

offer the

ck No.

.28-1

.28-2

.28-3

.28-4

.28-5

.28-6

.28-7

.28-8

.28-9

.28-10

.28-11

.28-12

.28-13

.28-14

.28-15

.28-16

.28-17

.28-18

.28-19

.28-20

.28-21

.28-22

.28-23

.28

.28-25

.28-26

.28-27

.28-28

.28-29

.28-30

.28-31

.18

volumes,
volumes

members.

11, ILL.

022.28-15

VOLUME 16

1958

**NATIONAL
SAFETY
CONGRESS
TRANSACTIONS**

INDUSTRIAL SAFETY



NATIONAL SAFETY COUNCIL
425 N. MICHIGAN AVE. • CHICAGO 11, ILL.

**PLAINTIFF'S
EXHIBIT**

WV-026572

**PLAINTIFF'S
EXHIBIT**

03050.15

CONTENTS

Some Essentials in Safety Programming.....	<i>Pierre E. Dery</i>	5
Methods and Procedures in a Multi-Plant Safety Program.....	<i>James W. Tysse</i>	9
Selling a Safety Program to Top Management.....	<i>Joseph A. Menendez</i>	11
Selling a Safety Program to Supervision.....	<i>M. C. M. Pollard</i>	16
Selling a Safety Program to Employees.....	<i>M. G. Bullock</i>	17
Accident Analysis	<i>W. Eugene Stuffing</i>	22
Inspection Techniques	<i>Robert Beeson</i>	28
Employee Training Procedures.....	<i>Dan F. Brady</i>	31
Safe Design of Industrial Furnaces.....	<i>J. B. Smith</i>	31
Safe Operation of Industrial Furnaces.....	<i>L. B. Wocholski</i>	38
Planning Safety Into Automation.....	<i>Thomas E. Seavey</i>	41
Off-the-Job Safety—Why? How? Benefits? (Panel Discussion).....		45
The Growing Importance of Recreational Boating Safety	<i>Robert H. Ferguson</i>	49
Recreational Boating Safety Under U.S. Coast Guard.....	<i>Vice Adm. Alfred C. Richmond</i>	50
Legislation for Safety in Small Boats.....	<i>Mrs. George Welles, Jr.</i>	52
Practical Application of Small Craft Regulations Through Local Safety Council.....	<i>Paul J. Hoover</i>	57
Problems of Administering Multi-Plant Safety Programs (Panel).....		59
Reports and Reporting Procedures.....	<i>D. T. Mould</i>	60
The Safety Engineer's Major Problems.....	<i>Myron L. Miller</i>	60
Safety Education by Integration or Specialization.....	<i>G. I. Cambre</i>	67

CONTENTS—Continued

Removing a Blind Spot in Engineering Education.....	Thomas H. Rockwell	69
Oxygen—Resuscitation, When, Why and How.....	Ralph E. DeForest, M.D.	72
Typical Emergencies Confronting the Nurse Working Alone.....	Happy B. Bruder, R.N.	79
Emergency in the Plant—Nursing Aspects.....	Anna J. Thrasher, R.N.	80
Is Training for Safety Different from Other Training.....	Ralph M. Hartmann	83
Is Safety Training Different for Management?.....	M. C. M. Pollard	86
On-the-Job Training with Safety— Is It Different?.....	Earle S. Hannaford, Ph.D.	88
Laboratory and Pilot Plant Safety		
Toxic Chemicals.....	Ralph V. Montello	98
High Pressure Equipment.....	Darrell D. Frederick	102
Laboratory Ventilation.....	James C. Barrett	106
An Engineering Approach to Material Handling Safety.....	Walter J. Byrne	113
Boy Scout Safety Good Turn—1958; A Report to the Nation.....		116
Decisions for the Future		
Introductory Remarks.....	Dr. William P. Yant	118
The President's Conferences.....	John J. Gilhooley	119
Avenues for Progress		
The Industrial Conference.....	Gerard O. Griffin	122
The Industrial Sections.....	W. O. Wilson	123
Trade Associations.....	Gustave L. Nordstrom	125
Insurance Organizations.....	Donald G. Vaughan	127
Safety Engineering Profession.....	J. C. Stennett	130
Those Who Cause Large Loss Industrial Fires.....	Chester I. Babcock	133
Portable Fire Extinguishers—A Changing Picture.....	Dale K. Auck	138
Officers, AMERICAN SOCIETY OF SAFETY ENGINEERS, 1958-59.....		143

SOME ESSENTIALS IN SAFETY PROGRAMMING

By PIERRE E. DERY

Supervisor of Safety, Dominion Rubber Company, Ltd., Montreal, Quebec

A safety program is a form of insurance that helps protect a company's investment in its employees. It is essential for efficient operation.

My purpose is to give you what I believe to be the main essentials in safety programming. Some of these ideas are working successfully in the four large plants and eight smaller plants operated by Dominion Rubber Company Limited in Canada.

First, is your management in earnest about safety? There must not be any half-way measure—safety must come first. The prevention of accidents requires official leadership, since the success or failure of a safety program is dependent, in major part, upon the attitude of the top operating officials and their participation.

Accidents will happen. How often have you heard that remark? Safety must be considered as an essential phase of the daily operation of a plant. The elimination of unsafe practices demands a correct mental attitude on the part of every employee, and an indication of this attitude must come from the big boss.

Although a safety program must be tailor-made to suit a particular plant, it must contain certain essentials, and it is my pleasure to outline for you at this time the general safety program of my company and which all plants follow as closely as possible.

1. Executive Safety Committee:

a) In order to have full interest and participation, an executive advisory or staff committee is recommended. It is believed that such a committee will provide a sharing of responsibility, the plant manager thus getting the results he expects.

b) This committee should consist of as many staff members as possible, as it is the group responsible for the entire safety program.

c) Meetings should be held monthly, the factory manager being the chairman. It is important that attendance be mandatory. Each member should be expected to delegate a substitute if away on business or unable

to attend. Full attendance is extremely important, also regular meetings.

d) In order to obtain maximum results from these meetings, the agenda should be well prepared. Safety is a business. It should have a definite part in the business.

e) This committee shall act as a board of enquiry in all major accidents and fatalities, as well as serious fires.

2. Supervisory committee:

a) This committee should be made up of as many foremen as possible, the plant superintendent being the chairman. Regular monthly meetings should be held.

b) Additional to carrying out the policy program as established by the executive safety committee, this group should develop projects for clearance. It should also be asked to make specific recommendations.

c) Each member should be assigned a special activity, such as: 1, safety appliances; 2, unsafe practices; 3, good house-keeping; 4, publicity; 5, training program; 6, fire protection procedure; 7, new production; 8, suggestion plan; 9, job safety analysis, and 10, industrial hygiene.

3. Departmental safety committees or departmental meetings, whichever is the most suitable for the needs of the plant:

a) A departmental safety committee should be established for each department, or group of departments, on each shift. They should be composed of a foreman (or supervisor) as chairman, and a certain number of selected employees. The number of employees to be determined by the size and variety of operations. Membership in these committees shall be rotated among all employees of the departments to obtain maximum coverage. These committees should be training committees. They should be utilized to teach accident prevention principles and as they apply to the work of the employees and to enlist their aid through specific assignments to eliminate calls for a formal training program to enable this management group to approach their responsibilities with confidence and

competence. Some of the fundamentals are:

1. Attitude that safety is part and parcel of production and therefore the responsibility of line-supervision.

2. Put over safety by personal and group contact, by precept and example.

3. Frequent inspection of work, keeping a check on work methods, condition of equipment and tools.

4. Guarding of machinery.

5. Good housekeeping.

6. Knowledge of the hazards of all jobs so he can let his people know about them. Where necessary see to it that safeguards are provided, mechanical or personal protective equipment.

7. Keep talking safety at every opportunity.

8. Accept the responsibility for the safety programme in his department. In other words, be the safety director of his area.

9. Fire protection.

10. Employee Training:

a) This to be carried out by foremen and supervisors through:

a) Frequent on-the-job contacts.

b) Safety committees.

c) Departmental meetings.

11. Accident Investigation:

a) By a special committee in the case of all disabling injuries. This committee shall comprise the plant superintendent and a sufficient number of members within the supervisory committee. With the foreman of the department concerned, the safety supervisor, the committee shall investigate all disabling injuries and recommend stops that should be taken to prevent recurrence.

b) By the foreman or supervisor:

The foreman or supervisor shall be required to investigate personally and determine to the best of his ability the causes of all accidents involving employees, equipment or operations under his supervision. This includes those accidents which do not result in property damage or injury but which, if allowed to recur, could cause property damage or injury. He will record this information on the employee's pass to First Aid.

c) The safety department:

1. To obtain all the necessary particulars

to facilitate the work of the accident investigation committee, such as:

a) Interview injured person or persons; witnesses, etc.

b) Procure and analyze employment and medical records.

c) Plan corrective action with the accident investigation committee and other interested parties and follow-up for action.

d) Complete all necessary accident reports to record and publicise the details.

2. Maintain complete, accurate and up-to-date records of all accidents to be used in making statistical studies and cause analysis.

a) Prepare a quarterly report for the plant with a copy to head office safety department and listing the following:

1. Injuries by occupations.

2. Plant and departmental trends.

a) Hazardous conditions, practices and processes requiring attention.

3. Compile records for inter-department contests.

4. Prepare material for safety committee meetings, including speakers, films, safety-graphs, etc.

5. Compile and issue all required accident reports.

6. Compile and issue reports and summaries to keep supervision informed as to their accident experience.

7. Safe operation procedures:

a) The safety supervisor shall develop and issue through the industrial relations manager written standard practices and safe operating procedures for supervision covering various phases of the accident and fire prevention program.

8. Bulletin boards:

a) Bulletin boards shall be maintained by the safety department throughout the plant on which accident and fire prevention material will be displayed.

b) Material on bulletin boards will be changed at least once per week.

9. Safety rules:

a) The safety department shall cooperate with foremen in developing written safety rules for various operations.

b) All rules must be approved before they are placed into effect, and adequate

means set up for clearance with union representatives.

c) Approved rules will be prepared for distribution to employees and for posting in departments.

10. Inspections:

The plant shall establish an effective inspection program covering all items necessary to insure the discovery of unsafe work practices, and unsafe physical or mechanical conditions, and the control of hazardous operations.

a) By plant supervision:

1. Regular inspections by departmental foremen and supervisors of their operations, equipment and machines, to determine unsafe physical and mechanical conditions and unsafe operating methods.

2. Regular periodic inspections and reports on special safety equipment such as mill and calendar emergency stopping devices, curing equipment, "bite" guards, etc.

b) By safety department:

1. Regular and detailed inspection of machines, equipment, yards, buildings, working surfaces, processes, etc. to determine unsafe physical and mechanical conditions, and the use of personal safety protective equipment.

2. Regular inspections of hazardous operations to see that established safe procedures are being followed.

3. Regular inspections of all departments to determine the housekeeping conditions being maintained. A rating system should be used with posting of the results each month on a master bulletin board.

4. Regular inspections of emergency equipment and safety devices to determine their physical and mechanical condition.

a) Emergency stopping bars, cradles, cables and switches.

b) Finger bars at inrunning rolls.

c) Emergency tools and equipment.

c) By outside agencies—safety supervisor to follow up on reports and recommendations of:

1. Insurance companies—elevators, boilers and pressure vessels.

2. City and provincial authorities.

3. Head office safety department.

11. Inter-departmental co-ordination for safety:

The safety supervisor must establish and maintain the full cooperation and co-ordination necessary to insure the success of the safety program between the safety department and all other departments.

a) Medical Department:

1. Establish arrangements for the immediate notification in all cases of serious or unusual accidents.

2. Cooperate in establishing and maintaining adequate standards in pre-employment physical examination classifications to insure the avoidance of injuries arising from accidents which are the result of placing employees on jobs for which they are not adapted, physically or otherwise.

3. Arrange for the giving of periodic physical examinations, of workers exposed to harmful or toxic substances and fumes.

4. Arrange for periodic inspections of the plant in order to obtain detailed first-hand information concerning the nature and degree of exposures to occupational diseases.

5. Arrange surveys of new operations or processes to ascertain what health exposures may be present.

6. Establish a system for assigning injured employees to jobs they can readily handle in spite of their disabilities, in order to reduce the productive time lost as the result of disabling injuries.

b) Employment department:

1. Establish collaboration between the medical, employment, and safety departments relative to the placement of employees on jobs in the plant, so that those requiring special considerations because of physical or mental limitations, are properly assigned to work which they are capable of handling safely.

2. Arrange for cooperation and assistance in the rehabilitation of injured employees.

3. Establish cross-file controls which will prevent physically or mentally limited employees from transferring from their approved work to any other work without clearance from the safety and medical departments.

c) Engineering and maintenance departments:

1. Establish a system for expediting safety work requests and giving priority preference to requests for correction of critical hazards.

2. Establish a system for routing all work requests to the safety department for clearance where safety interests and conformity with codes and safety rules are important factors.

3. Establish cooperation between the engineering, maintenance, and safety departments to such an extent that the safety department is consulted before any work is begun on new installations or changes to existing buildings, processes, operations, or equipment.

4. Establish a system for the incorporation of safety requirements in the plans and specifications for the design of machines and equipment at the time of their conception.

5. Allocate from hours available daily for job order work specified time for safety orders.

d) Purchasing department:

1. Establish close co-ordination between the purchasing and safety departments in order that all purchases of equipment, tools, materials and personal protective equipment are in keeping with safety standards.

2. Establish a system whereby purchase requests for hazardous chemicals and materials are routed to the safety department for investigation and clearance before purchases are made.

12. Contests, awards and publicity: Each plant shall establish a program designed to stimulate interest in accident and fire prevention among supervision and employees through the use of contests, awards and publicity.

a) Contests:

1. Company-sponsored. Encourage active participation in company-sponsored safety contests, both accident and fire.

2. Plant-sponsored. Arrange and supervise contests of various types between departments and designed to supplement phases of the overall accident prevention campaign.

a) Lost time accidents; b) housekeeping; c) safety suggestions; d) safety slogans.

b) Awards:

1. Establish a program of recognition for contest winners through appropriate awards.

c) Publicity:

1. Utilize all recognized means of publicity to call attention to and promote interest in the contests and award winners.

13. Correction of hazardous conditions. Establish and supervise a program for the rapid correction of unsafe mechanical or physical conditions or hazardous operations.

a) Work requests for new installations:

1. Initiate or cause foremen to initiate.

2. Follow-up for approvals and completion of work.

3. Inspect completed work and approve if conforms to safety requirements.

b) Repair and maintenance work:

1. Same procedure as "a.—Work Requests."

14. Miscellaneous Duties:

a) Maintain files of up-to-date information pertaining to all phases of the accident and fire prevention program.

1. Federal, provincial and city labor laws.

2. Workmen's compensation act.

3. Provincial and city building and fire codes.

4. Central safety department regulations.

5. Fire protection, personal protection, and miscellaneous safety equipment.

Maintain liaison with and follow up all recommendation of outside agencies:

1. Head office safety department.

2. Accident prevention association, provincial department of labour.

3. City departments, health, safety and fire prevention.

4. Insurance companies—fire, pressure vessels, elevators, compensation, etc.

b) Fire Protection: The safety supervisor shall establish and supervise the following program designed to protect fully the plant buildings, processes, materials and equipment from damage by fire:

1. Isolation and control of hazardous operations.

a) Collaborate with the engineering department on the design and location of all

processes and installations utilizing flammable liquids or hazardous materials, to insure that the hazard of these operations is adequately controlled and that the installations are made in accordance with provincial, city and insurance company requirements.

b) Establish inspection controls over these operations to see that adequate safety standards are maintained.

2. Control over receiving, storing and using flammable liquids: Establish procedures for the safe handling of all flammable liquids during their receipt, storage and use throughout the plant.

a) Handling equipment, including pipe lines; b) area limits, personnel and quantities; c) posting of warning signs, and d) fire and accident preventive measures.

3. Installation of fire extinguishing equipment. Establish and supervise a system for the periodic inspection of all fire extinguishing equipment designed to insure the maintenance of this equipment in continual good operating condition.

nance of this equipment in continual good operating condition.

a) Immediate repair or replacement of any equipment found to be damaged or defective.

5. Plant fire brigades: Establish and supervise the training of fire brigades on each of the three shifts.

1. Maintain all necessary equipment for plant fire brigade in a central location.

2. Hold practice drills for each brigade at regular intervals.

The one feature of safety work to which I attach the greatest importance, is that the accident experience of each plant and of the company should be regarded by top management as something worthy of regular and serious attention. I am very proud to work for a company whose management follow the practice of reviewing monthly the accident report. We do think that safety is a business, that it has a definite part in the business and we wish it to be known that we consider it so.

METHODS AND PROCEDURES IN A MULTI-PLANT SAFETY PROGRAM

By JAMES W. TYSSÉ

Manager of Safety, Republic Steel Corporation, Cleveland, Ohio

Recognizing the importance of a sound safety program, we also are aware of the psychology of safety. This is the need for awakening in every man in the plant a realization he can make an important contribution to his own safety and that of his fellow workers.

Since the inception of Republic's safety program, frequency and severity rates usually better than the average for the industry have been achieved. Basic to this planning has been the constant knowledge that everyone in each plant must be given a sense of participation in the program with an awareness of his own personal responsibility in it.

The structure of this safety effort was established in the early days of the corporation. Refined and adapted to changing conditions since then, the program is essentially the same today.

A fundamental consideration was the establishment of policies and regulations, consistent with local, state and federal requirements, that could be followed by all plants.

We compiled these policies and regulations into a book called *Manual Governing Medical, Workmen's Compensation and Safety Procedure*. This book has grown and today encompasses 92 pages which give our safety and operating people explicit instructions in these fields. As the title implies, it is divided into three main sections covering the fields of medical care, workmen's compensation and safety.

A few principles laid down under the title "Operation C.A.P.," as our 1958 safety program, will provide background for discussion of this manual.

CAP stands for "Contribution to Accident Prevention." It was aimed directly at our

district managers and through them at the men in our plants.

CAP was, and is, premised on three principles:

1. A basic program.
2. An objective at which to shoot.
3. Good communications.

The CAP program spotlights safety performance for top plant management, invites their cooperation and that of operating department committees. Any local plans can be coordinated into the basic corporate program.

Our 1958 objective is to better the outstanding performance in frequency and severity in each steel district, manufacturing division and mining district experienced during the six years from 1952 through 1957, inclusive. Where the best performance was a perfect performance, the objective is to equal that performance.

We set forth instructions for teletyping or telegraphing immediately to the general office about any disabling injury. This information requires a brief description of the accident and the apparent cause and is relayed without delay and in the same manner to steel, manufacturing and mine superintendents of industrial relations and safety people. Corporation operating committees have established similar communications. In the event of serious or fatal accidents, these communications are to be preceded by telephone advice.

A performance hasn't been achieved that is considered satisfactory, but significant results have been experienced in a number of plants.

Dovetailed with Republic's safety program are specific steps, outlined in our manual. This booklet calls for the establishment of three basic safety committees throughout the corporation: a corporation general safety committee, plant general safety committees, and departmental safety committees. Corporation operating committees assign subcommittees on safety—the first subject on the agenda in their scheduled meetings.

The corporation general safety committee is composed of the director and assistant director of industrial relations, the manager of safety and the district or plant superintendents of industrial relations. This committee also includes the director of plant protection and the manager of workmen's compensation and social insurance.

The committee serves in an advisory capacity on corporation matters pertaining to accident prevention, workmen's compensation, good housekeeping, fire prevention, etc.

Plant general safety committees consist of the district or plant manager and his assistant, the superintendent of industrial relations and his assistant, the supervisor of safety, the fire marshal and departmental heads. This committee meets monthly to discuss phases of accident, fire prevention and good-housekeeping activities; formulate plant safety policies; and recommend safety rules and accident preventive measures.

The departmental safety committee includes the superintendent and his assistant and the foremen of that department. These committees are required to meet at least once monthly to discuss all phases of safety in the department. The meetings are attended by a representative of the safety department in an advisory capacity.

In addition to these meetings, each foreman or assistant foreman is required to conduct at least one safety meeting, or discuss safety personally, with each employee under his supervision at a minimum of once each month.

The manual also provides for the establishment of an accident-investigating committee in all plants and outlines the procedures it shall follow. Subcommittees of corporation operating committees immediately investigate serious or fatal accidents and formulate preventive measures which become committee safety policy.

The manual encourages the cooperation of local engineering departments with local safety departments on matters pertaining to safety in contemplated new or changed installations. The booklet emphasizes the importance of making routine health surveys and provides for a rehabilitation committee to place employees disabled in previous accidents on jobs they can perform.

Occasionally changes or additions to the safety program are made, and these are incorporated in the manual by reference. One such program was the monthly leaflet and poster program. Started in 1948, it has proved so effective that it has been continued.

With this program, the safety department each month selects a subject for development by an advertising firm which prepares large, billboard-size posters and distributes them to

the plants and districts. Similarly, bulletin board posters and monthly safety leaflets are prepared and displayed or distributed to all employees.

After the establishment of general policy on safety, the manual devotes a large section to general and special reports required by the program. Examples include:

1. Monthly Report of Grinding Wheel Inspection.
2. Foreman's Accident Report.
3. Unsafe Practice Report.
4. Fire Extinguisher Report.
5. Weekly Accident Report.
6. Ladle Inspection Report.
7. Chain Inspection Report.
8. Crane Inspection Report.
9. Ore Bridge Inspection Report.
10. Turbines, Fly Wheels, Air Receiver Inspection Reports.
11. Crane Cable Inspection Report.

Many reports call for the appointment of district or plant inspection committees charged with the responsibility for making inspections on a periodic basis and submitting their findings and recommendations.

A section on references to the general safety orders and special rule books concludes the manual. These general safety or-

ders and special rule books are contained in a separate book.

In this book are provisions for current meeting material, foremen's instruction sheets, the general safety orders, the special rule books covering safety regulations for specific departments and operations, and district safety orders made up in various districts or plants to cover special local conditions.

Republic's safety program is administered by the industrial relations department, with direction and supervision at the general office and plant levels.

Each facility is inspected at least twice a year and sometimes more frequently by representatives from the corporation's general safety office. Inspectors check matters pertaining to the local administration of the basic program and advise on improvements.

Each district or plant manager is responsible for safety in his own operation. Usually, safety results achieved are in direct ratio to the manager's interest in the program.

We have found safety is more than just following the book. A good program includes diversifying educational techniques, maintaining and increasing the interest of the men in the mills in safety and in general advertising, and selling the importance of safety as a program for the mutual benefit of everyone.

SELLING A SAFETY PROGRAM TO TOP MANAGEMENT

By JOSEPH A. MENENDEZ

Safety Director, Falstaff Brewing Corp., St. Louis, Mo.

The title of my subject implies that top management is a prospective buyer and we the hopeful salesmen. We have a safety program to offer top management and are here to decide what approaches to use to assure this "sale".

Top management, as any prospective buyer, must have a need for a product in order to be receptive. We must reveal to them this need.

My first suggestion in selling a safety program to top management is to reveal

to them that accidents are inefficiencies and an effective safety program is an efficiency measure.

We must keep top management informed with facts. Intelligent use of statistics gives you tangible information and ammunition.

Statistics reveal that accidents are inefficiencies. It is top management's responsibility to its stockholders to maintain an efficient operation and they are interested in measures that produce efficiencies it's good business.

Frequency and severity rates are statistics that can aid you in conditioning top management for the sale. Top management welcomes statistics that are concise, which can be readily studied and understood. They are busy people with many reports to review and digest so reports must be palatable and easily digested.

These statistics should reveal trends. I suggest your monthly reports in order to indicate trends include year to date frequency and severity rates.

We use a frequency and severity rate form that is not uncommon. It keeps top management informed by individual production and maintenance departments and by totals for these departments.

Distinct separation is solely to pin-point responsibility so that top management can readily see exactly where a weakness may be and who is responsible.

The drivers, miscellaneous and semi-month figures are listed separately for the same purpose.

This entails more effort on our part but gives top management a report that provides information they can understand. It is not a report that just states "we are doing good or bad" but one that pin-points the strong and weak areas.

This monthly report also gives top management year to date rates. One month's rates alone are not conclusive, top management wants to know how we are faring to date.

We use another form that is a bulletin board notice, primarily, but is also sent to top management and it gives a simple year to date plant comparison of frequency and severity rates in the upper box-score as well as days since last disabling injury.

A footnote explains that the figures include only the experience of the plant production and maintenance departments and that they indicate frequency rate standings and not inter-plant safety contest standings.

A lower box-score reveals the current and previous year's lost-time injuries for plant departments by month and year to date, and the frequency and severity rates year to date.

It is a simple report with facts at a glance and which indicates a trend. Lengthy reports showing comparisons of five, ten or more years are too comprehensive and

should be used only for a specific purpose or periodically.

Another very effective selling point to top management is the direct injury expense report. This report is truly tangible. It points out efficiencies and deficiencies in a language in which top management is very fluent—cost figures.

Top management is comprised of people who are, in my experience, very sympathetic and kind. Many have in the past been closely associated with employees, many have visited injured and ill employees in the hospital and in the home. They are just as humane today as they were then, and they do not want to see their employees suffering and losing wages.

They have delegated this personal attention to department heads, supervisors, personnel managers and safety personnel. This responsibility has been delegated as many others, such as maintaining machines and equipment in which they are still interested but to which they can no longer personally attend.

I mention this for the mis-informed who picture top management as interested only in the dollar sign.

Direct injury costs figures cannot be juggled. The sharpest pencil cannot alter them. They are facts that are cut and dried.

One of our three direct injury expense reports is an annual report of injury costs by plant—per barrel—per employee for the four plant production and maintenance departments.

It also shows the previous year's comparative costs.

These cost figures include the medical hospitalization, and workmen's compensation paid on all closed or completed injury cases and the reserve figure on open or pending cases.

Another report reveals these same costs by departments, which pin-points for top management efficiencies and deficiencies. Again, this report gives a guide or trend to follow with the previous year's comparison.

A third report picks up the drivers, the semi-monthly and the miscellaneous group to complete the picture.

These figures are obtainable from the insurance carrier or if self-insured from the

insurance department or accounting department.

These should be presented so that top management can study them by department, by plant or in general by total costs.

Incidentally, I know of no company that includes these costs as production costs, which is actually what they are. If a bottler is injured in one of our plants it has cost Falstaff that much more to bottle the product on that particular shift.

These injury cost figures are revealed to the responsible persons, top management, and they are appreciated. They are important facts in selling top management a safety program.

The safety department sends our plant superintendents quarterly cost reports by department and individual injury cases to keep them posted currently. Several of our plant superintendents requested this report after we started our inter-plant safety contest which includes injury expense as an important category. Quarterly reports, they felt, kept them posted and they could direct their efforts accordingly.

The annual summary previously shown is prepared for distribution by top management but more about this later.

Statistics are facts that must be used to sell a safety program to top management. If they reveal efficiency the selling point is that the safety program is needed to maintain that efficiency. If deficiencies are revealed, the need of a stimulated safety program to eliminate them is indicated.

My second suggestion to aid in selling top management a safety program is for the safety director or engineer to be a ghost writer.

Top management does not have the time to prepare letters, directives, or memorandums to key personnel on safety. Neither does it have time to prepare them for the sales or advertising department or the many other departments.

You have been delegated the responsibility of selling safety for top management to all personnel and one of the best mediums is an occasional letter to key personnel from top management—from the big boss.

If letters are prepared intelligently and concisely, top management will appreciate the opportunity to do its part.

A word of warning: do not overdo it. Top management may tire of it, or it may lose its effectiveness if it becomes too commonplace.

A letter from the president to all drivers of company vehicles may be in order during a national or local traffic campaign and no one is better qualified to prepare a suggested letter on this theme for him than the safety director.

The frequency and severity rates may merit a compliment or a reprimand from the corporate production manager. The safety director who has made a careful study of existing conditions can include pertinent points for emphasis which will be most effective in a suggested letter or memo for the production manager to send to department heads and supervisors.

Our annual injury expense report is sent to key management personnel by our executive vice-president and general manager. He sends a letter of transmittal with these reports which include suggested remarks prepared by the safety director.

This letter in part reads "—this tells me that not only dollars and cents have been saved but also that less suffering has been experienced by our Falstaff family and less time has been spent in the doctor's office, in the hospital and away from work."

"It spells efficiency—better operation of your respective departments—Congratulations, etc."

This message coming from top management is much more effective than coming from the safety director. The safety director can prepare such a suggested letter to top management people for approval thus relieving them of valuable time in preparation—and you are selling your safety program to them simultaneously.

For those who are reluctant to offer top management suggested letters or remarks for fear they be disregarded, I have found that the bigger the man the more receptive and appreciative he seems to be.

My immediate superior, our personnel director, has encouraged me to prepare letters for him directed to his personnel managers and to the higher echelon on safety policies or subjects.

Carefully worded, concise letters or memoranda prepared for top management not only help to sell the safety program to

them but also puts teeth into your overall program. It keeps top management interested and all other levels on their toes.

My third suggestion is to make top management active participants in the safety program. Do not let them become figureheads.

This can be achieved without consuming too much of their valuable time and efforts.

Mr. Webster defines the word "figurehead" as "a nominal, but not real, head; one who allows his name to be used to give standing to enterprises in which he has no responsible interest or duties."

Top management must not be considered figureheads in the safety program. They have interests and duties and are very real.

General or steering safety committees in our operation are headed by the plant superintendent at each plant. He conducts the meetings and inspections. The department head has the same responsibility where such committees exist within the department.

These persons are top management in their respective areas. They have the responsibility of the health and safety of the personnel, equipment, and machines in these areas.

We cannot afford figureheads in our organization nor can you.

Many of you have seen at various management levels the individual who could not be sold on safety and who has completely and sincerely been converted into one of your best safety salesmen when this responsibility was placed solely on his shoulders. You sell them the safety program by making them active participants.

If you conduct contests, stay in the background. Be script writer and channel materials, etc., through top management. Make top management an active participant not only at award ceremonies but during the contest.

You got only sell the safety program to top management but to supervisors and employees as well by having top management's sincerity felt by all concerned.

We have devised a comprehensive interplant safety contest which has made our top management very active participants in our accident prevention program.

It is conducted by our corporate production manager. He announced the program

and sends out all pertinent information and correspondence. He has appointed a judging committee which he heads, comprised of the company's secretary and assistant treasurer, who heads our insurance department, the personnel director, the superintendent of engineering, the superintendent of construction, our workmen's compensation insurance broker and safety director.

It is the duty of these men, at two committee meetings per year, to report to the production manager on the status, as per contest schedule, of each plant. They do not make plant safety inspections in the body but as their work takes them to the various plants they are to observe and make note of physical conditions of the plants and attitudes not only for judging purposes but for recommendations to improve existing conditions.

This contest serves top management as a guide and control as the subjects included will readily reveal.

Frequency, severity, and costs are the main "point-getters" in the contest. The winner in each of these earn 100 points. All other categories can earn from 40 to 80 points.

An index accompanied the point schedule form when the program was introduced. It explained the point system and what was expected in each category.

This has made safety tangible as it is being measured not only by statistics but by effort exerted.

It has given top management a tool with which to work on the prevention of accidents.

Points were raised recently by the committee, after judging last year's contest, when they realized the importance of prompt and complete accident investigation reports and discussed housekeeping from an efficiency and sanitation stand-point as well as its accident prevention value.

The contest is flexible. For instance, one of our plants has one of the best fire brigades in the country, for its size. It is trained by the local fire department and its members are auxiliary firemen to the city fire department and Civil Defense organization. The local fire department sends a fire-truck, fully equipped with a driver and captain to train our plant fire brigade, several

times each year. Of course, they receive full point value.

Full points on this item may also be received in a plant located in a large city where they have an organized, trained crew which is discouraged by its city fire department from having fire-hoses in the plant. Set standards are difficult on this and many of the other contest items. Existing conditions dictate to the committee their decisions. Also points will be changed by the committee to improve weak areas.

The safety training category merits points from supervisory training courses which include a safety session and are conducted at plant level by the personnel manager who is responsible for the implementation of the safety program at each plant.

Also points are given for a three-hour safety course offered by our insurance carrier at each plant and such courses as offered by the National Safety Council or local safety councils.

Out-of plant meetings merit points for attendance by supervisors, personnel managers or department heads, at local safety council meetings, A.S.S.E. meetings, safety conferences or conventions, etc. This is to broaden their scope on accident prevention work.

Other activities encourage each plant to develop the safety program by initiating slogans, gimmicks, contests, etc.; to participate in community safety campaigns such as traffic and bicycle safety.

Publicity on any of their safety activities is taken into consideration as it indicates added effort and is conducive to improving attitudes of employees as well as the public.

This contest is an aid in selling top management our safety program as it has made it an active and interested participant.

The fourth suggestion I would make to sell a safety program to top management is for the safety engineer to blow his horn for safety, to make his wares known by the use of publicity.

It has been stated that "publicity is the voice of safety." We can use this voice to help sell our product.

Publicity, that is good publicity, helps achieve better public relations which top management is always striving to attain.

Safety, a non-controversial subject with much human appeal, can be and should be publicized. Public relations and publicity for safety is a subject in itself and I will take only a few minutes to touch on it. For those who may be interested, the 1955 edition of the NSC Accident Prevention Manual for Industrial Operations has a very interesting article on this subject.

If you have a public relations department you are neglecting your duty if you do not work closely with it. Remember that they are publishing newsworthy articles so don't burden them with routine activities.

Your public relations department can often use articles and photographs in the company or plant house organs. It can pass on to T.V., radio, newspapers and trade magazines what they consider newsworthy to such media.

If you have no public relations department, do some leg work, make contacts with above mentioned media, but use discretion and send only what may appeal to the reader or listener.

Publicity is news resulting from activity—top management knows this and recognizes the efforts exerted and results achieved. Blow the horn for safety. It helps to sell the safety program to top management.

My fifth and final suggestion to sell the safety program to top management is to sell yourself.

I do not think we need elaborate, but I will mention several suggestions that are, in my opinion, absolutely necessary to sell yourself in order to sell a safety program to top management.

A safety engineer must be sincere and deeply interested in his work. As a good salesman he must be sold on his product in order to sell it.

His enthusiasm must be such that it is catching, so it will permeate throughout the organization, including top management. This enthusiasm must reveal an intense, profound and eager interest with a liveliness of imagination and an ardent zeal for this product he believes to be worthy.

He must be able to accept a "no" answer and yet not to be a "yes" man. He must put up a fight for what he thinks is right, yet accept an occasional defeat gracefully.

He must respect and be respected.

In a nutshell by doing his job well, he

is selling top management himself and his safety program.

In summary, I have made the following suggestions for selling a safety program to top management:

1. Give top management facts, statistics presented intelligently, to reveal that accidents are inefficiencies and that your safety program is an efficiency measure.
2. Help top management help you by being a ghost writer. Prepare suggested let-

ters or memoranda which they may send to key personnel.

3. Make top management active participants in the safety program. Do not let them become figureheads.

4. Blow your safety horn by publicizing safety activities.

5. Be sincere and enthusiastic, and do your job well so that you may sell yourself and your safety program to top management.

SELLING A SAFETY PROGRAM TO SUPERVISION

By M. C. M. POLLARD

Director of Safety, National Gypsum Co., Buffalo, N. Y.

This is the most important aspect of any safety man's work. Unless he can successfully sell the program to supervision, no worthwhile results can be obtained in accident prevention in any plant. In most instances, the reason for failure to sell a program lies not with supervision but with the safety director.

Younger people in the profession especially fail to recognize that they are servants of supervision. Any approach based on the attitude that "What I say demands attention, because I am important" cannot help but face defeat.

The myriad responsibilities of any supervisor must be recognized. He is held accountable for everything that goes on in his department. A safety man who does not realize this is going to be the most frustrated person in the plant.

The only way to learn just what makes demands on the time of a supervisor is to visit his area of responsibility and learn just what it is he has to do. The safety of his people is only one of a thousand things that make up his daily routine.

Any successful safety program must be based on a thorough analysis of accident experience. This will highlight the locations and causes of accidents. With this information, a plan can be drafted to meet the major accident problem.

The entire plan must be developed through consultation with supervisors to keep it prac-

tical. If their ideas are incorporated in the program, they will not have to be sold on following the program because they had a part in its development.

Once the plan has been drafted and put into operation, it is essential that supervisors are required to make only a minimum number of reports, as the effort is followed through. The supervisor must have a very real role, at least prominent enough so he fully realizes the safety of his people is his primary responsibility.

It is not enough to tell the supervisor he is responsible, and then let him figure out what he is to do to meet that responsibility. He must be given information developed from plant experience, from industry-wide results and any literature that would keep his thinking alert and alive to the problem.

He must be thoroughly grounded in the fundamentals of accident prevention, so he understands how the application of these fundamentals will not only lead to accident-free operation, but to top efficiency in production as well. The language of the safety program must be the language of the supervisor and not that of the safety man.

A supervisor will not offer resistance to a program, if he knows what is being talked about and recognizes the final outcome as one that will be beneficial to him personally. Any supervisor wants to get good results.

He does not want to see any of his men injured. He wants to have the highest quali-

ty, most production, lowest cost of any operation in the plant. He wants his boss to pat him on the back and tell him he has done a good job. If he operates his department without accidents, he should get the credit not the safety man.

Without a strong top management policy for safety, almost any attempt made by a supervisor is thwarted. There is no question but that a matter of policy comes first in any company. When that policy is explained to the supervisor in a manner that he understands, it is to his best interest to carry it out.

He will not have to be sold on a safety program but will be continually asking assistance with this phase of his responsibility, and the safety man will be very busy satisfying those demands.

A safety supervisor may do a thorough job of selling a production supervisor the safety program and may have all of his work

undone because the supervisor's boss thinks that the safety man is the fellow who has the responsibility for safety in the plant.

When such a situation exists, then the safety man must make the attitude of that boss known to his superiors, and the corrective action can then be applied to the errant part of management.

Regardless of what a safety man thinks about a supervisor's attitude toward safety, he should never express his opinion to anyone except his immediate superior. A statement to the wrong person at the wrong time could pull the rug out from under any safety program, and it takes a long time to put such a house back in order.

The problem of selling safety to supervision becomes not one of forcing something down someone's throat but rather of shaping the approach in such an attractive fashion that the supervisor soon realizes he had better give accident prevention some attention for his own good.

SELLING A SAFETY PROGRAM TO EMPLOYEES

By M. G. BULLOCK

Supervising Engineer, Transit Casualty Co., St. Louis, Mo.

I believe it is obvious that one must first have a safety program before one can attempt to sell it.

To avoid any possible misunderstanding, I prefer to preface my program subject with some personal observations and opinions as to what constitutes a safety program.

I do not claim to be a Solomon, but 20 years in the field of safety engineering has produced some opinions as gained from the school of experience.

I believe that effective accident control is more than the indiscriminate and "scatter-gun" use of gadgets and gimmicks, bulletins and bull, posters and pins, meetings and movies, and dollars and don'ts. Every stage play has a plot; that's your safety goal. The window dressing to create interest and attention is your scenery; that's the gadgets and gimmicks department. I urge you not to make the mistake of having a safety meeting, or to put up posters, just because it seems like the proper thing to do.

I think one should first establish a definite and well organized program, based upon facts, with selected objectives, and then sell. In other words, establish a "compass bearing," or goal, to know where you are going, and why. You don't make a trip, for instance, without establishing a destination. Treat accident control the same way.

Another important point to always remember is to stress how safety benefits the employee. After all, keep in mind that the employee represents the consumer of your product, which we call "safety." If you can sell the employee on buying your commodity, you should automatically sell and resell your management.

The employee must be convinced that safety benefits him personally. Many employees believe that safety is good only for the company, primarily because most of the management promotion, all too often, deals directly with the prevention of accidents involving company property, or con-

trolling losses to the company. The employee, on the other hand, is usually only selfishly interested in himself.

A few years ago a Mr. Powers of the General Motors Corporation said, "Selling is like fishing. If you want to catch fish, you bait your hook with something the fish likes. You may like strawberries, but the fish may only be interested in worms."

Safety must be sold as a 24-hour product, and not as an 8-hour "tool kit"—good to use only on the job.

Off-the-job safety programs promoted by the company help convince the employee that safety is a product producing mutual benefit, and to be effective, it must be practiced 24 hours a day.

To summarize my comment regarding a safety program; be sure you have a safety program worthy of selling. I suggest you consider these factors:

1. *Analyze*—to determine the facts.
2. *Scrutinize*—to determine the primary problem.
3. *Mobilize*—to create corrective action.
4. *Be objective*—apply effort with a purpose and where you can expect the greatest returns.

To illustrate:

If you handle safety, management hired you to control accident costs; find out what they are, and design your activity to aim at the major cost problems. You can't cover the whole "waterfront," so don't try, but at least apply effort where it will do the most good.

5. *Be organized*—I have reference to necessary committees, inspections, follow-up procedures and communications within the company. No long range safety activity has lasting qualities without proper basic organization.
6. *Motivate and personalize*—think of ways to slant your program that will convince the employee that he will benefit by cooperating with accident prevention activities. Personalize the approach so that the employee will feel that the program was meant for him. Urge supervision to take a personal interest via direct con-

tacts, and to make safety a regular part of their supervisory job. As a tip to any safety man, I think you must concentrate on *selling yourself first*—before you can hope to sell an idea or safety program. Unfortunately, when a person is disliked or not respected, others will automatically close their minds to his ideas or proposals.

7. *Take periodic inventory*—re-evaluate your activities and your results at periodic intervals. Change tactics to meet the changing problems. If you are wrong, you had better beat the boss to this conclusion. As in football, a strong alert offense is the best defense.

Analyze the market before you sell. Experienced safety men know that safety is a difficult product to sell. It is ironic that it should be so hard to sell something that can save the buyer's life.

What then, are their mental blockades? I think the movie, "Knowing's Not Enough," as produced by the U. S. Steel Corp. summed it up very neatly.

For instance, they point out that most accident situations are created by four basic human traits, namely: *Improvising, Impatience, Impulsive, and Impunity.*

I will not take time to dwell on each, but I urge you to see this movie, or at least analyze your accidents in correlation to these basic causes. The obvious cause of a traffic accident may be "speeding," but he was either "impatient," or had a feeling of "impunity."

They may think, "So it can't happen to me." The graveyards are full of people that believe this. Recently an official of the State of Iowa stated that approximately 50 per cent of the traffic deaths in Iowa last year were by people who had their *first* and *last* accident.

The shop man fell from a ladder; you may say he was careless to put a block of wood under one leg. Actually he was "improvising." Other illustrations could easily be given.

I stress these points because you should slant your safety selling campaign to fit the basic causes. Be objective and be realistic.

Speaking of being realistic, let me comment on another point before you misunderstand me.

We know from experience that certain groups of human beings cannot comply with any form of regulation unless there exists some form of forceful control. That's why we have laws and police forces, and industry has supervision. Let's face it, some employees, therefore, can only be sold on safety when supervision is "breathing down their backs."

It is true that discipline and good supervision are necessary to maintain reasonable safe job performance. It's impractical to have a supervisor for each employee, and besides, who would supervise the supervisor? What percentage of the employees can we hope "to reach," therefore, by direct selling tactics?

As one illustration, studies that I have made of a number of city transit operations show that usually 10 per cent of the drivers go throughout a year without any kind of traffic and passenger accident. These are the "old reliables."

Approximately 13 per cent, however, will produce about 35 to 40 per cent of all the accidents. I call these drivers members of the "13 Per Cent Club." Generally, about 77 per cent of the operators fall into the category I refer to as "marginal performers." They waver from "not too good," to "not too bad!"

Those in the "13 Per Cent Club" will require close supervision and discipline. Supervision is needed to guide the "marginal performers," but in general, I believe they will respond to safety education providing they can recognize some personal benefit.

To sell safety to employees, therefore, I am a firm believer in first selling it to supervision, but that direct selling to employees is effective providing it is promoted as a 24-hour product, and not as an 8-hour "tool kit." I think a strong "off-the-job" approach with lots of reference to safety in the home, helps tremendously to establish the practice of safety on the job.

All of these conclusions, however, are based upon one important fact. Management has to be backing your safety selling campaign; or you will be like the man with an automobile, but without gasoline—you may have a nice vehicle, but you won't go

very far. Fortunately for us, H. L. Martin, vice president of Transit Casualty Co., believes in safety, and so does John Baine, president of the St. Louis Public Service Co., plus a number of other top management people involved with Transit Casualty Co. operations.

Let's Review a Few Ideas, To Sell Safety To Employees. I would like to preface these few ideas with the comment that I realize some might appear new, and some old, depending on your circumstances and experience. I offer them only to illustrate. Reference to most will be very brief.

For specific illustration, the following ideas have been used primarily at the St. Louis Public Service Company, the local transit system. I do this as a tie-in to results—because the National Safety Council's "Award of Honor" has been earned for the past three consecutive years, plus other safety honors.

For purpose of possible comparison, St. Louis Public Service Co. employs approximately 2,300 people and its buses and streetcars travel about 30 million miles annually. You will observe our use of the "home influence."

1. "The Key To Safety" is a special cartoon illustrated pamphlet that was sent direct to the home of the employees during a special campaign in December. Traffic and passenger accidents for a transit operation during December usually average 20 per cent higher than an average of the other 11 months, thus the reason for a special campaign. The title page, with appropriate illustration, reads, "The Key To Safety—It's In Your Hands." We Have a Problem—Your Choice—Either Help With The Solution, Or You Become Part of The Problem! Safety Is a Personal Responsibility—Get "Keyed Up" Over Safety!

On the inside page we have the broad caption "Fight Holiday Hazards—Wherever They May Be." Underneath are cartoon illustrations of hazards at home, on the job, off the job, in the streets, etc. Throughout the entire publication we stress the slogan "Safety is a Personal Thing." This pamphlet was accompanied by a letter of transmittal from the Vice President and Operating Manager of St. Louis Public Service Co. to again stress the phrase "Safety is a Personal Thing."

2. As another part of our December campaign for the holiday period, we prepared an 8½" x 13" bulletin entitled "*Safety Is A Personal Thing*." In the margin are these comments, "What's Your Safety IQ?," "Who Prevents Accidents?," "Safety Begins At Home," "Facts You Should Know." Opposite these statements in the margin are facts or answers. Each operating employee was interviewed by his foreman or superintendent and given one of these handouts. This personal contact helps to give importance to the drive, and to re-establish proper relations between the boss and the men. The data sheet gave them a proper subject to discuss. This year we plan to number each data sheet with a consecutive number, and later give out a few \$5 gift certificates to holders of the lucky numbered sheets. We hope this idea will get the sheets in the home, and delay the "wastebasket treatment."

3. An eye opener as to the influence of the family was brought out in what we call the "*Why-B-Safe Contest*." The members of the employees' families were eligible, such as the wives, daughters, or sons, to participate in a contest wherein they were to submit an article of 100 words or less as to what it meant to them to have the Public Service Company employee remain free from accidents, and to return home safely from the job without injury. (A few U.S. Savings Bonds were the rewards.) The articles were heartwarming and disclosed that the folks at home represent a powerful influence. It also helped us to evaluate a current safety campaign, because at the time, we were pushing "Zero Accident Days," and many referred to the term of "Zero." We also published the pictures of the winners in the company newspaper.

4. In the summer of 1957, the employee safety record was losing ground. A special, direct mailing was prepared, with cartoon illustrations, which stated:

"Safety And Your Job—They Go Together Like a Lock and Key; Like Bricks and Mortar; Like Ham and Eggs. Yes, safety on or off the job should be with you always! Although The National Safety Council has honored your company with various awards to recognize the reduction of injuries to employees, the current record is up and shows that we are losing our posi-

tion, and other transit properties will soon show us up. As a matter of pride, we believe you will want to do your part to improve your safety record by working safely. Of more importance, of course, is that you are giving yourself and your family the greatest benefit when you avoid accidental injury! Remember: "In life, as in baseball, it is the number of times you reach home safely that counts." Accidents can be avoided, if you think before you act!"

(Signed)—Employee Safety Council
St. Louis Public Service Co.

5. About 3 years ago, a special feature in the "Public Service" company newspaper was entitled, "*How Safe Is Your Home?*" A three column check list of things to look for was listed, and a scoring system developed. The underlying theme was "Safety Begins At Home."

6. An eye protection program was brought directly to the workers' attention through small meetings, movies, and handouts. This was on company time. The importance of vision to the ability to earn a living was particularly stressed. In fact, we said, "Without your eyes and fingers, could you earn a living? They are your working tools. Protect them!" In this manner, we stressed what safety meant to them.

7. A *First Aid* program with specific attention to the control of bleeding, and artificial respiration techniques—have been actually demonstrated to employee groups. Each employee was urged to take the lessons home and teach them to his family. We point out to each employee that if he passes this training on to his family, it may someday save his life.

8. Periodically, the use of *fire extinguishers* are reviewed at the division operational plants, with actual demonstrations. Fire prevention in the home was also stressed—to give it a personal meaning.

9. The *elimination of carbon tetrachloride* as a solvent was difficult, because workers recognized the efficiency, but did not recognize its dangers. No one knew of any specific trouble for the past 40 years, so it was therefore difficult to convince them of the hazard. This was finally done by direct salesmanship, wherein the safety engineer and the foreman were equipped with actual case records in industry. I know of one

properties will
tter of pride,
your
ty word by
importance,
giving your
greatest ben-
ental injury!
baseball, it
reach home
lents can be
re you act!"

ety Council
lic Service Co.
ecial feature in
my newspaper
Your Home?
things to look
system devel-
e was "Safety

ur. was brought
ention through
an. Jouts. This
importance of
a living was
act, we said,
ers, could you
working tools.
er, we stressed

with specific
bleeding, and
es. e been
ploy groups.
ake the lessons
s family. We
at if he passes
, it may some-

of fire extin-
division oper-
emonstrations.
me was also
meaning.

n tetrachloride
cause workers
did not recog-
w of any spe-
ears, so it was
e them of the
one by direct
afety engineer
ed with actual
know of one

hard headed individual that I finally told, "Yes, it is difficult to find a substitute for carbon tetrachloride. It really does the job. The only trouble with the stuff is that it will kill you." I then proceeded to show him case records. He was finally sold. Incidentally, I told him he had better caution his family too, because the lethal effects are usually delayed a few days following exposure, thus often difficult to trace back to the cause.

10. "Coffee and Donuts" days are used occasionally throughout a selected day, when a department has been successful in accumulating more than one million accident free man-hours, or as a result of a contest which we call "Improv-ur-Record." In the latter contest, when an operating division shows the greatest improvement in traffic and passenger accident experience over the corresponding month of the prior year, management gives them free coffee and donuts for a day. It's surprising how the men respond to these celebrations.

11. "Improving the Braking Distance IQ" is the title of a package training program that has been used at a large number of fleet operations throughout the country. We use a braking distance device manufactured by the Wagner Electric Company, called a "Wagner Fifth Wheel." It is a trailing bicycle wheel device, and is very effective to portray and demonstrate braking distances of trucks, autos and buses. The driver can subject his vehicle to a typical emergency stop condition, and the device will immediately record the initial speed and the total braking distance involved. This is a very effective safety tool in fleet work, because an experienced driver of either a bus or a truck is not going to accept braking distance figures as presented by a safety engineer, or anyone else, for that matter. He has to be shown. Our selling point is that the unit gives him facts, thus if he ever has to be on the witness stand, he will know what he is talking about. Actually, it makes him also respect following distances when he can see the actual braking distances involved. We also tie in the result with the safe driving of his personal automobile.

12. We have a "package" program to get drivers to secure witnesses if involved in traffic or passenger accidents. Our chief motivation is tied in to the slogan "If in

court, you need support. Get those witnesses." Naturally, witnesses are also very necessary to the claim department.

13. *Refresher courses* have been used extensively at the St. Louis Public Service Company, and also at a number of other properties that Transit Casualty Co. insures across the nation. These packaged programs are of various lengths, from one hour to two days, but they are primarily designed to educate. Each man receives a booklet, such as shown. Both on and off the job safety problems are included, with particular stress on traffic accidents. The broad subject of "Time" as related to speed and distance, is discussed and related to the cause of accidents. Audience participation, gimmicks, and a blackboard help to keep it interesting and effective. The one hour course has been particularly well received wherever it has been used.

14. *Safe-T-Coach*—a Mobile Safety Clinic. The Transit Casualty Company's special bus has traveled from coast to coast. It is equipped with tests for sight, hearing and reaction. Special electronic devices, and two-way mirror glass, help to make it attractive to visitors. The coach has traveled over 50,000 miles, and we have quit counting the number of visitors. A "Transitometer" was especially invented and built to portray reaction in terms of distance traveled, plus the elapsed time for any selected speed up to 80 mph.

The Safe-T-Coach has been very effective for selling safety direct to employees, and for general public relations promotion.

15. *Calibrated Cardboard Reaction Timer*—This little gimmick has been very effective to demonstrate eye to finger reaction. The bottom of the timer is held just above the opened thumb and first finger of the subject's hand, and when the instructor drops the card, the subject closes his thumb and finger to catch it. It usually falls about 8 to 10 inches before being caught (elapsed time of about 2 second), thus proving that everyone has a "built-in" accident handicap called "reaction," or delay of action.

This principle of delayed muscular response can easily be related to traffic accident causes, to accidents in the plant from falling objects, etc.

We particularly use it in connection with our Safe-T-Coach, the braking demonstra-

tions, and with the refresher courses. Following its creation and resultant publicity, my employer, the Transit Casualty Company, authorized me to give the idea to the National Safety Council. Copies can be secured from them.

In conclusion, I again review these points:

A. Before you attempt to sell a safety program, be sure you *have* a program, and obviously it is necessary to *know your problem*. Don't rely *alone* on gadgets and gimmicks; posters and pins; bulletins and bull.

B. Be factual and objective. Analyze, scrutinize, and then mobilize for action; apply effort with a purpose and where it will do the most good.

C. Sell yourself *first*. Remember: If

safety sold itself, we would not have 95,000 persons killed each year by accidents.

D. To sell the employee, be sure and stress how he benefits.

E. Be instructive, educational, and interesting. In other words, the employee is no fool, so don't treat him like one. Give him facts, but with interesting "window dressing" and in simple language.

F. Take frequent "compass bearings," or inventory of your activities. Prepare an annual report of safety activities, and submit recommendations for the new year.

G. Selling safety is not a "one shot" deal. It must be continuous and with a variety of approaches.

H. The safety story must be told again and again.

ACCIDENT ANALYSIS

By W. EUGENE STUFFING

Director of Safety, Carrier Corporation, Syracuse, New York

Gathering accident statistics and analyzing them, is, in the main, a lengthy, boring, cumbersome and expensive process. Time is money, so don't waste the time of yourself and your associates in the time-consuming process of analyzing accidents.

Don't do it—*unless* you wring the last bit of information out of your analysis and, secondly, but infinitely more important, utilize this information to its fullest in your endeavors to reduce your accidents and injuries.

Of course you must analyze your accidents. How else are you going to know how to best utilize the resources at your disposal in order to achieve your optimum effectiveness in reducing or preventing accidents. I am sure you have all heard the salesman's credo: "Plan your work and then work your plan." Let me advance the question, "How can you possibly plan your work, much less work your plan, unless you have at your disposal the information you need to develop a plan of accident prevention?"

I submit to you that accident analysis is basic. It's fundamental. No accident prevention program can really be successful or

effective without first analyzing your accidents and, secondly, using this information gained from the analysis to give you direction in developing your plan.

I am sure that if I were to ask any safety engineer if he had ever known a safety engineer who laboriously developed monthly and annual accident analysis reports and then didn't use them, I would get an affirmative reply. I know I have. And I can tell you very honestly that he wasn't doing the job of accident prevention that he should or could have been doing.

Because he did not plan his work, he could not work a plan. So all his efforts had a "shot-gun" effect instead of a rifle effect. He spread his efforts over such a wide area that he spent entirely too little time, energy and effort on those problems which would have paid off handsomely.

If I have been able to drive home the point to you that you *must* analyze your accidents and from this analysis develop a plan or plans to prevent future accidents, then my efforts will not have been in vain.

I fully realize that just because I say you must analyze your accidents is not enough.

have 95,000
id.
: sure and

and inter-
loyee is no
Give him
dow dress-

arings," or
Prepare an
, and sub-
year.

"one shot"
ad with a

told again

your acci-
information
you direc-

any
known a
developed
sis reports
ld get an
And I can
sn't doing
he should

he could
rts had a
fle effect.
a wide
tle time,
ms which

the point
accidents
plan or
then my

I say you
t enough.

So my next step should be to describe some of the benefits or results that can be arrived at through accident analysis. Here are some of the more important ones:

1. To reveal the nature and scope of accidents by departments, plants or by occupations.

2. The identification and location of the principal sources of accidents, by determining the materials, machines and tools most frequently involved in these accidents and the jobs or procedures most likely to produce the accidents.

3. Disclosing the unsafe practices that are causing the majority of accidents.

4. Determining the need for engineering or engineering revision by the identification of the principal unsafe conditions of various types of equipment and materials.

5. Disclosing improper operation processes and procedures, such as poor layout or inadequate methods being used, which are overtaxing workers.

6. The disclosure of the improper placement of personnel.

7. To assist supervisors or safety committees to use their time to the best advantage in their accident prevention activities by disclosing to them where the principal hazards or unsafe practices are in their departments.

8. To permit the objective evaluation of a safety program by noting, as the result of continuing analysis, the effect of different safety measures, educational techniques, campaigns, contests and other methods adopted to prevent injuries.

9. To disclose the proportion of property damage accidents, as opposed to injury accidents.

10. To determine the costs of accidents.

Now there are many other benefits or advantages to be gained from the analysis of accidents. Rather than take the time to list them for you here and now, may I suggest that you think about the problem and I am sure that other reasons or benefits will suggest themselves to you.

I should also like to point out to you that it is just not possible to analyze your accidents unless you first investigate your accidents and then prepare complete reports of your accident investigations. The information which should be contained in the accident in-

vestigation reports will come to you with experience and also as the result of analyzing your accidents. To dwell on the finer points of accident reports is not part of my assignment.

The designing of your own accident analysis forms is an area full of many pitfalls. Of course, the forms should be designed to give you information in the categories that you want, but keep the forms simple and concise. At this point many of the men who develop a form get in over their heads because they endeavor to place too much detail into their reports. Before you settle on a form, may I suggest that you design a simple form and then try it out. In all probability you will want to make some changes in it after you have given it a fair trial. I just can't overemphasize the importance of keeping your forms simple and uncluttered with unnecessary detail. Many a man with good intentions of analyzing his accidents has become discouraged or confused after trying to analyze a report that was so detailed that he couldn't find the significant factors that he knew must be in the report. So, make your reports simple and concise, and then if you wish more detailed information in a specific area, the designing of another form which contains more details and the using of only the part of the simple form that pertains to the problem at hand will help you arrive at the facts you need.

Naturally, you will not be able to use one form for all of your analyses. For example, a form used to determine the larger groupings of accidents by departments will be much different than a form used to determine the predominate types of unsafe acts on the part of injured employees. For this reason, you will need different forms for different purposes.

If you are inexperienced in the field of form design, let me suggest that you seek the help of other safety engineers of your acquaintance. Your local ASSE chapter should be an excellent source of help in this respect. So don't hesitate to ask for help if you need it. As many of you know who are acquainted with me, I never hesitate to ask the help of other safety engineers if I feel they have information I can use. I think it is a real compliment to my fellow workers in the accident prevention field that, in all my years as a safety engineer, I have

never been rebuffed or put off by anyone in the safety field I have turned to for help. You try it, if you feel the need for help or guidance. I am sure you will be pleasantly surprised at the help you get.

The American Standards Association, in conjunction with the National Safety Council; The Association of Casualty and Surety Companies; National Council of Compensation Insurance and the International Association of Industrial Accident Boards and Commissions has completed a tremendous amount of work in developing three codes which are used as guides and references by those engaged in accident prevention.

Z16.1 Code, "The American Standard Method of Recording and Measuring Work Injury Experience" has to do primarily with the classification and reporting of accidents. The original work on this standard dates back to an initial bulletin issued by the U. S. Bureau of Labor Statistics in 1920. Many revisions have been made to the original work, the latest being approved by the American Standards Association in December of 1954.

The original purpose of this standard, and I might add, the current purpose is to provide a practical and uniform method for recording and measuring work injury experience. Injury rates compiled in accordance with this standard may be used to evaluate:

- a. The relative need for accident prevention activities in different departments or plants.
- b. The seriousness of the accident problem in a department, plant or industry.
- c. The effectiveness of safety activities in establishments with comparable hazards.
- d. The progress made in accident prevention within a department, plant or industry.

The methods outlined in this standard for classifying work injuries are independent of workmen's compensation laws and rulings of workmen's compensation agencies.

Every safety engineer must have a thorough working knowledge of this standard for the reasons I previously mentioned. Although some analysis of the effectiveness of your accident prevention program can be realized by applying the formulas contained in this standard, two other ASA standards

are of much more importance to you in helping you analyze your accidents.

The first of these is the ASA standard Z16.2, Part I, entitled "American Recommended Practice for Compiling Industrial Accident Causes, Selection of Accident Factors". The purpose of this standard is to provide a statistical method of recording the accident facts which are so essential to know in order for you to do a better job of accident prevention.

Upon examining this standard you will find that a great deal of care was exercised in order to restrict the number of factors that you will have to work with. Only those factors most closely related to the accident and which are of most value to you as working tools for accident analysis have been listed. The rules for using these factors are quite simple and, if followed, will give you a large degree of uniformity in your statistical results. One of the outstanding features of the standard is its flexibility. It can be utilized equally well by a small plant which has only a few accidents a year, all the way to a state industrial commission, or the U. S. Department of Labor, which handles hundreds of thousands of disabling injury cases per year.

The key to this standard is the fact that only six factors are needed in order for you to analyze your accidents. These factors are commonly recognized by safety engineers as being those most closely related to the accident, and as being of the most value to you in your practical accident prevention work. Each essential point of information about an accident is referred to in the classification as an accident factor.

I am going to list these factors for you now and define each of them for you. They are as follows:

The Agency—The agency is the object or substance most closely associated with the injury, and which could have been properly guarded or corrected.

The Agency Part—The agency part is the particular part of the selected agency most closely associated with the injury, and which could have been properly guarded or corrected.

The Unsafe Mechanical or Physical Condition—That condition of the selected agency which could have been guarded or corrected.

you in help-

A standard can Recom-
Industrial
accident Fac-
ndard is to
ecording the
tial to know
job of acci-

d you will
is exercised
of factors
Only those
he accident
to you as
alysis have
ese factors
l, will give
ty in your
outstanding
flexibility.
by a small
nts a year,
trial com-
of Labor,
nds of dis-

fact that
er for you
se factors
fer
gigi-ly
ated
the most
ident pre-
nt of in-
rred to in
actor.

s for you
you. They

object or
with the
properly

art is the
ncy most
nd which
or cor-

ical Con-
d agency
orrected.

The Accident Type—The manner of contact of the injured person with an object or substance; or the exposure, or the movement of the injured person which resulted in the injury.

The Unsafe Act—That violation of a commonly accepted safe procedure which resulted in the selected accident type.

The Unsafe Personal Factor—The mental or bodily characteristic which permitted or occasioned the selected unsafe act.

The six factors I have listed and defined for you are only the general classification groups omitting all details. From here we go to what is called major groups which fall under each of the six accident factors. I would like to list just a minimum number of the general classification groups under each of the six factors to demonstrate how detailed the classification can be.

1. **Agency**—Machines (lathe, punch press, saw, drill press, etc.) Prime movers and pumps (engines, pumps, compressors, fans, etc.) Boilers and pressure vessels (steam boiler, super heater, condenser, etc.) Vehicles (motor, animal, railway, water, aircraft, etc.) Animals (domestic animal, insect, snake, fish, etc.) Hand tools (axe, cleaver, chisel, file, knife, etc.) Chemicals (explosives, vapor, fumes, etc.) Miscellaneous agencies (ladder, window, tank, can, etc.)

2. **Agency Part**—Agency parts are not itemized because the parts differ so greatly. Without referring to a list, however, you can usually figure what part of the agency is involved. A word of advice, however. Don't spend much time in selecting "agency parts", as they don't develop too much importance in the over-all analysis picture.

3. **Unsafe Mechanical or Physical Condition**—Improperly guarded agencies (unguarded, inadequately guarded, etc.) Defective agencies (rough, slippery, sharp, etc.) Hazardous arrangement, procedure, etc., in, on or around the selected agency (unsafely stored, congestion, overloading, etc.) Improper illumination (insufficient light, glare, etc.) Improper ventilation (insufficient air change, impure air source, etc.) Unsafe dress or apparel (absence of or defective gloves, aprons, shoes, etc.) No defective agency.

4. **Accident Type**—Striking against (refers generally to contacts with sharp or rough objects, resulting in cuts, slivers, punc-

tures, etc., due to striking against, kneeling on or slipping on objects). Struck by (falling, flying, slipping or moving objects). Fall on same level. Fall to different level. Exposure to temperature extremes (resulting in burning, scalding, freezing, heat exhaustion, sunstroke, frostbite, etc.). Inhalation, absorption, ingestion, (asphyxiation, poisoning, drowning, etc.). Contact with electric current.

5. **Unsafe Act**—Operating without authority; operating or working at unsafe speed; making safety devices inoperative; using unsafe equipment, hands instead of equipment, or equipment unsafely; unsafe loading, placing, mixing, combining, etc.; taking unsafe position or posture (under suspended loads, lifting with bent back, etc.); distracting, teasing, abusing, startling, etc.

6. **Unsafe Personal Factor**—Improper attitude (disregard of instructions, failure to understand instructions, nervous, excitable, etc.); lack of knowledge or skill (unaware of safe practice, unskilled, etc.); bodily defects (defective eyesight or hearing, fatigue, intoxicated, existing hernia, weak heart, etc.); no unsafe personal factor.

Part 2 of the ASA code Z16.2 goes into much more detail in describing the accident factors. There are literally thousands of detailed classifications which could be used in accident analysis which are listed in this part of the code. It is possible to select from these detailed listings only those factors which apply to your own particular industry. This will cut the list down considerably. On the other hand, you may need to supplement the selected factors by whatever degree of detail you consider necessary.

Just to give you a slight taste of how plentiful these detailed classifications can be, suppose we run through a couple of them at this time. You will recall that the first of the six accident factors that I listed was "The Agency". Under this heading there appeared several general classifications, such as "machines", "prime movers and pumps", "vehicles" and "chemicals". For the sake of our example, suppose we select the general classification of "machines". Under this classification we select "presses". In order to get more specific, let's look at some of the types of presses that we can select from in the code. Press (Metal)—arbor press, assem-

bling press, blanking press, drawing press, kick press, stamping and forming press, etc.

The last of the six factors I mentioned was "The Unsafe Personal Factor". If I haven't lost you yet, you will recall that there appeared several categories under the general classification, such as "improper attitude", "lack of knowledge or skill", "bodily defects", etc. Under the first of these—"improper attitude"—we find more detailed breakdowns, such as: willful disregard of instructions, violent temper, absentmindedness, willful intent to injure, nervous, excitable, and failure to understand instructions.

Now that we are all completely checked out in how to use the detailed and general classifications for the six accident factors, suppose we run through a couple of theoretical accidents and classify them together. Although you as the analyst will identify every accident factor in detail, it is surprising how many times you will find both the detailed and general classification to be the same. For example, let's classify this accident: "A ladder slipped causing a millwright to fall to the floor and fracture his arm. The safety shoes on the ladder were worn smooth and the millwright used it contrary to the instructions of his supervisor."

	<u>General Classification</u>	<u>Detailed Classification</u>
Agency:	Miscellaneous	Ladder
Agency Part:	None	Safety shoe
Unsafe Mechanical or Physical Condition:	Defective	Worn
Accident Type:	Fall to different level	Fall to different level
Unsafe Act:	Using unsafe equipment, etc.	Using defective equipment
Unsafe Personal Factor:	Improper attitude	Willful disregard of instruction

Let's try another one. For example: "An employee in a chemical manufacturing plant in willful violation of posted orders entered a gaseous and unventilated tank before it had

Earlier in my talk I advised you to keep your forms simple and concise. At this time I want to extend this same advice to you regarding the amount of detail you use in the classification of your accidents. Try to keep your analysis simple. If you can't find the factors or combinations of factors that are causing a large segment of your accidents, then go to a more detailed classification. In most cases you will find that you can obtain the results you are after by sticking to the general classification of your accident factors.

Experience has proved that the most effective way to reduce accidents is to concentrate on one phase of the accident problem at a time rather than to try to stop all accidents at once. There are many different ways in which the problem can be approached on this basis, any one of which should prove effective.

One type of analysis that you should make is a study of the injury frequency rates computed by departments. These studies will undoubtedly point out that injuries occur at sharply higher rates in some departments than in others. If such is the case, an analysis should be made of the accidents, the sources of the accidents and their causes.

been tested and cleared for entry by the tank inspector. An explosion occurred, causing him to be severely burned."

	<u>General Classification</u>	<u>Detailed Classification</u>
Agency:	Boiler and pressure vessel	Tank
Agency Part:	None	None
Unsafe Mechanical or Physical Condition:	Improper ventilation	Insufficient air change
Accident Type:	Contact with temperature extremes	Contact with temperature extremes
Unsafe Act:	Taking unsafe position, etc.	Entering unsafe vessel
Unsafe Personal Factor:	Improper Attitude	Willful disregard of instruction

This method will permit concentrating your efforts in those locations where accidents are occurring most frequently.

If your injury frequency rates reveal that a high rate of occurrence is general throughout your plant, you may wish to group the agencies of the injuries. In this manner you will be able to identify the principal sources of injuries; or by accident type to find out how your employees are being injured; or by unsafe act or unsafe condition. Any one of these accident factors may be used as a starting point for your analysis.

Tabulations of your accidents may be made by hand sorting and tallying. For analyzing a small number of reports, this method is the most efficient. The principal advantage is that the original records can be used, and all the information is immediately available for ready reference should you need to refer to it.

For analyzing a larger number of reports, key-sort cards may be used. This card would be similar to the original accident report in that all the information shown on the original appears on the card. In order to use this type of analysis, all the factors will have to be assigned code numbers. The code numbers are then punched on the individual cards and your analysis is made factor by factor by sorting through the cards with a special needle. Sorting would be a hand operation.

A third method of tabulation employs mechanical tabulating equipment. The accident factors are coded and then punched onto the cards. They can be accurately and very quickly sorted into various groups. This method reaches maximum usefulness when the number of reports to be analyzed is quite large, when many classifications and cross classifications will be required, or when tabulation of numerical data, such as days lost, will be made.

Of course, merely obtaining the informa-

tion will not prevent recurrence of the accidents. The conditions which contributed to the accidents must be corrected.

If your analysis shows the improper use of particular machines, then you have grounds for instituting or implementing your employee training programs. The very definite and specific causes of your accidents, as obtained from your analysis, can be stressed in your training activities. Your statistical evidence will furnish you data for developing your own safety posters and for other safety materials which you may wish to use in your all-out assault on the types of accidents which you now know you are having.

Your analysis will show you the causes of your machine accidents in such definite terms that all guess work is completely eliminated from your activities.

We have covered a lot of ground on the subject of accident analysis. My only concern is that I may have been too detailed or too technical and lost you along the way. I am sure that you will agree, though, that armed with the information I have presented, you will be able to "plan your work" and then to "work your plan". If you don't already have copies of the three ASA Standards that I have discussed, I recommend that you obtain them so you can "bone up" on the information contained in them. You will need them in order to arrive at a standardized method of analysis that is used throughout the United States and, I suspect, in many foreign countries.

In conclusion, allow me to return to the point which I stressed at the beginning of this talk, "Don't analyze your accidents unless you fully intend to utilize the information that you obtain from your analysis." "If you don't, you are wasting your time and you will never know what the factors are that are causing the majority of your accidents."

INSPECTION TECHNIQUES

By ROBERT BEESON

Plant Supervisor of Safety and Training, Perfect Circle Corp., Hagerstown, Ind.

In our business, manufacturing piston rings, about one-third of our employees' time is spent on inspecting the product. Every industry has a large inspection department checking its product before shipping to the customer. Trying to manage a safety program without safety inspections would be like trying to manage a business without an inspection department. You just can't do it and succeed.

The No. 1 purpose of safety inspection is to spot unsafe conditions and practices and have them corrected, but you accomplish other things at the same time. When you correct unsafe conditions you prove to your employees that your company really believes in safety.

Inspections help to sell safety to employees. Every time an employee sees an inspection being made in his department it demonstrates the company's interest in safety and perhaps will encourage him to inspect his own work area. Safety inspection will give you an opportunity to come in contact with the employee at his work place. You will often get good safety suggestions from employees during these inspections. This brings the employee into the safety program and tends to make him more safety conscious.

There are thousands of unsafe conditions to look for but here are a few of the general ones:

Housekeeping

Good housekeeping is a "must" if you aim to have a good accident prevention program.

Are aisles marked clearly with painted lines?

Are aisles kept clear of any objects that could cause tripping hazards?

Are machines cleaned regularly?

Are corners cluttered with scrap?

Are tops of lockers and bins dirty?

Are windows and light fixtures clean?

Are your toilets and washrooms clean?

Stairs

Are the stairs in good condition?

Are handrails provided and are they in good condition?

Is lighting adequate over the stairs?

Elevators

What is the maximum weight limit? Do your men overload your elevator?

Are signal systems, cables and other safety devices in good working order?

Is the floor of the elevator in good shape?

Is there adequate light in the elevator?

Ladders

Are your ladders the right type for the job?

Are they of sufficient strength and in good condition?

Are they provided with safety features?

Floors

Are floors free from protruding nails, splinters, holes, oil, water, greases, and loose boards or tiles?

Are floors overloaded?

Machinery

Checking machines to see that they are properly guarded is a very important part of your inspection tour. Remember that although you may have the machine guarded for safe operation conditions, your maintenance men may be in places the operators do not go. Your oiler may have to climb on top or behind the machine to see that the machine is guarded for him also.

Electrical Hazards

Is your electrical equipment grounded?

Are extension cords in good condition?

Do you have sub-standard electrical equipment?

Are electricians required to work on hot lines when it is not necessary?

Do you check the condition of coffee-makers, teakettles, fans, and heaters which your employees bring into the plant?

Fire Hazards

If you have smoking areas, are they clearly marked?

Do you allow flammable liquids to be stored and carried through your plant in glass containers?

Are there places where flammable vapors can collect that should be ventilated?

Are your fire extinguishers, hose and other fire-fighting equipment checked regularly to see that they are in good condition?

Is your fire-fighting equipment easy to get to, or is it blocked by material being stacked in front of it?

Are fire doors in good working condition?

If you have sprinkler protection, are the valves open? Are the alarms working? Are enough men trained to know where the shut-off valves are so the water can be shut off quickly after the fire is out, but not too soon?

Do you really know what explosive materials you have in your plant?

Protective Clothing

Is protective clothing (goggles, safety shoes, hard hats, etc.) made available to the job?

Is protective clothing in good condition?

First Aid

Are first aid facilities adequate?

Do your supervisors know the new method of artificial respiration and do they know how to control serious bleeding?

Are stretchers provided in the plant?

Do your employees know where the first-aid room is and that every injury is to be reported?

General Conditions

Is special equipment (boilers, air compressors, hoists, etc.) regularly inspected?

Is material handled, piled and stored in a safe manner?

Are hand tools kept in good condition?

Are any acids or corrosives handled? If so, are they handled and stored in a safe way?

If you use safety posters, are they changed regularly or are they allowed to become dirty?

Are exits clearly marked?

During this inspection you should watch for unsafe practices. These are some common ones that have probably taken place in every plant in the country:

Improper lifting.

Not wearing safety equipment.

Improper clothing, loose sleeves, rings and watches.

Improper use of hand tools and equipment.

Using defective tools.

Riding on trucks and dollies.

Cleaning and oiling machinery while it is running.

Throwing material and other objects.

Climbing over tote boxes, machinery, etc.

Running in aisles and on stairways.

Operating machinery without proper authority.

Making safety devices inoperative.

Distracting attention, teasing, abusing and horseplay.

Working on electrical equipment without locking out main switch.

Providing own first aid such as band-aids, merthiolate, etc.

The more people you get on your inspection team the more effective your inspection program will be. Here are a few of the people who should be making inspections:

Foreman

Safety Director

Insurance Company Safety Engineer

Plant Manager or Superintendent

Methods and Time Study Engineers

Tool Room and Maintenance men

Safety Committees

Every employee

Foreman

The foreman is the key to any safety program. He is right there with the problem. The foreman should constantly be looking for unusual conditions that might injure his employees, and should see that his employees follow all safety rules. If you get him to do a good inspection job you are well on your way toward your goal of preventing injury.

Safety Director

Like the foreman, every time the safety director goes into the plant he should be

looking for any hazard that might be lurking in a spot that has been missed.

The safety director should plan regular inspections. He may have a general inspection each month, fire extinguisher inspection every three months, and hoist and overhead crane inspection every six months. These inspections should be based on need, reports should be made out and follow-up work done to see that the unsafe conditions are corrected.

The Insurance Safety Engineer

This man can be of much value to you in your inspection program. He does not live with your problems every day, therefore may see things that others have overlooked. This man has the benefit of a broad experience from being in several plants and being familiar with many different types of accidents and injuries. He is a specialist, and you should make every effort to correct conditions that he lists on his report.

Plant Manager or Superintendent

Your plant manager knows that unless he operates a safe plant he is not qualified to operate the plant at all. He can be a very valuable member of your safety inspection team. It may be a little high pressure on the foreman but if he knows the plant manager is looking for safety hazards, he sure will try to keep him from finding any in his department.

Methods and Time Study Engineers

These men are dealing with the details of getting a production job done. If you have them looking for unsafe conditions they will make it a part of their everyday job to report hazards to you that they may uncover while working in the plant. Many times they will be in a position to correct the hazard by the method they establish in getting the production job done.

Tool Room and Maintenance

Here is another group of men who should report hazards. These men are every place over the plant from the roof to under the floors. They should report unsafe tools and equipment and can surely strengthen your inspection program. In many plants, because of the nature of their work, this group may receive numerous injuries, but

if they are a part of your inspection program, they will be more safety conscious.

Safety Committees

A committee to make plant inspections is common in most safety programs. The purpose of this committee is to detect and report unsafe conditions that could cause an injury. This committee does much to bring your employees into your safety program and acquaint them with the safety problems.

If your plant is small, one committee perhaps can inspect the whole plant. If it's large, perhaps you will have committees for specific areas in the plant. You may find it would be better to have employees inspect some other than their own department since they are so familiar with their own problems they could easily overlook some serious hazard.

Since you want to get as many into this safety inspection as possible it is suggested that you rotate the committee members occasionally, perhaps every three months.

The way you explain the purpose of the committee and plan your inspections will determine whether or not you accomplish your goal or fail to reach it. The employees on this committee should take their assignment seriously and not consider it a chance to get out of work or a chance to snoop into some other employee's business.

Items found during the inspection should be discussed with your committee. Also, it is a "must" that committee members be informed of unsatisfactory conditions corrected.

Machine Inspection Committees

Another type committee is one to inspect and approve all new machines and equipment before they are turned over for production use. Logical members would be the foreman, the engineer who designed the machine, the tool room man who is familiar with the machine, and the safety director.

Every Employee

Every employee should be instructed that it is his responsibility to report unsafe conditions.

After you have completed your inspection and have a list of conditions to correct, I would suggest that you use very careful judgment in demanding their immediate cor-

resection. If you really have a serious condition, see that every effort is put forth to correct it immediately, but don't put every item you find in this category because if it is maintenance work you must be fair

with them. I don't mean let these conditions ride, but put the important ones first and do the others as soon as possible.

I know that a carefully planned inspection program will reduce your injuries.

EMPLOYEE TRAINING PROCEDURES

By DAN F. BRADY

Manager of Safety, The Maytag Co., Newton, Iowa

Is there anyone in this hall this morning that feels there is no need for continuing employee training? If so, why not take a good look at your present accident experience and see who is responsible for your statistics. Is it the new employee you just hired, indoctrinated and trained, or is it the employee who has been with you for a period of time; long enough that his job has now become routine.

Analyze your own past. Most of you, no doubt, came into safety work from other phases of industrial work, such as machining, assembly, personnel, engineering, or some type of office work. During those days you were performing such work, how many times did you stop and check your job so far as the safety aspect of it was concerned? I am sure you gave safety far less thought then than you do now.

I'll wager that there isn't a person in the room that would think of putting a part in a lathe chuck before the chuck came to a stop, or would any of you think of using a straight ladder not equipped with safety feet. Why? It's simply because you are aware of "safety" every minute of the day. It is reasonable to assume, therefore, that if "thinking" safety has accomplished the desired attitude for us as individuals in safety work, it can do the same for our employees if administered correctly and effectively.

Our aim is to establish a program in our plants that will stimulate this idea of "thinking" safety in our employees. This will result in better accident experience in our plants, in the homes and, most of all, on our highways.

I assume that all of you have what you feel is a good safety program in effect in

your plants. If you are not getting the results you want, you are striving to revise your program to obtain the ultimate in accident prevention.

The first step that is most important is to create interest of employees by using new ideas and giving the employee an opportunity to participate in the overall plan of accident prevention. Many of these ideas and new ways of presenting safety can be obtained at safety meetings, such as this. Our safety program is made up of a number of ideas I picked up from other safety men at special meetings I have attended.

I feel certain that we, at the Maytag Company, are on the right track with our safety program. We are far from having the perfect program, but each year shows a definite improvement. To illustrate this point, in 1950 we have just put a new plant into operation and had hired several hundred new employees at such a fast rate that adequate training was not given them.

Our accident experience for that year was far from desirable. We had 79 disabling injuries with a frequency rate of 10.46 and a severity rate of 1.865. Severity was high because of the many amputations, resulting in high insurance costs.

Top management became quite concerned and a combined effort was directed towards an effective safety program, the results of which, showed quite an advance toward our goal of "no-accidents". Our experience for 1957 was a frequency rate of 1.54 and a severity rate of 1.000.

We were quite proud of this accomplishment, but to indicate that a better job can be done, our record for the first nine months of this year is now at 0.55 frequency rate and 0.060 severity rate.

In order to accomplish this reduction, we have used every means available to get the idea of safety over to our employees. We began, and are still using, all the standard methods, such as posters, signs, special notices on bulletin boards, letters to the employees and, in general, have tried to keep the plants so covered that, no matter where you walk or look you will see evidence of safety.

We mail a copy of our safety manual to the employee's homes following his probation period of thirty days. This manual is illustrated and in color. We think that the family will have an opportunity to see the manual and understand that the company is interested in the well-being of their husband, father, brother, etc. We know this has prompted safety discussions among the family and helps them to be concerned when someone of the family comes home from the plant with a bandaged finger, toe, etc.

These means, while effective, however, are hardly enough to obtain the desired results. A direct contact with the employees, as individuals, must be made. They must be made to feel that their safety and the safety of their fellow workers depends on their attitude, interest and effort in the matter at hand.

Our program of employee training begins immediately following their entrance as a Maytag employee, when the employee attends a two-hour indoctrination meeting. One hour of this meeting is devoted entirely to our safety program. They are given a copy of the general rules of the company and the company employee in charge of the meeting goes over the entire list with the group. This gives them a chance to obtain the initial background for the more specialized instructions that will follow when they are placed on specific jobs.

The conference leader makes it clear that the rules covered in this indoctrination meeting do not cover all the safety rules which will apply to their different work areas. Special instruction is given when the employee is assigned to a specific department and is placed on a job.

The supervisor is in charge of administering this phase of the employee training. This is done with the aid of a safety training sheet which is written by the supervisor for every operation. This sheet is

approved by the safety department before it is used.

The information given to the employee from this sheet naturally includes the method of operation, however, it's main objective is to point out all safety factors involved in the operation, which means any definite hazard, the presence of pinch points, the control buttons used, methods to stop and start, guards and their purpose, and protective equipment required.

To continue our program, so as to keep the employee mindful of his original instructions, we have posted, periodically, sections of our safety manual on our departmental bulletin boards. Supervision is required to discuss these rules each time with his employees and a group of questions is provided for the specific section that is posted for the supervisor to use to assure that he covers the important items concerning his specific area or department.

The next step in keeping the employee participating in our program is in our departmental safety committees. Most of our departments have one such committee, but in the larger ones three committees are formed.

These committees function on a regular weekly basis. They are composed of one general foreman, one line foreman (supervised by the general foreman) and one hourly employee (supervised by the line foreman).

In most cases the hourly member of the committee is selected by his safety record and his attitude. We aim to select the poorer employee in this regard to serve first.

These committees are given two hours each week to inspect their areas and to hold a meeting to discuss and take action or recommend action on the conditions observed. This inspection and meeting is held during the normal work period. During the meeting of this committee, the department head acts as chairman and is responsible for taking the necessary action to eliminate the conditions found and discussed. The report of this meeting is submitted by the department head on a special form to all management personnel concerned.

In most departments, all of the employees have served on these committees at one time. However, they merely rotate back through

the group again, a second time. When an employee is selected to serve on this committee he is scheduled, prior to his first inspection tour, to attend a one-hour special instruction period.

The safety engineer conducts these meetings and tells them why the committee functions, the purpose of the committee and why they have been selected to serve. He outlines the items they are to look for in their inspections, such as what constitutes poor housekeeping, what the company standards are in regard to housekeeping, what constitutes a hazard, the importance of observing unsafe acts of employees, etc. After this instruction period is over, the employee is ready to serve for a period of four weeks.

In addition to the departmental committee, we have another one which the hourly employees serves on as a member. This committee is called the plant safety committee, and is composed of the safety engineer, who acts as chairman, plant manager and the head of the maintenance department. These three are all permanent members of the committee.

The union officials select three members on their own, without any instruction from the company, to serve for a period of three months. At the end of the three months one member is dropped and a new one added. The member that has served the longest is automatically the one who is replaced.

This committee's function is to review the reports submitted by the departmental committees just discussed. In addition to this, they review plant-wide activities and recommend changes and new ideas that will broaden our program and make it more effective. A report of this meeting is submitted to top management.

The plant safety engineer follows up with the past members of the above committee to observe their attitude and their safety habits. He discusses the conditions prevalent in their areas and encourages them to continue looking for items that are of importance and to report them to the present members serving on the committee so they can report the items as a committee for proper follow-up.

Constant contact of the safety engineer and the supervisor with the employees is the only way we can make the employees

constantly aware of safety. The employee must see that corrective action is taken on his recommendations and, if not, it must be effectively explained to him why his recommendation was not carried out.

In order to impress the employees with our real interest in accident-free operation, every member of management must do his part in discussing safety with the employees, listening to their safety suggestions and complaints and then doing something about them, in one respect or another. If this part of the program is not carried out, the employee cannot maintain his interest, as he is not absolutely sure the company is behind him 100 per cent.

All is not perfect, however, in employee-safety relations. Disciplinary action is sometimes necessary and must be a part of the program also. No matter how many safety-conscious employees are employed, there are always some that are belligerent and fail to respond to the well-meaning efforts of management. Action has to be taken to combat the unsafe actions of this type of employee or the matter is likely to get out of hand and the other employees will lose interest.

We have a plan for disciplinary action which, when an employee wilfully violates a safety rule for the first time, he is given a verbal warning. On the second offense, he is given a warning in the form of a letter which he is requested to read and sign. This letter is placed in his personal history folder. If observed a third time, he is automatically given time off from work. The length of time is determined by his supervisor. If he commits a fourth offense, he is discharged from the company.

As of the present time, we have had to resort to the third step on only a couple of occasions and have never had an occasion to enforce the fourth step.

Our experience has shown that some departments do a better job of promoting safety than others. Recognizing the fact that safety problems differ with each department, the fact remains that the attitude of the department head is largely responsible for the safety experience in the department, regardless of the nature of the work. Because of this we have tried to impress our department heads with the fact that their safety program should be one of

their own planning, since they are more closely acquainted with the problems in their area than anyone else.

To promote the plan for individual safety programs, the safety department, the division superintendent and the plant manager meet individually with each department head at the beginning of each new year to discuss with them their experience for the past year. The safety department provides the necessary statistics regarding the number of minor injuries, type of accidents, reasons for accidents, etc.

As a result of this meeting, the department head is expected to review the information to make his plans for the safety program for the new year. He will submit an outline of his proposed program within approximately two weeks following the original meeting for approval. The group will suggest additions or corrections in his program, if necessary, and if all is agreeable, the department head formulates a final copy of his safety program which is primarily his responsibility for the coming year.

As a follow-up, the same group as mentioned previously continues to assist by scheduling meetings with the department heads at approximately three-month intervals. This meeting is to review his accident experience and to see if his department is carrying out the plan of action as outlined. If changes are necessary, this group assists in revising the program if it is failing to accomplish its original purpose.

This particular phase of our program has eliminated the general feeling that the safety department's program is not effective. Since the department has outlined its own program, it has the responsibility to see that it works. Department people take more pride in doing a good job since, because of the program being their own, they receive the credit for accomplishing their goals.

With the employees taking an active part in the program of safety and with departmental supervision meeting with top management to discuss safety, we feel sure everyone is convinced of the company's attitude towards safety. However, many times

it is necessary that more effort be given on the part of top management. To accomplish this, the vice-president of production, periodically, will make a complete inspection of the shops. He will contact the department head and have him accompany him through his individual department and the Vice-President will observe the house-keeping standards, safe operation of the equipment, unsafe acts by employees, etc. He will also stop now and then and discuss safety with employees during his inspection.

We have found this idea is very effective, since most of the employees are impressed by the fact that top management takes time and shows enough interest to make an inspection of their areas. They seem convinced that the company is interested in maintaining a safe and clean place for them to work.

Recognizing the fact that everyone likes to receive recognition for doing a good job, some of our departments are issuing individual letters to the employees in their department, complimenting them on a good accident record. A record is maintained at all times on each employee's accidents.

After an employee has had two injuries, his foreman and department head will discuss these accidents with the employee, in a constructive manner, and ask him for recommendations to eliminate recurrence. In most cases, the employee can recommend something that will eliminate future accidents. If practicable, the department head will see that his recommendation is given the proper attention, if not, he will explain why something else must be done.

To show the value of this part of our program, in 1955, we were averaging 160 minor injuries a month, and as of this year our average has been 75 minor injuries per month.

The main thing, as I stated in the beginning, is that the sooner we get our employees thinking and discussing safety with the same interest that we in safety do, the sooner we will eliminate, not only industrial accidents, but off-the-job accidents as well.

SAFE DESIGN OF INDUSTRIAL FURNACES

By J. B. SMITH

Chief Engineer, Factory Mutual Engineering Division, Norwood, Mass.

Industrial furnaces for metallurgical processing usually consist of a steel frame and steel casing with a refractory lining suitable for furnace operating temperatures and the work processed. Ordinarily, we define a furnace as a heating device with a work chamber that operates at more than 700F.

Consider the most common type of industrial processing furnace, the heat-treat type, from the standpoint of explosion safety. There are three basic requirements for an explosion in a furnace: a combustible material in gaseous or vapor state, an accumulated mixture of the combustible and air within the flammable range, and an ignition source.

In industrial heat-treat furnaces, there are two kinds of explosion, designated according to the source of the combustible. First is the fuel explosion in which the combustible is the fuel used to heat the furnace, usually fuel gas or fuel oil. Second is the flammable special atmosphere explosion; here the combustible is the flammable special atmosphere used in the furnace for metallurgical purposes.

Fuel Explosions

The most common type of furnace is the direct-fired, where the products of combustion from the heating flames enter the main furnace work space. In the indirect-fired type the products of combustion are restricted to the heating system and do not enter the furnace work space.

There are two methods of heating: with an external heater and a recirculating fan, and where the heat is distributed uniformly throughout the furnace by an arrangement of a multiplicity of burners. The second type we designate as a multi-burner furnace.

To understand how explosions occur, it must be recognized that the periods of burner operation consist of lighting-off or relighting, and firing.

During a recent 10-year period, 100 explosions from the fuel hazard alone occurred in industrial furnaces. In general, the amount

of property damage loss was proportional to the furnace size.

The explosion hazard which could result from a passage of fuel into the furnace through a valve left open or leaking during shutdown will be minimized chiefly by approved, manual-opening, automatic-closing, safety shut-off valves, and by adequate periodic testing of all valves and safety control devices.

Trained burner men are essential. At best, automatic safety controls furnish only partial protection against explosion. Entire dependence is placed on burner men for completing these vital precautions:

Before opening individual burner fuel cocks to light up, a reliable ignition source should be placed in front of the burners.

Too long or repeated unsuccessful attempts to light off can lead to accumulation of an explosive air-fuel mixture within the furnace. To minimize this hazard, the burner man should limit each trial for ignition to five seconds. If unsuccessful, fuel should be shut off, door reopened, or the furnace purged by the best available method before repeating the attempt.

Avoid the practice of using the burner mixer compressors or blowers to furnish a preventilation purge in the furnace. This method may introduce the hazard of purging with an explosive mixture created by drawing gas through a leaking shut-off valve as the combustion air passes through the mixer. A properly arranged F. M. cock gas safety control system may be used to protect against this hazard.

Effective explosion vents are generally impractical on industrial furnaces.

Gas-Fired Furnaces

Ninety-two of the 100 explosions mentioned occurred in gas-fired furnaces. Of these, 50 per cent occurred during the lighting-off period, 40 per cent during operation (firing), and 10 per cent during relighting after burner flame extinguishment. No ex-

plosions occurred while the work space temperature was more than 1400F. A number of explosions did occur while warming up furnaces, in which normal operating temperatures exceeded 1400F.

The majority of the lighting-off explosions occurred in multi-burner furnaces where the operator failed to close all individual main-burner gas cocks and to establish reliable pilot flames at all burners before opening the main furnace gas valve.

Firing explosions were equally caused by the operation of burners with scant air for perfect combustion, resulting in formation of an explosive carbon monoxide and hydrogen-air mixture; and by the accidental flame failure with no means for automatic fuel shutoff.

The majority of relighting explosions after accidental burner flame extinguishment were caused by failure to first purge the furnace before re-introducing an ignition source.

Recommendations for direct-internal-fired multi-burner furnaces. These four safeguards are needed to prevent explosions during the lighting-off period:

1. Use the F. M. cock and gas safety control system.
2. Provide individual burner cocks, where practical.
3. Install fixed pilot burners, where practical.
4. Provide manual prevention.

Three safeguards are recommended to prevent explosions during firing:

1. Well-designed and maintained mixers are recommended to safeguard against the accumulation of explosive, unburned, combustibles-air mixtures.
2. Provide continuous pilots, if practical, on furnaces operating at less than 1400F.
3. Interlock the fuel supply and the combustion air so failure of either will immediately shut off and lock out all gas supplied to the burners.

There are two safeguards recommended to prevent explosions during relighting periods:

1. Provide manual purge before relighting.
2. Relight burners individually.

Recommendations for direct-external-fired recirculating one- or two-burner furnaces. Two principal safety measures are recommended for lighting off:

1. Where fixed pilots are installed, they should be supplied with premixed gas.

2. Provide automatic prevention.

There are also several safeguards recommended during firing:

1. The recirculating fan should be reliably interlocked.
2. Provide combustion safeguards.
3. For heaters having burners with low-pressure-atmospheric inspirator-type mixers:
 - (a) The burner should generally be used only for constant firing at a fixed rate, or "on-off" firing with continuous pilot.
 - (b) Provide adequate combustion air by maintaining the suction in the heater produced by the recirculating fan above -0.20 in. water column.
 - (c) Provide a high-temperature limit switch at the heater outlet.
4. For heaters having burners with mixtures utilizing separate blowers or compressors, limit turndown so the proportion of air does not fall to less than 85 per cent of the amount needed for complete combustion.

There is one safety measure recommended to prevent explosions upon relighting. After an unscheduled shutdown, resulting from accidental burner extinguishment, the combustion safeguard should be interlocked to provide a five-min. prevention purge by the recirculating fan.

Recommendations for indirect-internal-fired radiant-tube-type multi-burner furnaces. Radiant-tube-type burners are explosion resistant and, unless in poor condition and leaky, there will be no fuel explosion hazard in the furnace. To protect against the discharge of unburned gas into the furnace room or into the products of combustion exhaust duct system, the fuel supply and the combustion air should be interlocked so failure of either will immediately shut off and lock out all gas to the burners.

Incidentally, many basic safeguards needed for gas-fired units are also applicable to oil-fired furnaces.

Flammable atmosphere explosion hazards of special atmosphere furnaces. In Factory Mutual plants during a recent 13-year period, 27 explosions occurred in heat-treating furnaces using special atmospheres. Twenty-five explosions were caused by the ignition of an accumulated explosive flammable special atmosphere-air mixture.

The most important factors in minimizing the explosion hazard in special atmosphere furnaces and generators are: selection by management of competent, well-trained operators to properly conduct phases of furnace and generator-operating procedure, and establishment and execution of periodic testing of controls and of a maintenance program.

The two critical periods of furnace operation with a flammable atmosphere are: starting the flow of flammable atmosphere, so the air is replaced with flammable atmosphere; and stopping the flow of flammable atmosphere, so the flammable atmosphere is replaced with air. During both periods the atmosphere in the furnace passes through the explosion range.

Accidental interruption of a continuous supply of the flammable atmosphere is also dangerous—air may immediately start to enter the furnace.

Experience has shown that 1400F furnace-operating temperature is a reliable piloting or ignition temperature, above which combustible-air mixture cannot accumulate and build up to dangerous amounts.

A special atmosphere, if it has a concentration exceeding 8.8 per cent of flammable incomplete products of combustion, will enter the explosion range when mixed with air. To obtain such a flammable special atmosphere from the combustion of common fuel gases, the aeration of the gas must be reduced to approximately 82.5 per cent or less. The term "aeration" means the proportion of air furnished to the burner to that amount of air required for chemically complete combustion of the fuel, expressed as a percentage.

Where practical, rinsing or purging with inert gas before starting and after stopping the flow of flammable special atmosphere is the preferred method of avoiding explosive flammable atmosphere-air mixtures. This is especially advantageous where furnaces or sections of furnaces are less than the generally reliable gas ignition temperature of 1400F. Flow rate indicators and time clocks should always be used to insure that the explosive mixtures have been eliminated.

On the average, an amount of atmosphere gas equal to five times the volume of the chamber is required. Often it is possible during starting-up and shutting-down to adjust the air-gas ratio of an atmosphere

generator so an inert atmosphere is obtained almost free of combustibles (more than 82.5 per cent aeration) as well as oxygen. Periodic checks of the generator output by gas sampling devices are desirable. In special cases, it may be practical to obtain an inert gas for purging from a bank of nitrogen or carbon dioxide cylinders.

Given sufficient time, gases of different densities diffuse and form a uniform mixture throughout a container. The minimum amount of mixing permits the most rapid purging with the least amount of gas. In furnaces with vertical chambers, such as the tower type, lighter-than-air atmosphere gas should be admitted at the top of the furnace and heavier-than-air atmosphere gas at the bottom, the air being discharged at the opposite end.

Where it is impractical to obtain an inert atmosphere, it becomes necessary during starting-up to burn out the air, and during shutting-down to burn out the flammable atmosphere. During starting-up when the air in the furnace is replaced with flammable atmosphere and during shutting-down when the flammable atmosphere is replaced with air, the possibility of explosion is avoided if all parts of the furnace are at more than 1400F.

If at the point where flammable atmosphere or air enters the furnace the temperature is less than 1400F, a reliable ignition source should be provided. In special furnaces such as the tower type which has an almost totally enclosed work chamber, whether the furnace is more or less than 1400F, an inert gas should be used to purge the work chamber, and the burn-out method should not be used.

With certain batch-type furnaces such as the bell-cover, box-cover, car and elevator furnaces, explosive mixtures cannot always be avoided; the process requires turning-on and shutting-off the special-atmosphere while the furnace is cold, and inert gas purge is not practical.

Explosion safety depends on keeping ignition sources away from the furnace interior and from the mixture issuing from the furnace vent pipe while the furnace atmosphere is in the explosion range on starting-up, and again on shutting-down.

When starting-up, if the base of the furnace contains a fan, it should not be operated until after completion of the purge.

Where the recirculating fan has supply and return ducts in which the gas may be trapped, it will be necessary to operate the fan throughout the purge.

The furnace heating shell must not be placed over the inner cover until the cover contents are proved to be almost free of air. Complete replacement of air by flammable special atmosphere should be proved by sampling the gas issuing from the vent pipe by a gas analyzer-type indicator or recorder which would not present an ignition source. By flow meters and clocks, the time required by purging with a standard flow rate should be determined.

The vent pipe of the furnace work chamber should be equipped with a properly arranged, approved automatic fire check to

protect against flashback during the purge period. Efflux should not be lighted until after positively determining that the mixture is not explosive.

Usually contact with air cannot be permitted until the work is cool. Under these conditions, special atmosphere should not be shut off and the work removed until the temperature of the work chamber has dropped to 300F or less.

Immediately on shutting off the flow of special atmosphere, the work chamber should be purged of flammable atmosphere by the burning-out method. This is accomplished by placing a reliable ignition source at the lip of the inner cover and lifting the inner cover slightly to allow air to enter so the atmosphere may be burned gradually.

SAFE OPERATION OF INDUSTRIAL FURNACES

By L. B. WOCHOLSKI

Associate Chairman, Physics, Heat Transfer and Electrical Department, General Motors Institute, Flint, Michigan

Safe operation of industrial furnaces is a highly controversial subject that has no simple approach or solution. It involves equipment and people. Since furnace explosions occur in practice and not on the drawing board or in the talking stage, it is important that industry be staffed with alert, careful, competent and well-trained personnel that can operate the available furnaces safely. Therefore, the purpose of this paper is to present an approach to training and a suggested program to develop operating furnace personnel.

It is important to consider that the available industrial furnace is only as safe as:

1. Engineers can recognize a safe installation.
2. Furnace personnel can recognize safe furnace operation.
3. Maintenance personnel can recognize the importance of proper maintenance.
4. Safety engineers can recognize the safety aspects of furnaces with their related equipment and their operation.
5. Manufacturing can recognize the importance of keying production with safe

furnace operation insofar as personnel, physical equipment and quality of the product are concerned.

If the above recognitions are made accurately and completely and are meaningful for safe operation, this paper would be unnecessary. However, I would like to review the severity of the four main areas of furnace explosions that occur in practice which were presented by J. D. Smith, chief engineer, Mutual Factory Engineering Division.

First, 46 per cent of the gas fired furnace explosions occur in the lighting-off period. Most of these explosions occur when the furnace operator fails to close all the individual main burner gas valves or he fails to establish a pilot flame at each burner before opening the main gas valve.

Second, 36.8 per cent of the gas fired furnace explosions occur during the firing operation. The common causes of these explosions are:

Formation of an explosive mixture of carbon monoxide, hydrogen and hydrocarbons which accumulate in a furnace when a burner operates with insufficient

air for complete combustion and accidental flame failure with no means for automatic fuel shutoff.

Third, 92 per cent of the gas fired furnace explosions occur during the relighting operation. Most of these explosions are caused by failure of the operator to purge the furnace before relighting.

Fourth, of all the explosions that occur in protective flammable atmosphere furnaces, 92.8 per cent are caused by the ignition of an explosive accumulation of flammable atmosphere gas mixture within the furnace.

From the above facts, one can easily say that most of the explosions can be prevented if the furnace personnel are alert, careful, competent and well trained. Operators with these qualifications can recognize a hazardous condition and can initiate the necessary corrective measures to eliminate the condition.

The approach to training requires the sincere participation of all key personnel directly associated with the successful operation of the plant, and it must include the following steps of policy making, designing, creating, training and follow-up.

It is essential that top management must recognize the need for greater-on-the-job safety training and to start the organizational set-up for the program. This action should be a preventive measure rather than one of meeting an emergency.

Therefore, improvements in the quality of the product, decreases in processing cost, and decreases in scrap must be recognized by management as secondary results of this program. The results of this type of training must be evident in personnel safety, first, and second, in physical plant equipment safety.

The policy group, made up of key supervisory members of management from areas, such as heat treat, safety, plant engineering, maintenance, metallurgy and manufacturing, must form a cooperative group to disseminate pertinent information concerning the safety aspect of their activities. By the interchange of this information, the personnel directly associated with furnace operation indicate acceptance of their responsibility for safety.

The important work of this group is in the area of determining policy and of deciding the organizational action required to meet the objective approved by top management.

The appointment of the right people in the organization to design the training program is also made by this group.

The design group decides on the content and coverage to satisfy the objective and desired end results of the training program. This group sets up the necessary guide-lines, such as titles, objectives, major topics and desired results for each session. In addition suggested methods of applying furnace principles and nomenclature to on-the-job furnace operation are included in the guides for the writer. The final act of this group is the selection of plant people best suited for creating the various sessions of the program.

This creative group consists of the writers and training aid builders who develop the best training methods, techniques and text materials necessary to effectively meet the desired results as established by the design group. This group must work very closely with the various processes in the furnace area, as their efforts must specifically emphasize safety of operation of these processes at all times.

Integration of training with plant operation includes the organization of training to obtain the greatest picture motivation for the application of the knowledge gained in the training program to his job, resulting in greater on-the-job safety.

After the operator completes the regular training program, a follow-up preventive measure is necessary to keep him alert, careful and competent. At definite intervals, lectures, demonstrations, films and/or conferences should be scheduled. A check list of safety measures and simulated emergency drills should be used to determine the effectiveness and the retention of the furnace operator's knowledge of safety. This follow-up is necessary for safe furnace operation.

The following are suggested sections of a training program for people directly associated with industrial furnace operation. An objective and suggested topical coverage are included in each section.

The first section must be a résumé of the factors which create hazardous conditions in the furnace area. All hazardous conditions must be discussed, with emphasis placed on fires, explosions and toxic characteristics of materials used in the furnace area. This section is necessary to develop the purpose of the program and to motivate the interest of

the operator. History of some of the hazardous conditions which resulted in accidents are important to this section.

The second section must give the operator an understanding of the nature of combustion as well as developing an appreciation of the hazards inherent in combustion. Basic information concerning fuels, combustion, related chemical reactions, products of complete combustion, products of incomplete combustion, flash point, fire point, explosive limits, toxic limits are included in this section. This material can be keyed to the factors covered in the first section and to the fuels used in the plant.

The third section must give the operator an understanding of the principal function, important construction features, operations and specific uses of the furnaces operated in the plant. Schematic drawings, models, manufacturer's brochures and inspection of the furnace on the job can be effectively used as training aids. Controlled atmosphere as well as noncontrolled atmosphere furnaces should be included in this discussion.

For plants that use protective atmospheres, the next section must give the operator a familiarity of the protective furnace atmospheres generally used in industry and a working knowledge of the specific atmospheres used within his plant. For industrial furnaces, the main types of atmospheres to be considered are endothermic (RX), exothermic (DX), dissociated ammonia, raw ammonia and steam. The association of the protective atmosphere to a specific plant application gives the operator a better understanding of the protective atmosphere. Discussion should include: effects of the protective furnace atmosphere on people, the duct, heating elements, thermocouples and furnace refractories; gas analysis of each type of atmosphere; and inertness and combustibility characteristics of each. This section must associate the characteristics of the furnace atmosphere to the methods of securing a furnace.

The next section must give the operator an understanding of the principles of the commonly used generators and dissociators with their related equipment. Emphasis must be placed on the types used within his plant. Chemical reactions, factors affecting the chemical reactions, normal operating conditions and methods of purifications must be

included. Flow diagrams for each method are good training aids for this section.

A safety device section must give the operator a working knowledge of the devices that are used on furnaces, generators, dissociators and their related equipment for safe operation. Emphasis of this section must be placed on: the nature of the device, its use, its limitation and its specific locations. Fuel safety shut-off valves, fire checks, temperature limit switches, pressure limit switches, purge timer, CO₂ systems, color coding, safety flame indicators and masks are some of the devices to be included in this section.

A section on analyzing, controlling and measuring gases must give the operator an understanding of the importance of each device to the safe operation of a furnace. Emphasis must be placed on gas analyzers, gas-analysis controllers and measuring devices, such as temperature, pressure and flow indicators. Operators must have a working knowledge and a skill to operate the measuring and controlling devices so that data meaningful to the proper operation of the furnace can be obtained and evaluated.

For the operator, the most important section gives him the correct step-by-step procedure of starting (lighting), firing and securing each furnace or furnace system for normal on-the-job conditions. A statement explaining each step is necessary to give the operator a better understanding and a greater appreciation of the procedure for safe operation.

An emergency procedures section must give the operator a step-by-step procedure for each furnace and its related equipment so that he can act safely in handling known types of emergency situations, such as power failure, heating gas supply failure, protective furnace gas failure for furnace temperatures above 1400 F and below 1400 F. Again, for the operator to understand and appreciate the procedure, each step must be explained completely.

The final section must give the operator an opportunity to use the knowledge gained in the program to analyze an actual operating situation as well as an emergency situation and to develop an approach to correct the situation safely.

The emphasis of this section is on solving a furnace operating problem; therefore, the

operator must be able to obtain the facts of the situation, isolate the trouble, evaluate the possible solutions, decide on a specific solution and activate the solution. This section is the pay-off of the program.

Summary.—A training program must be tailored to meet the peculiar characteristics and needs of the individual plant.

Since damages are proportional to the size of the furnaces, a training program may be considered more important for a large plant than for a small plant. No furnace regardless of size should be taken for granted.

Success of a training program depends on

the sincere participation of all people directly associated with furnace operation.

An effective training program must provide the operator with sound knowledge in the proper operation of a furnace that will enable him

First, to recognize the presence of a hazardous condition, and

Second, to initiate the necessary corrective measures to eliminate the condition to assure safe furnace operation.

A training program that successfully fulfills the above considerations is a practical answer to the problem of safe operation of industrial furnaces.

PLANNING SAFETY INTO AUTOMATION

By THOMAS E. SEAVEY

Master Mechanic, Pontiac Motor Div., General Motors Corp., Pontiac, Mich.

In the planning, designing and building of automated equipment for industry, safety has assumed equal importance with the life of equipment, cost, productive capacity and similar requirements, as seen from the buyer's viewpoint. Since the purchaser of new equipment is vitally concerned with safety, the automation manufacturer also has become concerned.

The ultimate user of this equipment is interested from a humane and economic standpoint. Safety is no longer a by-product, but a major objective of manufacturers. It is not good business to injure your employees when, through a concerted, conscientious effort, these accidents could be minimized or eliminated.

This is aside from the economic dollars-and-cents approach, in light of the rising insurance and compensation costs. The costs of an accident are not measured only in tangible black and white figures, but in hidden costs, suffering and sorrow.

It is now far safer to be at your job working than to be at home. Statistics show the home accident rate is many times greater than the industrial accident rate. A goodly portion of this success can be ascribed to planning and forethought to prevent accidents before they can happen.

Equipment has undergone an evolution to meet the needs of industry. Technical advances have been necessary to keep costs down and manufactured products within the reach of the consumer. Inherent in this evolution have been problems of control, lubrication, materials and safety.

The complexity of this equipment normally makes safety not only more necessary but also more difficult to attain. In the days of the simple drill press, an off and on switch was more than adequate from an electrical standpoint, with guarding at a minimum. Incorporating this drill press into an automated line multiplies the hazards manifold.

In planning or design, no one set of rules can apply to all situations that could occur in the design of a complex, special-purpose piece of automation or automated equipment. Some rules will have to be violated in the interests of other considerations. Still the hazard should not be allowed to exist, and a new approach might have to be instituted to cover the particular application.

General

There are safety considerations that cannot be readily classified as strictly mechanical or electrical. These factors can be examined as a general recommendation.

A definite need has always existed for some signal to indicate that a piece of automatic equipment is about to be started. Due to the obstructed view automated equipment is difficult to properly clear visually before starting.

A suitable audible signal should be installed in a timed circuit, compelling the operator to sound the signal before the machine will operate. Some manufacturers now incorporate these devices in their equipment.

In the operation of automated equipment, air is not desirable from a safety standpoint. Air is difficult to control, compressible, easily contaminated and expensive.

It is the control and compressibility that causes air to be inherently unsafe. A piece of air-operated equipment may be shut down electrically and still be potentially dangerous because its air motive force is still under compression.

During sudden stoppages, when possibly a part is wedged in the transfer mechanism, unless the air system is bled, the part or transfer mechanism can do great damage when released. This damage could easily involve the person or persons releasing the stoppage.

Air operation varies with control due to moisture, drops in line pressure and subsequent erratic action of air. There are instances where hydraulic equipment is not applicable, and air must be used, but air is normally not as desirable.

In the design stages, shear and pinch points in automated equipment are one of the most fertile fields for safety accomplishment. If machines could be designed more *wide open*, it would eliminate places where people can be trapped and a serious injury result.

Some machines are so designed on the rear of their horizontal wing units that a person could be caught between the returning head, or slide and the supporting base unit.

Bridge supports used to maintain upper mechanical units, such as transfer bars and hopper feeding units through which the part is transferred, are normally designed so close to the minimum clearance that a serious 'pinch point' is created. Attention to these factors during planning stages would eliminate many hazards.

Inspection gates should be provided on some types of automation. Certain types of parts many times must be removed after a critical operation to determine whether the parts are being machined within limits. Provisions should be made for properly interlocked gates that allow a part to be skidded or moved without back-wrenching lifting.

Swinging or rotating-type loaders, or unloaders, are frequently serious safety hazards. These loaders normally work very quickly and the cams, trip levers and control switches create a large number of pinch points. This situation is compounded, if the mechanism is operated by air. This type of equipment is virtually impossible to guard, particularly in protecting the repair or setup man.

In the general machine setup, hydraulic lines, conduit and air lines should be kept clear of the floor to eliminate stumbling but high enough to prevent hitting one's head on them. Pipes along the floor, or just above the floor, make too convenient a place to stand or lean. A worker can easily slip off of these pipes and injure himself.

Machines should be fitted with sensible guards that are a 'forethought' not an 'afterthought.' Some guards, attached to a machine create a greater hazard than the one being guarded against. Guards should be arranged so they can be easily replaced after tool change or repair, or they will not be used to advantage. A guard difficult to replace should not be used. Guards of expanded metal that allow visual checking of a machine operation without removal are widely and successfully used.

Mechanical

There are a large number of safety considerations that fall into the mechanical category, even though the mechanical and electrical divisions are often tied closely together.

The majority of automated machines and automated equipment between machines is not designed or built of a construction substantial enough to withstand the stress imposed by mass production.

Bracing, casting cross sections, and screw sizes are many times too light to retain their original alignment and accuracy. Consequently, the twisting and moving of the equipment causes accelerated wear and reduced safety.

When weight is not a prime consideration, heavier construction is almost always advisable to preclude the possibility of permanent distortion, when the unusual occurs, such as jams, wrecks, broken parts or cutters and sudden stoppages.

While equipment is still on the drawing board, the shop maintenance man frequently becomes the forgotten man. Objectives that are normally considered too few times include the factor of accessibility from the repair standpoint. This applies even to accessibility for minor adjustments which must be made relatively often.

Machines have been designed, built and put into service, requiring a small man to make repairs and adjustments. Such cramped working space can only lessen safety.

Cylinders, fittings, and lubrication facilities are placed in 'available' space rather than in a planned location. Some cylinders have been so hidden as to require a major tear-down to remove them for such maintenance as packing replacement.

Some pieces of equipment appear to have been assembled around the milling and drilling heads, making them inaccessible except from atop the machine. Working from atop a machine is a great safety hazard, because coolant and lubrication cause unsure footing. A large portion of industrial accidents are from falls.

Machines built along these lines are normally hazardous even for a jobsetter to change and set tools. Machines that must be climbed on to change or adjust tools or fixtures are not uncommon. Built-in walks or stiles on machines of this nature do much to reduce this hazard. Walks or steps of smooth metal are almost as poor as none at all.

Materials on the market of the expanded metal type are excellent for the fabrication of stiles or walks. These materials retain their skid resistance even after long use. The walks are not made hazardous with oil, water or other materials which cause surfaces to be slippery.

Hydraulic equipment on automation or automated equipment should be run on minimum pressures or only enough pressure to overcome operating resistances in normal operation. Operating equipment at abnormally high pressures causes undue strain to the structure of the equipment, and in sudden stoppages could multiply the damage and subsequent hazards.

All hydraulic equipment should be banded or permanently marked for proper operating pressures and settings. This procedure many times in addition to its safety benefits aids in trouble-shooting, because it indicates conditions of abnormality that point toward possible maintenance problems. In addition to identifying pressures, it is wise to have indicated on the control valves, the direction of motion of the element controlled when the valve is manually operated in a particular direction.

Many times solenoid-controlled valves must be moved manually for some reason of set-up, checking after a repair is made, or to release someone caught in the machine.

To know which direction the transfer bar will operate when the valve is manually pushed in one direction or the other is valuable. It could mean saving an arm, leg, or a life.

Regarding lubrication, a central lubrication system on a machine or piece of automation is almost a "must." The day of the individual fitting or oil cup has long since passed.

Although central lubrication has been a long step forward toward safer maintenance of equipment, there have been other hazards that have accompanied its use. The control of lubrication systems of the various types sometimes causes the use of too much lubricant, which finds its way to the floor and creates its own hazard.

All ways and other surfaces involved in 'expended' lubrication should be provided with drain troughs channeled into a tank or system through which the surplus lubricant can be controlled. Many plants make use of this expended lubricant in the reclaiming process, in which quantities of cutting oils are made. Provisions should be made to prevent this material from creating an additional hazard.

All filling facilities on central systems, hydraulic systems and grease fittings should be arranged, depending on the application, to be out of the danger areas of an operating machine. Almost all of the lubrication of equipment is accomplished while it is in operation.

Overhead automation with lubrication facilities, and even air line lubricators, should be serviced from the floor level rather than have workers use ladders or climb upon the equipment.

There are air-line lubrication systems in use that can be filled automatically from a central tank at floor level, keeping the level in the lubricators overhead at a working level without the hazardous necessity of climbing up to them.

Washers built as a part of an automated line are cause for a possible accident if the inspection or access doors have been removed while the equipment is potentially operative. Should the rest of the line cycle cause the washer to operate with these doors open, serious injury could result.

Access or inspection doors which, if left open, could cause injury should have the steam valves, pumps and other apparatus tied into a safety circuit controlled by limits on these doors. If a door were open, even if the rest of the line cycled, the washers would be inoperative—a situation true of much of the new automated equipment.

A section will appear harmless because of a condition elsewhere on the line when it is much like a 'loaded gun' waiting to be triggered.

In fixture design the use of controlled air blow-offs to clean locating pads is a safety feature. Here, there is no necessity for the operator to reach into the machine with risk to himself to clean the locators. Properly placed and controlled, these devices are an advantage.

Electrical

Electrical automation safety leaves much to be improved. Although there is some effort toward standardization, safety apparently is not always a prime objective.

Many plants have a general safety rule that a machine must have the master disconnect switch locked in the off position before a machine is to be worked on by maintenance people or jobsetters. Although important from a safety standpoint, this rule is difficult to enforce, particularly if the disconnect switch is inconveniently located, as on an elevated platform or at one end of a long machine.

It is advisable to have this disconnect on the floor level and normally as close to the midpoint of the machine as possible. A rule convenient to obey is more readily enforced than one requiring extra effort.

Many machines are built without emergency safety stops, or the stops are not readily accessible. Emergency stops should

be arranged to be available from virtually every spot on the machine and from either side.

A widely-used application of this type of stop, particularly on long extended machines, is the safety cord. All of the machine's functions and its related equipment should be stopped, using this safety stop.

Recessed start buttons on equipment are important. This stems from the number of accidents that occur when a person's body comes in contact with an exposed start button while the machine is being repaired or tools changed. This is especially true if the lockout rule is violated.

Since in many machines hydraulic power is used to activate the various functions of the machine, before transfer hydraulic pressure can be applied, all panel switches must be on. This would cause one of the most potentially dangerous elements of the machine to remain inoperative until the rest of the machine is made ready to cycle.

Some machines are arranged so, if one section is shut down, the transfer through this section could operate, because it gains its pressure from a hydraulic unit connected to a still-active adjacent section. Locking out one transfer section does not assure safety.

Through an economy effort, much equipment is made with single solenoid spring return control valves. These economies are soon lost through the potential accidents possible in their use.

A positively placed valve spool in a two coil valve is far superior because of the possibility on a single coil valve of the spool creeping or becoming mislocated and causing subsequent jamming, erratic cycle. Double coil valves should be used wherever possible.

In equipment operated pneumatically, the trapped air compressed against a sudden stoppage is as dangerous as a coiled spring. Electrically, a solenoid controlled dump valve should be arranged to dump all air pressure to the machine when the stop, or emergency stop button is used.

This accomplishes the same thing as shutting off the hydraulic system in a hydraulically controlled machine; the source of the moving force is removed; and in the case of the air operation, the back pressure is dumped.

Automatic washers, ovens and blow-off section should be arranged to become inoper-

ative when the covers or access doors are removed for inspection or repair.

These safetys would cause all pumps, hot water and steam facilities to be shut off until the doors and similar units were replaced. At this time the machine could be recycled and placed in automatic cycle.

Important in automatic equipment is finding what is wrong when its does not cycle as it should. Many accidents that occur on automation are during this period, when a repairman must subject himself to certain hazardous situations.

Many times a machine must be left in the "as occurred" conditions, so a repairman can correct a machine fault after discovering the cause of the irregularity.

Often, if a machine fails to cycle and is shut down, an electrician cannot determine what is wrong or what piece of equipment failed. Because the power must be left on, it presents certain hazards conducive to accidents. Placement of limit switches in areas easily reached without subjecting the repairman to serious hazard is advisable.

Remote controlled limit switches are advantageous for the preceding reason and because applications requiring a coolant normally move the switch out of the coolant area. Limit switches shorted by coolant are potentially dangerous.

A machine of automatic nature should be wired to be failure-safe. If a switch fails, the machine will not become a hazard. An example is in the feed of a milling head. It should be so designed, if a rapid traverse limit switch fails, that the machine would be in fine feed. This eliminates the possibility

of a machine going into the work in rapid advance.

The element of fluidity is inherent in the preliminary design and layout of the components in an automated production line. For instance, experience supporting this information has shown that the engine cylinder block line design could be helped by lessons learned in previous automated block line building: there were existing lines where debugging had made considerable progress. But the engine camshaft was on virgin ground, and the design had to be taken from the air.

In spite of this difference, both lines were alike in that they had to be custom-tailored to the floor plan and the work piece, and did not lend themselves to the stipulation of rigid safety specifications, other than those applicable to standard installations. It was not until the preliminary design had left the drafting board that it could be attacked from the safety angle.

A team composed of process engineering, plant layout, plant engineering, production supervision, and the equipment builder's engineers began the real work of constructive criticism and suggestion. An important part of that work was the detection and removal of potential safety hazards.

This scrutiny continued through the building and the initial tryout on the builder's floor, and through the activating on the factory floor. The safety department then was called in to inspect before and after.

This scrutiny has never ceased. There were no rules. There were only problems on safety that had to be solved, and solved before they turned into traps.

OFF-THE-JOB SAFETY—WHY? HOW? BENEFITS?

(A PANEL DISCUSSION)

(Co-sponsored by Petroleum Section, National Safety Council and American Society of Safety Engineers.)

Presiding: Lee F. Dougan, Senior Safety Engineer, Sinclair Oil and Gas Company, Tulsa, Oklahoma.

Discussion Leader—Thos. J. Berk, Safety Consultant, Metropolitan Life Insurance Co., New York City.

Participants: George A. La Husen, General Safety Supervisor, Crown-Zellerbach Corporation, Portland, Oregon; C. A. Miller, Chief Safety Engineer, The Texas Co., Houston, Texas; D. E. Mumford, Director of Safety, The New York Central System,

New York City; J. S. Queener, Manager, Safety and Fire Protection Div., E. I. Du Pont de Nemours and Co., Inc., Wilmington, Delaware.

Dougan: We are here to learn the fundamentals of off-the-job safety or to enlarge our present knowledge. Off-the-job safety is achieving long-deserved recognition. There will be three phases in today's discussion: (1) Why? (2) How? (3) Benefits. Questions from the audience will be answered by anyone on the panel who would like to answer, and the audience will be asked questions, too.

Berk: Mr. Queener will begin by telling us why we are emphasizing off-the-job safety.

Queener: We have had an off-the-job committee for several years, but have had difficulty in getting industry interested. Only about forty companies are participating actively. Off-the-job safety can lower frequency rates by 30 to 40 per cent. Anyone should want it, apparently, but we have been having trouble selling our gold brick. Maybe it's too good.

There are probably several reasons for the poor interest in off-the-job safety: management is not aware of the problem, people think that off-the-job safety is an invasion of privacy, they think that there is too much record keeping now, some unions are against it, and some safety people, frankly, are not selling it.

The reporting form has now been simplified. It is only one page and it is to be submitted quarterly, not monthly.

Berk: Do you know what happens to our employees the other 16 hours of the day?

La Husen: The story of Roy Campanella is probably the best-publicized off-the-job accident in recent years. His accident, though, is no more tragic than that of the 19-year old in our plant who lost a leg in an off-the-job accident. He had a good college career ahead of him. Then there was a man killed off the job—an employee of ours. He left a 32-year-old widow and six children under ten.

Three hundred and thirty-nine of our employees lost 6,000 man-days and \$70,000 in wages.

Berk: Do you include the entire family on a 24-hour basis?

Miller: Yes. You cannot separate the two if you want to reach your objective.

Question from floor: A cleaning woman in our office (Port of New York Authority) asked me, "Why is the company so interested in our activities when we're away from the job?"

Mumford: In labor relations now we hear the word "paternalism" quite frequently. Well, what's wrong with paternalism? It costs a great deal to train employees nowadays. An employee should be grateful for an employer who takes such an interest in his welfare that it begins to look like paternalism. Even if Roy Campanella had had this tragic accident occur to someone else in his family, it would have affected his ability to turn in a good job, too.

Question from floor: At General Electric we have had many employees hurt by power lawnmowers. It seems to me that manufacturers should advertise how to operate these lawnmowers safely. Why doesn't the National Safety Council encourage these manufacturers and also manufacturers in the do-it-yourself field to advertise for safety? These manufacturers spend millions to advertise merchandise for sale, and nothing to advertise for safety.

Queener: The power lawnmower is certainly the most dangerous piece of machinery around the home. One of our employees, wearing safety shoes, had the flesh taken off his foot behind the toe cap. But why pick on the power lawnmower companies, why not ask distillers, for instance, to encourage their customers to drive safely?

Berk: The question was directed to all products. Let us go on to the next question—what are the sources of off-the-job accident expenses?

Queener: The company has to pay for relief personnel, they have to train substitute employees, equipment is damaged and the product is spoiled by these green workers, additional workloads are placed on supervision, the injured employees, when they first come back to work are not up to their previous standards, accident and health insurance payments are increased, off-the-job injuries account for 10 to 20 per cent of disability wages paid, group life insurance payments are increased, hospital and surgical insurance payments are increased. Besides all these, we might point

parate the
bj. e.
ng woman
(Authority)
so inter-
e're away

ow we hear
requently.
alism? It
yes now-
ful for an
est in his
like pater-
had had
ne else
ected his

Electric
by power
at manu-
operate
doesn't the
ge these
rers in
rise for
millions
ale, and

r is cer-
machin-
nployees,
sh. en
Bui. hy
mpnies,
to en-
fely?

d to all
xt ques-
the-job

pay for
in sub-
ged and
green
aced on
when
not up
nt and
creased,
20 per
up life
hospital
re in-
t point

out the crowded condition of our hospitals these days.

Question from floor: We distribute hunting safety literature—does anyone else here do this? What I'd like to know is—how far do you go? We had a hunting safety campaign but there were these three men who got into a rowboat, started to cross a river, saw a deer trying to swim to the opposite side, and feeling sorry for the creature, lassoed it by the antlers and tried to help it into the boat. The boat capsized and all three men drowned. As I said, we had a hunting safety campaign, but none of us thought of mentioning the hazards of lassoing a deer in the middle of a river. On the whole, though, our hunting safety campaign has been successful. No one has been shot, and for that matter our whole off-the-job safety program has been a success—we have lost no toes to power lawnmowers.

Queener: We can't possibly hope to cover every hazard, but we try to inculcate a safe attitude.

Question from floor: A comment from the panel disturbs me. Should we continue to conceal the names of manufacturers of dangerous equipment?

Queener: Being from a conservative company, I tried to give a conservative answer. For example, we manufacture dynamite and we couldn't deny, even if we wanted to, that dynamite can be dangerous when improperly used. The founder of our company was confident that he could handle it properly, because he built his home just a short distance from the original powder mill. People buy these rotary power mowers because they are cheaper than the reel type.

Berk: We will now try some "how" questions. What is the most important off-the-job activity in the Texas Company?

Miller: We started with a first-aid program. We train and retrain our people every year and we have been doing this for the past 25 years. We have a chart that shows when first aid is up, accidents are down. This chart is such a striking demonstration of the effectiveness of first-aid training that it is used by the American Red Cross. We get the entire family interested.

Berk: Have any of you used a gimmick?

Reply from floor: We had six or seven fatalities from traffic in one year. We now

have a "highway safety audit." We watch how people are driving to and from work. We take the license numbers of poor drivers and have a little off-the-job safety talk with them. We have improved driving attitudes.

Floor: We have a family night twice a year. We get speakers on electrical hazards, fire hazards, bicycle hazards, swimming hazards, and especially electrical hazards at Christmas time. We find this very inexpensive—about \$50 for one night.

Floor: We're in a small town of about 9,000 population. Our safety department started a company-community safety committee. It has four divisions—home, school, traffic, and industrial. It is getting good publicity.

Floor: We had tools from the men's home workshops brought in and safety-checked. We emphasized proper buoyancy equipment for fishing. We had the usual gun safety training for the hunting season, too.

Floor: My company likes a continuing program, such as posters and mailed pamphlets. We had a company attorney who was on a big case. He had a skiing accident, and was laid up for a long time. The company suffered a tremendous loss because he was not able to defend the company in the litigation at the time. With his permission, we used him as an example and found it quite effective.

Floor: Our off-the-job safety program is tied in with the on-the-job. We have had one man concentrating on bonding hazards for over a year. We extend that to off-the-job to the extent of making home instructions. We have lost men to home electrocutions. In one sad case, the survivors pointed to the Underwriters' Laboratories label on a two-conductor cord. They asked us, "What can we do?" Why can't Underwriters' Laboratories' approval be removed from all two-conductor cords?

Mumford: You must understand the purpose of the Underwriters' Laboratories' label. That two-wire cord was adequate for its purpose, but a home drill needs a three-wire cord. Underwriters' Laboratories' tests only for the quality of the product for the purpose for which it was designed.

Floor: I would like to remind the audience that we are on the "how" phase. How

do you convince management—what are the mechanics?

Queener: In a multi-plant company such as ours, we get safety men in various plants interested. We started with a statistical form—a one-half sheet mimeographed form. After they realized what their problem was, the initiative came from the field. We did not have to sell management, they asked us, "What are you doing *this year* to reduce frequency?" Our answer was off-the-job safety.

Question from floor: What can the company do to foster off-the-job safety?

Miller: Tell employees of the hazards. For example, the electrical hazards story. Encourage community activities. In one community the Jaycees had a bike rodeo. They put reflective tape on the bicycles, inspected them, and told the kids how to correct hazardous riding habits. The women of the Sor-Optimists showed safety films to the kids.

Question from floor: How do you find out the nature of the injury on the form?

Queener: We have studiously avoided invasion of privacy. We do not put the employee on the spot. We think this has been a wise policy, because we have had no union complaints in five years of off-the-job program activities.

Floor: Do you send survey results to employees' homes?

Queener: No, but we get off-the-job safety information to the home through magazines and other mailed materials.

Berk: Does anyone in the audience have a form to survey off-the-job injuries?

Floor: The foreman uses our form. It gives the name, how the man was hurt, and how many days he was off. But we found that some places with good on-the-job records had bad off-the-job records.

Floor: Our form has a one-line description of the injury.

Miller: Our form is a modified sick benefit form. I analyze it and make up the report.

Berk: How do you spread off-the-job safety?

Mumford: Many years ago we had off-the-job interest in the National Safety Council, then it died, and we revived it again. Ten years ago no one would have come to this meeting. Even now, we are handicapped by a lack of information. I urge you to lose no opportunity to add to our fund of information on off-the-job safety. To get this movement started, we have had to *force* our way into other safety meetings.

Queener: About the new form—write to Harry Johnson at the National Safety Council for the form and information on about how to use it.

Berk: What are the benefits of an off-the-job safety program?

La Husen: The greatest benefit is in better attitude among the employees. The long-range benefit is this—our employees' children will some day be employees themselves. It is to our advantage to have them come to us with the proper safety attitude learned at home.

Berk: What are the benefits you have received from off-the-job programs other than those it brings to the employee?

Miller: Our ratio was eight to one before. Now we have better union relations. The attitude of the employees is improving. When they learn that the company is spending money on safety, their attitude improves.

Mumford: I saw labor at work at last year's Congress. Those men are looking for answers. At the President's Conference on Occupational Safety in Washington, Victor Reuther made a statement, "Safety is not a matter of codes or compulsions, but a matter of people working together."

Berk: What happens to on-the-job safety when attention is given to off-the-job safety?

Queener: We had reached a plateau, so in 1953 we adopted a comprehensive off-the-job safety statistical form. We broke through, and we are convinced that off-the-job safety did it. Another advantage is that off-the-job safety gives the supervisor a non-controversial matter to take up with workers.

THE GROWING IMPORTANCE OF RECREATIONAL BOATING SAFETY

By ROBERT H. FERGUSON

Asst. Dir., Industrial Relations, Republic Steel Corp., Cleveland, Ohio

This engineering meeting has been called because of the widespread interest in this important subject and so that we might discuss the basic fundamentals of the problem.

Recreational Boating Safety has grown so rapidly that many of us interested in the field were not even conscious of the problems which have developed. When I indicate that the people taking part in and using boats will increase 15 per cent in 1958 and approximately 25 per cent in 1959 and that one American in every twenty-five is now a boat owner, it is just a little difficult to realize the volume of this traffic in recreational waters.

These boats are used by Americans in all walks of life. The fisherman, the yachtsman, the water skier, are only a few to be mentioned. The problem is so great that shipping lanes and channels where the fisherman "wets his line" are often the scene of tragedy when the smaller craft gets involved with the freighter or the passenger boat.

This same statement applies to fresh water as well as salt water and the outboard motor enthusiast while in great numbers is certainly not outdone by the sailing craft and inboard-type recreational vessel.

Most of the persons here this morning realize that we have a problem in recreational waters. This is the first of a series of sessions to be held by the National Safety Council on the subject, and may I predict

that unless drastic action is taken to engineer, educate, setup and enforce safety rules, we will be faced with a problem approaching the one we are now struggling with on the vast highways of this country. I might add that for every two boats sold, there is one trailer.

The boating problem and the spending in relation to it has reached a retail level of more than \$2,000,000,000 in 1957. One of the major, sound credit organizations of this country has set up a separate credit branch to aid in the financing of the purchase of recreational boating equipment.

What has been done concerning water safety for boats? The United States Coast Guard under the direction of Admiral A. C. Richmond, who is with us this morning, has long advocated strict safety rules on the waters. These precautions are indicated not to limit the use of the pleasure craft but to get the individual "know how" and confidence in his boat to eliminate tragedy. We are indeed fortunate to have the splendid leadership of the Coast Guard personnel in this work. The Congress which has just closed passed the Bonner Bill. This is Public Law 85-911 and certainly is a start in the right direction to aid all of us who love the water.

In addition, the United States Coast Guard has proposed "Standards, Rules and Regulations" in an effort to further the educational and engineering work to aid safety.

THE SAFETY ACTIVITIES GOVERNING RECREATIONAL BOATING SAFETY DEVELOPED UNDER THE DIRECTION OF THE UNITED STATES COAST GUARD

By VICE ADMIRAL ALFRED C. RICHMOND
Commandant, U.S. Coast Guard, Washington, D.C.

Safety on our recreational waterways is the result of common sense, courtesy, and education. Whether a motorboat becomes a pleasure or a menace to life and property depends on the manner in which it is maintained and operated.

The Coast Guard, through its facilities and those of the Auxiliary, endeavors to assist boat owners and operators by recommending safe practices for the operation of motorboats. We re-emphasize to the nation's boating public that we are all working toward the same objective—safety.

Only with the help of all concerned can we hope to spread the gospel of self-regulation and common sense, and bring to a halt the growing record of needless death and destruction now attendant on the rapidly increasing family sport of motorboating.

We do not *govern* safety. Common sense, courtesy, and education cannot be governed. However, it must be admitted that safety in pleasure boating can be improved by a proper blending of law enforcement and education, and that both are required tools in any effective safety kit.

The Coast Guard conducts many activities in enforcement and education to promote recreational boating safety. These functions and responsibilities provide that the Coast Guard shall enforce or assist in the enforcement of all applicable Federal laws on the high seas and waters subject to the jurisdiction of the United States; shall administer laws and promulgate and enforce regulations for the promotion of safety of life and property on the high seas and on waters subject to the jurisdiction of the United States covering all matters not specifically delegated by law to some other executive department; and shall provide aids to maritime navigation and rescue facilities for the promotion of safety on and over the high seas and waters subject to the jurisdiction of the United States.

Promoting Safety

As the governmental agency directly concerned with promoting marine safety, the Coast Guard appreciates the contributions other organizations have made in this field. It is evident that individual educational programs have been pursued vigorously and have been expanded each year to accommodate a greater number of the boating public. However, it is also apparent we have reached only a segment of this growing fraternity.

The need to develop a more wide-spread educational program is most pressing. Intensifying existing programs will be a positive contribution. However, coordination of our efforts is a greater need.

The Coast Guard furnishes training films and various publications, such as *Motorboats*, containing information on equipment requirements and regulations; the *Motorboat Safety* pamphlet; *Aids to Navigation* booklet and others. We plan to produce a completely new publication on recreational boating safety this January.

Boat shows are other excellent means for stimulating safe boating education. Every effort is made to participate, with exhibits manned by Coast Guard and Coast Guard Auxiliary members available to answer inquiries and distribute Coast Guard publications. To further spread the word of safe boating, "National Safe Boating Week," was proclaimed this year by the President. The aid given by various boating associations was greatly appreciated and helped in making this new project a successful one.

Recognizing the important problems involved in promoting boating safety, the Secretary of the Treasury sponsored the first National Small Boat Safety Conference in Washington, D. C., December 11-12, 1957. Representatives of 36 industry and boating organizations, boating publications and government agencies attended the Conference which resulted in 19 recommendations for

the promotion of small boat safety. The National Safety Council was an active participant in this Conference, with three representatives attending.

In the Bonner Report on Recreational Boating Safety, comment was made on the "lack of comprehensive knowledge of the extent of fatalities and accidents in the recreational boating fields" and that "accurate and comprehensive statistics regarding boating accidents are almost non-existent." The report stated that the desired statistics must be "accurate," "be agreed upon" and "meet with the approval of all groups concerned with boating safety."

With the enactment of the Federal Boating Act of 1958, needed statistics now can be obtained on a nation-wide basis. This Act, in amending the Motorboat Act of 1940, provides that in the case of collision, accident, or other casualty involving a motorboat, the operator thereof, if the collision, accident or other casualty results in death or injury to any person, or damage to property in excess of \$100, shall file an accident report.

The Coast Guard is authorized and directed to compile, analyze and publish information obtained from such accident reports, together with such findings concerning the causes of such accidents and recommendations for their prevention. There are provisions for the coordination of the accident reporting and statistical programs with states that have adopted uniform systems.

Law Enforcement

The willingness of boatmen to comply with the law has been made clear to us in our daily contact with the boating public. The Coast Guard has found that the number of violations drops off sharply as the public is made aware of the requirements of federal laws for equipment and for safe operating practices.

Our major efforts have normally centered at and near well-established boating areas, where our facilities may be located. However, heretofore unnavigable waters have been improved or new waterways created. These circumstances, together with the industry's development of boats and trailers of improved mobility, have resulted in the creation of new boating centers far from the beaten path.

The Coast Guard recognized the need to service these areas. In addition to its regular

boarding program, mobile boarding teams were organized in recent years. Travelling from one body of water to another, stopping at each but a few days, they were able to stimulate interest in boating regulations and safe practices. The program was well received and is a most effective means of carrying out our law enforcement responsibilities and of providing safety educational material to those outlying areas.

Basic laws affecting recreational boating are the new Federal Boating Act of 1958, the Motorboat Act of 1940, and the Rules of the Road (or "Pilot Rules" as they are more commonly known.)

The Federal Boating Act of 1958 provides for the numbering of certain motorboats and the mandatory reporting of certain accidents. It also provides for the concurrent enforcement by federal and state governments on the navigable waters of the United States.

The Motorboat Act of 1940 places boats in various classes, establishes minimum requirements for safety and lifesaving equipment, and, as currently amended, specifies civil penalties or fines for reckless or negligent operation.

The Pilot Rules set forth various rules for the piloting of boats and vessels to prevent collisions.

These federal laws and regulations are enforced by the Coast Guard throughout the navigable waters of the United States, its territories and possessions.

Facilities, Services

The Coast Guard is responsible for providing aids to navigation and rescue facilities on waters subject to the jurisdiction of the United States. These aids include buoys, lighthouses, light ships, radio beacon stations and Loran stations. In the fiscal year ending June 30, 1958, the Coast Guard maintained some 39,992 of these aids.

Accidents will happen, and in that unhappy event the Coast Guard stands ready to use all of its services, facilities and manpower to search for and rescue survivors. Coast Guard rescue facilities are located throughout the waters of the United States, its territories and possessions. During the fiscal year 1958 the summary of rescue statistics shows about 24,000 assistance cases handled by the Coast Guard, and 2450 lives saved or persons rescued.

Coast Guard Auxiliary

The Coast Guard has since 1939 sponsored a voluntary, non-military organization to promote safety in the maintenance, operation and navigation of small boats. This affiliate is the Coast Guard Auxiliary. It numbers more than 15,800 men and women and functions in 500 communities throughout the continental United States, Alaska, and Hawaii.

It is most actively engaged in two expanding public service programs. During the past year 50,000 persons enrolled in the Auxiliary's three different free public instruction courses. At the same time 68,000 courtesy motorboat examinations of small craft were made at the request of the owners.

Boats meeting the requirements of the law and additional safety standards of the Auxiliary are awarded a decal for the current year. The record indicates a 50 per cent increase in each of these activities for the first six months of this year. In addition, the members patrolled 300 regattas and answered more than 2,200 calls for assistance.

The Auxiliary is a most valued adjunct in the Coast Guard program to arouse the interest of the ever-growing number of new and prospective boatmen in the maritime safety program, and to foster a wider dissemination of boating safety practices among small boat operators.

Promulgating Regulations

Proper blending of law, regulation and education is essential to the achievement of

a maximum safety program. The Federal Boating Act of 1958, the Motorboat Act of 1940, and the laws setting forth the Rules of the Road provide for the establishment of additional regulations by the Secretary of the Department under which the Coast Guard is operating.

The Merchant Marine Council of the Coast Guard is the deliberative body which, after public hearing required by the Administrative Procedure Act, recommends rules and regulations or changes to be prescribed. This process insures that the public will have every consideration and that such laws or regulations will promote safety.

I annually have appointed a Motorboat and Yacht Advisory Panel to the Merchant Marine Council, consisting of representatives of national reputation from industry and boating organizations, to advise me and the Council on boating safety matters.

The Coast Guard has consistently followed a policy of non-interference in matters of construction standards for small pleasure motorboats. We find boats designed by naval architects or built by reputable builders have scantlings adequate for the purpose. There are exceptions.

We have had requests for scantlings from builders, indicating a need for guidance in construction standards. We have in the past and will continue in the future to support industry-sponsored efforts, such as the American Boat and Yacht Council, in developing such standards.

LEGISLATIVE ASPECTS UNDER CONSIDERATION TO PROMOTE SAFETY OF THOSE OPERATING SMALL BOATS

By MRS. GEORGE WELLES, JR.
Governor's Boating Safety Committee, Duluth, Minn.

It might be a good idea in starting to have the record absolutely clear as to my position on this panel.

1. I am just an average boatman operating on inland or state waters.
2. Though I belong to and work with some safety organizations and boating

organizations, such as National Safety Council, St. Louis County Safety Council, American Red Cross (a chairman for water safety), a member of our Minnesota Committee on Boat and Water Safety and U. S. Coast Guard Auxiliary, I do not today represent offi-

cially any of these organizations nor will these remarks of mine necessarily represent the thinking of these groups.

3. I am a fisherman and I am a hunter.

4. I am both a "stinkpotter" and a sailor.

5. All together, our family (my husband and myself and seven children) can count seven boats of all types and sizes.

6. I am not a water skier or skin diver, but my sons are.

7. As a family, we have found both great pleasure and great annoyance coming from boating and boaters. We have strict family rules and regulations and will welcome and abide by sound state laws, because we believe in the need, to increase the pleasure for those using our public waters.

8. Lastly, I have read and studied the testimony in the 1600 published pages of the Bonner Committee hearings throughout the country, which can be fairly said to represent the thinking of the majority of boatmen in the U. S. I am familiar with the Bonner Committee report and the bill itself—Federal Boating Act 1958 or Public Law 85-911.

It is clear that the very rapid rise in the popularity of boating as a family recreation and its abuses has brought about this great interest and demand for some sensible safe boating legislation, both on a federal level and on a state level. The figures put out by the industry itself as estimates of the extent of recreational boating today are astounding.

1. \$1,912,000,000 retail level for boats, motors, equipment, docking, storage, etc.
2. Nearly \$400,000,000 for new boats and motors alone.
3. 35,000,000 persons using our waterways.
4. 7,071,000 recreational craft on all waters—nearly trebled in 10 years.

But, there are several other factors beyond the obvious over-crowding and increasing hazards that have done much to arouse the states' interest in better safe boating legislation. It seems to me that the earliest step forward in this direction was the two Water

Safety Afloat Conferences five years ago, sponsored by OBC, with the American Red Cross as a cooperating organization. At the second one held at Fox Lake, Illinois, four year ago, the delegates who came from 17 states were given OBC's first proposed model boating act and the influence of this was soon seen in several states. Two years later, OBC presented its second model boating act more up-to-date and streamlined, and more states fell into line.

The next great influence on state legislative trends was of course the Bonner Bill (now the Federal Boating Act) which H. I. Richmond has already covered. Looking at this from a state's view, we find this is in fact a "states rights" bill and as such was written with the close cooperation of the Coast Guard and the Council of States Governments. The result is that it tends to give the states wide latitude while promoting uniformity. In effect, it makes possible the return of all waters of a state for numbering purposes including federal waters. There is, of course, a set of standards set up which a state must meet if it is to be allowed to have jurisdiction to number motor boats on all waters. These include:

1. Coordination of state numbering with a national uniform numbering system including uniformity of location and display of numbers.
2. Renewal at least every three years.
3. Pocket size certificate of number.
4. Notice of transfer of ownership.
5. Reporting of accidents systems.
6. 90 day reciprocity on numbered out of state boats.

Another provision which has great appeal to the states is that which makes state law enforceable on the navigable waters of the U. S., as well as on other waters within the states' jurisdiction. Federal law applies here also.

Other parts of the act have to do with administration and enforcement. There are no special safety provisions. However, the Federal Motorboat Act of 1940 contains many safety requirements (though it has been generally agreed this could be brought up to date). When this bill passed Congress finally, we in Minnesota felt that it was definitely in our best interests to accept these standards and incorporate them into our own proposed legislation.

The next big step forward was still another suggested model "State Boat Act" sent to all the states by the Council of State Governments. The purpose of this new model was to assist the states in securing state legislation that would be complementary to the federal legislation. This was set up also with assistance from the Coast Guard.

Briefly, the suggested state act contains these essential provisions:

1. That the numbering of *all* (no 10 L.P. exemption) inboard and outboard boats will be uniform and conform with federal regulations and those standards I mentioned will be met.
2. It provides for safety equipment such as life preservers, lights, ventilating systems, whistles and fire extinguishers to meet C. G. requirements on federal waters. This means naturally that there will be no confusion in requirements taking your boat from state to federal waters. As you can also see, with complete uniformity it will not be necessary to worry about whether you are on federal waters or state—thus neatly sidestepping the problem of definition of "federal waters."
3. Also for the sake of uniformity this suggested state act provides that the state law will govern throughout the territory of a state but will permit a locality having an unusual local problem to apply to the appropriate state agency for special rules and regulations to handle that situation.
4. There are additional requirements included in the state act not covered by the federal law and which have become of great importance recently—that is, water skiing, boat races, tournaments, etc.
5. Also included and of interest to the states is the section on civil liability. The owner is liable only when a boat is used with his express or implied consent (such as being used by any member of the immediate family).
6. The proposed state act uses the term "appropriate state agency" in connection with administration. This was because it was felt there would be some variations in the way a state

chose to handle this. Some might set up a new state agency—others might divide the responsibility among existing state agencies.

Thus, at this point, the states are confronted with a growing demand for sound legislation and the question of how best to proceed. Do we adopt the federal numbering system, do we repeal our present boat laws, if there are any, and start all over or amend existing laws? Shall we use the suggested model act word for word or adapt it to our own?

In my humble opinion, I'd say take your state waters back and accept the federal numbering system and for the sake of uniformity use the suggested state boat act as closely as possible. Look at what a blessing a uniform automobile code throughout the country would be and it is plain that in the years to come we shall see the wisdom of passing *uniform* boat laws today.

For the benefit of those of you who have never gone through the labor pains of giving birth to proposed legislation, let me say that from my own personal experience in my state of Minnesota, I'd rather give birth to twins again than a bill. From now on, I am going to speak specifically about what we in Minnesota are doing, as I am not Fred Lifton, the well informed legislative coordinator from OBC who knows what *all* the states are doing. Sorry he couldn't be here today, but his help to us has been invaluable.

Our committee was fortunate in being called together as an official "Water and Boat Safety Committee of the State of Minnesota" and our primary task was the writing of proposed boat safety legislation. This somewhat official capacity had a tendency to *eliminate* the writing of dozens of "screwball" bills that have a tendency to spring up. This reminds me of one law in the state of Washington I came across as a fine example of what I'm talking about. In the law it actually says "There shall be no squirrelling or burning doughnuts."

Back to Minnesota. Our battles (I mean meetings) were held at the state capitol and, at first glance, the committee appeared to be made up mainly of non-boaters indignantly demanding operators' licenses, limiting speed, limiting distances, limiting horsepower, limiting boat size, limiting age of operators, throw out the water skiers and

let local regulations prevail, and one man who claimed the federal government was stealing the state house. We boatmen opposed all these as some of these demands actually could cause unsafe conditions or were restrictive to boating as a recreation.

I am reminded also of a letter received by Pop. Boating Magazine from a reader on the subject on this type of legislation who ended with "The legislators should listen to practical boatmen down by the water instead of a lot of windbags in the state house." He probably does have a point there, in that the good boatman certainly must be well represented in planning legislation on boat safety.

Well, when the smoke died down, there were representatives also from the industry, boatmen and enforcement groups. A subcommittee was named eventually to actually draft a bill and progress was smoother. After 13 months, the full committee has just approved the proposed bill.

We followed OBC's model act closely. We are still making changes and will incorporate some of the Council of State Government's "State Boat Act" just received. We plan to repeal, not amend.

Here, briefly, are a few highlights of our bill:

1. We have left out the 10 L.P. exemption set up in the Bonner Bill. We feel it is essential to number all if we are really to have a good system of identification. Also, we have included a stipulation that the system must be set up in a central bureau so information on owner identification will be available immediately (and not a week later).

Our equipment requirements follow Coast Guard regulations for federal waters. Also, even fishermen in small boats at night must display a light—or the hunter going out before dawn to his blind. (We don't expect to have everyone love us, but we stuck to our safety ideals.)

Our registration will be handled through the Conservation Department with the Commissioner empowered to set up additional rules and regulations for the purposes of carrying out the Act—such as, inspection of boats for hire, etc.

Enforcement in our case goes to the sheriffs. Also inspection of boats for hire. Those of

us who wished concurrent enforcement with all peace officers in the state lost out here, regretfully. We accepted the standards in the federal bill on numbering, but did not set up the actual scale of fees. However, we have specified 7 classifications of boats for this purpose and fees will be on a graduated scale. Funds will be in a dedicated fund and not the general revenue and it is likely that 50 per cent will go to the sheriffs for enforcement, 30 per cent to go for administration and 20 per cent for public access. You can't blame the sheriffs too much for wanting the entire enforcement when the slice is 50 per cent. We also must consider more public access to the less used lakes to relieve the congestion existing on many others.

We lost out to the group who want local regulations. This was due to a district court ruling in Minnesota to the effect this was legal. The Supreme Court is reviewing this now and there may be a reversal. We are still hopeful to knock out local regulations unless carried out by special dispensation from the Commissioner of Conservation. There are other items, too, but this is enough—it's not perfect—there will always have to be compromises and we will lose some of these provisions in committee, but we will be carrying out the provisions for uniformity.

Alright, so you've written a good bill—"there's many a slip" says the old bromide and how true—between writing it and getting it passed there's a long hard road to travel. Let's face it—you have opposition. It may line up like this:

1. Some resort owners—(usually 2nd raters).
2. Some hunters, fishermen and so-called sportsmen. (Good ones rarely object.)
3. The general "aginner" who knows his "rights" and "this is a free country" and "no one is going to tell me what to do," etc.
4. The legislator, with "influence, who has personal reasons for voting No and beware of the old excuse "My constituents would never go for this." Answer: Just go and sell his constituents.

Now please don't think I am just generally running down legislators. That is

not true, as I have worked on boat safety legislation before with a wonderful group of them who tackled the situation earnestly and worked long and hard to get some good legislation two years ago. Our bill was defeated, however, and as hindsight is always better than foresight, we on the outside learned a lot about what defeated our other bill. We were naive enough to think that a sound bill ran through on its own merits. How wrong we were. Even though we had used OBC's model boating act, we just hadn't learned about opposition.

Right here a word about interim committees. Some hearings in these committees have been most fruitful in eliminating misunderstanding, but not in my experience. The interim committee I met with already had made up their minds and there was no changing them. We were unfair to hunters, fishermen, they generally insinuated. We were unrealistic and didn't know what we were talking about. Most of them have since changed their minds, but the damage was done. Our earlier bill was defeated by three votes and was defeated by what we call the four intangibles, or you might say the "four Horsemen of the Legislature."

1. Ignorance. Too little was known about boat safety and what actually was in our bill so that when introduced late in the session there was little time for study. Therefore, our legislators had to rely on hearsay too often.
2. Misinformation. As an example 50 telegrams were received by 50 legislators when our bill came to a vote recommending NO as the bill was "restrictive to the industry." This was proven false information.
3. Rumor—deliberately spread, usually.
4. Selfishness. The legislator who was a resort owner and was afraid he'd have to put on lights and life preservers on his boats and some legislators who voted against to get even with another legislator.

It doesn't take many of these to lick our many hard working and conscientious lawmakers who are doing their best. Our fault lay in not spending enough time on selling and getting support. We have the advantage this year of the official status, an even greater demand for boating legislation and greater public acceptance.

Before I conclude, we in Minnesota would like to salute some of the other states who are doing a fine job of pioneering in modern boating safety legislation. Just to pick out a handful: Arizona, California, Louisiana, Michigan—(A leader in this field for many years—now building better marinas. Michigan also has set up a new committee to study such important matters as duplicate taxation of watercraft and marine fuels), New York—(Some fine legislation but did include some highly controversial restrictions, vetoed by the governor), Oregon, Rhode Island—(Excellent job), and Wisconsin.

However, three states do have the controversial operator's license and three states do have age limitations. Many still have speed, distance, horsepower limitation. We have opposed all these for the time being as being unenforceable or too restrictive. OBC has now a printed complete digest of all states laws which may be had upon request. It is very helpful.

Now, to those of you who are doing a fine job in this field—congratulations!

To those of you just starting out—remember the value of a state appointed official study committee. Twenty-two states now have.

To the eager beavers—beware of severe restrictions at this time.

Work for uniformity of numbering system, operation, equipment, etc.

Consider water pollution, harbor facilities and public access (possibly in separate bills).

Be prepared to get into politics.

Be willing to get out and sell boat safety. Education in this field is badly needed.

We owe a debt of gratitude to those who have already done so much in the field of education—USCG in training Auxiliarists, U. S. Power Squadron and the Auxiliary for Public Instruction Courses—OBC and the industry itself, American Red Cross for again moving ahead, and National Safety Council. There is a tremendous job ahead of us, if we are to have safe and happy boating in the years ahead.

But remember—a task without a vision is drudgery,

A vision without a task is a dream,

But a vision with a task is victory.

We can do it!

THE PRACTICAL APPLICATION OF SMALL CRAFT REGULATIONS THROUGH SERVICES OF LOCAL SAFETY COUNCIL

By PAUL J. HOOVER

Vice-President, The Halle Bros. Co., Cleveland, Ohio

Many problems relating to boating today are similar to those experienced in motoring 40 years ago. At that time roads were inadequate; proper driver training was almost unheard of; and regulations were only in the discussion stage.

Fortunately, the Coast Guard, Coast Guard Auxiliary, Power Squadron, Red Cross, and other groups have offered to many boat operators the opportunity to learn safe operation of their craft. Without this training, our boat accident and fatality rate would have climbed rapidly in the past decade, as it did in the twenties with the spectacular growth of automobile sales.

Boat accident statistics are difficult to compile, but a recent Outboard Boating Club of America study showed, boating is maintaining its outstanding record as one of the safest of all outdoor sports, in spite of the tremendous growth it has enjoyed. Although the number of outboards in use increased from 2,643,000 in 1949 to 4,740,000 in 1956, serious boating accidents have decreased—1,243 in 1949; 1,237 in 1956.

"The single most important cause of boating accidents is 'operator negligence'—failure to exercise common sense and courtesy afloat. Some 31.7 per cent of the accidents covered in the report fall into this category (overloading, standing, sharp turns at high speed.) Capsizing was the second most important cause, accounting for 28.8 per cent of the reported mishaps. And such factors as swamping by wave, the wake of another boat, windstorm, or rain squall accounted for an additional 15.5 per cent of the accidents."

We constantly read of or witness the carelessness of the new boat operator, who not only endangers his life but those about him. Some 35-million people use a boat once or more annually, and there are more than 7-million boats owned in the United States. It is estimated this figure will double in the next 10 years.

What can we, as safety people, do to keep abreast of this growth of boat operation?

After a rash of boating accidents in Lake Erie a few years ago, the Greater Cleveland Safety Council decided to take action. As Vice President for Public Safety (and a boat owner), I was asked to organize a boat and water safety program.

We of the safety council felt our organization was well suited to act as the coordinating body because:

1. Through our thousands of volunteer workers, we could obtain public support of any boat safety program.

2. We have the means of distributing literature and posters on boat safety through our many divisions covering industrial plants, schools, commercial companies, and private homes.

3. Our close relationship with the press, radio and television provides good publicity coverage.

4. Our constant work with the police departments and public officials in the various municipalities gives us good liaison for quick action at the local level.

5. We have the funds and trained staff to handle the many details in connection with an energetic boat and water safety program.

A meeting was called of representatives of all agencies interested in boating and water safety. These organizations included the United States Coast Guard, Greater Cleveland Boating Association, Cleveland Power Squadron, U. S. Coast Guard Auxiliary, American Red Cross, Cleveland Chamber of Commerce, U. S. Weather Bureau, and the Ohio State Waterways Safety Commission.

This first meeting was not very successful. Each of the agencies felt it had a well-developed and effective program and could see no necessity to coordinate its activities. However, they all admitted that not enough boat operators were exposed to their training

and educational materials. They recognized that need for some form of safe boating regulations was urgent and required quick action.

Finally, after almost three years and many meetings, agreement was reached on the principle of coordination of the eight organizations. A separate division in the safety council was formed for boating and water safety. Walter Liesegang, commander of the Greater Cleveland Boating Association, was named vice president for this division.

Mr. Liesegang and the group he represents—yacht clubs—had been working for some time on boating regulations for the waters adjacent to Cleveland. It is true that the Coast Guard has the authority to enforce federal regulations, and it does a wonderful job, particularly in regard to inspections for required safety equipment. However, there are minor infractions which are difficult to prosecute because of the cost and delays usually found in federal court cases.

The first thing needed was a city ordinance regulating boat operation. The new Boating & Water Safety Division was instrumental in passage of such an ordinance.

The enforcement problem was not so easy. There were no funds in the city treasury available for police patrol boats. A solution was found when Capt. Peterson, operations officer of the Ninth Coast Guard District, offered the use of their patrol boats for local enforcement. Chief Frank Story of the Cleveland Police Department was glad to cooperate and assigned 12 officers on a rotating basis to ride in the Coast Guard boats.

Coast Guard personnel on the boats are advisors and when a violator is spotted, he is questioned by Coast Guard representatives and police officers. If equipment violations are discovered, the boat operator may be cited for that infraction. If a local regulation has been disregarded, the police officer may issue a summons for that violation.

It was realized that wholesale arrests would be unfair, as most boat operators were

unfamiliar with the new regulations. Many thousand copies of the regulations were distributed by Mr. Liesegang and his committee to yacht clubs, boat ramps, dealers, and on the water, before enforcement became active. These new regulations received wide publicity. Thousands of small boat owners immediately applied for their certificates of operation and were almost unanimous in their acceptance of the regulations.

When the first two arrests were made for reckless boat operation, much publicity was given to the cases; the \$50 maximum fine assessed each of the boat operators not only gave them a good lesson in boat safety but undoubtedly had a sobering effect on many other careless and inconsiderate boat operators.

Members of the safety council's Boating and Water Safety Division meet monthly and discuss matters relating to water safety. "National Safe Boating Week" was well organized by this group. Publicity pictures were taken of the committee members with the mayor of Cleveland, when he signed the City of Cleveland "Safe Boating Week" proclamation. Green-cross flags imprinted with "Safe Boating" were distributed and flown at all yacht clubs and other boating docks during this week.

Incidentally, with the rise in popularity of water skiing and skin diving, many accidents have resulted. The Boating and Water Safety Committee invited representatives of the water-ski and skin-diving clubs to meet with it to discuss mutual problems. The first meeting was held in July, and before next summer it is expected many of these problems will be worked out.

It is our feeling that until state and national safety education and enforcement can catch up to the rapidly growing needs in water safety efforts, the local safety organizations must take immediate action. Most communities have the tools with which to work, but as in building a house, each skilled workman must coordinate his job with the others to accomplish the end results.

PROBLEMS OF ADMINISTERING MULTI-PLANT SAFETY PROGRAMS

D. T. MOULD, Safety Director, General Motors Corp., Detroit.

EARL H. STOCKDALE, Accident Prevention Div., Gulf Oil Corp., Pittsburgh, Pa.

C. H. HOOPES, Supvr., Safety & Health Services, Continental Can Co., Inc., Chicago

W. C. MAHLSTEDT, Safety Eng., Continental Baking Co., Rye, N. Y.

L. R. MORRISON, Safety Mgr., A. C. F. Industries, Inc., New York City.

J. E. NICHOLS, Dir. of Safety, Reynolds Metals Co., Richmond, Va.

D. A. PATRICIAN, Staff Administrator, Safety & Accident Prevention, Radio Corp. of America, Camden, N. J.

In this session 114 persons attended. Forty-eight of these represent 1,400 plants and 1,600,000 employees. Fifteen department heads or foremen, plus eight insurance company representatives, were present. Questions and summarized answers follow:

- Q. How many employees should be required to have a full-time safety man? A. Opinions ranged from 1,000 to 2,500.
- Q. Should the safety director have the authority to stop or change an operation? A. Only in an extreme emergency. Such responsibility must be that of the foreman or supervisor in day to day operations.
- Q. Does the safety department also handle fire protection? A. About one-third of those attending indicated it did.
- Q. Does the safety department also handle insurance? A. Only about 10 in attendance so indicated.
- Q. Does the safety department have a budget of its own? A. More than 50 per cent attending indicated it does.
- Q. Is the safety department budget absorbed by others? A. About 20 per cent attending indicated it is.

The majority of those attending were of the opinion that for greater effectiveness, safety should be the responsibility of the manufacturing VP and not personnel or industrial relations. Best results come when the safety man reports to a line and not a staff man.

In locations where up to 150 are employed, the safety representative should be the plant

manager or the person in charge of the operation.

It is costly, wasteful and dangerous when the experience of a company is not shared with all locations. Prompt exchange of information is essential in maintaining quality and effectiveness of multi-plant safety programs.

A majority of those present indicated they presented written accident prevention programs to their plants.

Plant management people must be involved in safety meetings, if the program is to be effective.

Best results come when the safety office is included in planning plant layout, operations. Standards should be drawn up for purchasing. Safety consultation should be sought in design and before action is taken on specific plant changes.

Attention of the safety director should be directed first to problem plants. It is of definite help, when he visits plants periodically. The size of the company determines frequency of his visits.

Several ideas were given regarding awards. Most of the panelists indicated recognition of good performance was essential to the maintenance of interest in the program.

When a local plant decides to do less than the company requires for safety, it is best to provide line management with the facts and have them take the necessary action to correct the situation.

Most multi-plant safety directors are involved only in the investigation of accidents

with serious results. Local plants normally investigate cases and report satisfactorily. Reason for home office participation is to have facts firsthand for answering top management questions.

Major function of the headquarters safety office is to maintain management interest. This is done by collecting data, publishing reports of results, suggesting line management action.

REPORTS AND REPORTING PROCEDURES

By D. T. MOULD

Safety Director, General Motors Corporation, Detroit

D. T. Mould described the program developed during his administration of General Motors' safety program. He stressed their use of ASA Z.16 code in measuring experience.

From information submitted by each plant, monthly reports are prepared and distributed, showing the position of each plant. This position is obtained by adding the position in relation to frequency to the position in relation to severity. Man-hours worked are used in

case of ties, the top spot going to the plant having the greatest exposure.

Attention up the management line is given to the bottom 20 plants and the top 20 plants. Home office safety assistance is given, as demanded, and when the plant record indicates need.

Integrity is maintained through adherence to standards. Promptness of reporting is essential to the success of the program.

THE SAFETY ENGINEER'S MAJOR PROBLEMS

By MYRON L. MILLER

Supervisor of Safety, Westinghouse Electric Corp., East Pittsburgh, Pa.

In an effort to find the safety engineer's major problems, I sent out 170 questionnaires to engineers all over the United States. The response was most gratifying. I received back 137 replies, which represents an 81 per cent return.

The No. 1 problem with the most of you is not a feeling of inadequacy as to your ability, your training, or your skill to deal with the engineering phases of your job. Rather it appears to be an inability to reach and influence people. One of my good friends in our profession summed it up very simply by writing, "My No. 1 problem can be stated by one word—people."

Before looking at the summary, I would like to consider one important aspect of the questionnaire. As you may recall it gave opportunity for you to list your own No. 1

problem before evaluating the 13 suggested sample problems.

Less than five engineers indicated they had a problem of equal or greater importance. It was interesting to note that each of these problems dealt with some phase of education and training. There was one problem statement however, which seemed to place the emphasis a little differently. Here it is:

"To train supervisors in the art of controlling worker safety performance."

We are indebted to our good friend, H. W. Heinrich, for this statement. I consider Mr. Heinrich one of the deans of safety engineering. He is an author and safety engineer of national repute. He has given active leadership to our society for many years, and though retired from one company, is still busy in the field of accident prevention, with

the Uniform Boiler and Pressure Vessel Laws Society Inc. of New York.

Mr. Heinrich refers to the ability to control worker safety performance as an art. This includes not only having a basic knowledge of the fundamentals on safety, but deals more specifically with the science of motivating or influencing human behavior.

Let's examine for a few moments this problem. We must agree that he has struck at the very core of one of our basic problems—that of understanding and being able to control human behavior.

Safety engineers accept quite generally the findings of the statistician—the majority of accidents result from human failure rather than from material failure. We are fully aware of the importance of safe working conditions and believe that effective safety programs must be premised on good control of work surroundings. However, after we have put our houses in order, there is no assurance that accidents will stop. In fact, the job is only begun. Our big task is to motivate safe workmanship.

Before a foreman or supervisor can instruct a workman in a safe work practice, he himself, must be fully familiar with the safe procedure. To do this requires some form of job safety analysis, to establish both the protective requirements for the job and the specific precautions to be followed.

Once the front line supervisor has determined the safe practices necessary to do the job, he must know how to teach this information to others. This requires a special skill known best to the training experts. I feel sure our professor friends from the colleges and universities can be of assistance here.

Mr. Heinrich's problem implies a skill beyond that of knowing and imparting information. It implies an ability to convince or motivate action. Mr. Heinrich calls it an art. We will touch briefly on motivation when we discuss this subject later in our study.

In answering the questionnaire, many of you sent in problems which I have compiled into a digest. There were almost 50 problems which I have grouped under seven categories as follows:

1. Self development
2. Professional status

3. Education and training
4. Skills and procedures
5. Promotion—selling safety
6. Attitude
7. Communication

I regret that time will not permit a discussion of all of your problems at this time. We will touch on some of them as they relate to your major problem selections.

I asked in my questionnaire letter for a numerical evaluation of 13 selected problems. I asked you to arrange them in the order of importance to you. Your replies have been summarized. Rather than attempt to deal with your selections individually, I chose to arrange them in their order of importance by taking the top 25 per cent of the total of the 1st, 2nd, and 3rd choices. Using this method of selection, the problem having received the largest number of choices was considered the No. 1 problem, etc. Here is the result:

1. To motivate supervisors to carry out their safety responsibilities.
2. To interest top management in accident prevention.
3. To establish good safety attitudes among workmen.
4. To set up an effective safety organization.
5. To find college courses to meet the needs of the safety engineer.
6. To secure trained safety engineers.
7. To train workmen on job safety.
8. To analyze and evaluate my own safety program.
9. To establish realistic accident costs.
10. To make a job safety analysis.
11. To use and evaluate significant statistics.

1. Motivate supervisors—Ninety-one safety engineers placed "motivating supervisors to carry out their safety responsibilities" in the top 25 per cent of their problems. Only 10 said it was no problem.

We are competing for a portion of the supervisor's time. For example, we know the front line supervisor has responsibilities almost too numerous to mention—production, quality control, work schedules, time and payroll, tooling, budget control, industrial relations, planning an efficient operation and

a multitude of others, to include accident prevention.

Because the front line supervisor is so important in controlling accidents, it is imperative that he discharge his safety responsibilities. Supervisors are human beings. They do not want accidents. They cooperate willingly and some cooperate enthusiastically with the safety program without particular motivation. In general, however, they reflect the emphasis of top management.

Motivation may be accomplished in various ways, but in my way of thinking there are three considerations which will get good results. You may have a better plan. I prefer this one.

1. The front line supervisor's responsibility for accident prevention must be clearly defined by his manager.
2. The front line supervisor must be trained to carry out his responsibility.
3. The front line supervisor must be required to make a regular accounting to his manager in the discharge of his responsibility.

This may sound rather blunt, but it works.

A few years ago one manager in our plant passed down instructions that each job in his department was to be studied and analysed by the immediate supervisor. The hazards were to be listed. The safety equipment was to be noted. The safe work practices were to be established. All workmen in the department were to be briefed in accordance with this analysis. All new men were to be instructed before they started on the job.

The job safety cards which were developed from the studies, were to be used monthly as the basis to talk to each man in the department. A record of these talks was required to be turned over to the general foreman monthly. At the end of the quarter, the reports were passed on to the superintendent who reviewed them and sent them to the manager's office. Each time a workman was disabled by accident, the foreman was to place a complete report on the manager's desk before the end of that shift.

This program resulted in a very marked improvement in the attitude of the foreman toward his safety responsibility. He was fully aware that he was responsible for the safety of the men working under him, and his boss wanted to be kept advised how things were progressing safety-wise.

You may have all kinds of interesting gimmicks and safety training courses, but if you want to get results, it is necessary to have top management make crystal clear its safety requirements of the line supervisor.

2. Top management interest—While 76 safety engineers rated this problem in the upper 25 per cent in importance, there were 23 engineers who stated they had no problem to keep top management interested. If time permitted, it would be very helpful to have these 23 tell us the methods they use to maintain top management's interest.

I was surprised at the number who indicated this to be their No. 1 problem. I will agree that top management needs to be kept informed. I will agree safety engineers must compete for a rightful share of top management's attention and consideration. I will agree that we do not always get what we ask for, and sometimes it appears we get neither "appreciation" nor "appropriation." I will not agree, however, that they are disinterested.

I hesitate to make an assumption, for fear of misinterpreting the intention of your answers. I wish it were possible to have all you who consider this to be your No. 1 problem to state your point of view. I wish time permitted us to sit down with those who do not consider it a problem and exchange thoughts.

May I venture a guess that some of the difficulty is not a lack of top management's interest but rather a lack of effective communication between us and top management. Fundamentally I feel top management is interested in accident prevention because accidents not only represent human suffering, but are profit detractors. I feel we as safety engineers can improve on our means of communication and our methods to stimulate more active top management interest.

Realizing the position of our top management people, we can hardly expect them to do the job they are paying supervisors and safety engineers to do. Fortunate is the supervisor or safety engineer who has top management's active interest to the extent that they participate personally in the accident prevention program.

Top management is held responsible by the stockholders to operate a successful business. The measure of top management's success is shown in the profit statement, return

sting gim-
bur you
y have
its safety
or.

While 76
m in the
here were
no prob-
rested. If
helpful to
they use
rest.

who indi-
m. I will
to be kept
eers must
manage-
I will
what we
s we get
piation."
are dis-

for fear
your an-
have all
a. l prob-
wish time
who do
exchange

ie r the
ge s
ive com-
ment.
nt is in-
use acci-
uffering,
as safety
of com-
stimulate

manage-
them to
sors and
is the
has top
extent
he acci-

sible by
ful busi-
at's suc-
return

on invested capital, growth and expansion of the business, public acceptance, a smooth operating and progressive organization, good employee and good community relations and a number of other measurements.

As safety engineers we must compete for the attention and financial backing of our programs with problems of marketing, production, quality control, engineering development, advertising, customer relations, budget and finance and a host of others. If we are to break through this competition barrier to secure a deserved share of attention, we need to learn to talk the language top management understands.

Are we exhausting every possible avenue to interpret our function as one of controlling a definite profit detractor? Have we been successful in telling top management that our job deals with the quality control of the human factor in the business? Have we got across to top management, when we speak of accident prevention, we really mean preventing the incident which results in delaying a shipment, losing a customer, breaking a machine tool and damaging a product: or have we been satisfied just to tell the story of the man who was struck by a flying particle and lost two days' work? Are we guilty of under-selling our product?

Do we provide top management a quarterly statement showing the dollar and cents losses in compensation, medical, and hospital expenses? Do we place before him the other money losses which accompany these incidents? Have we ever tried to interpret our lost-time reports in terms of profit detractors? Have we pointed out to top management the results of our accident prevention program in terms of units of product saved and profit made?

Have we made any effort to dramatize customer relations, employee tension and adverse public opinion which accompanies poor safety performance?

I am sure we will gain the attention of top management just as soon as we start evaluating our accident prevention program and our performance in terms of profit adders and profit detractors.

In saying this, I do not intend to infer that the human aspects of accidents are unimportant and of no consequence to top management. In fact I have found this to be quite the contrary. All top management men are

human beings. It makes no difference whether they work side by side with a man in the shop or whether they are separated by an office door. They are concerned and distressed when a fellow human being is involved in a serious accident.

If the only losses of accidents were expressed in human suffering, I am sure our top management would support our safety programs: however, why do we depend entirely on the humanistic approach? Why do we not try using some of the language which top management is concerned with every day? Why not express your program in terms of profit adders, and cover all aspects of the physical gains which accrue from a good well-engineered accident prevention program.

3. *Establish worker safety attitudes*—Attitudes have a great influence on the actions of people. I like to think of an attitude as that state of mind which determines how a person will react to a given situation. This is probably an over simplification of the definition: however, it will serve my purpose. A good safety attitude is like a safety valve in a boiler. It acts as a silent watchman to control a man's actions.

We are told that attitudes are affected by education and training, physical or mental conditions, religion, political beliefs, books, friends and associates, home, work experiences,—in fact every exposure to one's environment. While well established wrong attitudes are difficult to correct, they can be changed through proper persuasive methods.

Good safety attitudes must be cultivated. The foreman plays an important role in shaping employee attitudes. Most people are receptive to suggestions supported by sound reasoning. Most workmen will do as they are expected when they respect the foreman. Most workmen are influenced favorably by good example.

If the foreman expects people to conform to company policies and company regulations, he must let it be known by word and action what he wants. For example, if he wants his people to wear eye protection, he must first tell them what he wants, give them sound reasons why, demonstrate his convictions by wearing eye protection personally, and permit no exceptions either in himself, other management personnel, or other employees. He must be persistent and consistent, but patient.

What are some of the ways a foreman can use to build good attitudes? Unfortunately one of the best ways to teach a safety lesson is through experience. Those who have lost eyes are convinced that goggles must be worn. Those who have lost fingers will tell you to use punch press guards. Those who have lost a loved one in an automobile accident will tell you not to speed.

One of the most enthusiastic safety engineers it has been my privilege to work with was a fellow who lost his brother in a shop accident. He seemed to have a personal stake in accident prevention. To him it was a part of his way of life. He practiced the golden rule. He believed he was his brother's keeper.

A foreman cannot let his people learn to be safety-minded through personal experience. Education of this type is costly and painful, seasoned with blood and tears.

A foreman can tell a story: how well do I remember a young fellow studying for a musical career at C.I.T. He had outstanding talent as a violin player. The summer of his junior year he took a job as a press operator in one of our valley industries. His career was ended when he cut off two fingers on his left hand.

There is the financial appeal. Workmen's compensation will not pay the bills. A crippled man is dead weight on his family and society. No normal red-blooded man wants to be a charge on society. He is financially better off to be working. Safe practices will help keep him on the job.

A foreman can do a selling job. Sales are made by convincing people that the benefits of working safely are many. The losses of having an accident are great. When a supervisor associates man's basic wants with the security of safety, he has a sound motivator and attitude builder. If he can thoroughly convince a workman that safe workmanship will give him the things he wants and unsafe workmanship will destroy, or take away his security and wreck his future plans, he has one of the strongest motivators known.

Most of us will agree that attitude plays a very important part in our program and it behooves us as safety engineers to make sure that every one concerned with safety develops a healthy attitude toward accident prevention. This imposes an obligation on us, that we must never belittle or minimize

any effort, big or small, which contributes to building sound safety attitudes. Accident prevention is serious business.

4. Effective safety organization—There are various ways to organize people to carry out a safety program. It would be difficult to get agreement on an ideal arrangement to suit every situation. Some of you get good results with a staff type organization, others prefer a more direct approach. Others use a modified line and staff organization.

Many things influence organization—people, product, geography, plant construction and facilities, size of company, services rendered, company policies and other things. Each safety engineer must determine the organization structure best suited to his particular industry.

The arrangement with which I am most familiar and which has proved successful for us at the plant level, has the safety organization reporting to the industrial relations manager and performing a staff advisory service for the line organization. The line organization, from the manager to the front line supervisor is responsible for accident prevention and the safety of the people.

The foreman is the key man in this organization. He is responsible for carrying out the safety policies and has the solid backing of line management. He may secure aid to set up his program or to solve any of his safety problems by calling upon the staff safety organization—the supervisor of safety, the safety engineer, or the safety inspector. Also, the foreman may consult with his line superior on money expenditures and other management consideration. He may appoint workmen to act as safety observers. This gives a three angle approach to the job—line management, staff service, employee help and cooperation.

In this type organization the manager fixes the responsibility for safety in his line personnel. The supervisor of safety meets periodically with the manager to develop safety policies and to give consideration to general problems. The manager passes this information along to his line people. The safety engineer who reports to the safety supervisor, sits in on all regular meetings of the manager's staff and acts as a consultant in matters of accident prevention. The safety inspector attends the safety observer meetings where the foreman acts as the

h contributes
de accident

n—There are
to carry out
difficult to get
ment to suit
get good re-
tation, others
Others use
ization.

ization—peo-
construction
any, services
other things.
etermine the
ited to his

I am most
successful
he safety or-
dustrial rela-
a staff ad-
minization. The
nager to the
ible for acci-
of the people.

in this or-
for carrying
as the solid
e may secure
solve any of
po the staff
for safety,
ty inspector,
with his line
s and other
may appoint
ervers. This
to the job—
mployee help

he manager
y in his line
safety meets
to develop
sideration to
passes this
people. The
the safety
lar meetings
as a consult-
-ent. The
ety observer
acts as the

chairman. The program however is built around the foreman as the key man.

I have found this type of safety organization to be very effective in getting results in our type of industry. As stated before however, the safety organization is dependent upon many different factors. You must study your own industry to decide the type best suited to your needs.

5. *Safety engineering courses*—What are the college courses available to safety engineers to meet their needs? Thirty engineers considered this a major problem.

Clyde Rich of our Northern Ohio chapter writes, "I personally believe that college courses must be established to fit the practical needs of industrial safety engineers." He goes on to say that if we can meet these needs adequately, most of our present problems will be solved.

Homer K. Lambie, member of our national executive committee asks that we define the functions of safety engineering, as a requisite to determine the college course needs.

Joe C. Stennett, also of our national executive committee proposes several questions. "How much need is there for college trained safety engineers? Should safety engineering be taught as a separate course? To what extent can safety be integrated into college engineering courses?"

John V. Grimaldi, former chairman of our committee on cooperation with engineering societies and a present member of our national executive committee asks this question, "What exactly does safety engineering work include and how should a safety engineer go about his job?"

These are excellent questions. Our committee on cooperation with engineering colleges know some of the answers. Also many of our colleges and universities have given attention to the problem. Perhaps our friends from the universities here today will give consideration to some of these questions.

If time permits in our discussion period, I feel sure our able past national president, A.S.S.E., W. N. Cox, Jr., professor of safety and industrial engineering, School of Industrial Engineering, Georgia Institute of Technology, Atlanta, Ga., has engaged in research into the academic needs of the safety engineer and can offer some enlightenment from the university point of view.

Many engineering colleges offer a subject or two in industrial safety. Some colleges have expanded the curriculum to offer more extensive industrial accident prevention training. If you are interested in the colleges which offer safety courses, this information is available from our committee on cooperation with engineering colleges.

6. *Secure trained safety engineers*—John F. Juli, our past national president, writes in substance, "If we could get trained safety engineers well grounded in college courses to meet their needs, the other problems cited in your questionnaire would be pretty well taken care of."

The problem of finding the trained safety engineer rests with the industrial relations manager, the manager of accident prevention services or the staff management representative in charge of plant safety. Where does he turn?

A common practice is to up-grade within the organization. The one selected may or may not have had formal technical training, but usually he is well grounded in manufacturing procedures and job practices. If there is a college in the area that offers night school courses in accident prevention and related subjects, he will be enrolled. He will be scheduled to attend safety conferences and conventions. He will seek-out the local chapter, American Society of Safety Engineers and attend its meetings. Eventually he will seek membership. He will make contact with the local safety council or the National Safety Council and enroll in the basic and advanced courses in accident prevention. He will avail himself of the Safety Council services.

The manager may choose to hire a recent graduate in I.E., M.E., E.E., and bring him into the organization for a year's orientation training. If he has chosen to elect a course in industrial safety while in school, this fact will be to his advantage.

The problem of securing trained safety engineers will be acute until such time as colleges and the safety engineering profession come up with a course of study which meets the needs and skills of the safety engineer.

7. *Train workmen in job safety*—Before workmen can be trained in job safety, two things basically must be known, (A) What

to teach, (B) How to teach. It is up to us as safety engineers to assure ourselves that the first requisite is covered. We can look to our training specialists to furnish us with the method of teaching. In this area our professional men from the colleges and universities can be of help.

The knowledge of what to teach comes through experience and analysis. This implies some sort of job safety study. This study can be as comprehensive and detailed as your accident experience justifies. If you have complete records of all accidents, you can easily pin-point the areas to emphasize.

In simple, a job safety study or job safety analysis means first, a detailed review of the elemental operations of each job, arranged in proper sequence; second, a tabulation of the safe work practices for each operation with the protective devices to be used and the protective clothing to be worn.

As stated before, this study can be as detailed as your experience justifies. You may differ with me, but I believe the job study should be made by the foreman and reviewed by the safety engineer, with the minimum of alterations and refinements. Of course, it should be complete.

It is important that the supervisor making use of this information should understand it well. It should be translated to simple

shop language, when used as a teaching aid to train the workmen in safe work practices.

Time does not permit me to discuss the details of teaching. This is a task for the training expert. As implied by Mr. Heinrich, it is one of the most important jobs. The art of teaching should be mastered by every supervisor and instructor. It is one of the most important, yet probably one of the most neglected sciences. How many supervisors leave to chance or to other workmen the important task of training his employees. We could well afford to spend an entire session on this important subject.

The results of my meager endeavor to pin-point some of your problems lead me to these conclusions:

1. Your overwhelming response indicates the need for a more exhaustive study into the safety engineer's major problems.
2. Problem solutions should be sought from the combined experience of society members and university people.
3. Future conference programs should be devoted to specific problem solutions.
4. A digest of the problems with problem solutions will provide the basis for improvements in our safety engineering courses.

A SAFETY ENGINEER'S MAJOR PROBLEMS

The following is a classified list of problems sent in by 135 safety engineers to supplement those proposed in the questionnaire. While some were cited by two or more engineers, there were no specific problems which stood out as general problems. The classification, however, may be considered indicative of some general needs.

Self Development:

- To develop an effective speaking ability.
- To organize my time most advantageously.
- To get along with people.
- To stimulate safety engineers to take an active part in developing technical papers in the field of accident prevention.
- To motivate initiative and aggressiveness in safety personnel.
- To secure college degree in safety engineering.
- To learn a foreign language to convey safety in foreign operations.

Professional Status:

- To establish professional recognition of safety engineers.
- To influence state registration of safety engineers.
- To define the function of safety engineering.
- To define the job of the safety engineer.
- To place safety engineering properly in the plant organization structure.

Education and Training:

- To train supervisors in the art of influencing worker safe-performance.
- To establish safe work habits.
- To provide basic education in both management and employees safety responsibility.
- To educate shop men in specific subjects, as Workmen's Compensation.
- To approach the subject of accident prevention from the psychological point of view.
- To set up a fire protection training meeting.
- To integrate safety into M.S., C.E., E.E., Chem., Physics and related college courses.
- To establish the requirements for a science degree in safety engineering.
- To integrate safety in M.S., C.E., E.E., Chem., Physics and related college courses.
- To provide at least one semester subject in safety engineering to all graduate engineers.

Skills and Procedures:

- To develop work procedures which are free of accident hazards.
- To improve my accident investigation procedure.
- To find a test to screen out potential accident repeaters.
- To find a uniform measuring stick to properly evaluate safety performance.
- To furnish the Supervisor with "tools" to carry-out his safety responsibilities.
- To set up a preventive maintenance program.

Promotion—Motivation—Selling Safety:

- To develop new incentives, contests, and gimmicks.
- To stimulate top Management to take an active roll in Accident Prevention.
- To get top Management to impress front line Supervisors with the importance of Accident Prevention.
- To elevate Safety to equal status with Production.
- To convince the Engineering Profession of the need for Special Engineering Training in the field of Accident Prevention.
- To develop a rating system to measure a Foreman's Safety Performance and incorporate it into the salary and bonus plan.
- To get others to take an active part in Accident Prevention.
- To influence Design Engineers to integrate Safety into operations and equipment.

Attitude:

- To develop a spirit of cooperation, rather than antagonism, when one employee tries to correct another.
- To stimulate an interest in non-paid Safety Meetings.
- To sell employees on the use of protective equipment.
- To get workmen to report promptly for treatment of minor injuries.
- To maintain good Labor Relations.
- To prevent panic in severe accidents or near disasters.

Communication:

- To get better communication on accidents as they happen and the preventive measures taken.
- To establish good communications up and down the line.
- To coordinate the safety effort in 49 plant locations.

SAFETY EDUCATION BY INTEGRATION OR SPECIALIZATION

By G. I. CAMBRE

Associate Professor, Mechanical Engineering, Louisiana State University
Baton Rouge, La.

Let us begin this discussion by progressing from a study previously made on the subject of safety education by studying the report of the National Conference on Safety Education by Colleges and Universities (Nov., 1950), by the National Commission on Education of the National Education Association in which it states: "In consequence the whole emphasis of the National Commission on Safety Education and other groups is upon the key word *safety*: Upon prevention of damage and death rather than upon alleviation after damage and death have come."

(From the foreword of above report.)

Dr. Raymond Walters, president of the University of Cincinnati, and conference chairman said in part:

"The National Conference on Safety Education by Colleges and Universities was

held to enable representatives of such institutions to explore plans for more effective contributions to safety, in working and leisure activities of our people. The widespread expression of need for such a nationwide conference came from leaders in higher education as well as from outstanding representatives of government, business, labor, industry and school systems.

"As a working basis for the conference, the ultimate goals of *Safety Education by Colleges and Universities* were interpreted thus: (a) to educate those within their sphere of influence to an understanding that safety is an integral part of intelligent living and working; (b) to develop specialists and leaders in certain specific phases of safety education and accident prevention and (c) to establish and maintain a safe campus environment for students, faculty

and staff, and to encourage their habitual use of safe practices.

"In the three day meeting at the University of Maryland, the planning committee concluded that the conference should concern itself primarily with the following areas of college and university work: liberal arts education, teacher education, engineering education, agricultural education, university extension and services, and college and community living."

The panel speakers at the conference observed that the colleges and universities have not sufficiently emphasized safety, and that a large part of the knowledge of safe practices possessed by their graduates has been acquired *after* they left college. The panel speakers expressed the belief that our institutions of higher education should attempt to give a better safety background to all their students and should strive to indoctrinate them in the ideals of safety, and that textbook publishers should be informed of the need to incorporate specific areas of safety relating to the subject matter in their texts.

In discussing the relative merits of safety education by integration or specialization, let me state here that in order to develop specialists and leaders in certain phases of safety education and accident prevention as set forth as one of the goals of the National Commission on Education of the National Education Association, this must be done by special courses. I don't think anyone will argue that point. However, where safety by integration is taught, the specialist-to-be will have been indoctrinated in safety before he begins his specialization and too, this indoctrination may possibly have motivated him to specialize in safety.

I feel however, that the other goal set by the National Commission of Education "to educate those within their sphere of influence to an understanding that safety is an integral part of intelligent living and working" is the facet that needs discussion at this time.

Many institutions are on record as teaching safety by integration. In far too many cases this is a *statement* and not a *fact*. This is so probably because of the difficulty of making teaching safety by integration a *fact*.

The motivation to integrate appropriate safety principles and fundamentals comes only *after* one has at least developed a limited awareness and understanding of accident prevention possibilities, and far too often those who are in position to teach safety by integration in his discipline are too untrained to even visualize the facets of safety and accident prevention other than that which is only too obvious.

Perhaps we should at this point define safety, which involves much more than just accident prevention. "Safety means more than accident prevention—it means, also, conservation of all that goes into making life worthwhile; health, opportunity and the material resources upon which life itself depends. Safety is the opposite of waste."

What is needed in order that safety taught by integration may be effective?

1. That engineering text books be so written as to make the student analyze the need for safety considerations in each and every phase of every subject in his engineering curricula.

2. That some problems at the end of each chapter include one or more that specifically requires the student to consider the safety aspect of the subject.

3. That the humanistic and social studies required of the student also include the study of safety as applicable to that particular subject.

4. That the college or university authorities be sold on the need for safety being taught to all students and that academic deans make it known to all parties concerned that safety must be taught as applicable for each subject.

5. That all existing faculty be introduced formally to the need for teaching safety by an organized institute or seminar.

6. That each newly employed faculty member be indoctrinated in the need for teaching safety as appropriate for his specialty as soon as he is employed.

7. That annual regional seminars be held on teaching safety by integration and heads of colleges and universities be annually invited to send participants to these conferences.

8. That a one day conference be held annually for college heads on the same subject since they are the ones whose

interest and cooperation are necessary for the program to be successful.

Let us now consider teaching safety by specialization. This can be done by separate safety courses in the various curricula. If we are to be guided by the planning committee of the National Conference on Safety Education by Colleges and Universities, this would include liberal arts education, teacher education, engineering, and agriculture education.

For some of these disciplines this would include health and physical education, while in others it would include safety engineering in its many phases.

In order to make these courses effective, there is a need for a well prepared outline such as is prepared by the American Society of Safety Engineers in "Industrial Safety for Engineering Students." This outline is complete as to appropriate notes from which to teach as well as the sources from which this information has been obtained, chapter by chapter, and can be easily followed by anyone who is given the responsibility for teaching such a course. In studying these references the teacher can become very proficient in the subject in a short period of time.

Of course there remains the problem of fitting the separate course into a crowded curriculum—but the purpose of education is to prepare one for his role of service to our society in his chosen field and if he does not learn while he is a learner, to use

his acquired knowledge safely and thereby efficiently he may become a casualty himself before he can put his other acquired knowledge into practice or will misapply his other knowledge through his lack of knowledge of safety fundamentals.

Therefore whatever time is required to teach him these fundamentals will be worth while since it will tend to assure proper usage of this overall education.

College and university authorities would probably fit a special course in each discipline if the various industries were to realize the need for every graduate they hire having learned these fundamentals before being trained and assigned to their respective positions in industry, rather than learn these fundamentals piece-meal through the tough road of experience and demand that fundamentals of safety be taught in colleges and universities.

Since the writer has been teaching such a course for the past ten years at the senior level, it is my firm conviction that in each discipline a special course should be offered and in addition to the special courses an attempt be made to put into practice those suggestions above relative to teaching safety by integration, and that in every case the employment of safety instruction by specialization be accomplished first, since it is a direct approach and can assure positive results. Then relentlessly work toward the teaching of safety by integration to complete the requirements of the best possible safety education in college and universities.

REMOVING A BLIND SPOT IN ENGINEERING EDUCATION

By THOMAS H. ROCKWELL

Assistant Professor, Industrial Engineering Department, The Ohio State University

As a result of this new missile era and the need for technological supremacy, higher education in this country has been placed under greater scrutiny. Many indictments have been leveled against present engineering education. Some insist on more mathematics—others decry the lack of humanities and the engineer's shortcomings in oral and written communication.

However justified these charges may be, those of us concerned with safety engineering believe that many engineering graduates are deficient on another score which we might call the responsibility for the safeguarding of human life. In effect, this deficiency reflects itself in an unawareness of safety considerations in engineering functions. It is this lack of safety consciousness

that I term a "blind spot" in engineering education.

Fortunately, this blind spot is not a permanent disability of the student. Its treatment, which requires the efforts of both educators and practicing safety engineers, consists of an adaptation to sound safety philosophy and the illumination of safety engineering principles.

I would like to direct my comments to safety for engineers in general, not safety for safety engineers. I'm convinced that safety engineers cannot be made in the classroom, but rather must be forged from actual experience in the field. Thus, I'm referring to the chemical, mechanical, electrical, civil, and industrial engineering student who will indirectly be concerned with safety in his work.

Let me describe this blind spot by discussing some of its characteristics which I have observed in both my own undergraduate training and industrial experience, and have noted in fifth year engineering students. There is a prevailing attitude which is antecedent to these characteristics.

I'm afraid most engineering students cannot be considered humanitarian oriented. In fact, their training has emphasized efficient and economic design and has instilled a rugged individualistic aspect in their thinking that is reflected in such convictions as: (1) it is primarily up to the operator to protect himself from accidents; (2) accidents happen to those who take chances; (3) safety in design is obvious to any engineer; (4) safe design is often unwarranted because it is too expensive.

This attitude is manifested on the part of the student by his

1. failure to incorporate safe features into engineering design, such as not providing the operator with adequate control of his equipment, safety interlocks, guards or protective equipment;
2. design of man-machine systems which necessitate risk-taking on the part of the operator;
3. ignorance of the storehouse of sound and safe engineering practice found in the state and American Standards Association codes;
4. lack of human engineering considerations which result in designs which

fail to make use of data on the operator's capabilities and body dimensions;

5. underestimation of the true consequences of accidents, dollar-wise;
5. failure to relate the effect of environmental conditions on operator safety;
7. inability to anticipate the safety implications of a design.

These represent some of the more outstanding characteristics of this "blind spot." Doubtless others could be added and the ones above expounded upon. Those who have worked with the neophyte engineer may certainly recognize some of these characteristics.

The important aspect of this to my mind is that they are the product of the engineer's orientation in college. The solution to this problem lies in making the engineering student aware of the fact that safety is *his responsibility* and is just as important as other criteria of good engineering practice, such as economy, service life, efficiency, output and so forth.

Too seldom is the engineering graduate reminded that his professional stature implies a service to mankind, an obligation not just to raise the standard of living, but to enable people to enjoy it.

In considering the reorientation of the student engineer for the purpose of creating a safety awareness, I think we should distinguish between what is required and how it is to be achieved. Some aspects of safety belong properly in a thorough integration in all engineering courses, particularly in laboratory courses; other safety material can be best incorporated in the framework of specific courses in safety engineering.

On one hand, safety consciousness can be developed by bringing it into consideration in several phases of engineering training, such as machine design courses, electrical engineering labs, etc. This will be successful only with whole-hearted support of engineering faculty members, however.

On the other hand, it is desirable to acquaint the student with principles of human engineering, control of industrial hygiene hazards, and other material which is difficult to introduce outside of specialized courses. It is not my purpose to attempt to resolve the question of integration versus

specialization of safety material in engineering curricula.

My own experience has been that many safety requirements in engineering can only be properly developed within the framework of a unified course. Some of these requirements would be a knowledge of workmen's compensation laws, a realization of the costs of accidents, an understanding of what safety codes are available, how they can be obtained and their general content, principles of guard design, an understanding of the mechanism behind accidents and the complex interaction of environment and behavior in accident causation, and basic information on occupational diseases and industrial hygiene hazards. For example, in this atomic age our engineers will be working more and more with radioactive materials and must have a minimum knowledge of the measurement and control of ionizing radiation.

These are just a few of the knowledge requirements which ideally the graduate engineer should possess. However, we must realize that some compromise is needed between what the engineer should know and what we can realistically expect him to know in light of curriculum restraints. Engineering curricula is becoming more and more crowded. The trend towards greater specialization coupled with a countermove to include more humanities has resulted in compression, reduction and re-alignment of traditional course material.

Each course in curriculum reorganization must be clearly justified. We must accept the fact that safety engineering education per se is not universally accepted today by engineering educators, nor is it found in recommended curriculum suggested by The American Society for Engineering Education.

Unless such groups as the American Society of Safety Engineers or the National Safety Council can exert more influence on university faculty members, I fear that when curriculum pruning begins, courses in safety will be among the first to go. This will mean that if safety is to be a part of the engineer's training, it must be more than something the engineer can "pick up on the side."

Industry, which ultimately sets the requirements for engineering training, must

voice its demand for safety engineering education and acquaint such groups as the American Society for Engineering Education. In light of the general squeeze on hours devoted to education in safety it becomes more and more important that safety educators make effective use of their allotted time. The case study approach described below may be one method of removing the safety blind spot.

One last point in this regard concerns the general atmosphere in which safety is to be introduced to the student. It is not sufficient to expound upon the "do's and don'ts" of safety engineering design. A "thou shalt not" approach is doomed to failure. A positive position is necessary, especially when one recognizes the typical resistance to safety exhibited by our present day engineering student. Moreover, it should be emphasized that safety is not just the simple construction of guards. Accidents are extremely complex phenomena and require intensified effort for their elimination. I shall never forget the demoralizing blow in one of my classes when a guest safety engineer from industry blithely announced that the primary attributes of a safety engineer are "a winning personality and common sense."

I would like to make a few comments on the methods of safety instruction for two reasons. First, the basic problem I have found in safety education for engineers is motivation. Although motivation is a continual problem in education, it is perhaps more acute in safety because of the previously mentioned student preconceptions that must be overcome. In this case the method of instruction will greatly influence the student's reception to the course. Second, in considering methods we can see how the practicing safety engineer and educator can effectively "team up" for safety. Where possible, an emphasis on safety in all facets of engineering education is of a prime importance.

However, the difficulties in safety by integration and the complexity of the accident problem require us to consider methods of instruction in a unified safety engineering course. Here we can take several basic approaches. The teacher can lecture and demonstrate safety principles, or have the student solve safety problems. All are necessary to an extent.

One procedure that I've adopted which has had gratifying results is the use of the case study approach. By this mechanism (especially in the form of group action), it is possible to generate interest on the part of the student, allow him the fullest extent of his ingenuity, and thus increase the effectiveness of instruction. Moreover, in the case study method, the student is dealing with reality where there are several possible solutions to the problem, depending upon the dollars available for its accomplishment.

Many aspects of the engineer's role in accident prevention cannot be taught by professorial proclamations since generalizations must be made at the expense of conciseness. Rather than lecture on the "do's and don'ts" of plant layout and its effect on safe operation, it is usually far more effective if a specific problem is given to the student involving an accident precipitated by poor plant layout considerations.

In the case study approach, I usually have a team of engineers tackle an accident situation or a potential one. The team spends an hour reporting and justifying their results to the class, which takes the part of management and labor. The class, I might add, may or may not be safety-inclined and often will ask penetrating questions of those presenting the case.

In each case attention is given to cost considerations, legal positions in light of workmen's compensation laws, soundness of engineering design, relation to existing codes, industrial hygiene hazards (where appropriate), implementation of proposed solutions, etc. In many instances the case is used to introduce subsequent lecture material. Also, the case study team is often expected to present material which management would not be expected to know. For example, in discussing a control system for radioactive material, a short discussion on the methods of detection of ionizing radiation would be required.

By far the most difficult task for the instructor in using this method of teaching is finding realistic and appropriate case study material. Hypothetical accident situations lack the realism of actual cases and hence fail to achieve one of the primary aims of the case study method, namely, the generation of student interest. This is where practicing safety engineers can help.

To date I've received some fine support from many local industries in supplying cases from their files. These are then usually reworded to avoid any reference to the supporting company and edited to insure maximum discussion value. Controversial issues, such as chargeable costs of an accident, are not dodged—in fact, they are often inserted to force the safety team to take a position. At present nine cases are used each quarter, each one emphasizing a different facet of safety—such as the legal position of accident victim claimants, cost considerations, equipment guard design, use of radioactive materials, etc.

Unfortunately, good industrial cases are difficult to find, especially those involving actual *engineering* design. However, I'm sure that with a little investigation most safety engineers can recall past cases which typify the kind of problems an engineer would meet in his work. I'm convinced that a case study text on the role of safety engineering in accident prevention sponsored by the American Society of Safety Engineers would be a real contribution to safety education.

We can't make safety engineers out of all our graduating engineers, but we can make them all safety conscious. The primary task is to sufficiently impress upon our students the need for safety considerations in their engineering work. Then we can rely on the student's engineering capabilities and his personal moral code to insure his designing safety into the job. We must make the most of the few hours allotted to safety in the engineer's education.

The case study approach possesses many favorable advantages over traditional lecture methods. It considers safety problems in a total framework including engineering, financial, legal and moral implications. Most important, the realism of the cases does much to overcome the lack of interest typically demonstrated by engineering students.

This is a joint task for the practicing safety engineer and the educator. The engineer can provide the basic problems needed for the cases. With this help the educator can turn out safety-oriented engineers who, by designing safety into the job, can substantially lessen the burden on those charged with the responsibility for safety.

OXYGEN—RESUSCITATION, WHEN, WHY AND HOW

By RALPH E. De FOREST, M.D.

Secretary, Council on Medical Physics, American Medical Association

The when, why, and how of resuscitation and oxygen use involves a consideration of basic physiological principles and their therapeutic implications. Without attempting to go into detail, these principles and implications will be outlined and briefly explained.

How much oxygen is used by a normal adult seated comfortably in a chair? The answer is 300 cc per minute. And in so doing, this adult must inhale around 7,000 cc of air during the one-minute time interval. Since 20 per cent of this air is oxygen (i.e., 1,400 cc), it is readily apparent that the greater portion of the oxygen inhaled is also exhaled (i.e., 1,100 cc) and is not consumed.¹ Whereas *inhalation* provides the important function of bringing oxygen into the lungs, it must be kept in mind that *exhalation* provides the equally important function of *rid*ding the body of excess amounts of carbon dioxide. During normal respiration, breathing will saturate the blood with oxygen to the extent of 97.5 per cent to 98 per cent of its oxygen carrying capacity.

If the normal adult were now to breathe air consisting of 40 per cent oxygen and 60 per cent nitrogen, the oxygen concentration per 100 cc of arterial blood is increased by 0.9 cc. This increase per 100 cc of blood occurs as follows: An increase of 0.5 cc oxygen carried by the hemoglobin (thereby saturating the hemoglobin); and an increase of 0.4 cc oxygen dissolved in plasma.

On the other hand, if this adult were next to breathe air consisting of oxygen only, the increase of 0.4 cc oxygen already obtained in plasma is augmented by an additional 0.7 cc to give a total of 1.1 cc. However, no increase in oxygen bound to the hemoglobin can be expected because the hemoglobin was already saturated by breathing the air consisting of 40 per cent oxygen. Thus, in a normal person the total oxygen concentration of arterial blood can be increased by little over 2 cc per 100 cc of blood.²

Thus, it can readily be appreciated that a normal, adequately breathing person can ob-

tain only negligible benefits from breathing air composed of oxygen concentrations greater than ordinarily present. Any person capable of normal breathing can obtain the necessary oxygen to meet body needs simply by increasing the rate and depth of respiration. The respiratory mechanism is capable of a wide range of accommodation.

For instance, a person walking at a rate of four miles an hour will breathe 26,000 cc of air per minute and will extract from this amount 1,200 cc of oxygen.³ This represents a 400 per cent increase in oxygen consumption when compared to the resting adult mentioned above. Obviously, if the victim of an emergency situation can be induced to breathe deeply and rapidly, an abundant supply of oxygen is provided.

The various manual as well as mouth-to-mouth methods of artificial respiration provide pulmonary ventilation with ordinary air, and they can be most effective in sustaining life and providing an adequate blood-oxygen saturation without additional oxygen in the inhaled air. However, when it is difficult to maintain adequate blood-oxygen saturation for some other reason, the addition of oxygen to the air inhaled has a real and significant therapeutic value.

Although obviously not essential in an emergency situation, it is highly desirable that oxygen which is administered over long periods of time be humidified before being administered.

Failure of a person to receive an adequate supply of oxygen for any reason at all is called hypoxia. As a rule, emergency situations one will encounter result from conditions discussed in some detail in the sections immediately following. These conditions are:⁴

1. Inadequate oxygenation of blood in the lungs.
2. Inadequate transport of oxygen by the blood.
3. Inadequate tissue oxygenation.

Inadequate oxygenation of blood in the lungs can be caused by a number of conditions.

1. *Deficiency of Oxygen in the Atmosphere.* This condition most often results in a confined atmosphere when any gas displaces the oxygen of ordinary air. For instance, in mines certain gases—such as methane (fire damp) or nitrogen and carbon dioxide (black damp)—can displace the oxygen and thereby lower the oxygen concentration.

In such situations, the gases which have displaced the oxygen do not necessarily by their presence produce direct harmful effects upon the human body. They simply act by reducing the oxygen tension (concentration) in the confined atmosphere of a particular location.⁴ Readjusting the oxygen concentration of the air which the victim breathes is consequently most urgent and essential. Obviously, this can most easily be accomplished by moving the victim into the air of a less contaminated environment, or by the administration of oxygen by nasal catheter or oro-nasal mask.

A deficiency of oxygen in the atmosphere is also a characteristic of high altitudes. Although the percentage of oxygen in the air remains constant as one ascends, the absolute amount of component gases which comprise a unit volume of air is decreased because the air pressure at such heights is less, and all gases have expanded. Thus, there are fewer molecules of oxygen available in each breath.

Signs and symptoms due to atmospheric oxygen deficiency may begin to appear in healthy individuals at an altitude of 10,000 feet above sea level. These symptoms are characterized initially by feelings of exhilaration and hilarity accompanied by some increase in the rate of respiration. Generally speaking, an altitude of 23,000 feet represents the limit to which unacclimatized men can ascend without the aid of an artificial source of oxygen.

When reaching an altitude of 40,000 feet, a human being cannot maintain life even if breathing from an artificial source of pure oxygen. For this reason, airplanes flying at such heights are equipped with pressurized cabins.

2. *Inefficiency of Respiratory Activity.* Shallow breathing, as can be caused by a

painful chest injury, may result in a marked lowering of both tissue and blood-oxygen levels and in dyspnea (belabored breathing). In such cases, the administration of oxygen by nasal catheter or oro-nasal mask is indeed helpful. Adding carbon dioxide to the oxygen also has been advocated; this may be especially helpful if the victim's rapid, shallow breathing has caused him to exhale excessively large amounts of carbon dioxide. However, a word of caution is in order! One cannot be sure that this situation has indeed occurred. Therefore, it seems far wiser to relieve the victim's pain with the administration of suitable drugs and splinting, and to encourage the victim to breathe more slowly and deeply.

Complete and partial apnea can also be listed under this heading. Either complete or partial apnea is most often encountered in drowning, electrocution, stroke, or poisoning by drugs or certain chemicals (methyl chloride, benzol, etc.). Obviously, administration of artificial respiration by either the mouth-to-mouth or back-pressure arm-lift method should be begun immediately.

When available, an apparatus which provides pulmonary ventilation (i.e., breathes for the patient) can be used. Most of these apparatus, known as resuscitators, employ a face mask through which is provided air consisting of nearly pure oxygen. In addition, they facilitate removing carbon dioxide from the victim.

An abundance of carbon dioxide develops in the tissues of any individual who is not breathing because no carbon dioxide is expelled through the lungs. Thus, it is readily apparent that in cases of asphyxia (i.e., an inadequate supply of tissue oxygen and overabundance of carbon dioxide) no additional carbon dioxide is needed to stimulate respiration.

A victim of asphyxiation who has recovered sufficiently to maintain some degree of unaided respiration should be encouraged to greater breathing efforts. If the victim is comatose (unconscious) or nearly so, artificial respiration can be used if no resuscitator is available. The administration of oxygen by nasal catheter can also be of great help in this instance.

Victims of a stroke or an acute respiratory paralysis may also suffer from severely depressed respiration. Once again, oxygen ad-

ministration by nasal catheter is desirable if the victim is breathing. If breathing is extremely shallow or nonexistent, artificial respiration should be applied.

3. *Obstruction of Airways.* Obstruction of the airways can be caused either by foreign bodies which become lodged or by such conditions as laryngeal spasm, displacement of the tongue, or acute bronchiole spasm. Displacement of the tongue is as a rule found in victims who are either unconscious, semi-conscious, or paralyzed; acute bronchiole spasm is usually found in asthmatic subjects. These situations call for speedy relief of the condition causing the obstruction. Oxygen by nasal catheter is usually indicated.

Another condition which can block free passage of air to alveolar respiratory epithelium is pulmonary edema (fluid in alveoli). The edema may be secondary to acute, severe coronary occlusion, congestive heart failure, traumatic shock, or may be due to chemical poisoning such as occurs following inhalation of sulphides. In an emergency situation with no professional medical help immediately available, it is usually difficult to determine if pulmonary edema or coronary occlusion is actually present. However, the presence of severe shock can more readily be determined. At any rate, the administration of oxygen in these instances is indicated and desirable. The resultant increase in oxygen concentration in the lungs enhances the diffusion of oxygen through edema fluid and on into the arterial blood.

Inadequate transport of oxygen by the blood exists in subjects with coronary occlusion, congestive heart failure, traumatic shock (so-called peripheral circulatory collapse), hemorrhage, or carbon monoxide poisoning.

A study of two groups of patients revealed a number of pertinent facts.² One group suffered from coronary occlusion accompanied by pulmonary edema and shock, and the other group from coronary occlusion not accompanied by pulmonary edema or shock. It was found that the blood-oxygen saturation level of the first group had dropped to 80.8 per cent (normal = 97.5 per cent to 98 per cent). When these patients were ventilated with air composed of 40 per cent oxygen, around 4.2 cc oxygen were

added to each 100 cc of arterial blood; breathing nearly pure oxygen added around 5.5 cc oxygen to each 100 cc of arterial blood.

However, the investigation also revealed that the blood-oxygen saturation level of the second group had dropped to only 94.1 per cent. Here it was found that administration of air composed of 40 per cent oxygen added only 1.6 cc oxygen per 100 cc of arterial blood; administration of nearly pure oxygen added 2.9 cc oxygen per 100 cc of arterial blood.

The authors concluded that the administration of oxygen in patients with coronary occlusion not accompanied by pulmonary edema and shock is probably not needed, but that it helps to relieve dyspnea and adds to the oxygen dissolved in tissue fluids. They further concluded that the administration of nearly pure oxygen was desirable in all cases of coronary occlusion accompanied by shock and pulmonary edema.

Some authors³ feel more strongly on the point of relieving such deleterious effects as tissue anoxia (lack of oxygen). They feel that high oxygen concentrations are especially useful in such conditions as surgical shock, severe myocardial infarction, or cerebral infarction—all of which are characterized by severe localized tissue anoxia. Here, such high oxygen concentrations are applied for the primary purpose of increasing the amount of oxygen dissolved in plasma. (As stated previously, the hemoglobin is readily saturated by breathing low oxygen concentrations.)

Hemorrhage. The foremost problem in hemorrhage is, of course, to stop the bleeding and to restore the volume of blood by transfusion of whole blood or plasma. Supplemental oxygen is of help to a limited extent, since normal breathing provides sufficient oxygen to supply the decreased amount of hemoglobin remaining in the blood stream after hemorrhage. However, of greater importance is the increase of dissolved oxygen which will occur in plasma. Since hemorrhage is frequently accompanied by shock and subsequent pulmonary edema, oxygen therapy is desirable, particularly if voluntary respiration is depressed.

Carbon Monoxide Poisoning. Hemoglobin shows an affinity for carbon monoxide which is approximately 300 times stronger than its

affinity for oxygen. It is therefore of utmost importance that the hemoglobin-carbon monoxide combination be broken as quickly as possible. A high percentage of oxygen should be received by the lungs, for it is possible to displace the carbon monoxide by oxygen provided the tension of oxygen is high and the tension of the carbon monoxide is low.

The administration of carbon dioxide-oxygen gas mixtures has been recommended.* Such mixtures contain 90 per cent to 95 per cent oxygen and 5 per cent to 10 per cent carbon dioxide, and they are administered by means of a face mask. It is believed that carbon dioxide aids in releasing the carbon monoxide from the hemoglobin molecule. At any rate, if such a gas mixture is not available in an emergency, oxygen should—and can—be safely and appropriately used.

The amount of carbon dioxide a victim of carbon monoxide poisoning should receive might well be left to the discretion of the attending physician, for the physician can carefully watch the subject to insure that harmful levels of carbon dioxide do not accumulate within the subject.

The victim of carbon monoxide poisoning presents a severe problem in an emergency situation. He will undoubtedly hyperventilate due to his inordinate hunger for oxygen, unless too comatose and depressed to do so. Furthermore, while hyperventilating, he may "blow off" excessive amounts of carbon dioxide—thereby leaving his respiratory centers insufficiently stimulated. These reasons clearly show the victim of carbon monoxide poisoning to be a case for the hospital where careful attention can be given to his carbon dioxide balance and other needs.

In cyanide poisoning there is no interference with the carriage of oxygen by the blood. However, the tissue-enzyme mechanisms which are responsible for normal tissue respiration are poisoned. Such chemicals as methylene blue, amyl nitrite, sodium nitrite, or thiosulfates are used to counteract the effect of the cyanide.

In poisoning of this type, adequate oxygenation of arterial blood can usually be obtained by encouragement of deeper breathing. Administration of supplemental oxygen is desirable, particularly if the victim is depressed or in shock. The primary treatment,

however, is directed toward the removal of cyanide from the tissues.

The long taught back-pressure arm-lift method and the newly promoted mouth-to-mouth method of artificial respiration can both be effective.

The back-pressure arm-lift method has a disadvantage in that both of the rescuer's hands are occupied in applying pressure to the back and lifting the arms, thereby making it difficult for the operator to keep the airway open. It is, however, a "push-pull" method which provides active phases of both inspiration and expiration.

The mouth-to-mouth technique provides a positive form of insufflation of air from the rescuer into the victim. The rescuer provides around 10,000 cc of expired air per minute which contains 18 per cent (i.e., 1,800 cc) of oxygen and thereby can maintain adequate blood-oxygen saturation in the victim.[†] Another advantage of this method is the fact that the rescuer's hands are used to hold up the jaw and thereby maintain a patent airway.

Yet, this technique also has certain disadvantages. These are primarily in the esthetic area; i.e., some persons may be reluctant to come into such intimate contact with persons apparently dead or for some other reason. During the course of administering this technique, it is also possible to blow a quantity of air into the victim's stomach, and this air must be expelled by pressure on the abdomen. Unfortunately, the expelled air may carry with it some of the stomach's gastric contents; and the resultant disagreeable situation may make it difficult for some rescuers to perform this method of artificial respiration.

A number of resuscitators which provide 100 per cent oxygen through an oro-nasal mask are available in the United States. These resuscitators provide artificial respiration by one of two methods:

(1) Alternating positive and negative pressures are applied through the mask to the mouth. The positive side of the cycle inhales for the victim by blowing oxygen into the lungs, and the negative side of the cycle assists in exhaling.

(2) Intermittent positive pressure is used to provide inhalation. Exhalation in this case is accomplished by recoil of the thoracic cage. Resuscitators operating by either

method can also be used to supply a flow of nearly pure oxygen for inhalation by the subject who is able to breathe without outside assistance.

Three basic types of devices are available for emergency use.

The first device is the rubber or plastic oro-nasal face mask which fits over the mouth and nose—such as the BLB mask. Openings are located on either side of the mask. Outside air entering through these openings is mixed within the mask with oxygen from its source. In addition, these holes allow a part of the victim's expired air to escape. The mask is connected either to a rebreathing bag and to the oxygen source or to the rebreathing bag which in turn is connected to the source of oxygen.

Devices of this type have advantages as well as disadvantages. One major advantage is that high oxygen concentrations can be administered; disadvantages, on the other hand, may include rebreathing accumulations of carbon dioxide and the resistance to flow of air within the mask.

Oxygen can be administered in concentrations ranging from 40 per cent to 100 per cent, and the masks are especially useful in providing oxygen concentrations ranging from 70 per cent to 100 per cent. It should be noted at this point, however, that high concentrations of oxygen in the inspired air can only be achieved if high oxygen flow-rates to the mask are employed.

Rebreathing of carbon dioxide accumulations occurs as follows: When the victim on whom the mask is applied exhales, part of the breath flows into the rebreathing bag and remains there. When the victim again inhales the contents of the bag, the carbon dioxide just exhaled will once more be inhaled. This process will then repeat itself. In this way, it is possible for the victim to breathe air containing accumulated carbon dioxide concentrations of 2 per cent or more. As a result, these high carbon dioxide concentrations may increase respiratory rates around 40 per cent to 50 per cent and thereby increase the victim's dyspnea. This is particularly objectionable in cardio-respiratory patients. High oxygen flow-rates (eight to ten liters per minute) must be used to keep carbon dioxide "washed out" of the bag.

Resistance to gas flow encountered within the mask is usually not a great problem

during exhalation. However, in cases of obstructive apnea, the victim already suffers from severely belabored breathing, and the additional burden posed by the mask is objectionable.

It is the resistance encountered during inspiration which is most often of considerable concern. During inspiration the victim is required to suck air from the rebreathing bag and through the orifices in the mask. In some cases these orifices consist of sponge rubber disks; in other cases they are simple perforations. The resulting negative pressure within the mask is of little significance during quiet breathing.

However, the negative pressure becomes a serious problem in subjects who are suffering from dyspnea or whose respiration is markedly increased. In these cases a negative pressure of 1 to 2 cc water column during inspiration exerts a suction force on the respiratory epithelium; and breathing against a negative pressure has been shown in the laboratory to be cause for edema of the lungs.⁴

Therefore, resistance to inspiration should at all times be avoided, especially in subjects suffering from obstructive dyspnea, heart failure, or in any patient in whom a tendency toward edema of the lungs might develop. All of these statements support the contention that low flows of oxygen should not be used with this type of face mask.

The second device is another face mask, the so-called "meter mask," which does not allow the subject to rebreathe any part of the exhaled air. When the subject exhales, the breath escapes through a valve to the outside, and consequently the concentration of carbon dioxide in the subject's breath—while using this mask—does not rise above 0.2 per cent even with oxygen flow-rates as low as two liters per minute.⁵ Air consisting of 95 per cent oxygen can be supplied with flow-rates of eight liters of oxygen per minute. Air consisting of approximately 40 per cent oxygen can be supplied at flow-rates of two to three liters per minute.

In a non-dyspneic adult, a flow-rate of four liters of oxygen per minute can provide a supply of air consisting of 50 per cent oxygen. However, in the dyspneic subject higher flow-rates must be used in order to supply an equivalent percentage of oxygen in the inspired air. In order to obtain higher

oxygen concentrations in inspired air by the mask method, oxygen flow-rates in the order of 10 to 12 liters per minute must be supplied.

For these reasons it is well that such devices have a gauge indicating the rate of flow to meet the patient's needs. Or the device must deliver maximum oxygen flow-rates at all times. In this way the operator can be certain that adequate concentrations of oxygen are provided. Tank capacity should be at least 300 liters or greater ("D" tank) in order to provide at least half an hour's continuous supply of oxygen.

The third device, the nasal catheter, is inserted into the naso-pharynx and is one of the easiest and most efficient means of administering oxygen.⁵ For instance, with an oxygen flow-rate of six liters per minute and adequate breathing, concentrations of 40 per cent to 45 per cent oxygen can be obtained in the inspired air.

However, care must be exercised in placing the catheter properly. If the catheter reaches too far into the pharynx, the victim may be gagged or air may be forced into the stomach. If, on the other hand, the catheter does not reach far enough, the proper concentrations of oxygen may not be obtained. One method of estimating the proper distance of insertion is to measure from the tip of the nose to the front of the ear and then to add one quarter inch. This length is then inserted and the catheter is taped to the face.

This method of administering oxygen is particularly useful for several reasons. There is no mask to restrict the free exchange of air by the subject, and consequently there is little or no interference with elimination of carbon dioxide. The attending person does not have to pay attention to a mask and is free to attend to the patient's other needs. Furthermore, the catheter can readily be inserted into the non-breathing victim. This frees the rescuer to administer artificial res-

piration by either the mouth-to-mouth or back-pressure arm-lift method. And since asphyxia and apnea are indications for using either of these methods, the administration of added oxygen will have a useful purpose.

Conclusions—Whenever impaired oxygenation is either suspected or can subsequently be expected, attention must primarily be directed at maintaining adequate respiration, a sufficiently large supply of oxygen, and the elimination of carbon dioxide. In an emergency, the oxygen of ordinary air can always be relied upon. Attention must primarily be given to maintaining adequate pulmonary ventilation. This can be achieved by urging the victim to greater breathing efforts, by manual or mouth-to-mouth artificial respiration, or by use of a resuscitator as indicated by the victim's breathing status.

Air ranging in oxygen concentration from 40 per cent to 50 per cent can readily be applied, inhaled, and maintained by nasal catheter. Apparatus utilizing the mask and rebreathing bag can provide safe inhalation of higher oxygen concentrations, provided the mask is properly placed and high oxygen flow-rates are maintained.

REFERENCES

1. Karpovich, P. V.: *Physiology of Muscular Activity*, 4th edition, Philadelphia and London, W. B. Saunders Company, 1953, p. 114.
2. Borden, C. W.; Ebert, R. V.; and Wilson, R. H.: Anoxia in Myocardial Infarction and Indications for Oxygen Therapy, *J.A.M.A.* 148:1370-1371 (Apr. 19) 1952.
3. A.M.A. *Fundamentals of Anesthesia*, 3rd edition, Philadelphia and London, W. B. Saunders Company, 1954, p. 10.
4. Best, C. H., and Taylor, N. B.: *The Physiological Basis of Medical Practice*, 4th edition, Baltimore, The Williams & Wilkins Company, 1945.
5. Coates, E. O., Jr.; Brinkman, G. L.; Dumke, P. R.; and Green, E. W.: Oxygen Therapy, *Postgraduate Medicine* 24:60-66 (July) 1958.
6. Barach, A. L.: *Physiologic Therapy in Respiratory Diseases*, 2nd edition, Philadelphia, London, Montreal, J. B. Lippincott Company, 1948.
7. Elam, J. O.; Greene, D. G.; Brown, E. S.; and Clements, J. A.: Oxygen and Carbon Dioxide Exchange and Energy Cost of Expired Air Resuscitation, *J.A.M.A.* 167:328-334 (May 17) 1958.

TYPICAL EMERGENCIES CONFRONTING THE NURSE WORKING ALONE

By HAPPY B. BRUDER, R. N.
Saks Fifth Avenue, Chicago, Ill.

Within us all there is a great deal of pride, plus much loyalty to the company we serve, so I must tell you that although our Chicago store (Saks Fifth Avenue) only employs an average of 600 people, we can boast of being the largest chain of fine specialty shops in the country.

First of all, please remember—any establishment that opens its doors to the public is responsible for what happens to those who enter these portals.

For example, I recall the wife of a prominent citizen harbored in the powder room, one flight up a lovely winding stair case—not merely intoxicated, just plain drunk—with her several friends. A known alcoholic, she has been put in her car by a police officer, who also knows her and wants to protect the family. But it's a lovely day and they all come to the store to shop—shop they cannot—disturb they can.

It is your duty to straighten them up and get them down these stairs and off your property before they injure themselves and their reputations.

Another woman tries on a \$65 hat with a hornet in it. Hornets sting—and this one did!

There was an obese lady, who wears a size 44 and insists on trying on a size 40. The saleslady, in pulling up this garment—not without difficulty—lets her hand slip and she literally socks the customer in the nose. When I saw this woman, I thought Marciano couldn't have packed a better punch.

Then there's the customer who is zipped in the dress—skin and all. Sometimes I think these salespeople are in competition with the skin men. They have removed so many warts and moles.

There are the fitting pins in toes of women wearing toe-less shoes—and the corset stay that breaks (metal). It digs and cuts and scratches. And all these people bleed, you know. Some of the scenes are as good as Shock Theatre.

A plate glass mirror covers an entire wall

in a fitting room. It falls and strikes a small child.

A customer falls out of her car in your parking lot—and there are those who fall just getting in—or stumble on your sidewalk in front of your property.

The epileptic—the drunk—the truly ill have accidents near your store, and well-meaning employees bring them in and send for you—because you're such a nice nurse! I wonder?

You see the 75-year-old woman who falls two steps and fractures a hip. They just fall and you wonder, as you have a mental picture of your accident experience for the year. Why didn't they use the elevator provided for their convenience?

Then we have the over zealous beautician who trims the ear lobe as well as the hair.

And there's the customer who feels that time has been unkind to her, and she will improve on nature, forgetting she has any sensitivities. She suffers an acute reaction to the dye she has chosen for her new hair.

Burns sometimes come from permanent wave solutions. These people you must convince they will not develop cancer of the skin tomorrow.

Customers' children play in busy revolving doors. Indignant parents are completely oblivious to them until they are injured.

Now, a few things that happen to our own personnel—like the woman who deliberately walks into a parked truck in the alley—while talking and visiting with her friends. The laceration in her head requires four sutures.

A porter walks out the back door to be thrown back into the building by the impact of a truck passing through the alley.

A watchman, performing his duty, argues with an employee who insists on taking a package out of his door without proper authorization. He suffers a cerebral accident.

A stock girl has a spontaneous abortion in a washroom. You sit her on a hard gar-

bage can, and hope they will hurry with the ambulance.

And I recall the trickster who alleges she fell off a ladder and is having a nasal hemorrhage. She arrives in your office with the assistance of four people, who should be in their departments selling. This one has copious amounts of white tissue, stained brilliantly red, against her face. You look, and you must tell her—you may be old, but not a fool. The stain on the tissue is merthiolate. This one had just been refused a four-week vacation.

Eighteen men in one department are stricken one afternoon with acute gastric upsets and diarrhea. This is a real emergency. It will cripple a busy department during a most important sale.

All these men had eaten their lunch behind the scenes, a time saver to accommodate the crowds. Those who had eaten the tuna fish and egg salad, the food you might suspect, were well. Those who had failed to wash their hands were ill. I must tell you, these were shoe salesmen.

We had a hysterical woman who would sit on the floor instead of her chair. She sews. She spent four months in the hospital, with the services of the best in medicine, orthopedics and psychiatry, and took good care of my accident experience for that year.

Not three weeks ago, I was handed a subpoena to appear in court. The same woman tried it this time on the C.T.A.

And finally there was the elevator operator who had a "vision" and ran her car, loaded with patrons, well above the safety level.

And so it goes—each day a little different—interesting to say the least, but every day a new challenge.

Certainly I see the fellow with the acute abdomen that ends up as an acute appendix, the fellow with the kidney stones, and the acute gall-bladder and the usual cardiac emergencies. I must decide quickly which to call first—the doctor, the clergy, the family, or the fire department. You call one or the other, and sometimes all, and things seem to work out.

EMERGENCY IN THE PLANT—NURSING ASPECTS

By ANNA J. THRASHER, R. N.

Chief Nurse, Hawthorne Works, Western Electric Co., Chicago, Ill.

How should we as nurses prepare for emergencies in industry?

I will discuss this from the viewpoint of the individual nurse, not limiting it to a one- or a multiple-nurse unit. The needs are essentially the same. If the doctor is on call or on the premises we will prepare for his attendance.

Upon assuming a new position, acquaint yourself, as soon as possible, with the physical aspects of the plant. On your tour, determine not only the type of accidents that may occur but the accessibility of the injured to the medical department.

Designate a place for the stretcher or stretchers; see that the aisles are wide enough to accommodate them or find out which aisles are. Who does or will maintain the stretchers? Are there trained cot crews to bring the injured to the nurses' station;

will they recognize the need to call the nurse or the doctor to the scene?

Is this a factory with enough floors to warrant an elevator? If so, institute a signal system to be used for emergency purposes and see that the stretcher fits into the elevator.

If the doctor is not on the premises at all times, confer with the doctor on call as to his preference in medications and treatments of acute conditions so that you will have the necessary supplies in readiness.

Contact and negotiate with a nearby ambulance service so that there will be no waiting period for confirmation of responsibility at the time of need. Do the same for a car or cab service; and the local Fire Department. Discuss with the hospital of your attending doctor the possible admission needs. List all of these emergency services

with addresses and phone numbers in a very conspicuous place. Include the phone numbers of the local parish priest and police.

Having arranged for all of these community facilities, enumerate the essential details and refer to your procedure outline when the first occasion arises. Until you have followed through on a repeated number it is so easy to omit one step.

Make up a hospital admission form for entering all of the vital statistics that are readily available from your medical department records and that will be required by our hospitals. Also, provide a space for "tentative" diagnosis and medications that have been given. You can understand how important this is for the seriously ill patient.

Prepare a form letter for hospital admission, of company responsibility cases also. Designate to whom the reports and bills will be sent. This leaves only the identification of the employee to add at that time.

Include in your procedure the notification of relatives. If it is at all possible either by extension or plug-in phone, try to allow the patient to speak to his family. No matter how you try to soften the shock, it is difficult for the family to accept the fact that you have sent a husband or a father to the hospital.

Have a designated person or group to do the notifying in case you are unable to contact relatives by phone. This preliminary planning is so helpful in expediting the care of the acutely ill employee.

Attempt to arrange the medical unit to accommodate a seriously ill patient in some degree of privacy and quiet; a room separated if at all possible from the normal activity. Have your side rails attached to the bed so that you will not have to leave the patient to fetch them.

Designate one cupboard, shelf or unit for emergency equipment. Establish a routine for checking this regularly. When you and the doctor have decided on its contents list them, do not rely on your memory. Include here such articles as tourniquet, stimulants, syringes, blood pressure cuff and stethoscope, poison tray, airway, narcotics (if permitted in your situation), orange juice, glucose, eye wash, sterile dressings and small suture tray.

You might be duplicating equipment and supplies used elsewhere in your situation but this is not wasted effort or supplies.

Test your oxygen tank and equipment at least once a week. Keep a log on the amount in the tank; if you maintain an ambulance on the premises include this in your weekly inventory. Inspect the tubing and masks for leaks at the same time.

Strap a padded tongue blade on the wall next to the bed or in a familiar spot where it can be easily reached.

With all of this in readiness you are prepared for your first emergency.

Now, the specific nursing measures that we can employ until the doctor arrives:

In acute absorption from toxic fumes, remove the employee from the work environment immediately; notify the doctor; administer oxygen; if extremely weak, give some form of sugar by mouth e.g., Karo Syrup with dilute lemon juice.

In heat exhaustions put the patient at complete bed rest; give salt and sugar by mouth; if the patient can retain it, notify the doctor, and prepare the emergency tray for I.V. administration on order.

In cardiovascular accidents, start the oxygen if the patient is dyspneic and try to reassure him; attempt to keep interested on-lookers away; check the blood pressure and pulse, consult the medical history, have something concrete to report to the doctor.

In acute G.I. upsets where there is a food complaint or history of food contamination, induce vomiting using an emetic such as warm soda and water.

In acute gall-bladders give nothing by mouth; apply heat to the epigastric region and have your hypnotic ready.

Your acute G.U. emergencies are usually kidney stones; here again we are limited to using local heat and having an hypnotic ready.

Antiphylactic Shock—If you are administering flu vaccine or other prophylactic serums, it will be under the direction of the doctor. At the time you set up the program determine specific allergies which would make the vaccine contra-indicated; do not give it to those having these allergies. Also obtain the drug of the doctor's choice for injection, in case of sensitivity. Have ready, not only the vial of medication, but instru-

ments for cut down in case of complete collapse. It would be well to keep these packs on the table where you are dispensing the vaccine.

Drug Reactions—List all known sensitivities in the medical history; flag the record in an obvious place; attempt to have the record available at the time of the treatment. If, as sometimes happens, the patient doesn't admit to an allergy until after administration of a drug, use an antihistamine immediately, even before any untoward reaction occurs. Here some serious health counseling is indicated.

Acute Central Nervous System Emergencies—In any loss of consciousness, your first concern is to protect the patient. If he is having a convulsion or seizure, use the padded tongue blade; loosen his clothing; pull up the side rails; if he responds verbally reassure him; give him some mild sedation e.g., phenobarbital and let him rest. Do not allow him to return to work the same day. See that he is accompanied home, if not hospitalized. Advise him to consult his doctor before returning to work. This will re-emphasize the importance of adhering to his doctor's program of treatment.

Acutely Disturbed Employees—Have an established policy in writing, for the handling of the acutely disturbed. Have assigned personnel to help restrain until the doctor has ordered indicated disposition.

Insulin Shock—If possible, give orange juice by mouth and prepare your I.V. glucose; here again clearly flagged medical records will help in detection. However, also encourage personal identification. In the rare diabetic coma, prepare the insulin and use the same precautions that you would for all loss of consciousness.

In severe chemical burns—Wash with copious amounts of lukewarm water and apply a sterile dry dressing and firm bandage.

In thermal burns—Apply a sterile dry dressing and firm bandage. Force fluids; treat for shock if indicated. Avoid debridement or ointments until patient is under the care of a doctor.

In serious mechanical eye injuries—If the cornea is lacerated or there is a penetrating wound patch firmly and transport to the ophthalmologist.

In chemical burns of the eye—As in chemical burns to the body flush with copious

amounts of eye solution; when you are tired of holding the lids apart and have used up one bottle of solution start on the second one. You cannot flush too much. Patch firmly and transport to the doctor.

Thermal burns of the eye—are almost always due to ultra-violet and the patient will not notice the symptoms for about 6 hours. By this time the cornea has begun to peel. Do not flush these. Patch firmly. Thermal burns of the eye are almost bilateral. To facilitate locomotion you might want to use dark glasses instead and send to ophthalmologist.

In acute low back strain—If the employee has just dropped to the floor having incurred a severe acute back pain following lifting of a heavy object and you are called to the scene of the accident:

Try to move the patient without putting any more strain on the back muscles. If you transfer him to a cot keep the knees flexed. If you are transferring the patient from the cot to a bed, support him on either side under the arms, thereby avoiding the use of the back muscles. When in bed again, elevate the knees.

In hemorrhage of wounds—Apply pressure with compression dressing. If you are unable to control with this method apply tourniquet.

In severe bleeding from the nose—Keep the patient in sitting position until active bleeding has stopped. Advise patient to breathe through mouth. Press both nostrils together for 5 to 6 minutes. If bleeding does not stop pack a small amount of gauze back into nostril, leaving end so that it can be removed.

For internal bleeding—Complete bed rest. Do not sedate. Reassure the patient, give nothing by mouth.

In severe traumatic lacerations—Apply a sterile protective dressing and a firm compression bandage until operating room facilities are available.

In fractures and amputations—Our main concern is protection. Apply a sterile protective dressing, a firm bandage and immobilize by splinting. Avoid flat splinting. Attempt to splint in position of function. Bandage securely. Do not allow any motion of the injured area, thus avoiding additional damage to soft tissues.

Acute head injuries—Apply a compression bandage to control bleeding. Do not remove

any protruding foreign bodies. Watch closely and record such vital signs as bleeding from the ears or nose, conscious on admission, loss of consciousness, period of unconsciousness; contraction of pupils, alteration in pulse, respirations, and so forth. Normally, keep the head elevated to prevent congestion. However, if the patient has trouble breathing you can't maintain this. Do not sedate. This may mask the symptoms.

Non-Occupational—Appendicitis: History—Nothing by mouth; contact personal physician if your doctor has ordered hospitalization. Transportation to hospital.

Ruptured Ulcer: History—Nothing by mouth. Treat as any shock patient. Do not sedate. Treat for shock.

Obstetrical: Determine specific policy of management relative to length of time that pregnant employee may work. If there is no limitation on this you will have to be prepared for a delivery. In miscarriages if employee has been brought to you on stretcher do not transfer to a bed for examination. If there is any vaginal bleeding no not attempt to remove any visible clots. Use perineal pads with pressure and strap legs together. Then do all you can to expedite her removal to the hospital of her choice.

Again I would like to repeat that it is so important to instill confidence in the employee, not only in our technical skill but more important possibly in our sincere interest in him as an individual.

IS TRAINING FOR SAFETY DIFFERENT FROM OTHER TRAINING?

By RALPH M. HARTMANN

Mgr., Training and Development, Quaker Oats Co., Chicago, Ill.

In addition to my duties as manager of training and development for the Quaker Oats Company, I am responsible for the functioning of accident prevention effort throughout the Quaker organization. We do not find this inconsistent, nor is safety just an "added duty," because we consider that safety is one of several factors that must be built into our operation.

A training man is not simply a training man for quality or production or even safety. Training must reach into every phase of our working life. It will serve no purpose to train a supervisor merely in job instruction methods and neglect to train him in basic principles of management. Similarly, it is unwise to teach employees production methods without also coaching them in the safeguards that will assure continuity of operation.

The more we have studied the problem of accident prevention at the Quaker Oats Company, the more we feel that success in safety is the product of an environment which emphasizes individual responsibility—

exercised at all times and at all levels. It follows then that safety training should be so directed as to assist all people in the organization in discharging their safety responsibility, i.e., to get as many people as possible to perform the work assigned to them in the right way.

Now back to the question—Is Training for Safety Different From Other Training?

Today there is no universal agreement among professional training people as to the best methods, materials, etc. to be employed to meet every training need—then surely there can be no general agreement among training people on this particular subject. My personal opinion is that training (as such) for safety is not different from other training. However, in the approach to safety training, that is in preparing for and conducting of safety training, obviously some different considerations must be kept in mind, than were you, for example, preparing for and conducting training to make people more quality or cost conscious.

Let me suggest we handle our discussion of this subject in somewhat this manner. First, let's review a few of the considerations we should keep in mind when we are preparing to do a *safety training job*.

Then next let's examine and discuss a number of specific questions on the subject of *Safety Training*. This entire procedure may help you individually to explore this subject as it applies to your immediate circumstances, so that you may find your own answer to the question—*Is Training for Safety Different From Other Training?*

Let's take a look at some of the special problems or considerations we should keep in mind when preparing for safety training work.

1. The modern conception of accident prevention seems to identify it as a major executive problem. If so, it then follows that management must be responsible for the formulation of broad, all-inclusive safety policies and provide an organizational structure which will make possible and encourage an effective safety endeavor.

As safety men, do we do the informing, educating, and training of our executives, so that they have an appreciation of their safety responsibility and the safety job they must do? This means special training for executives is necessary.

2. Another concept, generally accepted, and to which we subscribe, is that the direct responsibility for safety is in the line supervisors. More and more, management is realizing the dominant position occupied in industry by supervisors and foremen. However, before safety training can be effective with the foremen, this concept must be known and accepted by foremen and supervisors alike.

3. And another point on which there is considerable agreement—is that safety—to a large degree, is pretty much a matter of attitude—a state of mind—on the part of an individual. An important phase of the training job is to instill safety consciousness into the individual workman. How many training and safety men consciously consider this factor when preparing for and conducting safety training?

4. In most instances, the mental resistance of the trainee to the subject of safety is greater than the normal resistance to production or quality training—the people to

be trained are very often not in a receptive frame of mind. More than in any other areas of training we encounter the attitude that "safety is sissy stuff"—"I don't have the time," and so on, which professional safety men know all too well. We must study and know our trainees.

5. Another factor—which has much to do with the receptiveness of individuals to safety training—is the concept that safety is primarily a matter of converting faulty physical conditions. Regardless of all the seemingly convincing data that has been published, industry still devotes a very substantial part of its accident prevention effort to physical conditions. We need to overcome this concept. Steady improvement of physical conditions is a must, but while doing this we must guard against creating an impression this is the whole answer to our safety problem.

6. In many concerns, training for safety is still handled on a somewhat amateur basis. Professional training in industry has made great strides in recent years, but much of it has been concentrated on Production, Management Techniques, etc. I have also noticed that in some companies where group training is conducted for safety that the same amount of time, attention, and expense is usually not given to the preparation of training materials for safety as is done preparing for other types of training.

7. One additional thought—In our safety training work have we been emphasizing too much the penalties, suffering, etc., that could occur if we do not perform our job correctly and safely? Would it be helpful—would our people be more receptive to safety training if it stressed more the advantages—to working safely?

8. And now, probably the most important single factor that must be considered when planning safety training activities has to do with participation. Probably the most effective technique known that can be utilized to gain cooperation and acceptance by fellow-workers in your accident prevention work is to provide for their participation. Participation helps to bring about a mutual desire for operators, supervisors, and executives to work closely together by creating the "conditions" necessary for cooperation to occur. How often we proceed to build training activities without thinking to in-

volve the people to be trained, and then we wonder why the training is not accepted enthusiastically!

Now let's examine and discuss briefly a few specific questions on the subject of safety training.

1. Should training for safety be included with other job training? Does stressing safety confuse job sequence while training?

Since safety can only be achieved as the job is being done, and is an inherent part of the job, then surely safety training should be a part of job training. This should be the responsibility of the individual's immediate supervision.

I see no reason why stressing safety, as it relates to job operation, should in any way make less effective the job instruction. However, I see no particular reason why the safety aspects of the job should be emphasized any more than the quality, quantity, and other phases of the total job operation.

As regards safety training to create a good safe working attitude in a new employee, more than the safety training provided in connection with on-the-job training must be done. Probably the best time to start this type of training is immediately after a man has been hired. An effective safety indoctrination program utilizing various visual aids, and first aid and fire equipment, covering a variety of subjects would be helpful. Such a program objective should create in the mind of the new employee a sense of belonging to a group of people, who are interested in their safety, as well as that of fellow workers.

2. Another question—Should training for safety be handled by the supervisor or by the safety man?

We have touched upon this point. Since the supervisor is the man who tells the worker what to do, and normally he will do a much better job of following through on his personal instructions than on instructions given to his workers by a third party, surely then, the supervisor should provide job safety training on an individual basis.

On the other hand, certain safety training activities may be better handled on a group basis, such as fire fighting—life saving techniques—proper lifting methods, etc. Training of employees in such subjects by the

safety man, or other well qualified people, is usually welcomed by supervisory personnel.

3. Someone asked, "How about handling safety training for particularly hazardous jobs as opposed to normal routine?"

My reaction is that as long as the regular supervisor supervises and directs the worker on this particular operation, then the supervisor should give the on-the-job safety training.

4. Another question—Can we motivate for safety at the same time we train for production?

Surely we can and must. Safety performance is a factor considered in our annual job performance appraisal of all supervisory and management people. This is considered on the same basis as quality—meeting of production schedules and costs.

This helps to motivate supervision. Proper safety orientation training—effective job training and provision for participation in group and departmental safety activities will all be needed to provide necessary safety motivation to workers.

The supervisor who understands certain simple concepts regarding learning will save himself untold aggravations and insure more pleasant relations in giving instructions and supervision to his employees. If he understands the fundamental principles of learning, he will use his energy best in giving instructions.

Learning is a process of forming habits—This requires a series of actions or experiences on the part of the one who is learning.

Many things may be done or caused to influence the rapidity with which habits are formed, but it is fundamental that the learner must take part in the process physically and mentally. As many of the senses as possible should be effectively supplemented by an appeal to thinking for the most rapid habit-forming. Learning requires participation on the part of the learner as well as repetition until the habit of following a sequence of actions is developed.

Certainly if supervision is to provide job safety training then all supervisors should be trained in the techniques of Job Instructor Training.

The question before safety and training people today seems to be—"How can we

most effectively deliver the goods?" Industry demands from all of its functions, departments and services, a good return for every dollar expended, including the costs for safety training. It is not a question of doing something in order to get something done for the record. It is a question of doing a needed job, when it is needed and doing it well.

The success of safety training depends upon the changes that are taking place within the individuals working in the plant. Our

success is measured in terms of frequency and severity. It is measured in terms of those in the plant, who as a result of safety training, habitually follow safe practices.

It is time we got our safety training into step with the Age of Automation. As this, I believe, can best be done by not thinking of safety training as being different from other training. Training for safety can be accomplished most completely and efficiently when integrated into an over-all well organized continuous training program.

IS SAFETY TRAINING DIFFERENT FOR MANAGEMENT?

By M. C. M. POLLARD

Director of Safety, National Gypsum Co., Buffalo, N. Y.

When a company believes in the importance of accident prevention, it establishes a policy and interprets it for application by line management people. There should be understanding of the fundamentals of accident prevention even more at this level because these persons must be able to give answers to questions raised by plant managers.

Like a first-aid instructor, they must know more than just procedures outlined in the textbook. The instructor must have advanced training, learn about the skeleton, the body, the circulatory and respiratory systems before he can teach. It would seem this same thinking applies for accident prevention.

When basic principles are understood by the people having the greatest responsibility, they are better able to interpret problems, and give assistance to those reporting to them.

In the administrative office of our company the senior vice president of operations held a meeting once a month with the vice president of manufacturing, general production managers, and production managers who have direct responsibility for plant operation.

The agenda for each meeting followed same pattern: safety, quality, cost and re-

lated problems. This program continued for a year and was then carried on by the vice president of manufacturing with the general production managers and production managers.

To properly place the importance of accident prevention, the first meeting of each year was devoted to safety, and subsequent meetings opened with a review of plant accident experience for the preceding month.

In each of these meetings those staff people having responsibility for administration of safety, quality, production control, etc. supply information for discussion and may be called on to report progress, but they do attend meetings and are available to answer questions.

Each production manager is called on to develop a personal program for safety and make accident prevention No. 1 among his responsibilities.

They, in turn, demand the same acceptance of responsibility on the part of each plant manager. Evidence of how it is followed can be best shown by the fact that periodic plant operating reports must begin with safety.

This includes activity in the program such as meetings, inspections, action on recommendations, listing of first aid cases, and

reportable injuries. Details of accidents are briefed and corrective action spelled out for each case. It also covers house-keeping and fire protection.

At the plant level, each meeting opens with safety. Department heads and foremen are required to hold frequent meetings and contact people individually about safety.

It is important that this level of line management also understands fundamentals. A special training course was developed. It calls for four one-hour sessions, each introduced with a sound slide-film that runs about 10 minutes, and the balance of the hour is spent in discussion.

You may ask how this applies to top management training? None of it would have been possible without top management having been convinced that such a program is essential for good operations. Results obtained over the years in reducing the number of accidents were the reason why they believe as they do.

Some may scoff, but humanitarianism—a sincere regard for the health and safety of employees—continues to be the greatest motivation for management interest.

If you were the president of a great corporation could you sleep nights, if you knew your accident experience was poor and that you were injuring people every day? Perhaps not enough has been said about the fact that American industry provides the best example that we are our brother's keeper.

Our management deplors the occurrence of an accident and its resulting injury. No cost report is required nor expected. If a man is injured, no expense is spared for medical attention. We hurt him. We should care for him. What does the cost matter if a man loses an eye, cuts off a finger—or even meets death? Are dollars and cents important then?

It is not necessary to have a continuing program for top management safety training. It is necessary to keep them informed of results and show them in every way possible that the policy they expressed is being followed.

Results come only through persistent effort on the part of line management. When a problem arises, the production man responsible for the operation may seek help. Here, the safety director can be of assistance in finding a solution. Action taken must be through the line organization, not by a staff man. If the latter were permitted to act, the strength of the management interest would slowly dissipate.

A safety man should have authority only for administration of a program. He may suggest, advise, recommend, analyze, plan, but never weaken any manager's effort through direct action.

Training is best through example. Sincerity of purpose can be best demonstrated, not forced on a person through harsh words.

A pat on the back for good performance carries a lot of weight. Safety men should let management know when a division, a plant, a department, a man deserves a "well done." Signature of the boss on a letter provides impetus for any program, when results merit congratulations.

Training down the line comes from example as well. Management must approve expenditures for safety, and some operations call for considerable amounts of money for this purpose. Knowledge that the company is willing to pay for it lets those down the line know the policy for safety is real and alive and sincere.

Failure to get approval for such items stems not so much from lack of interest, as it does from poorly prepared requests for appropriations. Given the proper facts, management will provide the means for better results.

Is safety training different for management? Yes, because management is the trainer. Having the desire to make a profit, and knowing that this comes only through safe, efficient operation that produces high quality, low cost, competitive, saleable goods, management trains in every way possible to achieve its goal. This approach provides jobs and secures the future of every person in the organization. This is the ultimate for safety.

ON-THE-JOB TRAINING WITH SAFETY— IS IT DIFFERENT?

(A Demonstration)

By EARLE S. HANNAFORD, PH.D.

Safety Engineer, Long Lines Department, American Telephone and Telegraph
Company, New York City

Assisted by:

William J. Hrdlicka, Staff Supervisor-
Personnel
St. Louis, Mo.

Edmund J. Kelly, Staff Supervisor
White Plains, N. Y.

Sidney Robbins, Staff Supervisor-Plant
Construction
White Plains, N. Y.

Phoebe M. Guyon, Welfare Supervisor
New York City

Lucille C. Sassmann, Staff Assistant
New York City

* * *

On-the-job training, usually described as training on the scene of action, is as old as man himself. Every single day of our lives, both on and off the job, we learn by doing. That's where the age-old axiom, "experience is the best teacher" comes from. In fact, on-the-job training is one of the major factors, and in all probability, the most vital factor in our lives. Without it we would be helpless for formal classroom or school training can never cover more than a small part of our living requirements.

On the job it's sometimes difficult to be sure just what is job training by the foreman or supervisor and what is called supervision. For so much of day to day supervision on the job is really training. Actually, only a limited part of job training is formally planned and given by the supervisor. However, the same fundamental, practical guiding rules apply for spur of the moment on-the-job training given on an as required basis. So let's cover them briefly. If we have them in mind the demonstration of on-the-job training will be more interesting as well as more meaningful.

At the risk of oversimplifying the elements of learning, I'm going to call your attention to a few proven simple psycho-

logical facts upon which the on-the-job training process is based:

1. There are paths into the mind and paths out of the mind.
2. What comes out of the mind depends upon how it goes into the mind.
3. We learn best by seeing.
4. Permanence of learning comes from actually doing.
5. Seeing something done, followed by doing it ourselves, ensures good learning.

The four step teaching-learning process for on-the-job training is founded on those principles. Here it is:

Four Steps in Job Training

Step I	Preparation	The Path Into the Mind The Path Out of the Mind
Step II	Presentation	
Step III	Application	
Step IV	Test	

Briefly, here's what each step does:

Step 1—Preparation— Prepares the Learner

Puts him at ease.
Focuses learner's attention on a known idea which offers tie-up for a new idea.
Gets him interested in learning job.

Step 2—Presentation—Do the Work Operation for Him

Show, tell, illustrate and explain carefully and patiently.
Instruct clearly and completely, taking up one point at a time, but no more than he can master.
Emphasize key points.

Step 3—Application—Learner Does Work Operation

Have learner try doing the job himself.
Have him explain key points.
Introduce safety aspects of job.
Ask checking questions and correct errors.
Continue until you know he knows.

Step 4—Test

Have learner perform the job without help. Observe work operations carefully. If he fails, go back into step 3 and correct errors. Do step 4 again. Tell him to see you if he needs more help. Follow up work operation on the job. Taper off extra coaching and close follow up. Check periodically and retrain if indicated.

This, then is the normal job training teaching-learning process. Step 1 in normal job training centers about the job and doing it. Keep in mind for our later discussions the fact that safety and accident prevention are not a part of Step 1 and only appear slightly in Step 2 which consists of showing and telling the learner how to do the job. As I have noted, accident prevention and safety appear in the third step—the step where the learner tries out his hand at doing the job. In Step 3, also, the supervisor checks on how the learner does the job and what he knows through the use of questions and by correcting the learner's errors.

Please note this. In actual practice Step 4 includes periodic checks on the job. These are actually part and parcel of good supervision. That's why I said it's hard to tell where job training ends and supervision as such starts.

Remember the old adage—"If the learner hasn't learned, the teacher hasn't taught." From the standpoint of safety let's make it—"If the learner hasn't learned to do the job safely, the teacher hasn't taught."

Since accidents do happen to well trained people, the question arises—"Is training for safety different?"

Obviously, if there is an accident retraining is indicated and the chances are that the original training didn't get the safety message "into the mind" so it would come "out of the mind" properly.

A short time ago I said we learn best by seeing. That leaves me no alternative but to demonstrate the job training teaching-learning process for you. We will show you the teaching of the same job twice—one without special emphasis on safety, and following that the same job with special emphasis on safety.

I would like to introduce the participants or role players:

William J. Hrdlicka
Staff Supervisor-Personnel
St. Louis, Mo.

Edmund J. Kelly
Staff Supervisor
White Plains, N. Y.

Sidney Robbins
Staff Supervisor-Plant Construction
White Plains, N. Y.

Phoebe M. Guyon
Welfare Supervisor
New York City

Lucille C. Sassmann
Staff Assistant
New York City

Actually we have two demonstrations. First we'll show you the job training in a man's job set up and follow it with one for women.

Our first demonstration shows the job training of how to prepare a lead sleeve in cable splicing. So just imagine you are watching a construction foreman and his men.

First I am going to teach the job *without* special emphasis on safety.

The cards will indicate what step in the four step job training process is taking place.

Note: Foreman and the two men do not wear safety glasses, gloves or hats during Part A of the demonstration.

Foreman—How are you this morning, fellows?

Bill and Ed together—OK, Boss, OK.

Foreman—Late yesterday I was checking a couple of the sleeves we put on earlier in the day.

Step 1—Preparation

We could stand a little review on it and I'm going to go over the preparation of lead sleeves so we'll all be on the ball.

Bill—Just a minute, Boss! I was the one who showed you how to prepare sleeves when you were just starting. Remember?—I *know* that I know how to do it—so—include me out.

Foreman—Yeah, Bill, that's right, you did break me in. That's one reason why I want you to go through it along with Ed.

Ed—As far as I'm concerned, I would like to go over it. You know, I haven't been

around long and can stand all the help I can get.

Bill—OK, I'll play along. In fact, maybe I ought to do the teaching.

Foreman—No, Bill, I want to do *that* myself. Preparing sleeves is a simple enough job but it's important that it be done right or the whole splice can turn out bad. I've got some sleeves and the tools are laid out. Here's the instructions, too. I've got them propped up so that we can all see them.

Ed—Let's not go too fast, Boss. Remember, this is all new to me.

Bill—Don't worry, Kid—Just watch me. I'm the original on this stuff.

Foreman—OK, Bill. What's the first thing to do?

Bill—Anyone knows you drift the sleeve first!

Foreman—Sure, sure but remember Ed's new. Supposin' I just show him what the tools are we're going to use. Now here's a sleeve, Ed. You know what it's for?

Ed—Sure, we put it over the splice joint and wipe it in with the hot lead. I've *seen* that done.

Foreman—Yeah, that's right. These are the tools. Here's a rasp which we will use to clean the sleeve.

Bill—Wait a minute, Boss, wait a minute! The first thing you do is to *drift* the sleeve as I said before. So why not show him the drift plug first?

Foreman—Well—maybe you've got a point, Bill! Here's what we call the drift plug, Ed. We have also a wire brush, a shave hook, a dresser, a cradle to hold the sleeve and some *stearine*.

Ed—Yeah—the names fit them pretty well. I can pick them out all right.

Step 2—Lecture and Demonstration

Foreman—First thing we do is to drift the sleeve. That's to make sure it's round, because in cutting it off and handling, it may have gotten out of shape. See—I start the drift plug in the sleeve and then force the plug through the sleeve by holding the sleeve and striking the handle of the drift plug on the floor. Once it's started, I grasp the sleeve in both hands and thump the handle on the floor until the plug clears the sleeve. Like this! Then I put the sleeve in the cradle.

Bill—Now, Kid, the next thing to do is pick up the rasp and—

Foreman—Yeah, that's right, Bill. Be my guest while I rasp it. (Takes rasp from Bill.) Hold the sleeve firmly in the cradle with your left hand, stroking the sleeve with the rasp, like this. The object is to get the sleeve clean for three or four inches on each end.

Ed—Yeah, I see.

Bill—You can turn it with your left hand while you rasp it.

Foreman—Hand me that shave hook, will you, Ed? That's what we use next. (Ed takes off the leather guard and hands the shave hook to foreman.)

Ed—Here it is. What's it for?

Foreman—You use it to bevel the inside edges of the sleeve and clean them.

Ed—Oh!

Foreman—See, like this. I hold the sleeve rigidly in the cradle with my left hand and wipe the shave hook around the inside edge with my right hand. There—see that bevel? Now—hand me that dresser, will you, Bill?

Bill—That's not the way I taught you, Boss!

Foreman—What do you mean, Bill?

Bill—Why, anybody knows you should brush the sleeve *before* you dress it!

Foreman—Yeah?

Bill—Yeah—

Foreman—Well—as I was saying, Ed—you take your dresser, hold the sleeve firmly in the cradle and shape it into approximately cable size. You rotate it as you strike it so as to shape it in evenly. See? (Strikes it.)

Ed—Why did you say you do that?

Foreman—To shape the sleeve down so that it is approximately the size of the cable. Then you beat it in for wiping after you get it on the splice.

Ed—Oh!

Foreman—You brush the sleeve smooth with a wire brush for a two-inch space on each end. That's so it will be clean and you will get a good wiped joint. Finally, you you are going to use it.

Bill—I still think you should have brushed it *before* you dressed it!

Foreman—OK! Supposin' you prepare a sleeve, Bill, and tell us *what* you are doing and *why* you are doing it as you do it.

Bill—Sure! This is old stuff to me! Just watch my smoke, Kid!

Ed—Sure, Bill, sure!

Foreman—OK, Bill.

Step 3—Demonstration By The Learner

Bill—First, I drift it with the drift plug.

Foreman—Why?

Bill—To make sure it's round—what else? Then I put it in the cradle and I rasp it clean at each end for three or four inches.

Foreman—Yeah! OK!

Bill—With the shave hook, I'm going to bevel the inside edges to clean them and make a good joint when we beat the sleeve in on the cable. Now—I brush the sleeve for three or four inches on each end so it will be good and clean for wiping.

Ed—Yeah—Bill—but the Boss said . . .

Bill—Sure the Boss said, dress it first, but—when I do it, I brush it first!

Foreman—Hmmm . . .

(Bill continues brushing.)

Bill—Now—with this here dresser, I beat it in.

Foreman—Tell Ed why you are beating it in!

Bill—To shape it to the size of the cable. This stearine will keep it good and clean, now!

Foreman—Bill, do you think that it's really clean after you have dressed it?

Bill—And why not?

Foreman—Well, the dresser might be dirty and then you have beaten a lot of little ridges in there, too. Could be that causes trouble.

Bill—Oh, I don't know!

Foreman—Well, if you brushed it again before you put on the stearine, you would be sure, wouldn't you?

Ed—If you waited to brush it till after dressing it . . .

Bill—Keep your cotton-pickin' fingers out of this, Kid. This is between me and the boss!

Foreman—Well, if you want to go through life brushing everything twice . . .

Bill—All right—all right—you're the boss!

Foreman—Now, Bill, don't you really think it's best to brush it afterwards?

Bill—Well, I'll try it that way and let you know.

Foreman—OK, Bill, I'm going to take you at your word. Let's see you run through the whole thing now without me saying anything.

Step 4—Test

Bill—OK—First, I drift it to make sure it's round. I put the sleeve in the cradle and then I rasp it clean for three or four inches on each end—like this—see! Hand me that shave hook, Kid! I'll teach you how to be a good helper.

Ed—OK, here it is.

Bill—Now that I've beveled the inside edge with the shave hook, I'll brush her up. No—wait a minute—wait a minute! I'll dress it first! There—that looks about cable size. Now—I'll brush it! It's got to be smooth for about two inches on each end and—here goes the stearine to keep it clean. How do you like them apples, Boss?

Foreman—Looks good to me, Bill.

Ed—You know—I've learned a lot this morning. How about my trying it?

Foreman—OK, Ed.

Leader's Remarks—This completes our demonstration of on-the-job training using the four-step teaching-learning process without special emphasis on safety. As you have observed, each of the four steps was easily recognized so, in our second demonstration of the on-the-job training teaching-learning process with special emphasis on safety. We will only run through Step 2 lecture and demonstration, and Step 3, demonstration by the learner. Steps 1 and 4 will be omitted.

It's in these Steps 2 and 3 that safety should be introduced and emphasized. In fact, safety is, for the most part, introduced in Step 3. This is so the actual job operations, as demonstrated by the supervisor, will be clear and clean-cut with respect to the job sequence. Of course, since the safe way and the right way are one and the same thing, this should in no way detract from the effectiveness of introducing the greater part of the safety concepts in the succeeding step, Step 3, demonstration by the learner.

For the purposes of our demonstration, remember that Step 1 has already been completed.

Note: Foreman has his safety glasses and gloves on but men have gloves in back pockets and are not wearing safety glasses.

Foreman—Now, Ed, I'm going to show you how to prepare the sleeve.

Ed—That's fine, Boss.

Foreman—By the way—where's your safety glasses, Ed? You are supposed to wear them eight hours a day on the job, you know that.

Ed—They're in my pocket. I don't need glasses!

Foreman—Yeah, but you do need eyes, so how about getting your safety glasses on.

Ed—OK! (Bill glances around and quietly puts on his safety glasses also.)

Foreman—There's something else missing, too. (Bill and Ed silently check over the tools.)

Bill—The tools we need are all here—what do you mean?

Foreman—Yeah—except for what's in your back pocket.

Bill—You mean these? (Bill takes gloves out of his pocket and slaps them down on the table.)

Foreman—Now, Bill, you know you should wear gloves. We do not want any cuts and infections on this job.

Bill—But...

Foreman—No but's about it—both of you get 'em on and your hats, too. You wouldn't exactly enjoy sunstroke either.

Ed—The boss is right, Bill.

Bill—OK, OK. I notice you didn't have yours on either—Jet Job!

Foreman—The first step in preparing a sleeve is running the drift plug through it. This is done to make sure that the sleeve is round. Let me have the drift plug, Ed.

Ed—OK, here she is.

Step 2—Lecture and Demonstration

Foreman—See, I start it; then, holding on to the sleeve, I thump the handle on the floor until it emerges from the sleeve. Keep a good hold on the sleeve, keeping one hand under it so it won't fall when the plug clears it. If it fell, it could sure bust your toes.

Now I'm going to rasp the sleeve so as to clean it three or four inches back from each

end. First I put it in the cradle so I hold it securely and it won't get away from me and fall. That could cause a bad accident. Notice I rasp away from myself and rotate the sleeve slowly in the cradle.

Bill—(as if talking to himself) That's right—leave it out—don't bother to tell him!

Foreman—What was that, Bill? What are you grumbling about?

Bill—Oh, it's OK by me if you don't tell him everything he needs to know. I'll fill him in later, anyway.

Foreman—OK, Bill—What is it now?

Bill—Well—don't you think you ought to tell him which side of the rasp to use instead of just showing him?

Ed—I can see he's using the flat side!

Foreman—Yeah, Ed—that's the side to use—the flat side. Now, with the shave hook, I wipe her around the inside edge, like this, putting a good bevel on her. That's so when we beat it into the cable it will lie up against it good. That kind of cleans it out, too. Be very careful with that shave hook—the point is really sharp and if it slipped it would give a nasty wound.

Ed—Yeah—it would slice through the gloves easily.

(*Note:* The guard is left off the shave hook and laid to one side.)

Foreman—Using the dresser here, I beat the ends in to almost cable size.

Bill—(in a low voice, holding up the wire brush and shaking his finger at it.) I still think...

Foreman—Yeah—I know, Bill—the wire brush. Didn't we agree to try it the other way? (Pause) How about doing it my way, huh? That's the way I want it done on the job anyway, see?

Bill—OK, Boss, OK—If you say so.

Foreman—Well, I do say so. Now, I've got it dressed, I'll brush it—brushing it the safe way—away from me. Clean it about two inches at each end. Finally, I rub on the stearine to keep it clean. Any question, Ed?

Ed—No, I've got it.

Bill—That's what you think.

Foreman—OK, Ed. Supposin' you show me how to do it, telling me as you go.

Step 3—Demonstration By The Learner

Ed—OK. First, I drift it—like this—

Foreman—Why do you drift it?

Ed—To get it round.

(Bill turns away, pulls a newspaper out of his pocket and starts reading it.)

Foreman—Anything special to watch out for?

Ed—To keep one hand under it to hold it because it's heavy and could break up some toes. Now I put the sleeve in the cradle where I can keep it from getting away from me and causing an accident. Then using the flat side of the rasp, I clean the sleeve three or four inches back, like this.

Foreman—Yeah, be sure to stroke it away from you. You know these rasps can take off a big hunk of skin if you miss.

Ed—Yeah, that's right, I guess.

Foreman—What's next?

Ed—Well, with the shave hook I bevel the inner edge.

Foreman—Wait a minute, where's the guard for the shave hook? It should always be on it when it's not in use. That hook is pointed as well as sharp and can cut you up plenty.

Bill—Here it is.

Foreman—You used the hook last, Bill. Why didn't you put the guard back on when you finished?

Bill—I forgot—anyway I figured we'd be using it again soon.

Foreman—Makes no difference. Let's get this straight. I want all guards put back as soon as you finish using the tool—and I mean always.

Ed—Got it beveled now.

Foreman—Why did you bevel it, Ed?

Ed—So that when we beat it in, it will lie snug to the cable.

Foreman—That's right—and remember that shave hook has a keen edge on it, so keep it under control and stroke it right so you won't cut yourself. (Bill holds up finger and inspects Band-aid on left index finger—looks around and quickly puts hand back in glove.)

Ed—Now let's see. I'm a little confused here as to whether I dress it or brush it!

Bill—(looking up from his newspaper)—I'm not!

Foreman—Well—neither am I. Let's use the dresser.

Ed—Oh yeah—that's right, that's right—if I brush after I dress it, it will be clean and I'll only have to do it once.

Foreman—Yeah—and watch out for that wire brush. It doesn't give you a beauty treatment if you miss with it.

Ed—Ok, Boss. Now finally I rub on the stearine to keep it clean.

Foreman—That's OK.

Bill—Yeah—that's OK, Kid. Maybe some day you will be as good as I am.

Foreman—Now let me see you run through it completely on your own, Ed.

"A"

The second demonstration of on-the-job training will be presented by the ladies. It portrays some of the differences between job training women and that of men. The women—"God bless them"—look at things from a different standpoint than men and often have different reactions to similar situations. The job teaching-learning process is the same of course. The trainer's approach to and handling of the steps must be accommodated to the women's frame of reference as well as meet their tendency to personalize situations in a way which is seldom if ever experienced with men.

The points of difference are in no way critical of women. They are perfectly natural and arise out of the different things experienced by women as they grow up, the things that only they can contribute to society, and of course their basic philogenetic and psychological drives. Without these feminine characteristics the human race could not have survived, for the characteristics we are discussing also give rise to that fanatical devotion to and protection of the young. So we heartily agree with the Frenchman who said: "Vive le difference!"

Here are some of the female foibles which will be portrayed. Watch for them and note how they color the handling of the job training process.

Women tend to personalize everything

Women should never be criticized directly

Women are never wrong

Women like to parade

Women like to verbalize

"B"

Women ask questions even when they understand

Women's minds may wander—attention is less critical

Women do not have a mechanical background

Of course, some of the illustrations of these may be a little overdrawn in this demonstration. That is for emphasis and to meet the needs of role playing.

The girls and Mr. Kelly will demonstrate the job training process in teaching how to operate a drill press. The first time we will do it *without* special emphasis on safety.

On-the-Job Training With Safety— Is It Different?

A Demonstration of On-the-Job Training Job Taught—Operation of a Drill Press A. Without Special Emphasis on Safety

Note: Foreman and both girls do not use safety glasses during part "A." Girls do not wear caps and do not remove jewelry.

Foreman—As I discussed yesterday, I'm going to start you gals on drill presses today. Has either of you ever operated drill presses before?

Loo and Phoebe together—No, I haven't.

Foreman—Well, OK, then. I'm going to go over the job with you and teach you the things to do.

Phoebe—I don't know whether I like drill presses or not! I was happy enough on bench assembly.

Loo—So was I but the higher price rate on this job won't make me mad!

Foreman—Let's not make up our minds before we've tried the job, Phoebe. I think you will like it.

Phoebe—Well . . . OK, if you say so.

Step 1—Preparation

Foreman—Here's the spindle you will be drilling. (Holds up one) It doesn't look like much but it goes in the central part of a guided missile so it really is an important item. What you are going to do is drill a hole in one end of it. A hole like this.

Phoebe—This is wonderful! Just think—little ole me working on guided missiles—that sends me.

Loo—By the way, Boss—what is the piece rate on this job, anyway?

Foreman—It's 10 per cent more than it was on your old job.

Loo—That's what sends me—that extra 10 per cent.

Foreman—The first thing to do is to turn on the press. Here's the switch. Then you pick up one of these rods and put it in the fixture. See? You tighten the holding screw so as to hold the piece firmly in the fixture. Then you turn it over and place it flat on the table of the drill press, like this. Next, you dab a little of this lard oil on the point of the drill with this brush. See?

Phoebe—What was that?

Foreman—I said, you take this little brush which is in the can here and dab some of the lard oil on the point of the drill.

Phoebe—Oh! I see!

Foreman—The oil will make the drill cut smoothly and evenly without heating up or binding. Now I place the fixture under the drill, holding it flat on the table with my left hand, lining the hole up with the drill. Then I bring the drill press handle down smoothly and evenly with a steady pressure. I sort of ease up as the drill breaks through. If I don't, it might catch and the whole fixture would start whirling around.

I raise the press handle to the all clear position.

Finally, I loosen the screw, take the piece out of the fixture and put it in the tote box with the hole to the right.

Now—any questions?

Loo—What was that part about easing up? How're you gonna drill it if you don't have any pressure on it?

Phoebe—Yes, I don't get that either. Just how are you going to drill it if you don't press on it?

Foreman—Maybe if I drill a couple of pieces and you put your hand on mine as I do it, you will get the feel of it.

Phoebe—This part I like!

Loo to Phoebe—(As foreman is putting piece in fixture)—Phoebe, this isn't Elvis Presley, remember! It's the boss. Turn off the glamor. The only oil we need here is the lard oil. (Phoebe gives Loo a dirty look)

Foreman—Break it off, girls, break it off! Now, Loo, put your hand on mine as I drill

this. Notice how I ease up on the pressure as the drill goes through?

Loo—Yeah, I get it!

Foreman—Now, Phoebe, you try it. See—notice how I do it?

Phoebe—Uh, huh.

Foreman—Loo, you try it first. If you have any questions, I'll help you if you need it.

Loo—OK. (*Loo hesitates, looks at Phoebe, and makes no move towards starting.*)

Foreman—All right, Loo, let's go. You run through the operation and tell me what you are doing and why you are doing it.

Loo—What?

Step 3—Demonstration By The Learner

Foreman—You run through the operation and tell me what you are doing and why you are doing it.

Loo—Oh—well, I turn on the machine here, like this. I put the rod in this here thingamabob and turn this dingus until it's down tight.

Foreman—Yeah! That's a fixture and you turn down the screw to hold it tight.

Loo—Yeah, that's what I said—you turn the dingus down so as to hold it tight. Next I put a little lard oil on the point of the drill with this brush.

Foreman—Why?

Phoebe—So it won't get "all het up," dearie!

Loo—Why don't you wait until your turn before you get all het up yourself!

Foreman—Let's have Loo do this and keep your minds on it, huh? Now, Loo, why do you put lard oil on it?

Loo—Well, let's see. Oh, yeah—that was so it would cut the material easily and the drill wouldn't stick or bind.

Foreman—Yeah—and also so it won't "get all het up!"

Loo—Now—I put the gadget flat under the drill and hold it with my left hand so it won't move. I bring the handle down steadily and evenly, like this. But I sort of ease up as the drill goes through.

Foreman—That's good—but why do you do it?

Loo—Well—hmm—Why do I do it?

Foreman—So the drill won't grab and the fixture whirl around with the drill.

Loo—Oh, yes, I remember, now! Then—I unscrew it and put the piece in the tote box, like this.

Foreman—Yeah—except that the hole should always be to the right.

Loo—OK, if that's the way you want it.

Foreman—Were you watching that, Phoebe?

Phoebe—Sure . . . watching what?

Foreman—Watching the whole operation.

Phoebe—Oh—yeah—I've got it.

Foreman—That's fine, Loo. I think you are ready to take over but you might as well wait until after I have run through this with Phoebe.

Leader's Remarks—This completes the first demonstration of the four-step teaching-learning process without special emphasis on safety. Step IV was omitted in the interest of saving demonstration time and because it is purely repetitive. In actual job training it must be completed because it is where we make sure that what we taught "comes out of the head" correctly.

In the second part of the demonstration in which special emphasis will be on safety, we are going to do only Steps 2 and 3. Steps 1 and 4 would, of course, be the same for, as previously mentioned, safety features in the work operation are introduced in Steps 2 and 3 with the majority of them being brought out in Step 3. This ensures a clear cut presentation of the job sequence in Step 2. Furthermore, when the safety items are brought out in Step 3, demonstration by the learner, retention and recall are strengthened by the learner's actually doing the operation herself.

B. With Special Emphasis On Safety

Note: Foreman wears his safety glasses all through Part B. Girls do not put on their safety glasses and caps or remove their jewelry until foreman tells them to do so.

Foreman—Phoebe, I'm going to show you and tell you the work operation.

Phoebe—OK. I saw Loo do it. I think I can do it all right if she can—but go ahead.

Foreman—Wait a minute, though! You should both have caps on to keep your hair tucked up and out of the way. It might

catch on a shaft and you would get injured. Also, we wear safety glasses on this job. Your eyes are mighty important to you and they can't be replaced, either.

Phoebe—Oh, I don't think I want to wear a cap or glasses.

Loo—Let's not get all shook-up, *Phoebe*. The other girls who had this job wore caps and safety glasses. We can.

Foreman—That's right, *Loo*. Now one other thing—on this job you will have to take off all jewelry—those rings, wrist watch and bracelets.

Phoebe—That does it! I just don't feel dressed without my rings and dangle bracelets.

Loo—You should have brought your horse, too, *Mrs. Astor*!

Foreman—Well, girls, the reason you can't wear rings, wrist watches and bracelets is that we don't want you to lose those pretty fingers. I think you'd miss them more than giving up wearing your rings. While we're doing this, just lay them here where we can see them and then take them back later and lock them up. *(The foreman hands each girl her cap and safety glasses.)*

(Girls step to one side and remove jewelry and put on safety caps and glasses.)

Loo to Phoebe (aside)—And all this for a lousy 10 per cent.

Phoebe to Loo—Now who's getting shook up?

Step 2—Lecture and Demonstration

Foreman—Well, *Phoebe*, first you turn on the drill press. Here—like this. Then you pick up the piece and put it in the fixture, tightening down the thumb screw to hold it securely. Using a fixture prevents injury to your hands while drilling.

Of course, it also holds the piece firmly and steadily which would be a little hard to do with your fingers. Then I take the fixture and locate it under the drill. Now I dab a little of the lard oil on the drill so as...

Phoebe—Yes—that's so the drill won't heat up.

Foreman—That's right. Also it will make it cut easier and keep it from binding.

Then I bring the handle of the drill down with an even pressure and ease up as the

drill goes through. If I didn't ease up the drill might catch and the fixture would whirl around and it might hurt you.

Phoebe—Uh-huh.

Foreman—I raise the press handle to the all-clear position. Then I unscrew the fixture and finally take the piece out of the fixture and put it in the tote box with the hole to the right. Any questions?

Phoebe—Oh no!—I've got it.

Foreman—Well—now let's have you do it and I'll help you, if necessary. You tell me what you are doing and why you are doing it.

Step. 3—Demonstration

Phoebe—OK! First, you turn on the drill press with this switch. Then you put the piece in the... in the... uh... in this thing. You dab a little oil on the drill point and then you put it...

Foreman—Wait a minute. Haven't you forgotten something?

Phoebe—Why no—of course not—are you implying I'm a dope?

Foreman—Of course not. Next you've got to tighten the screw that holds the piece in the fixture. You didn't do that.

Phoebe—Of course, I did, I'm no dope!

Foreman—*(heaving a sigh)*—Well—anyway—let's tighten it again, huh, and be sure to check and see that it's tight every time.

Loo (to herself)—Now I wonder who sneaked in and loosened that screw! *(Phoebe gives Loo a dirty look and flings her head)*

Foreman—*Loo*, I'm sure you've got this OK. Why don't you take your rings and put them in your locker? *(Loo picks up jewelry and goes to one side of platform)* Now, *Phoebe*, let's try it again.

(Note: In the meantime, the foreman has removed the piece from the fixture.)

Phoebe—Well—I pick up the piece and put it in this block. What do you call it—the block that is? Oh, yes, it's a fixture. Then I tighten the screw so that it's in there good and tight. OK?

Foreman—That's fine, *Phoebe*. Why, though?

Phoebe—Well—that's because the fixture will hold it firmly, which I probably couldn't do with my fingers, and I might get hurt.

Foreman—That's right, *Phoebe*. That's good.

Phoebe—Then I dab a little of this oil on the point of the drill so it won't bind and it will cut easier and—oh, yes—so it won't get all het up! Then I locate the fixture under the drill and bring the handle down evenly until it's about to break through and then I sort of let up on it.

Foreman—Yes, that's fine, but why do you do that?

Phoebe—Well, if the drill caught, the whole thing...

Foreman—The whole what?

Phoebe—. . . the whole fixture would start going around and I might get hurt.

Foreman—That's right; that's good.

Phoebe—Then I unscrew the fixture and put the piece in the tote box. *(Phoebe picks up the piece and puts the wrong end up, grabbing the part where the hole was drilled.)*

Foreman—Yeah, but Phoebe—you put the piece in the tote box with the hole to the left. Also, you must be careful not to pick it up where the hole is because there are burrs on it and you might cut your finger.

Phoebe—I'm sure you said to put the pieces in the box with the hole to the left . . . and . . . I didn't grab it tightly.

Foreman—Well—anyway—starting now, let's put them with the hole to the right! You know, you could get a badly infected finger from a burr cut, so be sure to pick the piece up on the clear end.

(Loo returns to the drill press and stands nearby.)

Foreman—Since you're back, Loo, Now I can emphasize a couple of things to both of you.

Loo—OK.

Foreman—What's the first thing you do when you get on the job each day?

Phoebe—I start thinking about the coffee break.

Loo—The boss means—what you should do, wiseacre.

Foreman—Like what, Loo?

Loo—Like taking off your jewelry and getting your safety glasses and caps on.

Foreman—You're right—Those things are musts.

Phoebe—I was just kidding.

Foreman—OK—but remember, safety is one thing we can't kid about—it's for real. Are you sure you've got that?

Loo—I have.

Phoebe—Me, too.

Foreman—Fine, girls. *(Glances at watch)* Guess it's time for that Coffee break.

Leader—That completes the demonstrations of job training. I'm sure you were able to distinguish the differences in training with special emphasis on safety as well as the variations in approach and handling of the process when men and women are trained.

The importance of making sure that things "go into the mind" with the needed emphasis on safety insures their "coming out of the mind" in such a way as to get the job done safely.

No doubt many of you are thinking—"Important as it is, on-the-job training with safety is not the only factor in good job performance." You are correct. Motivation, that is, the "will to do," is also essential. Here's a simple statement that expresses the relationship in the form of a formula.

$$\begin{array}{ccccc} \text{Ability} & \times & \text{Motivation} & = & \text{Performance} \\ \downarrow & & \downarrow & & \downarrow \\ \text{Aptitude} & & \text{Will to Do} & & \text{Job Results} \\ \text{and} & & & & \text{Including} \\ \text{Training} & & & & \text{Safety} \end{array}$$

Ability can be 100 per cent but if motivation is only 10 per cent their product when multiplied gives only 10 per cent performance. It work the other way also. However, good training with safety includes stimulating and developing the will to do.

The key that unlocks the door to safety on the job is *complete acceptance of personal responsibility for safety*. For supervision it means supervision with special emphasis on safety by each and every supervisor. And, as we have seen, that calls for on-the-job training with safety stressed. For each and every worker it means accepting and fulfilling their individual safety responsibility at all times.

There is only one way to get safety and that is on the job while the job is being done. You can't get safety after the job is completed any more than you can save money after you have spent it.

LABORATORY AND PILOT PLANT SAFETY

(A Symposium)

TOXIC CHEMICALS

By RALPH V. MONTELLO

Research Div., National Cash Register Co., Dayton, Ohio

As Americans we are reared to believe that human life is most precious, and that human suffering can never really be measured in terms of dollars and cents.

Today's accident toll reflects the major progress made by those persons who work diligently to cut down the accident rate throughout the United States. Yes, compared to 50 years ago great strides have been accomplished in the untiring crusade against accidents of all kinds. With all of this progress, where are we today? Let's examine the field of industrial poisoning which concerns toxic chemicals.

In one state, alone, for which figures were available, 408 claims of industrial poisoning occurred in a recent year. The direct cost of these claims amounted to \$244,228. This breaks down to an average of two compensable accidents per working day at a cost of \$1,200. Far greater must the cost be in terms of personal suffering for which no adequate yardstick can be devised.

Thirty-five of these claims were based on systemic effects due to chemical agents. Fifteen of these involved lead and its compounds, and eight were due to other metal compounds. Other toxic substances causing poisoning were: carbon monoxide and benzol, each with two injuries, and paints and paint thinners, a germicide, ammonia, volatile petroleum solvents, and volatile acids, each with one injury. The report further states that the poisoning due to the germicide was one of the most costly of all occupational disease injuries. It had a compensation cost of \$3,939 and a time charge of over 2,000 days. Another unclassified chemical agent was responsible for an occupational disease with systemic effects in which a total of \$5,837 in compensation indemnity was paid. These figures do not accurately reflect the near misses, but we can be sure that they were quite high.

With the expansion of the chemical industry, an increase in the rate of accidents due to toxic chemicals can be expected. The report from which the above statistics were taken shows that in the four years preceding, a definite rise in the trend had been noted. The problem of accident prevention in the field of toxic chemicals has not been solved.

We've got work to do!

Surprisingly enough, the formula for safety bears a striking similarity regardless of the branch of safety or the type of industry. Whether we are dealing with toxic chemicals or general laboratory safety, a good safety record depends upon the effective distribution of sound safety practices.

The similarity of safety practices referred to above include two basic concepts. The first concerns knowledge, knowledge of the hazards involved. A step by step analysis of the whole experiment should provide this knowledge. The second, and equal in importance, concerns the dissemination of this knowledge to all personnel who require this knowledge to carry out their assigned duties safely. It is not enough to write good safety specifications only to find that no one opens the book of safety specifications to read them.

It, virtually every chemical industry accident reported in the National Safety Council newsletter someone was ignorant of the hazards. More often than not someone pays dearly for this ignorance. It is generally the case that the knowledge regarding the hazard was available, but somehow just never got to the victim.

An interesting case history which illustrates the failure to adequately impress people with hazards of toxic chemicals can be told by the following story. This account relates that a trucker was transporting a cyanide salt in a cardboard container. On the same truck bed was a pint bottle of

chromic acid which overturned and wet the cardboard box. When the trucker arrived at a confined area, the generation of hydrogen cyanide was enough to overcome the trucker and several people who came to his rescue. Quick action on the part of the medical department saved the lives of these people. This was a near tragedy.

If one were to look for the elements lacking in a safety program, the failure to acquaint each man with the specific hazards of his job must certainly qualify as one of the important missing links. Often this failure is not intentional, but results from the delegation of safety responsibility. When this responsibility is passed too far down the line, the strength of the safety program is diluted beyond the effective point.

This latter remark needs clarification. A non-management person is hardly the one to enforce safety rules or to give safety information to his co-worker. He lacks the authority. No one wants advice, safety or otherwise, that he does not ask for, especially from one who has equal or less rank. The safety program can deteriorate to a dangerous level with this kind of safety program.

Let us be reminded that an accident is like a coiled spring—it's just waiting to happen. When supervision entrusts the responsibility of carrying out a safety program to a departmental representative who otherwise lacks this supervisory control, supervision is inviting failure. Why? The answer is to be found in the words, "lacks supervisory control."

The use of safety representatives on a departmental level is believed to be widespread. Probably the main advantage for such a system is that the safety representative receives training in safety work and thereby becomes safety conscious himself. This type of training is quite effective as long as the representative is active in the program. After the representative is replaced on the safety committee, he is no longer active. His interest in safety will lessen.

It is known that the power of retention of safety awareness varies among individuals. Seldom does it approach the 100 per cent mark. But what happens to the other laboratory personnel who are not on the safety committee? If the service of appoint-

ment on the safety committee is one year, and it usually takes this long for a new group of people to orient themselves and carry out a safety program, it would take 20 years to train every person in a department of 20 people. This is, of course, too long and therefore unsatisfactory.

In those industries whose safety records are outstanding the common denominator is active supervision. The active part played by the supervisor is then the keystone to any good safety program. A statement of policy of the A. O. Smith Corporation bears mentioning for it underlines the active responsibility management is expected to assume.

"When a man enters the employ of A. O. Smith, he has a right to expect that he will be provided with a proper place in which to work, proper machines and tools with which to do his job, and that he will be able to devote his energies to his work without danger to his life and health.

"It is a basic responsibility of all those carrying executive authority to make the safety of human beings a part of their daily, hourly concern. This responsibility must be accepted by each one who conducts the affairs of the A. O. Smith Corporation, no matter in what capacity he may function."

The job that is expected of our supervision in maintaining an adequate safety program in the chemical industry is not an easy one. First he is dealing with chemicals that non-technical personnel do not understand. The problem of training this kind of personnel is often very delicate. No attempt should be made to scare them out of their wits and yet they must receive sufficient training to prevent a harmful exposure to either themselves or others in the area.

The minimum amount of safety information necessary to get the job done safely is usually better than to list everything known about the process. This latter kind of information rests with the group leader or other member of supervision whose responsibility it is to see that the safety rules are strictly followed.

One of management's problems in the safe conduct of individuals who are on a technical level is the person who feels that his knowledge of the chemicals involved is

sufficient to exempt him from any safety suggestions. Once again, as was stated earlier, knowledge alone is not enough to prevent an accident.

An excellent film entitled "Knowings Not Enough" from the U. S. Steel Corporation was first available two years ago. This film which was shown to some 3,000 supervisory and non-supervisory employees at The National Cash Register Company emphasized that most accidents occurred as a result of ignoring known safe practices. People get in the habit of taking chances perhaps because in the past they have gotten away with it. The symbol of the film was a yellow flag—this warning meant slow down, there is danger ahead. We would all do well to heed the yellow flag.

There are safety rules which point out the danger of using laboratory glassware to prepare food in the laboratory. And yet laboratory personnel who presumably should know better, violate this rule all the time. Another pet peeve of the speaker is the violation of the no smoking rule. Why some people will take chances, even though they are aware of the hazards, and others will not must have a complicated answer. On one thing we can all agree, any accident that can happen will happen. Once our people learn this, they are on the road to accident prevention, not in their daily job but also at home and on the highway.

Every person should study a formal course in first aid. Records show that those people who study first aid taught by the American Red Cross have at least 50 per cent fewer accidents.

In the chemical industry, data regarding toxic chemicals is available in a variety of publications. These include books, periodicals, and pamphlets. A *Bibliography of Toxic Chemicals* has been prepared with the aim of providing interested personnel with as complete a reference list on this subject as possible. The use of this list should go far toward acquainting one with the literature available and providing him with the knowledge necessary to work safely with toxic chemicals.

You will note that the bibliography contains a section on *books* and a section on *articles on toxic chemicals*. The first *Bibliography of Toxic Chemicals* was prepared in 1957 and was distributed at the National

Safety Congress in Chicago, October 24, 1957. In an attempt to make the compilation more complete, the list of references was not typed until the week preceding the National Safety Congress. As a result that work did not measure up to good library practice.

The book section of the *Bibliography of Toxic Chemicals* for 1958 has been modified to meet these requirements. Any deviation from this practice was made to permit additional information. Some of the references on books now show a brief abstract of the contents. This will overcome a major criticism of those individuals who were interested in specific safety information. Certain of these books bear mentioning as general texts on our subject and can usually be found in most technical libraries.

According to J. A. Houghton, Liberty Mutual Insurance Co., the 12 most current books and data sheets on toxic chemicals in industry would include: (1) *Industrial Hygiene and Toxicology*, two volumes by Patty, (2) *Industrial Toxicology* by Fairhall, (3) *Manufacturing Chemists Association's Chemical Safety Data Sheets*, (4) *National Safety Council's Industrial Data Sheets*, (5) *Safety in the Chemical Laboratory*, H. Pieters, (6) *Chemical Safety Supervision*, J. Guelich, (7) *Occupational Diseases of the Skin*, Schwartz and Tulipan, (8) *Noxious Gases*, Henderson and Haggard, (9) *Analytical Chemistry of Industrial Poisons, Hazards and Solvents*, M. B. Jacobs, (10) *Halogenated Hydrocarbons, Toxicity and Potential Dangers*, Von Oettingen, (11) *A Manual of Pharmacology*, Sollmann, and (12) *Dangerous Properties of Industrial Materials* by I. Sax.

The format of each reference in the book section of the bibliography is as follows: (a) author, (b) title, (c)—publisher, (d) date of publication or copyright, (e) number of pages, (f) price, and (g) abstract. More than 50 publishers were contacted for information necessary to complete each reference. Not all of the publishers have replied. It will therefore be necessary for this year's bibliography to go to press with some incomplete entries. If you have a copy of the book for which the reference shows an incomplete entry, please forward to the speaker the information for next year's bibliography.

October 24,
 cation
 rences was
 ng the Na-
 result that
 od library

ography of
 m modified
 deviation
 rmit addi-
 references
 act of the
 ajor criti-
 ere inter-
 m. Certain
 as general
 usually be

Liberty
 st current
 emicals in
 stral Hy-
 umes by
 by Fair-
 Associa-
 ets, (4)
 rial Data
 Labora-
 Safety
 upational
 Tulipan,
 nd g-
 nd al
 l. Jacobs,
 Toxicity
 en, (11)
 ann, and
 industrial

he book
 follows:
 er, (d)
 number
 More
 for in-
 each
 s have
 try for
 ss with
 have a
 ference
 orward
 next

The section entitled "Articles on Toxic Chemicals" has been revised. A standard procedure based on good library practice has been used in this year's issue of the bibliography. Our thanks go to Mrs. Janet S. Schroeder, head librarian of the technical library at the National Cash Register Company in Dayton, Ohio, for a careful revision of this section.

In the book section the number of entries has been increased while in the section on articles, the entries have been reduced from 166 to 89. Some of the deleted articles were removed because the information given was obscure or the references were too incomplete to be useful.

The section, "Articles on Toxic Chemicals," could be an important asset to the *Bibliography of Toxic Chemicals*. But it will take the help of many people. If you would like to see this section grow, please submit the necessary information on the next safety article on toxic chemicals that you read. Use the form as shown in the bibliography, otherwise the article may be too difficult to locate. It may be possible, once this section has grown, to list these articles in groups according to a classification which is based on the toxic chemical or the type of industry. Feel free to write to the speaker and let him know your opinions regarding the treatment of the section on "Articles on Toxic Chemicals."

One of the problems which confronts the safety director in the chemical industry is the justification of complaints by employees who believe they are being poisoned by chemicals encountered on the job. The question in the minds of management is whether the individuals who make such complaints have an ulterior motive.

In all such cases, it would be extremely helpful if a rapid analytical procedure which measured the concentration of the toxic material were available. While many good analytical procedures are available in the literature, some procedures require several hours to complete. Furthermore these procedures require analytical chemists who must have access to a chemical laboratory. In our larger industries which have well equipped analytical laboratories, this is no serious problem.

The speaker would be interested in learning about the more recent methods of

chemical analysis of toxic materials with the aim of editing a review of these methods and making a distribution to interested personnel similar to the distribution of the *Bibliography of Toxic Chemicals*. A very real service could be made to non-technical safety directors who do not have a supporting chemical laboratory if a list of rapid and simple instrumental methods of analysis were made available to them.

To pass judgment on whether a toxic condition does exist is at times very difficult. The maximum allowable concentrations of toxic chemicals usually found in the literature should be used as a guide only. These limits are usually derived from studies on small animals such as the rat or mouse, guinea pig, monkey, dog, or rabbit. The correlation between man and the test animal is not always known. The susceptibility of individuals will differ with body weight, age, and general health. Even traces of materials not usually considered to be in themselves toxic have produced severe symptoms.

There is the case of an employee who even though he used a commercial protective hand cream broke out in a severe rash about his fingers. This employee who worked near a degreasing operation was found to be allergic to trichlorethylene, a solvent used in the degreasing operation. Interestingly enough, the operator who removed stock from the degreasing bath was not affected. Nor were any of the other individuals affected who worked in the area of the employee with the rash. Removal of this person from the contaminated area to another department showed a remarkable recovery in the condition of his hands.

The literature reports individuals who are allergic, of all things, to strawberries. In fact only recently a woman who worked in a bank was found to be allergic to paper money. An excellent section on allergic disease in industry can be found in Sax's *Dangerous Properties of Industrial Materials*.

There are agencies working on the state and national levels whose primary aim is to turn the tide of waste of human life. The chemical industry is more alert than ever to the creation of new toxic hazards which arise from the use of new materials. A survey of the more recent literature indi-



cates that knowledge is available to make it safe to work with these new materials.

Permission has been granted by Interscience Publishers, Inc., to quote the dedication which appears in *Analytical Chemistry of Industrial Poisons, Hazards and Solvents* by M. E. Jacobs which was copyrighted in 1944.

"I dedicate this book to those who toil,
Within the factory, the shop or mine,
To those who work with brain, or hand,
or spine,
To those who labor where foul vapors boil,
To those who sweat their bread out of
the soil.

To those whom gases in the streets assail,
To those whom industry may cause to ail,
To all of those whom dust and fumes
despoil.

No worker should his heritage so lose
When there are ways most hazards to
detect.

When we can have our health, if we but
choose,

Why let a noxious cause have its effect?
All those who work, this book will help,
I trust,

And spare them years ere they return to
dust."

HIGH PRESSURE EQUIPMENT — DESIGNING FOR SAFETY

By DARRELL D. FREDERICK

Chief Engineer, Autoclave Engineers, Inc., Erie, Pa.

Safety with regard to high-pressure equipment usually means two things—the safety of personnel performing the work and the protection of valuable equipment. Naturally, the safety of personnel is by far the most important, and all precautions possible should be taken to produce equipment which will operate safely at its rated conditions.

Safe practices involving the design and operation of pressure equipment usually are applied in varying amounts depending on conditions. For example, in considering the amount of work done in this country today utilizing pressure equipment, we find it varied in nature, ranging from small bench scale studies in the research laboratory to actual full scale plant operation.

These studies in the laboratories are, for the most part, fundamental research in which development and search takes place for new products which can be made utilizing high pressure. There is a great deal of pilot plant work being done in the use of high pressure as a tool in proving different processes.

There is a definite trend today to use high pressure reactors for hydrostatic forming of molded parts previously formed in huge hydraulic presses. The use of reactors results in more uniformity of pieces, and economy and savings in time.

Another important factor, increasing the need for pressure equipment, is the ex-

haustion of some of our natural resources. It has been determined that quartz can be grown synthetically under high pressure and temperature, producing crystals with grain structures more suitable than those found in natural quartz. Diamonds have been produced utilizing extreme pressure and temperature. These are a few examples indicating the uses of high pressure today. Certainly the usefulness will be expanded greatly based on the work done in fundamental high-pressure research.

Assume you have several experiments involving the use of a high-pressure reactor. You should have some knowledge as to the type of reaction expected in the reactor. If the reaction is to be exothermic, proper protection should be obtained. This sometimes can be done by including a full-area blow-out disc in the reactor.

If you are running an experiment in which the final results are completely unknown, full protection against any type of accident must be sought. If this cannot be accomplished in the design alone, then suitable barricading must take place. However, there are types of high-pressure work where the reaction taking place is well known, and safe practices in the design and operation of the equipment are well defined.

Perhaps, one of the most serious effects due to the failure of a vessel or leakage of

a connection is the resulting fire or explosion caused by the escape of the contents of the equipment. Every precaution must be taken to ensure against any accumulation of dangerous explosive gases.

The field is broad, reaching from small bench scale work to actual plant operation, and there are many variables and considerations one must weigh prior to designing a piece of equipment to be used in high-pressure research or production.

To become acquainted with practices used in safe design, it might be informative to outline briefly the typical considerations in the design of a reactor. Before beginning the design, a person must know the operating conditions, such as pressure and temperature, the type of reaction expected, and what materials are best suited for the particular reactor involved, as far as their corrosion resistance is concerned.

Once these conditions are firmed up, the first step usually is the selection of the closure. If the reactor is to be operated at room temperature, we usually select a pliable sealing material. If the reactor is to operate at higher temperatures, a metal or heat-resistant type seal must be used. The type of seal selected depends to some extent on the inside diameter of the reactor.

Incidentally, the smaller you keep the inside diameter, the easier it is to provide a workable closure because of the reduced end load. If possible, it is helpful to know the number of openings and closings expected during the life of the vessel. This also would have some effect on the type of seal applied. Any cycling effects of the temperature and pressure should be known, so an investigation of the fatigue of the materials can be made, if warranted.

In one type of closure commonly used, we utilize a bolted closure for pressure ranges up to 5,000 psi. and temperature ranges up to 650F. This closure may apply to vessels up to 5 in. in diameter. As far as the gasket material is concerned, many different types may be used depending on the temperature at which the vessel is to operate.

Another type, the set screw closure, is capable of sealing pressures up to 5,000 psi. and temperatures up to 1000F. It can be utilized on vessels as large as 15 in. inside diameter.

Vessels of 15 in. in diameter have been

designed for operating conditions of 3200 psi. and 850F, and vessels of 5 in. in diameter have been designed for operating conditions of 5000 psi. and 1000F. The gasket used in this particular closure is a Flexitallic gasket made of a series of stainless steel spiral windings asbestos-filled.

Various closures can be applied for more extreme conditions. The self-sealing metal gasket type closure has been used successfully for pressures up to 15,000 psi. and temperatures up to 1000F. This type of closure can be applied to reactors up to 3 in. in diameter.

This closure is probably the most versatile closure for high-pressure and high-temperature combinations. Pressures up to and including 100,000 psi. have been sealed successfully utilizing this closure. Through the selection of the correct materials, this closure has operated in the range of 1450F. Also, the closure has been used on diameters up to and including 12 in.

Then there is the closure utilizing a pliable gasket, and another closure using an "O" Ring. The "O" Ring closure is perhaps one of the most straightforward and simple designs available. It has successfully held pressures in the 100,000 psi. range. Since the gasket is not heat resistant, the temperature range must be below 200F. This type of closure also has been used on vessels up to 8 in. in diameter.

The Full Bridgman type closure has been used successfully in pressure ranges of more than 150,000 psi. and depending on the type of packing, temperature ranges of 1000 degrees have been reached. This type of closure also may be used on large vessels up to 15 in. in diameter.

After the closure has been selected, the next step is to calculate the wall thickness based on the operating conditions of the reactor. In calculating the wall thickness of a vessel, we use, almost exclusively, the Lamé formula.

In the calculation of a wall thickness, the ASME Code and the Lamé formula can only be used as long as stresses involved in the unit are below the elastic limit of the material. A good many of our units are designed in accordance with the ASME Code regulations, but when we are faced with extreme temperature and pressure conditions, the Code does not apply.

When designing for extreme conditions, we usually have to choose what we term a *super-alloy* for the material of the unit. The Code does not list the allowable stresses we can use with these super-alloys, and we have to choose allowable stresses based on engineering data furnished by the makers of the material.

We use 80 per cent of the stress value which will cause the material to creep 1 per cent in 10,000 hours. We have used higher stress values than this for extreme conditions. There have been reactors designed based on only 500 hours of life. The ASME Code will allow you to design vessels for pressures up to and including 3000 psi. and for temperatures up to 1500F.

As in the case of the closures previously explained, these conditions cannot be used simultaneously, since the allowable stresses given in the Code for temperatures up to 1500F are exceeded when the 3000 psi. pressure rating is applied.

In many cases when we design for conditions beyond the ASME Code and are asked by our customer to have the vessel stamped, we can always do so by applying to the proper state agency and obtaining the permission to construct the vessel in accordance with the designs and calculations presented.

There are two other design tools that can be utilized when designing for extreme conditions insofar as the wall thickness is concerned. One tool is the use of a composite design in which several cylinders (usually no more than three) are shrunk together.

Composite design will allow you to design for pressures as high as 500,000 psi., providing the proper selection of materials is made. This is an extreme condition and is not utilized on a commercial scale. Vessels large in diameter and to operate at high pressures can be designed with a larger safety factor and in some cases more economically using the composite design rather than the monobloc construction.

By composite design, for example, consider a vessel designed for 100,000 psi. and with a 3 in. inside diameter. If this vessel had been made of a single cylinder and a pressure of 100,000 psi. was applied, a tangential stress of 122,200 psi. would result on the inner surface of the cylinder. By using the composite design utilizing a shrink

fit between the inner and outer shells, we have reduced this stress on the inner surface to 75,000 psi.

Another example of composite design is the liquid head of a 60,000 psi. pump. As in the case of the vessel previously explained, if a pressure of 60,000 psi. were applied to the packing section of this pump, the tangential stress on the inner fibres of the wall of the cylinder would be 75,000 psi. By utilizing the composite design, we have reduced these stresses to a value of 45,600 psi.

We do not consider a stress of 75,000 psi. to be extreme. In this case, we are faced with a problem of fatigue caused by the pulsating pressure encountered during the action of the pump plunger, and we feel that by reducing the stresses as much as possible, the liquid head will have a much longer life.

The other tool used in the manufacture of high-pressure reactors is Auto-frettagé. This may be defined as the process of automatically setting up the effects of shrinking a number of infinitely thin hoops on one another to make up the wall thickness of a cylinder in such a manner that the inner layers are in states of residual compression and the outer layers in states of residual tension.

These effects are produced in a monobloc cylinder by the application and release of an internal pressure on the bore, which during its application sets up yielding in some or all of the layers in the wall.

After Auto-frettagé the inner fibres of the cylinders are left in a state of compression. Since the greatest tensile stress caused by internal pressure is produced on the inner layers of the cylinder, a higher internal pressure can be attained in a vessel which has been Auto-frettagé before reaching stresses in the dangerous range.

Now that the vessel wall thickness has been determined and the required type of closure chosen, it is necessary to provide tubing connections in the vessel. These connections are machined in the covers and are of various sizes depending on the size of tubing to be used.

Probably the most commonly known connection used in high pressure work today, the cone and threaded joint, has been in service for many years. This joint should be considered as a precision piece of equipment and treated as such. The most common error

made by most operators when using this joint is the application of too much torque on the gland nut.

Compare a properly made joint in which the seal is accomplished by line contact with a joint improperly made as the result of excessive torque. The seal for the latter joint must be made over the entire surface area of the cone, because the tubing has been forced into the cone seat by the application of too much torque.

If a joint of this type is found to be leaking, it is important to know that it should never be tightened while pressure is in the system. If the joint leaks, it usually means that it was improperly made up and any further torquing or application of force in any way may cause the joint to fail. This joint has been successfully used commercially up to and including 100,000 psi.

Again, in a tubing joint used for lower pressures, compare a proper joint with an improper joint torqued to the point where deformation of the tubing has taken place. The rules for making this joint are the same as the joint shown previously. It is of the utmost importance that you avoid the error of applying too much torque to a joint of this kind.

A cold-wall vessel illustrates the incorporation of additional safety into a vessel. This design is applied where it is necessary to provide a vessel which will operate with an extremely high internal temperature. This temperature is usually generated by the use of an internal furnace.

To keep the wall cold so it can retain its strength, we have incorporated a liner containing grooves on its outside diameter through which a cooling fluid may be circulated. This arrangement has been found to be effective on vessels in which internal temperatures of 2000F and greater are generated.

The problem of storing hydrogen at high pressures and temperatures is troublesome,

because hydrogen atoms and molecules penetrate the steel and cause it to become brittle. If vessels for this service are not properly designed, hydrogen embrittlement can cause brittle fracture of a vessel in very short periods, sometimes in several hours.

In a high pressure hydrogen storage vessel, an internal liner can be utilized with a phonographic finish turned on its outside diameter. The liner is shrunk into the vessel. There are vents through the main pressure wall of the vessel which allows the H_2 that has penetrated through the liner to escape to the atmosphere, eliminating embrittlement of the main pressure containing shell.

Before a design can commence, one must consider all of the variables or all of the conditions expected, such as environment of the tests, the operating conditions, reactions expected, and personnel.

One can never be 100 per cent safe, because we always have the human element with which to deal. Equipment is only as safe as the operators that use it. Pressure equipment ranging from only a few pounds per square inch to several million pounds per square inch is in use in this country today. It is only through proper design, barricading and proper training of personnel that actual plant operations are being safely conducted in pressures ranging as high as 50,000 psi.

Little can be said about safety factors, as such, that we would use in the design of a vessel, because of all the conditions mentioned previously. The greatest safety factor possible commensurate with good design is strived for and maintained. For most commercial applications of pressure equipment, a safety factor of at least 2:1 on the wall thickness can be used, and in the majority of cases 3:1 or better can be obtained.

The higher the pressure, the lower the safety factor. There are cases where extreme conditions are present, and design and calculations can carry you only so far; from there on, the equipment is just built and tested.

LABORATORY VENTILATION

By JAMES C. BARRETT

Occupational Health Division, Michigan State Department of Health, Lansing, Mich.

Today there is an increasing need for adequate ventilation in the laboratory. All around us are evidences of increased basic research, new methods of quality control, and the emphasis on science in our schools and universities.

In our laboratories, chemists are working with materials of various degrees of hazards and toxicity, and with our growing family of radioactive isotopes. Especially in the laboratory, the safety engineer must have a working knowledge and appreciation of fundamentals of ventilation and the things that ventilation can do to protect and safeguard the worker.

Much has been written about the hazardous properties of almost all of the materials handled routinely in laboratory work. Our concern is with the available tools to provide a healthy and safe laboratory, so it is most important to examine the fundamentals of ventilation and what it can do for us.

Hood Design. Good laboratory ventilation will confine the toxic contaminant and will exhaust it to the out-of-doors through suitable ductwork and fan, passing the material through a collector or scrubber as needed before release to the neighborhood. Consider a basic laboratory hood reduced to the bare fundamentals—a simple box. After confinement of the material in the box it may escape in any of three ways.

First, agitation from chemical or mechanical action may disperse the contaminant through the open doorway of the hood. Second, there may be thermal action from the chemical reaction or from the use of heating equipment to aid the reaction. Third, crosscurrents of air may be sufficient syphon the air and contaminant out of the hood.

To overcome this tendency to escape, it is necessary to exhaust enough air to create an indraft through the face of the hood. *Ventilation control cannot be achieved without adequate air flow.*

Capture velocity has been a controversial subject in recent years, but it is not as con-

fusing as it may seem. Since we must confine the material within the hood, there are to be a certain minimum velocity through the door. Certain velocities are recommended for laboratory bench-type hoods by the American Conference of Governmental Industrial Hygienists.

For chemical and moderate toxicity material the average face velocity should be a minimum of 100 feet per minute (fpm) through the open door area with an 80 fpm minimum at any point. *For high toxicity and radioactive material* this should be raised to an average of 125 to 200 fpm with an absolute minimum of 100 fpm.

Recently I had the opportunity to see a movie prepared by the staff engineers at the Ethyl Corporation Research Laboratories in Detroit for their own use in investigating the behavior and control of various laboratory hoods. Using standard equipment arrangements and a standardized series of movements by the chemist, they were able to obtain comparative results on several types of hoods exhausting at different face velocities. By using chemical smoke (titanium tetrachloride) they could show visually the air flow patterns created.

From these observations, as well as those we have made in industry and in laboratories, there is no question that a minimum of 100 fpm face velocity is needed. At lower velocities the material and air in the hood will *follow* the chemist, as he moves about in front of the hood or leaves the hood to perform some other function in the laboratory.

These conclusions were also substantiated by a group of engineers at the Los Alamos Scientific Laboratory performing work for the Atomic Energy Commission. They point out that velocities less than 100 fpm do not provide adequate control.

Some authorities claim certain laboratories (such as in schools and universities) do not use high-toxicity materials regularly and that the individual exposure may not be for a full working day. We have no guarantee that a material used in a hood on any given day or for a particular project

may not be succeeded by a material of high hazard, whether flammable or toxic.

We know also that with many materials the problem is not only one of chronic exposure over long periods, but that serious illnesses or death can occur from even one short exposure. With such materials as the oxides of nitrogen, a single exposure may often be sufficient to kill or seriously impair the health of the individual. *We cannot afford to have accidents.* We cannot settle for anything less than adequate ventilation control, and adequate face velocities must be used.

There are times when it may be practical to use lower velocities at the hood. Many chemical reactions progress over long periods, with the greatest danger coming when equipment is set up and before it is completely sealed. After setup by the chemist the apparatus may be left without direct supervision. Under these conditions, with a favorable location of the hood in the room, it is possible to reduce face velocities, since there are no operating personnel to disturb conditions at the face of the hood.

Many companies have found that two-speed fan control is entirely satisfactory in these cases. For the low-volume operations, face velocities of 75 to 80 fpm have been used successfully. When the exhaust volume is reduced, the usual case is to find that the doors of the hood have been partially or completely closed as an additional safeguard.

It must be emphasized that this can be accomplished only under ideal conditions with a minimum of disturbance at the face of the hood and with a minimum of agitation or chemical reaction inside the hood. Either of these conditions will require the use of higher velocity to maintain ventilation control.

Another common type of laboratory hood used for work with radio-isotopes, tuberculosis germs and in many standard chemical laboratories is the glove box hood. Here, the chemist is entirely outside of the hood, and his only contact with the interior is through the glove ports.

This hood has actually been called a laboratory in itself, since it is usually equipped with water, gas, vacuum, lights and any other facilities needed. In some

instances the hood is maintained with an atmosphere of inert gases for special purposes. When using radioisotopes or neutral atmospheres in the hood, it is necessary to provide airlocks, so apparatus or materials may enter and leave the hood without exposing the hood contents to the room.

The exhaust volumes for this hood are based on maintaining a 50 fpm in velocity draft at any opening; usually this means an exhaust of 20 to 30 cfm of air for each glove box. In many designs, filters are used in the exterior of the box in portions of the airlock doors to provide for clean entering air. If such filters are used, they should be located at the back or sides of the glove box so as not to expose the chemist's body in a puff-back or explosion of any materials in the hood.

For radioactive materials where it is important to keep the ductwork clean, pre-filters can be mounted at the duct inlet with provision for a cleanup of absolute filter in the exhaust branch. In other designs the pre-filter is incorporated in the same enclosure with the absolute filter, so when these become loaded too heavily, they may be discarded as a unit, requiring less handling of the contaminated filter material.

Hood Location. The location of the exhaust hood in the room is most important. In one example, typical of many poor hood locations, there may be no means of supplying air to the laboratory except through the open doorway, and the hood is in the direct path of the incoming air stream. Cross draft velocities will be in the range of 40 to 50 fpm across the hood face. We cannot expect the air will turn directly and into the hood, as so many trained arrows like to indicate.

A second example illustrates a more favorable hood location for the same room. In this case the distance between the hood and the doorway is such that the supply air will lose velocity before coming within the influence of the hood. If this room were shorter, it would then be possible to get a condition where the entering air would come into the hood and still have sufficient momentum to rebound and cause turbulence inside the hood and at the hood face.

A very simple hood can do a satisfactory job; but in a poor location—such as near to the doorway exhaust velocities must be

higher than the average to overcome cross-drafts.

In a simple hood constructed largely of glass and stainless steel, the hood located well away from the doorway through which the air must enter can perform satisfactorily at average face velocities.

Exhaust Ductwork. Good laboratory ventilation provides that the ductwork inside the building will be under negative pressure; thus, any leakage due to poor construction or general depreciation of the ductwork will be into the ducts, confining the contaminant. This is a relatively simple point, and yet we find many poor installations.

The most convenient location for the fan on top of the hood is generally the wrong one. While a fan on the roof or on the building wall requires weather-proofing for the motor, it is still the preferred location. Another advantage is that in use of flammable materials there is a distinct advantage in mounting the fan outside the laboratory, since explosion-proof construction is not required for the motor, and the cost is much less. Also, in cases of motor failure, replacements can be obtained rapidly and economically.

The same principal holds true for large involved systems of ductwork with more than one hood connected to the exhaust system. All ductwork inside the building should be under negative pressure to prevent leakage of materials. In these systems duct connections should be streamlined, with branch ducts entering at angles of 30 to 45 degrees, instead of the straight-T connections we see so often.

In handling the ventilation air at high velocities, streamlined connections are important, just as streamlined smooth-flow highways are required to handle high volumes of modern-day traffic. Ductwork must be sized to maintain minimum transport velocities, whenever particulate matter is being carried. Otherwise, settling of material will occur in sections where the duct is too large.

The usual range of transport velocities is 3,500 to 4,500 fpm. In hoods intended to remove only fumes, gases, or vapors, the duct velocity may be reduced to any practical figure; the usual choice is about 2,000 fpm, since it offers a good compromise between horsepower servings and the space

required by large ductwork.

In recent years there has been rapid development in the field of corrosion protection for ventilation systems. It is impossible to do more than mention the variety of plastics, plastisol coatings, inorganic materials, as well as special metal alloys which may be used for this purpose.

We see applications ranging from transite pipe of stainless steel alloys, metals coated with polyvinyl chloride and recently applications of fibrous glass-reinforced plastic ductwork. Each of these materials has its own special application, but there usually is considerable overlapping, allowing selection on the basis of everyday economics.

The fan for the system should always be located outside the building. An often-overlooked point is that the fan should be installed properly to achieve its rated performance. One typical fan connection uses an elbow directly at the fan inlet; usually the only excuse for this is that it is convenient, since this elbow will reduce fan performance. All fans rated in accordance with the standards of the Air Moving and Conditioning Association are tested with straight runs of ductwork and the inlet and the outlet. These are necessary to obtain expected performance of the fan.

Usually laboratory fume hoods are not provided with collectors or scrubbers to remove the contaminant from the air before it is released to the atmosphere. Therefore, the fan discharge must be located properly. Preferably the discharge should be a minimum of 5 to 10 ft. above the laboratory roof.

This cannot be applied as a rule, since the proximity of other buildings or the existence of peculiar wind currents will affect the ultimate paths of the exhausted air. Generally, the exhaust should not be so located that fumes are redirected to the laboratory roof or in such a position that prevailing winds may carry fumes into the building at another point.

Illustrating a poor fan installation, a straight T is sometimes used as weather protection. The exhaust is directed back down to the roof and may be carried over the roof and into the laboratory windows on the lee side of the building. Also, in terms of fan efficiency, this is a very poor discharge arrangement.

In a typical inverted cone type of weather cap, obsolete for years, the cap not only imposes additional resistance on the system, but also reverses the flow of the exhausted fumes and places them back on the roof. If high temperature or corrosive materials are in the air stream, you can imagine what happens. Also, since this location is near the parapet, the fumes may be trapped on the roof and may re-enter the building at any convenient point.

The most practical fan discharge is the straight vertical stack with no directional baffles or projections. A fume released vertically will travel upwards considerable distances before being subjected to atmospheric conditions. A common type of stack head offering weather protection is the so-called butterfly type of damper.

The variety of corrosive and toxic materials handled in the laboratory hood, plus the varying demands of air cleanliness, are such that use of collection equipment is a highly specialized problem, and each particular case must be handled separately. Generalization is dangerous at any time and especially here, since we have often seen the results of faulty collector application; usually the insides of the collector disappear in a very short time! However, proper engineering attention must be given to the over-all problem of eliminating toxic and nuisance fumes from the atmosphere in which we live.

Air Supply. We have discussed the fundamentals of removing the contaminant by exhausting air through the exhaust hood, glove box or other enclosure. To accomplish this, we are dependent upon an adequate supply of clean ventilation air. "Make-up air," or in the broader sense *air supply ventilation*, is necessary in the laboratory. Properly engineered, supply air ventilation will not only supply sufficient make-up air to the exhaust system, but will also provide good ventilation for the laboratory, offices, and often to the entire building.

The supply of air in any room or building is not infinite. Since the air from the laboratory is exhausted outdoors, the supply of air must come from outside, whether directly to the laboratory or indirectly through the offices and adjacent areas.

In exhausting, a fan creates a pressure

below atmospheric, a so-called *negative pressure*, causing air to flow into the hood and ductwork. Replacement air is attracted to the negative pressure area at the inlet to the exhaust system, which in the typical small laboratory is the room itself.

Without provision for air supply there will be an inward leakage of air through the outside windows, doors, and in extreme cases through any other exhaust equipment in the room. Experience has shown that where there are two fans exhausting from the same space with no provision for make-up air, the stronger fan will overcome the weaker, and air will actually enter the room against the weaker fan.

In multiple exhaust hoods, when one hood is turned off, the results can be disastrous, since outside air will immediately downdraft through the fan not in operation. When a fan must exhaust out of the room without air supply, the capacity of the fan will be reduced from the original design volume, and there may be less control at the hood.

The only satisfactory ventilation system is one providing for exhaust of contaminated air and the replacement of the air with controlled air supply. This may be done on an individual laboratory basis, or an air supply system can be designed to satisfy the general ventilation requirements of the entire building, as well as the laboratory. In an air supply arrangement, such as that in a central air supply system, the main supply duct is carried in unused space above the corridor ceiling, and the air supply is split. A portion of the air goes directly to the laboratory, where it is under the control of the exhaust fan at the hood.

This air volume is less than the exhaust air requirements of the laboratory; the balance of the exhausted air enters the laboratory from the corridor through suitable grill work. The corridor obtains its air supply from the adjacent offices, which receive a portion from the main supply system and are provided with returns to allow this air to pass through the corridor.

In practice the offices are under a slight positive pressure; the corridor is under less pressure; and the laboratory is under a slight negative pressure with respect to the corridor and offices. In the event of exhaust fan failure or a reduction in volume due

to belt wear, fan corrosion, or the like, a sensitive control in connection with a metering orifice in the exhaust system will close the direct air supply to the laboratory. The only air which the laboratory can obtain must come from the corridor, minimizing any possibility of leakage to other areas of the building.

There is a considerable cost involved in supplying heated or cooled outside air to the building; air supply ventilation is not a luxury but a necessity. When air supply is used, it is often possible to eliminate auxiliary fans and roof ventilators to remove the nuisance or odor-producing materials which may be in use in other parts of the laboratory.

For general ventilation of this type, one cfm of supply air more than offsets a cfm of additional exhaust air, since it provides a supply of fresh uncontaminated air to the laboratory and eliminates a critical negative pressure situation that may be developing.

Air Conservation. In recent years there have been a number of radical designs proposed for laboratory hoods; these include so-called "low-velocity air-foil" hoods and "air supply hoods." These, it is claimed, will reduce the amount of air necessary for ventilation and will reduce the heating and air-conditioning load. In practice these designs do reduce the heating and ventilating load, because they operate at lower exhaust volumes; but unfortunately the consensus is they are not effective in providing control.

Basically, the air-foil hood design is good, since we know that with a more streamlined hood entry the better the flow characteristics will be. Flow characteristics at the face of the hood are not the only criterion for establishing face velocity.

Face velocity must overcome both the tendency for the material to leave the hood under its own power and the crossdrafts at the face of the hood. Experience shows a minimum of 100 fpm average velocity is required to give adequate face control. The use of air foils will be beneficial, but they cannot be used to reduce the face velocity.

In so-called air supply hoods, the one design which has attracted a great deal of attention involves the use of air supply slots or grills at the face of the hood to

blow a curtain of air across the opening; in most cases this air is taken directly from outdoors.

We know from experience that any air jet supplied under pressure creates a considerable amount of turbulence and tends to entrain adjoining air into the stream—a basic operating principle of air ejectors. We cannot see that this stream of supply air will always enter the hood without spreading contamination at the face of the hood and throughout the laboratory, since some of the entrained air must certainly come from the hood.

We have yet to see an air supply hood that has been working properly. Once, where a hood of this design was installed in a small room to be used for radio-isotopes, we were called in because of the chemist's fears that the hood was not functioning properly.

This hood had been designed for the simultaneous supply and exhaust of air, the net exhaust volume being equivalent to 50 fpm face velocity. The hood also was provided with two-speed control of the exhaust fan; however, there was no way of preventing the air supply from being used while the exhaust fan was on low speed!

In addition, there was a large upright room air conditioner about 5 ft. from the hood, creating excessive cross drafts. And the exhaust fan was running backwards and handling only 20 per cent of the correct volume of air! These problems were corrected, but this hood is no longer in use.

A second instance occurred in the chemical laboratory of a large manufacturing plant. Here there are three large bench hoods about 10 feet long, plus a 10 ft., walk-in type hood. These hoods also were designed to supply air through slotted ducts at the face; however, we were informed this supply air had never been used since the hoods were installed.

We found that exhaust volumes were very low, and examination disclosed the various acids (nitric, hydrofluoric, and sulfuric) had almost completely destroyed the exhaust fans. The company is now purchasing new fans to give adequate control velocities, and the firm is also providing separate air supply to the laboratory through a perforated ceiling to avoid cross

draughts and disturbances at the face of the hoods.

There are three principal objections we have found to the use of the hood with the built-in air supply:

1. There will be excessive turbulence at the face of the hood due to basic problems of the design or to normal obstructions at the hood face.

2. Over the course of the hood's life it is to be expected that the various corrosive materials used in the hood will have a serious effect on the exhaust fan. Unless this fan is given careful maintenance, it will lose efficiency and exhaust lower volumes of air.

At the same time, the supply fan is handling relatively clean air and will provide almost a constant volume. The result is a steady decrease in face velocity.

3. Under many conditions of winter use, the cold supply air will cause condensation in the hood resulting in serious problems. It is always possible to turn the supply air off in the winter time, but this defeats the purpose of the entire installation.

We believe it is foolish economy to purchase hoods with two fans, two sets of ductwork and two sets of controls, with the thought of saving money in heating or cooling air. It would appear that the over-all increase in capital investment and maintenance will go a long way toward offsetting any savings in heating or conditioning the necessary make-up air.

In future laboratory ventilation, we expect to find our laboratories will be handling more materials of very high toxicity or of suspected high toxicity, as fundamental research programs continue to expand. We may also find that increasing numbers of radioisotopes are used in all of our laboratories.

As we handle more dangerous materials, we will be called on to provide additional ventilation in the laboratory, and the problems of air conservation will become quite critical. I do not believe refinements of existing designs (such as air foil hoods, or air supply hoods) will assist us greatly in meeting the problem. It is our responsibility to examine our techniques of ventilation and laboratory design.

I have visited laboratory facilities with engineers at the Upjohn Company in Kala-

mazoo, Mich. This firm, has used local exhaust ventilation to provide *spot* control with a small volume of air.

A small hood, moving on nylon rollers, exhausts 270 cfm, which is sufficient to control benzene vapors released. The nylon rollers and a bonding wire used in the non-metallic flexible ductwork are included as fire safety protection. With this type of ventilation, engineers avoided the installation of a large bench type of hood which would have required many times more exhaust.

In another application a form of local or *spot* exhaust ventilation is again used. Many apparatus can be set up safely in the laboratory room requiring exhaust at only one or two points. This can be done successfully with short drops of flexible duct, with provision for positioning these to give the necessary ventilation control.

Additional technique provides the standard bench hood with a horizontal sliding sash instead of a vertical sliding one. In this way the hood can be large enough to give sufficient working space; yet the open area at the face of the hood is reduced in half. With this type of arrangement the chemist can have the luxury of large hoods with the safety advantages they possess and can still reduce the air volume to the minimum.

The use of the glove box should increase in the laboratory. It has the advantage of being small, occupying little space. It can be built to offer suitable protection for explosive gases and can be airtight to permit the use of special atmospheres. It is well suited for work with radioisotopes and bacteria.

The small size of the glove box makes it possible to move the entire box to a central decontamination station; this is especially important when radioisotopes are being used, since it isolates any possible contamination. In one decontamination station we saw, large enclosing hoods were used. The individual glove box was placed in the decontamination hoods, and all operations were carried on through glove ports in the outer hood.

We have also observed the use of a hood similar to a glove box in industry on an ordinary production arc-welding job in the manufacture of fractional horsepower

motors. With this installation the normal glass front was replaced with tinted welding safety glass, and instead of glove ports the hood had a slot at the bottom through which the operator's arms could project. The principle was the same, and good control was afforded with a minimum amount of exhaust air.

We expect similar designs can give adequate ventilation and personal protection for small, noisy operations. Obviously the use of the glove box will reduce the necessary volumes of exhaust air required.

Successful ventilation of any process depends on close cooperation of all persons involved, including the chemist, the safety engineer and the design engineer. In improving our techniques of ventilation we should be able to make rapid progress in the laboratory, since we are dealing with highly trained professional people who have shown themselves able and willing to absorb new techniques.

Local or spot ventilation will not work, if it does not recognize the nature of the contaminant and the way it is dispersed, and if it is not used by the chemist. Similarly, the glove box technique will not be effective unless the chemist is willing to accept minor inconveniences in his work to obtain the benefits of the additional safety that can be provided. If he wants to work in an air-conditioned laboratory, he must be willing to accept responsibility in helping to plan and use the ventilation provided for him.

Good ventilation is the result of careful planning and design. The hood must be selected for practical use; the exhaust volume of air must be determined on the basis of the hood's frontal opening and the conditions under which the hood is used.

For the ordinary chemical hood, the face velocity should be an average of 100 fpm, with a minimum of 80 fpm. For highly toxic material and for radioactive material, the velocities should be from 125 to 200 fpm, with an absolute minimum of 100 fpm.

The ductwork, fan, collector and discharge stack must be designed to transport the material effectively and efficiently to the out-of-doors, leaving no possibilities for re-exposure to contaminated material. Proper supply air ventilation must be incorporated in the over-all laboratory design to insure

the fans will not be operating under negative pressure and to insure there will be sufficient general ventilation to reduce concentrations of nuisance materials.

The laboratory ventilation should be designed to maintain slight inward leakage to the room at all times to prevent the contamination of other laboratories or other rooms in the building.

We need to look for methods of conserving exhaust air. Effective ventilation considers not only the problem in the individual laboratory but the air balance of the entire building. I do not believe significant air conservation can be obtained through refinement of our existing designs.

Proper air conservation can be obtained only by a re-evaluation of techniques. This involves the close cooperation of the ventilation engineer, the safety engineer and the chemist who will be working with future ventilation.

To quote Mr. George Jepson, "The additional cost of 'adequate and safe' design over 'barely sufficient' design is the cheapest insurance you can buy. There can be only one practical limit to hood design and that is 'adequate and safe'."

ACKNOWLEDGEMENTS

1. *'Industrial Ventilation—A Manual of Recommended Practice'*, Committee on Industrial Ventilation, American Conference of Governmental Industrial Hygienists.

2. *'Design of Laboratories for Safe Use of Radioisotopes'*, AECU-2226, Donald R. Ward, Isotopes Division, U. S. Atomic Energy Commission.

3. *'Evaluation of Laboratory Fume Hoods'*, H. F. Schulte, E. C. Hyatt, H. S. Jordan, R. N. Mitchell, Industrial Hygiene Group, Los Alamos Scientific Laboratory, Los Alamos, N. M.

4. *'Ventilation and Fume Hoods—Survey of Information'*, G. L. Jepson, Ventilation Engineer, Upjohn Company, Kalamazoo, Mich., presented to National Safety Congress, October 24, 1957.

5. Dr. A. Somerville, Director Isotope Laboratory, General Motors Corporation, Research Center, Detroit, Mich.

6. Mr. F. T. Schroeter, Safety Engineer, Ethyl Corporation, Detroit, Mich.

7. Mr. G. L. Jepson, Ventilation Engineer, Upjohn Company, Kalamazoo, Mich.

AN ENGINEERING APPROACH TO MATERIAL HANDLING SAFETY

By WALTER J. BYRNE
Walter J. Byrne & Co., New York City

Handling of materials is an integral and important phase of every business enterprise. But, despite the fact that great strides have been made in improving handling techniques in many industries during the last three decades, this segment of operations still accounts for one of industry's biggest cost items.

Quoting reliable statistics, upwards of 20 to 25 per cent of all labor hours go into some form of handling. This considerable expense item becomes all the more impressive when it is recognized that "materials handling adds nothing to the value of a product."

In the opinion of many management authorities, this improvement drag has been caused by a lack of appreciation of the problem and a lack of accurate cost data pertaining to it. The major credit for what progress has been made to date would appear to be rightfully assigned to the research and development of the materials handling equipment manufacturers.

A seeming current required ingredient is a greater effort on the part of individual business concerns to explore their own operations, with the view to isolating deficient methods and practices and the adoption of more efficient procedures.

Handling of materials is the principal single source of work accidents and injuries in American industry. Again quoting responsible records, 25 per cent of all job injuries stem from some form of materials handling.

Despite similar great strides made in the last few decades in the broad field of industrial accident prevention, materials handling accidents and injuries are a recurring problem. Could it not be that the same reasons that apply to the efficiency lag may also be assigned to the safety lag as far as materials handling is concerned?

In tracing forward the evolution of modern management, as we know it today, its development can be broken down into three fundamental forms: rule-of-thumb, sys-

tematic and scientific. Following the Industrial Revolution of the 17th Century and the beginnings of the transfer of skill from men to machines, factory managers operated on hunches and inspirations. Because the demand for goods was so great, 'rule-of-thumb' snap judgments sufficed, with the numerous mistakes made being readily absorbed.

As individual enterprises grew in size and complexity, supply caught up with demand and competition commenced to show itself. Of necessity, the rule-of-thumb management was replaced by a so-called 'systematic' procedure, wherein those methods and practices which seemed to work well in the past were standardized.

This technique, although a step forward, was systematic only as it tried to reduce a set of practices that proved successful in the past to a routine for dealing with operations of a recurring nature.

Some sixty to seventy years ago, Frederick Taylor entered the scene and introduced the beginnings of scientific management to business. Taylor's approach endeavored to look behind those methods and practices which appeared to bring about desired results to ascertain what laws and principles, if any, were operating.

Where the systematic approach asked the question, "What practices have worked in the past?" the scientific approach asks, "Why do some practices work out and others fail?"

A recognized aim of a successful industrial safety program is to build-in accident prevention measures into work procedures and physical facilities and thereby greatly minimize the uncertain and unpredictable human factor inherent in all of us. Present-day machine guarding, dust and fume control, are examples of successful built-in safeguards.

On the subject of materials handling, the achievement of built-in controls has been spotty. Despite the ever increasing use of mechanical aids, such as lift trucks, cranes and conveyors as a means of by-passing manual muscle-moving, hazards and injuries from this source remain numerous.

All of us are aware that an important and necessary ingredient towards arriving at any solution is an accurate spelling out of the actual problem in question. In this connection, I have found myself continually focusing attention on the strict meaning of an industrial accident, where materials handling is concerned.

As generally defined, an accident is an unexpected happening which may result in personal injury, property damage, or both. When one closely examines materials handling incidents, is it not realistic to classify certain so-called work accidents as work injuries, not as unexpected, but rather as *inherent* in the job procedures being followed?

Most competent observers attribute the primary cause of materials handling accidents to personal actions under such specific headings as unsafe habits, improper lifting, etc. Safety people have worked and continue to work long and hard trying to come up with more effective means of educating individual workers in safer handling methods.

Despite numerous recognized successes here, many others are doomed to failure on a long range basis. This suggests, in our view, a re-examination in the light of both hazard and inherent injury potential. It is here wherein we believe Taylor's fact-finding and analysis techniques provide the most effective means.

In advancing this undertaking, we are not unmindful that a safety engineer is primarily a coordinator of accident prevention activities and not an individual who knows all the answers about everything. Where firms already employ methods, time study and similar staff specialists, is it not reasonable for the safety coordinator to present the fact-finding and analysis assignment to them?

Perhaps it is timely for many safety engineers to break out of certain confining wraps concerning their activities and responsibilities within the organizational framework of their companies and take a more aggressive interest in methods, particularly as they apply to materials handling.

In this connection, a review of process charts, layouts, individual operational studies, and a 'questioning attitude,' all tools borrowed from methods engineers, are presented herein.

Fact-Finding

The flow process chart is a written record or charting of a materials handling cycle, calling for data on the material to be handled, the methods of handling and transport, the distances moved and similar information pertinent to the problem. The scope of individual cycles would naturally vary with the type industry involved and its complexity.

In a product manufacturing layout, wherein the various machines and equipment utilized are placed in connecting sequence (chemicals, bakery, etc.), it is feasible to chart the handling and transport of individual materials from their point of receipt as raw materials to their shipment as a finished product.

In a process manufacturing layout, wherein similar machines and equipment are grouped in departments (machine shop), it is preferable to record the handling activity in three separate stages: raw material and purchased finished part handling, transport and storage; materials-in-process handling, transport and storage; and finished product handling, transport, storage and shipment.

Coincident with process charts, layouts of the arrangement of production machinery, work centers and auxiliary activities provide the means of tracing the physical route of materials and identifying the adequateness of available space.

The individual operational study focuses on the recording of the handling requirements of machine and equipment operators, fabricators, assemblers, and materials handlers themselves. While it is admitted that the recording of such operational data in even the smallest company can be extensive, the procedure is greatly simplified with little loss of thoroughness by breaking down similar handling routines into a reasonable number of groupings or classifications.

Those who have engaged in surveys of any types of business procedures have undoubtedly learned that quick and easy mental analyses are conspicuous in their incompleteness. The quest for safety in materials is no exception. There is no miraculous, overnight cure.

Work involved in compiling written fact-finding records need not be an overwhelming task. Detailed handling data associated with one commodity can be effectively applied to all similar situations.

record handling cycle, to be handled transport, information type of industry with the complexity.

you, where-shipment utilizing sequence feasible to sort of indigent of receiptment as a

you, where-shipment are shop), it is activity in rial and purransport and dling, trans-product han-shipment.

s, layouts of machinery, ities provide cal route of equateness of

nducuses require operators, aterials han-dmitted that onal data in be extensive, ed with little g down simi-onable numns.

rveys of any ive undoubt-easy mental incomplete-aterials is no is, overnight

written fact-verwhelming ociated with ly applied to

In a paint manufacturing concern, the handling of a drum of one chemical would be employable for analysis of other drum chemicals in similar usage. Recorded data on the handling of small, medium and large castings would have wide, recurring application at turret lathes, milling machines, and drill presses.

Analysis

The gathering and recording of operational data is followed by the analysis phase. Most simply defined, this is a testing out of actual procedures by a series of pertinent questions aimed at isolating hazard and injury producing conditions. Suggested questions, some of which overlap for greater assurance of completeness, are as follows:

1. Can the handling operation be eliminated in whole or in part? If a 'don't touch' idea is applied diligently and open-mindedly, the results may be most fruitful.

And an important axiom of efficient materials handling has been often stated as: Efficiency in moving materials is best obtained by *not* handling them.

2. Can the handling operation, assuming it is a required one, be carried out in a simpler, safer manner?

3. Does the handling operation call for the transfer of materials from the floor to a conveyance, or vice-versa?

4. Are work places so arranged as to require machine and equipment operators, and assemblers to do a considerable amount of manual lifting, bending, stretching and positioning in connection with the materials they work with?

5. Are the weights of individual materials or unitized packages of same required to be manually lifted within a reasonable range? Is the added problem of a required positioning element coupled with a manual lift taken into account?

Are the limitations of female workers allowed for? Where time study is used, do the standards allow for (and enforce the use of) crane time at prescribed weight limits?

6. Are all dangerous properties of the materials accounted for?

7. Are raw materials, materials-in-process, and finished parts and products stored in neat, stable piles? Is ease in rehandling taken into account?

8. Are materials of different types, sizes and shapes segregated to insure a minimum of reshuffling?

9. Does the plant layout consider adequate storage areas in warehouse and production areas as necessary adjuncts to efficient and safe operation?

10. Are definite routes of travel and sufficient unobstructed aisle space available to avoid congestion and uncontrolled movement of materials handling equipment?

11. Are overhead cranes, lift trucks and other mechanized handling equipment of sufficient capacity to safely sustain the loads to be applied?

12. Does a preventive maintenance program insure the continued availability of sound equipment?

13. Are employees well grounded in safe handling methods of a routine nature? Are special instructions given employees as to safe handling methods of a non-recurring nature?

Is protective apparel (gloves, safety shoes, etc.) required where hazard or inherent injury producing conditions exist?

As these and other pertinent questions are asked about every step in the materials handling process, safety deficiencies evolve. No single handling category can fail to benefit from such a survey.

Underlying all of the foregoing fact-finding and analysis procedure is work simplification, utilizing the well-known and oft-repeated guiding principle the best way is the easiest and safest way.

In the development and accumulation of the pertinent questions required to test out handling procedures, an analysis of past accidents is invaluable. The worth of the analysis is in direct proportion to the relevance of the accident cause classifications used.

It has been my experience that many accident cause classifications have been misleading almost to the extent that they were unusable. It is urged that such data should receive careful consideration so meaningful cause classifications be established.

A further related subject pertinent to any organized industrial safety plan should consider, in our opinion, the item of compensation claim costs. Safety people have long based accident prevention performance on frequency and severity, and particularly the

former. The true meaning of these statistics is known mainly to the safety people themselves.

It is our view that the higher echelons of management would be much more amenable and appreciative of safety efforts were claim costs to be included. The growing trend of permanent partial disability awards on 'non-disabling' injuries has greatly watered down the significance of frequency data.

It is impossible to examine the American industrial scene for long without coming to the conclusion that management is smarter than ever before. This is as it should be. It is evidence of progress.

Perhaps it explains in part why one often hears the complaint that it gets harder and harder to compete. Thus, the theme for greater smartness becomes continuing dissatisfaction.

The best executives are found to be those who won't ever admit that everything is going as well as it should. This is generally not a happy frame of mind but it sure leads to progress.

Perhaps safety people should enthusiastically embrace continuing dissatisfaction as respects materials handling. I believe fact-finding and analysis is a blueprint to point out the way.

BOY SCOUT SAFETY GOOD TURN—1958 —A REPORT TO THE NATION

Presiding: DON HIGGINS

Health & Safety Executive, Boy Scouts of America

Don Higgins opened the meeting and asked each one present to introduce himself. He then expressed thanks to all who aided in this very successful campaign.

Mr. Higgins gave a brief summary of how the campaign was inaugurated. He explained about the "kickoff" of the Good Turn year, beginning with Boy Scout Week in February, when a number of boys visited the President and subsequently each of the governors of all the states and territories. Three aspects of safety were to be handled during the year; traffic, recreation, and home safety in that order.

It was brought out that 40 million emergency handbooks for the home were printed and sent to local Boy Scout councils for distribution by the scouts. The schedule called for these books to be distributed in October.

Mr. Higgins reported that the results of the campaign are being set down on a report form. These reports will be collected by December, the results tabulated during that month, and a final report issued in January.

T. A. Kraklow, director of safety, John Deere and Company, Moline, Ill., explained how he was first drawn into the Good Turn campaign through his work in safety for his

company. He in turn enlisted the aid of others in his plant and also went to the Quad Cities Industrial Organization for more help.

Those who agreed to participate in the Campaign were assigned several scout units with which to work. The men visited their assigned units to get the leaders and the boys started on the campaign. With the "kickoff" everyone pitched in and gave everything they had to make the campaign a success.

Mr. Kraklow said he thought his group did a good job, however, he cited an example of what he believed was a most outstanding job. The Peoria area safety engineers banded together to assist in the campaign, and not only did they contribute to the success of the campaign, but also have shown great interest in staying with the Boy Scouts and continuing to help in other facets of the scouting program.

Ivan Le Gore, safety director, Portland Cement Association, Chicago, related how he was favorably impressed with the materials being prepared by NSC for the campaign when he viewed them in the summer of 1957. At the next meeting of the National Executive Committee of the association, 39 members approved of the program for the campaign.

y one often
h and
th for
inuing dis-

to be those
everything is
is generally
sure leads

enthusiasti-
sfaction as
lieve fact-
it to point

B

ie aid of
nt to the
ation for

te in the
out units
ited their
ar the
Wi he
nd gave
mpaign a

is group
l an ex-
nost out-
safety en-
in the
ontribute
also have
with the
in other

Portland
ed how
ie mate-
he cam-
summer
the Na-
associa-
rogram

Each member of the association was informed of the campaign and was asked to cooperate with local Scout executives. Various regional meetings were held where Scout executives attended as the main speakers. At 21 such conferences there were over 1,000 men in attendance. Mr. Le Gore reported that at this time he found many people already participating in scouting programs.

The assistant chief scout executive of the Boy Scouts addressed a luncheon in New York of 350 association members to further build up enthusiasm. With the "kickoff" the campaign began in high gear and everyone devoted great effort and large amounts of time to insure success.

Mr. Le Gore cited some examples of what was done during the year to bring about this success. In June, some companies had the boys come out to the plants to assist in presenting various activities for safety, such as first aid demonstrations, outdoor habits, etc. It was explained that June is a high accident month in the industry and it was hoped that the scouts could help make the employees more safety conscious.

Taking an idea from the scouts, the association had printed for the summer part of the campaign the rules for the Scouts Merit Badge for Safety. These rules in the form of a leaflet were distributed to the members of the association and were received with enthusiasm. Even Boy Scout groups requested copies for their use.

Another PCA idea, reported in *Rock Products*, an industry magazine, was to picture a hike through the month of June. The picture had various outdoor activities depicted and a winding path with the sections numbered to show each day. As the day passed without an accident the section was blacked out.

Mr. Le Gore believes that the campaign will have continuing effects and benefits to both Scouting and industry.

J. S. Queener, manager of safety and fire protection for E. I. Du Pont de Nemours & Company, Wilmington, Del., reported that while he was immersed in the promotion of off-the-job safety activities, the Good Turn campaign appeared to offer equally good material to promote in conjunction with the O-T-J work.

Key people of the Du Pont Company and of the Wilmington area were asked to par-

ticipate in the "kickoff" of the campaign. Bands, scouts, and various organizations participated in a big parade. Buses were chartered and used to bring boys from 200 miles away for the big event.

Since a large portion of the area sponsoring the activities was under volunteer firemen's protection, the Volunteer Firemen's Association gave their wholehearted cooperation.

A "Live For Tomorrow" pennant was developed for exhibit throughout the campaign. The boys in the area taking part in the scouting program did a wonderful job in the distribution of the *Emergency Handbook for Home Safety*. A scout was made available for high school assemblies to give talks on home safety.

Mr. Queener said the campaign taught him that great gains can be made in various phases of safety, such as off-the-job, with the cooperation of organizations such as the Boy Scouts, Junior Achievement, Women's Clubs, etc.

Harold Heldreth of the National Safety Council explained how the Council became interested in the Safety Good Turn Campaign, the idea being first discussed when the Safety Merit Badge requirements were being revised in 1955. From this time the idea slowly developed until 1957, when it was definitely determined that 1958 was to be the campaign year.

This caused the Council to take a good look at the potential of youth in safety activities. It also caused the Council to further examine the program operation as a whole, to see if it could be used to better advantage in support of youth and other activities. The campaign finally began with the Council's full cooperation.

Mr. Heldreth related that the campaign was promoted through the use of publicity in Council magazines, newsletters, and other media.

Don Higgins listed other sources of publicity, such as outdoor advertising, Metropolitan Life Insurance pamphlets, Post Office posters, and others.

Mr. Heldreth reported that, in conjunction with home safety, the Excello Corp. put safety messages on milk carton panels for dairy companies to be distributed by the companies in their daily sales. It was reported that 12 million half-gallon cartons had been printed.

DECISIONS FOR THE FUTURE

(INTRODUCTORY REMARKS BY THE CHAIRMAN)

By DR. WILLIAM P. YANT

Director of Research, Mine Safety Appliances Co., Pittsburgh, Pa.

At its meeting in June 1957, the Board of Directors of the National Safety Council charged the Council staff with the task of implementing the action program of the President's Conferences on Occupational Safety insofar as those recommendations applied to the work of the Council.

During this Congress the Labor, Farm, and School and College Conferences are giving their attention to the aspects of occupational safety that lie within their scope of operations. Our program today will consider those problems which are of interest to the Industrial Conference of the National Safety Council and to the American Society of Safety Engineers.

Before one considers the problems of the future, accomplishments of the past and present status must be evaluated. The course for future action can be charted only on the basis of a knowledge of past accomplishments.

An evaluation of experience over any period since the initiation of organized occupational safety programs could not fail to indicate great progress.

On a chart showing the curves for frequency and severity rates of reporters to the National Safety Council from 1926 to 1957, frequency rates declined from a high of 31.87 in 1926 to 6.27 in 1957, a decline of 80.3 per cent. Over the same period severity rates declined 70.4 per cent from a high of 2,500 to the 1957 figure of 740.

A report presented by David L. Arm, manager of the Council's Industrial Department at the 1958 President's Conference on Occupational Safety, showed the progress in the ten year period from 1948 through 1957. It noted that while the work force increased from 46,700,000 in 1948 to 52,200,000 in 1957, or an increase of 11.8 per cent, occupational deaths decreased 3.4 per cent and injuries decreased 5 per cent over this period. The decrease in deaths from 1951 to 1957 was 11.3 per cent while injuries decreased 10.7 per cent in the same period.

Although such reports indicate that great progress has been made, we would call to your attention that there is no reason for complacency now or in the near future. The 9,400 deaths and the 1,455,000 disabling injuries due to occupational accidents which occurred in 1957 in the areas under consideration are an indication of the magnitude of the task which still confronts us.

Even though the total of the work force and its composition were to remain static, these figures are a challenge to the imagination and initiative of all who work for occupational safety to find ways to reduce even further.

Unfortunately, however, neither of these considerations will remain static. Ewan Clague, United States Commissioner of Labor Statistics, presented a paper entitled "Figures at Work" at the 1958 President's Conference on Occupational Safety. Mr. Clague said, "On the basis of current population data, and assuming favorable employment opportunities, our projections of the 1965 labor force show an increase over 1955 of about 10½ million persons.

"It is significant that only 1.2 million of this increase will be among men between the ages of 25 to 54, the primary working group of our population. The great bulk of the increase in the labor force will come from two groups—women 35 years and older, and young workers between the ages of 14 and 24. Each of these groups will account for more than 4,000,000 of the total growth."

Mr. Clague indicates that the work force will be increased primarily among young workers and older women with smaller increases in the primary working group and among older men. He also points out that "we also know that safety programs designed for groups of all male workers require modification when applied to predominately female groups. We know that special safety training problems arise when large numbers of young people enter employment."

We would emphasize that past experience indicates that three industrial groupings—construction, trade and service, and mining

—are the areas of employment where greatest emphasis is needed in order to show the greatest progress.

OBJECTIVES AND PLAN OF THE PRESIDENT'S CONFERENCES ON OCCUPATIONAL SAFETY

By JOHN J. GILHOOLEY

Assistant Secretary of Labor, Washington, D. C.

Many present and former members of the groups sponsoring this panel have contributed immeasurably to the President's conference. You—and they—were consulted on the organization of the very first conference and have participated in the planning of all subsequent conferences. National Safety Council staff and the ASSE have repeatedly served as technical advisors on program. Your leaders have addressed conferences and moderated panels and workshops. Many of you have served on conference committees and have influenced the objectives and plans of the conference by your counsel and advice to the President and the Secretary of Labor, who serves as general chairman.

First, I should like to describe briefly the broad objectives of the President's Conference.

They are threefold:

1. *To focus national attention on the importance of occupational safety and the continuing need to do something about it.*

From the nation's capital it has been necessary repeatedly to demonstrate the concern of the federal government and the personal interest of the President of the United States in reducing the social and economic waste of preventable work injuries. That done, we have been fortunate enough to enlist the program participation of some of the country's outstanding leaders as speakers, moderators and panelists. We have progressively broadened the scope of the conference until today attendance has tripled in volume and represents virtually every segment of the American economy.

2. *To identify and emphasize emerging problems in occupational safety.*

For example, at the 1958 conference we surveyed human motivation for safety, off-the-job accident prevention, radiation hazards, and the safety contribution of industrial medicine. We made a conscious effort

to foresee the problems we would face in the next decade. The prompt recognition of such problems offers the type of challenge which I regard as the business of conference leadership.

3. *To obtain a broad consensus of views and to formulate recommendations on matters which require consideration or action by appropriate groups concerned with occupational safety.*

Recommendations have been made by successive conferences, usually in the form of a report to the President, and disseminated by the Labor Department and even more widely and properly by the individuals and groups who attend.

To carry out these objectives, the plan of the conference embraces a biennial session open to a broad cross-section of the economy; plenary sessions but also workshops to encourage individual participation, to obtain a consensus on specific problems and to formulate recommendations for their solution.

There, in brief compass, are the objectives and plan of the conference.

Very early the conference had to demonstrate its nonpartisanship and overcome fears that it cloaked federal infringement of states' rights or management prerogatives. Soon to come was the policy to refrain from endorsing or opposing labor legislation. Since I have known the conference, those in this room whose advice we sought on these matters have counselled us wisely. You have urged us, for example, to expand the scope of the conference to include all segments of the American economy. We have done so progressively until now virtually all segments are invited to participate.

At the same time this expansion of coverage was sought, limitation of attendance to top echelons of management, labor, education and government was proposed by some; proposed on the grounds that these echelons

carried the power of decision for or against safety programs in their organizations.

But again, your wisdom reminded us that, constantly and by every means he can devise, the professional safety man has to "sell" his superiors on safety and their joint attendance at the President's conference gives him a favorable climate for such salesmanship. Conference attendance limited only by space accommodations and not by rank or other factors squared with the secretary's conviction that the President's name should not be associated with exclusiveness in the broad humanitarian endeavor to save life and limb. Accordingly, attendance is open to decision-maker and professional alike.

Nonetheless we are all aware of the importance of convincing top management of the value of safety. You have urged us, and we have endeavored, to attract to the conference company executives, especially from smaller firms which may not have organized safety programs. At the conference last March, for example, nearly 1,200 of the 3,000 delegates came from business and industry and of these, 414 were company presidents, vice presidents, managers or directors of industrial relations; 226 were company presidents.

Another question which arises periodically involves the nature of conference programming. Should these programs be stimulative, promotional, inspirational? Should they deal with new and forward-looking developments? Or should they be what we might call operational—calling for progress reports from different segments of the economy or the safety movement and looking toward action to be taken by, or in the name of, the President's conference? These alternatives were carefully considered when we were planning the 1958 conference.

Should we use our tenth anniversary to look forward or back? How much can the future learn from the past in safety? How much of the past is assessable? Some of our advisory voices said, "quite enough to help plan for tomorrow." Others asked, "who can accurately assess safety progress even in a single industry?" After a period of rather brisk discussion there came from your ranks a consensus to the effect, "Look to the future instead of the past." This was counsel which in the main we accepted and which I judge you have accepted too.

Questions such as these on program go back to basic conference objectives. Is it an institution designed to carry out recommendations formulated by delegates from your groups and others throughout the land? Or is it a forum where interested agencies and individuals exchange experience, survey emerging problems, recommend action to be taken not by the conference but by themselves and others as appropriate, and by such association refresh and recharge their own dedication to occupational safety in America? Viewpoints on these questions range all the way from criticism of the conference for not carrying out recommendations to intense fear that it might attempt to do so.

President Eisenhower has repeatedly expressed the philosophy of this administration, namely, that the federal government should do only those things which the people cannot better do for themselves. A generation of safety experience, the existence of a strong national safety movement removes work injury prevention from the area of exclusive federal implementation. In addition, such implementation would violate a basic conference policy *against federal infringement of states' rights or unwarranted government intrusion into private affairs.*

Summarizing conference objectives of 1958, I see this institution as non-partisan and voluntary in character; open to all segments of our economy and to top management and safety professionals alike, but seeking to attract company executives especially from smaller firms; with purposes and programs which are stimulative and forward-looking; and dependent for effective application of its recommendations upon the organizations, agencies, and individuals, whether they attend its sessions or not, who care about saving human life and limb in the work places of America.

As we search out what your program calls "the frontiers ahead," can we maintain or accelerate the present favorable downward trend in occupational deaths and injuries which Dave Arm outlined so brilliantly at the last President's conference? The past decade has demonstrated that these deaths and injuries can be reduced in the face of an increasing labor force. Those attending the last President's conference heard a lot about this problem. By 1965 we shall have

program go
ve it an
t recommen-
from your
ie land? Or
agencies and
nce, survey
action to be
ut by them-
ate, and by
charge their
d safety in
se questions
ism of the
t recommen-
ight attempt

peatedly ex-
ministration,
ment should
people can-
A generation
stence of a
ent removes
the area of
n. In addi-
ld violate a
federal in-
unwarranted
its affairs.

objectives of
non-partisan
n seg-
top manage-
s alike, but
cutives espe-
purposes and
re and for-
for effective
ons upon the
dividuals,
or not, who
and limb in

rogram calls
maintain or
e downward
and injuries
brilliantly at
? The past
these deaths
the face of
ise attending
heard a lot
e shall have

a population of over 193 million in the United States. We shall have a labor force of nearly 80 million—10 and one-half million more than in 1955—and it will look a lot different than it does today with a larger proportion of the young and the aged.

We shall also confront the problem—as many of you know far more intimately than I—of a changing technology, changing—literally, in many cases—with the speed of light. We have no panoramic portrait of tomorrow's technology but much of it will be found in industries such as aircraft and air transport, atomic energy, heavy construction, electronics, office machines and electric power. We also know that the demands of a soaring population, of science and national defense both in space and on the ground will require higher skills than ever before.

Higher skills among professional and technical personnel, among proprietors and managers, among craftsmen, clerical, sales and service workers.

You can count on future President's conferences to advance toward our common goal of reducing work injuries. I hope we shall continue to merit General Stewart's congratulations and his expression of pride that "council members had a role in this successful and effective conference."

The federal government representatives here have been happy to contribute to your evaluation of the frontiers you see ahead and of the means proposed by your several groups of crossing them. Thus we have attempted to serve our common objective of saving human lives and thereby strengthening, by all odds, our country's greatest asset.

AVENUES FOR PROGRESS

THE INDUSTRIAL CONFERENCE

By GERARD O. GRIFFIN

Safety Dir., Dravo Corp., Neville Island, Pittsburgh, Pa.

The Industrial Conference is the policy-making committee for the occupational accident prevention program of the National Safety Council. The conference, through its standing committees, acts in an advisory capacity to the Industrial Department in all of its operating areas.

Members of the conference are selected by two methods. According to the constitution of the National Safety Council the chairman and vice chairman of each section is automatically a member of the conference. This means that each of the industry segments represented by the twenty-seven sections has equal representation. In addition, about 95 members-at-large are nominated each year which, with honorary life members, and representatives from other conferences, brings the total to over 160 members.

Without a doubt, the Industrial Conference is the most influential body in the field of occupational accident prevention in the country. On the one hand, members are elevated from an industrial section because they have earned the respect of their fellow safety engineers in their industry. The average chairman of a section has been a volunteer committee member of the council for seven years before being placed on the conference. Ample time for his fellow safety engineers to recognize his ability and acknowledge his leadership.

The remainder of the conference, or members-at-large, are nominated by the conference itself, through its nominating committee. Here abilities beyond a single industry are recognized. The individual may have a technical knowledge, on a subject of interest to many industries, such as flammable liquids, radiation or standards. On the other hand, the member may be nominated because he or she has a proven ability in the promotional aspects of industrial accident prevention, such as visual aids, training, contests or awards.

The total makeup of the conference membership is also studied, to be certain that representation is assured from every element

interested in occupational safety. In this way, industry, insurance, governmental agencies, both federal and state, associations and agencies are all able to have a voice in policies formulated by the Industrial Conference.

To carry out its work, the conference meets three times a year. The new conference is named at the October meeting of the National Safety Congress. The winter meeting is usually held in New York, and the spring meeting of late has been held in various parts of the country.

There are twelve permanent standing committees of the conference and every member is assigned to one of these committees in accordance with his own indication of preference. In this way the members associate themselves with the phase of industrial safety in which they have a prime interest and in their own opinion can be most beneficial to the conference and the safety movement.

These committees represent the most important functions of industrial safety engineering and the members of each committee, by their own selection, have indicated their special interest in a particular phase of accident prevention. Consequently, committee action is bound to be effective.

Let us take the area of industrial safety training as an example . . . The training classes given at the Council office are under the cognizance of this committee. The chairman, and members of the training committee, work with the Council's industrial training director to improve the course and make it fit the needs of the enrolled students.

Through volunteer committees, this same course has been set up in other areas of the country. Local safety councils, A.S.S.E. chapters, and extension departments of universities and colleges cooperate to provide classrooms, instructors and administrative guidance of the training committee.

One of the important books published with the guidance of this committee was the *Supervisors Safety Manual*. Some chapters of

this book were re-written as many as four times before the conference committee considered them satisfactory for modern supervisory training. The fact that the first printing of 30,000 copies was virtually depleted in a little more than two years, proves the worth of this effort by the committee. The original work had been done so well that practically no change was necessary in the second printing.

In addition, the committee has been working on an extension course on safety for supervisors to be operated by the Council Industrial staff. The Training and Nuclear Energy Committee cooperated recently to present a special course on radiation hazards and control for safety engineers.

Another special course on industrial hygiene for safety engineers is planned for late this year.

You can see from the activities of the Committee that in the area of training, the committee keeps the Industrial Department and the Council not only aware of current and new problems, but sets up the mechanism by which solutions to these problems can be accomplished.

Since more than 80 per cent of large corporations are members of the National Safety Council, it is obvious that big business has pretty well accepted its responsibility for accident prevention. The small company, however, has not accepted this challenge. It has been estimated that small business employs close to 70 per cent of our working force. The Council has been making progress with a Small Business and Associations program. Through trade associations, emphasis is placed on an industry acceptance of a safety program. Since such a large segment of the working force is included in the small business group, it certainly should be considered one of the main problems of the moment.

It is obvious that the representation on the Conference is such, that through its efforts the National Safety Council is kept well abreast of the needs in occupational safety. As new problems arise they are brought to the attention of conference, receive the benefit of wide experience in the field of conference members and the Industrial Department is guided in the correct course of action.

THE INDUSTRIAL SECTIONS

By W. O. WILSON

Manager of Safety, Standard Oil Co. (Ind.), Chicago, Ill.

Each of the more than 7,000 industrial & commercial members of the National Safety Council is affiliated with one of the 28 industrial sections.

The section exists for the purpose of providing a primary group whose safety problems and interests are sufficiently related and applied to a large enough exposure that they warrant treatment as a segment of industry.

The objectives of a section, therefore, are to disclose, study and define the safety problems of its segment of industry, disseminate information about these problems and bring them into the scope of activities of the National Safety Council through the Industrial Conference.

The publication entitled "A Report of Occupational Safety Activities Under the Direction of the Industrial Conference," which is available for distribution at this meeting, outlines the current work of the sections.

This report clearly indicates the wide diversity of projects which are being conducted by these groupings of Council members.

Special note should be taken of the number of Data Sheets and other technical publications being developed by the sections. Each month a new data sheet appears for the first time in the *National Safety News*. In addition to these, at least 12 other data sheets are published during the year. During 1958, of the total of 24 data sheets published, 14 were originated, developed and written by sections. The report also lists special visual aids, such as films and safetygraphs, together with special sectional posters and poster series.

Outstanding among the activities in which these sections engage, and an example of how they secure and disseminate information, is found in the Council's inventory of occupational accident prevention activities.

ty. In this mental agencies and voice in poli- Conference. conference new confer- eting of the winter meet- ork, and the held in vari-

standing com- every member mmittees in ion of pref- ers associate of industrial time interest : most bene- safety move-

he most im- safety engi- h committee, dic their base of acci- committee

ustrial safety The training ce are under : The chair- ing commit- ustrial train- se and make idents.

s, this same areas of the ls, A.S.S.E. ents of uni- : to provide dministrative ee.

ublished with was the Su- chapters of



It has long been customary for a member with an industrial safety problem to ask the National Safety Council for assistance and the Council has established a reputation for finding a solution of the member's problem, if it was not already at someone's finger tips. The Council's Inventory of Occupational Accident Prevention Activities is finding solutions to many problems and it is getting some of the answers before some of the questions are asked.

Of course, it is not always easy to get the answer to every question that comes along. But, industry needs and asks for the answers to such questions as:

"What kind of induction and job safety training do other companies give to new employees?"

"What is the cost of total compensation and medical payments per plant employee in other plants?"

"What kind of safety contests do other companies find worth while?"

"Should job descriptions specify protective equipment and other safeguards to be used?"

This inventory seeks the answers to these and to many other questions about industrial safety activities. To minimize the influence of variations in hazards between industries, the information is developed from within the individual industrial sections of the Council. The information provided by the member plants through the inventory questionnaire. Some of the information has also been publicized this year by articles in the January, May and September issues of the *National Safety News*.

The function of the inventory is to fulfill one of the purposes of the National Safety Council; that is, to serve as a clearing house for the exchange of information on industrial safety practices and techniques among industrial organizations. It is expected that this exchange of information will enable many plants to compare their own accident prevention activities with those of others in their own field, and thus enable them to evaluate the effectiveness of their own activities, and to improve their safety programs.

This inventory was initiated in 1956 by the Member Opinion Committee of the Council's Industrial Conference. At present, 14 of the Council's industrial sections are participating.

The questionnaire used in this survey is set up in 10 individual parts, each of which covers one major area of accident prevention activity.

Approximately 1,000 plants in the 14 industrial sections presently participating in the inventory provided completed questionnaires. At present the inventory is approximately 20 per cent completed in these sections.

Accident prevention areas covered by the inventory questionnaire include:

Part 1, Records, and Classification of Plant; Part 2, Safety Personnel and Budget; Part 3, Supervision, Policy, and Safety Committees; Part 4, Accident Investigation; Part 5, Physical Facilities and Environment; Part 6, Safety Inspections; Part 7, Personal Protective Equipment; Part 8, Medical and First Aid Program; Part 9, Employee Selection, Placement, Job Instruction, and Education, and Part 10, Off-The-Job Accidents.

Long-range future plans for the inventory include its extension to 25 industrial sections, which would exclude only the Trades and Services Section, Occupational Health Nursing Section, and the Hospital Safety Committee.

It is anticipated that the information developed when the inventory is extended to 25 sections will be most valuable, and that much of it will find its way into Council publications and periodicals, as well as being made available through sectional reports to members of the participating Industrial Sections.

While many of the sections are fulfilling the objectives previously stated, too many are doing very little to stimulate accident prevention activities within their spheres of influence. Much technical information in certain occupational areas remains to be gathered, written and disseminated. Participation in the inventory should include more sections in order that the data being gathered might be more completely representative of all occupational situations. As the chairman of this meeting has indicated, the years ahead are ones which present a great challenge to the intelligence, skill and ingenuity of all who are engaged in accident prevention activities. Will the sections be prepared to assist in the attainment of the desired goals?

TRADE ASSOCIATIONS

By GUSTAVE L. NORDSTROM

Executive Director, Folding Paper Box Association of America, Chicago, Ill.

During the next ten minutes of this work-day, while I relate a few ideas as to the future of trade association safety activity, one man will be killed or permanently and totally disabled by an accident while at work.

One hundred sixty others will be injured less severely.

By tonight, 50 workers will have been struck dead or totally disabled on their jobs. Two hundred fifty will have suffered some permanent impairment, and 6,000 more will have suffered injuries that will keep them from work for an average of about 20 days.

In a year—this year—14,000 deaths, 80,000 permanent impairments, 1,400,000 temporary disabilities, and \$2,000,000,000 expenses in wage losses, medical costs, and insurance overhead.

A staggering figure, yes. And the fate of two billion dollars certainly deserves our combined attention. But—and this is the real dollars and cents point behind industrial safety development—this figure, gargantuan as it is, does not tell the whole story.

Behind these already tremendous expenses loom towering costs that multiply the price of wage losses, medical service, and insurance. Replacement of expensive equipment . . . retraining of personnel . . . depreciation of machinery . . . down time—add them all together in the 3,000,000 business installations and the 5,000,000 farms where men and equipment are at work, and you will have another \$2,000,000,000 of loss—a total of \$4,000,000,000 as the cost, direct and indirect, of work accidents.

Note how this works. In a folding carton plant out East, not too long ago, a worker was using a crane to move stock on the factory railroad siding. While trying to save time, he overextended the crane, causing it to crash down a steep embankment. Fortunately, the worker jumped free and incurred but a few scratches—which were quickly bandaged. The crane, however, plowed down the embankment into an adjacent metropolitan sewage installation and tore it up, causing extensive damage. Since the work in process was of great importance to the

company, another crane had to be rented in order to clean up the debris caused by the downfall of the first crane and to proceed with the original work. Since the plant's crane operator had received just a few scratches in the accident, he was able to stay on the job. But, perhaps unsteadied by the mishap, he swung the newly rented crane into action, smashed it into a wall, damaged the wall, and snapped the boom.

Medical cost of this accident: a penny for a bandage.

Cost to the company: \$10,000 dollars plus time lost on the job.

Since the net profit ratio in the folding carton industry is running at approximately 2.21 per cent, this plant would need to realize gross sales of about \$450,000 to recoup a \$10,000 loss at the net profit level. At present paperboard evaluation, this, in turn, would require gross sales of 1,200 tons of folding cartons. Seventy-seven tons of cartons are manufactured at this plant during an average day.

A little arithmetic yields the startling fact that sixteen working days would be required to earn back \$10,000 of lost profit—profit which appears on the safety ledger as one cent, the cost of a few bandages! The fact that property insurance covered the damage does not alter the point, which is that the property damage tends to be overlooked when safety costs are analyzed. Only the penny bandage cost shows.

Happily, though, this coin has two sides. If accidents cost money and eat into a company's profits . . . then prevention of accidents can serve to add to a company's profits. Because the trade association is vitally concerned with the over-all development of its industry, safety has a genuine dollars and cents importance.

I think we have witnessed an important change in safety philosophy in recent times, one which I hope will characterize future safety activity. Formerly, the matter of industrial safety was relegated to a factory safety engineer or line supervisor. Today, more and more, safety is becoming a concern of top management—as important to a

company's operation as cost accounting and assembly line efficiency.

Although much work remains to be done here, management executives are being made aware of the fact that industrial accident prevention is a profit-making consideration. And where profits are involved, executive attention becomes sharply focused.

This, it seems to me, is the area in which the trade association can make the most dramatic contribution to industrial safety, and to increased member company profits.

The formula is basically simple. First, convince the corporate executive that industrial safety is his concern; second, develop an industry program which will involve every workman in active safety practice.

To be sure, this problem is a difficult one—fortunately, being met on many fronts. The National Safety Council's promotional campaign is aimed at the businessman, not the safety engineers. The Council's many fine awards have set high standards of industry performance which must require the attention of corporate management. But more needs to be done. Too many businessmen still evaluate the success of their programs by the size of their insurance payments. And this criterion is so woefully inadequate today that dependence on it probably does more harm than good—as we can see from the \$10,000 crane mishap, and from hundreds of other similar catastrophes.

That the trade association can do a valuable job in these areas is attested by past performance. The Can Manufacturers' Institute reduced its accident frequency rate 50 per cent in the first five years of its safety program and estimates savings of \$15,000,000. The National Association of Refrigerated Warehouses saved \$160,000 over a three-year period. The Pressed Metal Institute of Cleveland cut its frequency rate 68 per cent in 10 years, with corresponding savings.

My own group, the Folding Paper Box Association, estimates savings to members since the start of our program in 1951 at over \$4,000,000 in workmen's compensation costs alone, representing additional savings in plant and equipment of over \$16,000,000. And accident frequency is down 50 per cent.

There are now over 10,000 local, state, or regional associations, and about 2,000 more with nation-wide representation. The

United States Department of Commerce estimates that through these 12,000 associations can be reached most of America's 3,000,000 employers. Together with the regional groups, the multiple association special interest groups, the ad hoc committees and other organizations, they hold over 75,000 conventions and meetings each year. That gives us quite an audience.

With an audience of this size, associations can achieve things for their members that the members cannot achieve as individuals.

Associations can exploit and disperse to their memberships the benefits of all the combined knowledge and experience represented by companies on their rosters. Member firms have mutual safety problems, similar operations and equipment, much overlapping of experiences.

Through sponsoring associations, small companies can join in spirited safety competitions. Individually, their lack of size is a severe handicap to any effective competition. They cannot organize inter-departmental competition as do larger plants. Only through an association can they join together in constructive, industry-wide safety competition. And competition, of course, is one of the most successful ways to increase the standard of performance.

Many small plants keep no accident records, or inadequate ones. Association activities can serve to stimulate meaningful record keeping, as well as thorough accident analysis and follow-up, to aid in future accident prevention.

Safety meetings, industry-wide, and association sponsored, can bring about a free and beneficial interchange of information, and members can profit from one another's experiences in solving accident problems, developing educational safety activities, stimulating interest among employees, and in other areas.

Industry communications, through the medium of the association, can reach company management and involve the business, as a dues-payer, in constructive safety development.

Safety educational materials, developed within the framework of a specific industry, with specific problems, are more apt to hit the mark than those developed elsewhere. The trade association is ideally situated to provide this service.

Commerce
Associations
America's
with the re-
lation spe-
cialized com-
mittees
hold over
each year.

Associations
members that
individuals.
disperse to
of all the
ice repre-
sents. Mem-
bers, Mem-
bers, Mem-
bers, much

ness, small
safety com-
mittees of
size is
competi-
tion-depart-
ments. Only
n together
safety com-
mittee, is one
crease the

ident rec-
ognition activi-
ties, coordi-
nated, bal-
ance accident

and asso-
ciation a free
information,
another's
problems,
activities,
yees, and

h the me-
chanical com-
pany
ness, as a
develop-

developed
industry,
apt to hit
elsewhere.
situated to

As an example, the Folding Paper Box Association recently produced a new guide to accident prevention in the folding carton industry. Since the guide deals with safety problems peculiar to our membership, users have given it a fine welcome and have called it extremely useful. Other industries have produced similar guides with much success . . . and many others will surely find the technique applicable.

Associations may also work effectively with suppliers of mechanical equipment toward desirable modifications of machine design to achieve better guarding standards. An association of manufacturers understandably, will have more influence with a machine supplier than would a single manufacturer.

There is much the trade association can do to contribute to the development of industry safety. Through meetings and conventions, letters to members, joint study committees, and a dozen other means, associations can rally their memberships to a high level of enthusiasm—once they have

made appropriate safety studies of their own industries.

The stakes are high enough—in lives and dollars—to warrant the interest and cooperation of every installation in the country where men and equipment are at work. Associations can provide the impetus; they are the quickest and most effective way to reach and sell the masses of American businessmen, large and small.

Those of us who have seen the results of association safety work have reason to be enthusiastic about the enormous potential in this field. We solicit your support—in your company and in your association.

I thank you for your attention during these few minutes. Although we are too late to save the man who died or was crippled in an industrial accident while I've been talking . . . and too late to save the broken equipment and the needlessly endangered company profits, we're *not* too late to save tomorrow's lives and tomorrow's dollars.

Just let us get to work today!

INSURANCE ORGANIZATIONS

By DONALD G. VAUGHAN

Sec'y., Safety and Engineering Dept., Aetna Casualty & Surety Co., Hartford, Conn.

It will be impossible in the few minutes allotted to give you in detail the many ways in which the Insurance Industry has tied in with the nationwide occupational safety movement. The President's Conferences held in Washington every two years have gathered together the key people interested in furthering the efforts to reduce occupational accidents.

Insurance safety engineers have played an important part in every one of these President's conferences. To mention just a few items, the committees at the 1950 conference had more than 20 insurance safety engineers as committee members. At the 1952 conference, four insurance men were members of the co-ordinating committee and more than 30 of the delegates were insurance safety engineers. In 1954, six insurance engineers were members of just one of the committees, the Engineering Committee.

I do not have figures as to representation on the other committees for that conference. Last spring at the 1958 conference, we find seven speakers from insurance companies on the program. The staffs of both the stock and mutual insurance associations were members of the technical advisory committee and among the delegates to the conference we find over 50 insurance safety engineers.

The follow-up of these conferences in Washington is through local effort, both state and individual community. Many of our insurance engineers participate at these levels. There is hardly a local safety council in this country that does not have several insurance engineers as active members participating in the activities of their several committees.

It is interesting to note that the insurance industry has helped over the years in advancing accident prevention activities. In

1894 the first safety specialist was employed by an insurance company. The first workmen's compensation law in the United States was passed in New Jersey in 1911, some 17 years later. The year 1911 has been considered by many to be the birthdate of the industrial safety movement. Industrial accident frequency and severity and death rates have been steadily reduced since that time. The earliest figures available, those of 1913, give 9.1 workers per 10,000 killed in industrial accidents. This has been reduced to 2.3 deaths per 10,000 workers in 1957. In 1926 the average industrial severity rate was 2,500 while in 1957 this had been reduced to 740. This severity rate is the number of days charged per 1,000,000 man-hours of exposure. Frequency rate, number of disabling injuries per 1,000,000 man-hours of exposure, has also been reduced from 31.87 in 1926 to 6.27 in 1957.

These records while achieved by industry, reflect in a great measure the activity of the insurance industry for each year casualty companies employ thousands of safety engineering specialists and spend a sum of money in excess of \$30,000,000 to support their activity.

DEATHS OF WORKERS

At Work (Blue)	14,200
(Includes, Agriculture, Motor Transport, Mining, Logging—All Occupations)	
Manufacturing	2,000
Away From Work (Pink)	
Motor Vehicle	18,500
Public (Non Motor Vehicle)	6,900
Home	6,400
Total	31,800

INJURIES TO WORKERS

At Work (Blue)	1,950,000
(Again Includes All Categories)	
Manufacturing	400,000
Away From Work (Pink)	
Motor Vehicle	650,000
Public (Non Motor Vehicle)	850,000
Home	950,000
Total	2,450,000

Insurance companies have, year after year, given their support to national safety organizations. They have given financial assistance and their representatives have participated in the major activities of these organizations. Such support has been given to the

National Safety Council. Members of 100 different current safety code committees of the American Standards Association are from insurance companies. Some of the other organizations similarly supported are the American Society of Safety Engineers, the American Society of Mechanical Engineers, the Industrial Hygiene Foundation, the National Fire Protection Association, the American Chemical Society, the Center for Safety Education at New York University, and the Northwestern University Traffic School.

The insurance industry has been most active in the problem of rehabilitation of injured workers. In addition to seeing that the best possible medical and hospital care is provided, they have sought ways and means of training the handicapped worker to return as quickly as possible to a gainful occupation in industry.

Unfortunately word has spread around falsely that insurance companies advised against the hiring of the handicapped worker. I would like to point out that there is no provision in workmen's compensation insurance policies or rates that penalizes an employer for hiring handicapped workers. Several pamphlets have been published by the insurance industry encouraging employers in the proper placement of the physically impaired so that they can safely be made a part of the working force.

Research studies by the federal government and others have shown that when placed at proper jobs, the handicapped have an accident experience that is as good as their able-bodied fellow workers, and many times is superior.

Individual insurance companies and their associations annually publish many safety posters and booklets for assistance in furthering the safety education of industrial workers and industrial supervisors. Millions of these pieces of literature are furnished gratis each year.

Motion picture films and sound slidefilms have been produced and circulated by the insurance industry. No fair estimate can be made of the millions of workers who receive and benefit from these safety messages each year.

Special studies have been made by the insurance industry of unusual hazards involved in chemical processes manufacture,

transportation and handling of such materials as liquefied petroleum gas, anhydrous ammonia, plastics, flammable liquids, etc. More recently studies have been made by the industry of the problems connected with impaired hearing from exposure to noise in industry. Insurance people have kept abreast of the precautions to be taken in handling materials with nuclear exposures. This procedure is the same as when they tackled the silicosis and lead exposure problems several years ago.

All of this research work has been conducted in order to assist management, who are the insureds and customers of the insurance industry, in adequately and safely controlling these hazards. This has helped to make these exposures less hazardous and helped to keep thousands of workers from being involved in serious injuries.

The automobile accident problem is part of the industrial safety picture. Last year, that is 1957, 2,900 workers were killed by motor vehicles while they were at work. Another 18,500 workers were killed by motor vehicles while they were off the job. Insurance companies have been most active in the highway safety field. The furtherance of safety education in the schools, driver education and other highway safety activities have been encouraged, financed and promoted by the insurance companies.

For many years insurance companies have been assisting in the maintenance of safety with respect to hazardous objects. Inspections of boilers, pressure vessels, machinery and elevators are made regularly. In many states these reports by law are filed with state authorities and serve as the state checkup on these devices. In addition it must be remembered that the safety codes governing the installation and operation of these objects were developed with the aid and assistance of insurance company safety engineers.

This briefly gives a summary of the active participation of insurance companies in the occupational safety movement. For many years this assistance has been contributed not only at the national level in Washington but also at the state and local level. While governmental departments in Washington can initiate and stimulate occupational safety on a national scale, the real activities must be conducted at the state and local level.

Finally, plant management and labor must be sold and must cooperate if continued reductions in accidents are to be accomplished. The insurance companies as they have in the past will continue to be an important part of this activity. Insurance representatives will be willing to support accident prevention activities at all levels. Insofar as their resources will permit, they will continue to assist industry to become an even safer place in which to work.

The following material is quoted from the proceedings of the March 1949 President's Conference on Industrial Safety. This gives some indication of the part played by Insurance Companies and Insurance Associations.

"We visualize a two-fold concept for the providing of accident prevention service to industry by insurance companies and insurance associations:

1. Services originated and offered directly to industry solely by the insurance carriers.
2. Services developed by insurance associations and made available either directly from the associations or indirectly to industry, through the association members.

In each of these two areas, consideration must be given to services presentable to the small business whose insurance premium is not great enough to support the cost of technical assistance.

We must accomplish our aims by following these steps:

- (a) Review of the insurance accident prevention services available to industry—emphasizing the small plant.
- (b) Collecting recommendations on accident prevention services desired from insurance companies and associations.
- (c) Analyzing and correlating this material.
- (d) Deciding which areas can best be developed by the insurance companies, by the association, or both.

This brief form serves to outline our approach to the problem. It is detailed as follows, each step to be considered solely in terms of its relation to insurance companies and association services, with emphasis on the small plant.

- (a) The coordinating of results obtained by other committees of the President's Conference, which can be distributed by or

employed in connection with insurance service.

(b) The means for attacking the human problem as the cause of accident.

1. Training (supervisory and employee).
2. Proper job placement to insure the success of the worker (handicapped and normal).
3. Education (differentiated from training; referring to visual aids, posters, meetings, publications, lectures, radio programs, etc.) accenting human interest approach.
4. Psychological.
5. Organization (methods of forming and duties of interplant service committees).
6. Coordinating of plant safety activities.

(c) Inspection and engineering—recommendations for standardization in guarding and compliance with existing standards.

(d) The convincing of industrial management and supervisory personnel of the need for and importance of accident prevention; for example, by simplifying information on insurance costs and their relation to accidents.

(e) Accident statistics (their value, how to maintain them, and their use).

(f) Study of incentive reward plans based on accident experience.

(g) Recommendations of agencies concerning methods that might be employed to supplement insurance company services.

THE SAFETY ENGINEERING PROFESSION

By JOSEPH C. STENNETT

Dir., Accident & Fire Prevention, National Association of Mutual Casualty Cos., Chicago, Ill.

Delivered by EDWARD B. LANDRY

Safety Director, U. S. Postoffice Department, Washington, D. C.

It is with a great deal of pleasure that I represent the American Society of Safety Engineers at this important meeting—to participate in a joint effort to evaluate the past in order to make "Decisions for the Future." This is an opportunity to establish new goals, to set new sights and to reactivate projects that remain to be done. Many members of our society believe that a meeting such as this one has been long overdue.

The American Society of Safety Engineers is an organization of 7,500 professional safety engineers with a grass roots organization of 69 chapters located in the large industrial population areas of this country; it also has members in many foreign countries and chapters in Canada and Hawaii.

The Society is composed of dedicated men banded together for two principal objectives:

- (1) To promote the conservation of life and property through accident prevention, and
- (2) To encourage the development of safety engineering as a profession.

It was only natural for the society and for its individual members to take a keen interest in the President's Conference for Occupational Safety from its inception. Members served on the planning and steering committees and on all technical and other committees; they participated in the programs of each of the conferences and cooperated in the preparation of reports. In fact, a large percentage of the delegates at each of the conferences and more than half of the membership of many of the committees were members of the ASSE—and in 1954, members of the society served as chairmen of six of the seven technical committees.

Yes, the American Society of Safety Engineers had had a large stake in the President's Conferences and had a great deal to do in drafting conference reports and recommendations. The society is vitally interested in the implementation of the conference recommendations on which so much time and effort were spent.

In 1954, the President's Conference on Occupational Safety was composed of seven technical committees essentially the same in

scope as those in the previous conferences. Hence, the 1954 proceedings contain an 8-year consolidated report of these committees and include approximately 130 recommendations in the seven different areas. It is my understanding that today we are to evaluate the progress made in implementing these recommendations—and to plan for the future!

Broadly, the recommendations covered the fields of (1) research, (2) community safety, (3) government services to industry, (4) public employee safety, (5) safety education, (6) engineering and (7) accident records.

I am happy to report that the society has had active projects in most of these areas for many years and some were developed before the President's conferences were established. The ASSE continues to carry out many projects in these fields of activity. For example, it has completed, in cooperation with the National Safety Council, a number of important research projects. The society has also developed others yet to be done. It has conducted a broad program of education, especially in engineering colleges and universities—and has extended, through its chapters, Industrial safety institutes, Engineering training and foremanship training programs.

In the area of community safety many chapters of the society have cooperated in local community safety projects. For example, the voluntary inspection by ASSE members of public and private schools for safety and fire hazards.

It has devoted much time in the preparation of technical information for accident prevention, most of which has been made available to the National Safety Council for publication. The society has also assisted in developing many American Safety Standards.

ASSE has been of service to city and state governments in setting up accident records and statistical analyses—and in some localities, chapters on request, have assisted in setting up safety programs for public employees. The society is proud of its accomplishments and recognizes the urgent need to continue its efforts to further the common goals of accident prevention.

Plans for the future will be materially more effective if they are tempered by the experiences of the past.

The American Society of Safety Engineers, during the past year, has given serious thought to its role as the official representative of the safety engineering profession, in the President's Conference on Occupational Safety.

The evaluation of the resources and capabilities of the American Society of Safety Engineers, as well as consideration of its responsibilities to the safety engineering profession have resulted in the identification of the following "Decisions for the future:

1. Expand and intensify activity in all of the society's program areas which parallel recommendations of the President's conferences.

2. Realizing that the solution to most safety problems is attainable only at the grass roots level, the ASSE will concentrate efforts to give leadership and to cooperate with other agencies in organizing community safety organizations in locations without such facilities and give additional and more inspired leadership in those communities where safety organizations have become weakened or otherwise require stimulation and assistance.

3. By research or by other means determine the personal and human factors in occupational accident causation and prevention,—through studies of people and work places—through design of machines and work areas—through new methods—through job analysis and job requirements—through studies of employee selection and placement as well as environmental influences in relation to physiological and psychological characteristics of people—determine information and find methods for wide dissemination and use of such safety knowledge.

4. Study and evaluate the peculiarities and variables in the organization, methods, procedures and techniques of accident prevention programs from the viewpoint of determining the essential components and most important details of successful safety programs for particular situations and also to determine the deficiencies and weaknesses of unsuccessful programs.

5. Develop better methods and improved media for achieving wide dissemination and application of present available knowledge of occupational accidents and to study and evaluate available safety services to industry.

6. Maintain increasing emphasis to improve the professional development of the safety engineer by appropriate professional training programs and by other means such as professional registration.

7. Develop a career selection program to attract young people to the safety engineering profession in order to meet the increasing demands for professionally qualified personnel not only in the basic business enterprises but also to meet the newer technological developments in the nuclear energy and space age which is now unfolding.

8. Accelerate the society's program of cooperation with other engineering and professional societies to the end that these organizations will have a better appreciation of the significance and import of the integration of safety engineering into their areas of activity.

These are the *Decisions for the future*—for which the American Society of Safety Engineers feels it is in a position to contribute and to exercise leadership.

Before closing, we wish to present one more decision for the future—a decision

which we hope will meet with general acceptance. This is of vital interest to all of the participating groups of the President's Conference on Occupational Safety.

9. An objective study and evaluation should be made of the organizational structure of the President's Conference on Occupational Safety. It is the considered judgment of many of the leaders in the safety engineering profession that there is a pressing need for a continuing top-level policy committee, appointed by the President of the United States, representing business, labor, government, the organized safety movement, and the safety engineering profession.

Such a top-level policy committee, composed of national leaders in each area, would serve the important and necessary function of providing continuing direction to the objectives and action program of the President's Conference on Occupational Safety. This is not an untested concept. Such an organizational pattern has been successfully functioning for several years in the critical area of combatting the national traffic accident problem.

THOSE WHO CAUSE LARGE LOSS INDUSTRIAL FIRES

By CHESTER I. BABCOCK

Manager, Fire Record Department, National Fire Protection Association

Last year 41,000 industrial fires caused property damage totalling \$232,000,000. Of these 41,000 fires, only 161 accounted for \$106,000,000 loss or 46 per cent of the total loss caused by all industrial fires.

These few fires, with individual losses ranging from \$250,000 to \$14,000,000 are the ones that close down plants, put people out of work, unsettle insurance company reserves and disrupt our national economy which depends on continuous and ever expanding production for its existence.

Is it any wonder, then, that the large loss industrial fire has been the subject of continuous study? We must find out what causes these fires and cure our country of this economic disease.

Almost from the day the NFPA was founded more than 62 years ago, large loss industrial fires have been the subject of exhaustive study. What have we found to be the causes of these fires? We've found all sorts of things—weaknesses in fire-safe design of buildings, such as open stairways, excessively large fire areas, highly combustible interior finish; we found that other large fires are caused by substandard or non-existent fire protection—improperly maintained sprinkler systems, substandard watchmen and a lot of other fire protection features which should be well known to every man responsible for plant fire protection.

If you are interested in a review of these and the other factors responsible for last year's large loss industrial fire experience see the April 1958 issue of the NFPA Quarterly.

But underlying all these factors responsible for large loss industrial fires is one primal cause—people. Every one of these factors, and consequently every large loss fire, is caused by some person—and it is these persons that I want to talk to you about today. These people are the cause of our disgraceful annual record of large industrial fires and it is these people that must be helped if we are going to put a stop to the

continually worsening record of bad industrial fires.

Who are these people? They are the plant owners, operators or safety directors whose responsibility it is, whether they know it or not, to protect their properties against serious fires. They fall conveniently into three groups.

One includes those who have never given fire protection more than lip service or even completely ignore it, possibly under the illusion that an insurance policy premium solves all their fire problems.

A second group includes those in positions of authority who realize they'd better do something along the lines of fire protection but, because of lack of understanding of the complexity of the problem or, because of lack of proper guidance, make certain gestures in the direction of fire protection that may stop one or two holes in the wall of fire defense but leave others unattended. They fail to recognize that fire defense is no defense unless it is complete. This is a pathetic group that wants to do the right thing but doesn't know how.

Then there is the third group. This includes those in authority who have looked beyond the insurance policy to the fire protection standard. They have provided protection which on paper appears to be adequate in all respects, but in so doing have overlooked the fact that fire protection recommendations invariably depend upon one or more people somewhere along the line if the protection is to do the job assigned it. Automation in fire protection is still a long way from a reality.

Let's take a look at some of the large loss industrial fires of last year to see just how people go about it to cause this fire waste. The first group, you will recall, includes those who, for one reason or another, completely ignore fire protection. You all know of some such individuals—and I don't plan to dwell on them at length, but since they are responsible for more than half of our

bad industrial fire experience, they certainly demand first mention.

The man responsible for a \$283,000 feed mill fire in Madera County, California, is typical of those plant operators who, for all intents and purposes, have never heard of fire protection. Local papers labelled the cause of the fire a mystery but, to anyone who took the trouble to investigate the facts, the fire was no mystery. It became abundantly clear that it was caused by the person in authority at the mill who permitted it to exist without sprinklers, watchman or any other form of private fire protection, despite the fact that the mill was located 18 miles from the nearest fire station. The fire broke out after the plant had closed for the night and was out of control when discovered at 3:15 a.m.

A lumber mill fire at Palmyra, N. J., is typical of those that are caused by people who give lip service to fire protection but for all practical purposes ignore it. Although the proprietor of this plant did make the gesture of providing watchman protection, it turned out that the man he hired for the job suffered from palsy. This so handicapped his speech that in the excitement of discovering the fire he was unable to telephone the alarm. The fire was later discovered by a passing truck driver.

Excessively large areas that should have been subdivided by division walls were among the factors responsible for 55 of the 161 largest U. S. industrial fire losses last year. One example was a tire recapping plant in Columbus, Ga. The fire originated at a barrel of rubber cement solvent in the 1-story section and after enveloping the 1-story section spread through doorways to the 4-story section.

A hasty decision might place the blame for this fire on the employee who was trying to fix a leaking faucet on the solvent drum when the fire started. But a little more thought would show that the responsibility clearly lay on the man who was so blind to fire hazards that he was willing to conduct his hazardous business in an unsprinkled building and did not recognize the importance of separating the 1- and 4-story sections by installing fire doors in the intervening wall and by bricking up windows in the exposed side of the 4-story section.

Before leaving this fire I should comment

on the construction of the 4-story section. This building, although reported to be of "fire resistive" construction, demonstrated the fundamental principle that the fire load of a building must be taken into consideration when determining adequate fire resistance for structural members. In this instance columns and girders were insulated with two inches of concrete, and floors and roof slabs were 3½-inch reinforced concrete. Since the upper stories of the building were loaded principally with rubber tires and rubber recapping material, it is not surprising that parts of the roof and two upper floors collapsed.

I wonder what the directors of a Keystone, S. D., feldspar plant were thinking about when the subject of fire protection came up. Perhaps they glanced at their insurance policies and passed on to the next item on the agenda. The fire originated in a small shed containing an oil-fired hot water heater. It was discovered by an employee without appreciable delay, but in the absence of a cut-off between the shed and main plant, and due to the complete lack of private fire protection, the fire spread from the shed to the communicating main building. The only water for fire department use was a shallow creek. This was frozen solid. Water carried on apparatus from neighboring towns froze on the way to the fire.

Perhaps we should have more compassion on the directors of this plant. Perhaps it was too cold to think clearly about the possibility of fire.

So much for examples of that group of industrial plant people who caused large loss fires last year because of ignorance of the value of fire protection or lack of interest in it. It is safe to say that, because of their experience, this particular group of people now know that fire is something they cannot afford to have and will take steps to prevent a recurrence. But what will they do?

Will anyone offer them the sound advice needed for complete fire protection? Or will they advance only to membership in the second classification of plant management—those who, because of lack of understanding or guidance, fumble in the dark, so to speak, do a partial job, and leave weaknesses that may combine to cause another disastrous fire for some future year's record.

Here are some large loss fires caused by people in this second group.

The management of a tractor assembly plant at Baraga, Mich., did do some thinking about fire. In fact they decided they would solve all their fire problems by permitting the local volunteer fire department to house its engine in a partitioned-off corner of the assembly plant. They also agreed to have the village fire siren mounted on top of the building.

A person across the street discovered the fire at 6 p.m. He tried to operate the fire siren, only to discover that it had already been put out of order by the fire. He then was stymied in his efforts to get the fire station door open to get at the engine. During the next 15 minutes while unsuccessful attempts were made to rescue the engine, the partitioned-off fire station became enveloped in flames. The fire department of a neighboring town was then called.

A \$430,000 fish cannery fire occurred at Anacortes, Wash., last November and was beyond control when discovered by an outsider at 5:55 a.m. Why was the building destroyed?—Because the owners were willing to leave the building without watchman or automatic fire alarm protection during the night, and because they chose to drain the sprinkler system to prevent its freezing, rather than make certain changes in the system that would allow it to remain in operation without freezing during the winter months.

A shirt factory at Souderton, Pa., was swept by a \$925,000 fire last year. Word apparently had filtered through to management that fires must be discovered promptly if the fire department is to have a chance to bring them under control, since they hired a night watchman. They forgot about Sundays, however. The fire was beyond control when discovered one Sunday morning by a neighbor, about an hour after the night watchman had gone home.

The owners of a washing machine assembly plant at Greenville, Ohio, provided a supervised night watchman, and apparently went to bed each night confident that they could never have a bad fire. The watchman did as was expected of him—discovered the fire promptly after an oil supply pipe to the oil burner broke in the boiler room. And yet the fire eventually levelled the plant and caused \$660,000 worth of damage. Why?

The owners had failed to cut off the boiler room from the rest of the plant and had neglected to install sprinkler protection. Fed by several thousand gallons of oil escaping from the broken pipe the fire spread rapidly from the boiler room to the communicating main building and was out of control when firemen arrived.

The stories of some of these fires would be laughable if it weren't for their disastrous results. One plant was destroyed despite good watchman protection because the boiler room was not cut off from the main building. At a furniture factory at Fort Smith, Ark., the operators did nothing about watchman protection but apparently they had heard that small fire areas mean small losses, since they subdivided their 250-ft.-long building into three sections with two parapeted fire walls.

The fire originated in the middle section during the night. In the absence of watchman or automatic protection it is not surprising that it was through the roof before discovery by a passerby. Nor was it surprising that the fire entered and destroyed an adjoining section when it was learned that the fire doors in the division wall had been allowed to be blocked open.

One of the most pathetic incidents in last year's large loss fires was a \$2,400,000 fire in a Cleveland paint factory. I won't go into the details of the fire except to say that it started in the basement where cartons of filled paint cans were stored, and spread quickly to communicating sections through unprotected openings and to upper stories through chutes and other vertical openings. The saddest part of the story is the fact that management had recently accepted the advice of professional fire protection engineers and had agreed to install complete sprinkler protection. The fire occurred before the system could be installed.

Seven paper-making machines were destroyed in a \$5,000,000 fire at Cornerbrook, Newfoundland, last year. From outward appearances the fire protection appeared adequate to prevent any fire serious enough to cause a shutdown. Among other things there was a trained fire brigade, the paper machine room was sprinklered, deluge sprinklers protected driving gears on the machines and there was a two-source water supply for sprinklers and standpipe hoses.

Then a fire broke out at the drier end of one of the machines that quickly exposed two serious weaknesses in the protection. The first showed up when burning paper fell through a floor opening and ignited loose paper or broke in the basement beneath the machines. Since sprinklers had never been installed in this basement, the fire spread rapidly and was soon coming up through floor openings under the seven paper machines.

The deluge sprinklers operated but these only protected the driving gears and the fire spread to the unsprinklered hoods over the machines and then to the wood roof where several hundred sprinklers opened.

It was then that the second serious weakness in the fire protection showed up. It had to do with the water supply. A connection to a 12-inch city main and three fire pumps should have been able to supply the deluge and regular sprinklers but did not because more than 800 domestic and process connections also took water from the fire main, and the suction supply for the fire pumps was not adequate when the three pumps were operating simultaneously. The plant fire brigade was unable to use stand-pipe hoses until after deluge valves were closed. The brigade was then able to attack and control the basement and roof fires.

In a tenant manufacturing building fire in New Haven, Conn., last year, 15 lives were lost and property damage totalling \$325,000 resulted. On the plus side, the building had a central-station-supervised automatic fire alarm system, but on the negative side there was no sprinkler protection, rubbish was allowed to accumulate in the hallways, self-closing doors to the main stairway were blocked open and employees had not been taught how to release the latched up-swinging lower section of a fire escape stair.

This New Haven case is the last one I shall cite as evidence that a substantial number of bad industrial fires are caused by people who recognize the need of fire protection but through lack of proper guidance have failed to do the job properly. These people need help, and what's more, they have demonstrated by their willingness to do something that they would be amenable to suggestions as to how to do the job right.

The third group of people responsible for bad industrial fires include those who set

up adequate fire prevention and fire protection programs, do just about everything you or I could ask, and then, because they neglect to keep their defenses up, in other words, permit a slight relaxation of the maintenance program or let up a little in training employees, allow hidden cracks to develop in their plant's protection that only show up after a fire occurs.

An example is the fire protection at a drug factory in Linden, N. J. Three men lost their lives when a vacuum still exploded last year. The explosion is believed to have occurred because a small amount of caustic that had been used to clean apparatus had been allowed to remain in the equipment. Careful attention had been given to fire and explosion prevention at this plant and there was no skimping where fire protection was concerned. Yet this explosion occurred—killing three employees and causing \$270,000 damage—all because of one little slip-up.

A plastics manufacturing plant at Pittsfield, Mass., had a somewhat similar experience. An explosion in a reaction kettle killed three employees and caused \$500,000 property damage. The operators of this plant had not spared expense or effort in their desire to avoid such a disaster, yet it occurred because somebody apparently added too much catalyst or added it at the wrong time. Perhaps some employee had *forgotten* the importance of handling catalysts in just the right way.

A fiber pipe plant at Orangeburg, N. Y. was sprinklered, manually operated open sprinklers were installed at pitch impregnating tanks, a good supply of portable extinguishers was on hand and employees had been taught what to do in case of fire. Then a fire occurred at a pitch tank. Employees attacked it with dry chemical extinguishers and had it practically out when they ran out of extinguishers. What about the open sprinklers? No one thought to turn them on. The fire spread to the roof and had soon opened so many sprinklers as it spread over pitch residues that the water supply was overtaxed—another case where fire protection collapsed because employees were allowed to forget one part of the emergency procedure.

What better illustration is there to close our discussion of fires caused by people in

this group than a \$14,000,000 rubber reclaiming plant fire at Butler, N. J.? Those responsible for the fire protection at this plant apparently had taken all the steps necessary to protect the plant against a serious fire. It was completely sprinklered with a good water supply, a steam smothering system protected the rubber drier, there was a standpipe hose system and a trained plant fire brigade.

The fire originated in the drier, and flames bursting from openings ignited lint and dust on building members overhead. The fire protection immediately took over as scheduled—the steam smothering system and sprinklers operated and the fire brigade went into action—when the hidden flaw in the protection showed up.

You know the story. An employee who had run to the street to pull a fire alarm box heard what he thought was a shout for water. It was dark out. He checked the post indicator valve in the yard controlling sprinklers, and not being aware that this particular valve was one of a few left-hand valves at the plant, closed it under the impression that he was opening it. Thereafter the fire spread beyond control.

There aren't very many bad fires in this category and that's to be expected since the fire protection in these plants is in the hands of people who insist upon a superior grade of protection—far above the average. The few cases that do show up each year, however, emphasize that a plant fire protection engineer can never drop his defense for a moment. He must be ever on the job to seek out hidden hazards and to be sure that the protection he has provided will not fail because somebody else slipped up.

The plant fire protection supervisors in this third group warrant our sympathy but I doubt if they can use our help. They know their problems and how they should be solved and only they can know whether they themselves have done everything necessary to assure good protection when fire occurs.

So there are a few cases from last year's large loss industrial fires to demonstrate my contention that bad fires are caused by people. I am sure you know this as well as I, but I do feel that in our efforts to spare people's feelings, particularly people who have experienced a disastrous fire, we fail to make it clearly understood that although the fire was caused by one or more fire protection weaknesses, some person allowed these weaknesses to exist.

Now, the purpose of this talk is not to point the finger at individuals. My purpose is solely to point at the fundamental cause of bad fires so that our efforts to prevent them can be directed more effectively. For I do feel that the fire protection program fails so often in its objective because the human element is not sufficiently appreciated. Bad fires are not caused by any serious deficiencies in the science of fire protection.

The trouble is with the way men think about fires and fire protection and unless we keep this point continually in mind we have little chance of making real progress in putting a stop to this needless industrial fire waste.

What does this mean to the fire protection engineer, to the plant safety supervisor, to the public fire official, to all of us who are trying to lick this problem?

It means just this: In addition to our knowledge of fire protection, we must also be skilled as teachers, psychologists and diplomats. For the basic task is to change the thinking of the plant owner or manager—to convince him that fire protection is his responsibility and must have his full and continuous support.

To accomplish this goal may require all your powers of persuasion, but once he is convinced, the rest will be easy. You will now have a sympathetic and willing ear for your fire protection recommendations, and you will have the assurance that fire protection will be an important and continuing activity in that man's plant.

PORTABLE FIRE EXTINGUISHERS —A CHANGING PICTURE

By DALE K. AUCK

Director, Fire Protection Division, Federation of Mutual Fire Insurance Companies
Chicago, Ill.

Unfortunately, fire and its resultant loss in property, lives and jobs seems to be a part of the cost of doing business in our national economy. Why there isn't a line on the balance sheet of every plant for this fire cost item has always been a mystery to me. I suppose you could construe the expense item of fire and business interruption insurance as the "fire" item of the balance sheet but that is only part of the whole story—insurance merely endeavors to lessen the economic shock suffered by a company that has had a fire. It is not a panacea or a cure-all or a substitute for adequate fire protection.

Modern merchandising and industry has a very tangible stake in the American economy. A conservative estimate of its worth would be in the neighborhood of \$165 billions of dollars. That is a lot of money even to us blasé Americans when it is expressed in terms of our present day dollars.

I didn't pick this \$165 billion figure out of thin air. The U. S. Department of Commerce publishes annual estimates (by states and counties) of the assessed valuation of non-farm residential, farm, mercantile, and industrial property. These are the valuations for taxation purposes. Another group within the same governmental agency is constantly studying the ratio of assessed valuations to current sales prices, also by states and counties.

By taking the state totals of assessed valuation and sales prices, I arrived at the alleged sales price of all industrial property in the country for 1956 and that came to \$165 billion. That figure does not include the industrialization of any tax-free facets of industry nor does it include any industrialization within the armed services. They'd make it much higher than \$165 billion.

The National Fire Protection association recently reported that in 1956, industry suffered 38,300 fires within industrial structures—that's 5 per cent of all structural

fires occurring that year. The dollar loss for them was \$207,500,000—that's 20 per cent of the total structural fire loss for that year. Last year, there were 125 "large loss" industrial fires that caused \$97,700,000 loss. (A "large loss" fire is one where the loss exceeds a quarter of a million dollars.) Thus we begin to get the overall picture of "flaming" industry.

Modern industry has been pretty well schooled to act promptly in times of fire emergency—the first thing they are taught to do is "call the fire department," whether it be the local plant fire brigade or the municipal tax-supported fire department.

It takes an interval of time for any fire department to arrive on the scene and begin fire fighting operations. An old axiom, true regardless of its age, is that the first five minutes of work on a fire are more important than the next five hours of fire fighting. All fires start out in life as little fires—if they can be caught then, the fire extinguishment job is correspondingly small. So, what to do until the fire department arrives?

The answer lies in another old axiom—"The Lord helps those who help themselves". Who is present when the small fire starts during working hours? The employee. Who is present when the small fire starts after working hours? The security force. What of the plant that has no watchmen or guards for the night period? They need either a good dependable automatic fire detection system or the prayers of the faithful. They're really vulnerable.

What can this employee or this security guard do when fire starts? He can use a portable fire extinguisher, provided a suitable one is available and he has been trained in its correct usage.

Employees in industrial plants have a stake in industry also. If their plant has a serious fire they face the possibility of an immediate layoff until the plant is rebuilt.

They also face the potential possibility of not having any job at all because the fire has caused the firm to lose many customers during the rebuilding time and thus curtailed production.

Note the limitations I imposed on the employee a moment ago—they're the keynote of this talk. Let's talk about several words—"suitable", "available", "trained" and "usage".

Now everything in the world seems to go hand-in-hand with its opposite. We have male and female, high and low, good and bad. So it is with portable fire extinguishers. We have good and bad, approved and unapproved. So we need a yardstick to measure them to determine if they're good or bad.

We have such a yardstick—it has two parts. The first part is the Technical Committee on Portable Fire Extinguishers of the National Fire Protection Association. They are an aggregation of technically qualified engineers from fire equipment manufacturers, rating bureaus, testing laboratories, industry, fire departments and insurance companies. They have published a standard for the performance of good fire extinguishers.

Based on this standard, the second part of this yardstick comes into play. The three nationally-recognized fire protection equipment testing laboratories relate this standard into criteria of manufacture to insure the required performance. The manufacturers of repute of fire extinguishers submit their products to these laboratories for checking and testing. If the extinguisher unit meets the criteria of the labs and test shows it meets the performance desired by the standard, the manufacturer is permitted by the labs to attach a brass label to each unit manufactured that shows it is "approved" and is "listed" in their list of worthwhile protection devices.

Insurance companies and fire insurance rate making bureaus will recognize ONLY fire protection equipment with an Underwriters' Laboratories (US & Canada) or Factory Mutuals Laboratories label on it. There may be others of equal worth but we who write the liability on the plants and pay the losses must be assured of the integrity of the protection device and we recognize only these two laboratories in this regard.

The standard which the NFPA technical committee has prepared is known as NFPA pamphlet No. 10. An industrial safety man or fire protection engineer cannot function efficiently in the best interests of his employer unless he has procured and has read and understands this pamphlet.

At the point of being trite, condescending and insulting your intelligence, I must state the basic fundamentals of the fire triangle at this time—whenever you have a burnable substance, the heat equivalent of the substance's ignition temperature, and air, all present in the same place at the same time, you cannot avoid having a fire.

Conversely, if you want to extinguish that fire, merely remove one, any one, of the three constituents causing the fire. Fire extinguishment is very simple—you either remove the fuel from the fire, you cool the burning material down below its ignition temperature or you exclude air by smothering the blaze.

There are three fire and extinguisher classifications, again very simple. They're A, B, and C. "A" fires involve ordinary combustible materials where the cooling-quenching effect of quantities of water solution are most effective. "B" fires are those involving petroleum products, flammable liquids and greases where the smothering or oxygen-excluding effect is best suited for fire extinction. "C" fires are merely "A" or "B" fires involving "live" electricity and thus the extinguishing medium must be a nonconductor of electricity to protect the user from electrical shock.

Now that wasn't very hard to take, was it? Just 3 kinds of fires, A, B and C. Just 3 kinds of extinguishers, A, B and C. All you have to remember is to use A units on A fires, B units on B fires and so on. This pretty well sums up what we meant by "suitable" in our original thesis.

Now let's talk about the word "available." Obviously this means that management has to buy and install some fire extinguishers so that they are available but what kind shall they buy, how many are needed, what size is best, and how shall they be distributed?

Down in the corner of the testing laboratories label it says that this extinguisher is classified as "4A,6B" or "10A" or "6B,C" or some other cryptic designation. We have

already discussed the A, B and C classes. The numeral is indicative of the approximate relative fire extinguishing potential of the unit. For instance, a 4B unit will extinguish twice as much fire as a 2B one will, or it will extinguish only half as much fire as an 8B unit will. Thus the numeral expresses a ratio or relativity of one unit when compared with another of the same letter classification.

Class C extinguishers have no numeral shown. The size of the Class C unit purchased should be commensurate with the size and extent of the area involving the electrical hazard or containing electrical equipment to be protected. The type and the degree of enclosure of electrical equipment is also a factor.

How did the testing laboratories ever determine what numeral an extinguisher should have? Their determination was based upon actual fire tests. They constructed a series of square fire pans of heavy metal. These pans had surface areas of $2\frac{1}{2}$ sq.ft., 5, 10, 15, 20 and on up to 100 sq.ft. They were all filled with water to the same depth, they all had a certain number of inches of gasoline floated on that water, they all had the same number of inches of bare metal sides above the gasoline surface.

Let's imagine a 10-lb. dry chemical unit was up for test. The $2\frac{1}{2}$ sq.ft. pan was first ignited, allowed to burn for a specified time, the unit was applied and the fire was extinguished before the extinguisher became exhausted. Then the 5 sq.ft. pan was fired and extinguished, and so on until a pan was reached which could not be extinguished by the total content of the extinguisher. In the 10-lb. dry chemical size, this usually was the 25 sq.ft. pan, so they went back to the successful extinguishment on the 20 sq.ft. pan as the unit's limit.

They then divided this 20 sq.ft. by a factor of $2\frac{1}{2}$ and this gave the numeral 8. The extinguisher was then rated as 8B. Now you ask, where did they dig up this $2\frac{1}{2}$ factor? They call it a "booger factor". By actual test they found that a trained fire laboratory engineer could extinguish $2\frac{1}{2}$ times as much fire as could an untrained person who had never operated an extinguisher before in his life. They actually tried this out numerous times, taking the "man in the street" and letting him put out test fires.

To digress for a moment at this point, this $2\frac{1}{2}$ booger factor should give you industry men a clue to good fire protection and the best argument you can advance to management for having a good trained fire brigade in your plant. Suppose you determine that a certain hazardous area needs an 8B unit. You install one there. That means that an UNTRAINED employee can use it and be reasonably sure to extinguish the fire that required the 8B unit. But, if your men in your fire brigade are trained in extinguisher usage, that 8B unit has the inherent potential of extinguishing $2\frac{1}{2}$ times the amount of fire that may occur in that area. That gives you plenty of reserve extinguishing power.

Who says that training doesn't pay off?

Now before you can determine how many extinguishers you should have to adequately protect a building or a portion thereof, you must determine what class of occupancy you want to protect.

Is it a light hazard such as offices, class rooms or libraries? Is it an ordinary hazard structure such as a manufacturing building, metalworker or a warehouse? Does it contain extra hazard occupancy such as paint spraying, flow coat dipping or wood-working? You may even have a building where all three types of occupancy are present. In that case, you must determine which is the predominant one and its degree of cutoff from the rest of the building and base your extinguisher coverage on that, increasing the coverage in those portions of higher occupancy hazard.

The reason you must make this occupancy determination lies in the fact that it determines two things; i.e. the travel distance to the nearest extinguisher and the floor space that each unit will protect.

In speaking of Class A extinguishers, the standard states the following:

Light hazard occupancies
100 ft. travel distance
2500 sq.ft. per unit.

Ordinary hazard occupancies
50 ft. travel distance
1250 sq.ft. per unit.

Extra hazard occupancies
same as ordinary hazard, plus additional ones as determined by authority having jurisdiction.

this point, iv... in... p... section advance to trained fire you deter-area needs here. That ployee can extinguish it. But, if : trained in it has the ; 2½ times ur in that reserve ex-

t pay off?

how many adequately ereof, you occupancy

fices, class inary haz-ring build-? Does it such as or wood- t building nancy are determine its yee ldi. And : that, in- ortions of

occupancy at it de- l distance the floor

shers, the

us ad- ed by

In speaking of Class B extinguishers, the Standard states the following:

There is no light hazard B occupancy.

Ordinary hazard B occupancy

50 ft. travel distance

625 sq.ft. per unit.

Extra hazard, deep-layer flammable liquid fires, as in dip or quench tanks, use 1 numerical unit of B extinguisher for each square foot of dip tank surface.

Now things begin to get a bit complicated. I don't expect any of you to remember every last item I talk about from here on—I respectfully recommend to you a detailed study of Pamphlet No. 10. However, I'll mention a few items for discussion.

Many times Class B hazards are contained in Class A buildings. In establishing the number of extinguishers—necessary, you must provide for the building's protection first. If it has 10,000 sq.ft. of floor area and is of ordinary combustible construction, you need 10,000 divided by 1250 or 8 units of "A" extinguishers. If the occupancy therein is all spray painting (an extra hazardous occupancy) you will need 10,000 divided by 625 or 16 units of "B" extinguishers. An ordinary 2½-gal. soda-acid unit is rated as 2A so you would need 4 of them to get a total of 8A extinguishing potential. An ordinary 2½-gal foam extinguisher unit is rated as 4B so you would need 4 of them to get a total of 16B extinguishing potential. If you don't like foam, you could use four 4B 10-lb. CO₂ units or one 16B 20-lb. dry chemical unit. However, the standard states that an extinguisher carrying BOTH A and B classifications can be accepted for area requirements under each individual letter classification. Now a foam unit of 2½-gal capacity has such a dual designation, it's 2A,4B. Thus 4 such 2½-gal foam units would do the trick, they're good for four times 2A or 8A building protection and also four times 4B or 16B occupancy protection.

When you have a dip tank in the area, you do essentially the same thing—you determine the A units needed to protect the structure and the B units needed for so many square feet of surface area of the dip tank. Of course, if there happens to be some extensive electrical equipment in the B area, you may want to use units having both a B and C classification.

Believe me, no matter how you write these rules, it can be a bit complicated in this actual determination of extinguishers. Maybe the best way is to throw the problem back to the fire insurance rating bureau having jurisdiction in your state and let them tell you how many you need to get an extinguisher credit in your insurance rate.

I know the question you're going to ask me now—it is "Why did the NFPA committee establish such a complicated set of rules to determine what should be a very simple thing?" They, too, had a reason.

Prior to 1955, we had only a few classifications of A and B extinguishers. They were A-1 or A-2, B-1 or B-2, C-1 or C-2. The labs had only one test fire for each class. If an extinguisher put out the A fire, it was A-1, if it didn't, they called it A-2 meaning it took 2 of them to do the job. That was fairly good until some sharp engineers with some of the extinguisher manufacturing concerns started to improve their extinguishers. In the pre-'55 days, CO₂ and dry chemical units were comparable, they both got B-1 classification in anything above the 5-lb. size. But good design and better applicators, together with improved dry chemical soon had the dry chemical units engineered to the point where they were putting out twice the amount of fire as did the same sized CO₂ units.

However, these improvements cost money and the price of the dry chemical units was slightly higher than the CO₂ units. Since both types of units had the same B classification and since both types had the same square footage criteria, it was obvious that when one recommended Class B protection for a hazard, management would buy the less expensive type regardless of the fact that for a few dollars more they could get units having twice the extinguishing power.

Further in considering only one class of extinguisher, say the CO₂ class, all units above a certain size merely had a B-1 classification and there was no incentive for management to buy the larger units which the increasing hazards of our modern technological advancement were being brought into consideration for protection.

Thus, the NFPA committee establishing the standards for fire extinguishers had to develop a formula that would recognize the differences in extinguishing potential and

extinguishing efficiency rather than a mere designation as to type of extinguishing media. That alone is the reason for the revised fire extinguisher standards today.

Many of you have extinguishers presently in your plants that were purchased prior to 1955 and which have the old A-1, B-1 classifications on their laboratory labels. In order to meet the requirements of the new standard, you must know how to evaluate these old classifications in the light of the new classifications. In the appendix to pamphlet No. 10 is a list of all types and kinds of fire extinguishers manufactured. Each has its old and new classification indicated and it is an easy job to relate your old units to the criteria under the new standard. That's just another reason why you must have Pamphlet No. 10 in your library—you can't get along without it.

Another facet in the changing picture in fire extinguishers is the recognition in the new standard of the difficulty in extinguishing metal fires, a product of our expanding technology. Fires in magnesium, calcium, zirconium, lithium, sodium and potassium are really tough ones to control. Normal extinguishing agents are not too effective, the extinguisher industry must come up with some new answers to this problem. Present day extinguisher units may intensify these fires rather than subdue them. Specialized techniques are under development and if you have these hazards in your plant, you should sit down with reputable manufacturers and let them advise you what is the best they have to offer at the moment.

Another facet in the changing picture of fire extinguishers is the new requirement for the hydrostatic testing of extinguisher shells. Most units should be so tested to not less than 300 psi or more than 350 psi every five years they have been in service. Certain ones that have not been subjected to the five year test required by the ICC must be tested at 12-year intervals. Extinguishers which have been physically damaged by dropping or have had their shell deformed by any means need to be hydrostatically tested. It should be kept in mind that extinguishers develop considerable internal pressures as a result of chemical interaction or release of stored pressure inside and therefore, the pressure container or shell should be able to withstand these pressures, if plant and employee safety is to

be considered. The standard contains specific rules on how the testing is to be conducted.

One more facet to the picture—management must be responsible for providing this all important first line of fire defense. Fire protection is not a luxury—it is a tangible expense of doing business.

We hear a lot about labor-management relations these days. Labor has a stake in this protection picture. We hear a lot about the demands labor is continually making on management, such as wages raises, more vacations, free insurance, other fringe benefits. The time has come when I feel that management should make some demands from labor.

In many plants, labor (and I use the word in its collective sense) indulges in certain horseplay and practical jokes, many of which involve playing around with fire protection equipment. I had this horseplay matter right square in my lap some years ago when I was the fire marshal of a major American industry. We got labor to agree that any employee who was found indulging in horseplay or maltreating any fire protection device, whether it be an axe, an extinguisher or an instruction card telling how to use an extinguisher was summarily fired on the spot and had no case before the union grievance committee.

It took a bit of selling to the labor union to impress them with the utter necessity of insuring at all times the integrity of every bit of fire protection installed in the plant, but when they saw their jobs were at stake, they agreed to management's request in holding fire protection equipment inviolate.

Gentlemen, don't sell the lowly fire extinguisher short in the industrial production race we're all engaged in. It is the one item which answers the question of "What can I do until the fire department arrives?"

Don't think that its use will cheat the fire laddies out of some fun, they'd a thousand times rather pull up to your plant and have you tell them that you knocked it down with an extinguisher.

The fire extinguisher is right down at the grass-roots level of fire protection—right where fires start. All it needs is a bit of training and intelligence in its proper application and it will pay you big dividends.

OFFICERS OF THE

AMERICAN SOCIETY OF SAFETY ENGINEERS

EXECUTIVE COMMITTEE 1958-59

President—DONALD G. VAUGHAN, Secretary, Aetna Casualty & Surety Co., Hartford, Conn.

First Vice-President—JOHN F. JONES, Safety Supervisor, Commonwealth Edison Co., 72 W. Adams St., Rm. 1933-E, Chicago 90, Ill.

Second Vice-President—GEORGE L. GORBELL, Safety Director, Personnel Relations Dept., Monsanto Chemical Co., Lindbergh & Olive St. Rd., St. Louis 24, Mo.

Secretary and Managing Director—J. B. JOHNSON, American Society of Safety Engineers, 425 N. Michigan Ave., Chicago 11, Ill.

Treasurer—MICHAEL F. BIANCARDI, Manager, Safety Services Dept., Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wis.

Members-at-Large

Term Ending 1959—FRED CLAIBORNE, Safety Assistant, Pan American Petroleum Corp., P.O. Box 3092, Houston 1, Tex.; FRANK E. LADERER, Director of Safety, Nationwide Insurance, 246 N. High St., Columbus 16, Ohio; E. PETER MARCONI, Manager, Safety Branch, Aro, Inc., Tullahoma, Tenn.

Term Ending 1960—GEORGE M. KINTZ, Chief, Accident Prevention & Health Div., U. S. Bureau of Mines, Region VI, 1114 Commerce St., Rm. 1602, Dallas 2, Tex.; CLYDE F. SCHLUETER, Accident Prevention Manager, Employers Mutuals of Wausau, 407 Grant St., Wausau, Wis.; VIRGIL L. WOMELDORFF, Safety Director, Illinois Power Co., 500 S. 27th St., Decatur, Ill.

Term Ending 1961—JOHN V. GRIMALDI, Consultant-Safety & Plant Protection, General Electric Co., 570 Lexington Ave., New York 22, N. Y.; LEE B. JOHNSON, Chief Safety Engineer, Northrop Aircraft, Inc., 1001 E. Broadway, Hawthorne, Calif.; WALTER E. MONTGOMERY, Safety Director, Robertson, Hall & Henshaw, Ltd., 1510 Drummond St., Suite 102, Montreal 25, Que., Canada.

Regional Vice-Presidents

Eastern Region—ARTHUR H. CHRISTIAN, Corporate Safety Engineer, American Viscose Corp., 1617 Pennsylvania Blvd., Philadelphia 3, Pa.

Northeast Region—MERRILL C. M. POLLARD, Safety Director, National Gypsum Co., 325 Delaware Ave., Buffalo 2, N. Y.

Southeast Region—P. W. LOGAN, Division Manager, Engrg. Dept., Liberty Mutual Ins. Co., 828 W. Peachtree St., N.W., Atlanta, Ga.

Central Region—JOHN A. DEPEW, Director of Safety, Dohrn Transfer Co., Robinson Bldg., Rock Island, Ill.

East Central Region—MYRON L. MILLER, Supervisor of Safety, Westinghouse Electric Corp., 700 Braddock Ave., East Pittsburgh, Pa.

West Central Region—HOLLEY P. BRADLEY, Supervisor of Safety, Service Pipe Line Co., Box 1979, Tulsa 2, Okla.

Southwest Region—FRED W. SCHATZMAN, Safety Engineer, Chance Vought Aircraft, P.O. Box 5907, Dallas, Tex.

Western Region—

Past Presidents—EDWARD B. LANDRY, P.O. Box 7580, Benjamin Franklin Station, Washington 4, D. C.; HENRY B. DUFFUS, Administrator, Accident Prevention, Westinghouse Electric Corp., 3 Gateway Center, P.O. Box 2278, Pittsburgh 30, Pa.; JOHN F. JULI, Safety Manager, Consolidated Western Steel Div., U. S. Steel Corp., Box 2015, Terminal Annex, Los Angeles 54, Calif.

Standing Committee Chairmen

Committee on Awards & Honors—MELVIN G. BULLOCK, Supervising Engineer, Transit Casualty Co., 901 W. Washington Ave., St. Louis 1, Mo.

Committee on Chapters—OTTO C. HAIR, Safety Director, Standard Oil Co. of Ohio, 1540 Midland Bldg., Cleveland 15, Ohio

Committee on Cooperation with Engineering Colleges—FRANK E. LADERER, Director of Safety, Nationwide Insurance, 246 N. High St., Columbus 16, Ohio

Committee on Cooperation with Engineering Societies—JOHN V. GRIMALDI, Consultant-Safety & Plant Protection, General Electric Co., 570 Lexington Ave., New York 22, N. Y.

Committee on Finance—MICHAEL F. BIANCARDI, Manager, Safety Services Dept., Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wis.

Committee on General Publications—GEORGE F. NUERNBERGER, Safety Dept., Kaiser Steel Corp., Fontana, Calif.

Committee on Membership—EDWIN B. LOCKE, Manager, Engineering Dept., Texas Employers Insurance Assn., P.O. Box 2759, Dallas 21, Tex.

Committee on Public Relations—ROLAND C. BAUER, Safety Supervisor, Koppers Co., 1248 Koppers Bldg., Pittsburgh 19, Pa.

Committee on Research—ROBERT HAGOPIAN, Research Engineer, Acci. Prev. Dept., Association of Casualty & Surety Cos., 60 John St., New York 38, N. Y.

Committee on Safety Laws and Regulations—THOMAS R. LEADBEATER, Supervisor of Safety, Niagara Frontier Div., Bell Aircraft Corp., P.O. Box 1, Buffalo 5, N. Y.

Committee on Safety Standards—CLYDE F. SCHLUETER, Accident Prevention Manager, Employers Mutuals of Wausau, 407 Grant St., Wausau, Wis.

Committee on Technical Publications—HENRY G. LAMB, 10 Wiltshire St., Bronxville, N. Y.

Special Committee on Action Program—J. C. STENNETT, Manager, Accident & Fire Prev. Dept., National Association of Mutual Casualty Cos., 20 N. Wacker Dr., Chicago 6, Ill.

Special Committee on Congress Program—JOHN F. JONES, Safety Supervisor, Commonwealth Edison Co., 72 W. Adams St., Rm. 1933-E, Chicago 90, Ill.

Nestinghouse

Se Pipe

Vought Air-

kin Station,
Prevention,
rgh 30, Pa.;
Steel Corp.

ig Engineer.

Oil Co. of

RER, Direc-
Ohio

ALDI, Con-
Ave., New

rvices Dept.,

safety Dept.,

De, Texas

or, Koppers

Acci. Prev.
38, N. Y.

ER, Super-
c 1, Buffalo

Prevention

Bronxville,

Accident &
N. Wacker

visor, Com-
l.

Special Committee on Junior Achievement—HOMER K. LAMBIE, 7473 Stockton Ave., El Cerrito, Calif.

Special Committee on Long Range Planning—HENRY B. DUFFUS, Administrator, Accident Prevention, Westinghouse Electric Corp., 3 Gateway Center, P.O. Box 2278, Pittsburgh 30, Pa.

Special Committee on Membership Services—E. PETER MARCONI, Manager, Safety Branch, Aro, Inc., Tullahoma, Tenn.

Special Committee on Motor Vehicle Operation—A. E. NEYHART, Admin. Head, Institute of Public Safety, The Pennsylvania State University, General Extension Annex, University Park, Pa.

Special Committee on NSC-Society Relationship—W. P. YANT, Dir. of Research & Development, Mine Safety Appliances Co., John T. Ryan Memorial Laboratory, 100 N. Braddock Ave., Pittsburgh 8, Pa.

Special Committee on Review of the Constitution and By-Laws—WILLIAM N. COX, Jr., Prof. of Safety & Industrial Engr., School of Industrial Engineering, Georgia Institute of Technology, Atlanta, Ga.

Historian—EDWARD B. LANDRY, P.O. Box 7580, Benjamin Franklin Station, Washington 4, D. C.

National Safety Council Representative—DAVID L. ARM, Manager, Industrial Dept., National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Other Volumes in this (1958) Series

Users of this volume will find much value in its companion volumes, which offer the complete record of the 46th National Safety Congress! Here is the list:

Vol. No.	Title	Single Copy	Stock No.
1	General Sessions and Index to all Volumes.....	.65	022.28-1
2	Aeronautical Industries; Air Transport.....	.65	022.28-2
3	Automotive and Machine Shop; Power Press and Forging.....	.65	022.28-3
4	Cement, Quarry and Mineral Aggregates.....	.40	022.28-4
5	Chemical.....	.65	022.28-5
6	Church Activities; Women's Activities; Youth.....	.65	022.28-6
7	Coal Mining.....	.65	022.28-7
8	Commercial Vehicle.....	.65	022.28-8
9	Construction; Public Employee.....	.65	022.28-9
10	Electrical Equipment.....	.40	022.28-10
11	Farm.....	.40	022.28-11
12	Fertilizer.....	.65	022.28-12
13	Food and Beverage; Meat Packing, Tanning and Leather Products; Trades and Services.....	.65	022.28-13
14	Glass and Ceramics; Rubber.....	.65	022.28-14
15	Home.....	.65	022.28-15
16	Industrial Subject Sessions (Sponsored by ASSE).....	.90	022.28-16
17	Labor.....	.65	022.28-17
18	Marine.....	.65	022.28-18
19	Metals.....	.65	022.28-19
20	Mining.....	.65	022.28-20
21	Occupational Health Nursing.....	.65	022.28-21
22	Petroleum.....	.65	022.28-22
23	Printing and Publishing.....	.40	022.28-23
24	Public Utilities.....	.40	022.28-24
25	Pulp and Paper.....	.65	022.28-25
26	Railroad.....	.65	022.28-26
27	School and College.....	.90	022.28-27
28	Traffic.....	.90	022.28-28
29	Transit.....	.65	022.28-29
30	Wood Products; Textile.....	.65	022.28-30
31	Early Morning Sessions (Getting Results Through Team Play).....	.65	022.28-31
COMPLETE SETS (31 Volumes).....		\$10.50	022.18

QUANTITY ORDERS: On purchase of 10 or more copies of individual volumes, those single-copy priced (1 to 9) at 40 cents each are .35 each; 65-cent volumes are .55 each, and 90-cent volumes are .80 each.

All prices shown are subject to a 10 per cent discount to National Safety Council members.

NATIONAL SAFETY COUNCIL • 425 NORTH MICHIGAN AVE. • CHICAGO 11, ILL.

1800045902

PRINTED IN U.S.A.

022.28-16