VENTILATION - Exhaust ventilation is studied emphasizing laminar and turbulent flow and capture velocity concepts. Typical ventilation problems are examined.
14	CONTROL MEASURES - ISOLATION, SUBSTITUTION - LABELING - Isolation, substitution and labeling are studied as control techniques. Practical case problems are studied.
15	CONTROL MEASURES - PROTECTIVE EQUIPMENT - Protective clothing as related to toxic materials is reviewed. The role and use of respirators is studied in depth.
16	SANITATION IN THE WORK PLACE - The potential effects on man of water supply, liquid waste, solid waste, insect and rodent control and food handling is examined.
17	ENVIRONMENTAL CONCERNS - Federal policies on air and water pollution are examined. The resources of local, state and federal agencies are reviewed.

**RECOMMENDED TEXT:**

**Fundamentals of Industrial Hygiene**, National Safety Council, 1971.

**Industrial Environment - Its Evaluation and Control**, Washington, D.C.: U.S. Department of Health, Education and Welfare, Public Health Service.

**COURSE TITLE: OSH 17 - Industrial Fire Protection**

**UNITS: 3**

**COURSE PREREQUISITES:**

Mathematics, Chemistry and Physics are recommended, or consent of Instructor.

**CATALOGUE DESCRIPTION:**

A survey course covering fire cause, building construction, flammable materials, private fire protection and codes and laws.

**COURSE OBJECTIVES:**

- Understanding of the principle causes of fires, and the scope of the problem.
- Knowledge of the operation and maintenance of fire fighting devices and systems, building materials, flammable solids, liquids, and gases and of laws and regulations.
- Ability to maintain and operate fire detection and fire fighting equipment and systems.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	INTRODUCTION - In this session the purpose of the course is given, the magnitude of the fire problem is indicated and general comments about building, construction, occupancy and fire fighting by both industrial and public fire departments are made.
2	THE FIRE PROBLEM - The chemistry and physics of fires and explosions are discussed with emphasis on the time-temperature curve. In greater detail, principal causes of fires and fires by occupancy are reviewed.
3	BUILDING CONSTRUCTION - Principal types of building materials and assemblies are studied and leading types of interior finishes are analyzed.
4	PROTECTING STRUCTURES FROM FIRES - This subject is reviewed in regard to restrictions on height and area, protection of vertical and horizontal openings and protection from exposure. Fire loading principals are discussed.
5	BUILDING EQUIPMENT AND FACILITIES - Protection of heat producing equipment, air conditioning and ventilating systems, electric light and power systems and blower and exhaust devices are reviewed. Life safety design is discussed.
6	FLAMMABLE LIQUIDS AND GASES - The properties, identification, storage and dispensing of frequently used flammable liquids and gases are reviewed. The proper safeguarding and operation of ovens, driers and furnaces is analyzed.
7	FLAMMABLE SOLIDS - Properties and protection of such flammable solids as explosive dusts, combustible fibers, explosives, resins, plastics, oxidizing materials and radio active materials are reviewed.
8	PROCESS HAZARDS - Operational hazards, principally finishing, welding, cutting, warehouse storage, computers and the use of industrial trucks are reviewed with emphasis on good inspection procedures.
9	LOSSES CAUSED BY NATURAL DISASTERS - Discussion of property losses resulting from windstorms, earthquakes, floods and actions that can be taken to eliminate or reduce the extent of such losses.
10	FIRE STANDARDS - National Fire Protection Association codes, standards and recommended practices are reviewed and discussed.

<b>Week</b>	<b>Units of Instruction</b>
11	FIRE LAWS - Municipal and county regulations, State laws and Federal laws are reviewed. Emphasis is placed on the Federal Occupational Safety and Health Act of 1970.
12	PRIVATE FIRE PROTECTION - Principle aspects of private fire protection including mains and hydrants, gravity, suction and pressure tanks, fire pumps, and stand pipe and hose are reviewed. Waterflow hydraulics are covered.
13	DETECTION AND EXTINGUISHING SYSTEMS - The installation and operation of fire detection systems, automatic sprinkler systems and special systems such as foam, CO <sub>2</sub> , water spray, dry chemical are studied.
14	DETECTION AND EXTINGUISHING SYSTEMS (LABORATORY) - By means of a visit to an industrial or commercial establishment or through an appropriate laboratory demonstration fire detection and extinguishing system configurations or principles are outlined.
15	FIRE FIGHTING AND OTHER EMERGENCIES - The organization of personnel for proper response to fires and other emergencies is reviewed. Proper reporting procedures, operation of hand fire extinguishers and functions of emergency organizations are covered.
16	FIRE FIGHTING (LABORATORY) - By means of a visit to an appropriate fire department training location or by suitable laboratory demonstration the operation of various types of hand fire extinguishers and fire hose is shown.
17	CONCLUSION - A summary is made of principle concepts including building construction and occupancy, codes and laws, and fire fighting devices and activities. Their interrelationship using a systems approach is discussed.

**RECOMMENDED TEXT:**

**Fire Protection Handbook**, 13th Edition, Boston: National Fire Protection Association.

**Inspection Manual**, 3rd Edition, Boston: National Fire Protection Association.

**COURSE PREREQUISITES:**

OSH 16 - Elements of Industrial Hygiene is definite prerequisite, unless prior experience which instructor must evaluate.

**CATALOGUE DESCRIPTION:**

Exploration of basic categories of field instruments for detection of toxic substances with explanation of underlying theoretical principles.

**COURSE OBJECTIVES:**

To develop ability to select and use appropriate field equipment for monitoring toxic equipment under professional guidance.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	AIR CONTAMINANTS - GAS AND VAPORS - PARTICULATES - A review of the definition of terms and the collection properties of materials.
2	SAMPLING CONSIDERATIONS - The concept of representative sampling and sampling efficiency are studied. The effect of the nature of contaminant on sampling is examined.
3	CALIBRATION OF INSTRUMENTS - Specific calibration techniques are examined for: air flow metering devices, grab samplers, concentrating instruments and direct reading instruments.
4	CALIBRATION OF INSTRUMENTS (LABORATORY) - Volume calibration using a wet gas meter and flow rate calibrator using a manometer.
5	AIR SAMPLERS - A review of the following instruments: hand pump, piston pump, ejector, fans, vane pumps, diaphragm pump.
6	INERTIAL COLLECTORS - The theoretical principles are studied. The operation of impingers and cyclone collectors are studied in detail. Basic concepts of dust counting are covered.
7	AIR SAMPLERS, INERTIAL COLLECTORS (LABORATORY) - Samples are collected using impingers. Dust samples are counted.
8	DIRECT READING COLORIMETRIC INDICATORS - The theory and use of liquid reagents, chemically treated papers and indicating tubes is studied. The collection of samples for future laboratory analysis is covered.
9	DIRECT READING INDICATOR TUBES - The use and limitations of indicator tubes is examined. Various instruments and indicators are reviewed.
10	DIRECT READING COLORIMETRIC INDICATORS AND INDICATOR TUBES (LABORATORY) - Air pump calibration is conducted. A variety of colorimetric indicators and indicator tubes are used on unknown materials.

<b>Week</b>	<b>Units of Instruction</b>
11	DIRECT READING PHYSICAL INSTRUMENTATION - The theory of operation is studied. The general consideration of use - calibration, interferences, sensitivity and specificity is covered.
12	DIRECT READING PHYSICAL INSTRUMENTATION (LABORATORY) - The measurement of unknown concentrations of ozone, oxygen and combustible gas using the appropriate instrument.
13	DIRECT READING PHYSICAL INSTRUMENTATION (LABORATORY) - The measurement of unknown concentrations of carbon monoxide, mercury, halides and hydrocarbon using the appropriate instruments.
14	VENTILATION SURVEY INSTRUMENTATION - A study of the principles and instrumentation used in ventilation.
15	VENTILATION SURVEY INSTRUMENTATION (LABORATORY) - The use of vane anemometer, thermo anemometer, velometers and smoke tubes in evaluating ventilation systems.
16	NOISE EVALUATION - The study of the proper techniques used in noise survey instrumentation.
17	NOISE EVALUATION (LABORATORY) - Practical noise surveys are accomplished.

**RECOMMENDED TEXT:**

**Fundamentals of Industrial Hygiene**, National Safety Council, 1971.

**Industrial Environment - Its Evaluation and Control**, Washington, D.C.: U.S. Department of Health, Education and Welfare, Public Health Service.

**COURSE TITLE: OSH 19 - Human Factors in Safety**

**UNITS: 3**

**COURSE PREREQUISITES:**

OSH 11 - Introduction to Occupational Safety and Health  
May be taken concurrently

**CATALOGUE DESCRIPTION:**

Designed to acquaint the serious student with the physiological and psychological factors that contribute to accident causation, an exploration of theoretical and research findings.

**COURSE OBJECTIVES:**

To develop understanding of and appreciation for human factors in machine and environmental design and those factors as they influence accident causation.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	THEORIES OF ACCIDENT CAUSATION - A brief survey of significant and contemporary research, with overview of major theories and their application to accident prevention.
2	LIFE SCIENCES AND SAFETY - A review of the contributing disciplines, research methods and techniques and major contributions.
3	THE WHOLE MAN AT WORK - A view of the capabilities and limitations of man, of man as a thinking, feeling subsystem in a man-machine system.
4	PSYCHOLOGY AND SAFETY - Psychology's contributions to safety, training testing, indoctrination, understanding attitudes.
5	MOTIVATING EMPLOYEES FOR SAFETY - A review of contemporary theories of motivation and organizational behavior, their application to safety programming.
6	COMMUNICATIONS - An examination of the barriers to effective communication and of effective safety programs.
7	PHYSIOLOGY - An examination of the skeletal, muscle and respiratory systems with particular reference to environmental and work stresses.
8	PHYSIOLOGY (continued) - A look at the circulatory system, nervous systems and sense organs as determiners of the capabilities and limitations of man.
9	ENVIRONMENTAL STRESSES AND BODY RESPONSES - The effects of temperature, pressure, noise, fatigue and psychological stresses.
10	CHEMICAL EXPOSURES - A review of the concepts of toxicity, the modes of physiological attack and the normal control methods.
11	DESIGN FOR HUMAN FACTORS - Advantages and disadvantages of man vs. machine and typical concerns of man in relation to machine.
12	MAN AS A SUB-SYSTEM - A look at man-machine systems and the design of equipment for man as a sub-system.

<b>Week</b>	<b>Units of Instruction</b>
13	INDIVIDUAL DIFFERENCES - A look at the wide variation in human capabilities and the design requirements to cope with the variations.
14	HUMAN FACTORS AND PLANT DESIGN - A look at personal injuries and machine design with particular reference to human behavior patterns.
15	PLANT LAYOUT - Designing for human factors at the planning stage using OSHA or ANSI standards as guidelines.
16	SUPERVISION AND SAFETY - The supervisor's responsibilities and leadership as a trainer, as the man on the scene and discussion of tools to help the supervisor with his people.
17	HUMAN FACTORS IN PERSPECTIVE - An overview of the "people" problem and the means of coping with it.

**RECOMMENDED TEXT:**

**Accident Prevention Manual for Industrial Operations**, 6th Edition, Chicago: National Safety Council, 1967.

McCormick, E. J., **Human Factors Engineering**, New York: McGraw-Hill.

**COURSE PREREQUISITES:**

- OSH 11 - Introduction to Occupational Safety and Health
- OSH 13 - Physical Hazards Control I
- OSH 15 - Physical Hazards Control II

**CATALOGUE DESCRIPTION:**

Designed to acquaint the student with the common elements of a modern safety program.

**COURSE OBJECTIVES:**

To examine and define the structure of a typical industrial concern and the safety organization and its planning and budgeting process. To develop ability to plan and organize a program suitable for a typical facility.

**SUGGESTED TIME SCHEDULE AND SEQUENCE OF INSTRUCTION:**

<b>Week</b>	<b>Units of Instruction</b>
1	THE MODERN ORGANIZATION - An examination of the modern organization including the formal and informal organization, line and staff responsibilities, responsibilities of individual safety and health personnel. This is integrated into a general review of management principles.
2	SAFETY AND LOSS CONTROL ORGANIZATION - MANAGEMENT RESPONSIBILITIES - A review of management responsibilities as related to the establishment of policies, allocation of resources, implementation of programs and the enforcement of policies.
3	SAFETY AND LOSS CONTROL ORGANIZATION - SPECIALIZED STAFF - A study of the role of the specialized safety staff including its position in the organization, relationship to supervisors, and authority.
4	SAFETY AND LOSS CONTROL ORGANIZATION - PART-TIME FUNCTION, MEDICAL RESP. - An examination of methods of conducting a safety program or a part-time function shared with other duties. The role of insurance companies and medical supervision is covered.
5	ELEMENTS OF A SAFETY PROGRAM - ROLE OF COMMITTEES; POLICIES, ANALYSIS OF LOSS POTENTIAL - A study of the establishment and utilization of committees; the documentation of safety policy through manuals and handbooks; the techniques for analyzing the loss potential problem.
6	ELEMENTS OF A SAFETY PROGRAM - SAFETY PLANNING & BUDGETING - A review of the elements of program planning forecasting and the techniques of budgeting including the budget cycle, FTE concept and recharging.
7	ELEMENTS OF A SAFETY PROGRAM - CORRECTIVE PLAN, PRIORITIES - A study of the methods of developing a corrective plan based on adequate information gathering and interpretation. The methods of determining priorities is reviewed.
8	ELEMENTS OF A SAFETY PROGRAM - MANAGEMENT DECISION & ACTION - An examination of the techniques of advising management on decision and action including concepts of cost vs. risk, humanitarian concern and legal requirements.

Week	Units of Instruction
9	ELEMENTS OF A SAFETY PROGRAM - IMPLEMENTING PLAN - INSPECTION - The techniques of effectively implementing the safety plan are covered. The objective of safety inspections is examined covering standards, reports, techniques, and recommendations.
10	ELEMENTS OF A SAFETY PROGRAM - PHYSICAL PLANT MAINTENANCE & ACCIDENT INVESTIGATION - A review of the role of maintenance in plant safety. Accident investigation techniques are studied through the use of case studies.
11	ELEMENTS OF A SAFETY PROGRAM - COMMUNICATION, TRAINING - The techniques of safety communications are studied including media, programs, contests and family involvement. The role and techniques of safety training are reviewed.
12	ELEMENTS OF A SAFETY PROGRAM - MOTIVATION, REPORTS & STATISTICS - The techniques of safety motivation are studied considering employee needs, personalizing safety and award programs. Injury reporting systems are presented considering supervisory and employee responsibilities.
13	ELEMENTS OF A SAFETY PROGRAM - REPORTS & STATISTICS - Methods of reporting injury statistics are studied. Frequency and severity rates are calculated and OSH Act reporting requirements studied.
14	RISK MANAGEMENT - NATURE OF RISK, RISK ASSUMPTION - Nature of risk is examined including financial, production, and physical damage. The concept of risk assumption is reviewed.
15	RISK MANAGEMENT - RISK TRANSFER, RISK REDUCTION - The concept of risk transfer is reviewed considering costs and the role of insurance. Risk reduction techniques are studied.
16	RISK MANAGEMENT - RISK STATISTICS - The basic statistics of risk are presented including random events, probability and distribution. Product safety considerations are reviewed.
17	RESOURCES FOR THE SAFETY & HEALTH TECHNICIAN - ETHICS - Professional societies, insurance carriers, vendors, voluntary organizations, governmental agencies are reviewed as safety resources. Ethics, professional responsibility and liability are covered.

**RECOMMENDED TEXT:**

**Accident Prevention Manual for Industrial Operations**, 6th Edition, National Safety Council, 1969.

## RECOMMENDED PRINCIPAL TRAINING AIDS AND EQUIPMENT

The following is a suggested list of major equipment needed for the Occupational Safety and Health courses. Many other smaller items will be useful in demonstrations and practical experience. The instructor will frequently have his own sources or aids available. In addition suppliers are frequently most cooperative in providing samples or demonstration kits on a loan basis. Suppliers are also often willing to provide demonstrations of specialized equipment.

### OSH 13 and 15 - PHYSICAL HAZARDS CONTROL

Lifting Training Model -	1 required	\$ 75.00
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### OSH 14 - MOTOR FLEET SAFETY

Visual Testing Device -	1 required	365.00
Reaction Tester -	1 required	350.00

### OSH 17 - INDUSTRIAL FIRE PROTECTION

Flammable Liquid Demonstration Kit -	1 required	800.00
Cutaway Fire Extinguishers -	3 required (total)	325.00

### OSH 19 - HUMAN FACTORS IN SAFETY

Skeleton -	1 required	400.00
Heart-Lung Model -	1 required	100.00
Eye Model -	1 required	75.00
Ear Model -	1 required	75.00

### INDUSTRIAL HYGIENE LABORATORY COSTS

Following are estimates of Industrial Hygiene Instrument costs. The instrumentation is based on a 15 student laboratory with standard chemical laboratory facilities. The ideal goal would be one instrument for every two students, however, this is a very costly approach. The cost approach presented here is to provide at least one representative instrument for each category of instruments with duplication suggested for the less costly instruments. Costs provided are estimates and may be more or less when specific brand items are evaluated. The listing represents instruments for OSH 18. It is assumed that these instruments will serve as the source of instruments that are occasionally needed for demonstrations in OSH 16. Current Federal requirements for sampling equipment should be reviewed before purchasing laboratory equipment.

Instrument	Number of Instruments	Approximate Cost/Unit	Total Cost
Velometer Kit	1	\$350.00	\$350.00
Vane Anemometer	1	200.00	200.00
Thermoanemometer	1	300.00	300.00
Smoke Tubes	10 boxes	7.50	75.00
Rotameter	3	20.00	60.00
Wet Gas Meter	1	300.00	300.00
Impingers			
Large	3	38.00	114.00
Small	3	11.00	33.00
Personnel Samplers	3	240.00	720.00
Gravimetric Dust Samplers	7	50.00	350.00
Light Meter	3	70.00	210.00
Piston Pump	1	150.00	150.00
Vane Pump	1	150.00	150.00
Direct Reading Indicator Pump	3	75.00	225.00
Direct Reading Indicator Tubes	10 boxes	6.00	60.00
Oxygen Indicator	1	240.00	240.00
Mercury Detector	1	375.00	375.00
Halide Detector	1	750.00	750.00
Hydrocarbon Detector	1	650.00	650.00
Sound Level Meter	1	420.00	420.00
Combustible Gas Indicator	1	335.00	335.00
Microscope	1	500.00	500.00

## A NOTE ABOUT INSTRUCTIONAL METHODS

No specific recommendations pertaining to instructional methods have been made in this curriculum proposal. It is not that such concerns are unimportant, but rather, that qualified instructors can best suit the subject matter, facilities, and student abilities to the local resources and means available. Every opportunity should be utilized to include practical application and hands-on experience. Case studies, practical problems and audio-visual materials should be incorporated in the instructional program. Local business and industry can often provide useful resources.

Every effort should be made to obtain work experience or cooperative education opportunities for students. In cases where students are obtaining on-the-job experience, allowable work experience credit should be given and the OSH course that has corresponding educational value can be waived.

It is most important that instructors have adequate academic preparation as well as sufficient practical experience to enable them to relate both the theoretical and practical aspects of the subject matter to the students.



## **APPENDIX**

APPENDIX A.

Gilbert L. Rhodes AND ASSOCIATES

S A F E T Y   C O N S U L T A N T S

AREA CODE 415   444-4767  
1322 WEBSTER STREET  
OAKLAND, CALIFORNIA 94612

January 1972

Dear Sir:

The Federal Occupational Safety & Health Act of 1970 establishes far-reaching requirements upon employers and creates a demand for trained occupational safety and health personnel.

Our firm has been engaged by the Chancellor's Office, California Community Colleges, to determine the need and to assist in the development of a program to train occupational safety and health technicians. Your help is solicited. Your thoughtful responses on the enclosed questionnaire will help determine the need and the training requirements for technicians. Your answers, whether or not you currently employ occupational safety and health technicians, will be of significant value. We realize that you may not be able to respond to all the questions.

Funds for this project have been made available from the Federal Government as a result of the Occupational Safety and Health Act. With these funds California is pioneering the efforts in curriculum development for this occupational specialty. If, through this questionnaire, a significant need is demonstrated, technicians will be trained and made available.

Please return the questionnaire in the enclosed envelope as soon as possible. Those who desire will receive a summary of the results.

  
Gilbert L. Rhodes & Associates

Enclosures

**CALIFORNIA COMMUNITY COLLEGES  
EMPLOYMENT and CURRICULUM DEVELOPMENT SURVEY  
FOR OCCUPATIONAL SAFETY and HEALTH TECHNICIANS**

Conducted By  
GILBERT L. RHODES & ASSOCIATES  
Oakland, California

The purposes of this survey are to (1) obtain information about current utilization of safety and health personnel in California, (2) make estimates about the numbers and types of safety and health technicians who will be needed in the future, (3) determine if there is a need to offer safety and health programs in California Community Colleges, and (4) obtain information about the type and length of program that should be developed.

In this survey an occupational safety and health technician is defined as a person who possesses basic scientific knowledge and technical skills that allow him to support the activities of safety and health professionals. He is primarily concerned with the application of his knowledge in such tasks as monitoring, surveying and inspecting the safety and health aspects of a work place. His formal education is less than a baccalaureate degree. With proper training he may perform duties that are now done by professionals.

The technician position differs from the positions of safety engineer, safety director, or industrial hygienist who in this survey are defined as professionals. The professional position would require a baccalaureate or higher degree or a combination of education and responsible experience in safety and health activities.

1. Are you familiar with the requirements of the Occupational Safety and Health Act of 1970?  Yes  No

2. Who has the responsibility of developing your safety and health program? (Rank in order of time and effort contributed to your program.)

_____ Your Own Staff	_____ Association Staff
_____ Your Insurance Carriers	_____ (Other) _____
_____ Outside Consultant	_____

3. Who has the responsibility of carrying out your safety and health program? (Rank in order of time and effort contributed to your program.)

_____ Your Own Staff	_____ Association Staff
_____ Your Insurance Carriers	_____ (Other) _____
_____ Outside Consultant	_____

4. How many safety and health technicians and professionals (as defined above) are in your organization and what are their job titles?

FULL TIME	Job Titles	Number of:		% of Time spent on Safety & Health	Title of Person to whom he reports
		Technicians	Professionals		
_____	_____	_____	_____	100%	_____
_____	_____	_____	_____	100%	_____
_____	_____	_____	_____	100%	_____
_____	_____	_____	_____	100%	_____
_____	_____	_____	_____	100%	_____
PART TIME	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

5. What are the principle duties of full and part time safety and health personnel in your organization? (Indicate the number of people employed by the most appropriate description.)

Tech. _____ Prof. _____	Tech. _____ Prof. _____	Tech. _____ Prof. _____	Tech. _____ Prof. _____
_____ Safety Inspection	_____ Fire protection	_____ Safety program admin.	_____
_____ Safety training	_____ First aid and medical	_____ Claim settlement	_____
_____ Industrial hygiene	_____ Accident investigation	_____ (Other) _____	_____

6. What are the approximate annual salaries paid to full time safety and health personnel in your organization? (Indicate the number of people paid in each category.)

Tech. _____ Prof. _____	Tech. _____ Prof. _____	Tech. _____ Prof. _____	Tech. _____ Prof. _____
_____ Less than \$6,000	_____ \$8,000 - 10,000	_____ \$14,000 - 16,000	_____
_____ \$6,000 - 8,000	_____ \$10,000 - 12,000	_____ Over \$16,000	_____
_____	_____ \$12,000 - 14,000	_____	_____

7. How many **TECHNICIANS** have advanced in your organization in the last five years? (Indicate the number of people.)

\_\_\_\_\_ To professional safety and health positions  
\_\_\_\_\_ To other staff positions  
\_\_\_\_\_ To production  
\_\_\_\_\_ To sales  
\_\_\_\_\_ To management  
\_\_\_\_\_ Unknown  
\_\_\_\_\_ (Other) \_\_\_\_\_

8. To satisfy occupational safety and health staffing requirements in your organization, do you see a need to develop a Community College program to train **TECHNICIANS**?  Yes  No

8a. If yes, which of the following types of programs would best satisfy your needs for **TECHNICIANS** who are currently employed in safety and health by your organization? (Please rank in order of importance only those programs you feel necessary.)

\_\_\_\_\_ Day associate program (two years or 60 units) \_\_\_\_\_ Evening associate degree program  
\_\_\_\_\_ Day certificate program (less than 60 units) \_\_\_\_\_ Evening certificate program  
\_\_\_\_\_ Occasional day courses \_\_\_\_\_ Occasional evening courses

8b. What type of program should be planned for persons who have no safety and health experience but who, when properly trained, might be candidates for employment as **TECHNICIANS** in your organization? (Please rank in order of importance only those programs you feel necessary.)

\_\_\_\_\_ Day associated degree program (two years or 60 units) \_\_\_\_\_ Evening associate degree program  
\_\_\_\_\_ Day certificate program (less than 60 units) \_\_\_\_\_ Evening certificate program  
\_\_\_\_\_ Occasional day courses \_\_\_\_\_ Occasional evening courses

8c. What topics are most important in such a program? (Please rank in order of importance.)

\_\_\_\_\_ Mathematics \_\_\_\_\_ Psychology \_\_\_\_\_ Fire protection \_\_\_\_\_ Gov. laws & reg.  
\_\_\_\_\_ Statistics \_\_\_\_\_ Human relations \_\_\_\_\_ Industrial hygiene \_\_\_\_\_ Claim settlement  
\_\_\_\_\_ Physics \_\_\_\_\_ Bus. Administration \_\_\_\_\_ Motor vehicle safety \_\_\_\_\_ (Other) \_\_\_\_\_  
\_\_\_\_\_ Chemistry \_\_\_\_\_ Safety Engineering \_\_\_\_\_ Physiology \_\_\_\_\_

8d. From the following list of activities, which are the most important for a **TECHNICIAN** in your organization to perform? (Please rank in order of importance.)

\_\_\_ Safety engineering \_\_\_ Safety inspection \_\_\_ Motor vehicle loss control \_\_\_ Accident investigation  
\_\_\_ Industrial hygiene \_\_\_ Safety training \_\_\_ Record maintenance \_\_\_ Safety program operation  
\_\_\_ Fire protection \_\_\_ First Aid \_\_\_ and analysis \_\_\_ Claim settlement  
(Other) \_\_\_\_\_

9. Would you employ persons completing a Community College program that trained them to be occupational safety and health technicians?  Yes  No

9a. If 'yes', how many would you hire during: \_\_\_\_\_ 1972 \_\_\_\_\_ 1973 \_\_\_\_\_ 1974

How many additional occupational safety and health technicians will you have on your staff in 1982 beyond those currently employed? \_\_\_\_\_

9b. If 'no', how will your staffing requirements in safety and health be met?

\_\_\_\_\_ Training from within \_\_\_\_\_ Government inspectors \_\_\_\_\_ None needed  
\_\_\_\_\_ Outside evening courses \_\_\_\_\_ Experienced new hires \_\_\_\_\_ (Other) \_\_\_\_\_  
\_\_\_\_\_ for present employees \_\_\_\_\_ Outside Consultants \_\_\_\_\_

10. Additional Comments -  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

11. Identification -

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Name of Organization: \_\_\_\_\_

Address: \_\_\_\_\_

Type of Organization (Gov't, industry, etc.): \_\_\_\_\_ No. of Employees: \_\_\_\_\_

12. Do you wish to receive a summary of the questionnaire?  Yes  No

We would appreciate receiving your organization's job descriptions for safety and health professionals and technicians.

APPENDIX C.  
FOLLOW-UP POSTCARD

Gentlemen:

Some time ago, we sent you a questionnaire regarding the training of Occupational Safety & Health Technicians by California Community Colleges. Your response is urgently needed. Would you please take a few moments to complete and return the questionnaire.

Thank you.

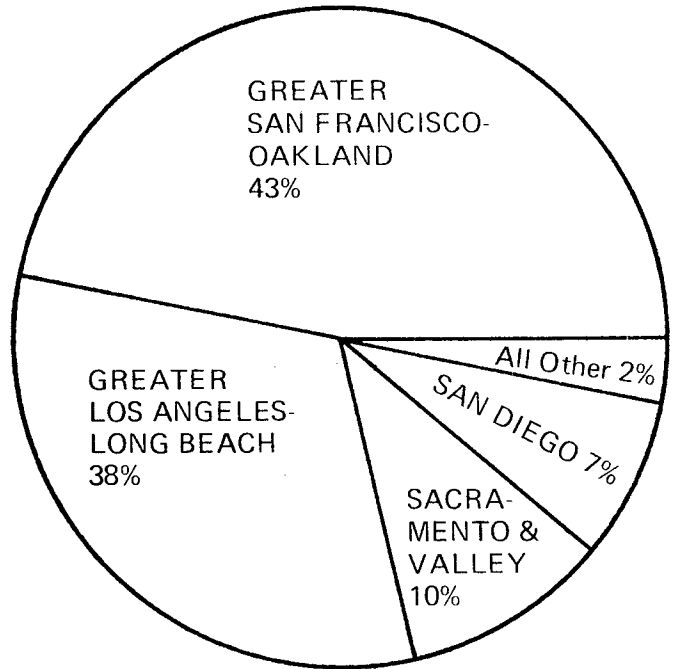
Gilbert L. Rhodes & Associates  
1322 Webster Street  
Oakland, Ca. 94612

**APPENDIX D.**  
**GEOGRAPHIC AREAS AND INDUSTRIES SURVEYED**  
**CHARTS 1 & 2**

RESPONSES BY GEOGRAPHIC AREA

LABOR FORCE IN CALIFORNIA  
 BY GEOGRAPHIC AREA\*

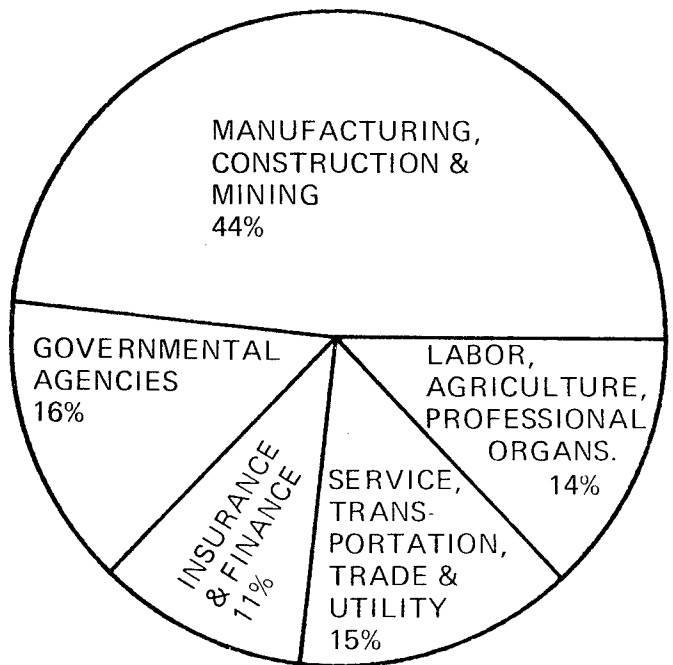
Greater Los Angeles- Long Beach	46%
Greater San Francisco- Oakland	22%
Sacramento & Valley	10%
San Diego	5%
All Other	17%



RESPONSES BY INDUSTRY

LABOR FORCE IN CALIFORNIA  
 BY INDUSTRY\*

Mfgr., Const. & Mining	26%
Governmental Agencies	17%
Insurance & Finance	5%
Service, Transportation, Trade & Utility	48%
Labor, Agriculture, Professional Orgns.	4%



\* State of California, **California Statistical Abstract**, 1970.

APPENDIX E.  
TABULATION FROM SURVEY QUESTIONS BY GEOGRAPHIC AREA

(For 257 Respondents)

	<u>San Francisco</u>	<u>Los Angeles</u>	<u>Sacto &amp; Valley</u>	<u>San Diego</u>	<u>All Other</u>	<u>All of the State</u>
<b>1. Are you familiar with the OSH Act?</b>						
Yes	97%	94%	96%	100%	100%	96%
No	3%	4%	—	—	—	3%
No Response	—	2%	4%	—	—	1%
<b>2. Who has the responsibility of developing program? (rank order)</b>						
Own Staff	1	1	1	1	1	1
Insurance Carriers	2	2	2	2	2	2
Association Staff	4	3	3	3	3	3
Other	3	4	4	4	—	4
Consultants	5	5	—	—	—	5
<b>3. Who has the responsibility for carrying out your program? (rank order)</b>						
Own Staff	1	1	1	1	1	1
Insurance Carriers	2	2	2	2	2	2
Association Staff	3	3	4	3	4	3
Other	4	5	3	4	3	4
Consultants	5	4	—	—	—	5
<b>4. How many technicians and professionals in organization?</b>						
Full-time Professionals	514	232	45	25	2	818
Part-time Professionals	83	39	22	4	3	151
Full-time Technicians	231	58	14	10	0	313
Part-time Technicians	168	420	45	94	0	727
Total Full-time	745	290	59	35	2	1131
Total Part-time	251	459	67	98	3	878
<b>5. Duties of professionals? (rank order)</b>						
Safety Program Administration	2	1	1	2	3	1
Safety Training	1	2	7	4	1	2
Fire Protection	3	6	4	1	4	3
Safety Inspection	5	3	2	3	2	4
Accident Investigation	6	4	5	5	5	5
Industrial Hygiene	4	5	6	—	6	6
First Aid and Medical	7	7	8	6	7	7
Claim Settlement	8	8	9	7	—	8
Other	9	9	3	8	—	9

	<u>San Francisco</u>	<u>Los Angeles</u>	<u>Sacto &amp; Valley</u>	<u>San Diego</u>	<u>All Other</u>	<u>All of the State</u>
<b>5. Duties of Technicians? (rank order)</b>						
Safety Training	1	3	1	7	2	1
Safety Inspection	2	2	2	1	3	2
Safety Program Administration	3	6	8	2	1	3
Fire Protection	6	1	4	4	4	4
Accident Investigation	4	4	5	6	—	5
First Aid and Medical	5	5	6	3	5	6
Industrial Hygiene	7	7	3	—	—	7
Claim Settlement	8	8	7	5	—	8
Other	—	—	—	—	—	9
<b>6. What are approximate annual salaries?</b>						
Professionals	\$14,454	14,500	14,048	12,213	13,000	14,337
Technicians	\$11,214	11,546	8,555	10,316	9,000	11,156
<b>7. How many technicians have advanced in your organization in last 5 years?</b>						
To Professional Safety & Health	61	37	11	8	2	119
To Other Staff	55	15	6	1	0	77
To Production	9	7	0	0	0	16
To Sales	4	1	0	0	0	5
To Management	12	19	5	0	0	36
Other	5	0	2	0	0	7
<b>8. Do you see a need for a Community College Program?</b>						
Yes	61%	60%	67%	94%	40%	63%
No	32%	30%	16%	6%	40%	28%
No Response	5%	8%	17%	0	20%	8%
Unknown	2%	2%	0	0	0	1%
<b>8a. If yes, which program is best for technicians currently employed? (rank order)</b>						
Evening Degree	1	1	1	1	—	1
Evening Certificate	2	2	3	2	1	2
Day Degree	3	3	2	3	—	3
Occasional Evening Course	4	4	4	4	—	4
Day Certificate	5	5	5	5	—	5
Occasional Day Course	6	6	6	6	—	6
<b>8b. What program is best for training potential employees for your organization? (rank order)</b>						
Day Degree	2	1	1	2	4	1
Evening Degree	1	2	2	1	1	2
Evening Certificate	3	3	3	3	2	3
Day Certificate	5	4	4	5	—	4
Occasional Evening Course	4	5	6	4	3	5
Occasional Day Course	6	6	5	6	—	6

	<u>San Francisco</u>	<u>Los Angeles</u>	<u>Sacto &amp; Valley</u>	<u>San Diego</u>	<u>All Other</u>	<u>All of the State</u>
<b>8c. What topics are most important?</b> (rank order)						
Safety Engineering	1	1	1	1	1	1
Human Relations	2	3	2	2	2	2
Industrial Hygiene	3	2	7	5	5	3
Fire Protection	4	5	4	3	3	4
Govt. Laws and Regulations	5	4	3	8	4	5
Psychology	6	6	5	6	7	6
Motor Vehicle Safety	7	7	6	4	12	7
Chemistry	8	8	8	10	11	8
Statistics	9	9	10	7	9	9
Business Administration	13	10	9	12	6	10
Physics	11	12	14	11	10	11
Mathematics	12	14	11	9	8	12
Physiology	10	13	12	13	13	13
Claim Settlement	14	11	13	14	14	14

**8d. What activities are most important?**  
(rank order)

Safety Inspection	1	2	1	1	2	1
Safety Engineering	2	1	2	5	5	2
Safety Training	3	3	5	3	3	3
Accident Investigation	4	4	4	2	7	4
Safety Program Administration	5	6	3	9	1	5
Industrial Hygiene	6	5	7	8	6	6
Fire Protection	7	7	6	4	4	7
Record Maintenance and Analysis	8	8	8	7	10	8
Motor Vehicle Safety	9	10	9	6	9	9
First Aid and Medical	10	9	10	—	8	10
Claim Settlement	11	11	11	10	11	11

**9. Would you employ people completing program in Community Colleges?**

Yes	56%	65%	64%	66%	60%	61%
No	28%	27%	8%	17%	40%	25%
No Response	16%	8%	28%	17%	—	14%

**9a. If yes, how many during:**

1972	20	22	34	2	1	79
1973	44	38	34	5	0	121
1974	41	36	16	6	0	99
How many additional by 1982	138	112	36	21	1	308

**9b. If no, how will requirements be met?**  
(rank order)

Training From Within	1	1	1	1	1	1
Experienced New Hires	2	2	2	—	2	2
Outside Evening Course	3	3	3	2	—	3
Outside Consultants	5	4	4	—	—	4
None Needed	4	7	—	3	3	5
Government Inspectors	6	5	5	—	—	6
Other	7	6	6	—	—	7

	<u>San Francisco</u>	<u>Los Angeles</u>	<u>Sacto &amp; Valley</u>	<u>San Diego</u>	<u>All Other</u>	<u>All of the State</u>
<b>Number of Respondents</b>	110	98	26	18	5	257
<b>Percent of the Total</b>	43%	38%	10%	7%	2%	100%
<b>Type of Organization</b>						
Federal Government	7	5	6	5	0	23
State Government	1	0	3	1	0	5
Local Government	3	8	1	1	0	13
Manufacturing, Construction, and Mining	53	48	4	4	5	114
Service, Trade, Transportation, and Utility	21	13	2	2	0	38
Insurance and Finance	15	10	1	3	0	29
Labor, Agriculture, and Professional	10	14	9	2	0	<u>35</u>
						257

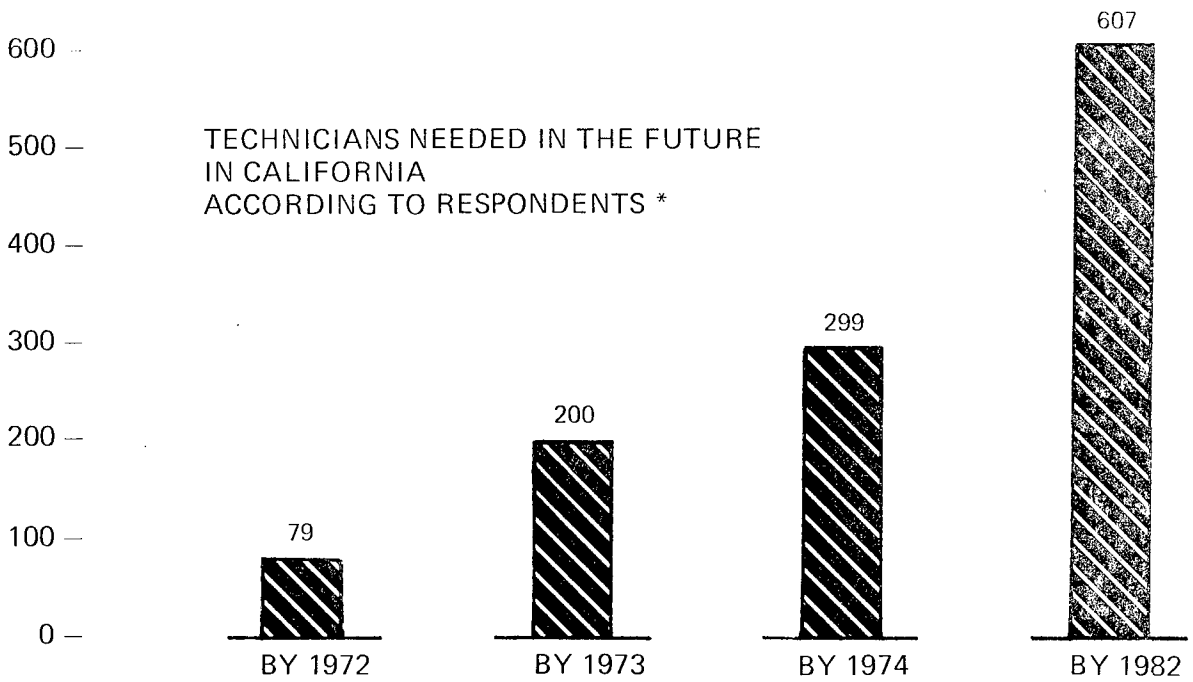
APPENDIX F.  
SURVEY RESULTS BY INDUSTRY

(For 257 Respondents)

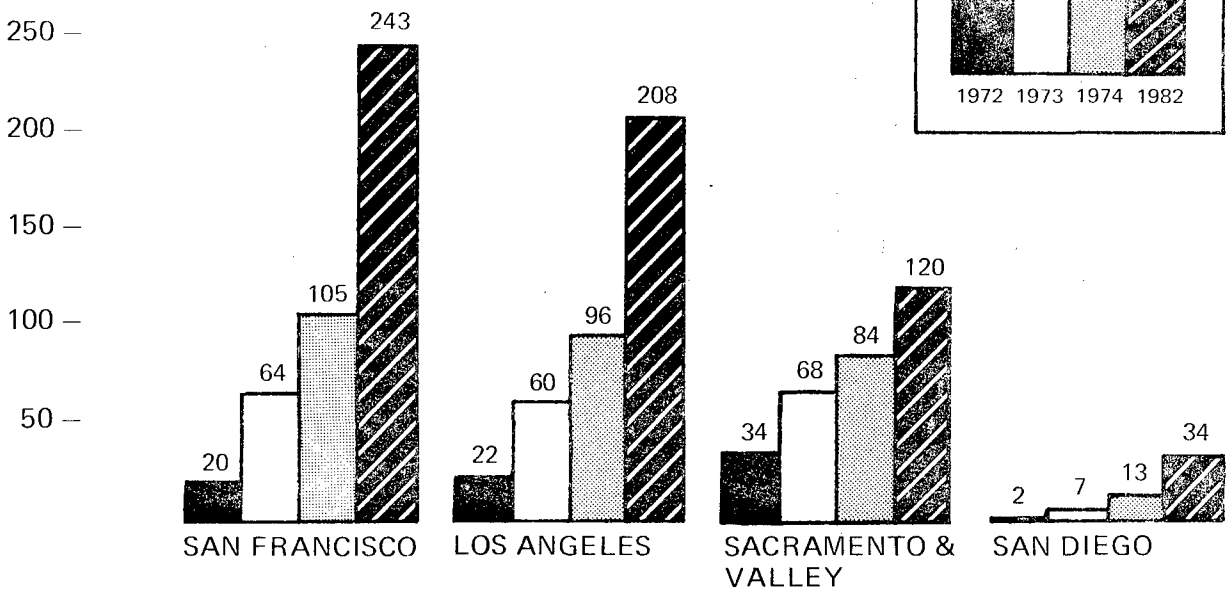
	<u>Fed. Govt.</u>	<u>State Govt.</u>	<u>Local Govt.</u>	<u>Mfg. Const.</u>	<u>Serv. Trans. Utility</u>	<u>Insur. Finan.</u>	<u>Other Labor Agr. Profs.</u>	<u>All Total</u>
<b>How many technicians and professionals in organization?</b>								
Full-time Professionals	92	225	24	165	85	145	89	825
Part-time Professionals	11	2	5	89	12	1	12	132
Full-time Technicians	38	0	7	43	44	159	15	306
Part-time Technicians	74	0	43	407	214	2	6	746
Total Full-time	130	225	31	208	129	304	104	1131
Total Part-time	85	2	48	496	226	3	18	878
<b>What are approximate annual salaries?</b>								
Professionals	\$13,772	13,669	13,750	13,723	14,728	12,383	14,083	14,337
Technicians	\$10,750	—	11,750	10,448	15,786	10,372	11,111	11,156
<b>Do you see a need for Community College Program?</b>								
Yes	94%	84%	54%	57%	66%	67%	57%	63%
No	6%	16%	46%	34%	30%	23%	17%	28%
No Response	0	0	0	7%	2%	10%	20%	8%
Unknown	0	0	0	2%	2%	0	6%	1%
<b>Would you employ people completing program in Community College?</b>								
Yes	75%	33%	62%	58%	58%	67%	55%	61%
No	15%	17%	38%	28%	16%	17%	21%	25%
No Response	10%	50%	0	14%	26%	16%	24%	14%
<b>If yes, how many hired during:</b>								
1972	9	0	3	18	9	12	28	79
1973	16	11	6	31	13	16	28	121
1974	12	5	5	40	13	18	6	99
How many additional by 1982?	24	20	22	104	43	69	26	308

	<u>Fed</u> <u>Govt.</u>	<u>State</u> <u>Govt.</u>	<u>Local</u> <u>Govt.</u>	<u>Mfg.</u> <u>Const.</u>	<u>Serv.</u> <u>Trans.</u> <u>Utility</u>	<u>Insur.</u> <u>Finan.</u>	<u>Other</u> <u>Labor</u> <u>Agr.</u> <u>Profs.</u>	<u>All</u> <u>Total</u>
<b>What topics are most important?</b> (rank order)								
Safety Engineering	1	2	1	1	1	1	1	1
Human Relations	2	3	2	3	2	2	3	2
Industrial Hygiene	4	4	5	2	4	4	2	3
Fire Protection	5	6	8	4	3	3	5	4
Government Laws and Regulations	7	1	6	5	5	7	4	5
Psychology	6	7	3	6	7	6	7	6
Motor Vehicle Safety	3	5	7	7	6	5	8	7
Chemistry	8	13	11	9	13	8	6	8
Statistics	9	8	12	8	9	11	10	9
Business Administration	11	14	9	10	8	12	12	10
Physics	12	11	10	11	14	9	13	11
Mathematics	10	9	4	12	12	10	9	12
Physiology	13	12	13	13	11	13	11	13
Claim Settlement	14	10	14	14	10	14	14	14
<b>What activities are most important?</b> (rank order)								
Safety Inspection	1	1	1	1	2	2	2	1
Safety Engineering	5	7	2	2	1	1	1	2
Safety Training	3	4	3	4	3	4	5	3
Accident Investigation	4	5	4	3	5	3	3	4
Safety Program Administration	2	2	5	7	4	6	6	5
Industrial Hygiene	8	8	6	5	6	5	4	6
Fire Protection	7	3	7	6	7	7	7	7
Record Maintenance and Analysis	9	6	9	8	9	8	8	8
Motor Vehicle Safety	6	9	10	10	8	10	9	9
First Aid	10	10	8	9	10	9	10	10
Claim Settlement	11	11	11	11	11	11	11	11
<b>Number of Interviews and Questionnaires</b>	23	5	13	114	38	29	35	257
<b>Percent of Total</b>	9%	2%	5%	44%	15%	11%	14%	100%

APPENDIX G.  
ESTIMATED NEEDS FOR TECHNICIANS  
CHARTS 3 & 4



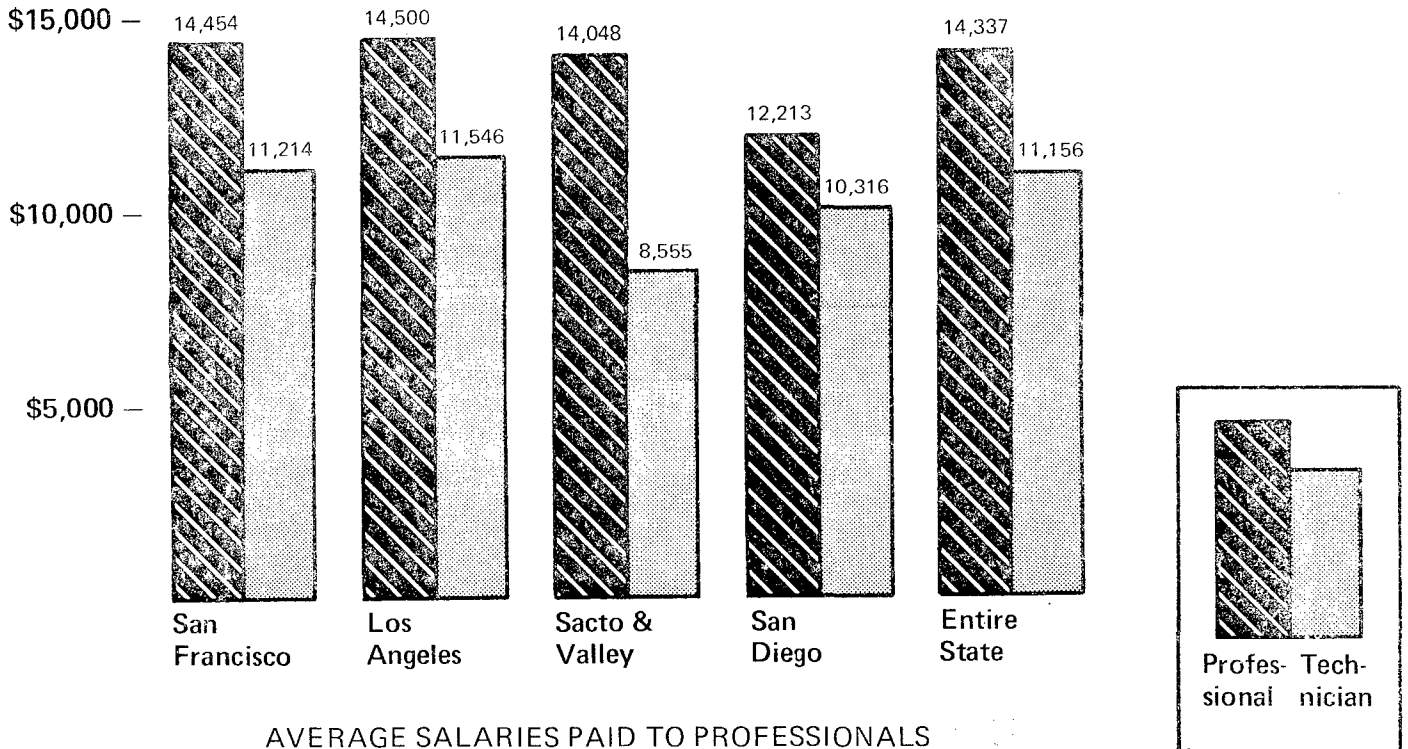
TECHNICIANS NEEDED  
IN CALIFORNIA  
BY GEOGRAPHIC AREA  
ACCORDING TO RESPONDENTS \*



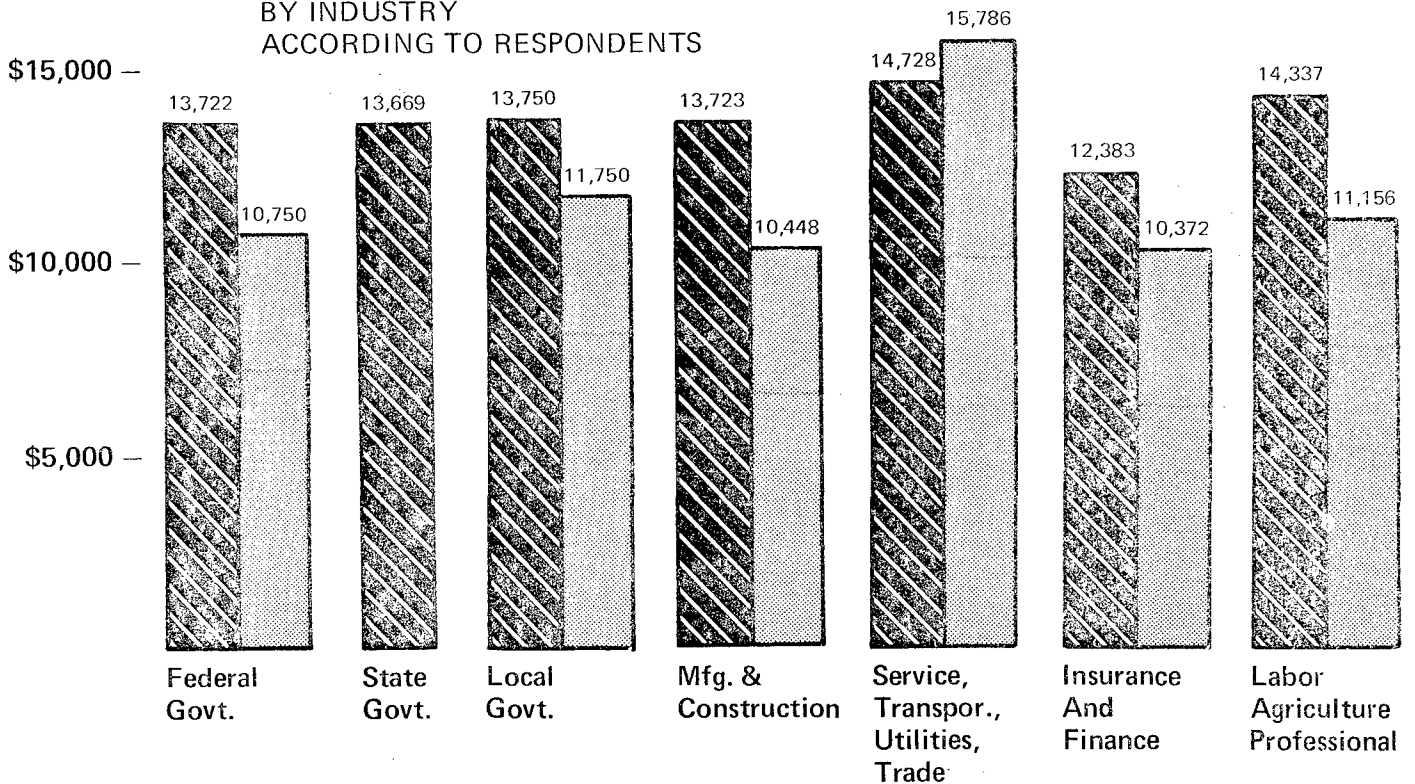
\* WHEN INTERPRETING THIS DATA IT SHOULD BE RECOGNIZED THAT THE STATISTICS REPRESENT ONLY THE NEED FOR TECHNICIANS BY THE 257 RESPONDENTS. THE TOTAL NEEDS SHOULD BE SIGNIFICANTLY HIGHER. GEOGRAPHIC COMPARISON MAY NOT RELATE BECAUSE OF DIFFERENCES IN NUMBERS AND TYPES OF RESPONDENTS.

APPENDIX H.  
AVERAGE SALARIES PAID  
CHARTS 5 & 6

AVERAGE SALARIES PAID TO PROFESSIONALS  
AND TECHNICIANS IN CALIFORNIA  
ACCORDING TO RESPONDENTS



AVERAGE SALARIES PAID TO PROFESSIONALS  
AND TECHNICIANS IN CALIFORNIA  
BY INDUSTRY  
ACCORDING TO RESPONDENTS



APPENDIX I.  
GENERAL COMMENTS FROM QUESTIONNAIRES

**QUESTION: What are your general comments about the proposed program?**

FEDERAL GOVERNMENTAL AGENCY	"Stress safety selling vs. safety enforcement - direct safety resources toward the fact rather than 'after the fact' "
SERVICE ORGANIZATION	"As awareness of the effects of OSHA grows the need for trained personnel will be appreciated"
INSURANCE COMPANY	"Presently individuals qualifying for our technical safety positions must have a baccalaureate degree or A.A. degree plus two years experience. However, the availability of well qualified safety technicians could alter these prerequisites"
INSURANCE COMPANY	"The technician program is definitely needed particularly in the millions of smaller industries and construction firms that are not large enough to afford the safety professional . . . . ."
LARGE MANUFACTURER	"Industrial hygienists will be in great demand for the next 15 years providing OSHA stays in force"
UTILITY	"Community College trained staff would complement staff personnel who have 'come up the ranks' and who have received training from within and by outside evening courses"
LARGE MANUFACTURING	"Your concept is greatly needed throughout California, especially for the smaller company"
INSURANCE	"We ordinarily hire people with four year technical degrees and train them in safety ourselves. However, I can see a growing need for safety technicians among our policyholders and think there is a great need for such a program. Also needed is safety training for people who will hold supervisory positions"

APPENDIX J.  
INTERVIEW QUOTES

DESIRABLE WORK HABITS, ATTITUDES AND OTHER PERSONAL  
CHARACTERISTICS OF A SAFETY AND HEALTH TECHNICIAN

**QUESTION: What personal characteristics, work habits and attitudes should an occupational safety and health technician possess?**

GOVERNMENT:

1. "reliability, maturity, integrity of skill regarding safety measurement"
2. "strong desire to do safety work, good health, stamina, dependable, self-confident, not looking for rewards, understanding of motivation"

MANUFACTURING:

1. "worker, leadership, initiative, project ideas, get along with others"
2. "able to put himself across and indicate how to do it"
3. "right personality - able to train others, get along and communicate with others, able to convince"
4. "be able to deal with people"
5. "get along well but, independent thinker, people oriented but familiar with engineering aspects of the business"

SERVICE:

1. "mature and able to establish rapport"
2. "ability to learn safety practices, rules and regulations, understanding of how people relate to work, pleasant personality, tenacity if necessary"
3. "practical down to earth man, ability to sell"
4. "understand self and how self relates to and effects other people"
5. "must be salesman, motivation, basic knowledge of industry"

AGRICULTURE:

1. "motivation and communications, calm and stable personality"

INSURANCE:

1. "get along with people, positive, warm, empathy, humor, able to adjust speech to fit circumstance"
2. "person able to recognize hazards of various sorts, physical or health, able to sell safety, good personality, neat, ability to speak out and get along with public and clients"
3. "feel for and understanding of people, verbal communication"
4. "some selling abilities, able to get along with people, make favorable impression"

PROFESSIONAL:

1. "able to accept responsibility, have patience, respect for people and desire to want to help them, must have skills to listen to people and sensitivity to desires and needs of others"
2. "understanding of what makes people tick"
3. "emphasis on psychological aspects of working with people, develops management oriented safety program"

LABOR:

1. "be a worker, leadership, initiative, get along with others, project ideas"

**QUESTION: What knowledge and skills are necessary for occupational safety and health technicians in the area of safety engineering?**

GOVERNMENT:

1. "should have basic knowledge of equipment, pressure systems and systems in operations"
2. "mechanical operations of machinery, electrical, wood working, stresses, auto mechanics"
3. "standards and codes, capable of doing physical hazard recognitions and evaluation, instrument reading and interpretation"

MANUFACTURING:

1. "knowledge of electrical and mechanical"
2. "needs skills gained by education or experience in this area"
3. "must be able to guard machinery"

#### MANUFACTURING (continued)

4. "able to apply knowledge and recognize hazards and substandard situations"
5. "physical knowledge of equipment, machine operations and how to guard them"
6. "should know basic manuals, government codes and have experience"

#### SERVICE:

1. "basic understanding of physics, electricity, gas"
2. "ability to find solutions to problems and sell them; person should have mechanical ability to solve problems"
3. "not as important as other areas because it is assumed he will have guidance"
4. "knowledge of protective devices as machine guards, protective equipment, knowledge of proper work procedures for a variety of all jobs"

#### AGRICULTURE:

1. "a specialized industry should know of hazards in the specialized equipment and compatability of chemicals"

#### INSURANCE:

1. "knowledge of guarding machinery, operations and plant layout"
2. "know about materials, plant layouts, machine design, construction"
3. "knowledge of machinery, guarding, legal standards"
4. "requires knowledge of the physical sciences"

#### LABOR:

1. "working knowledge - know generally how jobs work"

#### PROFESSIONAL:

1. "should know what hazards he is dealing with"

**QUESTION: What knowledge and skills are necessary for occupational safety and health technicians in the area of fire protection?**

**INSURANCE:**

1. "general knowledge, equipment operation"
2. "construction basics, fluid flow, solvents, book knowledge of extinguishing systems, codes, fire fighting, brigades"
3. "flammable liquids, heat producing devices, welding construction, processes, know hazards and what to recommend"
4. "types of extinguishers, theoretical knowledge of systems, fire doors, life safety, codes, sources of information"

**GOVERNMENT:**

1. "recognize hazards, operation of equipment, not maintenance, use FPE when necessary"
2. "causes of fires, fire extinguishers, fire inspection, fire hose, automatic sprinkler systems, knowledge of operation and maintenance"
3. "NFPA codes, automatic sprinkler systems, detection, instrumentation, good knowledge of construction"

**MANUFACTURING:**

1. "basic laws and codes, fire brigade, drills, provide and maintain extinguishers and life safety"
2. "technical ability"
3. "able to operate and maintain automatic sprinkler and CO<sub>2</sub> systems and hand extinguishers"
4. "maintenance and operation of equipment, applications - extinguishers, drills, no design"
5. "know basic equipment, types of fires and how to operate equipment"

**SERVICE:**

1. "basic origins and causes of fires, types of combustible materials, basics of engineering, operations and maintenance of equipment, calibration"
2. "causes, chemicals, extinguishers, emergency procedures, fire protection in high rise buildings"
3. "general automatic sprinkler systems, operation and maintenance, planning and control of disaster fires"

SERVICE (continued)

4. "fire codes, maintenance of systems"

PROFESSIONAL ORGANIZATIONS:

1. "important one must be able to operate equipment, flammable liquids, how to train others, how to establish fire brigades or assist"
2. "basic codes, flame spread, flash point, how to maintain systems"

**QUESTION: What knowledge and skills are necessary for occupational safety and health technicians in the area of industrial hygiene?**

GOVERNMENT:

1. "able to operate measurement equipment, noise, temperature, extremes, simple interpretation, know how to research problems"
2. "basic knowledge, operate equipment and understand Threshold Limit Values, not interpretation of data"
3. "know when exposure exist - chemicals, gases, operate simple equipment, basic controls, inspection procedures"
4. "able to operate measurement equipment"

MANUFACTURING:

1. "general knowledge and how to operate equipment"
2. "how to use measurement equipment, knowledge of properties of chemicals and maximum exposures"
3. "make tests but not evaluate"
4. "know kinds of problems and operate some equipment, know a little about standards"
5. "able to analyze chemicals and correct hazards"
6. "ability to recognize and correct hazards - fumes, dusts, paints"
7. "able to use monitoring equipment - noise, dust, fumes"

SERVICE:

1. "good technician able to recognize problems and hazards, operate sound level, CO, (most important) velometer"
2. "some knowledge of basic chemicals, dusts, noise control, plating operations, recognize hazards"
3. "knowledge of principles including noise, toxic and hazardous materials, operate equipment"
4. "maximum allowable concentrations"
5. "general knowledge of conditions, noise, toxics, general health exposures"

AGRICULTURE:

1. "must know properties of chemicals and effects, illness exposures from toxic and noxious gases, pesticides"

INSURANCE:

1. "toxic measurement and sources of information, measuring and protective devices, measurement of exposures and basic interpretation"
2. "general book knowledge only"
3. "chemistry or physics background, able to use instruments to collect data and interpret it"
4. "noise, recognize problem and ability to make surveys and determine problem - dust, toxic, etc."

PROFESSIONAL:

1. "basic understanding - perform simple atmospheric tests, noise, light and heat"

LABOR:

1. "general knowledge and how to operate equipment"

**QUESTION: What knowledge and skills are necessary for occupational safety and health technicians in the area of government laws and regulations?**

**GOVERNMENT:**

1. "Occupational Safety and Health Act (OSHA)"
2. "basic knowledge of OSHA, general safety orders, etc."
3. "thorough knowledge of OSHA requirements"
4. "OSHA, State codes, ANSI codes, etc."

**MANUFACTURING:**

1. "knowledge of OSHA, State codes and laws"
2. "must know and how to interpret"
3. "should know very well"
4. "OSHA, pollution laws, codes and regulations"
5. "must know OSHA"

**SERVICE:**

1. "very important - how to interpret laws and consensus standards"
2. "know OSHA, State orders, compensation laws"
3. "know Federal and State laws and codes and be able to interpret them - legal interpretation and determining whether standards apply to job"
4. "understanding of laws and regulations - sensitivity to the law"

**AGRICULTURE:**

1. "OSHA and State laws"

**INSURANCE:**

1. "understand OSHA and standards, philosophy, significance of change"
2. "OSHA"
3. "very important - should know OSHA"

INSURANCE (continued)

4. "OSHA"

LABOR:

1. "knowledge of OSHA, State codes and laws"

**QUESTION: What knowledge and skills are necessary for occupational safety and health technicians in the area of motor vehicle safety?**

GOVERNMENT:

1. "good operator training program"
2. "California vehicle code, formal training such as Defensive Driver Course, mechanical aptitude"
3. "Defensive Driver Course or similar effective system, able to converse and instruct"
4. "accident prevention driver education, ability to train people"

MANUFACTURING:

1. "knowledge of motor vehicle safety"
2. "know concepts but do not do testing, Defensive Driver Course"
3. "operation of various types of equipment - cars, trucks, derricks, cranes, fork lifts, bulldozers, etc. Should know mechanics of equipment - uses and limitations of equipment"
4. "know all State codes, including truck ICC qualifications, Department of Transportation, know cargos, Defensive Driver Course instructor training"
5. "principles, able to work with salesman and drivers"

SERVICE:

1. "how to teach Defensive Driver Course, material handling equipment"
2. "safety aspects of handling non-licensed equipment as bulldozers, trenchers, etc."
3. "know how to maintain equipment"
4. "Defensive Driver Course certificate, operation of larger vehicles, maintenance of vehicles, operation of auxillary equipment"

AGRICULTURE:

1. "should know how to control losses on fork lifts, front end loaders, trucks, guarding of equipment important"

INSURANCE:

1. "should recognize hazardous conditions, maintenance, should know Defensive Driver Course"
2. "principles of motor vehicle safety"
3. "knowledge of fleet operations, maintenance of vehicles, training Defensive Driver Course"
4. "familiar with Department of Transportation codes, vehicle maintenance, driver selection, broad knowledge and where to get help"

PROFESSIONAL:

1. "specialized field - Defensive Driver Course valuable"

**APPENDIX K.  
SUGGESTED LESSON OUTLINE**

	pages
OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH.....	64 - 85
OSH 12 – SAFETY & HEALTH STANDARDS, CODES AND REGULATIONS ...	86 - 103
OSH 13 – PHYSICAL HAZARDS CONTROL I .....	104 - 120
OSH 14 – MOTOR FLEET SAFETY.....	121 - 137
OSH 15 – PHYSICAL HAZARDS CONTROL II.....	138 - 154
OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE.....	155 - 171
OSH 17 – INDUSTRIAL FIRE PROTECTION.....	172 - 192
OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE.....	193 - 209
OSH 19 – HUMAN FACTORS IN SAFETY .....	210 - 226
OSH 20 – SAFETY PROGRAM MANAGEMENT.....	227 - 253

**NOTE:**

Each weekly outline is preceded by a statement of objectives which identifies the major points the student should gain. It should be understood that each weekly objectives statement begins with, "At the completion of the week, each student should be able to . . . ."

## OSH 11 — INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline — Week 1 — **ORIENTATION**

**OBJECTIVES:** Identify major concerns and basic legal responsibilities for occupational safety and health by matching the general principles of safety with existing laws.

#### **OUTLINE:**

- I. ADMINISTRATION OF COURSE
  - A. Admission procedure as prescribed by college
  - B. Course Administration
    - 1. Text
    - 2. Mid-term, final and project requirements
- II. THE WORLD OF WORK
  - A. Ask for work experience of various students
    - 1. Ask for any contact with safety on jobs
    - 2. Ask for current ideas about occupational safety and health
  - B. Use latest Department of Labor Statistics for the following:
    - 1. Number of work establishments
    - 2. Number of people employed in broad categories
  - C. Kinds of jobs
    - 1. Use Dictionary of Occupational Titles
    - 2. Relate to possible job hazards
- III. THE SCOPE OF OCCUPATIONAL SAFETY AND HEALTH
  - A. Major industrial classifications
    - 1. Manufacturing
    - 2. Chemical
    - 3. Agriculture
    - 4. Construction
    - 5. Transportation
    - 6. Government
    - 7. Service
  - B. Typical safety and health concerns in each
    - 1. Manufacturing — mechanical hazards (explain)
    - 2. Chemical — toxicity (explain)
    - 3. Agriculture — mechanical, toxicity, biological, and physical stress
    - 4. Construction — mechanical, falls, physical stress
    - 5. Transportation — mechanical, physical stress, vehicular
  - C. Public and product liability
    - 1. Public access or public contact
    - 2. Product hazards
- IV. GENERAL PRINCIPLES OF OCCUPATIONAL SAFETY AND HEALTH
  - A. Prevention
    - 1. Correction
    - 2. Prediction
    - 3. Standards
    - 4. Statistics
    - 5. General duty
  - B. Inspection
    - 1. Standards as guides
    - 2. Check lists
  - C. Training
    - 1. Employer indoctrination
    - 2. Job training
  - D. Enforcement
    - 1. Policy
    - 2. Safety rules
    - 3. Self-policing
  - E. Motivation
    - 1. Incentives and contests
    - 2. Recognition
- V. SAFETY AND HEALTH AND THE LAW
  - A. General requirements of O.S.H.A.
    - 1. Basic purpose
    - 2. Record keeping and reporting
    - 3. Standards
    - 4. Inspections
    - 5. Penalties
  - B. State Labor Codes
    - 1. Basic requirements
    - 2. Implementation
    - 3. Enforcement agencies
  - C. Other legal requirements
- VI. SUMMARY
  - A. Work and Safety and Health
  - B. Major concerns
  - C. The law
  - D. Introduction to next session
    - 1. Safety and health is a long-time thing
    - 2. Modern concerns did not start from scratch

## **INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th edition), Chicago: National Safety Council, 1969.

**California Labor Code.**

**Occupational Safety and Health Act of 1970**, (P.L. 91-596).

**Title 8, Administrative Code**, State of California.

Session Outline – Week 2 – **HISTORICAL PERSPECTIVES**

**OBJECTIVES:** Relate the major historical antecedents to contemporary occupational safety and health practices.

**OUTLINE:**

- I. THE ANCIENTS
  - A. Slavery deeply routed in all cultures
    - 1. Some occupational diseases were recognized
    - 2. Life was cheap, little concern
  - B. Early concerns for occupational health
    - 1. Hippocrates – 5th Century BC
    - 2. Pliny the Elder (23-79 AD)
    - 3. Avicenna (780-1037)
    - 4. First Treatise on occupational hygiene in 1473
  - C. Rapid spread to other countries
  - D. The consequences
    - 1. Congestion – health hazard
    - 2. Unskilled, untrained workers
    - 3. Unfamiliar system
    - 4. Mechanical power vs. handpower
    - 5. Child labor
- II. THE CHANGING ECONOMY
  - A. The emerging factory system
    - 1. Origins in Italy – 15th and 16th centuries
    - 2. England and the cottage industries
    - 3. Developed from several sources
- III. THE INDUSTRIAL REVOLUTION
  - A. Basic requisites for development
    - 1. Economic demand
    - 2. Source of power and mechanization
    - 3. Standardization of product, specialization of task
    - 4. Labor supply
  - B. The rapid development
    - 1. Origins in British textile industry
    - 2. One development led to others
  - C. Two parallel approaches to problems
    - 1. Preventing injury and occupational disease
    - 2. Alleviating loss - workmen's compensation; industrial health facilities, rehabilitation
- IV. SUMMARY
  - A. Ancients to Industrial Revolution
    - 1. Life was cheap, but were concerns
    - 2. Natural disasters and epidemics were greater killers than accidents or industrial health problems
    - 3. Outlook, technology and social conditions were "primitive"
  - B. With factory systems problems became more apparent
    - 1. Muckrakers or other advocates of change
    - 2. Early efforts
  - C. The Safety Revolution

**INSTRUCTOR REFERENCES:**

- Buckingham, W., **Automation - It's Impact on Business and People**, New York: New American Library, 1963.
- Collis, E. L. and Greenwood, M., **Health of Industrial Workers**, London: Churchill, 1921.
- Hamilton, Alice, **Exploring the Dangerous Trades**, Boston: Little Brown and Company, 1943.
- Selleck, H. B., **Occupational Health in America**, Detroit: Wayne State University Press, 1962.

Session Outline – Week 3 – THE EMERGENCE OF THE SAFETY MOVEMENT

**OBJECTIVES:** Describe the contemporary professional occupational safety and health function by analysis of problems and their evolution.

**OUTLINE:**

- I. INTRODUCTION
  - A. The origins of the safety movement are in the human costs of the Industrial Revolution
    1. Development paralleled that of Workmen's Compensation - common goals
    2. Once compensation laws became effective, they provided further economic justification for safety efforts
    3. The same forces - humanitarian and economic - are operant today
  - B. The history of safety is related to history of several other fields
    1. Insurance - Workmen's Compensation, Fire, Public, Liability, etc.
    2. Industrial Medicine - in many instances the plant physician has been the initial force
    3. Industrial Hygiene - in time span it parallels safety
    4. Production Technology - particularly with regard to human factors
- II. THE EMERGING INTEREST IN SAFETY AND HEALTH
  - A. Roots had to be in modern industry
    1. Probably some rudimentary concern in apprentice system
    2. Factory brought concentrated safety and health problems
    3. Social mores were slow to change
    4. Compensation laws developed new philosophy
  - B. Slow development tied to past
    1. Factories were more efficient than crafts
    2. Machines were new ideas, hazards unrecognized
    3. Opinion reflected old idea of worker as an independent craftsman
    4. Slow progress
      - a) Factory inspections
      - b) National Safety Council
      - c) Development of A.S.S.E., N.F.P.A., I.H.A.
- III. THE PROFESSIONAL FUNCTION IN THE SAFETY AND HEALTH FIELDS
  - A. Identification and appraisal
    1. Exposure to accidents or physiological stress
    2. Loss producing conditions and practices
    3. Evaluation of hazards
  - B. Development of prevention procedures, controls and programs
  - C. Communications of control systems to those involved
  - D. Measurement and evaluation of program effectiveness
- IV. MANY INVOLVED IN OCCUPATIONAL SAFETY AND HEALTH
  - A. Organizations
    1. N.S.C., N.F.P.A., U.L.
    2. Foundations
    3. Schools, colleges, etc.
  - B. The professionals
    1. A.S.S.E.
    2. I.H.A.
    3. I.M.A.
    4. I.N.A.
    5. Fire
    6. A.C.G.I.H.
    7. S.S.S.
  - C. Professional certification
- V. SUMMARY
  - A. Slow development, but really moving - e.g. OSHA
  - B. Many involved
  - C. Workmen's Compensation laws a spur at first

## **INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition) Chicago: National Safety Council, 1969.

Milestones, **National Safety News**, 87, 5 (May '63) (excellent photos for slides)

Scope and Functions of the Professional Safety Position, **J. American Society of Safety Engineers**, 11, 12 (Dec. '66).

The Safety Revolution, **National Safety News**, 87, 5 (May '63).

Session Outline – Week 4 – **THE DEVELOPMENT OF WORKMEN'S COMPENSATION**

**OBJECTIVES:** State basic purposes and requirements of Workmen's Compensation and the law's influence on operating costs.

**OUTLINE:**

- I. INTRODUCTION
  - A. Basically Workmen's Compensation is a system to provide care for an injured worker and limit liability of industrial enterprises
    - 1. Medical treatment
    - 2. At least partial wages until return to work
    - 3. A pension to compensate for inability to return to full employment
  - B. Laws were a consequence of the factory system
    - 1. Increased number of injuries
    - 2. Loss of personal relationship and responsibility as with master-apprentice
    - 3. Burden on society of accident victims or their families
- II. THE DEVELOPMENT OF THE LAW
  - A. Before the Industrial Revolution
    - 1. No clearly defined legal responsibility for employees
    - 2. Generally local opinion forced master craftsman or employer to aid injured employee or apprentice
  - B. The Industrial Revolution brought significant changes
    - 1. Mass production and large-scale changes
    - 2. Change from hand tools to powered machinery
    - 3. Movement from home workshop to factory
    - 4. Increased number of injuries
  - C. Early recourse to the law
    - 1. Factory system brought "who's to blame" concept to fore
    - 2. Common law provisions
  - D. The early Workmen's Compensation Laws
    - 1. First in Germany in 1884
    - 2. Started in U.S. in 1885
    - 3. Early laws fought in court
- III. CONTEMPORARY COMPENSATION LAWS
  - A. Purpose
    - 1. Eliminates proof of employers negligence
    - 2. Substitutes system of certain, but limited liability
    - 3. Principle that liability is cost of operation
  - B. Changes from common law
    - 1. No proof of negligence required
    - 2. No right to sue for unlimited damages
    - 3. Eliminates speculative bargaining
    - 4. Provides standard benefits
  - C. General provisions of contemporary law
    - 1. Eliminates negligence
    - 2. Provides medical care
    - 3. Provides weekly payments
    - 4. Provides disability pension
    - 5. Covers occupational diseases
    - 6. 50% penalty for serious and wilful negligence
  - D. Needed changes
- IV. SUMMARY
  - A. Compensation Laws gave economic impetus to occupational safety and health
  - B. Implications
    - 1. Make accidents and illness a cost of doing business
    - 2. Can look toward increasing benefits
  - C. Third party recoveries

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Hanna, W. L., **Workmen's Compensation in California**, San Francisco: Mathew Bender and Co. (published annually).

Selleck, H. B., **Occupational Health in America**, Detroit: Wayne State University Press, 1962.

## OSH 11 - INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline - Week 5 -- THE DEVELOPMENT OF CODES AND STANDARDS

**OBJECTIVES:** Cite the sources, scope and application of safety standards by evaluating a simple manufacturing process in terms of standards that apply.

#### OUTLINE:

- I. DEFINITION OF STANDARDS
  - A. General definition
    - 1. Webster
    - 2. Has several meanings
    - 3. Safety standards include all meanings
  - B. Safety standards
    - 1. Consensus trade standards
    - 2. Professional safety standards
    - 3. Company standards
    - 4. Government agency standards
    - 5. Legislative standards
  - C. Standards, regulations, manuals, ordinances, statutes, public laws and state-of-the-art.
- II. THE DEVELOPMENT OF SAFETY AND HEALTH STANDARDS
  - A. General standards were attempt to bring order
    - 1. Confucius - 500 BC first standards
    - 2. Modern standards evolved after Industrial Revolution
    - 3. Industrial standardization
    - 4. Self regulation
    - 5. External regulation
  - B. Safety standards has slow development
    - 1. Social values and technology slow to change
    - 2. Early standards - usually result of catastrophic event - e.g. marine, Iroquois Theatre, Triangle Shirt Waste Fire
    - 3. Presently over 150 safety and health standards from ANSI alone
  - C. Other agencies developing standards
    - 1. NSC - data sheets
    - 2. NFPA
    - 3. ACGIH
    - 4. MCA, etc.
    - 5. Are consensus standards
  - D. All are sources of guidance
    - 1. Some are law - OSHA
    - 2. All are written by bloody experience
    - 3. Are guides for accident, illness and fire prevention
- III. THE SAFETY STANDARDS OF OSHA
  - A. Are generally adapted from Consensus Standards
    - 1. ANSI - examples
    - 2. NFPA - examples
    - 3. ACGIH - examples
    - 4. Others
  - B. Scope
    - 1. See index subparts
    - 2. Are also construction, marine and longshore standards
  - C. Example of detail
    - 1. Section 1910.21 - Walking, Working Surfaces
    - 2. Section 1910.24 - Stairways
  - D. Sample problems
    - 1. Bench grinder
    - 2. Fixed verticle ladder
    - 3. Flammable liquid storage
    - 4. Fork trucks
    - 5. Interpretations
  - E. Rule making
    - 1. Notice
    - 2. Due process
    - 3. Amendment
    - 4. Appeal
- IV. SUMMARY
  - A. Standards define the environmental conditions
  - B. Safety standards have been written by experience
  - C. Scope of problem is defined by experience
  - D. Real productive effort is to set standards before experience - e.g. radiation, system safety

#### **INSTRUCTOR REFERENCES:**

Blackman, A. C., Safety Standards - A discussion of their definition, concepts and potential uses, **J. American Society of Safety Engineers**, **10**, 4 (April '65).

**Federal Register**, Part II, **36**, 105 (May 29, 1971) or subsequent revisions.

Johnson, R. E., The Economics of Safety Standards, **J. American Society of Safety Engineers**, **7** (Jan. '62).

The Safety Revolution, **National Safety News**, **87**, 5 (May '63)

## OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline – Week 6 – OCCUPATIONAL INJURIES AND ILLNESSES

**OBJECTIVES:** Identify occupational losses by cause and relate them to national accident statistics.

#### OUTLINE:

- I. INTRODUCTION
  - A. Types of concerns
    - 1. Occupational injuries and illnesses
    - 2. Property damage
    - 3. Vehicle accidents
    - 4. Fire losses
  - B. Sources of information
    - 1. National Safety Council
    - 2. NFPA
    - 3. Bureau of Labor Statistics
    - 4. Other
- II. GENERAL ACCIDENT EXPERIENCE
  - A. Principle classes of accidents
    - 1. Motor vehicle
    - 2. Work
    - 3. Home
    - 4. Public
  - B. Costs of accidents
    - 1. Wage losses
    - 2. Medical
    - 3. Insurance costs
    - 4. Property damage
    - 5. Fire
    - 6. Other costs
- C. Causes of death
  - 1. Motor vehicles
  - 2. Machinery
  - 3. Toxic substances
  - 4. Fires
  - 5. Other
- III. WORK ACCIDENTS
  - A. Sources
    - 1. Usual classifications
    - 2. Parts of body
  - B. Industry averages
    - 1. Comparison of NSC and BLS
    - 2. Costs
- IV. ACCIDENTS HAPPEN TO PEOPLE
  - A. Case studies
    - 1. Industrial accidents
    - 2. Vehicle accidents
    - 3. Fire losses
  - B. Cost examples
    - 1. Personal loss
    - 2. Company loss
- V. SUMMARY
  - A. Standard classification of losses
  - B. Statistics and preventive efforts

#### INSTRUCTOR REFERENCES:

**Accident Facts**, (latest edition), Chicago: National Safety Council, (published each year).

Simonds, R. H. and Grimaldi, J. V., **Safety Management**, Homewood, Illinois: Richard D. Irwin, 1963.

Session Outline -- Week 7 -- **BASIC ELEMENTS OF A LOSS PREVENTION PROGRAM**

**OBJECTIVES:** Identify the fundamental loss control techniques and select the appropriate method for simple occupational problems from an analysis of case studies.

**OUTLINE:**

- I. INTRODUCTION
  - A. Loss prevention and goals of organization
    - 1. Profit or cost-benefit
    - 2. Necessary vs. unnecessary expenditure
  - B. Loss prevention as a total concept
    - 1. Usual view - accidents and property losses
    - 2. The total loss - delay, spoilage, etc.
- II. THE NATURE OF LOSS PREVENTION
  - A. Risk and uncertainty
    - 1. Uncertainty
    - 2. Risk - results predictable
  - B. Techniques of risk management
    - 1. Do nothing - valid in some instances
    - 2. Eliminate the risk - basic engineering
    - 3. Reduce exposure
    - 4. Transfer risk - insurance
- III. LOSS CONTROL TECHNIQUES
  - A. Eliminating hazards
    - 1. Substitution
    - 2. Change of operations
  - B. Reducing exposure
    - 1. Guarding
    - 2. Training
    - 3. Isolation
    - 4. Substitution
    - 5. Change of procedures
  - C. Specific goals
    - 1. Maximum benefit
    - 2. Most positive means
    - 3. Economic justification
  - D. Requirements
    - 1. Identification of risk
    - 2. Evaluation of alternatives
    - 3. Specific recommendations
  - E. Roles in loss prevention
    - 1. Insurance industry
    - 2. Industry representation
    - 3. Labor unions
    - 4. Management
    - 5. Case studies
- IV. SUMMARY
  - A. Goal is conservation of organization's resources
  - B. Implications for safety personnel
    - 1. Broader responsibility
    - 2. Greater knowledge

**INSTRUCTOR REFERENCES:**

Adams, E. E., The Nature of Loss Prevention, *J. American Society of Safety Engineers*, 11, 8 (Aug. '66).  
*Handbook of Industrial Loss Prevention*, (2nd Edition), Factory Mutual, New York: McGraw-Hill, 1967.

Session Outline – Week 8 – **LOSS CONTROL POLICY AND RESPONSIBILITY**

**OBJECTIVES:** Draft general safety and health policies and procedures which will meet legal requirements and general industrial practice.

**OUTLINE:**

- I. INTRODUCTION
  - A. Definitions
    - 1. Policy
    - 2. Responsibility
    - 3. Organization
  - B. The responsibility under the law
    - 1. Federal
    - 2. State
- II. FACTORS TO BE CONSIDERED IN POLICY STATEMENTS
  - A. Position and interest of top management
    - 1. Interest and support for action
    - 2. Assignment of responsibility and authority
  - B. Objectives to be considered
    - 1. Scope of responsibility -- what areas
    - 2. Current status
    - 3. Reasonable goals
    - 4. Resources available
  - C. Items to be included
    - 1. General organization policy
    - 2. Compliance with standards
    - 3. Employee obligations
    - 4. Performance standards
    - 5. Procedures for compliance with policies
    - 6. Format
  - D. Dissemination
    - 1. Top management action
    - 2. Supervisory meetings
    - 3. Safety meetings
    - 4. Enforcement
- III. WRITING THE POLICY
  - A. Sample policy statements (use NSC and local organization examples)
  - B. Practice in drafting (set up dummy organizations and ask individuals to draft policy statements, review in group critique)
- IV. IMPLEMENTING THE POLICY
  - A. Policy statements form basis of operating plans
    - 1. State management support
    - 2. State employee requirements
    - 3. Procedures indicate means of attainment
  - B. Statements imply knowledge and resources to comply
    - 1. Knowledge of loss prevention methods
    - 2. Resource availability
    - 3. Establishment of priorities
  - C. Future sessions will explain tools
    - 1. Loss prevention techniques
    - 2. Industrial hygiene
    - 3. Human factors
    - 4. Fact finding

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
Data Sheet 583, **Management Safety Policies**, Chicago: National Safety Council.

## OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline – Week 9 – LOSS CONTROL TECHNIQUES

**OBJECTIVES:** Identify typical environmental hazards and determine corrective action required by the appropriate governing safety standard.

#### OUTLINE:

- I. BASIC ENVIRONMENTAL HAZARDS
  - A. Mechanical energy
    1. Prime movers and power transmissions
    2. Point of operation
    3. Direct contact
    4. Work in process
    5. Mechanical failure
    6. Electrical failure
    7. Human failure
    8. Impact, acceleration, deceleration
  - B. Electrical energy
    1. Main power
    2. Wiring
    3. Controllers
    4. Outlets and appliances
    5. Hand power tools
    6. Grounding
    7. Static electricity
    8. Radio frequency
    9. Induced EMF
  - C. Fire
    1. Sources
    2. Control
    3. Escape
    4. Prevention
  - D. Chemical energy
    1. Corrosion
    2. Contamination
    3. Hazardous materials
    4. Explosions
    5. Material compatibility
  - E. Exposure to toxicants and environmental stresses
    1. General concerns
    2. General controls (details in next session)
- II. PRINCIPLES OF MECHANICAL GUARDING
  - A. Types of mechanical motion
    1. Rotary – shafts, wheels, pulleys, etc.
    2. Reciprocating or sliding – pistons, belts, shapers, etc.
    3. Combination – cams, shear points, etc.
  - B. Examples of hazards
    1. Common machines
    2. Prime movers
    3. Bench tools
  - C. Principles of guarding
    1. Intrinsic danger
    2. Inevitability
    3. Non-reliance
    4. Elimination
    5. Non-use and no-risk
    6. Training
    7. Production
    8. Gumperson's Law (Murphy's Law)
- III. CODE REQUIREMENTS FOR TYPICAL INSTALLATIONS
  - A. OSHA
    1. Enclosure
    2. Trough or cup
    3. Barriers
  - B. State Safety Orders
    1. Specific machines
    2. Construction of guards
    3. General provisions
- IV. ELECTRICAL SAFETY
  - A. Electricity as a source of power
    1. Economy
    2. Easily transported
    3. Clean
  - B. Effects on human body
    1. Factors affecting amount of damage
    2. Body resistance
    3. Types of injuries
    4. Scope of problem – statistics
  - C. Protective measures
    1. Respect
    2. Grounding
    3. Training
    4. Meeting codes and standards
- V. FIRE SAFETY
  - A. Scope of problem
    1. Fire losses
    2. Causes
  - B. Types of fires
    1. Class A
    2. Class B
    3. Class C
    4. Class D

- C. The Fire Triangle
  - 1. Relation to prevention
  - 2. Relation to fire fighting
- D. 10 Points to fire safety
  - 1. Management interest and concern
  - 2. Automatic sprinklers
  - 3. Water supply
  - 4. Valve supervision
  - 5. Houskeeping
  - 6. Maintenance
  - 7. Construction
  - 8. Control of special hazards
  - 9. Emergency organization
  - 10. Protection against serious exposure and natural hazards

VI. SUMMARY

- A. General environmental hazards
- B. Types of control
- C. Other environmental concerns

**INSTRUCTOR REFERENCES:**

**Accident Facts**, (latest edition), Chicago: National Safety Council.

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Blackman, A. C., Safety Standards - A discussion of their concepts and potential uses. **J. American Society of Safety Engineers**, 10, 4 (April '65)

## OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline – Week 10 – OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE

**OBJECTIVES:** Recognize potential environmental health hazards and identify general control measures available.

#### OUTLINE:

- I. THE ELEMENTS OF INDUSTRIAL HYGIENE
  - A. IHA definition
  - B. Key concepts
    - 1. Recognition of factors influencing occupational health
    - 2. Evaluation
    - 3. Prescription
  - 2. Types
  - E. Non-ionizing radiation
  - F. Ionizing radiation
    - 1. Types
    - 2. Controls
  - G. Noise
    - 1. Measurement
    - 2. Effects
- II. CHEMICAL HAZARDS
  - A. Classification
    - 1. Dusts
    - 2. Fumes
    - 3. Mists
    - 4. Smoke
    - 5. Gases
  - B. Modes of physiological attack
    - 1. Inhalation
    - 2. Ingestion
    - 3. Absorption
  - C. Toxicity vs. hazard
    - 1. Differentiation
    - 2. Key elements in evaluation
    - 3. Threshold limit values
- III. PHYSICAL ENERGY STRESSES
  - A. Thermal
    - 1. Heat extremes
    - 2. Cold extremes
  - B. Pressure
    - 1. Altitude
    - 2. High pressure atmospheres
  - C. Mechanical vibration
    - 1. Sources
    - 2. Effects
  - D. Motion
    - 1. Effects
- IV. BIOLOGICAL AGENTS
  - A. Types
    - 1. Bacterial
    - 2. Fungi
    - 3. Viruses
  - B. General controls
    - 1. Sanitation
    - 2. Medical evaluation
    - 3. Resources
- V. CONTROL OF HEALTH HAZARDS
  - A. Basic steps
    - 1. Determine properties and effects of agent
    - 2. Evaluate exposure
    - 3. Control
  - B. General methods of control
    - 1. Substitution
    - 2. Change
    - 3. Isolation
    - 4. Wet methods
    - 5. Local exhaust
    - 6. Dilution ventilation
    - 7. Personal protective equipment
    - 8. Housekeeping
    - 9. Special control measures
    - 10. Training and education

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

## OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline – Week 11 – HUMAN FACTORS IN SAFETY

**OBJECTIVES:** Identify possible human factors in accident causation by evaluating accident case studies.

#### OUTLINE:

- I. THE PSYCHOLOGY OF SAFETY
  - A. Human needs
    1. Maslow's Hierarchy
    2. Herzberg's motivation – hygiene theory
    3. Relation to safety efforts
  - B. Attitudes and behavior
    1. Foundation of attitudes
    2. Building safe attitudes
  - C. Theories of accident causation
    1. Accident Proneness
    2. Goals - Freedom - Alertness
    3. Adjustment – Stress
- II. MOTIVATING FOR SAFE PERFORMANCE
  - A. The environment as a motivator
    1. Hygiene factors (Herzberg)
    2. Make the safe way the easiest
  - B. Building support
    1. Recognition (Maslow, Herzberg)
    2. Participation (Herzberg, Likkert)
    3. Feedback
    4. Group process
  - C. Typical safety programs
    1. Award systems
    2. Contests
    3. Committee meetings
- III. THE CAPABILITIES AND LIMITATIONS OF MAN
  - A. Data sensing
    1. Sensory organs
    2. Limitations
  - B. Data processing
    1. Perception
    2. Mental ability
    3. Memory – short or long term
    4. Recall
    5. Attention
  - C. Speed
- IV. MAN, MACHINE AND ACCIDENTS
  - A. Man vs. machine
    1. Speed of mechanical action
    2. Strength of mechanical action
    3. Judgement of motion
    4. Familiarity breeds contempt
    5. Habit patterns
  - B. Guarding man
    1. Training
    2. Protective equipment
    3. Fail-safe
  - C. Guarding machines
    1. Guarding principles
    2. Permanent protection
  - D. Types of accidents
    1. Caught in or between
    2. Struck by
    3. Striking against
  - E. Case studies

## **INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Haddon, W., Jr., Suchman, E.A. and Klein, D., **Accident Research – Methods and Approaches**, New York: Harper & Row, 1964

McFarland, R. A., Measurement of Human Factors in Accident Research, **Traffic Digest and Review**, **14**, 6 (June '66).

Tarrant, W. E., The Role of Human Factors Engineering in the Control of Industrial Accidents, **J. American Society of Safety Engineers**, **8**, 2 (Feb. '63)

## OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline – Week 12 – BIOMECHANICS

**OBJECTIVES:** Analyze simple man-machine systems and will identify biomechanical features that are possible causal factors in accidents.

#### OUTLINE:

- I. INTRODUCTION
  - A. Definitions
    - 1. Human factors engineering
    - 2. Biomechanics
    - 3. Ergonomics
    - 4. Anthropometry
  - B. Typical concerns
    - 1. Man as a sensor
    - 2. Man as a data processor
    - 3. Man as a controller
- II. MAN AS A SENSOR
  - A. Visual information
    - 1. Perceptual limitations
    - 2. Perceptual stereotypes
    - 3. Optimum displays
  - B. Auditory information
    - 1. Threshold limits
    - 2. Ambient noise, masking
    - 3. Warning vs. operational
- III. MAN AS A DATA PROCESSOR
  - A. Memory and experience
    - 1. Training
    - 2. Performance standards
  - B. Judgement
    - 1. Absolute
    - 2. Relative
- IV. MAN AS A CONTROLLER
  - A. Physical demands
    - 1. Strength
    - 2. Body dimensions
    - 3. Visual acuity
  - B. Psycho-physical considerations
    - 1. Reaction - perception time
    - 2. Visual span
    - 3. Attention capability
    - 4. Boredom
- V. FATIGUE FACTORS
  - A. Working conditions
    - 1. Temperature
    - 2. Air supply
    - 3. Humidity
    - 4. Noise level
    - 5. Illumination
  - B. Task elements
    - 1. Repetitiveness - duration, repeat of cycle
    - 2. Physical effort
    - 3. Mental effort
    - 4. Working position
- VI. DESIGNING MACHINE TO FIT MAN
  - A. Starting from scratch
    - 1. Task analysis
    - 2. Codes and standards
    - 3. Anthropological data
  - B. Upgrading machines
    - 1. Codes and standards
    - 2. Mechanical assists
    - 3. Control relocation
    - 4. Using accident data

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations**, (6th Edition), Chicago: National Safety Council, 1969.

Cornman, G., Fatigue Allowance – A Systematic Method, **J. American Society of Safety Engineers**, 15, 11 (Nov. '70).

Ross, D. M. and Hatch, T. F., The Application of Biomechanics to Safety Engineering, **J. American Society of Safety Engineers**, 2, 2 (Feb. '57).

Woodson, W. E. and Conover, D. W., **Human Engineering Guide for Equipment Designers**, (2nd Edition) Berkeley: University of California Press, 1964.

## OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline – Week 13 – ACCIDENT INVESTIGATION

**OBJECTIVES:** Classify accident causes by standard methods and identify the key causal factors in sample case studies.

#### OUTLINE:

- I. INTRODUCTION
  - A. Why investigation is necessary
    - 1. Preventing future accidents
    - 2. Education
    - 3. Litigation
    - 4. System safety analysis (failure mode)
  - B. Objectives
    - 1. Fact finding – not fault finding
    - 2. Timeliness
    - 3. Objectivity
  - C. Who should investigate ?
    - 1. Role of safety engineer
    - 2. Supervision
    - 3. Employee committees
    - 4. OSHA or state investigators
  - D. Accident type
    - 1. Slip, trip, fall, etc.
    - 2. Overtaking, intersection, etc.
    - 3. Fall from shelf, packaging, etc.
  - E. Hazardous condition
    - 1. Unguarded, faulty guard, etc.
    - 2. Road surface, blind intersection, brakes, etc.
    - 3. Poor packaging, faulty conveyor, etc.
  - F. Agency of accident
    - 1. Specific machine or environmental factor causing injury or accident
    - 2. The specific hazard
  - G. Agency part
    - 1. Specific part of agency, e.g. tool rest
    - 2. Relation to accident
  - H. Unsafe act
    - 1. Standard classifications
    - 2. Antecedant events
  - I. Other factors
    - 1. Emotional set
    - 2. Distraction
    - 3. System failure
    - 4. Procedures
- II. ACCIDENT CAUSES
  - A. Traditional views
    - 1. 80 – 20 ratio
    - 2. 330:29:1
    - 3. NSC analysis (Accident Facts)
  - B. The accident sequence
    - 1. Domino analogy
    - 2. DeReamer's accident flow chart
    - 3. System view
- III. THE KEY FACTORS IN ACCIDENTS
  - A. The nature of injury or property damage
    - 1. Injury – i.e. laceration, strain, etc.
    - 2. Vehicle damage – fender bender, etc.
    - 3. Damaged property – broken, bent, cut, etc.
  - B. The part injured or damaged
    - 1. Part of body
    - 2. Part of vehicle
    - 3. Kind of property and part
  - C. The source of injury or damage
    - 1. Type of machine
    - 2. Type of motion
    - 3. Type of action, etc.
- IV. INVESTIGATING AN ACCIDENT
  - A. Attitude
    - 1. Objectivity
    - 2. Compassion
    - 3. Diligence
  - B. Using a report form
    - 1. Provides guidelines
    - 2. Provides acceptable format
    - 3. Should not be restrictive
  - C. Questioning witnesses
    - 1. Fact-finding, not fault-finding
    - 2. Cover stories
    - 3. Patience
    - 4. Timeliness
    - 5. Everything may be important
- V. CASE STUDIES

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th edition), Chicago: National Safety Council, 1969.  
DeReamer, R., **Modern Safety Practices**, New York: John Wiley and Sons, 1958.

## OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline – Week 14 – FACT FINDING AND ACCIDENT REPORTS

**OBJECTIVES:** Select from available data information to complete standard accident report forms, draft a narrative report, and describe the investigation techniques used.

#### OUTLINE:

- I. THE STANDARD ACCIDENT REPORT FORMS
  - A. O.S.H.A.
    - 1. Brief review
    - 2. Required notification
  - B. Insurance company
    - 1. Comparison with OSHA
    - 2. Usual requirement for notifications
  - C. Other
    - 1. NSC
    - 2. Company
    - 3. State, including doctor's first report
- II. WHAT TO DO ON THE ACCIDENT SCENE
  - A. Don't panic
    - 1. Emotional undercurrents
    - 2. TLC approach
    - 3. Calmness sets the tone
  - B. Observation
    - 1. Open eye and open mind
    - 2. Who did what in what sequence
- III. ACCIDENT CASE STUDIES
  - A. Verbal fact finding  
(Use fact sheets from actual cases, ask class to determine facts by questions. After facts are determined ask for recommendations.)
  - B. Photo case studies  
(Use slides to show facts. Use same technique.)
  - C. Individual investigation  
(Use prepared case study narratives with illustrations. Each student to draft reports and recommendations.)
  - D. Critique
- 3. Witnesses - interview separately
- 4. Record all facts
- 5. Who, what, why, where, how, when
- 6. Go back if necessary
- 7. Using forms as guidelines

#### INSTRUCTOR REFERENCES:

**Accident Case Studies**, National Safety Council.

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

U.S. Department of Labor, OSHA Form 101, **Supplementary Record of Occupational Injuries and Illnesses**.

Session Outline – Week 15 – SAFETY REPORTS AND RECORDS

**OBJECTIVES:** Calculate standard measures of accident experience and utilize resulting statistics for reporting and comparative purposes.

**OUTLINE:**

- I. THE PURPOSE OF RECORDS AND STATISTICS
  - A. Legal requirements
    - 1. OSHA – records required
    - 2. State -- reports required
    - 3. Litigation – compensation and public liability
  - B. Reference and analysis
    - 1. Measurement of progress
    - 2. Analysis of problem areas
  - C. Reports
    - 1. Contests
    - 2. Reports to management
- II. STANDARD SAFETY STATISTICS
  - A. Injury frequency rate
    - 1. Computation - monthly and cumulative
    - 2. National industry comparisons (NSC accident facts)
    - 3. Z16.1 - provisions
  - B. Injury severity rate
    - 1. Computation
    - 2. National industry averages
    - 3. Z16.1 - time charges
  - C. Serious injury index
    - 1. Computation
    - 2. Usefulness in measurement
  - D. Workmen's Compensation costs
  - E. Motor vehicle accident rate
  - F. Fire average loss
  - G. New proposed National Method
- III. CONTESTS vs. REALITY
  - A. The weaknesses of standard measures
    - 1. After the fact
    - 2. No predictive value
    - 3. Subjective interpretation
    - 4. Measures only injuries (330:29:1)
  - B. Contests
    - 1. Competitive value
    - 2. Fudging of rates
  - C. Reality is costs
    - 1. Direct and indirect
    - 2. Compensation premium
    - 3. Loss ratios
- IV. FUNDAMENTALS OF STATISTICS
  - A. Measures of central tendency
    - 1. Mean
    - 2. Median
    - 3. Mode
  - B. Frequency distribution
    - 1. Standard deviation
    - 2. Relationship to testing data and research
  - C. The normal curve
    - 1. Probability
    - 2. Confidence levels in research reports

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**California Labor Code**, Section 6407 ff.

U.S. Department of Labor, **Record Keeping Requirements Under Williams-Steiger Occupational Safety and Health Act of 1970.**

Session Outline – Week 16 – THE SAFETY ORGANIZATION

**OBJECTIVES:** Identify key elements of an organizational structure as they affect safety and health and outline responsibility assignments in accordance with accepted industry practice.

**OUTLINE:**

- I. THE PURPOSE OF AN ORGANIZATION STRUCTURE
  - A. Assignment of responsibility
    - 1. Specifies function
    - 2. Indicates chain of command
  - B. Provides a system for achieving organization's goals
    - 1. Provides functional control
    - 2. Provides "formal" communications channels
- II. THE INFORMAL ORGANIZATION STRUCTURES
  - A. Act as "Overlays" to formal structure
    - 1. Formal chart cannot detail all relationships
    - 2. Formal charts are often not up to date
    - 3. Formal charts often overlook man as a social animal
    - 4. Are not intrinsically bad
  - B. Types of overlays
    - 1. Social
    - 2. Influence
    - 3. Communications
    - 4. Group patterns
- III. SAFETY AND THE ORGANIZATION
  - A. Working within the organization
    - 1. Formal responsibility assignments
    - 2. Organization procedures
- IV. THE SAFETY ORGANIZATION
  - A. Policy determination
    - 1. Specific scope of concern
    - 2. Authority
    - 3. Reporting responsibilities
  - B. Line vs. staff responsibility
    - 1. Staff function usual
    - 2. Responsible for advice and counsel
    - 3. Usual authority for emergency situations
  - C. The safety staff
    - 1. Many hats or many people
    - 2. Usual responsibilities
  - D. Assigning responsibilities to others in organization
    - 1. Maintenance and engineering
    - 2. Supervision
    - 3. Management
    - 4. Safety committees
    - 5. Others

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- DeReamer, R., **Modern Safety Practices**, New York: John Wiley and Sons, 1958.
- Likert, R., **New Patterns of Management**, New York: McGraw-Hill, 1961.
- Simonds, R. and Grimaldi, J., **Safety Management**, Homewood, Illinois: Richard D. Irwin, 1963.

## OSH 11 – INTRODUCTION TO OCCUPATIONAL SAFETY AND HEALTH

### Session Outline – Week 17 – SAFETY AND THE FUTURE

**OBJECTIVES:** Identify trends in occupational safety and health and needs for further training.

#### OUTLINE:

- I. SAFETY – AN OVERVIEW
    - A. The legal requirements
      - 1. OSHA
      - 2. State
      - 3. Other government agencies
      - 4. Common law
    - B. Scope of concern
      - 1. Occupational injury and illness
      - 2. Public liability
      - 3. Vehicle fleets
      - 4. Product safety
    - C. Methods of attaining goals
      - 1. The safety organization
      - 2. Safety techniques
      - 3. Standard and code compliance
      - 4. General duty
      - 5. Technical competence
      - 6. Professionalization
  - II. SAFETY AS A PROFESSION
    - A. Requirements
      - 1. Technical competence
      - 2. Integrity
      - 3. Diligence
      - 4. Patience
      - 5. Interpersonal skills
    - B. Training
      - 1. Academic
      - 2. On-the-job
      - 3. Seminars
      - 4. Societies
    - 5. Self-help
  - C. Opportunity
    - 1. Growth in field
    - 2. Management
    - 3. Related fields
  - D. Challenge
    - 1. Developing technology
    - 2. Social changes
    - 3. Increasing influence
    - 4. Increasing responsibility
- III. FUTURE TRENDS
  - A. Legislative
    - 1. Increasing Workmen's Compensation coverage and benefits
    - 2. Federal laws and standards
    - 3. State laws and codes
    - 4. Public and product liability codes
  - B. Technology
    - 1. Instrumentation – measurement
    - 2. Equipment, e.g. lasers
    - 3. Materials, e.g. cryogenics
    - 4. Processes, pre-fab, tilt-up, nuclear excavation
  - C. Job opportunities
    - 1. OSHA
    - 2. State
    - 3. Insurance
    - 4. Industry

#### INSTRUCTOR REFERENCES:

**Journal of American Society of Safety Engineers**  
**Journal of Safety Research** (quarterly)  
**National Safety News** (monthly)  
**Occupational Hazards** (monthly)

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 1 – HISTORY OF CODES AND STANDARDS

**OBJECTIVES:** Identify the major causes that led to the development of standards and identify the agencies promulgating standards.

#### OUTLINE:

- I. THE ANCIENTS
  - A. The economy
    - 1. Based on slavery
    - 2. Master-apprentice system
  - B. Ancient codes or standards
    - 1. Confucius – 500 BC
    - 2. Code of Hammurabi
    - 3. Moses
    - 4. Aristotle
- II. THE INDUSTRIAL REVOLUTION
  - A. Changes involved
    - 1. Mechanical power
    - 2. Concentrated work force
    - 3. Greater injury exposure
  - B. The consequences
    - 1. Social ills
    - 2. Injury victims
    - 3. Unionization
  - C. Recourse to common law
    - 1. Employer responsibilities
    - 2. Employer defenses
    - 3. Results
- III. WORKMEN'S COMPENSATION
  - A. Basic provisions
    - 1. Absolute liability
    - 2. Serious and willful
    - 3. Medical expenses
    - 4. Disability allowances
- 5. Pension
- 6. Liability limitations
- 7. Third party tort actions
- B. Administration
  - 1. Private carrier
  - 2. State insurance plans
  - 3. Self-insurance
  - 4. Employer responsibilities
- IV. PROMULGATION OF CODES AND STANDARDS
  - A. Legislative
    - 1. Federal
    - 2. State
    - 3. Local government
  - B. Administrative
    - 1. Federal
    - 2. State
    - 3. Local government
  - C. Consensus standards
    - 1. ANSI
    - 2. NFPA
    - 3. Others
  - D. Dissemination
    - 1. Memberships
    - 2. Subscriptions
    - 3. Journals
  - E. Responsibilities of employers
    - 1. "Ignorance is no excuse"
    - 2. Relations with government agencies

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Blackman, A. C., *Safety Standards – A discussion of their definition, concept and potential uses.*

**Journal of American Society of Safety Engineers**, 10, 4 (April '65).

Hanna, W. L., **Workmen's Compensation Laws of California**, San Francisco: Mathew Bender and Co.

Johnson, R. E., *The Economics of Safety Standards*, **Journal of American Society of Safety Engineers**, 7, 1 (Jan. '62).

Milestones, **National Safety News**, 87, 5 (May '63).

**Safety Standards** (July-August 1963), U.S. Bureau of Labor Standards.

Source list of organizations who develop safety standards, **Journal of American Society of Safety Engineers**, 10, 4 (April '65).

## OSH 12 — SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline — Week 2 — CALIFORNIA LABOR CODE

**OBJECTIVES:** Identify the various State agencies concerned with occupational safety and health and describe their functional responsibilities.

#### OUTLINE:

- I. THE CALIFORNIA LABOR CODE
  - A. General provisions
    - 1. Powers and duties of Department of Industrial Relations
    - 2. Employment regulations
    - 3. Employment relations
    - 4. Workmen's Compensation and insurance
    - 5. Safety in employment
  - B. Organization of the Department of Industrial Relations
    - 1. Division of Industrial Welfare
    - 2. Division of Labor Law Enforcement
    - 3. Division of Industrial Accidents
    - 4. Industrial Safety Board
    - 5. Division of Labor Statistics and Research
- II. THE DIVISION OF INDUSTRIAL SAFETY
  - A. Responsibilities
    - 1. Promulgation of safety orders (Industrial Safety Board)
    - 2. Enforcement
    - 3. Safety inspections
    - 4. Accident investigations
  - B. Organization
    - 1. Staff
    - 2. Areas
    - 3. Special services
  - C. Operations
    - 1. Procedures on notification of accidents
    - 2. Complaints
- III. WORKMEN'S COMPENSATION AND THE CALIFORNIA INSPECTION RATING BUREAU
  - A. Basic factors in determination of insurance
    - 1. Basic (manual) rate
    - 2. Industry group loss experience
    - 3. Company experience
    - 4. Insurance company experience
  - B. California Inspection Rating Bureau
    - 1. Organization and responsibilities
    - 2. Operation
  - C. Experience modification
    - 1. Concept of own experience modifying own rate
    - 2. Calculation of modification
  - D. Schedule Rating
    - 1. A modifier of insurance rates
    - 2. Types of employers covered
    - 3. Considerations in determination of schedule
    - 4. Calculations of rates
  - E. Workmen's Compensation and occupational safety and health
    - 1. Fewer injuries and illnesses lower insurance costs
    - 2. Perspective should be prevention before claim

#### INSTRUCTOR REFERENCES:

**California Workmen's Compensation Insurance Manual**, San Francisco: California Inspection Rating Bureau, 1971.

**Labor Code**, State of California, 1971.

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 3 – THE CALIFORNIA HEALTH AND SAFETY CODE

**OBJECTIVES:** Describe the provisions of the State Health and Safety Code which relate to occupational safety and health.

#### OUTLINE:

- I. THE STATE DEPARTMENT OF PUBLIC HEALTH
  - A. General powers
    - 1. Public health
    - 2. Enforcement
    - 3. Research
    - 4. Education
  - B. Sanitation (sanitary engineering)
    - 1. Regulations
    - 2. Enforcement
  - C. Air sanitation (pollution)
    - 1. Standards
    - 2. Research
    - 3. Enforcement powers
    - 4. Local districts
  - D. Pest abatement
    - 1. General authority
    - 2. Relation to local agencies
- II. FIRES AND FIRE PROTECTION
  - A. General provisions of Code
    - 1. Liability in relation to fires
    - 2. Fire equipment
- B. The State Fire Marshall
  - 1. Responsibilities
  - 2. Standards
- C. Explosives
  - 1. Definitions
  - 2. Scope
  - 3. General provisions
- III. HOUSING
  - A. Building standards
    - 1. Promulgation
    - 2. Enforcement
    - 3. Building permits
  - B. Earthquake protection
    - 1. Application
    - 2. Enforcement
  - C. Special standards
    - 1. Housing for elderly
    - 2. Physically handicapped
    - 3. Factory built houses
- IV. MISCELLANEOUS HEALTH AND SAFETY PROVISIONS
  - A. Radiation control
  - B. Abandoned excavations

#### INSTRUCTOR REFERENCES:

State of California, **Health and Safety Code** (annual)

## OSH 12 -- SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline -- Week 4 -- CALIFORNIA VEHICLE CODE

**OBJECTIVES:** Interpret and apply certain sections of the State Vehicle Code and Public Utilities Commission General Order 95.

#### OUTLINE:

- I. THE VEHICLE CODE AND APPLICATION TO ACCIDENT PREVENTION
  - A. Organization liability
    - 1. Company vehicles and drivers
    - 2. Parking lots and public access
  - B. Organization personnel
    - 1. Off-the-job safety responsibility
    - 2. Civil liabilities
- II. KEY SECTIONS OF THE VEHICLE CODE
  - A. Accidents and accident reports
    - 1. Section 20000 - General Applicability
    - 2. Section 20001-20004 - Injury or Death
    - 3. Section 20002 - Property Damage
    - 4. Section 20008-20012 - Accident Reports
  - B. Equipment of vehicles
    - 1. Section 24000-24012 - General Provisions
    - 2. Section 25350-25351 - Commercial and Common Carrier Vehicles
    - 3. Section 26301-26522 - Brakes
  - C. Loading of vehicles
    - 1. Section 29200, 29800, 31510, 31520, 31540 - Major Cargoes
    - 2. Section 31400 - Transportation of Workmen
    - 3. Section 31300 - Flammables
    - 4. Section 31600-31620 - Transportation of Explosives
- III. PUBLIC UTILITIES COMMISSION GENERAL ORDER 95
  - A. General provisions
    - 1. Formulation of standards
    - 2. Applicability
  - B. General Definitions
    - 1. Section II
    - 2. Illustrations (pages 300 ff)
  - C. Concerns in plant design
    - 1. Public access
    - 2. Vehicle traffic
    - 3. Rail access and docks
- IV. SUMMARY
  - A. Importance of other standards and codes
    - 1. Liability and penalty for violation
    - 2. Guides for initial design considerations
    - 3. Based on experience
  - B. The use of various codes
    - 1. Know their availability
    - 2. Cannot know details
    - 3. Check whenever doubt

#### INSTRUCTOR REFERENCES:

**Rules for Overhead Electric Line Construction**, (General Order No. 95) State of California Public Utilities Commission

**Vehicle Code**, State of California (published annually)

Session Outline – Week 5 – **STATE DIVISION OF INDUSTRIAL SAFETY ORDERS**

**OBJECTIVES:** Interpret State Safety Orders and apply requirements to specific devices, systems and operations.

**OUTLINE:**

- I. UNFIRED PRESSURE VESSELS SAFETY ORDERS
  - A. Definitions
  - B. Air tanks
    - 1. Design and construction
    - 2. Safety devices
    - 3. Inspections
    - 4. Using the nomographs
  - C. Other pressure vessels
    - 1. Controls
    - 2. Inspection
  - D. L.P. gas systems
    - 1. Design and construction of tanks and vaporizers
    - 2. Control of products in tanks and cylinders
    - 3. Operating procedures
    - 4. Location of tanks and regulating equipment
    - 5. Safety devices
    - 6. Inspection
  - E. Anhydrous ammonia
    - 1. Installation of tanks
    - 2. Operating procedures
    - 3. Safety devices
  - F. Safety practices
- II. BOILER AND FIRED PRESSURE VESSEL SAFETY ORDERS
  - A. Design and construction
    - 1. Definitions
    - 2. General considerations
  - B. Installation
    - 1. Safety devices
    - 2. Access for cleaning
- C. Operation
  - 1. Permits required
  - 2. Attendance required
  - 3. Safe practices
- III. CONSTRUCTION SAFETY ORDERS
  - A. General
    - 1. Definitions
    - 2. Safety programs
    - 3. Safety precautions
  - B. Excavations
    - 1. General provisions
    - 2. Shoring
  - C. Explosives
    - 1. Magazines
    - 2. Transportation
    - 3. Drilling
    - 4. Blasting
  - D. Derricks, cranes and hoisting
    - 1. Definitions
    - 2. Operating precautions
  - E. Warning signs and barricades
  - F. Construction towers and elevators
    - 1. General requirements
    - 2. Construction
    - 3. Operating procedures
  - G. Temporary floors
  - H. Saws – powered
    - 1. Portable circular saws
    - 2. Radial saws
    - 3. Table saws
  - I. Powder actuated tools
    - 1. Operator requirements
    - 2. Limitations on use
  - J. Miscellaneous construction equipment

**INSTRUCTOR REFERENCES:**

**Title 8. Industrial Relations**, California Administrative Code  
Division of Industrial Safety, Safe Practices Pamphlets

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 6 – STATE DIVISION OF INDUSTRIAL SAFETY ORDERS – Window Cleaning, Plant Equipment, Power Transmission, Prime Movers, Machines

**OBJECTIVES:** Interpret State Safety Orders and apply requirements to specific devices, systems and operations.

#### OUTLINE:

- I. WINDOW CLEANING
  - A. Definitions
  - B. General provisions
    - 1. Safe practices
    - 2. Belt terminals, anchors and bolts
    - 3. Belts
    - 4. Ladders
    - 5. Boatwain's chairs
- II. THE GENERAL INDUSTRY SAFETY ORDERS
  - A. Introduction
    - 1. Purpose
    - 2. Variations and exceptions
    - 3. Definitions
  - B. General hazards
    - 1. Definitions
    - 2. Railings and stair rails, stairs
    - 3. Platforms, floor openings
    - 4. Housekeeping and maintenance
    - 5. Accessibility and location
    - 6. Safe practices
- III. GENERAL PLANT EQUIPMENT AND SPECIAL OPERATIONS
  - A. Containers and vessels
    - 1. Vats, pans, bins
    - 2. Bunkers and hoppers
    - 3. Other containers and vessels
  - B. Engines, compressors, portable boilers
  - C. Automotive lifts
  - D. Abrasive wheels
    - 1. Types of wheels
    - 2. General requirements
  - E. Special operations
    - 3. Safety precautions
    - 1. Agriculture
    - 2. Longshore
- IV. GENERAL MOBILE EQUIPMENT AND AUXILIARIES
  - A. Definitions
  - B. Industrial trucks
    - 1. Guards required
    - 2. Operating rules
  - C. Industrial railroads
    - 1. Definitions
    - 2. Track clearance
  - D. Gantry trucks
  - E. Tiering conveyors
- V. POWER TRANSMISSION, PRIME MOVERS AND MACHINES
  - A. Definitions
  - B. Guarding in general
    - 1. Types of guards
    - 2. Guard standards
    - 3. Guard clearance
  - C. Prime movers and machinery
    - 1. Flywheels, connecting rods, governors
    - 2. conveyors
  - D. Machine parts
    - 1. Shafting, collars, couplings, clutches
    - 2. Pulleys
    - 3. Belt and pulley drives
    - 4. Gears, chains, sprockets
- VI. PROBLEM SETS

#### INSTRUCTOR REFERENCES:

Title 8, California Administrative Code, Chapter 4, Division of Industrial Safety, **General Industry Safety Orders.**

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 7 – STATE DIVISION OF INDUSTRIAL SAFETY ORDERS

**OBJECTIVES:** Interpret State Safety Orders and apply requirements to specific devices, systems and operations.

#### OUTLINE:

- I. POINTS OF OPERATION
  - A. Definitions
  - B. Guarding required
    - 1. Metal working machines
    - 2. Die casting machines
    - 3. Wood working machines
    - 4. Pulp and paper mills
    - 5. Paper and printing machines
    - 6. Textile machines
    - 7. Laundry machines
    - 8. Leather, rubber and composition machines
  - C. Operating rules
  - D. Inspections
- II. GAS SYSTEMS FOR WELDING AND CUTTING
  - A. Definitions
  - B. General requirements
    - 1. Acetylene generators
    - 2. Calcium carbide
    - 3. Service piping
    - 4. Manifolding
  - C. Operating procedures
- III. CRANES AND OTHER HOISTING EQUIPMENT
  - A. Definitions (use diagrams in order)
  - B. Requirements
    - 1. Cranes
    - 2. Boom types mobile cranes
    - 3. Hoists
    - 4. Auxiliary hoisting equipment
  - C. Fumigation
  - D. Labeling
- IV. CONTROL OF HAZARDOUS SUBSTANCES
  - A. Definitions
  - B. Control required
    - 1. Dusts, fumes, mists, vapors and gases
    - 2. Hot, flammables, poisons, corrosives and irritants
    - 3. Special substances and processes
  - C. Fumigation
  - D. Labeling
- V. SPECIALIZED SAFETY ORDERS
  - A. General coverage
  - B. Highlights
    - 1. Compressed air
    - 2. Mines
    - 3. Petroleum
    - 4. Explosives loading
    - 5. Quarry and open pit mines
    - 6. Ship and boat building
    - 7. Tunnel
    - 8. Electrical (N.E.C. - covered in OSHA)
    - 9. Elevator
    - 10. Aerial passenger tramway
    - 11. Logging and sawmill
    - 12. Liquified petroleum gases
  - C. Application to general industry
- VI. PROBLEM SETS

#### INSTRUCTOR REFERENCES:

Title 8, California Administrative Code, Chapter 4, Division of Industrial Safety, **General Industry Safety Orders**

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 8 – FEDERAL REGULATORY BODIES AND THEIR OCCUPATIONAL INFLUENCE

**OBJECTIVES:** Identify Federal agencies concerned with occupational safety and health and describe their functional responsibilities.

#### OUTLINE:

- I. THE ROLE OF THE FEDERAL AGENCIES
  - A. Influence on safety and health standards
    1. Regulatory
    2. Research
    3. Publications
  - B. Internal safety and health operations
    1. Exemptions
    2. Participation in professional activities
- II. AGENCIES AND THEIR SAFETY AND HEALTH ACTIVITIES
  - A. Atomic Energy Commission
    1. Scope of responsibility
    2. Requirements
  - B. Department of Agriculture
    1. Research on forest products - e.g. flammability
    2. Publications and counsel
  - C. Department of the Air Force
    1. Safety development, pioneering in system safety
    2. Publications
    3. Regulations under contracts
  - D. Department of the Army
    1. Publications, reference
    2. Regulations under contract
    3. Environmental hygiene
  - E. Department of Commerce
    1. National Bureau of Standards
    2. Consultant services
  - F. Department of Health, Education and Welfare
    1. Public Health Service
    2. Food and Drug Administration
      - a) Office of Product Safety
      - b) Division of Safety Services
  - G. Environmental Control Administration
  - H. Bureau of Occupational Safety and Health
  - I. NIOSH (will be covered under OSHA)
  - G. Department of the Interior
    1. Bureau of Mines
    2. Water Pollution Control Administration
  - H. Department of Labor (will be covered next session)
  - I. Department of the Navy
    1. Research and publications
    2. Standards for contracts
  - J. Department of Transportation
    1. National Transportation Safety Board
    2. Federal Highway Administration
    3. Details in OSH 14 – Motor Fleet Safety
  - K. United States Coast Guard
    1. Marine safety regulations
    2. Port security and regulations
  - L. Interstate Commerce Commission
    1. Common carrier regulations
    2. Shipping document regulations
- III. WORKING WITH FEDERAL AGENCIES
  - A. Recognize their role
    1. Regulatory constraints
    2. Administrative procedures
  - B. Available Services
    1. Consultation
    2. Publications

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Occupational Safety and Health Reporter**, Washington, D.C.: The Bureau of National Affairs, 1971.

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 9 – FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

**OBJECTIVES:** Cite the major requirements of the Occupational Safety and Health Act of 1970.

#### OUTLINE:

- I. THE KEY POINTS OF THE ACT
  - A. Coverage
    1. Eventually all employers
    2. Target industries
  - B. Duties of employers
    1. Comply with standards
    2. Records and reports
    3. General duty
  - C. Standards
    1. Initial
    2. Emergency temporary
    3. Permanent
  - D. Inspections
    1. Right of access
    2. "no knock" policy
  - E. Reports and records
    1. Notification of employees
    2. Records required
  - F. Violations and penalties
    1. Violations of standards
    2. Penalties assigned
- II. THE OSHA STANDARDS
  - A. Adoption of Standards
    1. Existing Federal or consensus standards
    2. Promulgating new standards
  - B. Scope of Standards
    1. Initial standards
    2. Others authorized
  - C. Variances from Standards
    1. Procedures
    2. Notifications
- III. INSPECTION AND INVESTIGATION BY OSHA COMPLIANCE OFFICERS
  - A. Authority and procedures
    1. Section 1903.3 – Right of Access
    2. Employee representatives
    3. Consultation with employees
  - B. Employee complaints
    1. Anonymity – protection against harrasment
    2. Verification
  - C. Imminent danger
  - D. Citations
    1. De Minimus
    2. Proposed penalties
    3. Posting of notices
- IV. PENALTIES FOR VIOLATIONS
  - A. Protesting violations
    1. Time limits
    2. Informal conferences
    3. Occupational safety and health commission
    4. Judicial review
  - B. Failure to correct violations
    1. Notification
    2. Additional penalties
- V. RECORDKEEPING AND REPORTING REQUIREMENTS
  - A. Direct reports
    1. Fatalities
    2. Serious injuries
    3. Relation to State and insurance company requirements
  - B. Employee records required
    1. OSHA 100 – Log of Occupational Injuries and Illnesses
    2. OSHA 101 – Supplementary Record of Occupational Injuries and Illnesses
    3. OSHA 102 – Summary Occupational Injuries and Illnesses
    4. Records of exposure to toxicants or harmful physical agents
- VI. RELATION TO STATE LAWS AND STANDARDS
  - A. Provisions of Section 18
    1. State responsibility
    2. Approval of State plans
  - B. Current status of State plans
  - C. Dual jurisdiction
- VII. RELATED PROGRAMS AND GRANTS
  - A. General responsibilities
  - B. NIOSH
  - C. Research
  - D. State grants
  - E. Small Business Administration

#### INSTRUCTOR REFERENCES:

P.L. 91-596, *Occupational Safety and Health Act of 1970*.

(also *National Safety News*, *Occupational Hazards* and *ASSE Journal* contain regular update articles).

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline -- Week 10 – OSHA STANDARDS – INTRODUCTION

**OBJECTIVES:** Recognize the sources and rationale of OSHA standards.

#### OUTLINE:

- I. SOURCE FOR THE OSHA STANDARDS
    - A. Existing Federal Standards
      1. Building and construction – various Acts involved
      2. Mining – Federal Coal Mine Health and Safety Act of 1969, Federal Metal and Non-Metal Mine Safety Act of 1969
      3. Walsh-Healey Public Contracts Act
      4. Longshoremen's and Harbor Workers Compensation Act
      5. Service Contract of 1965
      6. National Foundation of the Arts and the Humanities Act of 1965
    - B. National Fire Protection Association
    - C. American Society of Mechanical Engineers
    - D. Others
  - C. Adoption in OSHA
    1. By reference
    2. In whole or in part
- II. THE CONCENSUS STANDARDS
  - A. Procedures in developing
  - B. Agencies
    1. American National Standards Institute
- III. AN OVERVIEW OF OSHA STANDARDS
  - A. Congressional intent
  - B. OSHA guidelines
  - C. Scope
    1. Construction
    2. Mining
    3. Ship building, repairing, shipbreaking
    4. Longshoring
    5. General industry
  - D. Review of industry standards
    1. Review table of contents
    2. Review current experience with inspections

#### INSTRUCTOR REFERENCES:

**Federal Register**, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

**Occupational Safety and Health Reporter**, Washington, D.C.: The Bureau of National Affairs (published monthly).

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 11 – OSHA STANDARDS Working Surfaces, Exits, Powered Platforms

**OBJECTIVES:** Interpret and apply OSHA standards to specific environmental problems.

#### **OUTLINE:**

- I. WALKING AND WORKING SURFACES
  - A. Definitions
  - B. General requirements
  - C. Detailed requirements
    1. Floor and wall openings and holes
    2. Fixed industrial stairs
    3. Portable ladders
    4. Scaffolding
    5. Mobile ladders and scaffolds
    6. Other working surfaces
- II. MEANS OF EGRESS
  - A. Definitions
  - B. Requirements
    1. General requirements
    2. Means of egress in general
    3. Means of egress by occupancy
- III. POWERED PLATFORMS, VEHICLE MOUNTED PLATFORMS AND MANLIFTS
  - A. Definitions
  - B. Power platforms for exterior building maintenance
    1. General requirements
    2. Design requirements
  - C. Vehicle – mounted elevating and rotating work platforms
    1. General requirements
    2. Design requirements
  - D. Manlifts
    1. General design
    2. Design requirements
- IV. PROBLEM SETS

#### **INSTRUCTOR REFERENCES:**

Federal Register, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

Session Outline – Week 12 – OSHA STANDARDS  
Occupational Health and Environmental Controls

**OBJECTIVES:** Interpret and apply OSHA standards to specific environmental problems.

**OUTLINE:**

- I. AIR CONTAMINANTS
  - A. Allowable exposures
    - 1. Use of tables
    - 2. Time weighted averages
  - B. Asbestos dust
    - 1. Time weighted averages
    - 2. Special controls required
- II. VENTILATION
  - A. Abrasive blasting
    - 1. Definition
    - 2. Key requirements
  - B. Grinding, polishing and buffing
    - 1. Definitions
    - 2. Application – key requirements
  - C. Spray finishing operations
    - 1. Definitions
    - 2. Application – key requirements
  - D. Open surface tanks
    - 1. General requirements
    - 2. Classifications and controls required
    - 3. Operation
    - 4. Personal protective equipment
- III. NOISE EXPOSURE
  - A. Allowable levels
  - B. Time weighting
- IV. IONIZING RADIATION
  - A. Definitions
  - B. Exposure limits
    - 1. Maximum limits
    - 2. Time weighting
    - 3. Airborne radioactives
  - C. Precautionary procedures and personal monitoring
    - 1. Procedural requirements
    - 2. Warning signs, labels and signals
    - 3. Notification of incidents
- V. NON-IONIZING RADIATION
  - A. Definitions
  - B. Guides for protection
    - 1. Power density and energy density
    - 2. Warning signs
- VI. HAZARDOUS MATERIALS
  - A. Compressed gases
    - 1. General requirements
    - 2. Acetylene
    - 3. Hydrogen
- 4. Oxygen
- 5. Nitrous oxide
- B. Flammable and combustible liquids
  - 1. Definitions
  - 2. Tank storage
  - 3. Container and portable tank storage
  - 4. Containers
  - 5. Handling requirements
- C. Explosives and blasting agents
  - 1. Definitions
  - 2. Construction of magazines
  - 3. Transportation
  - 4. Use and handling
- D. Liquefied petroleum gases
  - 1. Definitions
  - 2. Safety devices required
  - 3. General requirements for industrial use
- VII. PERSONAL PROTECTIVE EQUIPMENT
  - A. General requirements
  - B. Eye and face protection
    - 1. Where required
    - 2. Requirements for quality and use
  - C. Respiratory protection
    - 1. Permissible practice
    - 2. Minimum program
    - 3. Color coding for canisters
  - D. Head and foot protection
  - E. Electrical protection
- VIII. GENERAL ENVIRONMENTAL CONTROLS
  - A. Sanitation
    - 1. General requirements
    - 2. Sanitary and washing facilities
  - B. Labor camps
    - 1. Site requirements
    - 2. Requirements for facilities
  - C. Non-water disposal systems
  - D. Safety color code
    - 1. Color identification
    - 2. Color specifications
  - E. Accident prevention signs and tags
    - 1. Classifications
    - 2. Design and color
- IX. MEDICAL AND FIRST AID
  - A. OSHA requirements
  - B. Corrosive materials

X. PROBLEM SETS

**INSTRUCTOR REFERENCES:**

Federal Register, Part II, **36**, 105, Saturday, May **29, 1971** (or subsequent revisions).

## OSH 12 — SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline -- Week 13 -- OSHA STANDARDS

#### Fire Protection, Compressed Gases, Materials Handling and Storage

**OBJECTIVES:** Interpret and apply OSHA standards to specific environmental problems.

#### OUTLINE:

- I. FIRE PROTECTION
  - A. Definitions
  - B. Portable fire suppression equipment
    - 1. General requirements
    - 2. Selection of extinguishers
    - 3. Distribution of extinguishers
  - C. Fixed suppression equipment
    - 1. Automatic sprinkler systems
    - 2. Fixed dry chemical systems
    - 3. CO<sub>2</sub> systems
  - D. Other fire protection systems
    - 1. Local fire alarm systems
    - 2. Fire brigades
- II. COMPRESSED GASSES AND EQUIPMENT
  - A. Inspection of cylinders
    - 1. Definitions
    - 2. General requirements
  - B. Safety relief devices of cylinders
    - 1. Definitions
    - 2. General requirements
  - C. Safety relief devices for cargo portable tanks and
    - 1. Definitions
    - 2. General requirements
  - D. Air receivers
- III. MATERIALS HANDLING AND STORAGE
  - A. Handling materials — general
    - 1. Use of mechanical equipment
    - 2. Secure storage
    - 3. Housekeeping
  - B. Indoor general storage
    - 1. Definitions
    - 2. General requirements
    - 3. Fire protection requirements
  - C. Powered industrial trucks
    - 1. General requirements
    - 2. Safety guards
    - 3. Fuel handling and storage
    - 4. Changing and charging batteries
    - 5. Lighting for operating areas
    - 6. Operations
  - D. Overhead and gantry cranes
    - 1. Definitions
    - 2. General requirements
    - 3. Inspection and maintenance
    - 4. Operations
- IV. PROBLEM SETS

#### INSTRUCTOR REFERENCES:

Federal Register, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 14 – OSHA STANDARDS

#### Machine Guarding, Tools, Welding and Special Industries

**OBJECTIVES:** Interpret and apply OSHA standards to specific environmental problems.

#### OUTLINE:

- I. MACHINERY AND MACHINE GUARDING
  - A. Definitions
  - B. General requirements for all machines
    - 1. Types of guarding
    - 2. General requirements for machine guards
  - C. Woodworking machinery
    - 1. Machines construction – general
    - 2. Machines controls and equipment
    - 3. Types of machines – guarding required
  - D. Cooperage machinery
    - 1. Types of machines
    - 2. Guards required
  - E. Abrasive wheel machinery
    - 1. General requirements
    - 2. Guard design
    - 3. Tool rests
    - 4. Guard exposure angles
    - 5. Flanges – requirements
  - F. Mills and calendars in rubber and plastic industries
    - 1. General requirements
    - 2. Safety controls
    - 3. Fixed guards
    - 4. Stopping limits
  - G. Mechanical power presses
    - 1. General requirements
    - 2. Guarding and construction – general
    - 3. Point of operation guarding
    - 4. Operation
  - H. Forging machines
    - 1. General requirements
    - 2. Inspection and maintenance
    - 3. Operations
  - I. Mechanical power – transmission apparatus
    - 1. General requirements
    - 2. Prime-mover guards
    - 3. Cranks, rods, governors
    - 4. Horizontal shafting
    - 5. Pulleys
    - 6. Chains and sprockets
    - 7. Gears
    - 8. Belts
    - 9. Guard construction
- II. HAND AND PORTABLE POWERED TOOLS AND OTHER HAND HELD EQUIPMENT
  - A. Definitions
  - B. General requirements
  - C. Guarding of portable powered Tools
    - 1. Woodworking tools
    - 2. Portable abrasive wheels
    - 3. Explosives actuated fastening tools
    - 4. Mowers
  - D. Other tools
- III. WELDING, CUTTING AND BRAZING
  - A. General requirements for gas systems
    - 1. Flammable mixtures
    - 2. Pressure
    - 3. Apparatus
    - 4. Cylinders and storage
    - 5. Operating procedures
    - 6. Manifold systems
  - B. Personnel protection
    - 1. Eye protection
    - 2. Clothing
- IV. SPECIAL INDUSTRIES
  - A. Pulp, paper and paperboard mills
    - 1. General requirements
    - 2. Special requirements
  - B. Textiles
    - 1. Definition
    - 2. General requirements
    - 3. Machine guarding
  - C. Bakery equipment
    - 1. General requirements
    - 2. Definitions
    - 3. Special requirements
  - D. Laundry machinery and operations
    - 1. Definitions
    - 2. Point of operation guards
    - 3. Operating rules
  - E. Sawmills
    - 1. Definitions
    - 2. Special requirements
  - F. Pulpwood Logging
    - 1. Definitions
    - 2. General requirements
    - 3. Equipment requirements
- V. PROBLEM SETS

#### INSTRUCTOR REFERENCES:

Federal Register, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

## OSH 12 – SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 15 – OSHA STANDARDS, Electrical

**OBJECTIVES:** Interpret and apply OSHA standards to specific environmental problems.

#### OUTLINE:

- I. APPLICATION OF THE ELECTRICAL STANDARDS
  - A. Purpose of the National Electric Code
    - 1. General use
    - 2. Scope
    - 3. Definitions
  - B. Sections of the National Electric Code
- II. OVERCURRENT PROTECTION
  - A. Protection of equipment
    - 1. Interrupting capacity
    - 2. Circuit impedance
  - B. Location in premises
    - 1. Enclosures for devices
    - 2. Damp or wet locations
    - 3. Arcing or moving parts
- III. GROUNDING
  - A. Circuit and system grounding
    - 1. Direct-current systems
    - 2. Alternating current systems
    - 3. Special circuits
  - B. Location of grounding connections
  - C. Equipment grounding
    - 1. Fixed equipment
    - 2. Non-electrical equipment
  - D. Methods of grounding
    - 1. Effective grounding
    - 2. Common use of grounding conductor
- IV. OUTLET, SWITCH AND JUNCTION BOXES AND FITTINGS
  - A. General requirements
  - B. Conductors
    - 1. Openings
    - 2. Metal and non-metallic boxes
  - C. Installation
- V. FLEXIBLE CORDS AND CABLES
  - A. General requirements
  - B. Usage
    - 1. Permissible uses
    - 2. Prohibited uses
- VI. TRANSFORMERS
  - A. General requirements
    - 1. Guarding
    - 2. Grounding
    - 3. Marking
  - B. Specific provisions
    - 1. Dry indoor transformers
    - 2. Oil insulated indoor transformers
    - 3. Oil insulated outdoor transformers
    - 4. Transformer vaults
- VII. APPLIANCES
  - A. General requirements
    - 1. Application
    - 2. Specific requirements
  - B. Operating requirements
    - 1. Grounding
    - 2. Disconnection
- VIII. HAZARDOUS LOCATIONS
  - A. General
    - 1. Application
    - 2. Specific precautions
  - B. Classification of locations
    - 1. Class I
    - 2. Class II
    - 3. Class III
  - C. Restrictions
- IX. PROBLEM SETS

#### INSTRUCTOR REFERENCES:

Federal Register, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

## OSH 12 — SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline — Week 16 — ADVISORY OR CONSENSUS STANDARDS

**OBJECTIVES:** Compare other safety standards to OSHA. Preparation of background information and checklist for safety inspection.

#### OUTLINE:

- I. SAFETY AND HEALTH STANDARDS IN PERSPECTIVE
  - A. Accident — injury experience
    - 1. Sources of injury vs. actual experience
    - 2. Percentage of environmental causes
  - B. The need for standards and regulations
    - 1. Human fallability
    - 2. Getting one's house in order
    - 3. Legislative pressure
  - C. Using standards
    - 1. Planning facilities
    - 2. Construction of facilities
    - 3. Inspection for accident prevention
- II. SOURCES OF OTHER STANDARDS OR GUIDELINES
  - A. National Fire Protection Association
    - 1. Clearing house for information on fire protection
    - 2. Technical standards
    - 3. National Fire Code and Electric Code
    - 4. Handbooks
  - B. American National Standards Institute
    - 1. Consensus standards
    - 2. OSHA adoption
    - 3. Scope of coverage
  - C. Uniform Building Code
    - 1. Guide to local codes — usually adopt
    - 2. Defines usage and construction
    - 3. Details methods of construction
  - D. National Safety Council
    - 1. Publications
- 2. Services
- 3. Programs
- E. Underwriters Laboratories
  - 1. Testing and approval
  - 2. Limits of approval
- F. Factory Mutual Engineering Corporation
  - 1. Industrial fire engineering and inspection
  - 2. Research laboratory
  - 3. Handbook
- III. PREPARATION FOR FIELD INSPECTION
  - A. Why are you making the inspection?
    - 1. Routine
    - 2. Follow-up
    - 3. Initial
    - 4. Complaints
    - 5. Poor injury experience
  - B. Know the organization
    - 1. Processes and products
    - 2. Organization — who and where
    - 3. General facility plan
  - C. What do you look for?
    - 1. Standards as guides
    - 2. Special industry hazards
    - 3. Injury experience
    - 4. Processes and procedures
  - D. Using a check list
    - 1. Available forms
    - 2. Tailoring to fit needs
- IV. PREPARATION FOR FIELD EXERCISE
  - A. Background on site (instructor to detail facility and organization)
  - B. Inspection survey guide (each student to prepare check list and questions for use on field trip)

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Compliance Operations Manual**, Washington, D.C.: U.S. Department of Labor, January 1972.

## OSH 12 -- SAFETY AND HEALTH STANDARDS, CODES AND REGULATIONS

### Session Outline – Week 17 – **FIELD EXERCISE**

**OBJECTIVES:** Inspect a plant for conformance with applicable codes and accepted safe practices. Prepare a report detailing violations or codes referencing specific code sections. Recommend corrective action to comply with code.

#### **INSTRUCTOR RESPONSIBILITIES:**

##### ARRANGEMENTS:

1. Permission of firm visited
2. Compliance with company visitors rules
3. Protective equipment if required
4. School administrative requirements
5. Transportation arrangements

##### PREPARING STUDENTS:

1. Briefing on school and company rules
2. Background on company visited
3. Required assignments

#### **STUDENT RESPONSIBILITIES:**

Prepared check lists

Inspection report including location and description of discrepancies noted and code or standard requirements governing discrepancy.

Session Outline – Week 1 – **FUNDAMENTALS OF SYSTEM SAFETY**

**OBJECTIVES:** Make a simple system safety analysis, without statistical failure analysis, to discover failure potentials of an uncomplicated process such as warehousing.

**OUTLINE:**

- I. DEFINITION OF TERMS
  - A. The system
    - 1. The total complex of man, machine, materials and procedures
    - 2. Mission of objectives of the system
  - B. Sub-system
    - 1. Major part of system
    - 2. Depends upon area of concern
  - C. Components
    - 1. A part of the sub-system
    - 2. Detail required
  - D. Redundancy
    - 1. Man safety
    - 2. System safety
  - E. Value analysis
    - 1. Cost-benefit
    - 2. Risk analysis
- II. THE FACTORY AS A SYSTEM
  - A. Profit
    - 2. Public concerns
    - 3. Growth
    - 4. Employee welfare
  - B. Degradation of system performance
- III. KEY SYSTEM INTERFACES
  - A. Man-machine
    - 1. Point of operation
    - 2. Work in process
    - 3. Accidental contact
    - 4. Control
  - B. Process and procedure
    - 1. Procedure design
    - 2. Failure to follow procedure
    - 3. Process sequence
    - 4. Process hazards
  - C. Cost benefit
    - 1. What price safety?
    - 2. Safety vs. risk
    - 3. Safety vs. cost of protection
- IV. A SYSTEM SAFETY ANALYSIS
  - A simple operation such as a loading dock can be described, preferably with slides, and the students can list the elements of the dock as the system with its parts. Hazards and interfaces can be listed. At the simplest level this will be an analysis.

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**System Safety Techniques – Their Place and Utilization in the Occupational Environment**, Park Ridge, Illinois: American Society of Safety Engineers, 1971.

Session Outline – Week 2 – **FUNDAMENTALS OF HUMAN FACTORS  
ENGINEERING**

**OBJECTIVES:** Recognize the basic human error and stress potentials in man-machine systems

**OUTLINE:**

- I. THE CAPABILITIES AND LIMITATIONS OF MAN
    - A. Data sensing
      - 1. Range of detection
      - 2. Multiple abilities of man
      - 3. Mobility
      - 4. Discrimination
    - B. Data processing
      - 1. Deductive and inductive reasoning
      - 2. Absolute judgements
      - 3. Memory
      - 4. Speed of calculation and judgement
    - C. Physiological limitations of man
      - 1. Sensitivity to environmental stresses
      - 2. Strength, speed, precision
      - 3. Fatigue
  - II. MAN-MACHINE RELATIONSHIPS
    - A. Control
      - 1. Attention span
      - 2. Visual span
      - 3. Reach
      - 4. Complexity of sequence
      - 5. Error potential
    - B. Speed, space and time
      - 1. Speed of machine vs. man with respect to control, feed and take-off
      - 2. Speed of machine in relation to fatigue factors
    - 3. Space requirements for man in a static position
    - 4. Space required for movement
    - 5. Space in terms of movements required
    - 6. Time and fatigue and rest
    - 7. Time and delay factors
  - C. Fatigue
    - 1. Environmental stresses
    - 2. Physical demands
    - 3. Psychological stresses
  - D. Monotony
    - 1. Psychological demands
    - 2. Job rotation
- III. DESIGN REQUIREMENTS TO FIT MAN
  - A. Attention span
  - B. Perceptual limitations
  - C. Reactions and reaction time
  - D. Anthropometric dimensions
- IV. THE PRINCIPLE OF FAIL SAFE
  - A. Definition
  - B. Human frailties
    - 1. Memory
    - 2. Attitudes
    - 3. Training
    - 4. Attention
  - C. System performance
    - 1. Mechanical failure
    - 2. Error potential

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

**OBJECTIVES:** Specify significant safety features to be considered in site and building planning. Specify appropriate codes and standards to be applied.

**OUTLINE:**

- I. DESIGNING FOR SAFETY
  - A. Guiding codes and standards
    - 1. OSHA Standards
    - 2. ANSI Standards
  - B. Relationship of design to accidents
    - 1. Types of accidents
    - 2. Case studies
    - 3. Design and U.S. Codes
- II. PLANNING CONSIDERATIONS
  - A. Site planning
    - 1. Location
      - a) Effects on adjacent population
      - b) Effects of adjacent operations
    - 2. Climate
      - a) Prevailing winds and operations
      - b) Precipitation -- drainage
    - 3. Terrain
      - a) Traffic flow
      - b) People movement
    - 4. Space requirements
      - a) Code specifications
      - b) Storage
      - c) Parking
      - d) Disposal area
  - B. Outside facilities
    - 1. Transportation
      - a) Loading docks - traffic flow, hazardous materials
      - b) Railways - clearances, loading and unloading
      - c) Docks and wharves
    - 2. Parking lots
      - a) Safe access
      - b) Traffic flow
      - c) Entrances and exits
      - d) Lighting
    - 3. Traffic control and layout
      - a) Employee vehicles
      - b) Transportation vehicles
      - c) Construction sites
    - 4. Landscaping
    - 5. Waste disposal
      - a) Controlled areas
      - b) Pollution considerations
      - c) Safe storage
    - 6. Pits and openings
      - a) Guarding and covers
      - b) Drainage
    - 7. Lighting
      - a) Production
      - b) Security
      - c) Illumination levels

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Session Outline -- Week 4 -- **PLANNING CONSIDERATIONS**

**OBJECTIVES:** Specify significant safety features to be considered in site and building planning. Specify appropriate codes and standards to be applied.

**OUTLINE:**

- I. LOCATION OF BUILDINGS AND STRUCTURES
    - A. Segregation of hazardous operations
    - B. Fire risk considerations
      - 1. Code requirements
      - 2. Flammable liquid handling
      - 3. Barrier construction
    - C. Material flow considerations
      - 1. Raw materials
      - 2. In process
      - 3. Finished products
  - II. EXITS AND WALL OPENINGS
    - A. Process flow considerations
    - B. Emergency considerations
      - 1. Employee egress
      - 2. Emergency response access
    - C. Door swings
    - D. Steps
  - III. FLOORS, WALKWAYS, STAIRS, RAMPS, PLATFORMS
    - A. Stairs
      - 1. Treads and risers
      - 2. Lighting
      - 3. Handrails
      - 4. Non-slip features
    - B. Floor surfaces
      - 1. Slipping problems
      - 2. Special coverings (conductive)
    - 3. Metal floors
    - 4. Ramp slopes
    - 5. Ramp construction
  - C. Platforms
    - 1. Access
    - 2. Railings and toeboards
- IV. STORAGE FACILITIES
  - A. Specific materials
    - 1. Boxes and cartons
    - 2. Barrels and kegs
    - 3. Lumber
    - 4. Bagged material
    - 5. Pipe and bar stock
    - 6. Sheet metal
    - 7. Bins
  - B. Flammable and harmful substances
  - C. Yard storage
- V. FLOW OF PROCESS
  - A. Flow charts
  - B. Safety considerations
- VI. EQUIPMENT LAYOUT
  - A. Process continuity
  - B. Aisle space
  - C. Hazard separation
  - D. Use of models
- VII. VENTILATION, HEATING AND AIR CONDITIONING

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Session Outline – Week 5 – **PLANNING CONSIDERATIONS** (continued)

**OBJECTIVES:** Specify significant safety features to be considered in site and building planning; Specify appropriate codes and standards to be applied.

**OUTLINE:**

- I. FLOOR LOADING
  - A. General problem areas
    - 1. Warehousing
    - 2. Machinery layout
    - 3. Small storage areas
  - B. Strength of materials
    - 1. General terms
      - a) Compression
      - b) Bending and tension
      - c) Shear
      - d) Bearing
      - e) Modulus of elasticity
    - 2. Lumber
      - a) Hardwoods – grain structure, dryness
      - b) Softwoods
    - 3. Concrete
      - a) Pre-stress concept
      - b) Types of concrete
      - c) Variables of original pour
    - 4. Steel
      - a) Strength
      - b) Effects of corrosion
  - C. Basic calculations
    - 1. Use of structural tables
    - 2. Mathematics of calculation
    - 3. Column strengths
  - D. Prevention
    - 1. Load distribution
      - a) Live load considerations
      - b) Load estimating
    - 2. Visual indications
      - a) Deflection
      - b) Checking and cracking
      - c) Spalling
      - d) Twisting
- II. COLOR IN SAFETY
  - A. Perception and visibility
    - 1. Light reflection considerations
    - 2. Vision requirements
  - B. Esthetic considerations
  - C. National Standard Color Code
    - 1. Colors
    - 2. Designations
  - D. Pipe coding

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Session Outline -- Week 6 -- **PRINCIPLES OF GUARDING**

**OBJECTIVES:** Identify the types of hazardous motion and the general methods of protection.

**OUTLINE:**

- I. THE MACHINE INJURY PROBLEM
  - A. Types of injuries
  - B. The statistics of machine injuries
  - C. Relation to other sources of injury
- II. TYPES OF MECHANICAL MOTION
  - A. Rotating mechanisms
    - 1. Flywheels
    - 2. Pulleys and belts
    - 3. Shafting
  - B. Cutting and shearing mechanisms
    - 1. Band and circular saws
    - 2. Milling machines
    - 3. Lathes
    - 4. Grinders
    - 5. Drills
  - C. In-running nip points
    - 1. Belts and pulleys
    - 2. Chains and sprockets
    - 3. Gears
  - D. Screw and worm mechanisms
    - 1. Food mixers
    - 2. Meat grinders
    - 3. Screw conveyors
  - E. Forming and/or bending mechanisms
    - 1. Power presses
    - 2. Press brakes
    - 3. Metal shears
    - 4. Forging machines
- III. METHODS OF PROTECTION
  - A. Fail safe
  - B. Safety interlocks
    - 1. Maintenance
    - 2. Defeating problems
  - C. Limit switches
  - D. Dead man controls
  - E. Emergency controls
  - F. Control locations
    - 1. Two-hand operation
    - 2. Distance from hazard
  - G. Operating sequence
  - H. Standardization
    - 1. Design for people
    - 2. Similar machine, similar controls

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
Simonds, R. H. and Grimaldi, J. V., **Safety Management**, Homewood, Illinois: Richard D. Irwin, 1963.

Session Outline -- Week 7 -- DESIGN AND CONSTRUCTION OF GUARDS

**OBJECTIVES:** Specify and design guarding for common hazards that will meet code requirements.

**OUTLINE:**

- I. PRINCIPLES OF GUARDING
  - A. Prevent access to point of operation
    - 1. Machine design
    - 2. Limited openings
    - 3. Adequate openings
    - 4. Barrier guards
  - B. Access to points of operation -- control during hazardous exposure
    - 1. Two-hand controls
      - a) Tie down problem
      - b) Employee education
    - 2. Remote controls
  - C. Prevention of operation until operator is clear
    - 1. Electronic machine controls
    - 2. Moveable interlocked barriers
  - D. Automatic sweep
    - 1. Pull back devices
      - a) Operator training
      - b) Proper adjustment
    - 2. Sweep devices
- II. DESIGN AND CONSTRUCTION OF GUARDS
  - A. Materials
    - 1. Metal mesh
      - a) Clearance from moving parts
      - b) Proper adjustment
    - 2. Wood
      - 3. Plastic
  - B. Barrier distance vs. openings
    - 1. Maximum safe opening formula
    - 2. As used for in-running nip points
  - C. General considerations
    - 1. Visibility
    - 2. Access to equipment
      - a) Belt changing
      - b) Oiling
    - 3. Remote maintenance provisions
    - 4. Guard maintenance
- III. GENERAL SAFE PRACTICES
  - A. Rules regarding guard removal
  - B. Machine operation without guards
  - C. Power lockout for guard removal
  - D. Employee clothing around equipment
- IV. CODE REQUIREMENTS
  - A. Federal codes
    - 1. Point of operation
    - 2. Power transmission
    - 3. General guarding requirements
  - B. State code
    - 1. Point of operation
    - 2. Power transmission
    - 3. General guarding requirements

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- General Industry Safety Orders**, State of California, Title 8, California Administrative Code.
- Federal Register**, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

## OSH 13 – PHYSICAL HAZARDS CONTROL I

### Session Outline -- Week 8 – MACHINE GUARDING APPLICATIONS

**OBJECTIVES:** Survey a moderate size facility for compliance with guarding standards. Design at least one guard that meets code, cost, and production requirements.

#### OUTLINE:

##### I. SPECIFIC GUARDING APPLICATION

- A. Couplings
- B. Collars
- C. Keys and set screws
- D. Cranks and connecting rods
- E. Shafting
- F. Governors
- G. Pulleys and belts
  - 1. Belt fasteners
  - 2. Horizontal belts
  - 3. Belt idlers
- H. Gears sprockets and chains

##### II. FIELD APPLICATION

Arrangements should be made with a local manufacturing plant or, at the minimum, a school shop, for an inspection tour. Students would observe the guards in use, look for any guards that should be installed and sketch a design for any missing guard. The sketch should conform to design standards.

Session Outline — Week 9 — ELECTRICAL SAFETY — Principles

**OBJECTIVES:** Specify the effects of electric current on man. Recognize potential electrical hazards. Describe code requirements for ordinary plant facility safety.

**OUTLINE:**

- I. ELEMENTARY ELECTRICITY
  - A. Definitions
    - 1. Current
    - 2. Voltage
    - 3. Resistance
    - 4. Low voltage
  - B. The physics of electricity
    - 1. Static electricity
      - a) Attraction and repulsion
      - b) Examples of static charge
    - 2. Atomic structure
    - 3. Electrons in motion
      - a) Ampere
      - b) Ohm and volt
      - c) Conduction and resistance
    - 4. Ohm's Law
      - a) Resistance
      - b) Current
      - c) Voltage
    - 5. Basic circuits
      - a) Parallel
      - b) Series
  - C. Electricity as a source of motive power
- II. EFFECTS OF ELECTRIC CURRENT ON MAN
  - A. Injury statistics
    - 1. Sources of shocks
    - 2. Frequency of shock
    - 3. Severity of injury
  - B. Injury to man
    - 1. Current flow
    - 2. "Let go" threshold
    - 3. Effects
      - a) Contraction of chest muscles
      - b) Nerve center paralysis
      - c) Ventricular fibrillation
      - d) Hemorrhage and tissue destruction
    - 4. Differential circuit breakers
- III. SELECTION AND INSTALLATION OF EQUIPMENT
  - A. Governing codes and standards
    - 1. National Electric Code
      - a) Review of contents
      - b) Practical application
    - 2. Underwriter's Laboratories
      - a) Approval function
      - b) Standard specifications
    - 3. Others
  - B. Installation
    - 1. General considerations
      - a) Fail-safe features
      - b) Visible disconnect
      - c) Suitable barriers
      - d) Warning signs
    - 2. Wiring
      - a) Code requirements
      - b) Adequate protection

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**National Electric Code**, Boston: National Fire Protection Association, 1971.

Session Outline — Week 10 — **ELECTRICAL SAFETY** — Employee Training  
and Safety Procedures

**OBJECTIVES:** Describe the general requirements for safe installation of electrical equipment.  
Develop a lock-out program for electrically operated equipment.

**OUTLINE:**

- I. OVERLOAD PROTECTION
  - A. Definitions
  - B. Specific devices
    - 1. Fuses
    - 2. Circuit breakers
      - a) Thermal
      - b) Magnetic
  - C. Installation in circuits
- II. GROUNDING
  - A. Definition
  - B. Theory
  - C. Methods
    - 1. Ground rods
    - 2. Existing piping
    - 3. Plastic piping
  - D. Double insulated equipment
  - E. Testing and maintenance
- III. SPECIFIC EQUIPMENT
  - A. Transformers
  - B. Motors
  - C. Cords and receptacles
  - D. Heating appliances
  - E. Low voltage circuits
- IV. EXPLOSION-PROOF EQUIPMENT
- V. LOCKOUT PROCEDURES
  - A. Definitions
  - B. Code categories
    - 1. Classes
    - 2. Divisions
    - 3. Groups
  - C. Theory of EP fixtures
  - D. Installation and maintenance
- VI. HOT LINE WORK
  - A. Hazards of hot line work
  - B. Control program
    - 1. Lock control
    - 2. Multiple locks
    - 3. Lock removal
    - 4. Tagging
- VII. HOT LINE WORK
  - A. Procedure development
  - B. High voltage equipment
    - 1. Specifications
    - 2. Maintenance
- VIII. EMPLOYEE TRAINING
  - A. Hazards of electricity
  - B. Emergency considerations
  - C. Standard procedures
  - D. General rules

**INSTRUCTOR REFERENCES:**

*Accident Prevention Manual for Industrial Operations* (6th Edition), Chicago: National Safety Council, 1969.

## OSH 13 – PHYSICAL HAZARDS CONTROL I

### Session Outline – Week 11 – MANUAL MATERIALS HANDLING

**OBJECTIVES:** Demonstrate safe manual handling of materials. Develop a program for training and control of manual lifting.

#### OUTLINE:

- I. GENERAL CONSIDERATIONS OF MATERIALS HANDLING
  - A. Injury statistics
    1. Sources of injury
    2. Frequency of injury
    3. Severity of injury
  - B. Mechanization vs. manual methods
    1. Feasibility
    2. Handling aids
- II. MANUAL LIFTING
  - A. The back problem
    1. Anatomy of the back
    2. Back injuries
    3. Pre-employment physicals
  - B. General considerations
    1. Material inspection
    2. Pinch points
    3. Long, large or bulky items
    4. Grease, oil, slippery objects
  - C. Lifting techniques
    1. Considerations in lifting
    2. Handling specific shapes
      - a) Boxes
      - b) Sacks
      - c) Barrels
      - d) Sheet metal
      - e) Glass
      - f) Miscellaneous items
  - D. Accessories for lifting
    1. Hooks
    2. Bars
    3. Jacks
    4. Handtrucks and dollies
- III. MATERIALS STORAGE
  - A. Techniques of storage
    1. Types of materials
    2. Safe procedures

Hazardous materials

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition) Chicago: National Safety Council, 1969.

## OSH 13 – PHYSICAL HAZARDS CONTROL I

### Session Outline – Week 12 – WAREHOUSING AND MATERIALS HANDLING EQUIPMENT

**OBJECTIVES:** Specify the hazards in the use of hoisting devices. Inspect a warehouse for conformance with accepted safe design and practices.

#### OUTLINE:

- I. WAREHOUSING
  - A. Physical facilities
    - 1. Floors and aisles
      - a) Strength
      - b) Adequate width
      - c) Cross access
      - d) Maintenance
      - e) Housekeeping
      - f) Corner protection
    - 2. Lighting
  - B. Traffic flow
    - 1. Aisle markings
    - 2. Pedestrian access
    - 3. Blind corners
    - 4. Other
  - C. Fire considerations
  - D. Power trucks
    - 1. Safe operation
      - a) Rules
      - b) Licensing
      - c) Training
      - d) Physical examination of operators
    - 2. Overhead guards
    - 3. Use for overhead work
    - 4. Other equipment
  - E. Freight car loading and unloading
    - a) Straddle carriers
    - b) Motorized hand trucks
    - c) Powered hand trucks
    - d) Remote control trucks
    - 5. Use of dock plates
- II. HOISTING APPARATUS
  - A. Types of equipment
    - 1. Overhead cranes
      - a) Nomenclature
      - b) Safe operation
    - 2. Gantry cranes
    - 3. Jib cranes
    - 4. Hammerhead cranes
    - 5. Tower cranes
    - 6. Construction cranes and hoists
      - a) Erection
      - b) Operator training
      - c) Job use
      - d) Disassembly
    - 7. Mobile cranes
      - a) Boom indicators
      - b) Outriggers
      - c) High voltage lines

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 13 – PHYSICAL HAZARDS CONTROL I

### Session Outline – Week 13 – RIGGING EQUIPMENT AND PROCEDURES

**OBJECTIVES:** Direct the rigging of small loads to meet accepted safe practices. Properly select and use slings. Develop a sling inspection program.

#### OUTLINE:

- I. RIGGING ROPE
  - A. Fiber rope – definitions and strengths
    - 1. Yacht rope
    - 2. Bolt rope
    - 3. Manila #1, 2, 3
    - 4. Hemp
    - 5. Sisal
    - 6. Jute
    - 7. Cotton
    - 8. Synthetics
  - B. Fiber rope storage
    - 1. Moisture
    - 2. Chemicals
    - 3. New coils
  - C. Wire rope
    - 1. Lays
    - 2. Strand and wire numbering
    - 3. Grades of steel
    - 4. Rope care
      - a) Kinking
      - b) Lubrication
      - c) Corrosion
      - d) Chemicals
  - 5. Attachments
    - a) Crosby clips
    - b) Sockets
    - c) Flemish eye
- II. ROPE INSPECTION
  - A. Broken strands
  - B. Crushing
  - C. Bird caging
  - D. Kinks
  - E. Splices
- III. CHAINS AND HOOKS
  - A. Use
  - B. Inspection
    - 1. Non-destructive testing
    - 2. Measurement
- IV. TURNING MOVEMENTS
  - A. Center of gravity
  - B. Single hoists
  - C. Two hoists
- V. CRANES AND HOISTS – GENERAL
  - A. Safety hooks
  - B. Dynamometer
  - C. Crane signals

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Session Outline – Week 14 – CONVEYORS AND ELEVATORS

**OBJECTIVES:** Recognize and evaluate the hazards of conveyors and elevators. Specify corrective measures.

**OUTLINE:**

- I. CONVEYORS
  - A. Types of equipment
    - 1. Gravity conveyors
      - a) Hazards
      - b) Chute conveyor
      - c) Roller conveyor
    - 2. Line roll
    - 3. Slat and apron conveyors
      - a) Pinch points
      - b) Shearing hazards
    - 4. Screw conveyors
      - a) Interlocking requirements
      - b) Dust explosion hazards
    - 5. Pneumatic conveyors
      - a) Air pressure considerations
      - b) Static bonding
      - c) Entrapment hazards
    - 6. Portable conveyors
      - a) Stability
      - b) Guarding considerations
    - 7. Belt and chain conveyors
    - 8. Vibrating conveyors
  - B. Operating considerations
    - 1. Overpasses
    - 2. Maintenance
    - 3. Control locations
    - 4. Emergency stop devices
- II. ELEVATORS
  - A. Types of equipment
    - 1. Passenger
    - 2. Freight
    - 3. Side walk
    - 4. Dumbwaiters
  - B. Code requirements
  - C. Operations
    - 1. Drives
      - a) Electric
      - b) Hydraulic
    - 2. Landings and doors
      - a) Interlocks
      - b) Self-leveling
    - 3. Operating control
      - a) Stopping devices
      - b) Safety devices
    - 4. Signal systems
  - D. Hoistways
  - E. Maintenance
    - 1. Limit switches
    - 2. Cables
    - 3. Buffers
    - 4. Other
  - F. Inspections
    - 1. Requirements
    - 2. An inspection program

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Session Outline – Week 15 – **WELDING AND CUTTING OPERATIONS**

**OBJECTIVES:** Inspect gas welding and cutting operations and equipment for conformance with safety codes and accepted safe practices.

**OUTLINE:**

- I. GAS WELDING AND CUTTING – PRINCIPLES OF OPERATION
  - A. Oxygen
    - 1. Properties
    - 2. Hazards
    - 3. Safe handling
  - B. Acetylene
    - 1. Properties
    - 2. Hazards
    - 3. Safe handling
    - 4. Generators
      - a) Medium pressure
      - b) Low pressure
      - c) Calcium carbide properties
  - C. Other gases
    - 1. Properties
    - 2. Safety considerations
- II. EQUIPMENT
  - A. Cylinder use and handling
    - 1. Indoor use
    - 2. Storage
    - 3. Acetylene cylinder construction
  - B. Manifolds and piping
    - 1. Material specifications
    - 2. Check valves and hydraulic seals
  - C. Regulators
    - 1. Principles of operation
    - 2. Pressure considerations
    - 3. Oxygen-oil problem
    - 4. Safety considerations
  - D. Hose and hose connections
    - 1. Color coding
    - 2. Thread difference
    - 3. Back flow
    - 4. Leak checking
  - E. Torches
    - 1. Types
    - 2. Tips and nozzle
    - 3. Flash back

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 13 – PHYSICAL HAZARDS CONTROL I

### Session Outline – Week 16 – RESISTANCE WELDING

**OBJECTIVES:** Inspect arc and resistance welding operations and equipment for conformance with safety codes and accepted safe practices.

#### OUTLINE:

- I. RESISTANCE WELDING
  - A. Principles of operation
    - 1. Current
    - 2. Time
    - 3. Pressure
  - B. Types
    - 1. Spot welding
    - 2. Seam weld
    - 3. Projection weld
    - 4. Flash and upset weld
    - 5. Percussion weld
  - C. Power supplies
    - 1. Electrical energy
    - 2. Capacities
    - 3. Safety considerations
  - D. Cables
    - 1. Power levels
    - 2. Cable care
    - 3. Inspection
  - E. Electrodes
    - 1. Materials
    - 2. Water cooling
    - 3. Safety considerations
  - F. Portable equipment
    - 1. Grounding
    - 2. Interlocking
- II. ARC WELDING AND CUTTING
  - A. Principles of operation
    - 1. Gases
    - 2. Flux
  - B. Power supplies
    - 1. Electrical energy
    - 2. Arc blow
  - C. Converters
  - D. Cables
    - 1. Care
    - 2. Inspection
  - E. Electrodes and holders
  - F. Gas shielding
    - 1. Tungsten arc
    - 2. Metal arc
    - 3. Gases
  - G. Shock protection
    - 1. Body insulation
    - 2. Insulated holders
    - 3. Grounding
    - 4. Dry surfaces

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 13 – PHYSICAL HAZARDS CONTROL I

### Session Outline – Week 17 – GENERAL SAFETY CONSIDERATIONS

**OBJECTIVES:** Identify the significant hazards in welding and cutting operations and select the proper personal protective equipment.

#### OUTLINE:

- I. GENERAL SAFETY CONSIDERATIONS
  - A. Eye protection
    1. Ultra violet light
      - a) Production
      - b) Effects
    2. Protection
      - a) Clear glass
      - b) Filter lens shades
  - B. Respiratory protection
    1. Inert gases
    2. Toxic fumes
      - a) Ventilation
      - b) Respirators
      - c) Medical surveillance
      - d) Coatings and fluxes
  - C. Fire considerations
    1. Combustible materials
    2. Permit system
    3. Housekeeping
    4. Standby equipment
    5. Blankets
  - D. Tanks and closed containers
    1. Combustible gases
      - a) Detection
      - b) Control
    2. Toxic materials
  - E. Protective clothing
    1. Masks and hoods
    2. Gloves
    3. Flame retardent clothing
- II. REVIEW OF CODE REQUIREMENTS FOR WELDING OPERATIONS

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Federal Register**, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 1 – THE COMMERCIAL MOTOR FLEET

**OBJECTIVES:** Identify the types of commercial motor vehicles. Specify the types of losses in motor fleets.

#### OUTLINE:

- I. INTRODUCTION
  - A. The scope of the industry
    - 1. Mileage
    - 2. Number of units
    - 3. Revenue
  - B. Comparison with other carriers
    - 1. Tonnage
    - 2. Revenue
  - C. Regulatory agencies
    - 1. D.O.T.
    - 2. D.M.V.
    - 3. P.U.C.
- II. THE TYPES OF MOTOR FLEETS
  - A. Common carriers
    - 1. Common
    - 2. Permitted
    - 3. Certificated
    - 4. Owner-operators (sub-haulers)
  - B. Proprietary carriers
    - 1. Highway operators
    - 2. Delivery
  - C. Bus and taxi companies
- III. TYPES OF VEHICLES
  - A. Power units
    - 1. Diesel
    - 2. Gas
    - 3. LPG
    - 4. Axle combinations
  - B. Trailer types
    - 1. Straight truck - types
    - 2. Semi - types
    - 3. Doubles - types
- IV. MOTOR CARRIER LOSS EXPERIENCE
  - A. Vehicle accidents
    - 1. Numbers
    - 2. Costs
    - 3. Causes
  - B. Personal injuries from vehicle accidents
    - 1. Numbers
    - 2. Costs
  - C. Personal injuries - non-motor vehicles
    - 1. Numbers
    - 2. Causes
  - D. Cargo losses
    - 1. Accidents
    - 2. Theft
    - 3. Damage

#### INSTRUCTOR REFERENCES:

**Accident Facts**, Chicago: National Safety Council (annual)

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.

**Trucking Trends**, Washington, D.C.: American Trucking Association (annual)

Session Outline – Week 2 – THE TYPICAL FUNCTIONAL ORGANIZATION

**OBJECTIVES:** Draw an organization chart of a typical trucking firm and list areas of contact for the safety and health function.

**OUTLINE:**

- I. PRINCIPLES OF ORGANIZATION
  - A. Definitions of management
    - 1. Short
    - 2. Long
  - B. Basic functions
    - 1. Planning
    - 2. Organizing
    - 3. Controlling
- II. ORGANIZATION AS A FORM OF CONTROL
  - A. Defining function and responsibility
    - 1. Job descriptions
    - 2. Chain of command
  - B. Span of control
    - 1. Traditional view - number of people
    - 2. Better view - key result areas
  - C. The organization chart
    - 1. Defines function and responsibility
    - 2. Indicates formal communications links
  - D. The informal organizations
    - 1. Social
    - 2. Power
    - 3. Influence
    - 4. Communications
- III. THE TYPICAL TRUCKING COMPANY ORGANIZATION
  - A. Corporate
    - 1. Typical chart
    - 2. Special concerns
  - B. Terminal level
    - 1. Operations
    - 2. PUD
    - 3. Line
    - 4. Office - OS&D, rate and billing, accounting
    - 5. Maintenance
    - 6. Sales
    - 7. Personnel, safety and security
- IV. WORKING WITH THE ORGANIZATION
  - A. The formal organization
    - 1. Assignment of responsibility
    - 2. Management support
    - 3. Selling program
  - B. The informal organization
    - 1. Importance of maintenance cooperation
    - 2. Finding key personnel
  - C. Building support
    - 1. Cost benefit
    - 2. Total loss control
  - D. Collateral duties
    - 1. Security
    - 2. Personnel
    - 3. Public relations
    - 4. Insurance administration

**INSTRUCTOR REFERENCES:**

**Effective Communications on the Job**, New York: American Management Association, 1963.

Haire, M. (Ed.), **Organization Theory in Industrial Practice**, New York: John Wiley and Son, 1962.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 3 – SAFETY AS A LOSS PREVENTION ACTIVITY

**OBJECTIVES:** Make an analysis of a trucking operation as a system. Determine loss potentials with particular relation to human failures.

#### OUTLINE:

- I. THE ECONOMICS OF TRUCKING
  - A. Regulatory restrictions
    - 1. PUC controls
    - 2. ICC controls
    - 3. Taxes
  - B. The labor agreements
    - 1. Wage rates
    - 2. Restrictions
    - 3. Grievance procedure
  - C. Operating ratios
    - 1. Definition
    - 2. Typical examples
- II. THE COSTS OF LOSSES
  - A. Typical vehicle accident
    - 1. Vehicle damage
    - 2. Cargo loss
    - 3. Public liability
    - 4. Personal injury
    - 5. Revenue required to cover costs
    - 6. Tonnage hauled to produce revenue
  - B. Work injury
    - 1. Direct costs
    - 2. Tonnage required to pay costs
  - C. Other losses
    - 1. Cargo damage
    - 2. Theft
    - 3. Pilferage
    - 4. Hijacking
    - 5. Downtime
- III. FINDING THE CAUSE OF LOSSES
  - A. The importance of reports and records
    - 1. Analyzing causes
    - 2. Analyzing trends
    - 3. Spotting trouble areas
  - B. Personal contact
    - 1. Keeping channels of communications open
    - 2. Observation of procedures
    - 3. Anticipating trouble
- IV. THE SYSTEMS APPROACH
  - A. Objectives of organization
    - 1. Definitions of management
      - a) Profit
      - b) Service
      - c) Growth
  - B. Barriers to attaining objectives
    - 1. Accidents
    - 2. Injury
    - 3. Mechanical breakdown
    - 4. Procedural errors
    - 5. Omissions of procedure
    - 6. Control system failure
    - 7. Murphy's Law
  - C. The elements of the system
    - 1. Organization structure
    - 2. Procedures
    - 3. Equipment
    - 4. Facilities
    - 5. People
  - D. Looking at the system for error
    - 1. Find the losses
    - 2. Find the causes
    - 3. Look for alternatives
    - 4. Establish controls

#### INSTRUCTOR REFERENCES:

**California Truck Facts**, Burlingame, California: California Trucking Association (published annually).

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1962.

**Trucking Trends**, Washington, D.C.: American Trucking Association, (published annually).

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 4 – DRIVER SELECTION

**OBJECTIVES:** List the desired qualifications of a truck driver and the means available for driver selection.

#### OUTLINE:

- I. THE SELECTION PROCESS
  - A. Establishing qualifications
    - 1. Job analysis
    - 2. Established criteria
    - 3. Regulatory requirements
    - 4. Realistic objectives
  - B. Recruiting
    - 1. Sources
    - 2. Evaluation of sources
    - 3. The union hiring hall
  - C. Selection
    - 1. Application blank
    - 2. Interviews
    - 3. Testing
    - 4. Reference checks
  - D. Placement
    - 1. Matching man to the job
    - 2. Job instruction
    - 3. Follow-up
- II. DRIVER QUALIFICATIONS
  - A. General abilities and aptitudes
    - 1. Responsibility
    - 2. Honesty
    - 3. Adaptability
    - 4. Job interest
  - B. Personal characteristics
    - 1. Age
    - 2. Physical condition
    - 3. Intelligence
    - 4. Education
    - 5. Personality
  - C. Driving ability
    - 1. Training
    - 2. Experience
    - 3. Violation record
    - 4. Accident experience
- III. DRIVER SELECTION METHODS
  - A. The application form
    - 1. The information needed
    - 2. Use as preliminary screening
  - B. The interview
    - 1. Common errors in interviewing
    - 2. Using the application blank
    - 3. Interview techniques
  - C. Psychological testing
    - 1. Limitation of tests
    - 2. Legal requirements (EEOC guidelines)
    - 3. Types of tests
  - D. The physical examination
    - 1. Liaison with the physician
    - 2. Company requirements
    - 3. Legal requirements
  - E. Final selection
    - 1. The selection ratio
    - 2. Using the data
    - 3. Reference checks
- IV. FOLLOW-UP
  - A. Supervision
    - 1. Job instruction
    - 2. Checking performance
    - 3. Evaluation
  - B. The probationary period
    - 1. Company policy
    - 2. Union Agreement

#### INSTRUCTOR REFERENCES:

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1962.

Session Outline -- Week 5 -- **FEDERAL AND STATE REGULATIONS**

**OBJECTIVES:** Specify the State and Federal driver qualification requirements and the employer responsibilities with regard to those qualifications.

**OUTLINE:**

- I. THE REGULATIONS AND THEIR EFFECTS
    - A. Application
      - 1. Set minimum requirements
      - 2. Responsibility for compliance
    - B. Penalties
      - 1. Federal - can be up to \$1,000/day
      - 2. State - fines to imprisonment
    - C. Positive benefits
      - 1. Sets minimum qualifications
      - 2. Allows upgrading quality of personnel
      - 3. Disallows unqualified physically or violators
  - II. THE FEDERAL (D.O.T.) DRIVER QUALIFICATIONS
    - A. Qualifications of drivers
      - 1. Age
      - 2. English
      - 3. Driving ability
      - 4. Road test
      - 5. Physical requirements
    - B. Disqualification
      - 1. Conviction of felonies
      - 2. Drug use
    - C. Road tests
      - 1. Examiner
      - 2. Test requirements
  - D. Written examination
    - 1. Familiarity with D.O.T. regulations
    - 2. Review of examination
    - 3. Sample questions
  - E. Physical examination
  - F. Exemptions
- III. STATE REQUIREMENTS FOR DRIVER QUALIFICATIONS
  - A. License classifications
    - 1. Class 1 - permitted vehicles
    - 2. Class 2 - permitted vehicles
    - 3. Class 3 - permitted vehicles
  - B. Physical requirements
    - 1. Adoption of D.O.T.
    - 2. Drugs, alcohol, epilepsy
    - 3. Mental deficiency
    - 4. Vision and hearing
  - C. Examination
    - 1. Vehicle code
    - 2. Driving test
- IV. APPLICABILITY TO THE FLEET OPERATOR
  - A. Driver selection
    - 1. Minimum requirements
    - 2. Legal responsibility
  - B. Driver evaluation
    - 1. Violation record
    - 2. Examinations

**INSTRUCTOR REFERENCES**

**Motor Carrier Safety Regulations**, Washington, D.C.: U.S. Department of Transportation, 1971 (as revised).  
**Vehicle Code**, Sacramento, California: California Department of Motor Vehicles, (published annually).

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 6 – DRIVER RECORDS AND PHYSICAL REQUIREMENTS

**OBJECTIVES:** List the driver records required by law. Describe the common fleet records systems. Specify the Federal physical requirements for drivers.

#### OUTLINE:

- I. THE PURPOSE OF RECORDS
  - A. Legal responsibility
    - 1. Regulatory requirements
    - 2. Litigation
  - B. Program administration
    - 1. Evaluation
    - 2. Analysis
    - 3. Correction
- II. THE DRIVER QUALIFICATION FILES
  - A. D.O.T. Requirements – regular and casual
    - 1. Application form
    - 2. Reference and violation checks
    - 3. Road test certification
    - 4. Examination and responses
    - 5. Medical examiner's certificate
    - 6. Annual driving record
    - 7. Certification of violations
  - B. Use of files
    - 1. D.O.T. examiner reviews
    - 2. Evaluation of drivers
    - 2. Tickler system
- III. D.O.T. PHYSICAL QUALIFICATIONS
  - A. General requirements
    - 1. Physical limitations
    - 2. Visual acuity
    - 3. Hearing
  - B. Medical history
    - 1. Health history
    - 2. Medical guidelines
  - C. Persons requiring examinations
  - D. Waivers
- IV. THE FLEET RECORD SYSTEM
  - A. Personnel records
    - 1. Driving qualification files (D.O.T.)
    - 2. Accident reports
    - 3. Safe driving record
    - 4. Road patrol reports and violations
    - 5. Disciplinary notices
    - 6. Commendations
    - 7. Safety and service awards
  - B. Preventive maintenance records
    - 1. Driver vehicle condition report
    - 2. Inspection and repair records
    - 3. Road failure reports
  - C. Performance records
    - 1. Accident tabulations
    - 2. Accident analysis
    - 3. Investigation reports

#### INSTRUCTOR REFERENCES:

**Motor Carrier Safety Regulations**, Washington, D.C.: U.S. Department of Transportation, 1971 (as revised).

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.

Session Outline – Week 7 – **PSYCHO-PHYSICAL TESTING**

**OBJECTIVES:** List the usual tests used in driver selection and their capabilities and limitations.

**OUTLINE:**

- I. THE PRINCIPLES OF TESTING
  - A. Purposes
    - 1. Evaluation
    - 2. Prediction
  - B. Requisites of a test
    - 1. Validity
    - 2. Reliability
    - 3. Administrative feasibility
  - C. Types of tests
    - 1. Intelligence
    - 2. Aptitude
    - 3. Ability
    - 4. Personality
  - D. Limitations
    - 1. Are only samples of behavior
    - 2. Qualifications of test administrator
    - 3. Quality of test
- II. INTELLIGENCE TESTS
  - A. Availability
    - 1. Restricted usage
    - 2. Publisher's
  - B. Limitations
    - 1. Qualified interpretation
    - 2. Requires verbal ability
    - 3. May screen unfairly
  - C. Use
    - 1. Must relate to job demands
    - 2. Careful administration
    - 3. Discretion in use of details
- III. APTITUDE TESTS
  - A. Wide variety
    - 1. Types available
    - 2. Publisher's
  - B. Usage
    - 1. Predicted
    - 2. Training evaluation
- IV. TESTS OF ABILITY
  - A. Types
    - 1. Job sample
    - 2. Performance
    - 3. Abstractions
  - B. Common uses in industry
    - 1. Road test
    - 2. Driving range
    - 3. Reaction time
    - 4. Depth perception
- V. TESTS IN PERSPECTIVE
  - A. Uses
    - 1. Screening
    - 2. Evaluation
    - 3. Upgrading
  - B. Cautions
    - 1. Know the limitations
    - 2. Do not rely solely on test results

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- Freeman, F. S., **Theory and Practice of Psychological Testing**, New York: Holt, Rinehart and Winston, 1963.
- Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.
- Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.
- Super, D. E. and Crites, J. O., **Appraising Vocational Fitness**, New York: Harper and Row, 1962.

OSH 14 – MOTOR FLEET SAFETY

Session Outline – Week 8 – **EXPERIENCE WITH TESTS**

**OBJECTIVES:** Administer, with no significant errors, the standard driver tests.

**OUTLINE:**

**SUGGESTED WRITTEN TESTS:**

- D.O.T. regulations quiz
- D.M.V. Commercial Vehicle Supplement quiz
- Matching
- Clerical
- Numerical ability
- Intelligence
- Interest inventory

**PERFORMANCE TESTS:**

- Visual acuity
- Reaction time
- Glare recovery
- Depth perception

A schedule should be prepared in advance so that some students are acting as timers while others are taking the written tests. Students taking tests will correct their own answer sheets while timing other students.

The instructor should administer the performance tests to the first group which in turn can then test other students.

A critique should be held to close the session so that the questions, problems and evaluations can be discussed.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 9 – THE TRAINING OF DRIVERS

**OBJECTIVES:** Perform a training needs analysis.

**OUTLINE:**

- I. THE LEARNING PROCESS
  - A. Is an internal process
    - 1. Cannot observe directly
    - 2. Must infer from changed behavior
  - B. Conditions for learning
    - 1. Motivation
    - 2. Appropriate stimuli
    - 3. Response from learner
    - 4. Confirmation of response
  - C. The dimensions of learning
    - 1. Level of proficiency
    - 2. Rate of learning
    - 3. Retention
    - 4. Generalization
- II. FACTORS AFFECTING LEARNING
  - A. The stimulus
    - 1. Simple vs. complex
    - 2. Recognition
  - B. The response
    - 1. Type
    - 2. Simple vs. complex
    - 3. Familiarity
  - C. Association
    - 1. Between stimulus and response
    - 2. With familiar stimulus and response
  - D. The learning situation
    - 1. Physical conditions
    - 2. Emotional conditions
    - 3. Feedback
    - 4. Time between stimulus and response
    - 5. Practice
  - E. Motivation
    - 1. Goal orientation
    - 2. Reinforcement
    - 3. Conflicts in motives
- III. DETERMINING THE NEED FOR TRAINING
  - A. Three levels of analysis
    - 1. Organizational
    - 2. Operations
    - 3. Man
  - B. Methods
    - 1. Analysis of activity
    - 2. Analysis of equipment
    - 3. Analysis of problems
    - 4. Analysis of behavior
    - 5. Analysis of organization
    - 6. Analysis of performance
- IV. TRAINING METHODS
  - A. Individual
    - 1. Tutoring and coaching
    - 2. Individual study
    - 3. Outside resources
  - B. Group
    - 1. Lecture
    - 2. Discussion
    - 3. Seminar
    - 4. Role play
  - C. On-the-job
    - 1. Tutoring-coaching
    - 2. Buddy system
    - 3. J.I.T.
  - D. New approaches
    - 1. P.I.
    - 2. Video-tape
    - 3. Work-study
    - 4. Computer assisted

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Craig, R. L. and Bittel, L. R., **Training and Development Handbook**, New York: McGraw-Hill, 1969 (revised edition on press).

McGehee, W. and Thayer, P.W., **Training in Business and Industry**, New York: John Wiley and Sons, 1961.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week10 – PLANNING THE TRAINING PROGRAM

**OBJECTIVES:** Draft a program for driver training which will include objectives, methods of training, and suggested subject areas.

#### OUTLINE:

- I. DETERMINING THE TRAINING NEEDS
  - A. Review
  - B. Course content must be related to needs
    - 1. Build on existing knowledge
    - 2. Retraining on weaknesses
    - 3. Must have meaningful purpose to trainee
- II. SETTING OBJECTIVES
  - A. Three kinds of training objectives
    - 1. Appreciation
    - 2. Knowledge
    - 3. Performance
  - B. Objectives in behavioral terms
    - 1. What should student be able to do on completion?
    - 2. Should be realistic and attainable
  - C. Objectives as guide to course
    - 1. Method of instruction
    - 2. Sequence of instruction
    - 3. Evaluation of instruction
    - 4. Evaluation of student
- III. PLANNING COURSE CONTENT
  - A. Introduction
    - 1. What is to be learned – objectives
    - 2. How is it to be presented
    - 3. What results are expected
- B. The instructional sequence
  - 1. Known to unknown
  - 2. Simple to complex
  - 3. Relationships
  - 4. Practical appliances
  - 5. Tests of performance
- IV. THE TRAINING OF DRIVERS
  - A. Determining present abilities
    - 1. Experience verification
    - 2. Road tests
  - B. Classroom training
    - 1. Regulations
    - 2. The vehicle
    - 3. Operating techniques
    - 4. Emergency procedures
    - 5. Safety rules and safe practices
    - 6. Paper work
  - C. Field training
    - 1. Pre-trip inspection
    - 2. Starting and warm-up
    - 3. Shifting
    - 4. Braking
    - 5. Maneuvers
    - 6. Coupling and uncoupling trailers
    - 7. Road practice
- V. RESOURCES
  - A. National Safety Council
  - B. Trucking associations
  - C. Private driver schools
  - D. Fleet safety consultants

#### INSTRUCTOR REFERENCES:

McGehee, W. and Thayer, P. W., **Training in Business and Industry**, New York: John Wiley and Sons, 1961.  
**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 11 – DRIVER SUPERVISION

**OBJECTIVES:** List the common methods of driver supervision and draft a program for maintaining communications with drivers.

#### OUTLINE:

- I. COMMUNICATIONS
  - A. The nature of communications
    1. Methods
    2. Effectiveness
  - B. Symptoms of poor communications
    1. Errors
    2. Attitudes
    3. Delay
  - C. Barriers to effective communications
    1. Language
    2. Personalities
    3. Timing
    4. Policies, procedures, rules
  - D. Improving communications
    1. Openness
    2. Personal contact
    3. Planning
- II. THE DRIVER MEETINGS
  - A. Planning
  - B. Selection of topics
  - C. Timing
- III. ROAD PATROLS
  - A. Qualities needed by road supervisor
    1. Maturity and rapport with drivers
    2. Initiative and resourcefulness
    3. Knowledge of driving and operations
  - B. Road patrol procedures
    1. Observation
    2. Reports – forms and required information
    3. Using information
- IV. DISPATCH
  - A. Procedures
  - B. Dispatch as control
    1. Clarity of instructions
    2. Radio and phone checks
    3. Checking pickups and deliveries

#### INSTRUCTOR REFERENCES:

**Effective Communications on the Job**, New York: American Management Association, 1963.

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 12 – MECHANICAL RECORDING DEVICES

**OBJECTIVES:** Interpret and utilize information obtained from mechanical recording devices such as tachographs.

#### OUTLINE:

- I. THE WHY OF RECORDERS
  - A. Supervision
    1. No contact with drivers on road
    2. Gives indication of travel and usage
  - B. Maintenance
    1. Engine hours and treatment
    2. Smoothness of operation
- II. TYPES OF RECORDING DEVICES
  - A. Tachograph
    1. Most widely used varieties
    2. Operation
    3. Information available
  - B. Motion indicators
    1. Side sway
    2. Engine hours
    3. Vibration meters
- III. INITIATING THE USE OF RECORDING DEVICES
  - A. Overcoming resistance
    1. Standards of performance
    2. Professional driving
    3. Records in event of investigation
    4. Proper training
  - B. Attempts at tampering
    1. Methods
    2. Means of checking
    3. Disciplinary action
- IV. USING THE INFORMATION
  - A. Checking the record
    1. Trip reports
    2. Mileage
    3. Stops
    4. Idling
  - B. Driver contacts
    1. Standards of performance
    2. Constructive interviews
    3. Discipline
  - C. Preventive maintenance
    1. Squawk sheets and tachograph
    2. Engine hours and mileage

#### INSTRUCTOR REFERENCES:

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.  
Manufacturer's manuals.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 13 – MOTOR VEHICLE ACCIDENTS

**OBJECTIVES:** Draft a report of a motor vehicle accident which will include all the information required for litigation and preventive measures.

#### OUTLINE:

- I. ACCIDENT CAUSES
  - A. Human factors
  - B. Mechanical conditions
  - C. Environmental conditions
- II. INFORMATION REQUIRED FOR DETERMINING CAUSES
  - A. Time and location
  - B. Parties involved
  - C. Witnesses
  - D. Vehicles involved
  - E. The results
  - F. The accident
  - G. The accident scene
  - H. Background information
- III. THE ACCIDENT REPORT
  - A. Organization of the report
  - B. Practice in writing reports

Instructor should prepare narrative reports of several typical vehicle accidents for students to draft formal reports utilizing the standard organization.

- C. Critique
  1. Review of essential details of cases presented
  2. Open critique of student drafts

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 14 – DETERMINING PREVENTABILITY

**OBJECTIVES:** Determine preventability of motor vehicle accidents utilizing standard criteria.

#### **OUTLINE:**

- I. THE CONCEPT OF PREVENTABILITY AND ITS USE
  - A. Two aspects
    1. Legal liability
    2. Driver record
  - B. Using the determination
    1. Fair treatment
    2. Driver supervision
    3. Program administration
- II. GUIDELINES FOR DETERMINATION
  - A. Struck in the rear
  - B. Struck while parked
  - C. Intersection accidents
  - D. Striking another vehicle in the rear
  - E. Sideswipe and head-on collisions
  - F. Squeeze plays
  - G. Backing
  - H. Passing
  - I. Entering traffic
  - J. Pedestrian accidents
  - K. Mechanical defects
- III. PRACTICE IN DETERMINING PREVENTABILITY
  - A. The Accident Review Board
    1. Use in the industry
    2. Common procedures
  - B. Mock review board

Students should bring in personal or newspaper stories of vehicle accidents. Instructor should have several case studies prepared in advance.

Class can serve as review board as the cases are discussed. If the instructor has experience in role play he may assign students to roles of drivers, investigators or witnesses.

#### **INSTRUCTOR REFERENCES:**

**For Experts Only**, Chicago: National Safety Council (NSC Safe Driver Award Program Booklet).

**Motor Fleet Safety Manual**. Chicago: National Safety Council, 1967.

## OSH 14 — MOTOR FLEET SAFETY

### Session Outline — Week 15 — ACCIDENT REPORTS AND RECORDS

**OBJECTIVES:** Design a recordkeeping system which will meet legal requirements and accepted fleet safety practices.

#### OUTLINE:

- I. THE NEED FOR AN ACCIDENT RECORDS SYSTEM
  - A. Legal requirements
    1. D.O.T. — Driver Qualification File
    2. Litigation
    3. Hazardous materials (to be covered next time)
  - B. Program administration
    1. Means of control
    2. Problem analysis
    3. Program evaluation
    4. Personnel evaluation
- II. THE TYPICAL SYSTEM
  - A. D.O.T. Driver Qualification File (review)
  - B. The Driver Record Card
    1. Typical form
    2. Information recorded
  - C. Physical examination record
  - D. Time worked form
    1. Driver's logs
    2. Use
    3. Entries
  - E. The Accident Register
    1. Use for analysis
    2. Entries
  - F. Vehicle accident report forms
    1. Memorandum reports
    2. Preliminary reports
    3. Investigative reports
    4. Review board decisions
  - G. Personal injury reports
  - H. Property loss and damage reports
  - I. Preventive maintenance forms
  - J. Road patrol reports
  - K. Accident cost analysis

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** Chicago: National Safety Council, 1969.

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 16 – HANDLING OF DANGEROUS ARTICLES

**OBJECTIVES:** Draft a dangerous articles control program utilizing available references. Specify the classes or dangerous articles, the general shipping paper rules, and resources available.

#### OUTLINE:

- I. INTRODUCTION
  - A. Scope of problem
    - 1. Amount of material hauled
    - 2. Incident reports (D.O.T.)
  - B. Basic regulations
    - 1. Motor Carrier Safety Regulations (Section 397.01)
    - 2. Dangerous Articles Tariff 14
  - C. Criteria for determining regulated hazard
    - 1. Quantity
    - 2. Degree of hazard
    - 3. Packaging
    - 4. Injury or damage potential
- II. THE CLASSIFICATION OF DANGEROUS ARTICLES AND DEFINITIONS
  - A. Explosives
  - B. Flammables
  - C. Non-flammable gases
  - D. Corrosives
  - E. Poisons
  - F. Oxidizers
  - G. Radioactives
  - H. Etiologic agents
- III. SHIPPING PAPER REQUIREMENTS
  - A. Bill of Lading
  - B. Way or freight bill
  - C. Special rules
- IV. LOADING AND STORAGE REQUIREMENTS
  - A. Permissible combinations
  - B. Quantity limits
  - C. Distance or special loading requirements
- V. LABELING AND PLACARDING REQUIREMENTS
  - A. Quantity levels
  - B. Combination loads
  - C. Exemptions
  - D. Placarding errors
- VI. A DANGEROUS ARTICLES HANDLING PROGRAM
  - A. Rules and procedures
    - 1. Regulatory requirements
    - 2. Training
  - B. The "Key Man" as a control
    - 1. Level of management
    - 2. Authority
    - 3. Resources
  - C. Dispatch responsibilities
    - 1. Notification
    - 2. Driver instruction
    - 3. Allowable limits for pickups
  - D. Driver responsibilities
    - 1. Documentation
    - 2. Labels and placards
    - 3. Safe handling and transport
  - E. Dock responsibilities
    - 1. Documentation
    - 2. Notification
    - 3. Handling and storage
- VII. RESOURCES AVAILABLE
  - A. D.O.T.
  - B. C.H.P.
  - C. American Trucking Association
  - D. Insurance carriers

#### INSTRUCTOR REFERENCES:

**Dangerous Articles Handling Guide**, Washington, D.C.: American Trucking Association, 1970 (Also have slide program available).

**Discussion Leader's Guide – Hazardous Materials Handling**, Burlingame, California: California Trucking Association, 1972.

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.

## OSH 14 – MOTOR FLEET SAFETY

### Session Outline – Week 17 – MANAGING A FLEET SAFETY PROGRAM

**OBJECTIVES:** Draft a preliminary fleet safety program which will include the major elements and their rationale.

#### OUTLINE:

- I. THE MANAGEMENT FUNCTION
  - A. The management cycle
    - 1. Planning
    - 2. Organizing
    - 3. Controlling
  - B. Responsibilities
    - 1. Leadership
    - 2. Policy
    - 3. Motivation
    - 4. Growth
    - 5. Customer relations
    - 6. Training
    - 7. Profit
  - C. Others
  - D. Support of employees
    - 1. Incentive programs
    - 2. Meetings
    - 3. Participation in programming
  - E. Supervision
    - 1. Responsibilities
    - 2. Cooperation
    - 3. Motivation
  - F. Selling the safety program
    - 1. Cost benefit
    - 2. Determine all losses
    - 3. Find loss potential
    - 4. Regulatory requirements
- II. THE ELEMENTS OF A FLEET PROGRAM
  - A. Management leadership
    - 1. Interest
    - 2. Support
    - 3. Policy
    - 4. Assignment of responsibility
  - B. Safety direction
    - 1. Duties of a safety supervisor
    - 2. Basic tools
  - C. A records system
    - 1. Review
    - 2. Use of records
  - D. Training
    - 1. Drivers
- III. FLEET SAFETY IN REVIEW
  - A. The regulatory requirements
    - 1. D.O.T. and State
    - 2. Changes anticipated
  - B. The broadening scope of concern
    - 1. Human factors
    - 2. Ecological issues
    - 3. Public liability
    - 4. Dangerous articles
  - C. Contribution of organization's objectives
    - 1. Monetary loss control
    - 2. Production efficiency
    - 3. Morale

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Motor Fleet Safety Manual**, Chicago: National Safety Council, 1966.

**Motor Fleet Safety Supervision**, Chicago: National Safety Council, 1967.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 1 – HAND TOOLS

**OBJECTIVES:** Recognize the injury potential of unsafe use of hand tools.

#### **OUTLINE:**

- I. INJURY STATISTICS
  - A. Ratio of hand and power tool injuries to other causes
  - B. Relative severity of injuries
  - C. Parts of body injured
- II. CONTROL OF TOOL ACCIDENTS
  - A. Right tool for the right job
  - B. Good condition
  - C. Proper use
  - D. Proper storage
- III. MAINTENANCE AND REPAIR
  - A. Tempering
  - B. Sharpening
  - C. Handles
- IV. USE OF TOOLS
  - A. Chisels
  - B. Hack saws
  - C. Files
  - D. Snips and cutters
  - E. Saws
  - F. Axes, adzes and hatchets
  - G. Knives
  - H. Hooks
  - I. Shovels
  - J. Wrenches
    1. Open end
    2. Socket
    3. Adjustable
    4. Pipe
  - K. Pliers
  - L. Screw drivers
  - M. Hammers

#### **INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 15 — PHYSICAL HAZARDS CONTROL II

### Session Outline — Week 2 — POWER TOOLS

**OBJECTIVES:** Recognize the hazards in the use of power tools. Draft safe operating rules for specific tools.

#### OUTLINE:

- I. SPARK RESISTANT TOOLS
  - A. Effects of sparks
  - B. Properties of spark resistant tools
- II. POWER TOOLS
  - A. Inspection and repair
  - B. Electric hazard
    1. Proper use
    2. Grounding
    3. Double insulation
    4. Low voltage
  - C. Guarding
  - D. Specific tools
    1. Drills
    2. Saws
    3. Grinders and buffers
    4. Sanders
  - E. Pneumatic tools
    1. Compressed air hazards
      - a) Over pressure
      - b) Whipping hoses
      - c) Compressed air entering the body
    2. Specific tools
      - a) Grinders
      - b) Impact tools
      - c) Nailers
  - F. Powder actuated tools
    1. Training and licensing
    2. Principles of operation
      - a) High velocity
      - b) Low velocity
    3. Safety considerations
      - a) Protective clothing
      - b) Tool shield
      - c) Selection of material and stud

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 3 – PERSONAL PROTECTIVE EQUIPMENT – Head, Ear, and Eye

**OBJECTIVES:** Select the appropriate protective equipment for protection against specific environmental hazards.

#### OUTLINE:

- I. PERSONAL PROTECTIVE EQUIPMENT
  - A. Role of personal protective equipment in accident prevention
    1. Use of equipment
    2. Rules of enforcement
    3. Supervisory example
    4. Injury statistics
      - a) Ratio of head, ear and eye injuries to other causes
      - b) Relative severity of injuries
  - B. Head protection
    1. Hard hats
      - a) American Standard Specifications
      - b) Materials and accessories
    2. Bump caps
    3. Inspection and maintenance
  - C. Ear protection
    1. Fitting program
    2. Education
    3. Ear plugs
      - a) Types
      - b) Attenuation
  - D. Eye protection
    1. Impact resistant lenses
      - a) Types
      - b) American Standard Specifications
      - c) Plastic lenses
    2. Fitting program
    3. Education program
    4. Face shields
      - a) Wire mesh
      - b) Plastic
      - c) Welding and cutting
    5. Goggles
    6. Hoods
      - a) Chemical
      - b) Sand blasting
    7. Other

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 4 – PERSONAL PROTECTIVE EQUIPMENT Footwear, Respiratory

**OBJECTIVES:** Select the appropriate protective equipment for protection against specific environmental hazards.

#### OUTLINE:

- I. FOOTWEAR
  - A. Safety shoes
    - 1. Construction features
      - a) Steel toe
      - b) Protective insoles
      - c) Instep guards
    - 2. American Standards Specifications
      - a) Classification 75
      - b) Classification 50
      - c) Classification 30
    - 3. Safety shoe program
      - a) Legal requirements
      - b) Company policy
      - c) Availability of shoes
        - 1) Free issue
        - 2) Shoe mobile
      - d) Proper fitting
  - B. Other foot protection
    - 1. Boots
    - 2. Plastic covers
    - 3. Others
- II. RESPIRATORY PROTECTION  
(covered in depth in OSH 16)
  - A. Respirator program
    - 1. Selection and use
    - 2. Training
    - 3. Supervision
    - 4. Respirator testing and approval
  - B. Air purifying respirator
    - 1. Particulate removing
    - 2. Gas and vapor removing
      - a) Gas masks
      - b) Chemical cartridge
      - c) Canister color coding
    - 3. Combination particulate removing and gas and vapor removing
  - C. Supplied air respirators
    - 1. Hose masks
    - 2. Air line respirators
    - 3. Air hoods and suits
  - D. Self contained breathing apparatus
    - 1. Demand self contained
    - 2. Oxygen generating self contained
    - 3. Recirculating compressed oxygen
    - 4. Liquid oxygen/air

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 5 – SAFETY BELTS AND PROTECTIVE CLOTHING

**OBJECTIVES:** Select the appropriate protective equipment for protection against specific environmental hazards.

#### OUTLINE:

- I. SAFETY BELTS
  - A. Code requirements
  - B. ANSI standards
  - C. Selection
    1. Materials of construction
    2. Hardware
    3. Types of jobs
      - a) Window washing
      - b) Overhead construction
  - D. Inspection and testing
    1. Frequency
    2. Criteria
  - E. Maintenance
    1. Washing
    2. Preserving
    3. Considerations for various materials
- II. LIFE LINES
  - A. Code requirements
  - B. Construction standards
  - C. Selection
  - D. Inspection and testing
  - E. Maintenance
- III. OTHER CLOTHING
  - A. Heat protection
    1. Effect of heat on body
    2. Heat stress index
    3. Air suit
      - a) Vortex tube principle
    4. Piped refrigeration
    5. Aluminized clothing
  - B. Cold weather clothing
    1. Effect on body
    2. Wind chill index
    3. Clothing
  - C. Impact protection
  - D. Hard protection
    1. Leather
    2. Cotton
    3. Plastic
    4. Metal
  - E. Lineman's high voltage protection
    1. Code requirement
    2. Types of protection
    3. Use
    4. Maintenance and testing
  - F. Other

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 6 – CHEMICAL HAZARDS -- Injury Causes, Responsibility

**OBJECTIVES:** Identify the primary causes of chemical laboratory accidents. Specify safe disposal methods for chemicals.

#### OUTLINE:

- I. CHEMICAL HAZARDS
  - A. Basic causes of laboratory accidents
    1. Inadequate instruction
      - a) Failure to give necessary instruction
      - b) Wrong instructions
      - c) Inadequate instructions
    2. Inadequate plan
      - a) Use of unsafe methods
      - b) Use of unskilled people
      - c) Failure to enforce rules
    3. Inadequate design
      - a) Inadequate engineering
      - b) Faulty construction
      - c) Inadequate ventilation and lighting
    4. Lack of protective devices
    5. Failure to follow instructions or rules
      - a) Work without permission
      - b) Equipment not inspected
    6. Failure to use protective devices
      - a) Physical handicap
      - b) Under influence of intoxicants or drugs
      - c) Improper use of equipment
    7. Physical handicap
      - a) Chronic illness
      - b) Acute illness
      - c) Fatigue
      - d) Lack of physical aptitude
    8. Improper attitude
      - a) Failure to concentrate
      - b) Lack of knowledge
      - c) Temper, anger
    9. Faulty apparatus
      - a) Defective tools
      - b) Failure of material
      - c) Faulty protective devices
  - B. Responsibility for chemical safety
    1. Researchers plan
    2. Review panel
    3. Working alone
  - C. Labeling
    1. Manufacturing Chemist Association Classification
    2. D.O.T. requirements
    3. Dating requirements
  - D. Waste disposal
    1. Collection
    2. Handling
    3. Transportation
    4. Disposal
      - a) Evaporation
      - b) Neutralization
      - c) Dilution
      - d) Burial
      - e) Burning
      - f) Environmental considerations

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
Steere, N. V., **Handbook of Laboratory Safety**, Cleveland, Ohio: Chemical Rubber Co., 1971.

Session Outline – Week 7 – CHEMICAL HAZARDS – Control Methods

**OBJECTIVES:** Specify safety considerations for control of common chemical reactions. Specify appropriate personal protective equipment for chemical and biological hazards.

**OUTLINE:**

- I. PROTECTIVE CLOTHING FOR CHEMICAL OPERATIONS
    - A. Respirators
      - 1. Brief review of material covered in week 4 with emphasis on chemical safety
      - 2. Selection criteria
        - a) Identify substance
        - b) Determine properties
        - c) Determine conditions of exposure
        - d) Determine user requirements
      - 3. Employee acceptance
        - a) Require respirators as a last resort
        - b) Educate the wearer: Why, proper use
        - c) Provide fitting program
        - d) Provide for maintenance and cleanliness
      - 4. Gas mask cannister color coding
        - a) Acid gas - white
        - b) Organic vapor - black
        - c) Ammonia - green
        - d) Carbon monoxide - blue
        - e) Acid gas & organic vapor - yellow
        - f) Acid gas, vapor and ammonia - brown
    - B. Eye Protection
      - 1. Equipment
        - a) ANSI Standards - Z2.1
        - b) Concept of tempered lenses
        - c) Chemical goggles: types, use and abuse
        - d) Face shields: types, use and abuse
        - e) Shields and barricades
  - 2. Emergency aid
    - a) First aid procedures
    - b) Eye washes & showers: placement criteria, maintenance & testing
  - 3. Contact lenses
    - a) Chemical safety problems
  - 4. Protective clothing
- C. Chemical Reactions
  - 1. Peroxides
    - a) Formation
    - b) Detection techniques
    - c) Inhibition
    - d) Removal
  - 2. Oxidizers
    - a) Types
    - b) Techniques of handling
    - c) Safety considerations
  - 3. Perchlorates
    - a) Properties
    - b) Handling techniques
- D. Biological hazards
  - 1. Infectious process
  - 2. Animal handling
  - 3. Laboratory infections
  - 4. Design of facilities
  - 5. Experimental rules

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
 Steere, N. V., **Handbook of Laboratory Safety**, Cleveland, Ohio: Chemical Rubber Co., 1971.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 8 – HIGH PRESSURE SAFETY

**OBJECTIVES:** Specify the critical parts and the familiar modes of a high pressure system.

#### OUTLINE:

- I. DEFINITIONS
  - A. Fluids
  - B. Liquids
  - C. Gases
  - D. Forces
  - E. Area
  - F. Pressure
- II. GAS LAWS
  - A. General gas law
    - 1.  $\frac{PV}{T}$
    - 2. Definition of terms
    - 3. Problem solving
  - B. Pascal's Law
    - 1. Force = Area x Pressure
    - 2. Definition of terms
    - 3. Problem solving
  - C. Amagat curves
  - D. Energy of gas systems
- III. PRESSURE ACCIDENTS
  - A. Overpressure
    - 1. Safety factors
    - 2. Relief devices
    - 3. Barricades
  - B. Gauges
    - 1. Safety features
    - 2. Med scale use
    - 3. Placement in system
    - 4. Pressure rating
  - C. Whipping lines
    - 1. Causes of line failure
    - 2. Corrective actions
  - D. Hydrostatic testing
    - 1. Energy calculations
    - 2. Code requirements
    - 3. Safe procedures
  - E. Compressed fluids entering body
    - 1. Medical significance
    - 2. Avoidance techniques
  - F. Oxygen reaction
    - 1. Physical properties
    - 2. Grease - oxygen reaction
    - 3. General flammability
    - 4. Safety rules

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Compressed Gas Association, Handbook of Compressed Gases**, New York: Reinhold, 1966.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 9 – COMPRESSED GAS CYLINDERS – General

**OBJECTIVES:** Develop a program for the safe handling of gas cylinders. Inspect an operation using gas cylinders for compliance with codes and accepted safe practices.

#### OUTLINE:

- I. COMPRESSED GAS CYLINDERS
  - A. General
    - 1. Construction details
    - 2. D.O.T. regulation
    - 3. Relief provisions
  - B. Cylinder handling
    - 1. Use carts
    - 2. Electromagnetic lifting
    - 3. Dropping
    - 4. Use as rollers and supports
    - 5. Striking arcs
  - C. Cylinder storage
    - 1. Sun protection
    - 2. Flammable gases
  - D. Use of cylinders
    - 1. Securing
    - 2. System review
  - E. Manifolds
    - 1. Construction
    - 2. Safety devices
  - F. Gas regulators
    - 1. Function
    - 2. Details of operation
    - 3. Attachment techniques
  - G. Leaking cylinders
  - H. Color coding
- II. SAFETY CONSIDERATIONS
  - A. Good engineering design
    - 1. Safety factors
    - 2. Relief protection
    - 3. Barricading
    - 4. Compatibility of materials
    - 5. Design review
    - 6. Change control
  - B. Quality parts
    - 1. parts rating
    - 2. Parts control
    - 3. Inspection

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
Compressed Gas Association, **Handbook of Compressed Gases**, New York: Reinhold, 1966.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 10 – COMPRESSED GAS SYSTEMS – Operation and Maintenance

**OBJECTIVES:** Inspect a high pressure system for proper assembly and develop an operational control system for safe practices.

#### OUTLINE:

- I. SAFETY CONSIDERATIONS
  - A. Proper assembly
    - 1. Trained personnel
    - 2. Parts control
    - 3. Tie downs
    - 4. Testing
    - 5. Inspection
  - B. Proper operation
    - 1. Pressure source control
    - 2. System Changes
    - 3. Operator training
    - 4. Periodic inspections
  - C. Maintenance
    - 1. Training
    - 2. Inspection
- II. COMPRESSED AIR
  - A. Shop uses
    - 1. Pneumatic tools
    - 2. Pressure source
    - 3. Clean up
  - B. Code requirements
  - C. Hazards
    - 1. Eye protection
    - 2. Skin protection
    - 3. Oxygen reaction
    - 4. Overpressurization
  - D. Controls
    - 1. Regulators
    - 2. Process changes
    - 3. Air nozzles
    - 4. Education

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
Compressed Gas Association, **Handbook of Compressed Gases**, New York: Reinhold, 1966.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 11 – ILLUMINATION

**OBJECTIVES:** Conduct a lighting survey and evaluate a work area for compliance with illumination standards.

#### OUTLINE:

- I. ILLUMINATION AND SAFETY
  - A. Lighting related to accidents
    1. Trips, slips and falls
    2. Housekeeping
    3. Quality of work
    4. Quantity of work
  - B. Units of measurement
    1. Lumen
    2. Foot candle
    3. Foot lambert
  - C. Standards - Illuminating Engineering Society Standards
    1. Office areas
    2. Storage areas
    3. Work areas
  - D. Types of lighting
    1. General lighting
    2. Localized lighting
    3. Supplementary lighting
    4. Emergency lighting
  - E. Lighting considerations
    1. Quantity
    2. Quality
      - a) Brightness ratios
      - b) Glare
      - c) Diffusion
      - d) Direction
      - e) Color
  - F. Light sources
    1. Incandescent lamps
    2. Fluorescent lamps
    3. Mercury lamps
  - G. The light survey
    1. Light meter
      - a) Principles of operation
      - b) Using techniques
    2. Survey techniques
    3. Record
    4. Light survey - a practical exercise for groups of students to conduct and record a light survey
  - H. Interpreting survey findings
  - I. Implementing results

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

## OSH 15 — PHYSICAL HAZARDS CONTROL II

### Session Outline — Week 12 — SLIPS, TRIPS AND FALLS

**OBJECTIVES:** Inspect a work site and evaluate its potential for slips, trips and falls. Recommend a specific program of corrective action.

#### **OUTLINE:**

- I. STATISTICS
  - A. Types of injuries
  - B. Severity of injuries
  - C. Relation to other sources of injury
- II. CAUSATION AND PREVENTION
  - A. Floors
    1. Maintenance
    2. Waxing and falls
    3. Construction materials
  - B. Stairs
    1. Treads
    2. Railings
    3. Lighting
  - C. Housekeeping
  - D. Material storage
    1. Aisleways
    2. Traffic flow
  - E. Ladders — fixed and portable
    1. Cause of falls
    2. Corrective steps
  - F. Scaffolds
  - G. Overhead work
    1. Nets
    2. Life lines and harnesses
  - H. Cranes and hoists
  - I. Equipment design
  - J. Slipperiness testing
  - K. Wear and surface hardness, roughness
  - L. Lubricated surfaces
- III. CONTRIBUTING FACTORS
  - A. Footwear
  - B. Female fashions
    1. Footwear
    2. The maxi look
  - C. Lighting
  - D. Safe practice
- IV. WINDOW WASHING
  - A. Code requirements
  - B. Safety equipments
  - C. Building design
- V. THE CONSTRUCTION SITE
  - A. Temporary railings
  - B. Elevators
  - C. Housekeeping

#### **INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 13 – WORKING AT ELEVATIONS

**OBJECTIVES:** Specify the required safety features for the major types of elevated work structures.

#### OUTLINE:

- I. THE STATISTICS OF FALLS
  - A. Elevated work surfaces related to other causes
  - B. Typical causes of falls
  - C. Typical injuries
- II. Ladders
  - A. Types
    1. Stepladders
    2. Extension ladders
    3. Trolley ladders
    4. Trestle ladders
  - B. Standard requirements
    1. Cleat construction
    2. Dimensions
    3. Materials
    4. Bases
  - C. Use
    1. Base vs. height
    2. Top overhang
    3. Horizontal
  - D. General considerations
    1. Inspection
    2. Testing
    3. Coatings
    4. Safety harnesses
    5. General safety rules
    6. Electrical hazards
- III. SCAFFOLDING
  - A. Types and specifications
    1. Rolling
    2. Suspended
    3. Pole scaffold
  - B. Safety requirements
    1. Rails and toeboards
    2. Overhead protection
    3. Safety lines
  - C. Materials
    1. Safe loads for timbers
    2. Simple calculations
  - D. The wooden scaffold
    1. Nails and joints
    2. Care of planks
- IV. BOATSWAINS CHAIR
  - A. Construction
  - B. Safe use

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

## OSH 15 – PHYSICAL HAZARDS CONTROL II

### Session Outline – Week 14 – INSPECTION TECHNIQUES

**OBJECTIVES:** Plan and implement a safety inspection program from descriptions of the process, equipment and accident experience of a typical concern.

#### OUTLINE:

- I. INSPECTION AS A CONTROL TECHNIQUE
  - A. Continuous
    - 1. Designated employees
    - 2. Types of equipment
  - B. Periodic
    - 1. Buildings and grounds
    - 2. Areas covered
      - a) Housekeeping
      - b) Aisles and passageways
      - c) Electrical equipment
      - d) Elevators
      - e) Hoists
      - f) Pressure vessels
      - g) Fire prevention
      - h) Other
  - C. Intermittent
    - 1. Unannounced inspections
    - 2. Inspection personnel
  - D. Inspections as a positive force
  - E. Unsafe conditions and unsafe acts
    - 1. Relationships
    - 2. Role of inspections
  - F. Supervisory involvement
    - 1. Training value
    - 2. Safety at the proper level
- G. Scheduling techniques
- II. INSPECTION TECHNIQUES
  - A. Checklists
  - B. Proper start of inspection
    - 1. Contact responsible personnel
    - 2. Systematic approach
  - C. Notes
    - 1. Non-dependance on memory
    - 2. Consolidation of small items
    - 3. Requisite detail
  - D. Reports
    - 1. Emergency reports
    - 2. Routine reports
    - 3. Periodic reports
  - E. Follow-up
    - 1. Handling of recommendations
    - 2. Corrective action check
  - F. Condemning equipment
    - 1. Tag system
    - 2. Urgent action

#### INSTRUCTOR REFERENCES:

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- De Reamer, R., **Modern Safety Practices**, New York: John Wiley and Sons, 1958.
- Simonds, R. N. and Grimaldi, J. V., **Safety Management**, Homewood, Illinois: Richard D. Irwin, 1963.

Session Outline — Week 15 — THE SAFETY OBSERVER PLAN

**OBJECTIVES:** Develop a safety sampling program that will be statistically accurate and administratively feasible.

**OUTLINE:**

- I. SAFETY SAMPLING
  - A. Statistical background
    - 1. The principle of probability
    - 2. Random sampling
  - B. Field application
    - 1. Job selection
    - 2. Observations
    - 3. Analysis
- II. SAFETY OBSERVATION
  - A. Purpose
    - 1. Check on training
    - 2. Corrective action
    - 3. Provides positive feedback
    - 4. Attitude development
    - 5. Job improvement
  - B. Implementation
    - 1. Select objective
    - 2. Knowledge of process and task
    - 3. Practice session
    - 4. Fair judgement
    - 5. Systematic recording
    - 6. Checklist
    - 7. Development of schedule

III. FIELD EXERCISE

Utilizing a school shop or industrial operation the students can perform an hour of safety observation and sampling. The observations will be converted into a meaningful report with conclusions.

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- De Reamer, R., **Modern Safety Practices**, New York: John Wiley and Sons, 1958.
- Simonds, R. H. and Grimaldi, J. V., **Safety Management**, Homewood, Illinois: Richard D. Irwin, 1963.

Session Outline – Week 16 – ACCIDENT INVESTIGATION

**OBJECTIVES:** Select and use the appropriate technique to investigate and report the findings of a variety of industrial accident cases.

**OUTLINE:**

- I. THE PURPOSE OF ACCIDENT INVESTIGATION
  - A. Fact finding vs. fault finding
    - 1. Fix responsibility
    - 2. Ignore consequences of fact finding
  - B. Determine causes
    - 1. Unsafe acts
    - 2. Unsafe conditions
  - C. Determine system failure
    - 1. Change or deviation
    - 2. Poor design of system
  - D. Publicity
    - 1. Protect personnel
    - 2. Broadcast facts
  - E. Legal fact finding
    - 1. Generally not enough preventive information
- II. WHO INVESTIGATES?
  - A. Supervisor or foreman
    - 1. Closest to facts
    - 2. Protects employees
    - 3. Takes future action
  - B. Safety staff
    - 1. Unbiased viewpoint
    - 2. Trained in investigation
  - 3. Far from facts
- C. Safety committees
  - 1. Fellow employees are protective
  - 2. Broad representation
  - 3. Training experience
- D. Special boards
  - 1. Determined by severity
  - 2. Highly qualified
  - 3. Impartial
- III. COLLECTING FACTS
  - A. Nature of injury
  - B. Part of body
  - C. Source of injury
  - D. Accident type
  - E. Hazardous condition
  - F. Agency orf accident
  - G. Unsafe act
- IV. CASE STUDIES
  - Specific accident cases should be presented. The students will choose the method of investigation and conduct the investigation by interrogation for the facts. A report should be prepared for each case outlining the cause or causes and the necessary corrective action to be taken.

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- De Reamer, R., **Modern Safety Practices**, New York: John Wiley and Sons, 1958.
- Simonds, R. H. and Grimaldi, J. V., **Safety Management**, Homewood, Illinois: Richard D. Irwin, 1963.

## OSH 15 — PHYSICAL HAZARDS CONTROL II

### Session Outline — Week 17 — ACCIDENT ANALYSIS

**OBJECTIVES:** Analyze accident data and draft a report incorporating an evaluation of the data and recommendations for action.

#### OUTLINE:

- I. USE OF AUTOMATIC DATA PROCESSING
  - A. Availability of computers
  - B. Availability of programmer assistance
  - C. Cost/value analysis
- II. HAND TABULATION METHODS
  - A. Charts and tables
  - B. Keysort cards
  - C. Punched cards
- III. COST ANALYSIS
  - A. Insured costs
  - B. Uninsured costs
    1. Wages
    2. Damaged material and equipment
    3. Overtime
    4. Supervisory costs
    5. Decreased output
    6. Retraining costs
    7. Medical costs
    8. Miscellaneous costs
- IV. INCIDENT REPORT SYSTEM
  - A. Incidents vs. injuries
  - B. Information collecting
  - C. Information utilization
- V. USING THE REPORTS AND RECORDS
  - A. Periodic reports
  - B. Pinpointing trouble areas
  - C. Program evaluation
- VI. PRACTICAL EXERCISE

Utilizing accident data from a hypothetical company each student will organize the information into form for presentation to management.

#### INSTRUCTOR REFERENCES:

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- De Reamer, R., **Modern Safety Practices**, New York: John Wiley and Sons, 1958.
- Simonds, R. H. and Grimaldi, J. V., **Safety Management**, Homewood, Illinois: Richard D. Irwin, 1963.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 1 – HISTORY, RESPONSE TO TOXIC MATERIAL

**OBJECTIVES:** Define the basic terms of industrial hygiene. Specify the body responses to certain toxicants.

#### OUTLINE:

- I. HISTORY OF THE INDUSTRIAL HYGIENE MOVEMENT
    - A. The ancients
      1. Hippocrates – 4th century BC
      2. Pliny the Elder – 1st century AD
      3. Galen – 2nd century AD
      4. Ramazzini – 1700
      5. Alice Hamilton – 20th century
    - B. The industrialization period
      1. Hazards of the period
        - a) Early attitudes
        - b) The factory
      2. Government action
        - a) Factory Acts of England
        - b) Child labor laws
        - c) Workmen's Compensation laws
    - C. World War II and later
      1. Effects of expanding work force
      2. Legislation
    - D. The problem today
  1. Distribution of work force
  2. Statistics on exposure
  3. Manpower available
  4. Government programs
    - a) Federal level
    - b) State level
  5. Coal mine legislation
  6. OSH Act of 1970
- II. DEFINITIONS
    - A. Industrial hygiene
    - B. Toxic
    - C. Toxicology
  - III. BODIES' RESPONSE TO TOXIC MATERIAL
    - A. Mode of action
      1. Acute poisoning
        - a) Quantity of material
        - b) Time period
      2. Subacute poisoning
      3. Chronic poisoning
        - a) Quantity of material
        - b) Time period
      4. Individual differences
      5. Type of effects
      6. Intensity of response

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I, New York: Interscience Publications, 1963.

## OSH 16 — ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline — Week 2 — ROUTES OF ENTRY INTO BODY — LUNGS

**OBJECTIVES:** Describe the anatomy and physiological function of the lung. Relate the lung function to the effects of various toxic materials.

#### OUTLINE:

- I. ANATOMICAL REVIEW OF THE RESPIRATORY SYSTEM
    - A. Respiratory system
      1. Nose
        - a) Cilia
        - b) Sinuses
      2. Larynx
      3. Trachia
      4. Bronchi
      5. Lungs
        - a) Respiratory bronchiole
        - b) Alveolar ducts
        - c) Air sacs
        - d) Pulmonary alveoli
    - B. Physics of respiration
      1. Lungs
        - a) Alveoli
        - b) Partial pressures
      2. Tissue
      3. Chemistry of oxygen to carbon dioxide transport
        - a) Pulmonary capillaries
        - b) Hemoglobin
        - c) Oxy-hemoglobin
      4. Respiratory control
        - a) Medulla oblongota
        - b) Hering Brewer reflex
  5. c) Carbon dioxide  
Air volumes
    - a) Total air
    - b) Vital capacity
    - c) Residual air
  6. Hyperoxia
  7. Anoxia
- III. NON-INFECTIOUS CONDITIONS
    - A. Emphysema
    - B. Asthma
    - C. Pleurisy
    - D. Pneumoconeoses
    - E. Lung cancers
  - IV. NATURAL DEFENSES
    - A. Temperature
    - B. Mucous linings
    - C. Valves
    - D. Cilia
    - E. Muscular contraction
    - F. Capillary action
    - G. Cells
  - V. SPECIFIC EFFECTS
    - A. Gases
    - B. Aerosols
    - C. Particles
    - D. Other

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I, New York: Interscience Publications, 1963.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 3 – ROUTES OF ENTRY INTO BODY – SKIN – Anatomical Review

**OBJECTIVES:** Relate the physiological structure of the skin to the effects of certain toxicants on the body.

#### OUTLINE:

- I. ANATOMICAL REVIEW OF THE SKIN
  - A. Epidermis
    - 1. Function
    - 2. Damage actions
  - B. Dermis
    - 1. Function
    - 2. Damage actions
  - C. Subcutaneous tissue
    - 1. Function
    - 2. Damage actions
- II. SKIN AS A ROUTE OF ENTRY
  - A. Absorbtion
  - B. Typical materials
  - C. Effects on the body
- III. DERMATITIS
  - A. Causes
    - 1. Mechanical
      - a) Friction
      - b) Pressure
      - c) Trauma
    - 2. Physical
      - a) Heat
      - b) Cold
      - c) Sunlight
    - 3. Chemical
      - a) Acids
      - b) Alkalais
  - B. Prevention
    - 1. Engineering
    - 2. Substitution
    - 3. Protective clothing
    - 4. Protective ointments and creams
    - 5. Personal hygiene
  - C. Medical control
    - 1. Pre-employment screening
    - 2. Patch tests
    - 3. Diagnosis and treatment
    - 4. Job placement
- IV. SKIN CANCERS
  - A. Carcenogenic
    - 1. Tar
    - 2. Aneline
    - 3. Petroleum
    - 4. Arsenic
    - 5. Chromates
  - B. Prevention
    - 1. Solvents
    - 2. Oils
    - 3. Others
    - 4. Plant poisons
    - 5. Biological
      - a) Bacteria
      - b) Fungi
      - c) Animal parasites
      - d) Virus

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I., New York: Interscience Publications, 1963.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 4 – ROUTES OF ENTRY INTO BODY – INGESTION

**OBJECTIVES:** Describe the digestive system and related organs. Relate the digestive function to the absorption of toxicant materials.

#### **OUTLINE:**

- I. ANATOMICAL REVIEW OF THE DIGESTIVE TRACT
  - A. The stomach
    1. Structure
    2. Function
  - B. Small intestine
    1. Structure
      - a) Duodenum
      - b) Jejunum
      - c) Ileum
      - d) Mucosa
    2. Function
  - C. Large intestine
    1. Structure
      - a) Cecum
      - b) Rectum
  - D. Liver
    1. Structure
      - a) Lobes
      - b) Lobules
    2. Function
  - E. Kidney
    1. Structure
      - a) Nephrons
      - b) Medulla
      - c) Cortex
    2. Function
  - F. Body fluids
    1. Structure
    2. Function
- II. EFFECTS OF MATERIALS ON THE DIGESTIVE SYSTEM
  - A. Solvents
    1. Specific organ sensitivity
    2. Effects
  - B. Dusts
    1. Specific organ sensitivity
    2. Effects
  - C. Liquids and aerosols
    1. Specific organ sensitivity
    2. Effects

#### **INSTRUCTOR REFERENCES:**

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. 1, New York: Interscience Publications, 1963.

## OSH 16 — ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline — Week 5 — THRESHOLD LIMIT VALUES

**OBJECTIVES:** Apply the Threshold Limit Values of certain toxic materials in the evaluation of sample exposures.

#### OUTLINE:

- I. THE CONCEPT OF THRESHOLD LIMIT VALUES (TLV's)
    - A. Definitions
      1. Units of expression
        - a) Part per million
        - b) Particles per cubic meter
        - c) Millions of particles per cubic foot
      2. Maximum allowable concentration
      3. Maximal acceptance concentration
    - B. TLV
      1. Intended use
        - a) Changes in body structure or bio-chemistry
        - b) Undesirable functional reactions
        - c) Irritation or adverse sensory effects
      2. Not intended for:
        - a) Relative toxicity
        - b) Air pollution
        - c) Continuous exposure
        - d) Proof of disease
      3. Time weighted averages
  4. "C" values
  5. Mixtures
  6. Emergency exposure limits
  7. Effect of temperature and pressure
- II. RELATED CALCULATIONS
    - A. Calculating parts per million
    - B. Milligrams per liter conversion to other weight per unit volume
      1. Contaminant in STP convert to milligram per cubic meter
      2. Milligram per liter to milligram per cubic meter
      3. Other
    - C. Time weighted calculations
  - III. SPECIFIC TLVs
    - A. Airborne contaminants
      1. Values
      2. Discussion of common materials
    - B. Mineral dusts
      1. Categories
      2. Specific values
    - C. Physical agents
      1. Categories
      2. Specific values
    - D. Hygienic Guide Series

#### INSTRUCTOR REFERENCES:

**Documentation of Threshold Limit Values**, Cincinnati, Ohio: American Conference of Governmental Industrial Hygienists (issued annually).

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I, New York: Interscience Publications, 1963.

**Threshold Limit Values of Airborne Contaminants**, Cincinnati, Ohio: American Conference of Governmental Industrial Hygienists (issued annually).

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 6 – TOXIC AGENTS – SOLVENTS, GASES AND VAPORS

**OBJECTIVES:** Evaluate the safety and health hazards of solvent usage. Provide recommendations for handling that meet code requirements and accepted safe practices.

#### OUTLINE:

- I. SOLVENTS
  - A. Definition
  - B. Classification
    - 1. Organic solvents
      - a) Definition
      - b) Aliphatic hydrocarbons
      - c) Cyclic hydrocarbons
      - d) Aromatic hydrocarbons
      - e) Halogenated hydrocarbons
      - f) Nitro hydrocarbons
      - g) Esters
      - h) Ketones
      - i) Alcohol
      - j) Glycols
    - 2. Others
  - C. Effects on man
    - 1. Exposure factors
      - a) How used
      - b) Type of job
      - c) Length of exposure
      - d) Temperature
      - e) Exposed surface
      - f) Ventilation efficiency
      - g) Air movement
      - h) Concentration of vapors
      - i) Housekeeping
    - 2. Effects on man
      - a) Central nervous system damage
      - b) Dermatitis
      - c) Local irritation
      - d) Vasodilation
      - e) Narcosis
      - f) Bone marrow
      - g) Kidney
      - h) Liver
      - i) Vision
      - j) Brain
      - k) Other
    - 3. Other considerations
      - a) Fire and explosions
      - b) Air pollution
  - D. Threshold limit values
  - E. Quantification
    - 1. Indicator tubes
    - 2. Direct reading instruments
    - 3. Laboratory analysis
  - F. Protection considerations
    - 1. Proper selection
    - 2. Ventilation
      - a) Local exhaust
      - b) General ventilation
    - 3. Skin protection
      - a) Barrier creams
      - b) Gloves
        - 1) Penetration
        - 2) Dermatitis
      - c) Protective clothing
    - 4. Respirators

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I & II, New York: Interscience Publications, 1963.

**The Industrial Environment – Its Evaluation and Control**, U.S. Department of Health, Education and Welfare, Publication No. 614, 1963.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 7 – TOXIC AGENTS – DUSTS, MISTS

**OBJECTIVES:** Describe the physiological responses to toxic and harmful dusts and mists. Specify the general control methods available.

#### OUTLINE:

- I. DUSTS
  - A. Definition
  - B. Particle size
    1. Definition of micron
    2. Size of specific dusts
    3. Under 5 micron particles
    4. Fall out rates
  - C. Body physiology related to dusts
    1. Cardiopulmonary
    2. Systemic reaction
    3. Allergic
    4. Bacterial
  - D. Nuisance dusts
  - E. Pneumoconiosis producing dusts
    1. Definition
    2. Silicosis
    3. Asbestosis
    4. Anthracosilicosis
    5. Berylliosis
    6. Siderosis
    7. Others
  - F. Influencing factors
    1. Amount inhaled
    2. Kind inhaled
    3. Size of particles
    4. Length of exposure
    5. Individual physiology
  - G. Controls
    1. Change of operations – substitution
    2. Engineering
    3. Exhaust system
    4. Respirators
- II. MISTS
  - A. Definition
  - B. Specific operations
    1. Machinery
      - a) Oil mists
      - b) Control measures
    2. Plating and pickling
      - a) Acid and alkali mists
      - b) Control techniques

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I, New York: Interscience Publications, 1963.

**The Industrial Environment – Its Evaluation and Control**, U.S. Department of Health, Education and Welfare, Publication No. 614, 1965.

## OSH 16 — ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline — Week 8 — TOXIC AGENTS — DUST, FUMES, SMOKE

**OBJECTIVES:** Describe the sources and physiological effects of fumes, smokes, gases and vapors. Specify appropriate general control measures to minimize exposures.

#### OUTLINE:

- I. FUMES, SMOKE
  - A. Definitions
  - B. Fumes
    - 1. Typical fumes
      - a) Sulphuric acid
      - b) Metal fumes
      - c) Common chorides
    - 2. Effects on man
      - a) Metal fume fever
      - b) Other
    - 3. Controls
      - a) Substitution
      - b) Engineering
      - c) Exhaust systems
      - d) Respirators
  - C. Smoke
    - 1. Typical smokes
      - a) Oil
      - b) Rosin
      - c) Carbon
    - 2. Effects on man
    - 3. Control
      - a) Substitution
      - b) Engineering
- II. GASES AND VAPORS
  - A. Definitions
  - B. Effects on man
    - 1. Local irritations
    - 2. Vasodialation
    - 3. Narcosis
    - 4. Kidney
    - 5. Liver
    - 6. Brain
  - C. Quantification
    - 1. Indicating tubes
    - 2. Direct reading instruments
    - 3. Laboratory analysis
  - D. Control measures
    - 1. Substitution
    - 2. Ventilation
    - 3. Engineering
    - 4. Respirators

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. 1, New York: Interscience Publications, 1963.

**The Industrial Environment — Its Evaluation and Control**, U.S. Department of Health, Education and Welfare, Publication No. 614, 1965.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 9 – IONIZING RADIATION

**OBJECTIVES:** Define the common terms in radiological safety. Describe the basic principles used in personnel protection.

#### OUTLINE:

- I. IONIZING RADIATION – THEORY
  - A. Definitions
    1. Roentgen
    2. Roentgen Absorbed Dose – RAD
    3. Roentgen Equivalent Man – REM
    4. Roentgen Biological Effectiveness – RBE
    5. Curie
    6. Maximum Permissible Level – MPL
    7. Maximum Permissible Concentration – MPC
    8. Others
  - B. Radiation
    1. Alpha
      - a) Definition
      - b) Hazard
    2. Beta
      - a) Definition
      - b) Hazard
    3. Gamma
      - a) Definition
      - b) Hazard
    4. X-Ray
  - C. Theoretical concepts
    1. Decay – half life
    2. Inverse square law
    3. Energy
- II. IONIZING RADIATION – HAZARDS
  - A. General
    1. Genetic considerations
    2. Cell damage
    3. Organ susceptibility
  - B. External radiation
    1. Energy consideration
    2. Contamination
  - C. Internal radiation
    1. Biological half-life
    2. Organ selectivity
    3. Solubility
- III. PROTECTION CONSIDERATIONS
  - A. Shielding
  - B. Distance
  - C. Isolation

#### INSTRUCTOR REFERENCES:

Abbott, J. C., Lakey, J. R. A. and Mathias, J., **Protection Against Radiation**, Springhill, Ohio: Charles C. Thomas, 1961.

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 10 – NON-IONIZING RADIATION

**OBJECTIVES:** Describe the hazards of non-ionizing radiation. Draft an acceptable set of operating rules for each source.

#### OUTLINE:

- I. ELECTROMAGNETIC SPECTRUM
  - A. Electromagnetic waves
    - 1. Intensity
    - 2. Frequency
      - a) Definition
      - b) Physical units
    - 3. Wave length
      - a) Definition
      - b) Physical units
    - 4. Electromagnetic spectrum
      - a) X-Rays
      - b) Infrared
      - c) Radar
- II. ULTRAVIOLET RADIATION
  - A. Physical properties
    - 1. Wave length
      - a) Near
      - b) Far
      - c) Vacuum
    - 2. Transmission
  - B. Effects on man
    - 1. Eyes
    - 2. Skin
  - C. Protection
- III. VISIBLE LIGHT
  - A. Physical properties
    - 1. Wave length
    - 2. Inverse square law
  - B. Definitions
    - 1. Lumens
    - 2. Foot lamberts
    - 3. Foot candles
  - C. Effects on man
  - D. Light levels
- IV. INFRARED RADIATION
  - A. Physical properties
    - 1. Wave length
    - 2. Absorbption
  - B. Effects on man
  - C. Protective measures
- V. Lasers
  - A. Theory
  - B. Types of lasers
  - C. Hazard to man
  - D. Protective measures
- VI. MICROWAVES
  - A. Physical properties
  - B. Hazards to man
    - 1. Body heating
    - 2. Other
  - C. Protective considerations

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I, New York: Interscience Publications, 1963.

**The Industrial Environment – Its Evaluation and Control**, U.S. Department of Health, Education and Welfare, Publication No. 614, 1965.

## OSH 16 — ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline — Week 11 — TEMPERATURES, PRESSURE, NOISE AND VIBRATION

**OBJECTIVES:** Evaluate the effects of temperature and pressure in the work environment. Describe the principle effects of vibration on man.

#### OUTLINE:

- I. TEMPERATURE EXTREMES
    - A. Cold
      - 1. Normal temperature
      - 2. Measurements
        - a) Windchill index
        - b) Shiver index
      - 3. Effects on man
      - 4. Protective considerations
    - B. Heat
      - 1. Body physiology
        - a) Metabolic rate
        - b) Blood flow
        - c) Body regulation
          - 1) Convection
          - 2) Evaporation
          - 3) Radiation
      - 2. Effects on man
        - a) Heat exhaustion
        - b) Dehydration
        - c) Heat cramps
        - d) Heat stroke
      - 3. Measurement of heat
        - a) Dry bulb
        - b) Wet bulb
        - c) Humidity
      - 4. Comfort charts
  - 5. Thermal index
  - 6. Protective considerations
    - a) Acclimatization
    - b) Personal protection
    - c) Ventilation
- II. PRESSURE
  - A. Man's response
    - 1. Bends
    - 2. Middle ear response
    - 3. Oxygen starvation
  - B. Protective considerations
- III. NOISE AND VIBRATION
  - A. The physics of sound
    - 1. Sound velocity
    - 2. Decibel
    - 3. Sound pressure level
    - 4. Sound intensity
    - 5. Transmission of sound
  - B. Physiology of the ear
    - 1. External ear
    - 2. Middle ear
      - a) Ear drum
      - b) Ossicles
    - 3. Inner Ear
      - a) Window
      - b) Organ of Corti

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

**Guidelines for Noise Exposure Control**, Cincinnati, Ohio: American Conference of Governmental Industrial Hygienists, 1967.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I, New York: Interscience Publications, 1963.

**The Industrial Environment — Its Evaluation and Control**, U.S. Department of Health, Education and Welfare, Publication No. 614, 1965.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 12 – NOISE

**OBJECTIVES:** Evaluate potential noise problems. Describe noise survey procedures and the basic corrective controls.

#### OUTLINE:

- I. NOISE
  - A. Exposure standards
    - 1. Damage risk criteria
    - 2. Speech interference
    - 3. Daily exposure
  - B. Effects on man
    - 1. Auditory effects
    - 2. Pathology
    - 3. Presbycusis
    - 4. Psychological
  - C. Instrumentation
    - 1. Sound level meters and analyzers
    - 2. Frequency analyzers
    - 3. Narrow band analyzers
    - 4. Frequency band analyzers
    - 5. Peak indicating meters
  - D. Noise surveys
    - 1. Selection of equipment
    - 2. Calibration
      - a) Electric
      - b) Accoustic
    - 3. Noise characteristics
      - a) Steady noise
      - b) Intermittent
      - c) Impulse
      - d) Wide or narrow band
  - 4. Survey procedure
    - a) Selection of position
    - b) Data collection
    - c) Screening survey
    - d) Octave band survey
    - e) Engineering survey
    - f) Environmental considerations
  - E. Noise reduction
    - 1. Process
    - 2. Engineering
    - 3. Personal protection
  - F. Audiometric program
    - 1. Pre-employment physical
    - 2. Periodic testing
    - 3. Termination testing
- II. VIBRATION
  - A. Effects on man
    - 1. Tenosynovitis
    - 2. "Dead fingers"
    - 3. Psychological
  - B. Survey evaluation
    - 1. Instrumentation
    - 2. Evaluation
  - C. Corrective measures
    - 1. Engineering
    - 2. Process change

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

**Guidelines for Noise Control**, Cincinnati, Ohio: American Conference of Governmental Industrial Hygienists, 1967.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I, New York: Interscience Publications, 1963.

**The Industrial Environment – Its Evaluation and Control**, U.S. Department of Health, Education and Welfare, Publication No. 614, 1965.

## OSH 16 — ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline — Week 13 — CONTROL MEASURES — VENTILATION

**OBJECTIVES:** Define the principles and types of ventilation systems used to control air contaminants. Describe ventilation survey procedures.

#### OUTLINE:

- I. VENTILATION THEORY
  - A. Definitions
    - 1. Capture velocity
    - 2. Coefficient of entry
    - 3. Transport velocity
    - 4. Slot velocity
    - 5. Static pressure
    - 6. Plenum
    - 7. Resistance
  - B. Principles
    - 1.  $Q=AV$
    - 2. Pressure drop
    - 3. Blowing vs. exhausting
    - 4. Make-up air
    - 5. Laminar vs. turbulent flow
  - C. Dilution ventilation
- II. SYSTEM DESIGN AND OPERATION
  - A. Typical designs
    - 1. Hood
      - a) Flanging
      - b) Capture velocity
      - c) Slots — air distribution
    - 2. Canopy hoods
    - 3. Down draft
    - 4. Spray booths
    - 5. Local exhaust
  - B. Fans
    - 1. Axial
      - a) Propeller
      - b) Vane
    - 2. Centrifugal
    - 3. Other
    - 4. Estimating capacities
    - 5. Maintenance
  - C. System testing
    - 1. Pitot tube
    - 2. Orifices and nozzles
    - 3. Anemometers
    - 4. Smoke tubes
  - D. Air cleaning
    - 1. Electrostatic precipitators
    - 2. Fabric collectors
    - 3. Wet collectors
    - 4. Dry collectors
    - 5. Absorbtion
    - 6. Catalytic combustion and incineration
  - E. Practical field problem (testing a simple ventilation system)

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

**Industrial Ventilation**, Lansing, Michigan: Committee on Industrial Ventilation, American Conference of Governmental Industrial Hygienists, 1966.

**The Industrial Environment — Its Evaluation and Control**, U.S. Department of Health, Education and Welfare, Publication No. 614, 1965.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 14 – CONTROL MEASURES – ISOLATION, SUBSTITUTION, LABELING

**OBJECTIVES:** Describe isolation and labeling of hazardous materials as a control technique. Define the requirements for substitution as a control.

#### OUTLINE:

- I. ISOLATION AS A CONTROL TECHNIQUE
  - A. Philosophy of isolation
  - B. Isolation technique
    - 1. Physical barrier
      - a) The gloved box
        - 1) Confinement
        - 2) Ventilation control
      - b) Noise isolation
      - c) Others
    - 2. Time
      - a) Automatic equipment
      - b) Other
    - 3. Distance
      - a) Radiation protection
      - b) Remote controls
- II. SUBSTITUTION AS A CONTROL TECHNIQUE
  - A. Philosophy of substitution
  - B. Substitution examples
    - 1. Noise reduction
      - a) Machinery
      - b) Material change
    - 2. Solvent substitution
      - a) Less toxic
      - b) Non-flammable
    - 3. Other
- III. LABELING AS A CONTROL MEASURE
  - A. Code requirements
  - B. Manufacturers data
  - C. In-plant control
    - 1. Toxic data
    - 2. Local labels
    - 3. Purchase control
- IV. ISOLATION OF PLANT UTILITIES
  - A. Water supply
    - 1. Source
      - a) Quality
      - b) Quantity
      - c) Treatment
    - 2. In-plant use
      - a) Process use
      - b) Domestic use
  - B. Cross connections
    - 1. Definition
    - 2. Control measures
      - a) Air gap
      - b) Check valves
      - c) Differential pressure devices
    - 3. Cross connection surveys
    - 4. Installation control
    - 5. Device maintenance

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Patty, F. A., **Industrial Hygiene and Toxicology**, (2nd Edition), Vol. I, New York: Interscience Publications, 1963.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 15 – CONTROL MEASURES – PROTECTIVE EQUIPMENT

**OBJECTIVES:** Select the appropriate respiratory protective equipment for specific respiratory hazards.

#### OUTLINE:

- I. PERSONAL PROTECTIVE EQUIPMENT – GENERAL
  - A. Philosophy of protection
    1. Not generally the best answer
    2. Subject to improper use
    3. Used when –
      - a) Temporary expedient
      - b) Non-repetitive jobs
      - c) Engineering not practical
  - B. Types of equipment
    1. Gloves
    2. Clothing
    3. Ear protection
      - a) Plugs
      - b) Muffs
    4. Heat control
    5. Other
- II. PERSONAL PROTECTIVE EQUIPMENT – RESPIRATORS
  - A. General types
    1. Remove contaminants – air purifying
    2. Provide in contaminated air – air supplied
      3. Carry in contaminated air – self contained
  - B. Air purifying
    1. Dusts
    2. Chemical sorbants
      - a) Gas masks
      - b) Color coding
  - C. Supplied air
    1. Hose masks
    2. Hose mask with blower
    3. Air line
  - D. Self-contained
    1. Rebreathing
    2. Compressed air tank
    3. Liquid air/oxygen units
  - E. Training
    1. Medical exam
    2. Technology
    3. Practice
  - F. Maintenance
    1. Repair
    2. Cleaning
  - G. NIOSH approval
  - H. General considerations
    1. Oxygen deficiency
    2. Lethal materials
    3. Explosive atmosphere

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

**Respiratory Protective Devices Manual**, American Conference of Governmental Industrial Hygienists, Lansing, Michigan: Braun and Brumfield, 1963.

**The Industrial Environment – Its Evaluation and Control**, U.S. Department of Health, Education and Welfare, Publication No. 614, 1965.

## OSH 16 — ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline — Week 16 — SANITATION IN THE WORK PLACE

**OBJECTIVES:** Develop a checklist for a sanitation inspection of the usual industrial plant that will insure a proper survey of the sanitation problems.

#### OUTLINE:

- I. SOLID WASTE DISPOSAL
  - A. Collection systems
    - 1. Proper container
    - 2. Segregation
    - 3. Pick up schedule
  - B. Disposal
    - 1. Land fill
    - 2. Grinding
    - 3. Incineration
    - 4. Environmental considerations
- II. INSECT AND RODENT CONTROL
  - A. Disease transmission
    - 1. The disease cycle
    - 2. Vectors
      - a) Fly
      - b) Mosquito
      - c) Rat
      - d) Squirrel
      - e) Cockroach
  - B. Control measures
    - 1. Construction
      - a) Screens
      - b) Rodent stops
    - 2. Proper sanitation
      - a) Elimination of breeding
      - b) Eliminate food supply
- 3. Chemical control
  - a) Environmental considerations
  - b) Control of material
  - c) Applicator training
  - d) Applicator protection
  - e) Control program
- III. FOOD SANITATION
  - A. Food and illness
    - 1. Bacterial
    - 2. Toxic
  - B. Food handling
    - 1. Storage practices
    - 2. Preparation considerations
    - 3. Serving
    - 4. The food handler
  - C. Clean up
    - 1. Garbage storage
    - 2. Garbage disposal
    - 3. Dishwashing
  - D. Inspection programs
    - 1. Inspection techniques
    - 2. Schedules
    - 3. Corrective action
    - 4. Outside agencies
  - E. Vector control
    - 1. Program
    - 2. Food considerations

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

## OSH 16 – ELEMENTS OF INDUSTRIAL HYGIENE

### Session Outline – Week 17 – ENVIRONMENTAL CONCERNS

**OBJECTIVES:** Describe the environmental health functions of the major State and Federal Agencies

#### OUTLINE:

- I. FEDERAL PROGRAM
  - A. Environmental Protection Agency
    - 1. Scope of program
    - 2. Laws
    - 3. Regional organization
    - 4. Impact on places of employment
      - a) Legal
      - b) Services
  - B. National Institute of Occupational Safety and Health
    - 1. Scope of program
    - 2. Laws
    - 3. Regional organization
    - 4. Impact on places of employment
      - a) Legal
      - b) Services
  - C. Department of Labor
    - 1. Scope of program
    - 2. Laws
    - Regional organization
    - 4. Impact on places of employment
      - a) Legal
      - b) Services
  - D. Other
- II. STATE PROGRAM
  - A. Division of Industrial Safety
    - 1. Scope of program
    - 2. Laws
    - 3. Regional organization
    - 4. Impact on places of employment
      - a) Legal
      - b) Services
  - B. State Department of Public Health
    - 1. Scope of program
    - 2. Laws
    - 3. Regional organization
    - 4. Impact on places of employment
      - a) Legal
      - b) Services
- III. COUNTY AND LOCAL AGENCIES
  - A. Health Department
    - 1. Laws
    - 2. Impact on places of employment
      - a) Legal
      - b) Services

#### INSTRUCTOR REFERENCES:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 1 – INTRODUCTION

**OBJECTIVES:** Describe the principal controls used to prevent fires. Identify the agencies concerned with fire protection.

#### OUTLINE:

- I. PURPOSES OF THE COURSE
  - A. To gain increased understanding of the magnitude of controllable losses caused by fires, wind-storms, and earthquakes
  - B. To learn the principal causes of such incidents
  - C. To learn some of the fundamentals of protecting structures from fire
  - D. To learn some of the ways to protect flammable solids, liquids and gases from fire
  - E. To learn about the operation and maintenance of principle types of fire fighting devices and systems
  - F. To learn about pertinent standards, laws and regulations
- II. THE MAGNITUDE OF THE FIRE PROBLEM
  - A. Loss of life by fire
    - 1. Deaths and injuries caused by fire
    - 2. Life safety and fire protection
    - 3. Trends of fire casualties
    - 4. Loss of life statistics
  - 5. Fires causing large loss of life
  - B. Property fire losses
    - 1. Property losses by fire, U.S. and Canada
    - 2. Indirect fire losses
- III. PRINCIPAL CONTROLS OF FIRES
  - A. Proper building construction
  - B. Proper location and protection of machinery and equipment
  - C. Proper location of materials stored and processed
  - D. Necessary water supplies, hydrants, hoses, automatic sprinkler systems and portable fire extinguishers
  - E. Proper organization and training
  - F. Appropriate managerial controls
- IV. SOURCES OF INFORMATION
  - A. National Fire Protection Association
  - B. Insurance service organizations
  - C. Fire service organizations
  - D. Governmental agencies
  - E. Building code groups
  - F. New commercial organizations having fire protection interests
  - G. Professional organizations
  - H. Trade associations

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 2 – THE FIRE PROBLEM

**OBJECTIVES:** Describe the reactions involved in fires and explosions and the theories of fire and explosion control.

#### OUTLINE:

- I. ANALYSIS OF FIRE LOSSES
  - A. Evaluating large-loss building fire experience
  - B. Fire losses by cause of fire
  - C. Average fire losses by occupancy
- II. CHEMISTRY AND PHYSICS OF FIRE
  - A. Basic definitions and properties
  - B. Principles of fire
  - C. Heat measurement
  - D. Heat transfer
  - E. Heat energy sources
- III. EXPLOSIONS
  - A. Explosions from detonation of gases
  - B. Explosions from detonation of dust
  - C. Explosions from detonation of mists
  - D. Pressure-release explosions
  - E. Decomposition explosions
  - F. Nuclear detonations
- IV. PRODUCTS OF COMBUSTION AND THEIR EFFECTS ON LIFE SAFETY
  - A. Fire gases
  - B. Flame
  - C. Heat
  - D. Smoke
  - E. Insufficient oxygen
- V. THEORY OF FIRE AND EXPLOSION CONTROL
  - A. Extinguishment by cooling
  - B. Extinguishment by separation of the oxidizing agent from the fuel
  - C. Extinguishment by dilution or removal of fuel supply
  - D. Chemical extinguishment
  - E. Explosion suppression

#### INSTRUCTOR REFERENCES:

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- Davis, T. L., **The Chemistry of Powder and Explosives**, New York: John Wiley and Sons, 1941.
- Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.
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- Thompson, N. J., **Fire Behavior and Sprinklers**, Boston: National Fire Protection Association, 1964.

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 3 – BUILDING CONSTRUCTION

**OBJECTIVES:** Identify potential fire problems of various building structures.

#### **OUTLINE:**

- I. FUNDAMENTAL CONSIDERATIONS  
IN BUILDING DESIGN AND  
CONSTRUCTION
  - A. Influence on the design of  
buildings
  - B. Location and exposure
  - C. Occupancy considerations
  - D. Fire loading
  - E. Selection of building materials  
and assemblies
  - F. Fire subdivisions – heights and  
areas
  - G. Structural stability and fire  
integrity of building assemblies
  - H. Accessibility for fire fighting
- II. FRAMING
  - A. Definition of framing  
components
  - B. Framing materials
    1. Reinforced concrete
    2. Prestressed concrete
    3. Steel
    4. Iron
    5. Aluminum
    6. Wood
  - C. Fireproofing of structural  
members
- III. WALLS AND PARTITIONS
  - A. Definitions of types of walls
  - B. Types of wall construction
    1. Reinforced concrete
    2. Masonry
    3. Steel frame
    4. Wooden frame
  - C. Fire walls and partitions
  - D. Fire stopping in wood frame  
construction
- IV. ROOF COVERINGS
  - A. Classifications of fire retardant  
roof coverings
  - B. Roof deck insulation and  
vapor barriers

#### **INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Building Weaknesses – Do You Know Them?**, Boston: National Fire Protection Association Publication No. F37-3.

**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

**National Fire Codes, Volume 4**, Boston: National Fire Protection Association.

**Standard Methods of Fire Tests of Building Construction and Materials**, Boston: National Fire Protection Association, Fire Test Procedure Publication No. 251.

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 4 – PROTECTING STRUCTURES FROM FIRE

**OBJECTIVES:** Specify the more common protective measures for various structures and parts of structures.

#### OUTLINE:

- I. FIRE RESISTANCE OF BUILDING MATERIALS AND ASSEMBLIES
  - A. Anticipating fire severity
  - B. Fire test methods
  - C. Estimates of fire resistance by interpolations
  - D. Fire resistive constructions
  - E. Ceilings
  - F. Beams, girders and trusses
- II. INTERIOR FINISH
  - A. Definition of interior finish materials
  - B. Types of interior finish materials
  - C. Methods of applying interior finish materials
  - D. Fire safety considerations
  - E. Determining fire characteristics
- III. TYPES OF BUILDING CONSTRUCTION
  - A. Fire resistive construction
  - B. Heavy timber construction
  - C. Noncombustible construction
  - D. Ordinary construction
  - E. Wood frame construction
- IV. PROTECTION OF OPENINGS IN FLOORS, WALLS AND PARTITIONS
  - A. Vertical openings
  - B. Horizontal openings
  - C. Fire doors
  - D. Methods of operation of doors
  - E. Door closing devices
  - F. Fire door maintenance
  - G. Fire shutter and glass blocks
  - H. Wired-glass windows
  - I. Smoke stop doors
  - J. Special methods of protecting open shafts
  - K. Water spray method for protecting conveyor openings

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Approval Guide**, Factory Mutual Engineering Corp.

**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

**National Building Code**, New York; American Insurance Association, 1967.

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 5 – PROTECTING STRUCTURES AND PERSONNEL FROM FIRES

**OBJECTIVES:** Identify the critical exposures and specify the measures necessary to protect life and building integrity from exposure to fire.

#### OUTLINE:

- I. EXITS
  - A. The Life Safety Code
    1. Sufficient exits
    2. Protection of exits from fire
    3. Alternate exits
    4. Areas of refuge
    5. Alarm systems
    6. Adequate lighting
    7. Signs
    8. Safeguarding of equipment along escape route
    9. Exit drills
    10. Control of interior finishes
    11. Control of psychological factors
  - B. Hazards of contents
    1. Influence of occupancy
    2. Influence of building construction and design
    3. Influences of interior finishes and decorations
    4. Influence of psychological and physiological factors
    5. Influence of fire protection equipment
  - C. Definition of the term "exit"
    1. Access to exits
    2. Capacity of unit of exit width
    3. Occupant load
  - D. Exit facilities and arrangements
    1. Doors
    2. Exit door hardware
    3. Horizontal exits
    4. Stairs
    5. Smokeproof towers
    6. Ramps
    7. Fire escape stairs
  8. Windows
  - E. Exit lighting and signs
  - F. Alarm systems
  - G. Fire exit drills
  - H. Exit maintenance
- II. SMOKE AND HEAT VENTING
  - A. Progress on smoke and heat venting
  - B. Ventilating methods and applications
    1. Roof venting methods
    2. Curtain boards as aids to venting
    3. Size and spacing of vents
    4. Application of vents
    5. Effects of wind on roof vents
  - C. Theory of smoke and heat venting
- III. PROTECTION AGAINST EXPOSURE
  - A. Factors influencing severity of exposure
  - B. Ignition studies affecting fire exposure
  - C. Methods of protection against exposure fires
    1. Clear spaces
    2. Walls
    3. Protection of openings
    4. Protection devices
      - a) Inside automatic sprinklers
      - b) Outside automatic sprinklers
      - c) Fire doors
      - d) Wired glass windows
      - e) Glass block panels
      - f) Shutters

#### INSTRUCTOR REFERENCES:

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- Fire Doors and Windows**, Boston: National Fire Protection Association, Publication No. 80.
- Fire Protection Handbook** (13th Edition) Boston: National Fire Protection Association, 1971.
- Fire Tests of Door Assemblies**, Boston: National Fire Protection Association, Publication No. 252
- Law, M., **Heat Radiation from Fires and Building Separation**, London: 1963.
- Life Safety Code**, Boston: National Fire Protection Association, Publication No. 101, 1967.
- Suggested Practice for the Protection Against Fire Exposure of Openings in Fire Resistive Walls**, Boston: National Fire Protection Association, Publication No. 80-A.

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 6 – FLAMMABLE LIQUIDS AND GASES

**OBJECTIVES:** Develop a program for the proper storage and handling of flammable gases and liquids that meet requirements of State and Federal codes.

#### OUTLINE:

- |   |  |
|---|--|
| <p>I. FIRE HAZARD PROPERTIES OF FLAMMABLE AND COMBUSTIBLE LIQUIDS</p> <ul style="list-style-type: none"><li>A. Classification of flammable and combustible liquids</li><li>B. Physical properties of liquids</li><li>C. Fire characteristics</li><li>D. Burning characteristics of flammable and combustible liquids</li></ul>  | <p>III. FIRE HAZARD PROPERTIES OF GASES</p> <ul style="list-style-type: none"><li>A. Gases defined</li><li>B. Classification of gases</li><li>C. Chemical structure and physical properties</li><li>D. Gas laws</li><li>E. Diffusion rates</li><li>F. Cryogenic gases</li><li>G. Fires characteristics</li><li>H. Transportation</li></ul>   |
| <p>II. STORAGE AND HANDLING OF FLAMMABLE AND COMBUSTIBLE LIQUIDS</p> <ul style="list-style-type: none"><li>A. Discussion of fire prevention principles</li><li>B. Classification of flammable and combustible liquids</li><li>C. Tank storage of flammable and combustible liquids</li><li>D. Other storage of flammable liquids</li><li>E. Handling of flammable and combustible liquids</li><li>F. Transportation</li></ul> | <p>IV. STORAGE AND HANDLING OF GASES</p> <ul style="list-style-type: none"><li>A. Air</li><li>B. Acetylene</li><li>C. Ammonia</li><li>D. Anesthetic gases</li><li>E. Carbon dioxide</li><li>F. Chlorine</li><li>G. Ethylene</li><li>H. Hydrogen</li><li>I. Oxygen</li><li>J. City gas</li><li>K. Liquefied petroleum gases</li><li>L. Other gases</li><li>M. Extinguishing gas fires</li></ul> |

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Compilation of Labeling Laws and Regulations for Hazardous Substances**, New York: Chemical Specialties Manufacturing Association.

**Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids**, Boston: National Fire Protection Association, Publication No. 325M, 1965.

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**Flammable and Combustible Liquid Code**, Boston: National Fire Protection Association, Publication No.30.

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Perry, J. H., **Chemical Engineer's Handbook**, New York: McGraw-Hill, 1964.

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 7 – FLAMMABLE SOLIDS

**OBJECTIVES:** Draft a program for the safe handling and storage of flammable solids, develop a checklist for the inspection of facilities.

#### OUTLINE:

- I. FIRE HAZARD PROPERTIES OF ORDINARY COMBUSTIBLE SOLIDS
  - A. Definition of ordinary combustible solids
  - B. Chemical composition of ordinary combustible solids
  - C. Variables influencing ignition and burning characteristics
    - 1. Physical form
    - 2. Heat conductivity
    - 3. Moisture content
    - 4. Ignition temperatures
    - 5. Rate and period of heating
    - 6. Spontaneous heating and ignition
    - 7. Rate of combustion
    - 8. Speed of flame propagation
    - 9. Amount of fuel contributed
    - 10. Products of combustion
- II. GENERAL STORAGE PRACTICES
  - A. Discussion of fire protection principles
  - B. Indoor storage practices
    - 1. Building arrangement
    - 2. Storage arrangement
    - 3. Fire protection
    - 4. Building facilities and maintenance
  - C. Outdoor storage practice
    - 1. Selection of site
    - 2. Zoning regulations
    - 3. Preparation of the site
    - 4. Utilization of the site
    - 5. Maintenance of the site
    - 6. Materials stored outdoors
    - 7. Private fire protection
  - D. Storage of specific materials
    - 1. Wood and wood products
    - 2. Paper and paper products
    - 3. Rubber tires
    - 4. Cellular rubber and plastic materials
    - 5. Plastics
    - 6. Combustible fibers
    - 7. Coal
    - 8. Miscellaneous
- III. THE STORAGE AND HANDLING OF CHEMICALS
  - A. Storage of chemicals
    - 1. Separation
    - 2. Fire control
    - 3. Storage and fire protection of oxidizing chemicals
    - 4. Storage and fire protection of water and air reactive chemicals
    - 5. Storage and fire protection of unstable chemicals
    - 6. Storage and fire protection for corrosive chemicals
    - 7. Storage and fire protection of radioactive materials
    - 8. Explosives and blasting agents
  - B. Handling chemicals
    - 1. Reactive and unstable chemicals
    - 2. Toxic chemicals
    - 3. Radioactives
    - 4. Salt baths
  - C. Transportation of chemicals
  - D. Waste chemical disposal
- IV. HOUSEKEEPING PRACTICES
  - A. Building care and maintenance
    - 1. Cleaning and treatment of floors
    - 2. Dust and lint removal
    - 3. Chimney cleaning
    - 4. Kitchen exhaust ducts
  - B. Occupancy and process housekeeping
    - 1. Rubbish disposal
    - 2. Housekeeping hazards
    - 3. Refuse chutes
    - 4. Combustible metal waste
    - 5. Radioactive waste
    - 6. Lockers and cupboards
  - C. Outdoor housekeeping
    - 1. Weed and grass control
    - 2. Refuse and rubbish disposal

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Factory Mutual Engineering Corp., Handbook of Industrial Loss Prevention**, New York: McGraw-Hill, 1967.  
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**Rubbish Handling**, Boston: National Fire Protection Association, Publication No. 82-A, 1948.

**Standard on Incinerators**, Boston: National Fire Protection Association, Publication No. 82, 1960.

**Standard for Indoor General Storage**, Boston: National Fire Protection Association, Publication No. 231, 1965.

**Standard for the Installation of Sprinkler Systems**, Boston: National Fire Protection Association, Publication No. 13, 1968.

**Standard for the Installation of Standpipe and Hose Systems**, Boston: National Fire Protection Association, Publication No. 14.

## OSH 17 — INDUSTRIAL FIRE PROTECTION

### Session Outline — Week 8 — PROCESS HAZARDS

**OBJECTIVES:** Identify the major fire problems and general controls in the common manufacturing process.

#### OUTLINE:

- I. PROCESS HAZARDS — FLAMMABLE LIQUIDS
  - A. Incidental use of liquids
    - 1. Painting and finishing
    - 2. Spray finishing
    - 3. Dipping operations
    - 4. Silk Screening
    - 5. Dry cleaning
    - 6. Metal cleaning
    - 7. Hydraulic fluids
    - 8. Heat transfer fluids
  - B. Unit operations
- II. PROCESS HAZARDS — GASES
  - A. Welding and cutting
    - 1. Gas welding
    - 2. Gas cutting
    - 3. Oxygen-fuel gas apparatus
    - 4. Fire prevention in welding and cutting
    - 5. Protection of personnel
    - 6. Storage of oxygen cylinders
    - 7. Metal spraying
  - B. Refrigeration
    - 1. Refrigeration cycle
    - 2. Types of systems
    - 3. Uses of refrigeration equipment
    - 4. Hazards of refrigeration equipment
    - 5. Fire prevention
- III. OVENS AND FURNACES
  - A. NFPA Classifications of ovens and furnaces
  - B. Classification by type of handling system
  - C. Location and construction of ovens and furnaces
  - D. Oven and furnace heating systems
  - E. Ventilation of Class A ovens
  - F. Safety controls for Class A ovens and furnaces
  - G. Fire and explosion protection for Class A ovens
  - H. Testing and maintenance for Class A ovens
  - I. Class B industrial furnaces
  - J. Class C ovens and furnaces

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**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

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Safety Code for Mechanical Refrigeration, **USA Standard B9.1**, New York: USA Standards Institute, 1964.

Safety in Welding and Cutting, **USA Standard 249.1**, New York: USA Standards Institute, 1958.

**Standard for Fire Protection in Use of Cutting and Welding Process**, Boston: National Fire Protection Association, Codes and Standards No. 51-B, 1964.

**Standard for the Installation of Air Conditioning and Ventilating Systems**, Boston: National Fire Protection Association, Codes and Standards No. 90-A, 1968.

**Standard for the Installation of Gas Piping**, Boston: National Fire Protection Association, Codes and Standards No. 54, 1964.

**Standard for Installation of Oil Burning Equipment**, Boston: National Fire Protection Association, Codes and Standards No. 31, 1968.

**Standard for Ovens and Furnaces Designs, Location and Equipment**, Boston: National Fire Protection Association, Codes and Standards No. 86-A, 1966.

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 9 – LOSSES CAUSED BY NATURAL DISASTER

**OBJECTIVES:** Describe the potential losses from natural disasters and the normal control measures utilized.

#### OUTLINE:

- I. WINDSTORM PROTECTION
  - A. Types of windstorms
  - B. Wind forces on buildings
  - C. Recording wind velocities
  - D. Gross uplift force
  - E. Net uplift force
  - F. Wind forces on leeward walls
  - G. Roof anchorage
  - H. Steps in designing roof anchorage
- II. EARTHQUAKE PROTECTION
  - A. Earthquake design
  - B. Foundations
  - C. Shape of buildings
  - D. Height of buildings
  - E. Types of construction
  - F. Structural details
- III. LIGHTNING AND LIGHTNING PROTECTION
  - A. Factors determining the problem
    - 1. Frequency and severity of thunderstorms
    - 2. Value and nature of buildings and contents
  - 3. Personal hazards
  - 4. Relative exposures
  - 5. Indirect losses
  - B. Theory of lightning protection
  - C. The nature of lightning
  - D. Property of protection
    - 1. Conductors
    - 2. Grounding
    - 3. Structural steel buildings
    - 4. Reinforced concrete structures
    - 5. Metal roofed and metal clad buildings
    - 6. Underwriters' Laboratories lightning "Master Label Service"
    - 7. Tanks containing flammable liquids
    - 8. Tall structures
    - 9. Other specialized structures
    - 10. Grounding metal masses
    - 11. Maintenance
    - 12. Lightning arrestors
  - E. Protection of persons
    - 1. Places to seek shelter
    - 2. Locations to avoid

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Fire Protection Handbook** (13th Edition) Boston: National Fire Protection Association, 1971.

**Fire Protection Standard for Motor Craft**, Boston: National Fire Protection Association, Codes and Standards No. 302, 1968.

**Lightning Protection Code**, Boston: National Fire Protection Association, Codes and Standards No. 78, 1968.

**National Electrical Code**, Boston: National Fire Protection Association, Codes and Standards No. 70, 1968.

Session Outline — Week 10 — FIRE PROTECTION STANDARDS

**OBJECTIVES:** Identify the agencies promulgating fire standards. Utilize fire codes to specify design requirements of a simple structure.

**OUTLINE:**

- |  |   |
|--|---|
| <p><b>I. FIRE PROTECTION STANDARDS AND LAWS</b></p> <p>A. Scope and availability of NFPA standards</p> <ol style="list-style-type: none"> <li>1. Vol. I - Flammable Liquids</li> <li>2. Vol. II - Gases</li> <li>3. Vol. III - Combustible Solids, Dusts &amp; Explosives</li> <li>4. Vol. IV - Building Construction and Facilities</li> <li>5. Vol. V - Electrical</li> <li>6. Vol. VI - Sprinklers, Fire Pumps &amp; Water Tanks</li> <li>7. Vol. VII - Alarm &amp; Special Extinguishing Systems</li> <li>8. Vol. VIII - Portable &amp; Manual Fire Control Equipment</li> <li>9. Vol. IX - Occupancy Standards &amp; Process Hazards</li> <li>10. Vol. X - Transportation</li> </ol> <p>B. How NFPA Fire Protection Standards are prepared</p> <p>C. Other sources of fire protection standards</p> <p>D. Federal legislation in the United States</p> <p>E. State laws and regulations</p> <p>F. County and municipal ordinances and codes</p> | <p><b>II. DIGEST OF STATE FIRE PROTECTION AGENCIES, LAWS AND REGULATIONS</b></p> <p>A. Enforcement agencies in each state</p> <p>B. California — Office of the State Fire Marshall</p> <ol style="list-style-type: none"> <li>1. Application statutes</li> <li>2. Laboratory for testing and for fire research</li> <li>3. Division of Industrial Safety</li> <li>4. Division of Housekeeping</li> </ol> <p>C. Adoption of NFPA codes and standards into law</p> <ol style="list-style-type: none"> <li>1. NFPA codes adopted by reference</li> <li>2. NFPA codes adopted by prima facie methods</li> <li>3. NFPA codes and standards modified by states</li> <li>4. NFPA codes adopted as rules and regulations by the State Fire Marshall</li> <li>5. NFPA codes used as evidence of compliance</li> <li>6. NFPA codes used as references and guides</li> <li>7. NFPA codes applied by county or local jurisdictions</li> </ol> |
|--|---|

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Federal Register**, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

## OSH 17 — INDUSTRIAL FIRE PROTECTION

### Session Outline — Week 11 — FIRE LAWS

**OBJECTIVES:** Interpret and apply certain OSHA fire safety requirements to specific situations.

#### OUTLINE:

- I. THE OCCUPATIONAL SAFETY AND HEALTH ACT
  - A. Background
  - B. Purpose
  - C. Applicability
  - D. Occupational Safety and Health Standards
  - E. Administration
  - F. Inspections, investigations, record keeping
  - G. Procedure for enforcement
  - H. Judicial review
  - I. Occupational Safety and Health Review Commission
  - J. Penalties
  - K. National Institute for Occupational Safety and Health
  - L. Statistics
- II. REVIEW OF FEDERAL STANDARDS
  - A. Subpart E - means of egress
    - 1. Definitions
    - 2. General means of egress
  - B. Subpart H - hazardous materials
    - 1. Flammable and combustible liquids
    - 2. Spray finishing using flammable and combustible materials
    - 3. Dip tanks containing flammable or combustible liquids
    - 4. Storage and handling of liquefied petroleum gases
  - C. Subpart L - fire protection
    - 1. Portable fire extinguishers
    - 2. Standpipe and hose systems
    - 3. Automatic sprinkler systems
    - 4. Fixed dry chemical extinguishing systems
    - 5. Carbon dioxide extinguishing systems
    - 6. Local fire alarm signaling systems

#### INSTRUCTOR REFERENCES:

**Federal Register**, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

**The Fire Problem**, Boston: National Fire Protection Association.

**National Fire Protection Association's Guide to OSHA - Fire Protection Regulations**, Volumes i - V.

Volume I - NFPA - OSHA Regulations

Volume II - OSHA - NFPA Standards No. 10-32

Volume III - OSHA - NFPA Standards No. 24-58

Volume IV - OSHA - NFPA Standards No. 82-60

Volume V - OSHA - NFPA Standards No. 86A-490

Occupational Safety and Health Administration, **Federal Register**, Part II, 36, 105, U.S. Department of Labor (May 29, 1971).

OSHA Standards - Changes Underway and in the Offing, **Occupational Hazards**, May 1972.

Public Law 91-596, 91st Congress, December 29, 1970, **An Act**.

**Safety Standards**, Volume 20, No. 2, 1971.

Session Outline – Week 12 – PRIVATE FIRE PROTECTION

**OBJECTIVES:** Draft a checklist for the inspection of a private fire protection system.

**OUTLINE:**

- I. CONNECTIONS FOR FIRE PROTECTION FROM PUBLIC WATER SYSTEMS
  - A. Charges for connections for fire protection
    2. Control of connections during fires
    3. Control of water waste
  - B. Meters
    1. Disc meters
    2. Piston meters
    3. Current meters
    4. Compound meters
    5. Venturi meters
    6. Fire flow meters
    7. Hersey detection meters
    8. Neptune trident meters
    9. Rockwell turbo meters
    10. Meters for fire connections
    11. Friction loss in water meters
  - C. Check valves
    1. Double check valves
    2. Single check valves
    3. Backflow preventers
    4. Testing and cleaning check valves
- II. PIPED SYSTEMS OF WATER FOR FIRE PROTECTION
  - A. Requirements for hose lines outside of buildings
    1. Hydrants
    2. Monitor nozzles
  - B. Separate fire and domestic systems
  - C. Piping and fittings
    1. Size of pipes
    2. Lines supplying hydrants only
  3. Types of pipe
    - a) Asbestos-cement pipe
    - b) Cast iron and ductile pipe
    - c) Steel pipe
    - d) Reinforced concrete pipe
  4. Joints
  5. Fittings
  - D. Rules for laying pipe
    1. Protection against freezing
    2. Protection against breakage
    3. Care in laying
    4. Anchorage
    5. Testing
    6. Back filling
    7. Flushing
  - E. Hydrants
    1. Setting of hydrants
    2. Maintenance of hydrants
    3. Frozen hydrants
  - F. Valves and indicator posts
    1. Types and proper usage
    2. Tests of valves
    3. Location of valves
    4. Valve records
    5. Valve supervision
  - G. Hose and hydrant houses and equipment
    1. Amount of hose
    2. Accessories
  - H. Hose carriers
  - I. Standpipe and inside hose systems
    1. Capacity and arrangements
    2. Hose connections
    3. Water supplies
    4. Connections, valves and gauges
    5. Inspections

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Alarm Accessories for Automatic Water Supply Control Valves for Fire Protection Service**, Underwriters Laboratories Standards No. 753, 1967.

**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

**Gate Valve for Fire Protection Service**, Underwriters Laboratories Standards No. 262, 1966.

**Hose Valves**, Underwriters Laboratories Standards No. 668, 1967.

**Hydrants for Fire Protection Service**, Underwriters Laboratories Standards No. 246, 1966.

**Indicator Posts for Fire Protection Service**, Underwriters Laboratories Standards No. 789, 1966.

**Standard for Outside Protection**, Boston: National Fire Protection Association Standards No. 24, 1968

**Standard for Installation of Standpipe and Hose Systems**, Boston: National Fire Protection Association Standards No. 14, 1968.

**Standard for the Supervision and Care of Valves Controlling Water Supplies for Fire Protection**, Boston: National Fire Protection Association Standards No. 26, 1958.

**Unlined Fire Hose**, Underwriters Laboratories Standards No. 18, January 1957.

**Water Charges for Private Fire Protection**, Boston: National Fire Protection Association Standards No 292M, 1961.

Session Outline — Week 13 — DETECTION AND EXTINGUISHING SYSTEMS

**OBJECTIVES:** Describe the principles and operation of the common fire detection and extinguishing systems.

**OUTLINE:**

- |   |  |
|---|--|
| <p>I. AUTOMATIC AND MANUAL FIRE ALARM AND SIGNALING SYSTEMS</p> <ul style="list-style-type: none"> <li>A. Principles of fire protective signaling</li> <li>B. Functions of protective signaling systems</li> <li>C. Classification of protective signaling systems</li> <li>D. Operating principles of fire detectors</li> <li>E. Thermal lag</li> <li>F. Spacing of detection devices</li> <li>G. Types of automatic fire detection systems</li> <li>H. Single station units</li> <li>I. Fusible links and releases</li> <li>J. Fire extinguishing systems as fire detection systems</li> <li>K. Actuation of fire control equipment</li> </ul> <p>II. FIRE GUARD SERVICES AND WATCHCLOCK SYSTEMS</p> <ul style="list-style-type: none"> <li>A. Supervisory systems</li> <li>B. Guard clock systems</li> </ul> | <p>III. WATER AND WATER ADDITIVES FOR FIRE FIGHTING</p> <ul style="list-style-type: none"> <li>A. Physical properties</li> <li>B. Extinguishing properties</li> <li>C. Electrical conductivity of water</li> <li>D. Freezing temperatures and anti-freeze additives</li> <li>E. Surface tension and wetting agent additives</li> <li>F. Viscosity and additives to thicken water</li> <li>G. Water on combustible and flammable liquid fires</li> </ul> <p>IV. CARBON DIOXIDE</p> <ul style="list-style-type: none"> <li>A. Properties affecting fire extinguishment</li> <li>B. Extinguishing properties</li> <li>C. Limitations as an extinguishing agent</li> </ul> <p>V. DRY CHEMICAL</p> <ul style="list-style-type: none"> <li>A. Chemical and physical properties</li> <li>B. Extinguishing properties</li> <li>C. Uses and limitations</li> <li>D. Storage and handling</li> <li>E. Quality control</li> </ul> |
|---|--|

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- Control Units for Fire Protective Signaling Systems, UL846**, Underwriters Laboratories, September 1957.
- Dry Chemical Extinguishing Systems**, Boston: National Fire Protection Association Codes and Standards No. 17, 1968.
- Fire Protection Handbook** (13th Edition) Boston: National Fire Protection Association, 1971.
- Flammable and Combustible Liquids Codes**, Boston: National Fire Protection Association Codes and Standards No. 30, 1966.
- Signaling Boxes, UL464**, Underwriters Laboratories, 1956.
- Smoke Detectors for Fire Protective Signaling Systems, UL168**, Underwriters Laboratories, 1962.
- Standard for the Installation of Portable Fire Extinguishers**, Boston: National Fire Protection Association Codes and Standards No. 10, 1968.
- Standard for Water Spray Systems for Fire Protection**, Boston: National Fire Protection Association Codes and Standards No. 15, 1962.
- Standard for Installation of Sprinkler Systems**, Boston: National Fire Protection Association Codes and Standards No. 13, 1968.
- Thermostats, Fire Detection, UL521**, Underwriters Laboratories, December, 1962.

Session Outline – Week 14 – DETECTION AND EXTINGUISHING SYSTEMS –  
LABORATORY

**OBJECTIVES:** Develop a checklist for the inspection of a fire detection and extinguishing system.

**OUTLINE:**

- I. FIRE DETECTION SYSTEMS
  - A. Types of automatic fire detection systems
    - 1. Control station systems
    - 2. Local systems
    - 3. Auxiliary systems
    - 4. Remote station systems
    - 5. Proprietary systems
  - B. Single station units
    - 1. Gas powered type
    - 2. Mechanical type
    - 3. Photo electric type
  - C. Fusible links and releases
  - D. Fire extinguishing systems as fire detection systems
  - E. Actuation of fire control equipment
    - 1. Pneumatic rate-of-rise actuating devices
    - 2. Metal expansion rate-of-rise actuating devices
    - 3. Fixed temperature detection systems
    - 4. Recycling sprinkler systems
- II. AUTOMATIC SPRINKLER SYSTEMS – BACKGROUND
  - A. Development of sprinkler protection
    - 1. The automatic sprinkler
    - 2. Perforated pipe systems
    - 3. Open sprinklers
    - 4. Early automatic sprinklers
  - B. Value of automatic sprinklers
    - 1. Safety to life
    - 2. Protection of property
    - 3. Prevention of business interruption
    - 4. Minimizing of water damage
    - 5. Economics of sprinkler protection
  - C. Records of automatic sprinkler performance
    - 1. Effectiveness of automatic sprinklers
    - 2. Number of automatic sprinklers that operate
    - 3. Effectiveness of sprinklers occupancy group
- III. OPERATION OF AUTOMATIC SPRINKLERS
  - A. Standard sprinkler installation
    - 1. NFPA sprinkler standard
    - 2. Other NFPA standards
  - B. Considerations of building features
    - 1. Floor cut-offs – multi-story buildings
    - 2. Large floor areas
    - 3. High ceilings
    - 4. Concealed spaces
    - 5. Shielded fires
    - 6. Building location
  - C. Hazards of occupancy
  - D. Special occupancy conditions
    - 1. High piled combustible material
    - 2. Flammable and combustible liquids
    - 3. Combustible dusts
    - 4. Chemicals and explosives
  - E. Location and spacing of sprinklers
    - 1. Complete protection
    - 2. Partial installation
    - 3. Area and spacing limitations
    - 4. Obstructions to distribution
    - 5. Clearance between sprinklers and ceilings
  - F. Sprinkler piping
    - 1. General pipe schedule requirements
    - 2. Sprinklers on branch line piping
    - 3. Arrangement of sprinkler supply piping
    - 4. Risers
    - 5. Water supply connections
    - 6. Installation standards
    - 7. Test equipment
  - G. Valves and other features
  - H. Approval of sprinkler systems installations
    - 1. Preparation of plans
    - 2. Final approval
    - 3. Flushing and testing
- 4. Unsatisfactory sprinkler performance by occupancy group

## **INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Care and Maintenance of Sprinkler Systems**, Boston: National Fire Protection Association Codes and Standards No. 13A, 1968.

**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

**Standard for the Installation of Centrifugal Fire Pumps**, Boston: National Fire Protection Association Codes and Standards No 20, 1968.

**Standard for Outside Protection**, Boston: National Fire Protection Association Codes and Standards No. 24, 1968.

**Standard for Water Tanks for Private Fire Protection**, Boston: National Fire Protection Association Codes and Standards No. 22, 1967.

**Standard for the Installation of Sprinkler Systems**, Boston: National Fire Protection Association Codes and Standards NO. 13, 1968.

**Standard for the Installation of Standpipe and Hose Systems**, Boston: National Fire Protection Association Codes and Standards No. 14, 1968.

Session Outline – Week 15 – FIRE FIGHTING AND OTHER EMERGENCIES

**OBJECTIVES:** Draft a fire protection plan that meets regulatory requirements for small facilities.

**OUTLINE:**

- I. GENERAL MANAGEMENT FUNCTIONS IN A FIRE LOSS PREVENTION ORGANIZATION
  - A. President and Executive Committee
    - 1. Evaluation of loss potentials
    - 2. Making a loss evaluation
    - 3. Outside assistance
  - B. The General Manager
    - 1. The fire loss prevention manager
    - 2. The engineering manager
  - C. Management of the organization
    - 1. Pre-fire management
    - 2. Departmental fire organization
    - 3. Public and employee relations
    - 4. Management in emergencies
    - 5. Communications
- II. THE FIRE LOSS PREVENTION MANAGER
  - A. The position of the Fire Loss Prevention Manager
  - B. Establishment of inspection routines
    - 1. Valve supervision
    - 2. Inspection of extinguishers and other appliances
    - 3. Supervision of repairs, changes and extensions
- III. PRIVATE OR INDUSTRIAL EMERGENCY ORGANIZATIONS
  - A. The property and public fire department
  - B. Private emergency organizations
    - 1. Training
    - 2. Fire methods
    - 3. Procedure after emergency
  - C. Private or industrial emergency organization equipment
- IV. TRAFFIC AND EXIT DRILLS
  - A. Traffic
  - B. Exit drills
    - 1. Chief of exit drills
    - 2. Exit maintenance
- V. GUARD SERVICE
  - A. Guard service direction
  - B. Communication equipment
    - 1. Clocks or time recording equipment
    - 2. Control center
  - C. Guard service functions
    - 1. Prevent unauthorized entry
    - 2. Control activities of people on property
    - 3. Control pedestrian and vehicular traffic
    - 4. Control entry points
    - 5. Check permits for hot work
    - 6. Detect conditions which might cause a fire
    - 7. Check some fire detection and extinguishing devices
  - D. Patrol routes and rounds
    - 1. Check doors and windows
    - 2. Check waste disposal
    - 3. Check fire apparatus
    - 4. Check aisles
    - 5. Check motors and equipment
    - 6. Check for burning cigarettes
    - 7. Check heating and cooling devices
    - 8. Check hazardous manufacturing processes
    - 9. Check hazardous materials
  - E. Selection of guards
  - F. Training

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- Bond, Horatio, **Inspection Manual**, Boston: National Fire Protection Association, 1959.
- Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.
- Recommendations for Guard Service in Fire Loss Prevention**, Boston: National Fire Prevention Association Standards and Recommendations No. 601, 1968.
- Standard for Guard Operations in Fire Loss Prevention**, Boston: National Fire Protection Association Standards and Recommendations No. 601-A, 1968.
- Recommendations for Management Control of Fire Emergencies**, Boston: National Fire Protection Association Standards and Recommendations No. 7, 1967.

**Recommendations for Organization of Industrial Fire Loss Prevention, Boston: National Fire Protection Association Standards and Recommendations No. 6, 1967.**

**Recommendations for Organizations Training and Equipment of Private Fire Brigades, Boston: National Fire Protection Association Standards and Recommendations No. 27, 1967.**

## OSH 17 – INDUSTRIAL FIRE PROTECTION

### Session Outline – Week 16 – FIRE PROTECTION ( LABORATORY )

**OBJECTIVES:** Use the standard portable extinguishers and 1½ inch hose in fighting a fire. Describe maintenance requirements for each type of portable extinguisher.

#### OUTLINE:

- I. GENERAL DESCRIPTION OF FIRE EXTINGUISHERS
  - A. Background
  - B. Role of extinguishers in property protection
  - C. Reliability and design safety of fire extinguishers
  - D. Relation of extinguishers to class of fire
  - E. Extinguisher testing by Underwriters Laboratories, Inc.
  - F. Extinguisher testing by the factory materials
- II. SELECTION OF PORTABLE FIRE EXTINGUISHERS
  - A. Nature of combustibles
  - B. Potential fire severity
  - C. Matching extinguishers to the hazard
  - D. Ease of use
  - E. Upkeep and maintenance requirements
- III. DISTRIBUTION OF FIRE EXTINGUISHERS
  - A. Occupational hazard considerations
  - B. Arrangement of extinguishers in a building
  - C. Identification of extinguishers
- IV. OPERATION AND THE USE OF EXTINGUISHERS
  - A. Operational characteristics
  - B. Extinguisher usage and training
- V. INSPECTION AND MAINTENANCE OF FIRE EXTINGUISHERS
  - A. Basic principles
  - B. Maintenance
  - C. Hydrostatic testing
  - D. Extinguisher maintenance services
- VI. OPERATION OF FIRE HOSE
  - A. Demonstration
  - B. Maintenance
- VII. EMERGENCY ORGANIZATIONS
  - A. Organizations
  - B. Assignments
  - C. Demonstration

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Classification, Rating and Fire Testing of Fire Extinguishers, Class A, B, C, D for Use on Combustible Metals**, Underwriters Laboratories Safety Standard UL711.

#### Federal Specifications

- O-E-910c – Extinguishers, Fire, Carbon Dioxide
- O-E-915b – Extinguishers, Fire, Dry Chemical
- O-E-920a and 925a – Extinguishers, Fire, Foam
- O-E-927 and 930a – Extinguishers, Fire, Soda-Acid
- O-E-940, 942a and 945a – Extinguishers, Fire, Water
- O-F-361 – Extinguishers, Fire, Foam
- O-F-371 – Fire Extinguishing Agent Sodium Bicarbonate Dry Chemical

**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

**Know the A, B, C, and D's of Portable Fire Extinguishers**, Boston: National Fire Protection Association.

**Know the A, B, C, and D's of Fire Extinguishers**, Boston: National Fire Protection Association Fact Chart Set.

**Standard for the Installation of Portable Fire Extinguishers**, Boston: National Fire Protection Association

## OSH 17 — INDUSTRIAL FIRE PROTECTION

### Session Outline — Week 17 — CONCLUSION

**OBJECTIVES:** Relate the fire prevention function to other aspects of loss control and the organizational function.

#### OUTLINE:

- I. SUMMARY OF THE COURSE
  - A. Scope and magnitude of the problem
  - B. Principal causes of fires and other controllable property losses
  - C. Principal ways of protecting structures from fires by proper construction
  - D. Principal ways of protecting equipment and materials from fires
  - E. Characteristics and protection of flammable solids, liquids and gases
  - F. Ways of controlling losses resulting from lightning, wind-storms and earthquakes
  - G. Fire protection standards, codes and laws
  - H. Fire detection and extinguishing devices and systems
  - I. Emergency organizations
  - J. Managerial controls
- II. INTERRELATIONSHIP BETWEEN THE FIRE PROBLEM AND OTHER ASPECTS
  - A. Relationship to principal objectives of various organizations
    - 1. Manufacturing, mining, construction
    - 2. Trade and service industries
    - 3. Transportation and utilities
    - 4. Governmental agencies
    - 5. Agriculture
  - B. Relationship to external influences on organizations
    - 1. Federal, State and local laws
    - 2. The public
    - 3. Employees
- III. INTERRELATIONSHIP BETWEEN THE PARTS OF THE PROBLEM
  - A. Human and engineering aspects
  - B. Levels of knowledge of personnel within organizations
  - C. Levels of knowledge in the field
- IV. POSSIBLE FUTURE TRENDS
  - A. Governmental regulations
  - B. Greater awareness of current information
  - C. Research
    - 1. Chemistry and physics of fire
    - 2. Extinguishing agents
    - 3. Extinguishing devices and systems

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Fire Protection Handbook** (13th Edition), Boston: National Fire Protection Association, 1971.

## OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline – Week 1 – AIR CONTAMINANTS – GASES, VAPORS AND PARTICULATES

**OBJECTIVES:** Define the terms used in industrial hygiene and the physical properties of the common toxic materials. Specify the appropriate collection methods for sampling various toxicants.

#### OUTLINE:

- I. ADMINISTRATION OF COURSE
  - A. Admission procedure prescribed by college
  - B. Course administration
    - 1. Text
    - 2. Mid-term, final, project requirements
- II. GASES
  - A. Definition
  - B. Review of gas laws  $PV = WRT$
  - C. Diffusion, mixing, gravity flow of concentrated gases
  - D. Stability of concentration of dilute mixtures - will not settle out
  - E. Molecular sieve, chemical reaction, freeze out traps, plastic bags, bottles, evacuated flask
- III. VAPORS
  - A. Definitions
  - B. Vapor pressure - calculate equilibrium concentration
  - C. Flash points
  - D. Evaporation rates - diffusion - mixing
  - E. Stability of dilute concentrations
  - F. Collection methods for analysis
- IV. FUMES
  - A. Definition
  - B. Particle size - range, mass median diameter
  - C. Settling rates - solubility - resuspension
  - D. Collection methods, ESP, milipore filter paper
- V. DUSTS
  - A. Definition
  - B. Particle size - respirable fraction
  - C. Settling rates - rafter samples - floor
  - D. Dust counting, gravimetric sampling
  - E. Sampling methods for concentration analysis
- VI. SMOKE
  - A. Definition
  - B. Examples
- VII AEROSOLS
  - A. Definition
  - B. Examples
- VIII. FOG OR MISTS
  - A. Definition
  - B. Examples

#### INSTRUCTOR REFERENCES:

The following are the basic references for all sessions:

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

**Industrial Environment – Its Evaluation and Control**, Washington, D.C.: U.S. Department of Health, Education and Welfare, Public Health Service.

Patty, F. A., **Industrial Hygiene and Toxicology**, Vols. I & II, New York: Wiler Interscience.

Session Outline — Week 2 — **SAMPLING CONSIDERATIONS**

**OBJECTIVES:** Determine the location and amount of sampling required. Calculate the peak time and time-weighted averages for simple, batch-type operations.

**OUTLINE:**

- I. **THRESHOLD LIMIT VALUES (TLV)**
  - A. Basis for establishing
    - 1. Narcosis
    - 2. Chronic poison, irreversible tissue change
    - 3. Irritation
  - B. Ceiling Limit Values ("C" Values)
    - 1. Maximum allowable exposure
    - 2. Excursions above the TLV for other substances
  - C. Time weighted average concentration
    - 1. Method of calculating
    - 2. Mixtures, additive, non-additive
- II. **SAMPLING LOCATIONS**
  - A. Operators breathing zone
    - 1. The welders hood problem
    - 2. General room atmosphere may sometimes be adequate
    - 3. Sampling rate and location to estimate his actual inhalation cycle
  - B. Peak level
    - 1. Grab samples - 10 minutes or less
    - 2. Sufficient sample for analysis
    - 3. High volume sampler
  - C. General room atmosphere
    - 1. Long term sampling
    - 2. Job locations only
    - 3. Variability in time and location determines number of samples
- III. **SAMPLING EFFICIENCY**
  - A. Filters
    - 1. Sampling velocity
    - 2. Particle size
    - 3. Damage to filters
    - 4. Too much efficiency - the clogged filter
  - B. Liquid chemical
    - 1. Fritted glass bubbler
    - 2. Bubble size
    - 3. Sampling rate
  - C. Effect of efficiency on accuracy of study
    - 1. How well is TLV known
    - 2. How representative is sample
    - 3. Is this day typical
    - 4. Windows and doors open, closed?

Session Outline — Week 3 — **CALIBRATION OF INSTRUMENTS**

**OBJECTIVES:** Describe the theory and procedures of instrument calibration. Specify the errors encountered with uncalibrated instruments.

**OUTLINE:**

- I. MEASUREMENT OF AIR VOLUME AND RATE
  - A. The spirometer - a primary standard
  - B. The wet gas meter - rate dependent
  - C. The bubble burette - for small volumes
  - D. Rotometers
  - E. Dry gas meters
  - F. Velometers and thermal anemometers
  - G. Fixed chambers and pressureless air bags
- II. THE STANDARD CONCENTRATION OF TOXIC MATERIAL
  - A. Calculating the volume of solvent to make TLV concentration in fixed chamber
  - B. Limitation on concentration based on temperature, vapor pressure and atmospheric pressure
  - C. Effects of condensation on cold surface
  - D. Errors in using the micro-pipette wetted vs. non-wetted bore
  - E. Lecture bottles and syringes for toxic gases
  - F. Calculating gas concentration in fixed chamber and avoiding pressure errors in volume measurements
- III. INSTRUMENTS WHICH NEED CALIBRATION
  - A. Sound level meter
    - 1. The Acoustic calibration
    - 2. Electrical calibration
  - B. Light meters
  - C. Combustible gas indicators
    - 1. How does vapor react with catalyst
    - 2. Poisoning catalyst, or part of catalyst
  - D. Electrostatic precipitator
    - 1. Air volume of sample
  - E. High volume sampler
    - 1. Built in rotometer
    - 2. Sample buildup
    - 3. Cooling air to motor
  - F. Rotometers
  - G. Carbon monoxide detectors
    - 1. Dynamic sampling or standard
  - H. Oxygen deficiency meters
  - I. Velometers
  - J. Detector tubes
  - K. Mercury vapor detectors
  - L. Halide detectors
    - 1. The pump
    - 2. Slit width
    - 3. Typical conversions

Session Outline – Week 4 – CALIBRATION OF INSTRUMENTS (LABORATORY)

**OBJECTIVES:** Set up standard solutions and measure air volume and air flow against a primary or secondary standard.

**OUTLINE:**

- I. THE BUBBLE BURETTE
  - A. Using 100 ml graduated burette and 100 cc piston sampling pump, compare volume through burette with pump volume
  - B. Using sampling tube and proper orifice in pump time soap bubble by marking time every 20 ml. Plot average flow rate during each 20 ml against total volume sampled at time T
  - C. Compare with specs
- II. STANDARD SOLUTION OF METHANE IN AIR
  - A. Using natural gas, set up a 2% volume concentration of methane in air, using a gas syringe and a bottle of known volume
- III. STANDARD SOLUTION OF 1,1,1 TRICHLOROETHANE (METHYL CHLOROFORM) IN AIR
  - A. Set of 100 ppm concentration of methyl chloroform in bottle of known volume of air, using a micro-pipette
  - B. Place 10  $\lambda$  of solvent in a dry 100  $\lambda$  pipette and run liquid to top and back - how much has stayed on sides of bore? What error could be made?
  - C. Measure concentration of methyl chloroform with length of strain detector tube
- IV. CALIBRATION KIT FOR COMBUSTION GAS INDICATOR
  - A. Use calibration kit according to instructions
    1. Plastic bottle and glass vial of methane
    2. Pressure bottle and rubber bag
  - B. Measure concentration above upper explosive limit
    1. Gasoline vapor in closed can
    2. Meter will quickly go full scale, and return to an intermediate level below lower explosive limit on scale

## OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline – Week 5 – AIR SAMPLERS

**OBJECTIVES:** Describe the operation and the advantages and disadvantages of various air sampling systems.

#### OUTLINE:

##### I. THE HAND PUMP

- A. Principles of operation
- B. Advantages
  - 1. Explosion proof
  - 2. Portable, no power required
- C. Sampling rate - vacuum at specified rate
- D. Disadvantages
  - 1. Only one sample can be collected at a time
  - 2. Variability in sampling rate
  - 3. Inefficient use of engineer's time, particularly where several sampling locations must be surveyed in an infrequently-repeated batch process

##### II. THE PISTON PUMP

- A. Principles of operation
- B. Advantages
  - 1. Explosion proof
  - 2. Portable, no power required
  - 3. Short sample time
- C. Sampling rate
  - 1. Characteristics of various orifices
  - 2. Not constant flow rate
  - 3. The effect of varying flow rate on chemical detector tubes
- D. Disadvantage - integrated sampling not possible except by using many tubes

##### III. THE SPRAY CAN EJECTOR

- A. Principles of operation
- B. Advantages

- 1. No power or pumping required
- 2. Portable
- 3. Explosion proof

##### C. Flow characteristics - variability with spray can pressure

##### D. Disadvantages

- 1. Expense and bother of many spray cans
- 2. More things to go wrong

##### IV. THE LAPEL SAMPLER

- A. Principles of operation
- B. Advantages
  - 1. Follows individual all day
  - 2. "Permissible" by Bureau of Mines
  - 3. Rechargeable batteries
  - 4. Several can be positioned for area sampling
- C. Flow characteristics - battery voltage - filter buildup
- D. Disadvantages
  - 1. Must be recharged 16 hours for each 8 hours of use
  - 2. Low sampling rate, therefore long sample time for weighable sample
  - 3. Tampering by user

##### V. VANE PUMPS

- A. Principles of operation
- B. Advantages
  - 1. Plastic diaphragm and valves do not contaminate air - may be used to blow sample
  - 2. Cheap, simple, trouble-free operation as suction pump

## OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline – Week 6 – INERTIAL COLLECTORS

**OBJECTIVES:** Describe the principles and techniques of operation of dust collectors.

#### OUTLINE:

- I. THE GREENBURG-SMITH IMPINGER
  - A. Description and principles of operation
  - B. Power requirements
  - C. Preparing sample for microscope
  - D. Calculations
  - E. Advantages and disadvantages - epidemiological, etc.
- II. MIDGET IMPINGER
  - A. Description and principles of operation
  - B. Power requirements - hand pump - vane pump
  - C. Preparing sample for microscope
  - D. Calculations
  - E. Advantages and disadvantages
- III. B & L IMPACTOR
  - A. Description and principles of operation
  - B. Humidity effects
  - C. Advantages
    - 1. Fast
    - 2. Small
  - D. Disadvantages - not "approved" method
- IV. CASCADE IMPACTOR
  - A. Description and principles of operation
  - B. Particle size analysis
  - C. Replaced by respirable dust separators for gravimetric analysis
- V. CENTRIFUGAL SEPARATORS
  - A. The spiral sampler
  - B. The conifuge
- VI. IMPACTOR WITH DIRECT READOUT
  - A. Radioactive carbon isotope
    - 1. Sample plotted on specially- prepared glass plate
    - 2. Beta absorption through sample is interpreted directly as milligrams of respirable dust per cubic meter
    - 3. 90 samples can be taken on one glass disk in a short time
- VIII. RESPIRABLE DUST SAMPLING
  - A. Physiology of the lung
  - B. What size-distribution correlates well with lung deposition?
  - C. The advent of gravimetric sampling in the U.S.

## OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline – Week 7 – AIR SAMPLERS, INERTIAL COLLECTORS (LABORATORY)

**OBJECTIVES:** Sample air for contaminants. Make proper connections. Protect sample from contamination. Determine proper sampling rate and proper marking of sample.

#### OUTLINE:

##### I. GREENBURG-SMITH

- A. Have available two standard impingers, two standard counting cells and a pump capable of 3" Hg negative pressure at 1 cfm
- B. Collect sample for 10 minutes
- C. Label sample and blank
- D. Dilute five-to-one, using squeeze bottle, washing down impinger nozzle
- E. Shake thoroughly and pipette portion into counting cell, cover and identify
- F. Do the same with blank
- G. Assume blank count and sample count, and calculate concentration in mppcf

##### II. MIDGET IMPINGER

- A. Have available several midget impingers and hand pump capable of 0.1 cfm at 12" H<sub>2</sub>O negative pressure, an ejector spray can system, and a battery-operated pump
- B. Using proper techniques, sample for 10 minutes in OBZ using each system
- C. Check air-measuring system for proper setting before and after sample

- D. Label and seal each impinger and blank and prepare for "returning to lab"

##### III. GAS BOTTLE

- A. 8-oz. bottle with septum screw top
- B. Using squeeze bulb, pump out bottle - 4 air changes
- C. Assuming complete mixing, what error can be expected from residual air in bottle?
  1.  $C=C_0 e^{-v/v_0}$  where  $v/v_0$  = number of air changes
  2. For 4 air changes the residual air is less than 2%
  3. Because of poor mixing it may be very close to 0 (piston effect)
- D. Sample is extracted by removing 1 cc with syringe and inserting into gas chromatograph
  1. How much is pressure in bottle reduced by removing 1 cc?
  2. How much gas should be drawn into syringe to give 1 cc at standard conditions?

## OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline – Week 8 – DIRECT READING COLORIMETRIC INDICATORS

**OBJECTIVES:** Describe the theory and operation of colorimetric indicators.

#### OUTLINE:

- I. SAMPLING ACID MIST OR VAPOR IN CAUSTIC BUBBLER
    - A. Use in dilute sodium hydroxide solution in bubbler
    - B. Draw HCl vapors through bubbler until pH indicator changes color
    - C. Calculate grams of HCl needed to neutralize NaOH solution
    - D. Knowing air sampling rate and time of sample, calculate concentration of HCl in air
    - E. Calculate NaOH solution to be normalized in 10 minutes at TLV for HCl when sampled at 0.1 cfm
  - II. CHEMICALLY TREATED PAPERS
    - A. MSA lead in air detector
      1. Pump and filter
      2. Reagent A and Reagent B
      3. Color comparison, poor accuracy
    - B. Papers and tiles for hydrogen sulfide
  - III. LENGTH OF STAIN DETECTORS
    - A. Reaction rate
      1. Particle size
    2. Sampling rate - variable with time
    3. Temperature
  - B. Interferences
    1. Increases indication - non-specific reaction
    2. Decreases apparent reading
  - C. Variation between batches
    1. Manufacturers tolerances
    2. Handling - exposure to temperature extremes
- IV. COLORIMETRIC TESTORS, TUBES, AND KITS
  - A. Mine safety appliance - carbon monoxide tube
    1. Color change is subjective
    2. Expose tube to cigarette smoke giving less than 100 ppm
    3. Have five students independently estimate exposure
  - B. Tetra-ethyl lead kit
    1. Sampling pump and toto meter
    2. Mixing reagents
    3. Possible contamination of reagents in plant environment
    4. Subjective color comparison

Session Outline — Week 9 — DIRECT READING INDICATOR TUBES

**OBJECTIVES:** Describe the limitations of colorimetric indicator tubes and their appropriate use.

**OUTLINE:**

I. THE PURPOSE OF MEASUREMENT

- A. Finding leaky equipment
  - 1. Requires direct reading
  - 2. Sensitive
  - 3. Quick response
  - 4. Accuracy is not too important
- B. Screening survey
  - 1. To determine where to sample
  - 2. Avoids overlooking hazardous areas when organoleptic survey is impossible
  - 3. Saves time sampling very low concentration areas
  - 4. Accuracy of ½ to 2 times TLV is acceptable when measuring TLV concentration
- C. Surveys to show compliance with regulations
  - 1. Must be accurate if close to TLV
  - 2. Must be representative - that is, each employee exposed above TLV shall have his time-weighted average concentration calculated
  - 3. Records must be kept so that employees exposure to each chemical can be estimated. Work habits and area measurements may be needed

II. DIRECT READING INDICATOR TUBE ACCURACY

- A. The best (CO length of stain) ± 15% at TLV
- B. The worst (CO colorimetric more than 5 years old) - 1000%
- C. What accuracy is necessary?
  - 1. TLV's are rarely known as well as ± 50%
  - 2. Exposures are often well above or well below TLV=
  - 3. The borderline case is legally difficult but practically unimportant
  - 4. The average of several samples is much more accurate

III. OTHER ANALYTICAL METHODS

- A. The modern analytical laboratory
  - 1. Gas chromatograph - fast, accurate, sensitive
  - 2. Non-dispersive infra red
  - 3. Atomic absorption
  - 4. Photometer for accurate, color/transmission measurements
  - 5. Spectrophotometer
  - 6. Wet chemistry methods
- B. Accuracy usually better than ± 10%
- C. Timeliness
  - 1. Fast when available
  - 2. Down time may conflict with priority
  - 3. Typically answer comes 2 to 8 days after sample taken

Session Outline – Week 10 – **DIRECT READING COLORIMETRIC INDICATORS  
AND INDICATOR TUBES (LABORATORY)**

**OBJECTIVES:** Check indicator tubes and other colorimetric indicators for accuracy.

**OUTLINE:**

**I. MEASURING HYDROCHLORIC  
ACID VAPOR IN SODIUM  
HYDROXIDE SOLUTION**

- A. Use weak HCl solution in stoppered flask such that air samples can be bubbled through acid solution
- B. Use weak NaOH solution in 2 fritted glass sampling bottles
- C. Adjust solution normalities so that at 0.1 cfm sampling rate color change occurs in about 10 minutes
- D. Pull sample through both bottles in series; when first bottle changes color, mark time ( $T_1$ )
  1. Place second bottle first, and continue sampling through both bottles
  2. Measure time required for second bottle to change color ( $T_2$ )
- E. Calculate HCl concentration in air
  1. Collection efficiency is approximately  $T_2/T_1$

**II. CALIBRATION OF DETECTOR  
TUBES**

- A. Set up known concentration of CO in plastic bag
  1. Using wet gas meter, place one cubic foot of air in large plastic bag

2. Using syringe and lecture bottle of carbon monoxide, inject 2:8 cc of pure CO into plastic bag. Mix well, calculate concentration
3. Measure concentration at rate recommended by instructions, use five tubes, compare
4. Measure at fastest rate (no orifice or largest orifice), compare
5. Estimated possible errors - volume in bag, air trapped in tubing, loss of CO in technique

**B. Set up known concentration of toluene in glass carboy**

1. Measure volume of carboy by filling with water
2. Purge-dry carboy with small vacuum cleaner
3. Install plastic bag connected through stopper to outside air. Expansion of bag prevents dilution of standard concentration
4. Inject sufficient toluene to set up TLV concentration in carboy
5. Sample standard concentration 10 times
6. Have two groups estimate concentration on each of 10 tubes
7. Calculate mean and standard deviation for each group

## OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline – Week 11 – DIRECT READING PHYSICAL INSTRUMENTATION

**OBJECTIVES:** Describe the theory of operation of the more common direct reading industrial hygiene survey instruments. Specify indications of instrument failure during operation.

#### OUTLINE:

- I. COMBUSTIBLE GAS DETECTOR
  - A. Theory of operation
    - 1. Catalized reaction
    - 2. Thermal conductivity of gases
    - 3. Heat of combustion
  - B. Response to mixed gases
    - 1. Difficult to predict
    - 2. Should be calibrated using mixture to be sampled
    - 3. Calibration kits
    - 4. Interferences
  - C. Instrument response
    - 1. Wheatstone bridge
    - 2. Filament temperature - cold edges
    - 3. Lead poisoning ar edge
    - 4. Reduction in response after poisoning - reason for calibration
- II. OXYGEN INDICATOR
  - A. Theory of operation
  - B. Calibration
    - 1. Approximately 21% oxygen in normal air
    - 2. Oxygen-nitrogen or air-nitrogen mixture
- III. CARBON MONOXIDE DETECTORS
  - A. Theory of operation
    - 1. Non-dispersive infra-red
    - 2. Hopcolite - heat of reaction
  - B. Sensitivity and specificity - water and CO<sub>2</sub> poison hopcolite
  - C. Method of calibration - standard concentration in lecture bottle
- IV. HALIDE DETECTION
  - A. Theory of operation
    - 1. The Davis Halide Meter
    - 2. Recent modifications
  - B. Sensitivity and specificity
  - C. Calibration methods
- V. HYDROCARBON DETECTION
  - A. Theory of operation - flame ionization
  - B. Sensitivity and specificity
    - 1. May be used with combustible gas indicator for certain mixtures
    - 2. Very sensitive, not too specific
  - C. Calibration method
- VI. MERCURY VAPOR DETECTORS
  - A. Theory of operation
    - 1. Optical absorption of ultra-violet
    - 2. While water vapor is not supposed to interfere, condensation on cold instrument windows does absorb UV
  - B. Sensitivity and specificity
  - C. Calibration - vapor pressure

## OSH 18 — TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline — Week 12 — DIRECT READING PHYSICAL INSTRUMENTATION (LABORATORY)

**OBJECTIVES:** Calibrate the combustible gas indicator and measure unknown concentrations of mixtures, estimate and calculate concentration from process information.

#### OUTLINE:

- I. CALIBRATION OF COMBUSTIBLE GAS METER USING MIXTURE OF TWO FLAMMABLE VAPORS
  - A. Using large carboy, with plastic expansion bag inside to prevent dilution while sampling, set up 500 ppm concentration of toluene
  - B. Connect wet gas meter to inlet to plastic bag to measure volume of mixture removed in sampling. Measure concentration on 0 - 1000 ppm scale and % LEL scaled record
  - C. Measure volume of carboy, and inject sufficient carbon-bisulfide to make 250 ppm. Measure concentration on 0 - 1000 ppm scale and on % LEL scale
  - D. Repeat C. three more times until final readings are taken with true concentration 500 ppm toluene and 1000 ppm carbon-bisulfide. If the concentration measured on the % LEL scale exceeds 20% of LEL, stop experiment and notify instructor
- II. CALIBRATION OF COMBUSTIBLE GAS METER USING MIXTURE OF FLAMMABLE AND NON-FLAMMABLE VAPORS - repeat experiment in Part I except this time use methyl chloroform instead of carbon-bisulfide
- III. MEASUREMENT OF MIXTURES APPROXIMATING CERTAIN PROCESS OPERATIONS
  - A. Use chemical fume hood in which air flow can be stopped and started
    1. Use a few cc's of toluene, pour on large metal tray and spread out with chemwipe to speed evaporation. Measure concentration in OBZ and inside hood. Turn on air flow, measure OBZ and inside of hood again
    2. Repeat 1. using solution of  $\frac{1}{2}$  carbon-bisulfide and  $\frac{1}{2}$  toluene
    3. Calculate concentration of toluene and carbon-bisulfide using appropriate assumptions
  - B. Use chemical fume hood in A. but with mixture of flammable and non-flammable vapors. Repeat A-1., A-2., and A-3. substituting methyl chloroform for carbon-bisulfide
  - C. Place mixture of  $\frac{1}{2}$  toluene and  $\frac{1}{2}$  methyl chloroform in shallow dish in fume hood
    1. Measure concentration above dish
    2. Turn on air flow, let 90% of solvent evaporate
    3. Measure concentration above dish after turning off air flow
    4. Calculate relative vapor concentration in 1., based on vapor pressure as outlined in the appendix of ACGIH-TLV List
    5. Does measurement made in 4. suggest the assumptions made to calculate relative vapors concentrations may not be valid after 90% evaporation?

Session Outline — Week 13 — DIRECT READING PHYSICAL INSTRUMENTATION (LABORATORY)

**OBJECTIVES:** Measure various contaminants using the common direct reading industrial hygiene survey instruments.

**OUTLINE:**

I. OXYGEN MEASURING INSTRUMENT

- A. Read instructions
- B. Set instrument on 21% O<sub>2</sub>
- C. Place burning candle in a covered flask. When flame goes out measure oxygen concentration
- D. Place 10% CO<sub>2</sub> in plastic bag and measure O<sub>2</sub> concentration (about 19% O<sub>2</sub>)
  1. Can a man live in this concentration?
  2. Check toxicity of CO<sub>2</sub> in Patty

II. CARBON MONOXIDE MEASURING INSTRUMENT

- A. Read instructions
- B. Set up instrument ready for use
- C. Measure concentration of CO in flask after burning candle goes out (see I.-C.)
- D. Back car into garage, leave door open
  1. After idling for a few minutes, measure concentration around car. Measure every few minutes until concentration stops increasing
  2. Assuming idling engine puts out 0.1 cfm of CO, what is the "effective ventilation" at the four corners of the car, 5 feet above floor?
  3. The "effective ventilation" may be defined as the ventilation rate that would be required to dilute the contaminant to the measured concentration. It results from thermal currents, wind and turbulence, diffusion leakage and forced ventilation
  4. In this case,  $Q_{eff} = (0.1 \times 10^6) / C$  where C is the concentration in ppm and  $Q_{eff}$  is the effective ventilation in cfm; 0.1 of course is the source of CO in cfm

5. If a detached garage is not available, make sure the CO does not enter an occupied space. Do not breathe concentrations above 150 ppm while sampling

III. MERCURY DETECTOR

- A. Read the instructions
- B. Place about ½ cc of mercury in stoppered flask. Allow to come to equilibrium concentration dependent on vapor pressure of mercury
- C. Measure mercury concentration and temperature of mercury
- D. Calculate mercury concentration from vapor pressure. Example at 25° C: the vapor pressure of mercury is 0.001836 mm Hg. The concentration in ppm =  $(.001836/760) \times 10^6 = 2.42$  ppm, and the concentration in mg/m<sup>3</sup> =  $(2.42 \times 200)/24.45 = 19.8$  mg/m<sup>3</sup>
- E. Discuss errors

IV. HALIDE DETECTOR

- A. Read instructions and set up instrument
- B. Use methyl chloroform to wash a part (like a greasy cup) on work bench
  1. Measure concentration in breathing zone
  2. If carbon tetrachloride had been used (evaporation rate about the same) would solution be different?

V. HYDROCARBON DETECTOR

- A. Read instructions, set up instrument
- B. Mix toluene and methyl chloroform equally by volume in beaker
- C.
  1. Measure concentration at fixed point above beaker
  2. Evaporate 90% of liquid and repeat measurement
- C. If time permits, the concentrations in B-1. and B-2. should also be measured with the combustible gas meter and Halide meter. Discuss

Session Outline -- Week 14 --VENTILATION SURVEY INSTRUMENTATION

**OBJECTIVES:** Describe the principles of evaluation of ventilation systems, the use of instruments, the location for measurement and location of trouble spots.

**OUTLINE:**

- I. THE INDUSTRIAL VENTILATION MANUAL
  - A. A review of the specifications for various hoods and collectors
    - 1. Flow rates
    - 2. How they are specified
    - 3. Where must measurements be made?
  - B. Fan laws
    - 1. Characteristics of fixed systems
    - 2. Fan characteristics and the effect of changing system friction
- II. AIR FLOW MEASURING DEVICES
  - A. Pitot tube
    - 1. Theory of operation
    - 2. Measurement of average duct velocity to traverse
    - 3. Sensitivity - 2000 ft/min with verticle manometer, 600 ft/min with inclined and best technique
    - 4. Advantages - sample, portable, no moving parts, resistant to corrosion and high temperatures
  - B. Deflecting vane anemometer
    - 1. Theory of operation
    - 2. Jets and fittings, where they are used
    - 3. Range of velocity measurements which can be made accurately
    - 4. Advantages and disadvantages - dust filter
  - C. Rotating vane anemometer
    - 1. Theory of operation
    - 2. Where it may be used - self-averaging
    - 3. Range of velocities
    - 4. Disadvantages
  - D. Thermal anemometers
    - 1. Heated thermocouple
    - 2. Hot-wire anemometer
    - 3. Where it can be used
    - 4. Range of velocities
    - 5. Advantages - accurate, low velocity
    - 6. Disadvantages - not directional
  - E. Orifice meters
    - 1. The orifice plate for calibrating high flow rate devices
    - 2. The critical or limiting orifice for use with industrial hygiene sampling instruments
    - 3. Theory of operation
    - 4. Range of each type
  - F. Rotometers
    - 1. Theory
    - 2. How to read
    - 3. Accuracy and range
  - G. The static pressure method for estimating the flow through branch duct hoods
    - 1. Theory - coefficient of entry
    - 2. Pre filters - must be removed
    - 3. Accuracy and range
    - 4. Advantages - simple O tube

## OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline – Week 15 – VENTILATION SURVEY INSTRUMENTATION (LABORATORY)

**OBJECTIVES:** Measure a ventilation system using standard techniques and instruments.

#### OUTLINE:

- I. FLANGED AND UNFLANGED EXHAUST DUCT
  - A. Using smoke tubes, velometer, manometer, thermal anemometer and vane anemometer, measure velocity contours and duct velocity of unflanged duct having greater than 3000 ft/min velocity
    1. Manometer measure suction pressure downstream from entry. Use coefficient of entry to estimate duct velocity
    2. Use thermal anemometer to plot velocity contours around opening. Using smoke tube to show direction of air flow
    3. Use vane anemometer to measure duct velocity. What does this do to entrance loss? Discuss
    4. Use deflecting vane anemometer with proper jets to measure duct velocity and static pressure downstream
  - B. Repeat A. using flanged duct
- II. THE CHEMICAL FUME HOOD
  - A. Use smoke tube, velometer, vane anemometer and deflecting vane anemometer to compare characteristics of fume hood with specifications for hazardous material fume hood
    1. Using vane anemometer measure average velocity through wide open door, calculate air flow through hood
    2. Repeat 1. using deflecting vane velometer
    3. Place large object in fume hood, and using smoke tube, examine air flow lines. Walk by rapidly to see if smoke is pulled from hood
    4. Close door to just clear velometers and repeat 1. and 2. Has air volume decreased? Is there a bypass?
    5. If a suction tap is available, measure suction pressure with door open and closed. Is this a good way to monitor fume hood air flow?
- III. GENERAL VENTILATION SYSTEM
  - A. Pick a system with an exhaust hood, a recirculating heating or cooling system, and a make up air supply
  - B. Using the proper jets on the deflecting vane anemometer, measure all inlet and outlet air velocities and calculate air flow
  - C. Sketch the room or rooms and indicate air flow in and out of each opening
    1. How much air is circulated?
    2. How much make up air is provided?
    3. How much air is exhausted?
    4. Do your calculations balance? Discuss

## OSH 18 — TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline — Week 16 — NOISE EVALUATION

**OBJECTIVES:** Describe the principles of sound level meters, the properties of sound as they affect meter accuracy, the regulations governing noise measurement, and calculate individual exposures.

#### OUTLINE:

- I. PROPERTIES OF SOUND
  - A. Velocity and wave length frequency
  - B. Wave motion, amplitude
    - 1. Reflection
    - 2. Absorption
    - 3. Attenuation
  - C. Intensity
    - 1. Sound pressure
    - 2. The decibel
    - 3. Sound power
  - D. Transmission of sound
    - 1. Through pipe - liquid and pipe itself
    - 2. Through structures to other areas
    - 3. Over walls, through ventilation ducts
- II. THE SOUND LEVEL METER
  - A. Theory of operation
    - 1. Microphone types
    - 2. The wind screen
    - 3. A, B and C scale weighting networks
    - 4. The root-mean-square sound-pressure level
    - 5. Fast and slow responses
  - B. The calibrator
    - 1. Adaptors for different-diameter microphones
    - 2. When to calibrate
  - C. Attachments
    - 1. Microphone extension
    - 2. Graphic recorder
    - 3. Tape recorder
    - 4. Impact noise analyser
    - 5. Vibration
    - 6. Octave band analyser
    - 7. Audiometric earphone calibrator
- III. THE REGULATIONS
  - A. The noise survey
    - 1. Plotting equal noise contours
    - 2. Estimating time of individuals in various noise fields
    - 3. Calculating individuals noise exposure
    - 4. Measuring their exposure (dosimeter)
  - B. Comprehensive noise control program
    - 1. Staffing
    - 2. Engineering, short and long range
    - 3. Administrative controls
    - 4. Ear protection
    - 5. Audiometric examination
    - 6. How to handle the hard-of-hearing
  - C. Record keeping
    - 1. Noisy equipment - plans
    - 2. Noisy equipment - noise levels
    - 3. Noise exposure calculations for employees
    - 4. Audiometric records

## OSH 18 – TECHNIQUES OF INDUSTRIAL HYGIENE

### Session Outline – Week 17 – NOISE EVALUATION (LABORATORY)

**OBJECTIVES:** Prepare for and conduct a noise level survey. Specify ear protection or engineering controls required.

#### OUTLINE:

- I. NOISE SURVEY OF WOODWORKING SHOP
  - A. Before starting survey, check calibration on sound level meter
    1. Keep organized field notes
    2. List date-time-type of construction
    3. Note the scale reading with calibrator in use
    4. Obtain list of employees
  - B. Operate each machine alone
    1. Estimate time machine is on per day
    2. Measure noise levels for typical tasks at the operator's position and other working locations nearby
    3. In making work load estimates it is useful to ask the foreman, the worker, and actually measure the time for one cycle. The estimates may be very poor
  - C. Make noise survey during normal operations
    1. Make plot plan record with equal noise level contours
    2. Several such plot plans may be necessary if the operations differ by more than a couple of db
  3. Note whether operation you are surveying jibes with production estimates and with the foreman's and worker's estimates
  - D. Calculate exposure of all individuals exposed to more than 90 dBA
    1. Determine whether a few noisy machines are requiring many people to be overexposed
    2. Determine whether process controls or location of employees can eliminate the overexposure
    3. Recommend the type of hearing protection devices those overexposed should use
- II. STUDY A NOISE EXPOSURE WHICH DOES NOT VARY MUCH DURING THE DAY AND IN WHICH THE EXPOSED PERSONS DO NOT MOVE AROUND
  - A. Follow the procedures outlined in I.
  - B. Note the simple report
    1. Are the solutions any simpler?
    2. Is engineering control the only long term solution?
  - C. Calibrate your instrument on completion of the survey. Note the calibration reading in your field notes

## OSH 19 — HUMAN FACTORS IN SAFETY

### Session Outline — Week 1 — THEORIES OF ACCIDENT CAUSATION

**OBJECTIVES:** Relate contemporary theories of accident causation to accident prevention efforts.

#### OUTLINE:

- I. ACCIDENTS AND HUMAN BEHAVIOR
  - A. The traditional views
    1. Domino analogy
    2. 80 - 20% ratio
  - B. Research efforts
    1. Primarily directed to traffic problems
    2. Generally oriented to specific objectives
    3. Most of effort has been on a trial and error basis
    4. General conclusions that some form of human factor is at the root of any accident
  3. Climate allowing goal - setting encourages alertness
  4. Reward system should be geared properly
  - B. Usual industrial pattern
    1. Little encouragement for individualism
    2. Encourages structure and passivity
    3. Evidence shows fewer injuries in individual type jobs
  - C. Application
    1. Need rewards for alertness
    2. Related to Herzberg's Motivation - Hygiene theory
- II. THE "MYTH OF ACCIDENT PRONENESS"
  - A. Origins of "theory"
  - B. Weaknesses of theory
    1. Unwarranted labels
    2. Statistical chance
    3. Variance with time
    4. Clouds issue of cause
  - C. Uses
    1. Describes cause - implies psychopathology
    2. Describe individual - statistical observation
    3. Forms excuse for inaction
- III. GOALS — FREEDOM ALERTNESS THEORY
  - A. Basic tenets
    1. Accident rate related to job climate
    2. Relation to freedom to set reasonably attainable goals
- IV. ADJUSTMENT STRESS THEORY
  - A. Basic tenets
    1. Stress increases liability to accident
    2. Stress-age patterns correlate with accident-age patterns
  - B. Industrial practice
    1. New job - higher stress
    2. Age-stress peaks - new employee, middle age, pre-retirement
    3. Usual times when most job stresses
  - C. Application
    1. Awareness
    2. Sensitivity and support
    3. Job assignments

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**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Frogatt, P. and Smiley, J. A., The Concept of Accident Proneness: A Review, *British Journal on Ind. Med.*, 21, 1, 1964.

Ghiselli, E. E., The Myth of Accident Proneness, *California Safety News* (September 1964).

Haddon, W. Jr., Suchman, E. D. and Klein, D., **Accident Research Methods and Approaches**, New York: Harper and Row, 1964.

King, B. G., Some Comments on Accident Prevention Research, *Traffic Safety*, 62, 6 (June 1963).

Rockwell, T. H., The Need for a Theoretical Framework in the Study of Accidents, *Journal American Society of Safety Engineers*, 33 (August 1958).

Session Outline – Week 2 – LIFE SCIENCES AND SAFETY

**OBJECTIVES:** Describe the contributions of the sciences to occupational safety and health and the common research methods.

**OUTLINE:**

- I. HUMAN CONSIDERATIONS IN SAFETY
  - A. Physical dimensions
    - 1. Physical dimensions
    - 2. Sensitivity to physical environment
    - 3. Physical demands
  - B. Mental
    - 1. Intelligence
    - 2. Skills
    - 3. Abilities
    - 4. Aptitudes
    - 5. Emotions
- II. CONTRIBUTING DISCIPLINES TO ACCIDENT PREVENTION
  - A. Physical sciences and disciplines
    - 1. Chemistry
    - 2. Physics
    - 3. Engineering
    - 4. Mathematics
  - B. Life sciences and disciplines
    - 1. Biology
    - 2. Physiology
    - 3. Anatomy
    - 4. Anthropology
    - 5. Psychology
    - 6. Education
- III. RESEARCH METHODS
  - A. The laboratory approach
    - 1. Measurement
    - 2. Observation
    - 3. Experimental controls
    - 4. Replication
  - B. Field study
    - 1. Observation
    - 2. Measurement
    - 3. Controls
    - 4. Case study
  - C. Approaches used in accident research
    - 1. Epidemiologic
    - 2. Sampling
    - 3. Intensive case analysis
    - 4. Risk taking experiments
    - 5. Psychoanalytic
- IV. PITFALLS IN RESEARCH METHODS
  - A. Oversimplification
  - B. Lack of theoretical framework
  - C. Deficiencies in information
  - D. Bias in sampling
  - E. Application of findings
- V. STATISTICAL MEASUREMENT AND RESEARCH
  - A. Basic statistical concepts
    - 1. The normal curve
    - 2. The random sample
    - 3. Reliability
    - 4. Validity
  - B. Research design
    - 1. Controls
    - 2. Sampling
    - 3. Statistical inference
  - C. Generalizations from research
    - 1. Size of sample
    - 2. Sample population

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- Haddon, W. Jr., Suchman, E. D. and Klein, D., **Accident Research Methods and Approaches**, New York: Harper and Row, 1964.
- McFarland, R., Measurement of Human Factors in Accident Research, **Traffic Digest and Review**, June 1966.

## OSH 19 — HUMAN FACTORS IN SAFETY

### Session Outline — Week 3 — THE WHOLE MAN AT WORK

**OBJECTIVES:** Relate the capabilities and limitations of man to the various factors of accident causation by means of case study evaluation.

#### OUTLINE:

- I. MAN AT WORK
  - A. The mechanistic view
    - 1. Mechanical demands
    - 2. Physical capabilities
    - 3. Intellectual demands
  - B. The total man
    - 1. Skills and abilities
    - 2. Emotions
    - 3. Attitudes
- II. PSYCHOLOGICAL FACTORS IN SAFETY
  - A. Individual differences
    - 1. Physical
    - 2. Mental
    - 3. Emotional
  - B. Motivations
    - 1. Goals and aspirations
    - 2. Individual differences
  - C. Attitudes
    - 1. Attitude formation
    - 2. Importance to safety
  - D. Capability to learn
    - 1. Motivation
    - 2. Conditions for learning
- III. THE MAN-MACHINE SYSTEM
  - A. Capabilities of man - as opposed to machine
    - 1. Data sensing and processing
    - 2. Judgement
- 3. Handling the unexpected
- B. Limitations of man
  - 1. Sensitivity to environment
  - 2. Strength and speed
  - 3. Fatigue
  - 4. Perception
- C. Considerations for safe design
  - 1. Anthropological measurements
  - 2. Perceptual abilities
  - 3. Fatigue factors
  - 4. Habit patterns
  - 5. Distraction
  - 6. Boredom
- IV. CONTEMPORARY PROBLEMS
  - A. Old machines
    - 1. Guarding
    - 2. Point of operation
    - 3. Controls and instruments
    - 4. Access
    - 5. Body posture and movement
    - 6. Noise
  - B. Processes and procedures
    - 1. Sequences and timing
    - 2. Movements
    - 3. Memory
    - 4. Boredom
    - 5. Fatigue
    - 6. Distractions

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McFarland, R. A., Human Factors in Industrial Safety, **Journal American Society of Safety Engineers**, 2, 3, (August 1957).

Tarrants, W. E., The Role of Human Factors Engineering in the Control of Industrial Accidents, **Journal American Society of Safety Engineers**, 7, 2 (February 1963).

## OSH 19 – HUMAN FACTORS IN SAFETY

### Session Outline – Week 4 – PSYCHOLOGY AND SAFETY

**OBJECTIVES:** Describe the contributions of psychology to accident prevention and specific applications to contemporary practice.

#### OUTLINE:

- I. PSYCHOLOGY AS A FIELD OF STUDY
  - A. Fields of interest
    1. Growth and development
    2. Mental abilities
    3. Perception
    4. Emotions
    5. Attitudes
    6. Individual differences
    7. Group behavior
    8. Learning
  - B. Research methodology
    1. Inference from observed behavior
    2. Laboratory research
    3. Case study methods
    4. Statistical studies
  - C. Industrial psychology
    1. Man at work
    2. Organizational behavior
    3. Training
    4. Human factors engineering
    5. Communications
    6. Advertising
- II. SPECIFIC APPLICATIONS TO SAFETY
  - A. Employee selection and testing
    1. Test construction and validation
    2. Interviewing
    3. Job analysis
    4. Performance evaluation
  - B. Employee training
    1. Learning theory
    2. Media development
    3. Effective presentation
- III. APPLYING THEORY TO PRACTICE
  - A. Employee selection and placement
    1. Test design or purchase
    2. Job analysis
  - B. Organizing for safety
    1. Organization theory
    2. Individual differences
  - C. Communications
    1. Advertising research
    2. Communications research
  - D. Motivating
    1. Motivation theory
    2. Incentive programs
    3. Employee participation
  - E. Resources
    1. NSC publications
    2. Safety journals
    3. Consultants
    4. Insurance carriers
    5. State DIS, OSHA

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**Accident Prevention Manual for Industrial Operations**(6th Edition), Chicago: National Safety Council, 1969.

Brody, L. and Dunbar, H. F., **Basic Aspects and the Application of the Psychology of Safety**, New York: New York University, 1959.

Ghiselli, E. E. and Brown, C. W., **Personnel and Industrial Psychology**, New York: McGraw-Hill, 1955.

Gilmer, B. Von H., **Industrial Psychology**, New York: McGraw-Hill, 1966.

## OSH 19 – HUMAN FACTORS IN SAFETY

### Session Outline – Week 5 – MOTIVATING EMPLOYEES FOR SAFETY

**OBJECTIVES:** Draft a safety promotion program which will utilize contemporary motivation theory.

#### OUTLINE:

- I. THE TRADITIONAL VIEW OF MAN AS A WORKER
  - A. McGregor's Theory X
    - 1. Expectations
    - 2. Supervision
  - B. Limiting features
    - 1. Supervision vs. leadership
    - 2. Performance vs. capacity
    - 3. Eight hours vs. creative effort
    - 4. Man's image of himself
- II. MOTIVATION AND BEHAVIOR
  - A. All behavior is caused
    - 1. Physiological needs
    - 2. Psychological needs
    - 3. Social needs
  - B. All behavior is goal directed
    - 1. Needs satisfaction
    - 2. Direct vs. indirect satisfaction
  - C. Conflicts and frustration
    - 1. Choices
    - 2. Barriers
    - 3. Reactions to frustration
- III. MOTIVATION THEORIES
  - A. Maslow
    - 1. Hierarchy
- IV. APPLYING THEORIES TO SAFETY
  - A. Basic needs are satisfied
    - 1. Wage packages
    - 2. Health, welfare and security benefits
    - 3. Social legislation
  - B. Higher order needs
    - 1. Achievement
    - 2. Recognition
    - 3. Participation
  - C. Safety programming
    - 1. Committees
    - 2. Incentive
    - 3. Suggestion programs
    - 4. Inspections
    - 5. Investigation

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- Gellerman, S., **Motivation and Productivity**, New York: American Management Association, 1963.
- Gilmer, B. Von H., **Industrial Psychology**, New York: McGraw-Hill, 1966.
- Hannaford, E. S., **Supervisors Guide to Human Relations**, Chicago: National Safety Council, 1967.

## OSH 19 — HUMAN FACTORS IN SAFETY

### Session Outline — Week 6 — COMMUNICATIONS

**OBJECTIVES:** Develop a safety communications program for a hypothetical organization.

#### OUTLINE:

- I. THE COMMUNICATIONS PROCESS
  - A. Sender-receiver concept
  - B. Assumptions
    1. Clear Transportation
    2. Clear reception
    3. No static
  - C. Filtering factors
    1. Words and meanings
    2. Non-verbal clues and symbols
    3. Prior experience
    4. Emotions
  - D. The feedback loop
    1. Sender-receiver-sender
    2. Checks response
    3. Doesn't guarantee understanding or action
- II. BASICS OF EFFECTIVE COMMUNICATIONS
  - A. Clarify ideas before communicating
    1. "Engage brain before starting mouth"
    2. Consider goals and ideas of receivers
  - B. Know the true purpose of each communication
    1. Know the objective
    2. The fewer the objectives the sharper the focus
  - C. Consider physical and human setting
    1. Timing
    2. Custom or past practice
    3. The right place
  - D. Consult with others
    1. Insight and objectivity
    2. Participation builds support
    3. Developing facts
  - E. Beware of overtones as well as basic content
    1. Non-verbal clues
    2. Shades of meaning
    3. Right language, cultural differences
  - F. Use opportunity to convey help or value
    1. "What's in it for me?"
    2. The receiver's point of view
    3. Immediate or long-range benefit
  - G. Follow-up - feedback
    1. Check response
    2. Check performance
  - H. Communicate for tomorrow as well as today
    1. Plan for the future
    2. Maintain consistency
  - I. Make sure actions support communications
    1. "It ain't what you say"
    2. Don't speak with forked tongue
  - J. Be a good listener
    1. Get feedback
    2. Get meaning and intent as well as words
- III. SAFETY COMMUNICATIONS
  - A. Usual media
    1. Meetings
    2. Posters
    3. Films
    4. Tailgate sessions
    5. Brochures
  - B. Common errors
    1. Glittering generalities
    2. Concern with media more than content
    3. Timing
    4. Individual assumptions
  - C. Planning safety communications
    1. Specific targets
    2. Analyzing problems
    3. Coordination of media
    4. Resources available

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Effective Communications on the Job**, New York: American Management Association, 1963.

Mendelsohn, H. A., **The Denver Symposium on Mass Communications Research for Safety**, Chicago: National Safety Council, 1964.

## OSH 19 – HUMAN FACTORS IN SAFETY

### Session Outline – Week 7 – **PHYSIOLOGY** – Skeletal, Muscle and Respiratory System

**OBJECTIVES:** Define the common anatomical terms and describe the form and function of the skeletal, muscle and respiratory systems.

#### OUTLINE:

- I. **PHYSIOLOGY AND SAFETY**
  - A. The need to know
    - 1. Medical terminology
    - 2. Injury reports
    - 3. Physical examinations
    - 4. Injury potential
  - B. The major concerns
    - 1. Skeletal injuries
    - 2. Muscle injuries
    - 3. Respiratory afflictions
    - 4. Eye injuries
    - 5. Noise-induced hearing loss
  - C. Supplementary information
    - 1. Circulatory system - stresses
    - 2. Nervous system - stress and impairment
- II. **DEFINITION OF TERMS**
  - A. Anatomy
    - 1. Gross anatomy
    - 2. Histology
  - B. Terminology determining location in body
    - 1. Body planes
    - 2. Anterior-posterior
    - 3. Superior-inferior
    - 4. Ventral-dorsal
    - 5. Proximal-distal
    - 6. Superficial-deep
  - C. Regions of the body
  - D. Body cavities and organs contained
- III. **THE SKELETAL SYSTEM**
  - A. Function
    - 1. Form
    - 2. Attachment
    - 3. Protection
    - 4. Blood cells and calcium
  - B. Bones
    - 1. Classification
    - 2. Structure
  - C. Divisions of skeletal system
    - 1. General divisions
    - 2. Most common to be injured
    - 3. Types of fractures
  - D. The spinal column
    - 1. Function and form
    - 2. Criticality in injury
    - 3. Low back pain
  - E. Joints
    - 1. Function and structure
    - 2. Injuries
- IV. **THE MUSCULAR SYSTEM**
  - A. Functions and properties of muscle tissue
  - B. Types of muscles
  - C. Factors affecting muscle function
    - 1. Physiological
    - 2. Work and training
    - 3. Disorders and injuries
- V. **THE RESPIRATORY SYSTEM**
  - A. The major elements
    - 1. Trachea
    - 2. Bronchial tubes
    - 3. Lungs
  - B. The respiratory process
    - 1. The function of oxygen
    - 2. Inspiration
    - 3. Respiration
    - 4. The mechanics of the respiratory cycle
  - C. Respiration and injury potential
    - 1. Cessation of cycle
    - 2. Lungs as absorbers
    - 3. Oxygen demands
    - 4. Potential injury sources

#### INSTRUCTOR REFERENCES:

Chafee, E. E. and Greisheimer, E. M., **Basic physiology and Anatomy**, New York: Lippincott, 1964.

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Steen, E. B. and Montagu, A., **Anatomy and Physiology**, New York: Barnes and Noble, 1959.

Note: Skeleton and heart-lung model and wall charts should be used.

## OSH 19 – HUMAN FACTORS IN SAFETY

### Session Outline – Week 8 – **PHYSIOLOGY** – Circulatory and Nervous Systems, Sense Organs

**OBJECTIVES:** Describe the form and function of the circulatory and nervous systems and the sense organs.

#### **OUTLINE:**

- I. THE CIRCULATORY SYSTEM
  - A. Structures
  - B. The heart
    - 1. Anatomy
    - 2. Mechanics
  - C. Blood vessels
  - D. General plan of circulation
  - E. Circulatory reaction to trauma
    - 1. Shock
    - 2. Bleeding
    - 3. Stress
- II. THE NERVOUS SYSTEM
  - A. General structure
  - B. Function
  - C. The sensory system
    - 1. The sense organs
    - 2. Range of response
    - 3. Sensitivity to trauma
- III. THE EYE
  - A. Structure
  - B. The mechanics of vision
    - 1. Lens
    - 2. Retina
    - 3. Focusing
  - C. Trauma
    - 1. Causes
    - 2. Effects
- IV. THE EAR
  - A. Anatomy
  - B. The hearing function
    - 1. Transformation of sound pressure
    - 2. The cochlea
    - 3. Effects of intensity
  - C. Hearing loss
    - 1. Criteria for determination
    - 2. Causes other than noise
    - 3. Noise induced hearing loss
    - 4. Common industrial exposure
- V. THE SENSORY SYSTEM AND THE MAN-MACHINE SYSTEM
  - A. Visual criteria
    - 1. Color discrimination
    - 2. Light intensity
    - 3. Eye hazards
  - B. Auditory criteria
    - 1. Hearing threshold
    - 2. Noise masking
    - 3. Noise limits
  - C. Thermal limits
    - 1. Sensitivity
    - 2. Comfort levels
    - 3. Danger limits

#### **INSTRUCTOR REFERENCES:**

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Chafee, E. E. and Greishmer, E. M., **Basic Physiology and Anatomy**, New York: Lippincott, 1964.

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## OSH 19 – HUMAN FACTORS IN SAFETY

### Session Outline – Week 9 – ENVIRONMENTAL STRESSES AND BODY RESPONSES

**OBJECTIVES:** Identify the common environmental stress factors in industry and describe their effects on the body.

#### OUTLINE:

- I. THE ENVIRONMENTAL STRESSES
  - A. Chemical
    - 1. Liquids
    - 2. Gases
    - 3. Dusts
    - 4. Fumes, mists, vapors
  - B. Physical
    - 1. Electromagnetic radiation
    - 2. Ionizing radiation
    - 3. Noise
    - 4. Vibration
    - 5. Temperature extremes
  - C. Biological
    - 1. Insects
    - 2. Molds
    - 3. Fungi
    - 4. Bacteria
  - D. Ergonomic
    - 1. Monotony
    - 2. Repetitive motion
    - 3. Fatigue
- II. THE THERMAL ENVIRONMENT
  - A. Comfort limits
  - B. Body responses
    - 1. Sweating - body salt loss
    - 2. Radiation - body equilibrium
    - 3. Conduction - clothing
  - C. Effects of high temperature
    - 1. Heatstroke
    - 2. Heat cramps
    - 3. Heat exhaustion
- III. ATMOSPHERIC PRESSURE
  - A. Normal tolerances
  - B. Working under compression
    - 1. Effects
    - 2. Required conditions
    - 3. Trauma
  - C. Reduced pressure
    - 1. Oxygen deficiency
    - 2. Effects
- IV. EFFECTS OF NOISE
  - A. Hearing loss
    - 1. Temporary effects
    - 2. Recovery time
    - 3. Permanent impairment
  - B. Fatigue
  - C. Psychological effects
    - 1. Annoyance
    - 2. Startle reaction
    - 3. Tension
  - D. Interference with communications
    - 1. Masking
    - 2. Signals
    - 3. Operational
- V. PSYCHOLOGICAL STRESSES
  - A. Mental demands
    - 1. Decision - scope and speed
    - 2. Intensity of work demands
    - 3. Responsibility
    - 4. Conflict
  - B. Fatigue
    - 1. Monotony
    - 2. Environmental factors – illumination, climate, noise
    - 3. Effects of fatigue

#### INSTRUCTOR REFERENCES:

Accident Prevention Manual for Industrial Operations (6th Edition), Chicago: National Safety Council, 1969.  
Fundamentals of Industrial Hygiene, Chicago: National Safety Council, 1971.

## OSH 19 – HUMAN FACTORS IN SAFETY

### Session Outline – Week 10 – CHEMICAL EXPOSURES

**OBJECTIVES:** Identify the potential chemical hazards in industry and describe the general control methods recommended.

#### OUTLINE:

- I. TOXICITY AND HAZARD
  - A. Toxicity - capacity
    - 1. Definition
    - 2. Threshold Limit Values
  - B. Hazard - possibility
    - 1. Means of evaluation
    - 2. Common control measures
- II. MODES OF PHYSIOLOGICAL ATTACK
  - A. Inhalation
    - 1. Lung tissue as an absorber
    - 2. Mucous membranes
    - 3. Body defenses
    - 4. Primary respiratory irritants
    - 5. Most common toxicants
  - B. Ingestion
    - 1. Means of entry
    - 2. Absorption in blood stream
    - 3. Necessity for personal hygiene
  - C. Skin absorption
    - 1. Dermatitis reaction
    - 2. Common toxicants absorbed by skin
    - 3. Protective clothing
  - D. Most common modes of attack
    - 1. Inhalation most important
    - 2. Inhalation critical because of rate of absorption
    - 3. Skin contact - primarily dermatitis
- III. REVIEW OF CONTROL MEASURES
  - A. Key concepts
    - 1. Recognition
    - 2. Evaluation
    - 3. Prescription
  - B. General methods of control
    - 1. Substitution
    - 2. Change or alteration
    - 3. Isolation
    - 4. Wet methods
    - 5. Local exhaust
    - 6. Dilution ventilation
    - 7. Personal protective equipment
    - 8. Housekeeping
    - 9. Special controls
- IV. OSHA AND CHEMICAL HAZARDS
  - A. Threshold Limit Values
  - B. Reporting procedures on exposures
  - C. Examples of standards

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.  
**Federal Register**, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).  
**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

## OSH 19 — HUMAN FACTORS IN SAFETY

### Session Outline — Week 11 — DESIGN FOR HUMAN FACTORS

**OBJECTIVES:** Identify the areas for application of human factors engineering in common processes and for common machine tools.

#### OUTLINE:

- I. HUMAN FACTORS ENGINEERING
  - A. Definition
  - B. Basic features
    - 1. Application to design
    - 2. Obtaining objective data
    - 3. Incorporation in preliminary design
    - 4. Consideration of system effectiveness and costs in design decisions
    - 5. Consideration of operational, field use
  - C. Basic principles
    - 1. Integration
    - 2. Capabilities and limitations
    - 3. Biomechanics
    - 4. Habit patterns
    - 5. Perception
    - 6. Location
- II. MAN VS. MACHINE
  - A. Man is superior to machine
    - 1. Unexpected events
    - 2. Perceptual constancies
    - 3. Profiting from experience
    - 4. Originality, creativity, improvising
    - 5. Signal detection in overlapping noise
    - 6. Sensitivity to wide variety of stimuli
    - 7. Working under overload
    - 8. Ability to select inputs
    - 9. Inductive reasoning
    - 10. Language ability
  - B. Machine is superior to man
    - 1. Monitoring other machines or men
    - 2. Memory ability
    - 3. Exerting a large force
    - 4. Routine, repetitive tasks
    - 5. Rapid computing
    - 6. Deductive reasoning
    - 7. Quick response
    - 8. Absolute judgements
- C. Man is normally excluded
  - 1. Tasks where high probability of error
  - 2. Perceptual requirements beyond limits
  - 3. Difficult responses
  - 4. Rapid decisions or strong memory
  - 5. Overload
  - 6. Certain communications
- III. APPLYING HUMAN FACTORS ENGINEERING
  - A. Steps
    - 1. Learn the system
    - 2. Make preliminary list of human tasks
    - 3. Decide machine tasks
    - 4. List step-by-step procedure for man
    - 5. Evaluate equipment design for human requirements
    - 6. Redesign as required
    - 7. Select personnel
    - 8. Develop training
    - 9. Plan layout
    - 10. Evaluate periodically
  - B. Practical application
    - A series of slides of the factory environment and machines should be developed. For each slide the students should specify the human factor considerations in keeping with the principles discussed.

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

McFarland, R. A., Human Factors Engineers, **Journal American Society of Safety Engineers**, 9,2 (February 1964).

Tarrants, W. E., The Role of Human Factors Engineering in the Control of Industrial Accidents, **Journal American Society of Safety Engineers**, 8, 2 (February 1963).

Woodson, W. E. and Conover, D. W., **Human Engineering Guide for Equipment Designers** (2nd Edition), Berkeley: University of California Press, 1964.

OSH 19 – HUMAN FACTORS IN SAFETY  
Session Outline – Week 12 – MAN AS A SUBSYSTEM

**OBJECTIVES:** Perform a hazards analysis of a simple man-machine system and relate them to human factors design requirements.

**OUTLINE:**

- I. SYSTEM SAFETY CONCEPTS
    - A. Definition
    - B. Key terms
      - 1. System
      - 2. Sub-system
      - 3. Component
      - 4. Redundancy
      - 5. Value analysis
  - II. MAN AS A SUBSYSTEM
    - A. Specific concerns
      - 1. Physical dimensions
      - 2. Capability for data sensing
      - 3. Capability for data processing
      - 4. Capability for motor activity
      - 5. Capability for learning
      - 6. Physical and psychological needs
      - 7. Sensitivities to psychosocial environment
      - 8. Capability for coordinated action
      - 9. Sensitivities to physical environment
      - 10. Variability within and between individuals
    - B. Man-machine interaction (interface)
      - 1. Functional analysis
      - 2. Task analysis
      - 3. Task elements
    - C. System reliability - human error analysis
- 1. Failure to perform all or part of the task
  - 2. Incorrect performance of the task or step
  - 3. Introduction of task or step which should not be performed
  - 4. Performance of some task or step out of sequence
  - 5. Failure to perform the task or step within the allotted time period
- D. Steps to hazard analysis
  - 1. Define the system in space and time
  - 2. Specify identifiable undesired outcomes
  - 3. Specify key undesired outcomes that will serve as a basis for decision
  - 4. Determine the probable modes of occurrence of the selected undesired outcomes
  - 5. Evaluate the likelihood of occurrence
  - 6. Decide if system is adequate or what design changes are necessary
  - 7. Analyze revisions as above
- E. Classification of system hazards
  - 1. Negligible
  - 2. Marginal
  - 3. Critical
  - 4. Catastrophic

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- Recht, J. L., **Systems Safety Analysis**, Chicago: National Safety Council, 1967.
- System Safety Techniques – Their Place and Utilization in the Occupational Environment**, Park Ridge, Illinois: American Society of Safety Engineers, 1971.

## OSH 19 — HUMAN FACTORS IN SAFETY

### Session Outline — Week 13 — INDIVIDUAL DIFFERENCES

**OBJECTIVES:** Identify those factors of human differences that are potential sources of accidents as they relate to machine and process design.

#### OUTLINE:

- I. THE CONCEPT OF INDIVIDUAL DIFFERENCES
  - A. Arose from psychology
    1. Physical sciences can measure and predict reactions
    2. Human behavior not consistent
  - B. Scope of human differences
    1. Anthropometric
    2. Psychological
    3. Psycho-physical
    4. Psycho-social
- II. INDIVIDUAL DIFFERENCES AND ACCIDENTS
  - A. Personal factors
    1. Sensory-motor skills
    2. Intelligence
    3. Emotions
    4. Physical attributes
    5. Motivation and personality
  - B. Social factors
    1. Conformance - non-conformance
    2. Cultural patterns
    3. Relation to and within group
    4. Social pressures
- III. DETERMINING INDIVIDUAL DIFFERENCES
  - A. Testing
    1. Psycho-physical
    2. Aptitude
    3. Intelligence
  - B. Anthropometric data
    1. Physical examination
    2. Resources for standard data
- IV. DESIGN REQUIREMENTS FOR INDIVIDUAL DIFFERENCES
  - A. Personnel selection and placement
    1. Job analysis and personnel criteria
    2. Selection ratios
    3. Match people with job criteria
  - B. Psycho-physical demands
    1. Sense organs required, range of sensitivity
    2. Physical responses - type, speed, accuracy
    3. Physical movement - interface, complexity, coordination
  - C. Anthropometric requirements
    1. Static measurements - body dimensions
    2. Dynamic measurement - body in motion, space, reach, etc.
  - D. Fatigue factors
    1. Stress
    2. Strength
    3. Environmental conditions

#### INSTRUCTOR REFERENCES:

- Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.
- Anastasi, Anne, **Individual Differences**, New York: John Wiley & Sons, 1965.
- Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

Session Outline — Week 14 — HUMAN FACTORS AND PLANT DESIGN

**OBJECTIVES:** Specify design requirements to correct for or accommodate normal habit patterns.

**OUTLINE:**

- I. HUMAN BEHAVIOR AND MACHINE ACCIDENTS
  - A. Accident cause analysis
    - 1. Total work injuries
    - 2. Machinery
    - 3. Machine parts
    - 4. Work practice
  - B. Common accident controls
    - 1. Engineering hazard from job
    - 2. Guarding hazard from job
    - 3. Training personnel
  - C. Non-reliance on training
    - 1. Attitudes
    - 2. Distraction
    - 3. Emotional upset
    - 4. Inattention
  - D. Human error analysis (review)
- II. HUMAN HABIT PATTERNS
  - A. Development of habits
    - 1. Instinctive reactions - pain, startle reaction
    - 2. Family patterns
    - 3. Cultural influence
    - 4. Some are useful
    - 5. Psychological reinforcement
  - B. Habit patterns or expectations and accident potential
    - 1. Doors below standard height
    - 2. Different floor levels at each side of door
    - 3. Steps of varying height in same flight
    - 4. Passing on right instead of left
    - 5. Low hanging obstructions over walkways
    - 6. Insecure railings or fences
    - 7. Hot water faucet on right side
    - 8. Change in established sequence
    - 9. Large objects light, small objects heavy
    - 10. Moving to left to turn right, or vice versa
    - 11. Change in coefficient of friction underfoot
    - 12. Sudden changes in necessary force required
    - 13. Obstacles in walkway
    - 14. Uninsulated electrical conductors
    - 15. Hazardous materials in unlabeled containers
- III. DESIGNING FOR HABIT PATTERNS
  - A. Standards as guides
    - 1. Strength of construction
    - 2. Dimensions of doors, walkways, steps, etc.
    - 3. Housekeeping and clearances
    - 4. Labeling of materials, controls, etc.
    - 5. Standards are based on anthropometric data, experience, and human expectations
  - B. Instrumentation and controls
    - 1. Instrument display
    - 2. Simplification of instruments and reading patterns
    - 3. Control identification
    - 4. Control movement in relation to movement controlled
    - 5. Effort required for control
    - 6. Spacing and location of controls
  - C. Power transmission
    - 1. Review of standards
    - 2. Expectations of workers
  - D. Point of operations
    - 1. Eliminating or reducing unconscious error
    - 2. Interlocks to reduce risk-taking

**INSTRUCTOR REFERENCES:**

- Accident Prevention Manual for Industrial Operations (6th Edition), Chicago: National Safety Council, 1969.
- De Reamer, R., *Modern Safety Practices*, New York: John Wiley & Sons, 1958.
- Fundamentals of Industrial Hygiene, Chicago: National Safety Council, 1971.

## OSH 19 — HUMAN FACTORS IN SAFETY

### Session Outline — Week 15 — PLANT LAYOUT

**OBJECTIVES:** Apply certain sections of OSHA and other standards to practical problems of plant design.

#### OUTLINE:

- I. SAFETY STANDARDS
  - A. Safety standards defined
  - B. Interpretations
    - 1. Most desirable
    - 2. Generally acceptable
    - 3. Minimum requirement
    - 4. Economically feasible
  - C. OSHA standards
    - 1. Purpose and scope
    - 2. Pertinent definitions
    - 3. Applicability
  - D. Consensus standards
    - 1. ANSI
    - 2. NFPA
    - 3. Other agencies
- II. USING STANDARDS AS GUIDELINES IN PLANNING FOR HUMAN FACTORS
  - A. Planning checklist
    - 1. Site
    - 2. Transportation facilities
    - 3. Exits and wall openings
    - 4. Working surfaces
    - 5. Materials handling and flow
    - 6. Health and personnel safety requirements
    - 7. Personnel service facilities
  - B. System safety analysis (review)
    - 1. Key concepts
    - 2. Steps in human factors engineering
- III. PRACTICAL APPLICATION OF STANDARDS
  - A. Typical problems for group discussion
    - 1. Access to higher location - steps, ladders, or ramps?
    - 1. Tank entry - non-toxic - what equipment and procedure?
    - 3. Clock alley entry and exit - what specifications?
    - 4. Repair to dryers or ovens - what requirements?
    - 5. Work in cold rooms - what requirements?
    - 6. Embossing machines - what requirements?
    - 7. Tank entry - hazard unknown - what requirements?
    - 8. Work rooms - what exits?
    - 9. Work in isolated locations - what requirements?
    - 10. Sanitation - what requirements?
  - B. Other sources of guidance
    - 1. NSC
    - 2. Trade associations
    - 3. Insurance carriers
    - 4. Consultants

#### INSTRUCTOR REFERENCES:

Accident Prevention Manual for Industrial Operations (6th Edition), Chicago: National Safety Council, 1969.  
Federal Register, Part II, 36, 105, Saturday, May 29, 1971 (or subsequent revisions).

Session Outline – Week 16 – SUPERVISION AND SAFETY

**OBJECTIVES:** Describe the supervisor's safety responsibilities as they relate to the overall safety function.

**OUTLINE:**

- I. THE SUPERVISOR'S SAFETY RESPONSIBILITIES
  - A. Broad responsibilities
    - 1. Establish work methods
    - 2. Give job instruction
    - 3. Assign people to jobs
    - 4. Supervise people at work
    - 5. Maintain equipment and work place
  - B. Specific safety tasks
    - 1. Instructing employees of chemical and physical properties of materials handled
    - 2. Instruction in the use of safeguards and safe procedures
    - 3. Housekeeping
    - 4. Inform safety engineer of hazards he cannot correct
    - 5. Inform safety engineer and/or medical department of accidents or exposures to toxicants
    - 6. Investigate accidents
    - 7. Discipline
  - C. The role of the supervisor
    - 1. Key man
    - 2. Closest to job and people
- 3. Attitudes significant in accident prevention
- II. HELPING THE SUPERVISOR HELP YOU
  - A. Gaining cooperation
    - 1. Mutual respect
    - 2. Mutual cooperation
    - 3. Assistance
  - B. Motivating the supervisor
    - 1. Recognition
    - 2. Participation in planning
    - 3. Recognition for achievement
  - C. Supervisory training
    - 1. In-house courses
    - 2. Outside resources
- III. KEY ELEMENTS OF A SUPERVISORY SAFETY TRAINING COURSE
  - A. The elements of accidents and investigation
  - B. The human element and human relations
  - C. Job instruction for safety
  - D. Employee health and hygiene
  - E. Housekeeping
  - F. Materials handling
  - G. Machine guarding
  - H. Hand tool safety
  - I. Fire Prevention and control

**INSTRUCTOR REFERENCES:**

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

De Reamer, R., **Modern Safety Practices**, New York: John Wiley & Sons, 1958.

Simonds, R. H., **Safety Management**, Homewood, Illinois: Richard D. Irwin, 1963.

## OSH 19 – HUMAN FACTORS IN SAFETY

### Session Outline – Week 17 – HUMAN FACTORS IN PERSPECTIVE

**OBJECTIVES:** Describe the key elements of human factors as they apply to occupational safety and health.

#### OUTLINE:

- I. THE WHOLE MAN
  - A. Physical and mental demands
    - 1. Skills
    - 2. Unique contributions vs. machines
    - 3. Environmental stresses
  - B. The attitudinal overlays
    - 1. The psychological needs
    - 2. Motivational factors
  - C. Communicating with the man as opposed to worker
    - 1. Motivational features
    - 2. Open communications channels
  - 3. Memory, habit patterns, and idiosyncrasies
  - 4. Individual variation - no standard product
- II. THE KEY CONSIDERATION
  - A. The strengths of man
    - 1. Adaptability
    - 2. Ability to learn
    - 3. Ability to work under overload
    - 4. Wide variety of performance capabilities
  - B. The weaknesses of man
    - 1. Fragility in hostile environments
    - 2. Susceptibility to emotional stresses
  - C. Human factors in design of facilities and equipment
    - 1. Anthropometric considerations
    - 2. Environmental sensitivities
    - 3. Sensory adaptability and limitations
    - 4. Habit patterns
    - 5. Limits of attention
  - D. Selection and placement
    - 1. Analyzing performance requirements
    - 2. Selection procedures
    - 3. Proper placement
  - E. Training
    - 1. Supervisory
    - 2. Orientation and indoctrination
    - 3. Job and job safety
  - F. Communications
    - 1. Effectiveness
    - 2. Media
  - G. Motivation
    - 1. Symptoms of poor motivation
    - 2. Tools for safety motivation

#### INSTRUCTOR REFERENCES:

**Accident Prevention Manual for Industrial Operations** (6th Edition), Chicago: National Safety Council, 1969.

Body, L. and Dunbar, N. F., **Basic Aspects and the Applications of the Psychology of Safety**, New York: New York University, 1959.

**Fundamentals of Industrial Hygiene**, Chicago: National Safety Council, 1971.

## OSH 20 – SAFETY PROGRAM MANAGEMENT

### Session Outline – Week 1 – THE MODERN ORGANIZATION

**OBJECTIVES:** Describe the magnitude of the loss control problem and the standard measures of loss experience.

#### OUTLINE:

- I. PURPOSES OF THE COURSE
  - A. To generally understand the organization and purposes of modern organizations
  - B. To understand the magnitude and nature of loss problems in various types of organizations
  - C. To understand the duties and responsibilities of various individuals in an organization
  - D. To learn in some detail how to perform various control duties in an organization. Principal activities are inspection, training, loss investigation and loss analysis
  - E. To generally learn about product safety
  - F. To learn how to organize and administer the loss control function in a smaller organization
- II. THE MODERN ORGANIZATION
  - A. General characteristics related to loss control
    - 1. Variations caused by natural hazards
    - 2. Variations due to loss control efforts
    - 3. Variations due to loss performance
      - a) Organizational differences
      - b) Managerial differences
      - c) Safety and efficiency
- III. MAGNITUDE OF THE PROBLEM
  - A. Types of losses
  - B. Nature and extent of losses
  - C. Human and economic costs
- IV. SPECIFIC OBJECTIVES OF LOSS CONTROL
  - A. Humanitarian objectives
  - B. Reduction of costs
  - C. Intangible results
    - 1. Morale
    - 2. Public relations
- V. DETERMINATION OF PERFORMANCE
  - A. Types of work injuries
    - 1. Deaths
    - 2. Permanent total disabilities
    - 3. Permanent partial disabilities
    - 4. Temporary total disabilities
    - 5. Medical treatment cases
      - a) Doctor's cases
      - b) First aid cases
  - B. Injury frequency rates
    - 1. Definition
    - 2. Examples
    - 3. Appraisal
  - C. Injury severity rates
    - 1. Definition
    - 2. Examples
    - 3. Appraisal
  - D. Measuring property losses
    - 1. Fires - numbers and rates
    - 2. Vehicle accidents - numbers and rates
    - 3. Other types of property losses
  - E. Federal standards

#### INSTRUCTOR REFERENCES:

De Reamer, Russell, *Modern Safety Practices*, New York: John Wiley & Sons, 1958.

Drucker, Peter F., *The Practice of Management*, New York: Hayes & Brothers, 1954.

Filley, A. C. and House, R. J., *Managerial Process and Organizational Behavior*, Glenview, Illinois: Scott, Forsman & Co., 1969.

McGregor, Douglas, *The Human Side of Enterprise*, New York: McGraw-Hill, 1960.

Odiorne, George S., *Management by Objectives*, New York: Pitman Publishing Corp., 1965.

## OSH 20 — SAFETY PROGRAM MANAGEMENT

### Session Outline — Week 2 — SAFETY AND LOSS CONTROL ORGANIZATION — MANAGEMENT RESPONSIBILITIES

**OBJECTIVES:** Draft policy statements outlining the line and staff responsibilities for occupational safety and health.

#### OUTLINE:

- I. RESPONSIBILITIES OF OWNERS AND MANAGERS FOR LOSS CONTROL
  - A. Owners and boards of directors
    - 1. Establishing long run objectives
    - 2. Establishing loss control objectives
    - 3. Responsibilities
  - B. Chief executive
    - 1. Carry out objective of the organization
    - 2. Carry out loss control objectives
    - 3. Responsibilities
    - 4. Operation of executive committees
  - C. Line management
  - D. Process engineering
    - 1. Engineering
    - 2. Liaison functions
  - E. Production control
  - F. Maintenance
    - 1. Building construction and maintenance
    - 2. Mechanical equipment maintenance
    - 3. Electrical equipment maintenance
    - 4. Yard and grounds maintenance
  - G. Product & process research
    - 1. Building safety into the design
  - H. Controller and accounting department
    - 1. Budgets
  - I. Purchasing
    - 1. Equipment
    - 2. Supplies
  - J. Personnel or industrial relations
    - 1. Employee selection & placement
    - 2. Employee counseling
    - 3. Employee training
  - K. First line supervision
    - 1. Major responsibilities
    - 2. Responsibilities
  - L. Employees
    - 1. Responsibilities
    - 2. Cooperation
  - M. Unions
    - 1. Responsibilities and leadership
    - 2. Labor contracts
    - 3. Activities
  - N. Safety specialists
    - 1. Duties
    - 2. Responsibilities
- II. POLICIES
  - A. Determination
    - 1. Can vary by industry and type of firm
    - 2. Can vary by organization of firm
    - 3. Can vary by personal characteristics of key personnel
  - B. Implementation
    - 1. Written communication
    - 2. Verbal communication
  - C. Determination of effectiveness

#### INSTRUCTOR REFERENCES:

- Argyris, C., *Executive Leadership*, New York: Harper & Bros., 1961.
- Filley, A. C. and House, R. J., *Managerial Process and Organizational Behavior*, Glenview, Illinois: Scott, Forsman & Co., 1969.
- Perrou, Charles, *Organizational Analyses, A Sociological View*, Belmont, California: Brooks-Cole Publishing Co., 1970.
- Tannenbaum, R., *Leadership and Organizations, A Behavioral Science Approach*, New York: McGraw-Hill, 1961.
- Tannenbaum, R., *Social Psychology of the Work Organization*, Belmont, California: Brooks-Cole Publishing Co., 1966.

## OSH 20 – SAFETY PROGRAM MANAGEMENT

### Session Outline – Week 3 – SAFETY AND LOSS CONTROL ORGANIZATION – SPECIALIZED STAFF

**OBJECTIVES:** Draft a table of organization and responsibilities of a loss control staff and its relationships in a small organization.

#### OUTLINE:

- I. SPECIALIZED LOSS CONTROL STAFF
  - A. Size of staff
    1. Size as related to nature of the organization
    2. Size as related to the number of people in the organization
    3. Effects of staff on loss performance
  - B. Location of staff
    1. Industrial relations or personnel
    2. Separate department
    3. Production
    4. Insurance or finance
    5. Factors affecting the location
      - a) Proper reporting relationship
      - b) Reporting to individual with interest
      - c) Reporting to individual with responsibility
  - C. Authority of staff
    1. Advisory role
    2. Responsibilities of staff
    3. Informal organization
    4. Power of staff based on knowledge
  - D. Qualifications of staff
    1. Personal characteristics
      - a) Ability to get along with others
      - b) Enthusiasm, drive, perseverance
    2. Readiness for new ideas and new approaches
    3. Specific knowledges
      - a) Knowledge of safety principles and techniques
      - b) Knowledge of engineering
      - c) Knowledge of business administration
    - E. Most frequently performed functions
      1. Develop and administer the loss control activity
      2. Perform inspections
      3. Investigate work injuries
      4. Recommend appropriate corrective action and follow through on it
      5. Maintain records of losses, analyze them and publicize the information obtained
      6. Advise all levels of management regarding loss control
      7. Provide guidance on organization compliance with Federal, State and local laws and regulations
      8. Provide assistance in the training and development of employees in the area of safety and loss control

#### INSTRUCTOR REFERENCES:

Filley, A. C. and House, R. J., *Managerial Process and Organizational Behavior*, Glenview, Illinois: Scott, Foresman & Co., 1969, Chapters 11 & 14.

Gulley, H. E., *Discussion, Conference & Group Processes*, New York: Holt, Rinehart & Winston, 1960.

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## OSH 20 — SAFETY PROGRAM MANAGEMENT

### Session Outline — Week 4 — SAFETY AND LOSS CONTROL ORGANIZATION PART TIME FUNCTION, MEDICAL RESPONSIBILITIES

**OBJECTIVES:** Describe the specific responsibilities and procedures for administration of medical and claims services.

#### OUTLINE:

- I. LOSS CONTROL ACTIVITIES PERFORMED BY PART TIME STAFF
  - A. Inspections
  - B. Employee selection, training and motivation
  - C. Communication with personnel at all levels in the organization
  - D. Investigations of losses and claims activities
  - E. Maintaining records and making reports
  - F. Medical and first aid facilities
- II. LOSS CONTROL STAFF RELATIONSHIPS TO MEDICAL AND FIRST AID FUNCTIONS
  - A. Relationship to loss control function
    1. Organization of the firm
    2. Size of the firm
    3. Management policies of the firm
  - B. Medical and first aid facilities
    1. Location
    2. Approximate size of facilities
    3. Ancillary facilities
    4. Physicians and nurses
    5. Records
    6. Coordination of efforts
  - C. Absenteeism
    1. Relationship to loss control function
    2. Visits by company nurses
    3. Causes of absenteeism
- III. LOSS CONTROL STAFF RELATIONSHIPS TO INSURANCE ACTIVITIES
  - A. Workmen's Compensation insurance
    1. Workmen's Compensation coverages
      - a) Indemnity benefits
      - b) Medical benefits
    2. Occupational disease coverages
    3. Claim procedures
    4. Employees covered by Workmen's Compensation
    5. Other restrictions on coverage
    6. Workmen's Compensation insurance rates
    7. Ways the risk is handled
      - a) Purchased coverage
      - b) State funds
      - c) Self insuring the risk
  - B. Other insurance coverages
    1. Fire and extended coverages
    2. Boiler and machinery insurance
    3. Automobile public liability, property damage, comprehensive and collision
    4. General liability
    5. Aircraft
    6. Inland and wet marine
    7. Miscellaneous coverages
- IV. OTHER ACTIVITIES OFTEN PERFORMED BY LOSS CONTROL STAFF
  - A. Off the job
    1. Magnitude of the problem
    2. Reasons for working to help control such occurrences
    3. Control activities
  - B. Plant security
  - C. Fire protection and prevention
  - D. Prevention of property damage and injury to the public
  - E. Controlling industrial wastes
  - F. Safety effects of new product development
  - G. Sanitation

#### INSTRUCTOR REFERENCES:

Filley, A. C. and House, R. J., *Managerial Process & Organizational Behavior*, Glenview, Illinois: Scott, Foresman & Co., 1969

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## OSH 20 — SAFETY PROGRAM MANAGEMENT

### Session Outline — Week 5 — ELEMENTS OF A SAFETY PROGRAM — ROLE OF COMMITTEES: POLICIES; ANALYSES OF LOSS POTENTIAL

**OBJECTIVES:** Describe the functions of safety committees in loss prevention. Analyze loss potentials in a typical organization.

#### OUTLINE:

- I. SAFETY COMMITTEES
  - A. Policy making committees
    1. Reviews loss experience
    2. Establishes safety regulations
    3. Recommends major expenditures
    4. Establishes policy on other related subjects
    5. Review of membership
    6. Records
  - B. Loss control inspection committees
    1. Duties
    2. Membership
    3. Records
  - C. Educational and promotional committees
    1. Activities
    2. Membership
    3. Records
  - D. Types of committees
    1. Management committees
    2. Departmental safety committees
    3. Inspection committees
    4. Employee safety committees
    5. Labor-management committees
  - E. Committee organization
    1. Most effective size
    2. Most effective composition
    3. Structure
    4. Limitations
- II. COSTS OF WORK INJURIES
  - A. Reasons for determining costs of work injuries
    1. To develop management support
    2. To determine the effect of losses on operational costs
    3. To more effectively allocate resources used to control losses
  - B. The insured cost of work injuries
    1. Medical payments
    2. Weekly indemnity payments
    3. Compensation payments
  - C. Unusual costs of work injuries
    1. Cost of wages paid for working time lost by workers who were not injured
    2. Costs to repair equipment or material damaged in the accident
    3. Money paid to the injured employee beyond Workmen's Compensation payments
    4. The extra cost of overtime necessary because of the accident
    5. Cost of wages paid supervision when they are doing activities caused by the accident
    6. Wage costs due to decreased output of the injured employee after he returns to work
    7. Cost of the learning period of a new worker
    8. Uninsured medical costs
    9. Cost of time spent by higher supervision and clerical personnel because of the accident
    10. Other costs — public liability claims, spoilage, etc.
  - D. Non-valid unusual costs
- III. COSTS OF PROPERTY LOSSES
  - A. Insured costs
    1. Examples
    2. Effect upon insurance premiums
  - B. Uninsured costs
    1. Loss of sales, if production is reduced or stopped because of the loss

2. Payments necessary for failure to complete work by a specified time
3. Non-insured expenses for salvage and debris removed
4. Non-insured expenses necessary to reconstruct records
5. Non-insured extra expenses determined necessary to expedite repairs or replacement
6. Costs to communicate with customers and the public
7. Non-insured additional costs of replacing the structure or equipment destroyed with a new structure or with new equipment
8. Costs to settle the claims arising from the loss

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**Accident Facts**, Chicago: National Safety Council, current year.

Grant, Gerald, S., "Measuring the Cost of Accidents", **Journal American Society of Safety Engineers**, 6,7 July '66).

## OSH 20 – SAFETY PROGRAM MANAGEMENT

### Session Outline – Week 6 – ELEMENTS OF A SAFETY PROGRAM – SAFETY PLANNING & BUDGETING

**OBJECTIVES:** Prepare a safety organization budget utilizing Simond's method of accident cost determination and organizational data provided.

#### OUTLINE:

- I. METHODS OF DETERMINING TOTAL COSTS OF WORK INJURIES AND PROPERTY LOSSES
  - A. Insurance costs
    - 1. Purchased insurance
    - 2. Self insurers
    - 3. Self insurance and excess
  - B. Uninsured costs - Heinrich's studies
    - 1. The four to one ratio
    - 2. Evaluation of this method
  - C. Indirect direct cost ratios
    - 1. The method
    - 2. Disadvantages of the method
      - a) Inaccuracies
      - b) Very closely keyed to averages
  - D. Simond's method
    - 1. Classification of accidents
    - 2. Determining average uninsured costs from Simond's study
    - 3. Example of cost estimates based on Simond's data
    - 4. Analysis and measures of reliability
    - 5. Catastrophes and fires
    - 6. Pilot studies of average accident costs
    - 7. Practical considerations
    - 8. Cost of making the study
    - 9. Educational value of the study
  - E. Pilot study procedure
    - 1. Authorization of the study
    - 2. Making the study
    - 3. Receiving information
    - 4. Possible sources of bias
    - 5. Determining average costs of first aid cases
    - 6. Instructions for the preparation of cost data sheets
- II. PLANNING AND FORECASTING A LOSS CONTROL FUNCTION
  - A. Obtaining available data
    - 1. Information about current operations
      - a) Numbers of employees
      - b) Financial data
      - c) Detailed information about operations
      - d) The past and current number and cost of losses by type
  - B. Obtaining forecasts about future operations
    - 1. Numbers of employees
    - 2. Forecasting size and scope of operations
    - 3. Obtaining financial data
  - C. Forecasting possible future loss trends
  - D. Determining the magnitude and cost of resources necessary to bring about desired controls
    - 1. Number of full time staff specialists
    - 2. Number of part time staff specialists
    - 3. Activities performed by others in the organization
    - 4. Use of outside resources
      - a) National Safety Council
      - b) Trade associations
      - c) Governmental agencies
      - d) Consultants
    - 5. Devices and equipment necessary to control losses and to meet Federal and State codes and standards
- III. BUDGETING PROCEDURES
  - A. Determination of current costs
  - B. Determination of estimated future costs
  - C. Standard accounting procedures
  - D. The budget cycle
  - E. FTE concepts
  - F. Recharging

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## OSH 20 — SAFETY PROGRAM MANAGEMENT

### Session Outline — Week 7 — ELEMENTS OF A SAFETY PROGRAM — CORRECTIVE PLAN - PRIORITIES

**OBJECTIVES:** Analyze the loss experience of an organization. Develop a plan of corrective action.

#### OUTLINE:

- I. ANALYSIS OF LOSS DATA
  - A. Comparisons of experience
    - 1. With past performance of the location
    - 2. To other locations in the organization
    - 3. To other similar locations in the geographic area or in the country
  - B. Sources of loss data
    - 1. Federal government - U.S. Department of Labor
    - 2. State or municipal government agencies
    - 3. National Safety Council
    - 4. Trade associations
    - 5. American Society of Safety Engineers
    - 6. Insurance companies
  - C. Analysis by various members of the organization
    - 1. Analysis by first line management
      - a) Investigations of work injuries
      - b) Investigations of other losses
      - c) Advantages and disadvantages of such investigations
    - 2. Analysis by safety specialists
      - a) Collection of available facts
      - b) Allow varying disciplines to be used
  - D. Types of analysis of information
    - 1. Periodic written reports
    - 2. Analysis by type
    - 3. Analysis by cause or causes
    - 4. Analysis by subdivision - division, location, department
    - 5. Analysis by time, day of week and month
    - 6. Analysis by insured and uninsured cost
- II. DEVELOPMENT OF A CORRECTIVE PLAN
- III. PLANNING AND CONTROL
  - A. Complete inventories
    - 1. Surveys by organization loss control specialists
    - 2. Surveys by committees
    - 3. Surveys by outside personnel
  - B. Types of information obtained
    - 1. Physical hazards
    - 2. Organizational defects
    - 3. Interrelationships between the various elements
  - C. Reporting techniques
    - 1. Verbal
    - 2. Written
- IV. ESTABLISHING PRIORITIES
  - A. By the use of historic data

1. Depends on accuracy of data available
2. Trends most evident over longer periods of time
3. Use of probabilities
- B. Operations analysis techniques
  1. Analyze work by element
  2. Assess potential hazards in each element
  3. Test necessary safety precaution or device
  4. Advantages of operations analysis
- C. Operations research approach
  1. Activities studied must be carefully determined - technique takes time and costs money
  2. Team approach
  3. Principle techniques used
    - a) Fault tree
    - b) PERT or critical path analysis
    - c) Linear programming
    - d) Stochastic programming models
  4. Advantages

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## OSH 20 — SAFETY PROGRAM MANAGEMENT

### Session Outline — Week 8 — ELEMENTS OF A SAFETY PROGRAM — MANAGEMENT DECISION & ACTION

**OBJECTIVES:** Describe the steps involved in implementing a safety program at all levels of an organization.

#### OUTLINE:

- I. IMPLEMENTATION THROUGH MANAGEMENT
  - A. Background information on human relations
    1. Findings of psychologists
    2. Findings of sociologists
    3. Relevant studies on decision making
    4. Implications for management practice
  - B. Relationships of specialized staff to management
    1. Selling management
    2. Justification of the plan
    3. Humanitarian aspects of loss control
    4. Legal aspects of loss control
    5. Periodic written reports to top management
      - a) Costs
      - b) Trends
    6. Resolution of conflicts with other goals of the organization
    7. Allocation of insured costs
      - a) By division or major organizational subdivision
      - b) By location
      - c) By work unit or department
    8. Measurement and allocation of uninsured costs
      - a) By organizational subdivision
      - b) By location
      - c) By work unit or department
    9. Periodic written reports to middle and first line management
      - a) Trends
      - b) Insured costs
      - c) Uninsured costs
- II. IMPLEMENTATION THROUGH FIRST LINE MANAGEMENT
  - A. Importance of leadership and example
  - B. Communication with employees
    1. Conversations
    2. Meetings
    3. Use of materials about loss control
    4. Enforcement of regulations
- III. IMPLEMENTATION THROUGH EMPLOYEES
  - A. Pertinent research findings
    1. Psychology
    2. Sociology
  - B. Communication
    1. Verbal - through supervision
    2. Verbal - through loss control staff
    3. Written communication
      - a) Handouts and posters
      - b) Through company publications
    4. Contests
      - a) Types
      - b) Basis
    5. Participation
      - a) Role of leaders
      - b) Suggestions

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## OSH 20 — SAFETY PROGRAM MANAGEMENT

### Session Outline — Week 9 — ELEMENTS OF A SAFETY PROGRAM — IMPLEMENTING PLAN — INSPECTIONS

**OBJECTIVES:** Specify the requirements and procedures necessary for the safety inspection and evaluation of plant facilities and equipment.

#### OUTLINE:

- I. IMPLEMENTING THE PLAN
  - A. Through established procedures
  - B. Through effective communications
  - C. Through the passage of time
- II. EVALUATING FACILITIES BEING PLANNED
  - A. General principles
    - 1. Begin at earliest planning stages
    - 2. Work closely with organization personnel, consultants and contractors
    - 3. Follow through on all related aspects
  - B. General considerations
    - 1. Arrangement of structures and outdoor equipment
    - 2. Construction of structures and equipment
    - 3. Internal layout of equipment and machinery
    - 4. Location and arrangement of exits and stairways
    - 5. Floor openings and platforms
    - 6. Flammable solids, liquids and gases
    - 7. Electrical, heating and cooling devices
    - 8. Lighting
      - a) General lighting
      - b) Localized general lighting
      - c) Supplementary lighting
      - d) Emergency lighting
    - 9. Ventilation
    - 10. Painting and finishing
    - 11. Noise, dusts, fumes and mists
    - 12. Identification of piping systems
    - 13. Flow charts
- III. EVALUATING EXISTING FACILITIES
  - A. General
    - 1. Principles of guarding
    - 2. Types of guards
      - a) Enclosure
      - b) Barrier type guards
    - 3. Guarding power presses
      - a) Parts
      - b) Maintenance
        - 1) Brake
        - 2) Clutch
        - 3) Raw counter balance
        - 4) Non-repeat devices
        - 5) Treadle
        - 6) Die setters
  - B. Point of operation hazards
    - 1. Barrier or enclosure guards
    - 2. Guarding by distance
    - 3. Hand removal devices
      - a) Hand pull away
      - b) Sweep guard
    - 4. Photoelectric eye
    - 5. Special feeding tools
    - 6. Flywheels
  - C. Automation
    - 1. General
    - 2. Feedback system
    - 3. Information input
    - 4. Controlling device
  - D. Elevators and lifting equipment
    - 1. Elevators
    - 2. Lifting equipment
    - 3. Wire ropes and chains
    - 4. Slings

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## OSH 20 – SAFETY PROGRAM MANAGEMENT

### Session Outline – Week 10 – ELEMENTS OF A SAFETY PROGRAM – PHYSICAL PLANT MAINTENANCE AND ACCIDENT INVESTIGATION

**OBJECTIVES:** Describe the role of the maintenance department in accident prevention. Describe the purpose and techniques of accident investigation.

#### OUTLINE:

- I. BOILERS AND MACHINERY MAINTENANCE & INSPECTION
  - A. Boilers
    1. Safety valves
    2. A.S.M.E. codes
    3. Gauge glass and water columns
    4. Instruments and controls
    5. Blow down valves
    6. Furnace explosions
    7. Hold off systems
      - a) Tagging systems
      - b) Lock out systems
      - c) Recording and notifications
    8. The boiler room
      - a) Arrangement
      - b) Power
      - c) Exits
  - B. Unfired pressure vessels
    1. A.S.M.E. codes
    2. Safety devices, instruments and controls
    3. Hydrostatic testing
    4. Inspections
    5. Training operators
    6. Vents
    7. Emptying, inspecting and repairing tanks
- II. FIRE PROTECTION
  - A. Structure and contents
    1. Housekeeping
    2. Storage
    3. Heating and cooling devices
    4. Storage of flammable solids, liquids and gases
    5. Process hazards
      - a) Welding and cutting
      - b) Finishing processes
      - c) Spontaneous heating
    6. Interior finishing
    7. Limitations of fire spread
    8. Fire doors and windows
    9. Roofs
  - B. Fire detection and extinguishing systems and devices
    1. Watchman and automatic fire detection systems
    2. Portable fire extinguishers
    3. Water supplies tanks and pumps
    4. Sprinklers and special fire extinguishing devices
    5. Emergency organizations
- III. OPERATIONAL WORK INJURY HAZARDS
  - A. Electrical hazards
    1. Principles
      - a) Electrical current
      - b) Electrical shock
    2. Guarding live electrical elements
    3. Electrical wiring, switches and fuses
    4. Grounding
    5. Work areas
    6. Storage batteries
  - B. Hand tools
    1. Storage
    2. Maintenance
    3. Use
  - C. Materials handling
    1. Manual lifting
    2. Transportation of materials
    3. Power trucks
    4. Conveyors
    5. Material storage
    6. Housekeeping
    7. Purchasing
- IV. THE INVESTIGATION OF LOSSES
  - A. Purposes of investigations
    1. To learn cause or causes of losses
    2. To learn changes which produced the error
    3. To determine facts which have a bearing on the legal liabilities
  - B. Personnel making the accident investigation
    1. Individual involved in the loss
    2. Immediate supervisor
    3. Loss control specialist
    4. Team of specialists
    5. Personnel from insurance carrier

6. Independent testing or evaluation organization
7. Personnel from a governmental agency
- C. Investigative techniques
  1. Conversations
  2. Sensory perceptions
  3. Photographs, drawings, blueprints
  4. Physical evidence
  5. Measurements by appropriate equipment and devices
- D. Conclusions and reports
  1. Reconstructions
  2. Analysis of available facts
  3. Conclusions
  4. Types of reports that can be prepared
    - a) Completion of a form
    - b) Preparation of short narrative report
    - c) Preparation of a complete transcript of data and available information

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## OSH 20 – SAFETY PROGRAM MANAGEMENT

### Session Outline – Week 11 – ELEMENTS OF A SAFETY PROGRAM – COMMUNICATIONS - TRAINING

**OBJECTIVES:** Describe the general principles of safety communications. Draft a safety training program.

#### OUTLINE:

- I. EFFECTIVE COMMUNICATIONS
  - A. Basic principles
    - 1. Findings of psychologists
    - 2. Findings of sociologists
    - 3. Competition for attention
    - 4. Involvement and relevance of the function
  - B. Objectives of communication
    - 1. Help develop proper attitudes and habits
    - 2. Help focus attention on causes of losses
    - 3. Help supplement training activities
    - 4. Allow employees to participate in loss control activities
    - 5. Provide a channel of communication between employees and management
    - 6. Help improve employee, customer and public relations
  - C. Basic considerations
    - 1. Company policy and experience
    - 2. Budget and facilities
    - 3. Types of operations
    - 4. Types of employees
    - 5. Other considerations
  - D. Meetings
    - 1. Management meetings
    - 2. Mass meetings
    - 3. Departmental meetings
  - E. Contests
    - 1. Purposes and principles
    - 2. Governmental agency contests
    - 3. National Safety Council contests
    - 4. Trade association contests
    - 5. Interdepartmental contests
    - 6. Intergroup contests
    - 7. Intralocation or intradepartmental contests
    - 8. Personalized contests
    - 9. Housekeeping contests
    - 10. Community and family contests
    - 11. Contest publicity
    - 12. Awards
  - F. Displays and posters
    - 1. Purposes
    - 2. Effectiveness
    - 3. Types of displays and posters
    - 4. Location of displays and posters
    - 5. Bulletin boards
    - 6. Exhibits
  - G. Other promotional methods
    - 1. Campaigns
    - 2. Demonstrations
    - 3. Stunts
- II. EMPLOYEE TRAINING
  - A. Types of training
    - 1. Lectures
      - a) Good for large groups
      - b) Doesn't allow for best feedback
    - 2. Vestibule instruction
    - 3. On-the-job training
    - 4. a) Introductory training  
b) Job instructions
    - 4. Discussion groups
      - a) Discussion leaders
      - b) Preparations by the leader
      - c) Techniques used by the leaders
    - 5. Retraining
      - a) When done
      - b) Techniques uses
  - B. Instructional aids or sensory aids
    - 1. Charts or diagrams
    - 2. Flannel board
    - 3. Photographs, slides, opaque projectors
    - 4. Motion pictures
    - 5. Models
    - 6. Teaching machines
    - 7. Programmed learning
    - 8. The job itself
  - C. Instructional techniques
    - 1. Positive instruction
    - 2. Relative effectiveness of various techniques
  - D. Specialized training for safety
    - 1. General
    - 2. Rule books and manuals
    - 3. Safety reminders
    - 4. Visual aids available

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## OSH 20 — SAFETY PROGRAM MANAGEMENT

### Session Outline — Week 12 — ELEMENTS OF A SAFETY PROGRAM — MOTIVATION, REPORTS & STATISTICS

**OBJECTIVES:** Develop a plan for motivating employees for safe work practices. Describe the requirements for a reporting record-keeping system.

#### OUTLINE:

- I. BASIC PRINCIPLES
  - A. Classical theory
    - 1. Outgrowth of work of Frederick Taylor
    - 2. People are rational and are functionally motivated
  - B. Need theory - A. H. Maslow - 1954
    - 1. A hierarchy of needs
    - 2. Psychological needs
    - 3. Safety needs
    - 4. Social needs
    - 5. Ego needs
    - 6. Self-fulfillment needs
  - C. Human relations theory
    - 1. Utilization of a variety of motivators
    - 2. Contrasts with classical theory
  - D. Preference expectation theory
    - 1. Advanced by V. H. Vroom - 1964
    - 2. People assign values to expected outcome of various actions
    - 3. Behavior is based on both objectives and expectations
  - E. Two factor theory - F. Herzberg - 1959
    - 1. Satisfiers such as achievement, recognition, work itself and responsibility contribute little to job dissatisfaction
    - 2. Dissatisfiers such as organization policy, supervision, working conditions and salaries contribute little to job satisfaction
    - 3. Motivation to work results from satisfying needs for satisfiers
- II. PRINCIPLES APPLIED TO LOSS CONTROL ACTIVITIES
  - A. Concepts of carelessness
    - 1. Uses and abuses of the term
      - 2. Limited value of the concept
  - B. Concentration
    - 1. Too many interests
    - 2. Lack of interests
    - 3. Worry and fear
  - C. Memory
    - 1. Impression
    - 2. Retention
    - 3. Recall
  - D. Habit
    - 1. Determining the desired habits to be acquired
    - 2. Practice the desired behavior
    - 3. Allow no exceptions to the desired behavior
  - E. Concepts of accident proneness
    - 1. Background information about the term
    - 2. Accident repeaters
- III. PHYSIOLOGICAL ASPECTS OF HUMAN RESPONSE
  - A. Aspects related to the response of an individual
    - 1. Vision
    - 2. Reaction time
    - 3. Relationship between perception and response time
    - 4. Relationship between intelligence and accident experience
    - 5. Hearing
    - 6. Age
    - 7. Experience
    - 8. Emotional factors
    - 9. Fatigue
  - B. Aspects relating to the work environment
    - 1. Illumination
    - 2. Noise
    - 3. Atmospheric conditions
      - a) Heat
      - b) Cold
      - c) Effects of certain fumes, dusts, and mists

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## OSH 20 – SAFETY PROGRAM MANAGEMENT

### Session Outline – Week 13 – ELEMENTS OF A SAFETY PROGRAM – REPORTS AND STATISTICS

**OBJECTIVES:** Describe the accident reports required by regulatory agencies. Develop an internal report system including types of reports required and their distribution.

#### OUTLINE:

- I. INTERNAL REPORTING METHODS
  - A. Types of reports
    - 1. To top management
    - 2. To operating management and staff
    - 3. To first line supervision
    - 4. To employees
    - 5. To the public and stockholders
    - 6. To governmental bodies
  - B. Information in reports
    - 1. Primary information
      - a) Numbers of losses by risk
      - b) Insured and uninsured costs by risk
      - c) Causes of losses by risk
    - 2. Rates and trends
      - a) Work injuries
        - 1) Frequency and severity rates
        - 2) Major injury frequency rates
      - b) Property losses
        - 1) Motor vehicle accident rates
        - 2) Fire rates
  - C. Governmental reports
    - 1. Federal reporting requirements
      - a) Log of occupational injuries and illnesses OSHA 100
      - b) Supplementary record of occupational injuries and illnesses OSHA 101
      - c) Summary of occupational injuries and illnesses OSHA 102
    - 2. State and municipal reporting requirements

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Session Outline — Week 14 — **RISK MANAGEMENT — NATURE OF RISK,  
RISK ASSUMPTION**

**OBJECTIVES:** Describe the principles of risk management and the general techniques of loss control.

**OUTLINE:**

- I. THE NATURE OF BUSINESS RISKS
  - A. Dynamic or speculative sources of risk
    1. Management risk
    2. Market risk
    3. Financial risk
    4. Production risk
    5. Political risk
    6. Innovative risk
  - B. Static or pure sources of risk
    1. Physical damage to assets
    2. Loss of possession by fraud or criminal violence
    3. Loss of ownership through an adverse judgement at law
    4. Loss of income resulting from damage to property of others
    5. Loss of net income resulting from the death or disability of key employees
  - C. Dynamic and static risk and probability
    1. Risk vs. uncertainty
    2. The dynamics of static risks
    3. Static risks and "pooling"
- II. PRINCIPLES OF MANAGING RISKS IN BUSINESS
  - A. Rules of risk management
    1. Determining the impact of potential losses on the organization
    2. Determining the cost of providing protection
    3. Determining probabilities
  - B. Applications of the rules
    1. Nature of risk situations
    2. Interaction among the rules
    3. Problems of applying the rules
- III. RISK ASSUMPTIONS
  - A. Planning
  - B. Assuming losses on a current basis
    1. Loss characteristics
    2. Size of possible loss
    3. Other losses
  4. Cost considerations
    - a) Operational costs
    - b) Loss costs
    - c) Tax costs
    - d) Accounting for losses
- IV. LOSS PREVENTION AND CONTROL
  - A. Costs and losses
    1. Nature and significance of loss costs
    2. Indirect costs to individual business
      - a) Work injuries
      - b) Property losses
      - c) Social costs
  - B. Loss control specialists
    1. Obtaining specialists
  - C. Insurer's loss prevention services
    1. Factors affecting availability of service
      - a) Type of insurance purchased
      - b) Amount of premium involved
      - c) Insurance company agency and broker involved
      - d) Types of prevention services available
  - D. Management's role in loss prevention
    1. Leadership support and responsibilities
    2. Significance of the problem
    3. Controlling frequency and severity
    4. Proper utilization of available resources
  - E. Risk Manager's role
    1. Cost control
    2. Communication with operating management
  - F. Controlling loss severity
    1. Controls exercised before the loss
    2. Controls after the loss - salvage

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Session Outline — Week 15 — **RISK MANAGEMENT — RISK TRANSFER,  
RISK REDUCTION**

**OBJECTIVES:** Describe frequently used means of transferring risk. Define risk reduction techniques.

**OUTLINE:**

- I. **PRINCIPLES OF RISK REDUCTION AND TRANSFER**
  - A. Purposes of risk reduction
    - 1. Identifying cost of risks
    - 2. Cost of risks as part of cost of loss
    - 3. Total cost of risks
  - B. Methods of risk reduction and transfer
    - 1. Risk avoidance and assumption
    - 2. Risk transfer
    - 3. Risk reduction and insurance
- II. **RISK TRANSFERS IN BUSINESS**
  - A. Risk transfer by contract
    - 1. Construction contracts
    - 2. Leases
    - 3. Agreements with bailees and carriers
    - 4. Contracts of sale, supply and service
    - 5. Contracts of suretyship
    - 6. Other transfers by contract
    - 7. Hedging
    - 8. The credit risk
  - B. Forms of business organization
    - 1. Sole proprietorships
    - 2. Limited and special partnerships
    - 3. Joint ventures
    - 4. Trusts and cooperatives
    - 5. Non-profit organizations
    - 6. Corporations
      - a) Risk shifting characteristics
      - b) Legal effects upon liabilities
- III. **RISK REDUCTION**
  - A. Accuracy of loss forecasting
    - 1. Frequency of accuracy in forecasting
      - a) Definition
      - b) Limitations
    - 2. Size of error in forecasting
      - a) Variance of error
      - b) Examples
    - 3. Accuracy over a range
  - B. Achieving risk reduction
    - 1. Knowing the best forecast
      - a) Selecting the best forecast
      - b) Examples
    - 2. Risk controls through loss control
      - a) Effects of managerial controls
      - b) Reducing all losses
      - c) Cutting large losses only
      - d) Relationship to the reduction of risks
  - C. Methods of risk reduction
    - 1. Segregation and diversification
      - a) Segregation of physical assets
      - b) Segregation of ownership arrangements
      - c) Diversification
      - d) Effects upon risk
    - 2. Pooling of risks
      - a) General average - shipping
      - b) Other loss sharing devices
    - 3. Law of large numbers
      - a) Principles
      - b) Effects upon business risk
      - c) A static loss illustration
      - d) What is a large number?
      - e) Applicability of the law of large numbers
        - 1) Requirement of predictability
        - 2) Individually random losses
      - f) Predictability of the sample
  - D. Summary
    - 1. Criteria for accuracy in forecasts
    - 2. Means of reducing losses
    - 3. Means of reducing risks

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Session Outline – Week 16 – RISK MANAGEMENT – RISK STATISTICS

**OBJECTIVES:** Define the common statistical terms used in risk measurement. Calculate the mean and standard deviation of a distribution of accident data. Describe the principle concerns of product liability.

**OUTLINE:**

- I. STATISTICS USED IN RISK MANAGEMENT
  - A. Expected frequency of random events
    - 1. Probability distributions
      - a) Possible distributions
      - b) Definition of terms
    - 2. Random events
  - B. Characteristics of probability distribution
    - 1. Frequencies
      - a) Factorial values
      - b) Formulas
    - 2. Measures of central tendency
      - a) Mean
      - b) Median
      - c) Mode
    - 3. Measures of dispersion
      - a) Range
      - b) Limits
      - c) Percentiles
      - d) Quartiles
      - e) Variance
      - f) Standard deviation
      - g) Average error of forecast
  - C. Important probability distributions
    - 1. Binomial distribution
    - 2. Poisson distribution
    - 3. Gamma distribution
    - 4. Normal distribution
      - a) Useful characteristics
      - b) Limitations on usefulness
    - 5. Logarithmic normal distribution
      - a) The logarithmic base
      - b) Characteristic values in natural logarithms
  - D. Definitions
- II. PRODUCT SAFETY
  - A. Background information
    - 1. Medieval codes
    - 2. Early legal decisions in the United States
    - 3. Recent legal decisions in the United States
  - B. Legal constraints
    - 1. Common
    - 2. Food and Drug laws
    - 3. Hazardous material labeling laws
    - 4. Occupational Safety & Health Act
    - 5. State laws
    - 6. County and municipal codes and ordinances
  - C. Product liability insurance
    - 1. Scope and applications of coverage
    - 2. Limitations of coverage
  - D. Control activities
    - 1. Designing safety into products
    - 2. Building safety into products
    - 3. Warning of unsafe features by proper labeling
    - 4. Complete instructions to users of products
    - 5. Appropriate inspection and testing of products
    - 6. Proper packaging and shipping of products
    - 7. Complete investigations of all incidents involving the product resulting in injury or in property damage
    - 8. Careful determination of proper action in regard to all incidents in which a complaint or claim involving a product occurred
    - 9. Communication of appropriate information regarding product defects to proper personnel in the organization
    - 10. Proper utilization of information which will enable products to be safer
    - 11. Maintenance of complete records

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## OSH 20 — SAFETY PROGRAM MANAGEMENT

### Session Outline — Week 17 — RESOURCES FOR THE SAFETY & HEALTH TECHNICIAN — ETHICS

**OBJECTIVES:** Describe the principal resources for occupational safety and health information. Specify the major concerns of each agency.

#### OUTLINE:

- I. SUMMARY OF PRINCIPAL CONCEPTS
  - A. The size and nature of the loss problem
  - B. The organization and purposes of various types of contemporary organizations
  - C. The responsibilities and duties of various individuals in an organization in the area of loss control
  - D. Principal duties and responsibilities of the loss control staff
  - E. Determining insured and non-insured costs of work injuries and property losses
  - F. Establishing priorities, planning and budgeting in order to properly control losses
  - G. Implementing the plan through management, other staff and employees
  - H. Determining potentially unsafe physical conditions in planned and existing facilities
  - I. Loss control aspects of employee selection, placement, counseling, training and continued motivation
  - J. Determining, assuming, reducing and transferring dynamic risks in an organization
- II. SOURCES OF INFORMATION
  - A. Service organizations
    1. National Safety Council, Chicago, Ill.
    2. Community Safety Councils, local
    3. American National Red Cross, Washington, D.C.
    4. Industrial Hygiene Foundation of America, Inc., Pittsburgh, Pa.
    5. National Society for the Prevention of Blindness, Inc., New York, N.Y.
  - B. Standards and specifications groups
    1. American Society for Testing & Materials, Philadelphia, Pa.
    2. American National Standards Institute, New York, N.Y.
  - C. Fire protection organizations
    1. Factory Insurance Association, Hartford, Conn.
    2. Factory Mutual Engineering Corp., Norwood, Mass.
    3. National Fire Protection Assn., Boston, Mass.
    4. Underwriters Laboratories, Inc., Northbrook, Ill.
  - D. Occupational health organizations
    1. American Association of Ind. Nurses, New York, N.Y.
    2. American College of Surgeons, Chicago, Ill.
    3. American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio
    4. American Industrial Hygiene Assn, Southfield, Mich.
    5. American Medical Assn., Chicago, Ill.
    6. American Nurses' Assn., Inc., New York, N.Y.
    7. American Psychiatric Assn., New York, N.Y.
    8. American Public Health Assn, New York, N.Y.
    9. Health Physics Society, Boston, Mass.
    10. Industrial Medical Assn., Chicago, Ill.
  - E. Insurance Associations
    1. American Association of State Compensation Insurance Funds, San Francisco, Ca.
    2. American Mutual Insurance Alliance, Chicago, Ill.
    3. American Insurance Assn., New York, N.Y.
  - F. Occupational safety organizations
    1. American Society of Safety Engineers, Park Ridge, Ill.
    2. American Chemical Society, Washington, D.C.

3. American Institute of Mining, Metallurgical and Petroleum Engineers, New York, N.Y.
  4. American Society for Industrial Security, Washington, D.C.
  5. American Society of Mechanical Engineers, New York, N.Y.
  6. Flight Safety Foundation, Inc., New York, N.Y.
  7. National Association of Suggestion Systems, Chicago, Ill.
- G. Principle Federal governmental agencies
1. Dept. of Health, Education & Welfare, Natl. Institute for Occupational Safety & Health, Washington, D.C.
  2. Dept. of Interior, Bureau of Mines, Washington, D.C.
3. Dept. of Labor, Occupational Safety and Health Administration, Washington, D.C.
  4. Dept. of Transportation, Washington, D.C.
- H. Departments and Bureaus in States
1. State of California, Dept. of Industrial Relations, Div. of Industrial Safety, San Francisco, Ca.
  2. State of California, State Compensation Insurance Fund, San Francisco, Ca.
  3. Dept. of Public Health, Berkeley, Ca.
- I. International safety organizations
- J. Educational Institutions
- K. Professional Registration
1. Board of Certified Safety Professional, Park Ridge, Ill.
  2. Certified Industrial Hygiene Board

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