Current Safety Topics in the

GLASS AND CERAMICS INDUSTRY

As presented in the Sessions of the Glass and Ceramics Section at the 1949 National Safety Congress

Volume 12
Transactions
1949 National Safety Congress

NATIONAL SAFETY COUNCIL
20 North Wacker Drive • Chicago 6, Illinois

What's New...

In safety, as in all other human activities, the question is repeatedly asked, "What's new?"

Many answers to that question are given every year by those who participate in the various sessions of the National Safety Congress. Many new methods, devices, and ideas which later became generally accepted first were presented at a Congress session.

Because of this fact, safety directors throughout the nation have always found the Transactions of the Congress a valuable tool in their accident prevention programs. Publication of the Transactions in small volumes—one for each Section or Division—permits wide distribution of pertinent portions of the Congress material to management and supervisory personnel at small cost.

The 33 volumes of the 1949 Congress Transactions are listed on the last page. Distribution of these volumes to key personnel is suggested as a valuable aid in the safety program.

In preparing these Transactions the proceedings of the Congress have been condensed and edited for reference purposes. Complete original manuscripts, with any charts or illustrations which were used, are available in National Safety Council files. Views expressed at the Congress or in this record are those of the Congress participants, and not necessarily those of the National Safety Council.

THE GLASS AND CERAMICS SECTION

This volume is a record of the sessions held at the 1949 National Safety Congress by the Glass and Ceramics Section. The conduct of these Congress sessions each year is only one of the many cooperative activities which the Glass and Ceramics Section carries on in behalf of its members, and for the benefit of accident prevention work in the glass and ceramics industry generally. The Section gives guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of glass and ceramics plants. The activities of the Section are under the direction of its Executive Committee, the members of which are listed at the close of this volume.

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A Safety Program in a Ceramic Refractories Plant

By R. K. SMITH
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Our plant is a ceramic plant within a glass plant. The pot and clay plant makes refractories in which the 14 other plants of the Corning Glass Works and its affiliates melt glass. Although we are a small plant, we have available the trained expert personnel and excellent technical equipment of the large company program.

It is also noteworthy that our program has no administrative director but is managed by a committee appointed by the director of industrial relations.

The safety program of the Corning Glass Works can be considered to be the three main divisions: educational, medical and technical.

The educational program is designed to produce an alert, safety-minded working force in both management and labor. Management makes continued use of the National Safety Council safety posters posted at several dozen strategic locations throughout the plant and changed at least once a month so that the employee's attention is always being attracted to some new angle of safety.

Subjects of general interest, such as materials handling, fire hazards, etc., are frequently treated with motion pictures presented by the training department and attended by selected interested employees on company time. Space and equipment are available to show sound motion pictures to approximately 100 people at the same time.

The plant magazine, the "Gaffer" is a potent source of morale on the subject of safety. This magazine, issued each month, is eagerly received in the employee's home and the special mention given to promoters of safety gives these people prestige where it is most effective, in their own families. It also serves to inform the family of the working member's hazard and enlists their cooperation in soliciting his careful behavior at work.

Finally, all employees are encouraged to offer improved safety practices through the plant suggestion system, receiving suitable monetary awards for acceptable ideas. This gives top management a valuable contact with the individual employee, who is assured that unsafe practices will receive immediate correction when brought to the attention of the suggestion department.

All of these approaches are backed up by a monthly inspection of each department by an impartial rotating committee, which posts its rating on a prominent scoreboard where all can see the department's status. A written summary of the committee findings is sent to all department heads each month, giving recommendations for improvement. Previous recommendations completed are removed from the list and those incompleted are followed by the number of months since first reporting. The committee also summons department representatives to a meeting where these recommendations are discussed and corrective measures or their lack are explained. Lack of action can have most embarrassing effects.

The medical program is designed to protect both employee and employer throughout the period of employment. The program is handled by a medical doctor, a dentist, a secretary, and five nurses who have an eight room, completely equipped hospital and dispensary at their service. The hospital is open 24 hours per day. A careful pre-employment physical examination prevents many hazards from being hired. It also classifies those that are hired so that they will not be used on work for which they are physically unsuitable. Any employee who has been ill for more than one week must undergo reexamination by the doctor prior to returning to work, and may also be required to return for subsequent examination if he is temporarily limited in his type of work.

The hospital is equipped with X-ray apparatus by which each employee is checked annually, as well as at other times, if any reason for more frequent or special examinations is apparent.

First aid service is available in the hospital at all hours.

Dental service is limited to the examination, cleaning, and extraction of teeth, services which keep one dentist busy full time. Dental X-ray equipment is available and much used.

All of these services are controlled through the departmental foreman. If an employee is injured or for any other reason desires medical attention, his foreman issues him a pass to the hospital stating the reason for the visit. This pass is submitted to the hospital attendant, who registers the time of admission and discharge. Any pertinent recommendations are written on the pass, which is given to the foreman upon the employee's return to work. Use of this pass has greatly reduced lost time for hospital visits.

The technical program is designed to determine the nature of our safety problems and to supply methods and equipment for their solution. If the inspection committee mentioned in the educational program should either observe or be informed of a dusty area, a technician would immediately be dispatched to measure the extent of the hazard by dust counts, equipment for which is available at all times. The technical director would then study the results and recommend suitable equipment to eliminate the hazard. This often involves the design and specification of new equipment for special conditions, examples of which will be given under the pot and clay plant program description.

If the committee should learn of an objectionably hot area (a common complaint in a glass plant), a technician would be sent to measure temperatures and radiant energy. These measurements will indicate whether air movement or heat shielding is the proper treatment of the problem. The technical program also includes a safety storeroom, which supplies and services masks and goggles, sells safety shoes to employees at cost and stores and maintains safety equipment.

The discussion to this point has had reference to a universal program of a broad nature, designed primarily to answer general problems. From here on we shall be concerned with a specific program designed to meet definite plant problems, so let us first enumerate the problems with which we have been faced and which we have found to fall into the following categories:

1. Dust
2. Heat
3. Heavy lifting
4. Moving machinery
5. Acid handling
6. Fire.

We approach the dust problem in several ways, the first of which might be considered an isolation or area separation. Our dust-forming operations are unloading, mixing, and grinding (of both raw materials and product). The areas where these operations are performed are completely closed off from other functions, such as fabrication, firing, office, and laboratory, by hallways with doors that are kept closed at all times. In this way, collection and protection problems are confined to the areas which are inherently dusty to some considerable degree.

Dust prevention in these areas is of two types, dry removal and wet removal. The dry removal is designed to prevent accumulation of dust and is accomplished by means of a heavy duty vacuum cleaner which completely covers all portions of the plant every two days. This confines the problem to the essentially dusty areas instead of accentuating the difficulty by allowing dust to accumulate until every point in the plant is dusty.

Wet removal, where applicable, is probably the most positive of our dust treatments. In dry grinding our products to final shape, enormous quantities of dust are not only formed, but they are imparted a high velocity which multiplies the difficulties of dry collection. Where the grinding surfaces can be covered with water, this water serves as an efficient collecting medium for the dust. While this eliminates any possibility of the escape of dust into the surrounding air, two words of caution seem in order. First, electric shock hazards are greatly increased in the wet areas which result, and we have found it necessary to use compressed air motors even on grounded portable tools. Second, the dust must be allowed to settle out of the water rather completely before the water is allowed to empty into a sewer if serious clogging problems are to be avoided.

Where dust formation cannot be prevented, dust collection is accomplished in one of several ways. A large low velocity dust collector (moving 18,000 cubic feet of air per minute at a velocity of 75 feet per second) is piped through a 27-inch main to the building where the dusty operations of unloading, grinding of raw materials, and mixing are performed. Every point of dust formation in this building is covered by a port from this main. If proper operating procedures are followed, this very effectively prevents escape of dust into the working atmosphere during normal working operations.

In the finished product grinding room, where wet grinding cannot be satisfactorily performed, a high velocity dust collector is used to remove the dry dust. This machine moves 13,000 cubic feet of air per minute through a 20-inch main at a velocity of 100 feet per second. Adjustable ports from this main are placed at strategic locations on dry grinding operations. Air at this velocity will entrain all of the fine dust from the grinding wheels on our lathes and do a fair job on a 30-inch dry face grinder if the exhaust ports are effectively designed.

In temporarily dusty areas, portable small-capacity dust collectors are used.

Where neither prevention nor collection is effective, protection by a mask is essential. The dustiest grinding operations are confined to a special grinding room which is kept under slightly reduced pressure by a fan which moves 3,300 cubic feet of air per minute. In this room the operator is required to wear a protective mask, although the work is performed on a 36-inch square grid through which the above fan exhausts air.

Heat problems are of two types, convection and radiation. Convection, or air temperature, problems are taken care of by central, large volume, "man-cooling" fans whose output is piped through massive ducts to all hot points about the furnaces. These ducts are studded with adjustable pipes which can be arranged to concentrate a considerable flow of air past any nearby point.

Most of our problems, however, are of the radiation type. Setting glass melting pots subjects the men to severe heat, especially on a hot summer day. During a period of as much as half an hour several men must work (in relays, of course) at a distance of only 10 feet from a radiating surface of 20 square feet at a temperature approaching 1,500°C. (2,732°F.). In spite of any flow of cold air over their persons, these men will "burn up" even in mid-winter unless they are protected from the radiation. This protection is furnished by the interposal of a water cooled metal mesh shield between the radiation source and the worker. In addition, the workmen wear gloves, aprons, hats, and heavy clothing.

Just to make sure we don't lack for trouble, we are furnished with an antiquated steam-powered pot-setting machine whose boiler must be kept in condition.

In a plant where articles weighing as much as 1,400 pounds must be lifted and moved by man power unassisted by any mechanical means, lifting is really a problem requiring continual educational and supervisory emphasis. Of course, we have minimized the problem where possible by the use of mechanical devices and handling accessories. Probably the greatest single improvement in this field has been the use of pallets and pallet lift trucks to avoid handling of finished product. All finished product, except special shapes, is loaded on pallets and moved into and out of storage and on to the job without removing from the pallet, a procedure which has not only greatly reduced the working hazards of handling the product, but has also allowed a 60 per cent reduction of personnel.

When pallets cannot be used and large articles must be moved individually, hoists are used when possible. In our grinding room, where large articles must repeatedly be moved and positioned, two overhead traveling cranes, each of two tons capacity, can pick up an article from any point and place it at any other point of 3,000 square feet of floor space. Several hoists are available at other strategic locations throughout the plant to assist in heavy lifting.

Much of the heavy lifting formerly encountered in the unloading of raw materials has been eliminated by the use of a mechanical unloading scoop which is also paying its way through savings of time.

In spite of the use of all possible mechanical aids, very heavy lifting by man power only is required in handling the dry, unfired ware which is too fragile for moving by mechanical means. Kiln loading is done with a husky crew of experienced men whose supervision constantly emphasizes the need of alertness and safe procedures.

All personnel continually are encouraged to purchase and wear safety shoes, because moving heavy articles involves an ever-present hazard to feet.

The monthly inspection of the safety committee is of great assistance in seeing that all moving machinery is kept thoroughly guarded. Stationary machines which do not require continual access are supplied with fixed guards. Stationary machines to which access is essential are supplied with movable shields which are interposed between machine and operator during operation of the machine, but which are removed while setting up the work with the machine idle. Some of the high speed portable machines have no satisfactory guards, so these are operated in the special grinding room, limiting the hazard to the operator who is required to wear suitable protective equipment.

The problem of handling acids is twofold, requiring not only protection from contact with the liquid but also from the fumes.

Contact with the liquid is avoided by use of suitable handling equipment, by wearing protective clothing, and by limiting the handling of acids to carefully trained and supervised technical personnel.

Fumes are removed by ventilating fans of sufficient power to provide rapid removal and replacement of the acid laden air in a room to which only the essential operating personnel are admitted. Since the presence of operating personnel is only intermittently needed in our process, men are required to wear masks as additional protection while exposed to the fumes.

All buildings are separated by openings which can be closed with fireproof doors. The doors are self closing when the fusible link in the chain which holds them open is melted. All buildings are completely provided with automatic sprinklers, and soda-acid type fire extinguishers are readily available at all points.

In addition, we have a plant fire brigade of 17 persons who meet once a month to review the status of fire protection. Regular fire drills are held every three months, with the result that water can be put on a fire at any point in the plant within 17 seconds of an unannounced alarm. The fire brigade suggests improvements in fire protection to management in a written report of the proceedings of their monthly meetings. Copies of this report are sent by their elected secretary to the fire chief for all plants, the safety committee, as well as to top management.

All members of the fire brigade are paid an annual stipend in addition to wages for time spent in fire protective activities.

Our average accident frequency for the last five years has been 11.0 disabling accidents per million man-hours worked. The 1948 frequency for the clay products industry as a whole was 19.53. It is our belief that our risks are far greater than average, adding to the significance of this figure.

Another measure of the results obtained can be found in the dust counts which have been determined to fall in the minimum ranges of 1.7 to 4.3 million particles per cubic foot at various points in the plant with normal operations in process. Dust counts in the same areas with the same operations in progress but without control machinery in operation have been found to range up to 750 million particles per cubic foot. Keeping the count at a low level requires constant supervision to assure operation of processing machinery and control machinery. Any relaxation of vigilance is immediately discernible as a cloud of dust, proving that our problems are still in existence, though usually concealed by careful control.

Perhaps the most important results are to be found in the field where results cannot be measured, the nebulous but important area of intangibles. High morale of the workers is assured when they feel that management has the workers' interests at heart, and I know of no more convincing demonstration of good intentions than concern for the safety of the employees. Appreciation of a clean place to work in a customarily dusty occupation also gives a boost to morale, particularly among the old timers who can remember when an inch of dust was a normal condition. One of the dividends of our morale is the low labor turnover which we enjoy. Our employees all have at least eight years of service with 10 per cent having 25-48 years, and we practically never lose a man except by promotion or lay-off.

It is our experience that most accidents occur in "safe" places, that is, in places where the employee's alertness is lulled into a false sense of security. Our program is designed to keep the personnel watchful at all times by establishing the conviction that safety pays only those willing to invest continual care in their work. Our aim is to keep the organization tuned up to that fine degree of perpetual caution which is essential to safe operation. By careful and continual concentration of our efforts on safe attitudes and procedures, we hope to improve our protection of working personnel and continue to reap the resultant benefits of co-operation, appreciation, and morale, as well as the more tangible benefits of less time lost and lower compensation costs.

Hazard Control for Glass Batch Plants

By FREDERICK S. KRIGER
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The inherent hazards of glass batch plants can be overcome by determining what they are, where they occur, and applying corrective measures.

A glass batch plant is primarily a material handling operation. The materials are to more or less extent toxic, dusty, abrasive, and in a finely divided state. As a result, the operation of handling them presents hazards to the persons who must come in contact with them.

The material handling problem falls into unloading, handling to storage, storing, assembling and weighing, mixing and distribution of the mixed material.

In designing a new batch plant or redesigning an old plant the following suggestions will reduce the hazards. First, design to reduce the number of men involved in the operation to the minimum. This requires a plant where every movement possible is done mechanically. Initial increased capital costs will result but the savings in lower operating rates will justify the cost. The result will be a reduction of the exposure to the employees. Consideration should be given to the following:

1. Whenever possible, purchase raw materials in bulk and take shipments by hopper bottom or tank cars which allow for gravity unloading. Other bulk materials can be unloaded by mechanically operated shovels. If bagged material is necessary, request shipment on pallets. If this is not possible, load in car on pallets and store on pallets. Reduce handling to only loading and unloading pallet.

2. Handle all materials in bulk by conveyors, elevators, pneumatic or other mechanical means, keeping such systems entirely enclosed. Enclosures must be tight but at the same time easily accessible for maintenance and cleaning in case any clogging should occur. Doors, cleanouts, removable panels must be gasketed and should be held in place with cams, quick acting locks or wing nuts. Decrease transfer points to a minimum, as any change in the velocity of the material will cause dust.

Periodic cleaning at frequent intervals of all conveying equipment is a requirement of such a system. Vacuum cleaning has the advantages of not raising dust and being more efficient from the standpoint of the overall cleanliness. All phases of housekeeping must be maintained continuously at a high standard.

In case of packaged materials, store in an orderly way as many units as are possible in a single handling. Watch that allowable floor loadings are not exceeded; that piles do not become too high, and that sufficiently wide aisles are provided for ease in transporting. Spillage from broken containers should be immediately cleaned up at the time the material is stored, preferably by vacuum, and damaged containers should be the first to be used.

When bulk storage is used, gravity flow bins to weighing reduce the amount of mechanical handling equipment to be installed. Tight connections to and from the bins into the conveying system must be maintained and the bins must be vented with such size vents that the air velocity in or out is not excessive. Vents should be provided with dust filters.

Provision should be made so that materials which cake while standing can be recirculated periodically. Thus it becomes unnecessary for employees to enter the bin to loosen or break materials. Entrances to the bin should be large enough to admit easily anyone who has to enter and proper safety ladders should be provided for access from top to bottom.

Materials should be handled, insofar as possible, by completely enclosed chutes or conveyors to the weigh scale which can also be completely enclosed. A slight negative pressure in this enclosure will reduce escape of dust without the loss of valuable material through the exhaust.

Reduce the distance through which the material has a free fall from the point of discharge into the weigh hopper to a minimum to further reduce dusting. Here again, easy access should be provided for cleaning and maintenance. In the enclosure avoid pockets, corners, ledges or surfaces upon which materials can accumulate.

From the weigh hopper to the mixer the circuit through which the material moves should be dust tight at both the weigh hopper and mixer. The mixer itself should operate under a slight negative pressure to reduce the escape of dust.

If the mixed material is to be distributed as a unit batch, the mixer discharge should be in an enclosed room in which the distributing container is set with the man outside during the loading operation. Here again, a slight negative pressure should be maintained. Containers for distributing the mixed material should not be filled to the point where they can drip material while being moved.

If the mixed material is distributed mechanically, the system should be totally enclosed throughout its entire length following the practices set forth previously in handling bulk materials.

Having reduced the number of employees to a minimum through mechanization and at the same time reducing the hazards to the employees, consideration should be given to any remaining hazards. This can be done through the following:

1. Provide proper type of respirators, properly fitted for protection when contact with materials becomes necessary. A system of cleaning respirators should be provided so that the individual can turn in his respirator daily, receiving a clean one at that time. The man should always receive his own respirator back.

2. Goggles of the proper type properly fitted should also be used whenever the need is shown.

3. Safety shoes should be worn by all those exposed to foot hazards.

4. Clothing used in handling mixing materials should be left in the locker room and never worn home. Cleaning of such clothing should be provided weekly. Street clothing should not be allowed to become contaminated with mixing materials and a shower should be required before ringing out at the end of a shift.

5. Proper locker rooms and lunch room should be provided for the employees' use close to, but not exposed to, the mixing materials.

6. Eating of candy bars, sandwiches, etc., should not be allowed on the job. Restrict eating to places provided.

7. Periodic health examinations including chest X-rays and blood and urine tests afford a continual check on how carefully the mixing plant is being operated.

It will be noted that nothing has been said about dust collecting systems. If the above suggestions are followed, it will be found that at the most only a small fan and collector will be required to maintain a slight negative pressure at the points noted.

The capital outlay ordinarily put into dust collecting systems can be better invested in enclosures to make the collection unnecessary, thereby saving the power for operation, the maintenance cost, and the loss of material.

No specific equipment has been mentioned here as details, choice of types of conveying, weighing and mixing machinery must be made to suit individual requirements and taste, but all of them can be safely built, installed or purchased to conform with the principles outlined herein.

An Engineering Educator Cites the Need for Safety Engineering

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At the annual meeting of the American Society for Engineering Education it was reported there that but 28 colleges in the United States teach safety engineering. In the United States, 12 colleges provide a full four or five year undergraduate course in ceramics. From my observations and from my familiarity with the curricula as taught in these ceramic engineering institutions, no safety engineering, as such, is included in these courses.

The combined efforts of the National Safety Council, the American Society of Safety Engineers, the American Society for Engineering Education, and others are making the case of safety well known. Further promotional efforts are needed. It is my prediction that more and more schools will follow the trail blazed by the 28 colleges by insisting that engineers be better qualified to cope with safety problems. All graduating engineers should at least be acquainted with the fundamentals of safety engineering, as well as the rudiments of industrial hygiene. The teaching of safety engineering immediately suggests two different approaches to its fulfillment:

(1) A full-time course in safety engineering. This course would be based upon the fundamentals of mathematics, physics, and chemistry, the same "core" as in other branches of engineering, but the specialization would be in safety and in hygiene.

(2) Safety taught in conjunction with other engineering courses as now given, namely, chemical, electrical, civil, ceramic, metallurgical, etc.

It is to this second consideration that I wish to confine my comments. I wish to propose that safety and industrial hygiene be included in a course that would indoctrinate engineers into these subjects. Included at the same time, an indoctrination into the *ethics* and *practices* of the present-day engineering profession should be taught.

It is impossible for every engineering graduate to be familiar with all there is to know about all branches of engineering. For example: a ceramic engineer cannot devote as much time to structural design as would a civil engineer. The graduate in ceramic engineering, however, should know the fundamentals of the resistance of materials and of structures in order to work intelligently with the civil engineer. The same analogy can be made with the ceramic engineer's grasp of the fundamentals of electricity, of business administration, of industrial engineering, and, now, of safety engineering and industrial hygiene.

The objectives of engineering education, during the past few years, have been largely guided by the Hammond Report,[1] which was made in 1940. H. P. Hammond, Dean of Engineering of the Pennsylvania State College, was chairman of this committee, which was composed of 12 outstanding engineering educators. These objectives are so vital to the present-day engineering outlook and so important when we are considering Safety Engineering that they shall be here repeated.

". . . Two stems are thus implied in the undergraduate curriculum which we have designated as the scientific-technonogical and the humanistic-social. Each of these should be organized in an articulated sequence of subject matter and disciplines designed to lead to definite educational objectives.

"The scientific-technological studies should be directed toward:

1. Mastery of the fundamental scientific principles and a command of basic knowledge underlying the branch of engineering which the student is pursuing. This implies:
   (a) grasp of the meaning of physical and mathematical laws, and knowledge of how they were

[1]H. P. Hammond, "Report of Committee on Aims and Scope of Engineering Curricula," Journal of Engineering Education, 30 (7) 555-66 (1940)

evolved and of the limitations in their use;

(b) knowledge of materials, machines, and structures.

2. Thorough understanding of the engineering method and elementary competence in its application. This requires:

(a) comprehension of the interacting elements in situations which are to be analyzed;

(b) ability to think straight in the application of fundamental principles to new problems;

(c) reasonable skill in making approximations, and in choosing the type of approach in the light of the accuracy required and the time available for solution—in sum, a foundation for engineering judgment;

(d) resourcefulness and originality in devising means to an end;

(e) understanding of the element of cost in engineering and the ability to deal with this factor just as competently as with technological factors.

3. Ability to select the significant results of an engineering study and to present them clearly and concisely by verbal and graphic means.

4. Stimulation of a continuing interest in further professional development.

The humanistic-social studies should be directed toward:

1. Understanding of the evolution of the social organization within which we live and of the influence of science and engineering on its development.

2. Ability to recognize and to make a critical analysis of a problem involving social and economic elements, to arrive at an intelligent opinion about it, and to read with discrimination and purpose toward these ends.

3. Ability to organize thoughts logically and to express them lucidly and convincingly in oral and written English.

4. Acquaintance with some of the great masterpieces of literature and an understanding of their setting in and influence upon civilization.

5. Development of moral, ethical, and social concepts essential to a satisfying personal philosophy, to a career consistent with the public welfare, and to a sound professional attitude.

6. Attainment of an interest and pleasure in these pursuits and thus of an inspiration to continued study.

"There can be no question in our minds regarding the soundness of these scientific-technological objectives. These objectives are mechnical; there is no degree of humanness or warmth to them. A person possessed of these talents alone would be a dreary sort of individual. The objectives of the humanistic-social studies are splendid; in fact, they are almost altruistic, and the spirit of these objectives as they are here printed varies in but one respect from my conception of what these studies should accomplish. Take, for example, No. 4, ". . . acquaintance with some of the great masterpieces of literature". This acquaintance develops the individual, but only indirectly does it affect the "man on the bench" in an organization. It has always been my belief that one of the greatest duties of an engineer is to protect the well-being of those with whom he associates, especially those who are in a subordinate capacity. It is a splendid thing for a person to be well educated and to have a satisfying personal philosophy, but my consideration is that he should not keep it to himself. We must contribute something; we must share with others. This does not necessarily mean financial support. The greatest thing in life, to me, is to be able to help the less fortunate to achieve happiness and to attain those same pleasures which we enjoy.

"Professional engineering is defined according to the Education Law of the State of New York[2]: "A person practices professional engineering, within the meaning an intent of this article, who holds himself out as able to perform, or who does perform any professional serv-

[2]Higher Education, Handbook 36, page 57, Education Law, Article 55, Section 6, The University of the State of New York.

ice, such as consultation, investigation, evaluation, planning design, or responsible supervision of construction or operation, or connection with any public or private utilities, structures, buildings, machines, equipment processes, works or projects *wherein the safeguarding of life, health or property is concerned or involved,* when such professional service requires the application of engineering principles or data."

The most significant part of this definition says, ". . . wherein the *safeguarding* of *life, health,* or *property* is *concerned* or *involved.*" I believe you will agree with me that the engineering colleges very efficiently equip their students to safeguard life and property from structural failure. Too little emphasis is placed upon safeguarding of life and health by any other means than that included in structural design. This definition and our own convictions should be sufficiently authoritative for us to justify the inclusion of safety engineering as a supplementary course in our engineering instruction.

It has been suggested by the A.S.S.E., by Georgia Tech, by Illinois Tech, and others that a one-semester, two-hour course in safety and hygiene would provide a sufficient background for an engineer. It would be my suggestion to make the course a three-hour course for one semester and to include the subjects of ethics and engineering practices.

I would like to enumerate a few thoughts on the objectives of a course in safety and industrial hygiene in the form of attributes which should be possessed by all engineering graduates:

(1) A young engineer, upon graduation, finds himself in a peculiar but interesting situation. In order to get along and to succeed, he must have the wholehearted support of those who work under him or with whom he associates in his business pursuits. At the same time, he must appreciate the objectives of the management and conform to management's demands for sound economic practices. Some engineers fail because they lean too heavily either up or down.

(2) An engineer must have the respect of the men with whom he associates.

(3) An engineer should be able to receive and to delegate authority.

(4) An engineer should have a degree of aloofness.

(5) An engineer should have a knowledge of mechanization. He should know the answers to the question, "What economic effect will be produced when machines replace persons?"

(6) The engineer should be a "father confessor". In order to get wholehearted cooperation, the engineer should have that degree of aloofness, but, at the same time, he should be prepared to advise with some degree of authority upon subjects as drinking, biological disorders, social diseases, wage incentives, Americanization, personal financing, and many other such topics. In other words, the engineer should have all the requisite qualification of a good guidance officer. The guidance should be spontaneous, natural, and given with earnest interest.

(7) An engineer should have an appreciation for history, so that he is aware of what has transpired in the past and so that he can again advise with authority upon subjects which come up and which are believed to be new.

(8) An engineer must realize that individual aptitudes vary widely. He must be acquainted with aptitude testing and with the results which may be obtained from these tests. An adjustment of personnel to positions for which they are qualified would surely assure greater efficiency in plant operation and largely help individuals to secure happiness and contentment in their work, to which they are certainly entitled.

A good safety program is a matter of good selling. The time and effort spent upon safety in an engineering college and in continued study after graduation would be lost unless it was put to use. It can be conceived that safety programs may fail due to the personal characteristics of those promoting the project. An engineer or such person equipped with the human qualifications or attributes listed above could put a safety program across.

It therefore seems to be expedient to include and to emphasize traits of leadership, of personal guidance, and of humanness in any engineering curriculum. A person qualified in these respects would materially aid in the promotion of safety and industrial hygiene work. In other words, it boils down to "the man".

The following presentation is a brief and condensed outline of those topics which I believe would make a well-balanced indoctrination course in safety, industrial hygiene, ethics and engineering practices.

1. The Engineering Profession
   - (a) Objectives of Engineering Education
   - (b) Objectives of Technical Societies
   - (c) Objectives of Engineering Institutes
   - (d) The Value of Membership in Societies
   - (e) Professional Engineering Licensure
2. Codes of Ethics in Engineering
   - (a) In Engineering
   - (b) In the other Professions
   - (c) In Business
   - (d) In the Community
   - (e) In the Country
3. Historical Fundamentals
   - (a) History of Civilization
   - (b) History of American Way of Life
   - (c) History of Labor Incentives
   - (d) History of Aptitude Testing
   - (e) Interpretation of Aptitudes
4. Biological Fundamentals
   - (a) Causes of Human Disorders
   - (b) Mental Hygiene
   - (c) Social Diseases
   - (d) Married Life
   - (e) Socialized Medicine
5. Codes as applied to:—
   - (a) Buildings and Structures
   - (b) Sanitation
   - (c) Electrical
   - (d) Fire Underwriters
6. Labor Laws
   - (a) Federal
   - (b) State
7. Safety

   Selections from:—

   "Industrial Safety Fundamentals; A Suggested Engineering College Course", presented by The American Society of Safety Engineers (Committee on Cooperation with Engineering Colleges)
8. Industrial Hygiene

   Selections from:—

   "Occupational Disease Control in the Ceramic Industry", by Karl L. Dunn, Industrial Hygienist, Corning Glass Works

Summary

In summary, the points which I wish to emphasize are as follows:

1. There is a demand for the teaching, to engineers, of a course in Safety and in Industrial Hygiene.

2. There is room for a three-hour course, as outlined, in our already overcrowded curricula.

3. Engineering Ethics and Practice is the indoctrination medium through which the realization of safety may be accomplished.

4. The safeguarding of the life and the health of our associates is a paramount duty of engineers.

5. The human approach to the teaching of safety is essential.

6. Good teaching by "A Teacher" is required.

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Officers of the

GLASS AND CERAMICS SECTION

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