SIMON FRASER UNIVERSITY

S.81-17

MEMORANDUM

To SENATE

From SENATE COMMITTEE ON UNDERGRADUATE STUDIES

Subject EXTENDED STUDIES DIPLOMA IN OCCUPATIONAL HEALTH SCIENCE

Date DECEMBER 19, 1980

Action undertaken by the Senate Committee on Undergraduate Studies at its meeting of December 9, 1980 gives rise to the following motion:

MOTION: "That Senate approve and recommend approval to the Board of Governors, as set forth in S.81-17, the proposal for an Extended Studies Diploma in Occupational Health Science, including

i) Requirements - 9 core courses (at least 26 credit hours) plus optional courses - a total of at least 30 credits
   1. Core courses
   2. Optional courses

ii) Change in course designation
   OHS. 480-3 - Ergonomics/Human Factors in Working Environments (now KIN. 480-3)

iii) New Courses:
   OHS. 300-3 - Introduction to Occupational Health Science
   OHS. 370-3 - Epidemiology and Biostatistics
   OHS. 481-3 - Principles of Industrial Hygiene
   OHS. 482-2 - Occupational Health Science Laboratory
   OHS. 489-3 - Occupational Safety and Hazard Management
   OHS. 490-3 - Field Practicum in Occupational Health Science."

The proposal includes background information concerning the development of the program which was instigated through encouragement by government agencies and labor to respond to the need for professionals in the field of health and safety in industry. The proposal is seen as a compromise measure pending eventual structuring of a more sophisticated program at the graduate level. Some concern was expressed concerning the limited training which some candidates would have in chemistry and physics; others observed that the proposal represents a compromise based on advice from government and labor and employers who are hiring individuals in these areas with a program designed for mature individuals who should have little difficulty meeting prerequisite requirements.

SIMON FRASER UNIVERSITY

MEMORANDUM

SENATE	From SENATE COMMITTEE ON ACADEMIC PLANNING
Subject OCCUPATIONAL HEALTH SCIENCE PROPOSALS	Date DECEMBER 30, 1980

Action taken by the Senate Committee on Academic Planning at its meeting of December 3, 1980 gave rise to the following motion:

MOTION: "That the following programs be recommended to Senate for its approval:

A. Honours Program in Occupational Health Science

B. Extended Studies Diploma in Occupational Health Science

C. Minor in Occupational Health Science."

For the benefit of members of Senate, the following represents a summary of the major areas discussed by the Senate Committee on Academic Planning in its consideration of these program proposals.

1. In response to an enquiry, it was stated by the Vice-President, Academic that these programs, if approved by Senate and the Board of Governors, will be submitted to the Universities Council of British Columbia for approval and new program funding.

2. The degree of consultation with the other two universities was discussed, particularly in relation to the implications of these proposed programs vis-a-vis the health related programs which they offer.

3. Concern was expressed regarding the adequacy with which the proposed core courses will cover the diversity of topics related to occupational health science. Particular attention was directed to the relationship between the proposed programs in Occupational Health Science and the proposal initiated by the Department of Biological Sciences for a program in Environmental Toxicology.

PROPOSAL

FOR AN EXTENDED STUDIES DIPLOMA PROGRAM

IN

OCCUPATIONAL HEALTH SCIENCE

Prepared by:

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Department of Kinesiology

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November 20, 1980

ABSTRACT

Occupational Health Science is the study of the physical, chemical, and biological factors which affect the health and safety of workers in the workplace. In 1979, work-related disease, injury, and death cost the Canadian economy directly and indirectly over $4 billion. However, despite growing awareness on the part of labour, business, and government of the magnitude of the problem, there remains a serious shortage of trained Canadian professionals equipped to deal with occupational health and safety (OHS) issues. Only two universities in eastern Canada presently offer baccalaureate or advanced degree programs in OHS. Consequently, industries and government, particularly in western Canada, must turn for OHS expertise to the U.S., where there are numerous academic OHS programs.

To address the need for more OHS professionals in Canada generally and western Canada in particular, this proposal advocates the development of three academic programs in Occupational Health Science at S.F.U.: (1) an Extended Studies Diploma (ESD) program, offered within the Kinesiology Dept.; (2) a Kinesiology undergraduate Honors program; and (3) a Kinesiology undergraduate Minor program.

NOTE: This submission deals specifically with the ESD program (for which it was originally written). Separate submissions have been made for the Kinesiology Honors and Minor programs, which will rely on subsets of the core courses specified in this proposal (Appendix 7) plus existing courses presently offered in Kinesiology and in other departments.

Core courses specified for the ESD program include two Environmental Toxicology courses, one existing Kinesiology course (Ergonomics/Human Factors) and 6 new undergraduate courses. The new courses include introductory, epidemiology and biostatistics, industrial hygiene, OHS laboratory, safety and hazard management, and field practicum courses. Except for the two Environmental Toxicology courses, the remaining core courses will be identified as 'OHS' courses in the undergraduate calender. No new graduate courses are requested.

New course proposal forms, references, and resource requirements are in Appendix 7. The remainder of the proposal deals with background, rationale, justification, and supporting material.

The academic programs proposed here represent one leg of a developing tripartite effort at S.F.U. which ultimately should establish the university as a national resource centre in occupational/environmental health. The second leg is the environmental toxicology program, recently approved for Biosciences. The third leg is the Occupational Health Resource Centre, currently operating in Continuing Studies to provide labour education, training, and hazard analysis and information in the area of OHS. It is fortunate and highly appropriate that all three of these efforts are coming to fruition at S.F.U. at about the same time, for they will mutually strengthen and benefit each other.

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Appendices:

I. Introduction

In Canada's modern industrial society, there are countless problems created by the effects of physical and chemical hazards in the workplace on the health of workers in particular and on society in general. Need exists for the development of rigorous academic programs in training professionals to adequately deal with such problems, in terms of recognition and monitoring, evaluation, management, research, and prevention.

Canada's poor record among industrialized nations in protecting the health and safety of workers (4), coupled with the paucity of academic programs in Canada dealing specifically with occupational health and safety (Appendix 1), underscore the intensity and dimensions of this need.

There are a number of compelling reasons why Simon Fraser University ought to mount an academic program in occupational health science (OHS) now. There are also good reasons for offering this program within the Kinesiology Department.

1. The resource-based industries of British Columbia - mining, logging, pulp and paper manufacturing, energy extraction/ generation, woodworking - involve acute occupational health and safety problems which merit closer scrutiny than has been forthcoming heretofore. An academic program would not only produce trained professionals to deal with these problems, it would serve as a catalyst to promote research in problem areas.
2. S.F.U. has many existing facilities, resources, staff, and courses which could be readily combined to form a nucleus of an OHS program, without a major commitment to new courses or new staff.
3. The Department of Biological Sciences is initiating a program in Environmental Toxicology. Since Environmental Toxicology and OHS programs frequently are offered in tandem at many institutions (10) , it seems highly appropriate to

establish an OHS program at this time.

4. Kinesiology has already established a record in OHS, through co-operative arrangements with both industry and labour. In 1978, Crown Zellerbach Corp. and the Department of Kinesiology jointly sponsored a symposium on Human Performance in Business and Industry (1). In both 1979 and 1980, grants have been received ($20,000 grants from the Pulp, Paper and Woodworkers of Canada (PPWC)) to support research on occupational health and safety problems. The relationship with labour is unusual, inasmuch as most academic OHS programs depend heavily or exclusively upon industry for support. These corporate and labour liasons constitute a foundation upon which an academic program could readily be built.
5. In 1979, there appear to only have been two baccalaureate or advanced degree programs in Canada devoted specifically to OHS (Appendix 1), both in eastern Canada. Initiation of a an OHS extended studies diploma at S.F.U. would establish the first academic OHS base in Western Canada.
6. A number of economic sectors in B.C. - government, industry, labour - have a practical interest in OHS. To date, these sectors generally have had to go outside the province to hire trained professionals in the OHS area. An academic program in OHS at S.F.U. would meet an existing need which will almost certainly expand in the future.

These points are treated in more detail in the following sections.

A. Background of OHS Program Development

Efforts at S.F.U. to develop an academic program in OHS were initiated by Dr. Ted Sterling of Computing Science. In a series of internal memos dating from June 29, 1978, he proposed a score and direction for the program, defined the need, and suggested a series of essential courses. Subsequently, the University approved the additional position in Kinesiology, and Dr. Thomas Smith was hired in January 1980 with a major responsibility to develop an OHS program.

A steering committee was formed in February 1980 to oversee OHS program development. Members are T. Calvert, Dean of Interdisciplinary Studies, E. Banister and T. Smith from Kinesiology, T. Sterling, C. Van Netten and P. Oloffs from Biosciences, S. Lower from Chemistry and G. Vizzard, student representative from Communication. On February 25, 1980, the committee approved the idea of an Extended Studies Diploma in OHS.

In March and April 1980 the steering committee held a series of meetings with external S.F.U. advisors, and with OHS professionals from industry, labour, and government, to review and critique the proposed program. Section VI summarizes these meetings and the participants involved.

II. Need for Academic OHS Programs in Canada

The question of need can be reduced to one simple statement: How can Canada ever expect to achieve effective control over national and provincial occupational health and safety problems without producing its own trained OHS professionals equipped to deal with these problems? The points summarized below graphically underscore the pressing nature of the need.

A. Existing Canadian Academic OHS Programs are Insufficient

Appendix 1 summarizes existing academic OHS programs in Canada. Only two institutions, one in Ontario and one in New Brunswick, offer baccalaureate or advanced degree programs specifically identified with OHS. Of these, only the University of Toronto seems to offer a rigorous, full-fledged post-graduate course of study in the OHS area (the University of Moncton program is difficult to assess from the information provided). There are eight Canadian baccalaureate/advanced degree programs in the ergonomics/human factors area (Appendix 1, Part III), but these programs clearly do not cover the full gamut of OHS issues (11). The availability of two OHS programs in two eastern provinces for the entire nation is clearly inadequate.

A suitable basis of comparison, because of geographic contiguity and similarities in the industrial mix, is the United States. Sixty-six baccalaureate and 61 advanced degree programs in OHS are offered in the U.S., with a reasonable geographic distribution (10). To match this academic emphasis on a per capita basis, Canada needs 10-12 more academic OHS programs, not an inconceivable number. The proposed S.F.U./program represents a starting point in the west.

ESD

B. Canada's Occupational Health and Safety Record is Distressing

Appendix 2 summarizes the incidence of fatal accidents in manufacturing and construction in selected countries for the years 1972-76 (4). Incidence rates for Canada during this five-year period were about 4-7 fold higher than those for Great Britain, which used the same reporting method. These data suggest serious shortcomings in the prevention of fatal workplace accidents in Canada.

The dismal Canadian fatality data are supplemented by statistics which indicate that work-related injuries and illnesses cost the nation $4 billion annually (5). Each year, one million Canadian workers are off the job because of work-related accidents or sickness, leading to 12 million lost man-days of work per year. Compensation payments cost Canadian companies 1-15 per cent of their annual payroll.

The availability of more OHS professionals, trained in Canada and sensitive to Canadian needs, might help turn this picture around.

C. Canada Must Establish an Independent Research Capability in OHS

Canada relies almost exclusively on American threshold limit values (TLVs) for setting exposure limits to airborne chemical or dust contaminants. The B.C. Workers' Compensation Board recommended permissable concentrations of airborne chemical and dust contaminants (6) are lifted directly from standards published by the American Conference of Governmental Industrial Hygienists (7), as are the comparable standards for Canadian Public Service employees (8). However, U.S. standards are not necessarily the "best" standards; many U.S. TLV values have been criticized as too high. Furthermore, Canadian OHS problems can differ from those in the U.S. This may be particularly true of the resource-based industries in B.C., because of environmental and operational factors. The point is, if Canada is to achieve effective control of Canadian OHS problems, then a national capability must be developed for independent investigation of such problems as exposure limits for airborne contaminants. Increased emphasis on academic training of OHS professionals is the first step in this direction.

D. OHS is Receiving Increased Emphasis in all Sectors

This conclusion is supported by the following evidence.

1. Occupational health was identified as a priority area by

Federal and Provincial Deputy Ministers of Health in June, 1975. This decision led to a national survey of the current status of Occupational Health (3). Appendix 13 lists the major OHS concerns identified in this report. The closing statement is significant: "These problems must be examined in more detail, for it is now time to decide what should and must be done about occupational health in Canada."

2. A Canadian Centre for Occupational Health and Safety (CCOHS) with headquarters in Hamilton, was organized in 1978. One of its major responsibilities is to serve as a national resource center and clearinghouse for OHS information, data, and statistics.
3. In 1973, there were 2 OHS professionals in the Canadian labour movement; there are now over 20 (9).
4. The following agencies identify occupational/environmental health as a priority area for research funding: (1) NSERC (Environmental Toxicology); (2) B.C. Health Care Research Foundation (Occupational Health); and (3) Science Council of B.C. (environmental problems).
5. A Quality of Working Life Centre (Director, Dr. Hans van Beinum) was established in Ontario in December, 1978, supported by provincial government funding. Alberta is working to develop a province-wide Quality of Working Life program, involving the Alberta Federation of Labour, the Alberta government, and employer representatives (contact Dr. Terry White, Department of Sociology, University of Alberta). An active Quality of Working Life Forum holds regular meetings in Vancouver.
6. The University of Waterloo has established a semi-autonomous Centre for Occupational Health and Safety (Director, Dr. T.W. Fraser) designed to provide service to both management and labour in the general areas of hazard analysis,

OHS problem consultation, and training and education in OHS areas.

III. Justification and Significance.

A. Choice of the Term Occupational Health Science

There is an incredible variety of names which have been affixed to academic programs in the occupational health and safety area: occupational safety and health, industrial hygiene, occupational safety, hazard management, human factors, ergonomics, human factors engineering, health and safety engineering, safety studies, occupational health, occupational hygiene, safety engineering, safety engineering technology, industrial hygiene, etc. This variety reflects the fact that OHS is a relatively new area of technology, and that definitions of the field and professionals working in it are still evolving.

The name Occupational Health Science has been chosen to describe our proposed program, following the guide of the 1977 Health and Welfare Canada publication (3) which deals with the current status of occupational health in Canada. This publication proposes the following definition:

> "Occupational health consists of those occupational or work-related factors potentially affecting worker (and secondarily community) health, the resulting effects on total health status, and the programs for the promotion of health and work adjustment."

By definition, occupational or industrial safety as related to injury or illness is embodied in this concept of occupational health. However, to emphasize that preventive safety measures (i.e. hazard management) also is central to occupational health, the publication uses the scheme illustrated in Figure 2 to illustrate the interrelationships between occupational health, occupational safety, and occupational (industrial) hygiene. Note that the definition of industrial hygiene is more restricted than that of occupational health or occupational safety.

Occupational Health Science, then, encompasses all three sectors illustrated in Figure 2 and refers to the scientific study of the factors, effects and programs related to occupational health and safety. Three specific subdivisions or subdisciplines of occupational health science can be identified: (1) human factors/ergonomics; (2) industrial hygiene; and (3) industrial toxicology. Human factors/ergonomics refers to the study of man-machine interactions (job design, workplace design, machine and tool design, etc.) and embodies the anatomic, physiologic, psychologic, and biomechanical principles affecting the efficient use of human energy. The definition of industrial hygiene is given in Figure 2. Industrial toxicology refers to the study of the adverse effects of industrial chemical, physical, or biologic toxicants (poisons) on workers and their environment.

It is the area of toxicology which binds together Occupational Health Science and Environmental Toxicology and makes current efforts at S.F.U. to establish programs in both areas so appropriate. This link was emphasized in the 1977 federal OHS status report (3), in which the following point about community interrelationships was made:

> "Much as occupational health and safety are integral, they are in turn integral to public (community) health and safety. People, work and the community are merely components of an integrated system. The labour movement learned a long time ago that it was impossible to

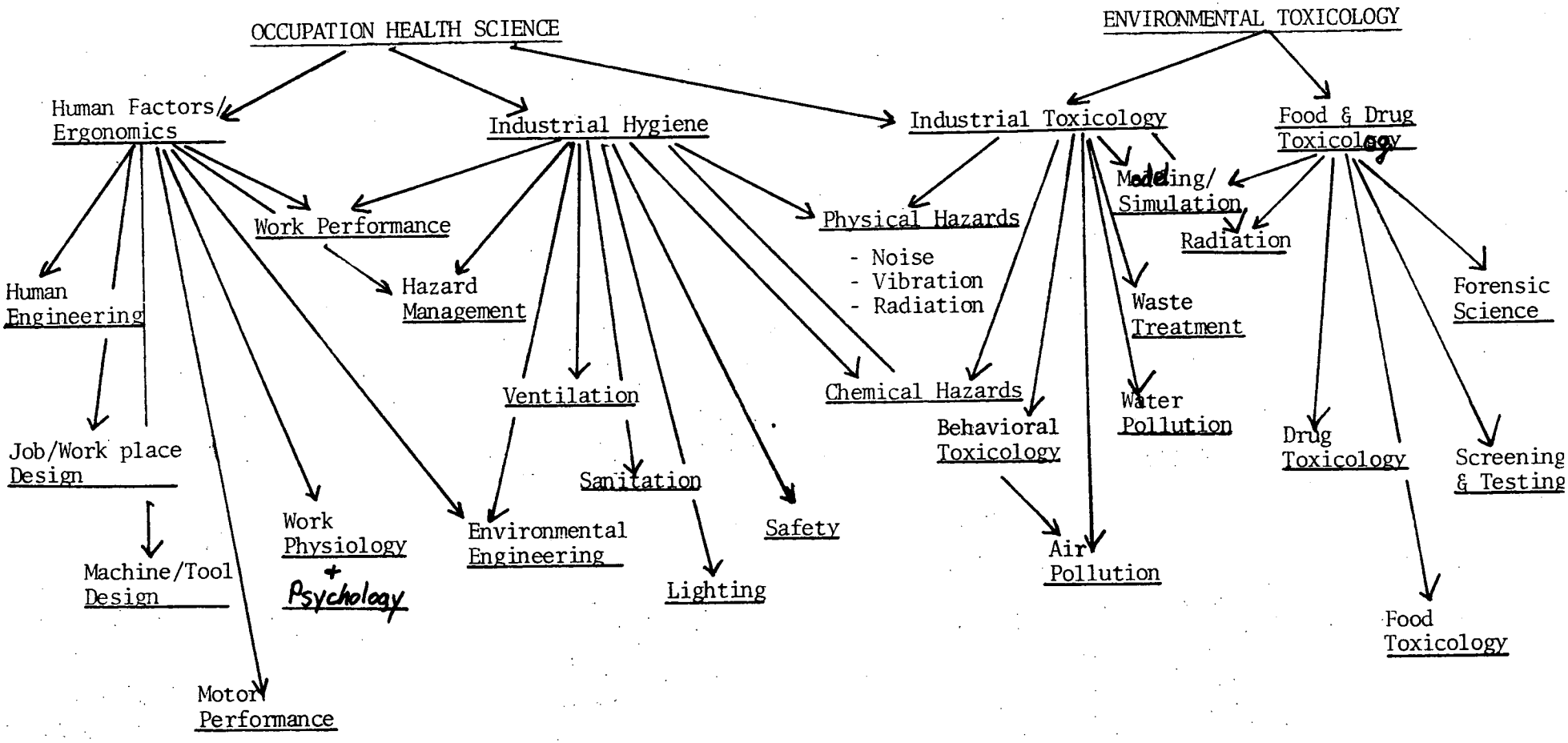
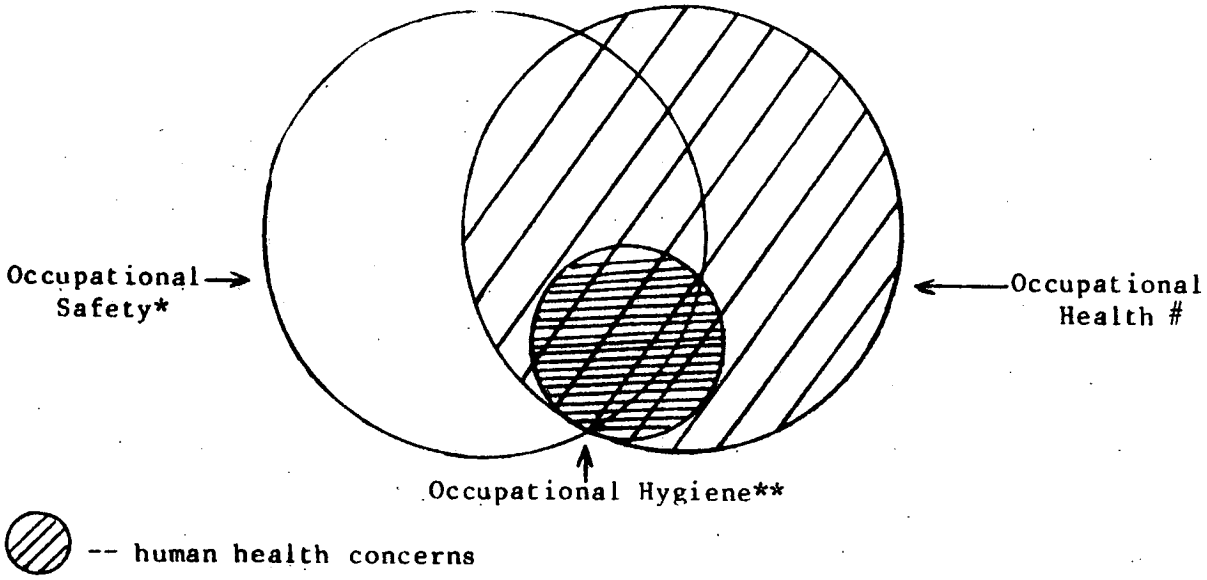


Figure 1. Links between Occupational Health and Environmental Health

FIGURE 2

OCCUPATIONAL HEALTH, SAFETY AND HYGIENE INTERRELATIONSHIPS



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* "Occupational safety" can be described as the "freedom from hazards" and is a matter of relative protection from exposure to such hazards.

** "Occupational hygiene" is a more restricted term used by some for the science devoted to the recognition, evaluation and control of those environmental hazards that may cause sickness, impaired health or significant discomfort to employees or residents of a community.

\# Occupational health consists of those occupational or work-related factors potentially affecting worker (and secondarily community) health, the resulting effects on total health status, and the programs for the promotion of health and work adjustment.

Taken from Occupational Health in Canada - Current Status. Ottawa: Health and Welfare Canada, 1977, p. 4.

> solve any problems which workers face without addressing society's problems. Everything is interconnected with everything else, as ecologists have reminded us in recent years. So it is with workers' health --- occupational hazards cannot be viewed apart from other problems of society."

These interrelationships are summarized in Figure 1, which illustrates the links between occupational health and environmental toxicology and lists some specialty areas in each discipline.

This figure emphasizes the point that occupational health science and environmental toxicology complement one another, and that the parallel development of programs in both areas at S.F.U. will strengthen both disciplines.

In summary, the term occupational health science seems to satisfactorily encompass the diverse speciality areas related to occupational health and safety, it reflects the emphasis of Health and Welfare Canada, and it implies definite links to the environmental toxicology area which also is being developed at S.F.U.

B. Rationale for an Extended Studies Diploma Program

Efforts at S.F.U. to develop an academic program in occupational health science must take into account a number of different, occasionally conflicting, requirements.

- Limited financial and staffing resources at S.F.U. for mounting a new academic program at present time.
- Need to provide adequate, vigorous coverage of the multi-disciplinary topics involved in OHS.
- Need to offer research opportunities in OHS for those who may be interested.
- Need to provide an intense, compressed course of study in OHS for those who may wish to acquire professional expertise in a modest period of time (months).

- Need to provide a course oriented program for those who may not be interested in research.
- Need to meet the needs of workers and trade unionists who may require academic training in specific OHS topics over a short time period (days).
- Need to accommodate those who are moving into OHS as a career change (change in profession) or for the enhancement of professional skills (career development).
- Need to accommodate those with no previous training in OHS.
- Demand for postgraduate training in OHS.
- Demand for pregraduate training in OHS.
- Need to attract enough students on a continuing basis to justify program.
- Reasonable assurance that graduates of the program will be able to secure employment relevant to their training.

Among the academic program options available at S.F.U. (12, 13), an Extended Studies Diploma in OHS was specified for development by a February 25, 1980 resolution of the steering committee. To quote from the undergraduate calendar (12):

> "The Extended Studies Diploma program offers persons who hold an undergraduate degree an opportunity to design and pursue a recognized program of study that is not generally provided by the conventional graduate degree. The program will be of particular interest to those who wish to fulfill or change career goals, to professionals who seek mid-career advancement through upgrading and expanding their knowledge of a particular field, and to those who want to develop their general educational background . . . Programs will consist of third and fourth year courses and possibly some graduate level courses. A graduate thesis is not required. A minimum of 30 credit hours of approved

study (the equivalent of two semesters of full-time study) is required. This may be accomplished on either a part-time or full-time basis."

An extended studies diploma format satisfies many of the requirements listed above. The diploma could be offered within the existing Department of Kinesiology, with 1½ additional faculty (App. 7) required for the new courses specified (Section IV). It would be a concentrated, non-research, post graduate program aimed at those who wish to enhance or extend their professional expertise in OHS. Students who are interested in research would be able to move into an M.S. or Ph.D. program.

The two major groups that an extended studies diploma would not serve are: (1) non-degree holders or pregraduates who may wish to major in OHS; and (2) workers who cannot get away from their jobs for any period but who may desire specific instruction in a particular OHS topic. The need for pregraduate education is addressed in an accompanying proposal for an Honors program in Occupational Health Science, within the Kinesiology Department. The need for labour education in OHS already has been met by the establishment in September of an Occupational Health Resource Centre at S.F.U. (Section V, Appendix 5).

C. ESD Program Objectives

1. To provide a detailed, integrated view of the multidisciplinary fields of occupational health, occupational safety, and industrial hygiene.
2. To provide information and experience regarding detection and evaluation of occupational hazards and their effects, and the laboratory and field equipment used for hazard analysis.

3. To provide information and training in methods of occupational hazard management, in terms of control, minimization, or elimination of hazards.
4. To insure that program graduates achieve a sufficient level of training and technical expertise to qualify as occupational health science professionals.

D. Significance.

The major significance of the proposed Program lies in the fact that it meets an existing need, that it will attract a cadre of students with an expressed commitment to occupational health science, and that program graduates will find ready employment opportunities as OHS professionals. The question of need was addressed in Section II. Projected student interest and employment prospects are summarized below.

1. Student Interest and Enrollment Projections

Information regarding student interest in the proposed ESD program comes from a survey of students in the 80-1 semester Kinesiology 480 class (Human Factors in Working Environments), and from statements made by OHS professionals from industry, labour, and government (Section VI). In the Kinesiology 480 survey, 12 students (11 of them undergraduates) responded to questions concerning their future plans in OHS, with the following results.

	Number of Students (N=12)		
	Yes	No	Maybe
Would Enroll in Postgraduate Program in OHS	3	7	2
Interest in a Career in OHS	0	5	7

Kinesiology 480 was chosen for this survey because it is the present S.F.U. course most directly concerned with OHS issues, which means that attitudes of students in the course should provide some insight into the appeal that the proposed program will have.

In addition to the interest documented in Kinesiology 480, since September I have been also approached informally by 6 students who have indicated a definite interest in enrolling in the program.

These figures should be supplemented by the projections made by OHS professionals from industry, labour, and government with whom the steering committee met during March and April, 1980 (Section VI). The indication from each of the three groups was that there might well be some definite interest in encouraging current or prospective applicants (employees, members, etc.) to enroll in the program for professional training in OHS. The hope generally expressed was that enrollees would retain their affiliation and return to enhance the OHS professionalism of their organization.

From these projections, it seems reasonable to suggest that a first year enrollment of between 10 and 20 students could readily be achieved for the proposed ESD program. Inasmuch as classes offered within the programs will be open to any registered S.F.U. student, a projected total program class enrollment of between 25 and 40 appears to be a reasonable estimate.

For the last three times it was offered, Kinesiology 480 has had an enrollment in this range.

ESD

2. Employment Prospects for/Program Graduates.

Firm predictions are impossible at this point. Canada does not have federal or provincial OHS bureaucracies and regulations on the U.S. scale which would fuel a massive need for OHS professionals. However, steering committee meetings with OHS professionals (Section VI) have revealed a growing emphasis on OHS issues and expertise in industry, labour, and government. The following comments on OHS employment potential in these sectors is based on comments made during the meetings.

Industry. An obvious prospect for program graduates is industrial hygiene. Our meeting with corporate industrial hygienists from the lower mainland suggests however that only the larger companies in B.C. are employing hygienists at present, and that a Ph.D. appears to be a prerequisite. Indeed, it was suggested that graduates of the proposed program would not qualify as full-fledged corporate industrial hygienists according to currently accepted criteria. However, we were told that program graduates would be strong candidates for technical OHS specialty positions under the principal hygienists. It was also pointed out that graduates may be attractive to smaller companies wishing to hire OHS specialists. In summary then, industrial job prospects are uncertain but not improbable. Furthermore, any student in the program would have the option of moving into a Masters or Ph.D. program (i.e. in Kinesiology, with OHS specialization) to obtain more complete credentials as an industrial hygienists.

Labour. The message from the labour meeting was that trade unions and labour organizations might well be interested in hiring OHS professionals. The number of trained OHS personnel working for labour in Canada has increased

since 1973 (9), and it is likely this trend will continue. Labour apparently feels that to deal effectively with OHS issues (i.e. in the workplace, during bargaining sessions, or for purposes of worker education), they must have their own experts to call upon. Thus, despite the fact that the proposed program is not aimed at workers (Section V), it is possible that program graduates may find opportunities in the labour community.

Government. This is probably the most promising source of employment for graduates of the proposed program. During the steering committee meeting with government OHS professionals (Section VI), interest in graduates of the proposed program was expressed by the following governmental departments.

(i) Labour Canada currently operates their own apprentice training program for developing OHS specialists. Employees selected for this program usually have minimal prior OHS experience. It was suggested that the proposed S.F.U. program would co-ordinate well with this apprentice program, and that S.F.U. graduates would most likely be able to move directly into intermediate or advanced stages of training for OHS specialist positions within Labour Canada.

(ii) B.C. Workers' Compensation Board has indicated a contingency need for OHS technical specialists, and has suggested that graduates of the proposed program most likely would be directly qualified for such positions.

(iii) B.C. Labour Ministry also has expressed an interest in possibly hiring graduates of the proposed program. Tangible evidence for this interest is provided by the decision of the Occupational Environment Branch of the Ministry to hire an S.F.U. Kinesiology graduate student during the 1980 summer semester to conduct ergonomics field surveys and to put together a collection of resource material on ergonomics.

Summary of Employment Prospects. From conservatives and meetings with representatives of industry, labour, and government, it appears

likely that the commonly expressed need for greater emphasis on occupational health and safety in B.C. will find concrete expression in terms of employment opportunities within these sectors for trained OHS specialists. There is reason to believe, therefore, that graduates of the proposed program will be able to find jobs appropriate to their training and skills.

IV. ESD Program Organization - Course Offerings

A. Prerequisites

Entry into the Extended Studies Diploma Program requires an undergraduate degree. An adequate background in chemistry (one year), physics or engineering (one year), human physiology (one semester, upper division), mathematics (through calculus), and statistics (one semester) represent basic prerequisites. The student should be able to substitute appropriate work experience for some of these prerequisites. However, each student should have an adequate background to understand such diverse topics as use of instruments, design of experiments, physical and chemical factors affecting the design of the workplace, possible diseases resulting from inadequate workplace design or hazardous exposures, and the analysis of data. A firm foundation of communication skills is also essential.

The prerequisite of some understanding of physiology merits particular emphasis, inasmuch as human physiology is the core discipline for most areas of occupational health and safety, from human factors to industrial hygiene to toxicology.

Students will be strongly encouraged to take physiology if their background in this area is weak.

B. Curriculum [#]

It is proposed that the Extended Studies Diploma in Occupational Health Science be offered as a one year program consisting of 9 core courses (26 credits) which all students must take, plus optional courses to fulfill diploma requirements (at least 30 credits).

The major features of the proposed curriculum are as follows.

(1) The program will be coordinated with the Environmental Toxicology program (Fig. 1). Two Environmental Toxicology courses are specified as core courses in the Occupational Health Science program.

(2) The program advocates 6 new courses to be developed for the core section. Of the new

[#] Proposal forms, course outlines, and resource requirements for the new courses specified are in Appendix 7.

courses proposed, two of them (Principles of Industrial Hygiene and Occupational Health Science Laboratory) represent an expansion of the current Kinesiology 480 course. The Field Practicum will entail student activities and projects in the field and will not involve classroom instruction. The 3 remaining courses are classroom courses: Introduction to Occupational Health Science, Occupational Safety and Hazard Management, and Epidemiology and Biostatistics.

(3) Except for the two Environmental Toxicology courses, all of the core courses specified will be listed as OHS courses in the course catalog.

(4) All new courses proposed are in the core section and are specified as undergraduate courses. No new graduate courses are proposed. No new optional courses are proposed.

PROPOSED CORE COURSES - 26 CREDITS

BISC 311-3	Introduction to Environmental Toxicology
*OHS. 300-3	Introduction to Occupational Health Science
*OHS. 370-3	Epidemiology and Biostatistics
OHS. 480-3	Ergonomics/Human Factors in Working Environments (now Kines. 480)
*OHS. 481-3	Principles of Industrial Hygiene
*OHS. 482-2	Occupational Health Science Laboratory

*OHS. 489-3	Occupational Safety and Hazard Management
*OHS. 490-3	Field Practicum in Occupational Health Science
BISC 650-3	Industrial Toxicology

*New course

PROPOSED OPTIONAL COURSES

Listed below are a series of courses already offered within the University which have some relevance to Occupational Health Science and which the student may choose from, depending on area of interest, to complete the program requirements. It is proposed that the students be allowed to choose 2-3 courses to bring the total credit load for the program up to 31-35 credits (the optional courses listed range from 2 to 5 credits). The optional courses can be divided into four reasonably distinct areas of interest: (i) ergonomics/human factors; (ii) industrial hygiene; (iii) physiology/toxicology; and (iv) socio-economic and legal aspects. Some courses are listed under more than one area.

Ergonomics/Human Factors

Undergraduate

KIN. 367-3	Psychology of Motor Performance & Skill Acquisition
KIN. 401-3	Mechanics of Human Movement
KIN. 405-3	Human Physiology I
KIN. 467-3	The Components of Skilled Performance
BUS. 371-3	Organization Theory
BUS. 373-5	Operations Management

Graduate

KIN. 827-3	Information Processing and Peformance
KIN. 828-3	Seminar on Current Topics in Psychomotor Behavior
KIN. 840-3	Gross Body Mechanics
KIN. 865-3	Neural Control of Movement
KIN. 890-3	Engineering Aspects on Human Function

Industrial Hygiene

Undergraduate

KIN. 401-3	Mechanics of Human Movement
KIN. 405-3	Human Physiology I
CMNS 359-3	Acoustic Dimensions of Communication

Graduate

KIN. 840-3	Gross Body Movement
KIN. 890-3	Engineering Aspects of Human Function
BISC 810-2	Ionizing Radiation in Biology - Part I
CMNS 839-5	Acoustic Dimensions of Communications

Physiology/Toxicology

Undergraduate

KIN. 405-3	Human Physiology I
KIN. 406-3	Human Physiology II
KIN. 407-3	Human Physiology Laboratory

Undergraduate Courses Related to Physiology/Toxicology (continued)

KIN. 401-3	Mechanics of Human Movement
CHEM 371-3	Chemistry of the Environment I
BISC 432-3	Chemical Pesticides and the Environment
GEOG 319-3	Physical Interactions in the Environment

Graduate

KIN. 821-3	Advanced Cardiorespiratory Physiology
KIN. 840-3	Gross Body Mechanics
KIN. 861-3	Control Mechanisms in Human Physiology
KIN. 865-3	Neural Control of Movement
BISC 651-3	Food and Drug Toxicology
BISC 846-3	Pesticide Chemistry and Toxicology
BISC 652-3	Problem Analysis in Environmental Toxicology

Socio-Economic and Legal Aspects

Undergraduate

BUEC 280-3	Introduction to Labor Economics
BUEC 293-3	Law in the Economic Society
BUS. 371-3	Organization Theory
BUS. 373-5	Operations Management
BUEC 386-5	Industrial Relations
BUS. 387-3	Personnel Management
BUS. 488-3	Human Relations in Business
ECON 381-5	Labor Economics

Directed independent study options are also available in the Biosciences (toxicology), Chemistry (radiation), Communication (audiology,

noise), Kinesiology (biomechanics, human performance, fitness, motor learning, physiology), and Women's Studies (Women in the Workplace) departments for students wishing to pursue a specific line of study in more detail.

C. Course Sequence[#]

A logical course progression over three semesters would be as follows.

Semester 1

*OHS. 300-3	Introduction to Occupational Health Science
BISC 311-3	Introduction to Environmental Toxicology
OHS. 480-3	Ergonomics/Human Factors
*OHS. 370-3	Epidemiology and Biostatistics

Semester 2

*OHS. 481-3	Principles of Industrial Hygiene
*OHS. 482-2	Occupational Health Sciences Laboratory
BISC 650-3	Industrial Toxicology
-- (2-5 credits)	Optional Course

Semester 3

*OHS. 489-3	Occupational Safety and Hazard Management
*OHS. 490-3	Field Practicum
-- (2-3 credits)	Optional Course

[#]Proposal forms, course outlines, and resource requirements for the new courses specified are in Appendix 7.

*New Course

D. Scope of Topics Covered in Core Courses

Some concern has been expressed regarding the adequacy with which the proposed core courses will cover the diversity of topics related to occupational health science. Clearly it would be desirable to have separate courses for different major topics (e.g., industrial noise, air contamination and control, industrial disease, radiation, etc.), yet this would demand an S.F.U. commitment to new courses and staff which is simply not feasible at present. I strongly believe that the proposed core curriculum is designed to deal with all of the important topics and issues in occupational health science in a reasonably thorough manner, and I have drawn up the following table to support this claim. It should also be emphasized that students will have the opportunity to concentrate on certain topics through the optional courses listed above, or through the directed independent study option.

In drawing up the proposed series of courses, with the topics specified in Table 1, I was guided by the course / offerings of the 11 Educational Resource Centers (ERC's) in Occupational Safety and Health in the U.S., which are summarized in Appendix 4. The curriculum proposed here covers every one of the eighteen core areas identified by at least one ERC, as can be seen by comparing Table 1 and Appendix 4. I suggest therefore that the program meets accepted criteria for academic content.

Table 1. OHS TOPICS EMPHASIZED IN PROPOSED CORE COURSES

Topic	Intro. to Env. Tox.	Intro. to O.H.S.	Ergo-nomics	Indust. Hyg.	O.H.S. Lab.	Epid. & Bio-stat.	Safety & Hazard Manag.	Indust. Tox.
Industrial Hygiene Principles		x		x			x	
Toxicology Principles	x							x
Occup. Safety Principles		x					x	
Environmental Health Principles	x							x
Biostatistics						x		
Epidemiology						x		
Air Pollution	x			x	x			x
Ergonomics/Human Factors		x	x		x		x	
Work Physiology			x		x			
Materials Handling			x					
Musculoskeletal Problems			x		x			
Job & Workspace Design			x		x			
Machine & Tool Design			x		x			
Work Psychology		x	x					
Socio-economic Factors		x	x					
Legal Aspects-Standards/Compensation		x					x	
Physical Hazards		x		x	x		x	x
Heat/Cold				x	x			
Noise Pollution				x	x			
Vibration				x				
Illumination				x				
Radiation-Ionizing/Nonionizing				x	x			
Industrial Ventilation				x			x	
Noise Control				x			x	
Chemical/Biological Hazards	x	x		x	x	x	x	x
Airborne Contaminants				x	x	x		x
Industrial Disease (Dermatoses, Respiratory, Cardiovascular)		x		x	x	x		
Occupational Cancers		x		x		x		
Behavioral Toxicology				x	x			
Instrumentation-Monitoring					x			
Occupational Safety		x	x	x	x	x	x	
Accident Theory						x	x	
Safety Hazards-Electrical, Fire, Materials, Design			x				x	
Emergency Procedures							x	
Safety Codes/Liability							x	
Safety Inspection					x		x	
Safety Programs							x	
Occupational Stress		x	x	x				
Women in the Workplace		x	x					

E. Course Descriptions of Core Courses

Brief descriptions of all of the core courses are given in this section. Course proposal forms, course outlines, and resource requirements are in Appendix 7.

BIOSCIENCES 311-3

Introduction to Environmental Toxicology

A course intended to give the student a general understanding of environmental toxicology with in-depth treatment of the toxic effects of a few representative examples. An opportunity is given for students with varying backgrounds to up-date their knowledge of basic ecological, physiological and biochemical processes.

Prerequisites: Completion of at least 60 semester hours credit in the biological sciences program, or permission of the department.

*OHS. 300-3

Introduction to Occupational Health Science

This course provides a general introduction to the field of occcupational health and safety. An overview of the major areas of importance will be provided to indicate the multidisciplinary nature of the field and the skills essential for a career in occupational health science.

Topics covered:

- Definition of the Field
- Duties and responsibilities of the OHS Professional
- Principles of Industrial Hygiene
- Principles of Occupational Safety
- Physical Occupational Hazards - Recognition, Evaluation, Control
- Chemical/Biological Occupational Hazards - Recognition, Evaluation, Control
- Methods and Instrumentation
- Human Factors and Ergonomics
- Legal Issues/Workers' Compensation
- Psychological and Social Factors
- Women and Work
- Careers in Occupational Health

OHS. 480-3

Ergonomics/Human Factors in the Working Environment

This course covers the broad area of human factors in working environments. Topics covered include workplace design, principles of human engineering, ergonomics, bioenergetics of work, motor performance in the workplace and psychological aspects of the workspace. (Lecture/ Tuturial)

Prerequisites: KIN 100-3, PHYS 101-3, Math 151-3 or 154-3, and not less than 45 hours.

Introduction to Ergonomics/Human Factors Engineering
Energy Cost and Efficiency of Human Activity
Physical Fatigue and Physical Stress
Biological Rhythm, Shift Work and Work Performance

Musculo/Skeletal Problems and Overexertion
Back Trauma and Injuries
Repetitive Motion Injuries
Materials Handling
Protective Clothing

Human Information Processing and Work
Decision Making and Reaction Time
Attention Demands and Movement Control

Job Design
Workspace Design
Machine and Tool Design
Social Factors
Women and Work

*OHS. 481-3

Principles of Industrial Hygiene

This course deals with the physiological aspects of work and the effects of occupational toxicants and stressors on human physiology and work performance.

Topics covered:

Definition of Industrial Hygiene
Historical Aspects
Physical Hazards - Recognition, Evaluation, Control
Heat and Cold

Industrial Noise and Noise Control
Vibration - Whole Body and Segmental
Illumination
Ionizing and Nonionizing Radiation
Chemical and Biological Hazards - Recognition, Evaluation, Control
Airborne Contaminants
Industrial Ventilation
Occupational Dermatoses
Occupational Respiratory Diseases
Cardiovascular Diseases of Occupational Origin
Behavioral Toxicology
Work and Cancer
Occupational Stress
Requisite Skills in Industrial Hygiene
Careers in Occupational Health

*OHS.482-2

Occupational Health Sciences Laboratory

The purpose of this course is to introduce the student to the technology and measurement techniques which are employed in detecting and assessing occupational or environmental effects on work performance.

Topics covered:

Evaluating Work Performance and Efficiency
Heat/Cold Effects on Work Performance
Pulmonary Function Testing
Noise Measurement and Control
Techniques for Dust and Toxic Gas Measurement
Workspace Design
Radiation Monitoring
Evaluating the Occupational Environment
The Safety Inspection
Ergonomic Aspects of Biomechanics
Effects of Toxicants on Human Behavior

*OHS.370-3

Epidemiology and Biostatistics

Types and procedures of epidemiological investigations, statistical problems in etiological surveys, epidemiological and survey research in environmental and occupational settings.

Prerequisites: Statistics through multiple regression , some knowledge of programming.

*OHS. 490-3

Field Practicum in Occupational Health Science

The purpose of this course is to provide the student with field experience in recognizing, detecting, assessing, and managing or controlling physical or chemical hazards, toxicants or stressors in the workplace which threaten occupational health and safety. It is envisaged that S.F.U. will be able to enlist the co-operation of local industries and/or institutions in providing opportunities for students to interact with hygienists or medical officers in the field on a part-time basis over a semester period. Credit would be earned through evaluation by these individuals and/or field reports by the students.

*OHS. 489-3

Occupational Safety and Hazard Management

This course deals with sources of industrial accidents, the role of ergonomics and human factors in job safety, the identification of workplace hazards, the design and implementation of safety programs, and legal and governmental regulations governing job safety.

Topics covered:

Theories of Accidents
Statistical and Epidemiological Approaches to Hazard Analysis
Ergonomics, Job Design, and Job Safety
Training and Accident Control
The Walk-Around - Recognizing Jab Hazards
Safety Codes and Workers' Compensation
Electrical Hazards
Hazardous Materials Handling
Fire Hazards
First Aid and Emergency Procedures
Product Liability
Hazard Management Programs
  Noise Control
  Ventilation

BIOSCIENCES 650-3

Industrial Toxicology

This course will give a detailed overview and study of the toxic effects of the major contaminants and waste products in the environment due to the industrial activity of the human population.

Prerequisites: BISC 311-3

V. Need for Labour Education and Training in OHS

Bluntly speaking, the proposed Extended Studies Diploma program does not meet the needs of labour for OHS education and training. Many union members do not have a college degree required for entrance into the program. Most who do have a degree would not be willing or able to take a year off from work to get the diploma. Nevertheless, there is an acute need and demand for occupational health and safety education and training among workers in British Columbia. The purpose of including this section as part of the program proposal is to underscore the intensity of the need, to present examples of how labour education is handled by other OHS programs, and to outline how the need currently is being met at S.F.U. I suggest that the credibility, appeal, and strength of the proposed program will be substantially enhanced by the labour education program in OHS already underway at S.F.U.

A. Evidence of Need

There appears to be a burgeoning interest in OHS issues among workers in B.C. At a February 25, 1980 meeting I had with over 40 PPWC safety representatives, repeated emphasis was placed on the need for improved access to OHS information and for better worker education and training in the occupational safety area. The OHS course for workers offered during the 1980 B.C. Federation of Labour meetings in Harrison Hot Springs was oversubscribed, with an enrollment roughly twice that of 1979 (14). During the steering committee meeting with labour (Section VI), one of the strongest messages was that the needs of B.C. workers for education and training in the OHS area are unfulfilled, and that any effort on the part of S.F.U. to meet these needs would be positively received. Safety representatives, shop stewards, OHS committee members, contract negotiators,

and union officers were pinpointed as individuals who would specifically benefit from OHS courses tailored to workers. One of the students at a University of Wisconsin School for Workers conference (April, 1980) on job stress and shift work was a member of IWA Region 1 (B.C.), who paid his own way to Madison because of an interest in the topic and because of the unavailability of a comparable course in B.C.

These various expressions of demand reflect the somewhat limited scope of worker education courses currently available in B.C. Thus, the Workers' Compensation Board and Capilano College both offer OHS courses for workers, yet the following topics are among those called to my attention as being dealt with inadequately or not at all: ergonomics and human factors, job stress, chemical hazards and carcinogens, occupational physiology, radiobiology and radiation hazards, vibration hazards, and industrial disease.

B. Worker Education Programs in OHS at Other Institutions

On-going OHS worker education programs at other institutions serve as models for S.F.U. efforts in this area. Typically, these programs are open to all but are aimed specifically at trade unionists. Typically, the programs are short, lasting from one day to one week, and concentrated, focussing on specific OHS topics such as noise, industrial accidents, ergonomics, etc. In the U.S., programs dealing with OSHA and OSH regulations also are popular. It is common for certificates to be awarded to students successfully completing the program. Programs of which I am aware generally are conducted in a seminar format, with one or more speakers lecturing on various aspects of the chosen topic. Films, field trips, plant walk-arounds, and round-table discussions are variations on the seminar format.

C. Occupational Health Resource Centre at S.F.U.

Within a week after the April meeting with labour OHS professionals concerning this academic proposal (Section VI), two of the guests at the meeting, Larry Stoffman and Susan Kennedy, came forward with a proposal of their own for the establishment of a program at S.F.U. concerned with labour education. The alacrity of their response is noteworthy, since I believe it illustrates the extraordinary interest which the OHS field in general, and S.F.U. efforts in particular, can arouse. Subsequently, Dean Calvert approved the interim appointment of Stoffman and Kennedy to organize and direct an Occupational Health Resource Centre at S.F.U., operating within the Institute for Human Performance and Continuing Studies.

Appendix 5 is a copy of a recent brochure announcing the Centre. The major aims are to provide service to the labour community, in the form of non-credit OHS courses, hazard surveys, and OHS information. The Centre has been averaging about one session per week since it started.

This success makes the argument for the academic program, embodied in this proposal, even more compelling. The academic and labour education programs together represent a base which will enable S.F.U. to build a solid reputation of both basic and applied involvement in occupational health science.

VI. Program Review and Critique

A series of steering committee meetings have been held since March 1980, with various individual and groups of OHS professionals, to review and critique the proposed program. The group's meetings were with S.F.U. advisors and with industrial, labour and governmental representatives active in the OHS field. We felt that these meetings were essential for establishing contact with professionals directly concerned with OHS, for eliciting objective, rigorous suggestions regarding strengths and weaknesses of the proposed program, and for exploring possibilities for future co-operation between S.F.U. and other individuals or agencies, as regards OHS research, education, and training. A preliminary proposal for this program was distributed to all of the guests at these meetings.

The schedule of meetings held is in Table 1. The individual guests at the group meetings with industrial, labour, and governmental OHS

professionals, and with the external S.F.U. advisors, are listed in Table 2. Dean Calvert also asked Dr. Gordon Atherley, President of the Canadian Centre for Occupational Health and Safety, to comment on our intentions to initiate an OHS program. A copy of his letter of reply is in Appendix 6, along with a letter from Dr. Lockhart commenting on the program.

The major points raised during these meetings have been cited in preceding sections, and I will not discuss the detailed minutes. In a number of respects (e.g. course content and emphasis, attention to worker education), the program and this proposal have been revised to reflect the views expressed. I believe the record indicates that we have been successful in subjecting the proposed program to rigorous, thorough, objective analysis and scrutiny by leading OHS professionals from B.C. and elsewhere. Considering the integral ties between OHS issues and society itself, we felt that external review was essential for the program to have real credibility and meaning. The meetings held are in line with that objective and have materially strengthened the program.

Table 1. Schedule of Meetings Held to Review Proposed Program

Date (1980)	Meeting
March 24	Industrial Hygienists Group*
April 8	Mr. Robert Sass, Director, Occupational Health & Safety Division, Department of Labour, Province of Saskatchewan
April 10	External S.F.U. Advisors Group*
April 18	Labour Group*
April 21	Government Group*
April 28	Dr. George Hagglund, Director, University of Wisconsin Extension School for Workers, University of Wisconsin - Madison

* See Table 2 for list of guests.

Table 2. Guests at Group Meetings Held to Review Proposed Program

Meeting	Guests
Industrial Hygienists	Dr. David Appleton Corporate Industrial Hygienist MacMillan Bloedel Ltd. Dr. Kelly Gibney Industrial Hygienist Industrial Safety Office B.C. Hydro Mr. Dwight Guy Personnel Gulf Oil of B.C. Dr. Robert Lockhart Industrial Hygienist Industrial Safety Office B.C. Hydro
Esternal S.F.U. Advisors	Mr. Clive Lytle Continuing Studies Labour Education Program Dr. Mary Lynn McDougall Women's Studies Dr. Barry Truax Communication
Labour OHS Professionals	Mr. Keith Graham Director of Occupational Health and Safety B.C. Federation of Labour Ms. Susan Kennedy Western Occupational Health Resources

Table 2 (cont'd)

	Ms. Verna Ledger Director of Occupational Health and Safety IWA, Region 1
	Mr. Angus McPhee President, PPWC
	Mr. Craig Paterson Attorney - Specialist in OHS Law Sun, Paterson & Brail
	Mr. Paul Petrie Compensation Advisory Services B.C. Ministry of Labour
	Mr. Larry Stoffman Western Occupational Health Resources
	Ms. Kathy Walker Director of Occupational Health and Safety CAIMAW
	Mr. Norton W. Youngs Health & Safety Officer Telecommunications Workers Union
Government OHS Professionals	Mr. Colin Aykroyd Research & Planning Branch B.C. Ministry of Labour
	Mr. David Bell Occupational Environment Branch B.C. Ministry of Labour
	Mr. Douglas Cameron Assistant Deputy Minister of Labour B.C. Ministry of Labour Provincial Representative - CCOHS
	Mr. Patrick Crawshaw Regional Director Health Services & Promotion Branch Health & Welfare Canada

Dr. Craig L.T. Galbraith
Assistant Director
Division of Occupational Health
B.C. Ministry of Health

Dr. James H. Lindsay
Director, South Unit
City of Vancouver Department of Health

Dr. Roy Makepeace
Medical Director
B.C. Hydro

Mr. Joe Sullivan
Labour Canada

Dr. William S. Whitehead
Assistant Director - Medical Services
B.C. Workers' Compensation Board

Dr. Val Wuorinen
Education Manager
Research & Education Department
Prevention Services
B.C. Workers' Compensation Board

VI. References

1. Banister, E. (Ed.), Human Performance in Business and Industry. Burnaby, B.C.: Simon Fraser University Press, 1978

2. Dimich, H. and Sterling, T., Report on the pulmonary function study of chemical workers, 1979. S.F.U. Computing Science Department, February 22, 1980.

3. Occupational Health in Canada - Current Status, Ottawa: Health and Welfare Canada, 1977.

4. "Fatal accidents in manufacturing and construction industry", Canadian Health and Safety News, September 3, 1979.

5. "Worker injuries cost $4 billion", The Province Newspaper (Vancouver), January 29, 1980, p. E16.

6. Industrial Health and Safety Regulations, Vancouver: Workers' Compensation of British Columbia, October 1, 1979, Appendix A.

7. Threshold Limit Values for Airborne Contaminants, Washington, D.C.: American Conference of Governmental Industrial Hygienists, 1976.

8. Handbook of Occupational Health and Safety, Hull, Quebec: Supply and Services Canada, 1978, p. 39.

9. Robert Sass (Director of Occupational Health and Safety, Ministry of Labour, Province of Saskatchewan) personal communication, May 5 , 1980.

10. Weis, W.J. III, Purcell, T.C., Street, M.H., and Kendrick, P.H. Directory of Academic Programs in Occupational Safety and Health. Cincinnati, Ohio: U.S. DHEW, PHS, Centre for Disease Control, NIOSH Division of Training and Manpower Development, 1979.

11. Pearson, R.G. (Ed.). International Directory of Educational Programs in Ergonomics/Human Factors. Santa Monica, California: International Ergonomics Association/Human Factors Society (U.S.A.) 1979.

12. Simon Fraser University Calendar, 1979-80. Burnaby: Simon Fraser University, 1979.

13. Simon Fraser University Graduate Studies Calendar, 1979-80. Burnaby: Simon Fraser University, 1979.

14. Graham, K., Director of Occupational Health and Safety, B.C. Federation of Labour (CLC), personal communication.

APPENDIX 1

CANADIAN ACADEMIC PROGRAMS IN OCCUPATIONAL HEALTH/OCCUPATIONAL SAFETY/INDUSTRIAL HYGIENE, 1979/1980

I. Certificate or Diploma Programs

1. British Columbia Institute of Technology; Vancouver, B.C.
   OHS Technology - 2 Year Certificate (Proposed).

2. Ryerson Polytechnic; Toronto Ontario
   OHS - 1 Year Course (night) for Health Inspectors - sponsored by Environmental Health Department.

3. Humber College; Rexdale, Ontario
   OHS Engineering, 6 semesters (3 years), diploma not specified.

4. Various community colleges in Ontario offer Extension Department courses for trade unions.

5. McMaster University; Hamilton, Ontario
   Occupational Health and Safety Diploma (3 months, 1 course).

6. University of Toronto (see II-3 below).

II. Baccalaureate and Advanced Degree Programs - OHS

1. University of Moncton; Moncton, New Brunswick
   Industrial Hygiene option in Industrial Engineering Program, M.S. (15 course credits and 33 thesis credits).

2. University of Toronto: Toronto, Ontario
   Occupational and Environmental Health, Master of Health Science (15-22 months), M.S., Ph.D.
   Diploma in Industrial Health (9 months)

III. Baccalaureate and Advanced Degree Programs - Human Factors/Ergonomics #

1. Simon Fraser University; Burnaby, B.C.
   Kinesiology - Bioengineering/Kinetics, B.Sc., M.Sc., Ph.D.

2. University of Calgary; Calgary, Alberta
   Psychology - Human Factors, M.S.

3. University of Guelph; Guelph, Ontario
   Ergonomics Unit, School of Human Biology - Human Kinetics, B.Sc., M.Sc.

4. University of Moncton; Moncton, New Brunswick
   Industrial Engineering - Human Factors/Biomechanics, M.Sc.

5. University of Regina; Regina, Saskatchewan
   Industrial Systems Engineering, B.Sc., M.Sc.

6. University of Toronto; Toronto, Ontario
   Industrial Engineering - Human Factors, M.Sc., Ph.D.

7. University of Waterloo; Waterloo, Ontario
   Kinesiology - Biomechanics, B.Sc., M.Sc., Ph.D.
   Systems Design Engineering - Human Systems, B.Sc., M.Sc., Ph.D.

8. University of Windsor; Windsor, Ontario
   Industrial Engineering, M.Sc., Ph.D.

#Reference: Pearson, R.G. (Ed.). International Directory of Educational Programs in Ergonomics/Human Factors. Santa Monica, California: International Ergonomics Association/Human Factors Society (U.S.A.), 1979.

Fatal accidents

Incidence of rates of fatal accidents in manufacturing industry for selected countries, 1972-76.

Country	*Code**	1972	1973	1974	1975	1976
Great Britain	I/c	4	4	5	4	3
France	II/c	12	10	10	..	..
Federal Republic of Germany	II/a	18	17	16	16	..
Irish Republic	I/b	7	10	8	9	5
Italy	II/a	8	8	8	..	..
Netherlands	I/a	4	4	4	4	..
Sweden	II/d	4	3	3	..	..
Canada	I/c	14	15	21	15	10
United States of America	I/d	4	3	3	3	..
Japan	I/d	3	3	2	2	1

*See Note 1.
Including mining and quarrying.
Provisional.
Based on sample surveys.
Establishments employing 100 or more workers.
Sources:
Health and Safety Executive
International Labour Office

Incidence rates of fatal accidents in the construction industry for selected countries, 1972-76.

Country	*Code**	1972	1973	1974	1975	1976
Great Britain	I/c	19	22	16	18	15
France	II/c	47	45	46	..	..
Federal Republic of Germany	II/a	39	37	33	35	..
Irish Republic	I/b	14	15	15	8	9
Italy	II/a	55	51	62	..	..
Netherlands	I/a	13	12	8	10	..
Sweden	II/d	8	6	8	..	..
Canada	I/c	90	96	121	96	75
United States of America	I/d	23	13	16	16	..
Japan	I/d	19	21	16	13	6

*See Note 1.
Based on sample surveys.
Establishments employing 100 or more workers.
Provisional.
Sources:
Health and Safety Executive
International Labour Office

Note 1 The codes given in the first column of each table, referring to the basis on which the accident incidence or frequency rates were calculated, are defined as follows:

Method of notification
I Reported accidents
II Compensated accidents

Exposure to risk
(a) Rates per 100,000 man-years of 300 days each
(b) Rates per 100,000 wage earners (average numbers)
(c) Rates per 100,000 persons employed (average numbers)
(d) Rates per 100 million man-hours worked.

Even though we have to be aware of the asterisks, etc., the figures have a certain cumulative effect: Canada is not doing very well at all. Furthermore, they seem to confirm our own national statistics.

In manufacturing, we use the same code as Britain. Our numbers are consistently higher, as much as five times as high. The comparison with Britain reflects even worse on us in construction, in which we also use the same code. In fact, the construction figures are downright frightening.

So, too, is the toll in mining. We use the same code as the Irish Republic. Look at the figures: 182 fatalities per 100,000 wage earners in 1972; 65 in the same year for the Irish. In 1976 it was 172 to 65. Neither country has improved much but Canada's situation is obviously more urgent.

These tables appear to reflect serious shortcomings in the prevention of fatal workplace accidents in Canada. We don't seem to be able to match countries that have at least as much, and in many cases more, productive capacity than we have.

Canadian Occupational Health & Safety News, Sept. 3, 1979.

APPENDIX 3

FEDERAL REPORT ON OCCUPATIONAL HEALTH IN CANADA, 1977. MAJOR CONCERNS.

1. FACING A NEW CHALLENGE

Occupational health was identified as a priority area by Federal and Provincial Deputy Ministers of Health in June 1975. As a major area of health promotion and preventive action, increased effort was required on a national basis.

The first step was a thorough study of occupational health in Canada. A year-long effort was directed to this, resulting in a comprehensive synthesis of information that forms the background document to this brief report.*

As with many technically advanced and complexly administered areas, the field of occupational health is continually changing. Concepts are evolving, priorities are being re-evaluated and revised, new or improved legislation and regulations are being rendered.

This document identifies a number of major concerns that need immediate investigation and evaluation if the well-being of all working Canadians and the public at large are to be improved.

1.1 Concerns

The initial study into occupational health in Canada revealed a number of major concerns that must be discussed and resolved. Let's look at some of the basic findings.

- Although the quality of working life has improved considerably during the last century the results are varied and uneven. Furthermore, the workplace has become more complex and new hazards have arisen. Each year at least 200 new health problems arise,[1] all unknown the year before, and most of these are associated, unwittingly and unwillingly, with the work environment.

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* Occupational Health in Canada - A Descriptive View. Department of National Health and Welfare, 1977. (publication pending)

- Canada lacks a national policy and co-ordinated program on occupational health and there is no Canadian focal point for information collection and exchange.

- Few professional, industry, government, or other organizations exist at a national level to promote co-ordination.

- Occupational health programs and workers' compensation systems vary among the provinces and a substantial variation in occupational health standards exists leading to inequalities, unevenness and inconsistencies.

- Development of worksite health and safety programs and services is highly variable and tends to be concentrated in areas where there are greater numbers of employees (Ontario, Quebec and, to a lesser extent, British Columbia) or in large corporations (more than 500 employees).

- Occupational health data (hazards, effects, health status) are not monitored comprehensively on national or provincial levels. The magnitude of occupational health problems can only be estimated based upon available data and is believed much higher than previously indicated.

- Traditionally, occupational health research and programs have focussed on acute accidents and injuries (immediate problems) rather than on the more insidious work-related illnesses and diseases (chronic problems).

- The array of legislation and regulations and agencies involved is complex, and compounds the difficulties of co-ordination, co-operation and employer compliance.

- The requirements (present and future) for occupational health workers, both professional and technical, are not known; at present only public health inspectors and safety professionals have specialty certification procedures.

- Until recently, employees have taken only modest responsibility for occupational health, whether on an individual, union, or joint labour-management level.

<u>These problems must be examined in more detail, for it now is time to decide what should and must be done about occupational health in Canada.</u>

APPENDIX 4

Courses Offered by Eleven Educational Resource Centers in Occupational Safety and Health in the U.S. - 1979

Course	Number of ERCs Offering Course	Number of ERCs Identifying It as Core Course
Air Pollution	6	3
Biostatistics	11	7
Chemistry - Environmental/Industrial Hygiene	4	2
Ecology - Human	1	1
Epidemiology	10	5
Ergonomics/Human Factors	3	1
Carcinogens	1	1
Hygiene/Health - Environmental	5	3
Hygiene/Health - Industrial	7	4
Hygiene/Health - Occupational	7	5
Hygiene Laboratory	3	2
Monitoring, Instrumentation, Measurement	7	4
Noise	5	2
Occupational Diseases/Medical	4	1
Physiology - Human	6	3
Safety - Industrial	4	1
Toxicology - Environmental/Occupational	10	7
Ventilation - Industrial	8	1
Aerosol Science	2	0
Air & Gas Cleaning	1	0
Analytical Chemistry	1	0
Computer Applications	1	0
Criteria & Standards - Environmental	1	0
Environmental & Work Physiology	1	0
Law - Environmental	1	0
Management - Environmental/Occupational Health	2	0
Meterology of Air Pollution	2	0
Physics - Medical	1	0
Policy - Occupational Health	1	0
Psychology/Behavior - Occupational	2	0
Radiation/Radiological Hazards	7	0
Social Implications	2	0

APPENDIX 5

OCCUPATIONAL HEALTH RESOURCE CENTRE

An Occupational Health Resource Centre has been established at Simon Fraser University.

The centre is committed to developing programmes and activities according to **your requests and needs** in occupational health and safety.

Upon the request, and with the cooperation of your union and the workers involved, we will be undertaking the following activities:

- ★ HEALTH HAZARD ANALYSES
- ★ IDENTIFICATION OF TOXIC SUBSTANCES AND SUGGESTIONS FOR THEIR CONTROL
- ★ UNION/WORKER CONTROLLED WORKPLACE MONITORING
- ★ A HEALTH & SAFETY INFORMATION SERVICE
- ★ PUBLIC SEMINARS, SYMPOSIUMS AND WORKSHOPS

YOU HAVE THE RIGHT TO BE INFORMED ABOUT ALL THE JOB HAZARDS YOU FACE!

For more information
or to be on our mailing
list contact:

OCCUPATIONAL HEALTH RESOURCE CENTRE
Institute of Human Performance
Simon Fraser University
Burnaby, B.C.
Telephone: 291-4589 or 879-8587
(Days or Evenings)

APPENDIX 6

COMMENTS ON PROPOSED PROGRAM BY

DR. GORDON ATHERLEY AND DR. ROBERT LOCKHART

Canadian Centre for Occupational Health and Safety

Centre canadien d'hygiène et de sécurité au travail

Office of the President

Cabinet du Président

435-150 Main,
Hamilton, Ontario
L8P 1H8
(416) 523-2981

1980 04 11
File Ref# P80-359

Thomas W Calvert Dean
Simon Fraser University
Faculty of Interdisciplinary
Studies
Burnaby B C
V5A 1S6

Dear Dean Calvert

Thank you for your letter about your plans for a post-bachelor's degree in occupational health.

I have a very strong interest in academic development of this kind, having been chairman of the Department of Safety and Hygiene at the University of Aston in Birmingham, U.K. For a short time, I was also a Professor of Occupational Medicine at the University of Toronto.

At the University of Aston, we developed programmes at all levels: PhD, Masters, Diploma, Certificate, and Undergraduate.

There was ample demand at all these levels domestically, and worldwide. Our programmes attracted students from countries as diverse as the U.S. and the U.S.S.R. My view, therefore, is that there is abundant scope for good programmes at all levels -- provided that the catchment is sufficiently wide. I feel sure that in order to maintain adequate student numbers, any programme would have to look beyond the needs of a single province. There is a tendency, an understandable tendency, to develop occupational health and safety programmes by the method of spatchcock. That is to say, programmes are built up by the interpolation of new fragments within existing frameworks. The method has obvious attraction, especially in these economy-minded times. But that method has been responsible, I believe, for some of the failures to thrive, on the part of occupational health and safety programmes, observable in certain Canadian universities.

My view is that academic responsibility and some resources should be given to an interested and well-qualified individual who can demonstrate knowledge and understanding of the field. That individual should be able to exploit the opportunities which currently exist, and be able to build up a successful academic enterprise.

Your question:
(1) What is the need for professionals in this area?

"Professionals" is a dirty word just now. Organized labour and, increasingly, employers doubt the usefulness of the current generation of professionals inthis field. On the other hand, there is an almost desperate shortage of competent and well-trained people capable of functioning in challenging, complex, diverse areas of expertise. My feelings are that academic development would be well advised to aim to produce graduates soundly educated in defined areas, but without too close an identification with any of the current professional orientations. At Aston, we deliberately concentrated on the educational development, and viewed with some skepticism the advice of the professionals. On this approach, the department in terms of student numbers at least, became the biggest in Europe and, I understand, continues in that position.

(2) What level of qualification is appropriate?

In my opinion, all levels are appropriate -- much depends on the expertise available in academic development.

Most academic developments begin at the post-bachelor's level. I suspect that this level is determined more by resource questions in universities, than by careful appraisals of society's needs. There seems to be a general, and I believe wrong, assumption that graduate-level studies require fewer resources than bachelor's-level studies. I don't agree with this assumption, and I consider that it has led to some very poor academic development, because I believe, faculty has failed to recognize the level of complexity to which occupational health and safety has now developed. Some people view the subject as a mixture of applied common sense and existing knowledge; this is not an adequate model, a criticism readily appreciated by intelligent graduate students.

In the medical and engineering areas, there is much to be said for the development of an undergraduate half-course aimed at preparing all physicians and all engineers with a modicum of relevant occupational health and safety expertise. For the faculty responsible for developing the half course, the introduction to occupational health and safety would be an excellent preparation for the more severe graduate work.

(3) What should be the areas of concentration for such a programme?

I believe that the answers to that question can be determined by means of established procedures of educational technology. We can begin by asking ourselves what the competent graduate/post-graduate/diplomate/post-doctoral student should be able to know/do/understand/research. Certainly, the professional organizations would provide some answers to these questions, but my experience is that their answers reflect their own perceptions of their own jobs, and not necessarily the perceptions of management and labour with whom they will in many instances have to work.

I do not favour the "catalogue" approach to curriculum development. You mention epidemiology, for example. At first sight, epidemiology appears highly relevant and, therefore, there would be a tendency to give weight to that subject on any curriculum. Closer scrutiny of epidemiology, however, shows that much of it is not in fact relevant to occupational health and safety, having been developed to deal with problems fundamentally different from those affecting the worker community. Further scrutiny also shows that certain of the key epidemiologic techniques are, in fact, misapplied in occupational health and safety. Therefore, I personally am cautious about the over-reliance on epidemiology seen in many curricula. Instead, I should prefer to see the curriculum developed from questions such as: what are the methods of measurement applicable in occupational health, and what does the graduate/post-graduate need to know about these, and which of these should s/he be able to apply, and with what level of skill?

The educational developments in the U.S. are difficult to evaluate. I have seen evidence of several unsuccessful attempts at transplants of U.S.-developed educational ideas into non-U.S. educational/social environment. My own feeling is that the academic development of occupational health and safety in Canada should be the subject of independent thinking, as implied in your letter.

Finally, you may find it useful to exchange ideas with my successor at Aston; he is Dr. Richard T. Booth, Professor and Head, Department of Safety and Hygiene, University of Aston in Birmingham, Birmingham B4 7ET, England.

Yours sincerely

Gordon Atherley

Gordon Atherley
President

54

GA:pm

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY
SAFETY ENGINEERING DEPARTMENT

6952 Merritt Avenue
Burnaby, B.C., Canada
V5J 4R6
(604) 438-6481

Dr. T.J. Smith
Coordinator, Occupational Health
Services Program
Dept. of Kinesiology
Simon Fraser University
Burnaby, B.C.
V5A 1S6

1 May 1980
File: 132.47
RWL-46-80

Dear Dr. Smith:

The training of an Industrial Hygienist as well as every other professional or administrative member of industry should include as a minimum an introduction to some basic "relating" skills that deal with psychology and the human element. I appreciate this opportunity to expound on some of my thoughts in this area that were raised in our earlier meeting. I am also using this opportunity to further the idea of a basic course designed to tie together some less technical concepts of industrial hygiene of which every Hygienist must be aware. I view this as a required course presented in the 1st year of your Diploma Program.

The format should be designed to open the following factors to discussion:

a) Industrial Hygiene: recognition, evaluation and control; the most important of which is control. Definition of industrial hygiene and occupational health.

b) Aspects of industrial hygiene: chemical, biological, and physical energy hazards, and ergonomic considerations. The relevance of each of these categories within industry in Western Canada must be covered, remembering the intensity of the Hygienist's effort in any one area will depend on the challenges of each specific industry.

c) Historical aspects of industrial hygiene:
- milestones (European and American)
- institutionalization
- current status (Canada vs U.S.A.)
  - .legal aspects
  - .Industries response
  - .Labours response
- future projections

d) Careers in Occupational health: Physician, Industrial Hygienist, Engineer, Safety Professional, Inspector and Technologist, and the role of each in the recognition, evaluation, and control of health hazards.

e) Skills required by an Industrial Hygienist: Technical competence is obvious, however, alone it is not enough since, to be successful in industry, an Industrial Hygienist must work with and through other people. This requires some specific administrative and "relating" skills. I see four major goals of an industrial hygiene program where these skills are necessary: training of safety staff and employees; promotion of industrial hygiene ideas to management; preparation of Corporate guidelines and work practices for dealing with potentially dangerous situations; and, representation of industry with outside organizations (eg; W.C.B.).

The skills of which I speak include communication ability (oral and written), planning ability, sound judgement (achieved by consulting and listening) and interpretive (analysis) ability. The Hygienist must be capable of documenting his ideas, decisions and actions; and be able to define and work within the limitations of budget, manpower and corporate restrictions of the system in which he works. Effective control of these skills will enhance the patience, persistence and confidence the Hygienist must possess to work effectively with other people to achieve his goals.

Rather than define each of these skills I will give a few examples where they are necessary to achieve the above four goals:

- the Industrial Hygienist must be able to instruct safety staff and employees in the recognition of hazards, and the benefits of certain work practices. Training is a major aspect of every industrial industrial hygiene program.
- the Industrial Hygienist must be able to interpret the significance of regulations and biological and technical facts. The danger associated with some hazards may require immediate action. Know when to be forceful and when to be patient.
- the Industrial Hygienist must develop credibility with management and unions (an appreciation of managerial problems is helpful).
- the Industrial Hygienist is successful only if he can sell his program to management, and the program is successful only if he can sell it to the union and employees.
- the Industrial Hygienist must be able to obtain product information from manufacturers. At times the desired knowledge is considered proprietary and the situation requires patience and persistence before the information is obtained.
- the Industrial Hygienist must be capable of clearly documenting his ideas, decisions and actions. This is especially important when action by others is required.

- it is unfortunate, but some WCB Orders are insufficiently supported by fact, or are not clear in the required action. Fortunately, the WCB is quite receptive to a review of these Orders if the Industrial Hygienist is supported by logical, well founded argument.
- chronic hazards are frequently viewed by employees as insignificant if there is no apparent damage. Counter-action of this common response by the Industrial Hygienist requires the use of all of the communicative and other "relating" skills the Hygienist possesses.

I agree with your suggestion to use specialized teaching staff to outline these basic skills with students. The learning experience will also be reinforced if the student applies these concepts in the preparation and presentation of his technical projects throughout the Diploma Program.

I hope you will find the ideas presented in the letter to be useful. They are not new but they are necessary I think to give the student a healthy overview of the situations and challenges he will deal with after graduation.

Again, I appreciate the opportunity to participate in the planning of your Diploma Program and look forward to meeting you again.

Sincerely,

Robert Lockhart

RWL;lc

R.W. Lockhart, Ph.D.

APPENDIX 7

PROPOSED EXTENDED STUDIES DIPLOMA IN

OCCUPATIONAL HEALTH SCIENCE.

NEW COURSE DESCRIPTIONS AND RESOURCE REQUIREMENTS

Contents:

I: NEW COURSE DESCRIPTIONS:

Proposal forms for the six new OHS courses to be offered within the Kinesiology Department follow. These courses are:

OHS.	300-3	-	Introduction to Occupational Health Science
OHS.	370-3	-	Epidemiology and Biostatistics
OHS.	480-3	-	Ergonomics/Human Factors in Working Environments
OHS.	481-3	-	Principles of Industrial Hygiene
OHS.	482-2	-	Occupational Health Sciences Laboratory
OHS.	489-3	-	Occupational Safety and Hazard Management
OHS.	490-3	-	Field Practicum in Occupational Health Science

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information **Department:** Kinesiology

Abbreviation Code: OHS. **Course Number:** 300 **Credit Hours:** 3 **Vector:** 3-1-0

Title of Course: INTRODUCTION TO OCCUPATIONAL HEALTH SCIENCE

Calendar Description of Course:

Provides a general introduction to the field of occupational health and safety. Topics discussed will include physical hazards, chemical/biological hazards, ergonomics/human factors, job stress, safety principles, hazard analysis, and industrial disease, in relation to man and work. The course is designed to survey the knowledge and skills essential for a career in occupational health science/industrial hygiene.

Nature of Course

Lecture and Tutorial

Prerequisites (or special instructions):

Completion of at least 60 semester hours credit in the Kinesiology program, or permission of the Department.

What course (courses), if any, is being dropped from the calendar if this course is approved: None

2. Scheduling

How frequently will the course be offered? Once per year

Semester in which the course will first be offered? 81-3

Which of your present faculty would be available to make the proposed offering possible?

Smith, Banister, Morrison

3. Objectives of the Course

To introduce the student to the systems principles involved in the interaction of man and work, to survey the benefits and hazards of that interaction, and to emphasize the multi-disciplinary nature of the field by focussing on four main topic areas: ergnomics/human factors, industrial hygiene, safety, and occupational toxicology.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff See Attached Schedule

Library

Audio Visual

Space

Equipment

5. Approval

Date: Nov 13th, 1980	21 Nov 1980	DEC 9 '80
[signature]	[signature]	[signature]
Department Chairman	Dean	Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

NEW COURSE DESCRIPTION

OHS. 300-3 INTRODUCTION TO OCCUPATIONAL HEALTH SCIENCE

SUMMARY:

This course will provide a general introduction to the field of occupational health and safety, and will survey the knowledge and skills essential for a career in this area.

JUSTIFICATION:

It is anticipated that students interested in occupational health and safety, either within the diploma program or otherwise, will have a diversity of backgrounds and preconceptions as to what the field entails. This course will lay the groundwork for the entire OHS program by:

(1) introducing the field of occupational health science as an integrated discipline
(2) defining major areas of emphasis to be dealt with in subsequent OHS courses and
(3) outlining professional career opportunities in occupational health and safety in terms of requisite skills and knowledge from both a theoretical and practical standpoint. These functions make the course essential to the entire program.

TEXTS:

Stellman, J.M. & Daum, S.M. Work is Dangerous to your Health, New York: Vintage, 1973.

Key, M.M. et al. (Eds.). Occupational Diseases. A Guide to Their Recognition. Washington, D.C.: NIOSH, 1977.

COURSE OUTLINE:

The following major topic areas will be covered (number of lectures in parentheses).

Introduction and Overview of Occupational Health Science (1).

Ergonomics/Human Factors in Job, Workplace, Machine and Tool Design (5).

Sources of Occupational Stress (3).

Workplace Hazards and Industrial Disease (12).

Physical Hazards
Chemical Hazards
Biological Hazards

MIDTERM EXAM

Principles of Industrial Hygiene (6).

Evaluation of Workplace Hazards
Setting Safe Exposure Limits

Behavioral Toxicology (1).

Accidents, Injuries and Safety (3).

Principles of Hazard Management (1).

Women in the Workplace (1).

Historical Aspects of Industrial Hygiene (1).

Legal Aspects/Workers' Compensation (2).

The Occupational Health Professional: Duties, Responsibilites, Career Possibilities (2).

FINAL EXAM

REFERENCES:

See reference section.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information

Department: OHS

Abbreviation Code: OHS. Course Number: 370 Credit Hours: 3 Vector: 3-0-0

Title of Course: Epidemiology and Biostatistics

Calendar Description of Course:

A study of types and procedures of epidemiological investigations, statistical problems in etiological surveys and epidemiological and survey research in environmental and occupational settings.

Nature of Course Lecture

Prerequisites (or special instructions):

MATH 101, CMPT 103-3

What course (courses), if any, is being dropped from the calendar if this course is approved:

None

2. Scheduling

How frequently will the course be offered? 1/year

Semester in which the course will first be offered? Fall, 1981

Which of your present faculty would be available to make the proposed offering possible? Weldon (Mathematics) Sterling (Computing Science)

3. Objectives of the Course

To provide insight into how morbidity and mortality relate to workplace hazards and are manifested in an epidemiological manner throughout entire populations.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty 1/4

Staff 1/4 time secretarial

Library In preparation

Audio Visual none

Space none

Equipment none

5. Approval

Date: 19 Nov 80 21 Nov 1980 DEC 9 '80

Department Chairman Dean Chairman, SCUS

New Course Description

OHS. 370-3 EPIDEMIOLOGY AND BIOSTATISTICS

SUMMARY

This course deals with the epidemiological and statistical aspects of workplace hazards as they affect entire populations.

JUSTIFICATION

Often, the first sign that hazardous conditions may exist in an occupational setting is when a statistical bias develops in the morbidity or mortality pattern of affected workers. This course will develop the knowledge and tools which will enable students to evaluate the epidemiology of workplace hazards. The course is central to the entire Occupational Health Science program, as it is at other institutions which offer OHS programs (Appendix 4).

COURSE OUTLINE

Vital Statistics
Epidemiology of Infectious Diseases
Epidemiology of Chronic Diseases
Life Table Analysis
Clinical Trials and Medical Surveys
Fallacies in Numerical Reasoning
Socio-economic Factors and Health
Estimation of Survivorship
Population Growth and Structure
Analysis of Contingency Tables
Economic Analysis of Health Care Systems
Research Design in Health Care Evaluation Studies

Redesignation of KIN. 480-3 7-5

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

~~NEW~~ COURSE PROPOSAL FORM

Department: Kinesiology

1. **Calendar Information**

Abbreviation Code: OHS. **Course Number:** 480 **Credit Hours:** 3 **Vector:** 3-1-0

Title of Course: Ergonomics/Human Factors in Working Environments

Calendar Description of Course:
A practical and theoretical consideration of the ergonomic and human factors involved in creating optimal working conditions, as related to job design, workplace design, and machine and tool design.

Nature of Course
Lecture and Tutorial

Prerequisites (or special instructions):
PHYS 101-3, MATH 151-3 or 154-3, OHS 300-3, KIN 405-3, and not less than 45 hours credit from Science, Computing Science, Psychology and Kinesiology.

What course (courses), if any, is being dropped from the calendar if this course is approved: This course replaces the former KIN. 480-3

2. **Scheduling**

How frequently will the course be offered? once per year

Semester in which the course will first be offered? 81-3

Which of your present faculty would be available to make the proposed offering possible?
Smith, Banister, Morrison, Dickinson

3. **Objectives of the Course**

To introduce the student to the physical, physiological and psychological principles of ergonomics and human factors as applied to design of jobs, work areas and machines and tools, and to detail the links between safe, efficient and fulfilling working conditions, worker health and proper ergonomic design.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty
Staff See Attached Schedule
Library
Audio Visual
Space
Equipment

5. **Approval**

Date: Nov 13th, 1980

For Department Chairman

21 Nov 80

Dean

DEC 09 '80

Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a.

NEW COURSE DESCRIPTION

OHS. 480-3 ERGONIMICS/HUMAN FACTORS IN WORKING ENVIRONMENTS

SUMMARY:

This course considers the ergonomic and human factors involved in job, workplace, machine, and tool design essential for creating optimal working conditions.

JUSTIFICATION:

An appreciation is developing among Occupational Health Science professionals of the central role that work design features play in insuring optimal conditions of health and safety in the workplace. This topic is receiving increased emphasis in the U.S. but not yet in Canada. Therefore, the major importance of this course is that it will deal with a fundamental OHS area of concern which so far has been relatively neglected in Canada.

TEXT:

Konz, S. Work Design. Columbus, Ohio: Grid, 1979.

COURSE OUTLINE:

Major topic areas are as follows (number of lectures in Parentheses).

Introduction (1).

Historical Aspects (1).

Engineering Principles of Work Design (2).

- Operations Analysis
- Movement Time Analysis

Physiology, Bioenergetics, and Efficiency of Human Work (2).

Biomechanical Principles in Ergonomics (6).

- Muscular Strength
- Materials Handling - Lifting, Carrying, and Holding
- Musculo/Skeletal Problems
- Back Trauma and Injuries
- Repetitive Motion Injuries

Design Principles in Ergonomics (8).

- Anthropometry
- Organization of Workstations
- Physical Design of the Workstation
- Design of Machinery and Equipment
- Design of Hand Tools
- Design of Knobs, Dials, and Displays
- Protective Clothing

MIDTERM EXAM

Ergonomics of Work Environments (3).

- Light and Illumination
- Principles of Industrial Engineering
- The Auditory Environment
- Climate

Occupational Stress (6).

- Physiology of stress
- Fatigue/Overexertion
- Shift Work
- Job Satisfaction and Fulfillment
- Behavioral Effects
- Somatic Effects
- Health Effects

Women in the Workplace - Ergonomic Considerations (1).

Psychological/Behavioral Principles in Ergonomics (6).

- Information Processing
- Decision Making/Reaction Time
- Attention Demands and Movement control
- Administrative/Interpersonal Aspects

Implementing Ergonomic Change in the Workplace (2).

FINAL EXAM

REFERENCES:

See reference section.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. Calendar Information **Department:** Kinesiology

Abbreviation Code: OHS. **Course Number:** 481 **Credit Hours:** 3 **Vector:** 3-1-0

Title of Course: Principles of Industrial Hygiene

Calendar Description of Course:
An analysis of physical, chemical and biological hazards which exist in working environments. Involving delineation of different hazards, the effects of these hazards on worker health and methods of industrial hygiene which can be applied to management or elimination of workplace hazards.

Nature of Course
Lecture and Tutorial

Prerequisites (or special instructions):
PHYS 101-3, MATH 151-3 or 154-3, CHEM 251-3, OHS. 300-3, KINS 405-3, and not less than 45 hours credit from Science, Computing Science, and Kinesiology

What course (courses), if any, is being dropped from the calendar if this course is approved:
None

2. Scheduling

How frequently will the course be offered? Once per year

Semester in which the course will first be offered? 82-1

Which of your present faculty would be available to make the proposed offering possible?
Smith, Banister, Morrison

3. Objectives of the Course

To describe different physical, chemical and biological hazards which exist in working environments; to detail the health effects of these hazards and to delineate methods of industrial hygiene which may be applied for elimination or optimal management of workplace hazards.

4. Budgetary and Space Requirements (for information only)

What additional resources will be required in the following areas:

Faculty

Staff

Library See Attached Schedule

Audio Visual

Space

Equipment

5. Approval

Date: Nov 18th, 1980 21 Nov 1980 DEC 9 '80

Department Chairman (C for) Dean Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

NEW COURSE DESCRIPTION

OHS. 481-3 PRINCIPLES OF INDUSTRIAL HYGIENE

SUMMARY:

This course considers the physical, chemical, and biologic hazards which exist in working environments, in terms of detection, evaluation, and control.

JUSTIFICATION:

The proposed OHS program intends to produce professionals with demonstrated competence and expertise in occupational health and safety. A thorough understanding of industrial hygiene, in relation to detection, evaluation, and management of hazards in the occupational environment, is an essential ingredient of this training. This course, along with the affiliated laboratory, will provide students a thorough grounding in the theoretical and practical aspects of industrial hygiene.

TEXT:

Olishifski, J.B. (Ed.). Fundamentals of Industrial Hygiene (2nd. Ed.). Chicago: National Safety Council, 1979.

COURSE OUTLINE:

Major topic areas are as follows (number of lectures in parentheses).

Introduction (1).

Historical Aspects (1).

Physical Hazards - Recognition, Evaluation, Control, Health Effects (9).

- Heat and Cold
- Noise
- Vibration
- Illumination
- Ionizing Radiation
- Non ionizing Radiation

Chemical Hazards - Recognition, Evaluation, Control, Health Effects (9).

- Toxic Gases
- Dusts
- Organic Chemicals
- Pesticides
- Metals

MIDTERM EXAM

Biological Hazards - Recognition, Evaluation, Control, Health Effects (3)

- Pollen, Fungi and Spores
- Infectious Disease

Establishing Safe Exposure Limits (1)

Industrial Disease (6)

- Occupational Dermatoses
- Cardiovascular Diseases of Occupational Origin
- Occupational Respiratory Diseases
- Neurotoxic Disorders
- Work and Cancer

Principles of Behavioral Toxicology (1)

Control of the Occupational Environment (4)

- Air Sampling Methods
- Industrial Ventilation
- Noise Control
- Respiratory Protective Equipment

Industrial Hygiene Programs and Careers (3)

- Governmental Regulations
- Occupational Medicine
- Industrial Safety
- The Industrial Hygienist - Requisite Knowledge and Skills
- Industrial Hygiene Programs

FINAL EXAM

References

See reference section.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

Department: Kinesiology

1. **Calendar Information**

Abbreviation Code: OHS. **Course Number:** 482 **Credit Hours:** 2 **Vector:** 0-0-3

Title of Course: Occupational Health Sciences Laboratory

Calendar Description of Course:
A study of laboratory and field methods and equipment used for detection and analysis of workplace hazards.

Nature of Course
Laboratory
Prerequisites (or special instructions):
OHS. 480-3

OHS. 481-3 (may be taken concurrently)

What course (courses), if any, is being dropped from the calendar if this course is approved:
None

2. **Scheduling**

How frequently will the course be offered? once per year

Semester in which the course will first be offered? 82-1

Which of your present faculty would be available to make the proposed offering possible?
Smith, Banister, Morrison

3. **Objectives of the Course**

To introduce methods and equipment used in the laboratory and in the field for detecting and evaluating workplace hazards.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty
Staff
Library See Attached Schedule
Audio Visual
Space
Equipment

5. **Approval**

Date: Nov 13th, 1980 21 Nov 1980 DEC 9 '80

for Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a.

New Course Description

OHS. 482-2 OCCUPATIONAL HEALTH SCIENCES LABORATORY

SUMMARY:

This course will offer students the opportunity to experimentally examine the methods, equipment, and technology used for detection and analysis of workplace hazards.

JUSTIFICATION:

Familiarity with practical methods and techniques used for detecting and analyzing physical and chemical hazards in the workplace is essential for all OHS professionals. This course will complement the lecture courses by introducing the equipment, instrumentation, and methodology used for hazard evaluation, and will enable students to gain proficiency in hands-on use of this equipment.

TEXT:

The Industrial Environment - Its Evaluation and Control. Washington, D.C.: NIOSH, 1973.

COURSE OUTLINE:

Twelve laboratories in the following topic areas will be presented.

Evaluating Work Performance and Efficiency

Workspace Design - Biomechanic and Ergonomic Principles

Heat/Cold Effects on Work Performance

Assessing the Auditory Environment - Noise Measurement and Auditory Testing

Assessing the Visual Environment - Measuring Illumination

Radiation Monitoring and Measurement

MIDTERM EXAM

Measuring Airborne Contamination - Methods and Instrumentation

Measuring Airborne Contamination - Dusts

Measuring Airborne Contamination - Gases and Vapors

Pulmonary Function Testing

Effects of Toxicants on Human Behavior

Evaluating Health and Safety Conditions - The Walkaround

FINAL EXAM

REFERENCES:

See reference section.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. **Calendar Information** **Department:** Kinesiology

Abbreviation Code: OHS. **Course Number:** 489 **Credit Hours:** 3 **Vector:** 3-1-0

Title of Course: Occupational Safety and Hazard Management

Calendar Description of Course:

This course deals with sources of industrial accidents, the role of ergonomics and human factors in job safety, the identification and evaluation of workplace hazards, the design and implementation of safety programs, and legal and governmental regulations related to job safety.

Nature of Course Lecture-Tutorial

Prerequisites (or special instructions):

OHS 480,481

What course (courses), if any, is being dropped from the calendar if this course is approved: None

2. **Scheduling**

How frequently will the course be offered? Once per year

Semester in which the course will first be offered? 82-2

Which of your present faculty would be available to make the proposed offering possible? Smith, Banister

3. **Objectives of the Course**

To introduce theoretical and practical approaches to understanding occupational accidents and job safety, and to describe systems principles of hazard management for controlling hazardous conditions.

4. **Budgetary and Space Requirements (for information only)**

What additional resources will be required in the following areas:

Faculty See Attached Schedule

Staff

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: Nov 13th, 1980 21 Nov 1980 DEC 9 '80 73

For Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b -- (When completing this form, for instructions see Memorandum SCUS 73-34a.

New Course Description

OHS.489-3 OCCUPATIONAL SAFETY AND HAZARD MANAGEMENT

SUMMARY:

This course deals with the theoretical and practical aspects of industrial accidents and hazard management methods which can be used to enhance safety in the workplace. Regulationas governing safety and health also are considered.

JUSTIFICATION:

Optimal working conditions depend upon an occupational environment which is both healthy and safe. This course indroduces the topic of industrial safety from both a theoretical and practical standpoint. The thorough grounding in safety principles provided by this course will be an essential part of the training which students will receive in the OHS program.

TEXT:

Firenze, R. J. The Process of Hazard Control. Dubuque, Iowa: Kendall/Hunt, 1978.

COURSE OUTLINE:

The following major topic areas will be discussed (number of lectures in parentheses).

Introduction (1)

Industrial Accidents - Theory (3)

- Accident Theory
- Accident Statistics and Epidemiology
- Ergonomic and Design Factors in Industrial Accidents

Industrial Accidents - Practice (12)

- The Walkaround - Recognizing Job Hazards
- Role of Ergonomic Faults
- Role of Physical Hazards
- Role of Chemical Hazards
- Role of Stress
- Training Benefits

MIDTERM EXAM

Safety Regulations (12)

- Machinery and Equipment
- Dangerous Environments
- Physical Hazards
- Chemical Hazards
- Personal Protective Equipment
- Hazardous Materials
- Electrical Hazards
- Fire Hazards
- First Aid and Emergency Procedures

Workers' Compensation (4)

History
Accident Compensation
Disease Compensation
Workers' Compensation Systems in Canada

Legal Aspects of Occupational Health and Safety (3)

Occupational Health and Safety Laws
Arbitration Law
Information Access
Product Liability

Principles of Hazard Management (3)

The Safety Committee
Investigating Accidents/Accident Reports
Positive Approaches to Accident Control and Prevention

FINAL EXAM

REFERENCES:

See reference section.

SENATE COMMITTEE ON UNDERGRADUATE STUDIES

NEW COURSE PROPOSAL FORM

1. **Calendar Information** **Department:** Kinesiology

Abbreviation Code: OHS. **Course Number:** 490 **Credit Hours:** 3 **Vector:** 0-0-0

Title of Course: Field Practicum in Occupational Health Science

Calendar Description of Course:

The purpose of this course is to provide the student with field experience in recognizing, detecting, assessing, and managing or controlling physical or chemical hazards, toxicants or stressorsin the workplace, based on practical, hands-on participation in health and safety activities in industry. Opportunities will be provided for students to interact with health and safety specialists, hygenists, or medical officers in the field. Credit will be earned through evaluations by these individuals and by written project reports.

Nature of Course Lecture-Tutorial

Prerequisites (or special instructions):

OHS. 482,489

What course (courses), if any, is being dropped from the calendar if this course is approved: None

2. **Scheduling**

How frequently will the course be offered? Once per year

Semester in which the course will first be offered? 82-2

Which of your present faculty would be available to make the proposed offering possible?

Smith

3. **Objectives of the Course**

To introduce the student to the practical aspects of occupational health and safety, through exposure to and involvement with instrumentation and procedures used in business and industry for dealing with workplace hazards.

4. **Budgetary and Space Requirements** (for information only)

What additional resources will be required in the following areas:

Faculty

Staff See Attached Schedule

Library

Audio Visual

Space

Equipment

5. **Approval**

Date: Nov 18th, 1980 21 Nov 1980 DEC 9 '80

per Department Chairman — Dean — Chairman, SCUS

SCUS 73-34b:- (When completing this form, for instructions see Memorandum SCUS 73-34a. Attach course outline).

New Course Description

OHS 490-3 FIELD PRACTICUM IN OCCUPATIONAL HEALTH SCIENCE

SUMMARY:

This course offers students the opportunity for field work in some area of occupational health and safety, under the supervision of a practicing OHS professional.

JUSTIFICATION:

Occupational health and safety is a real world issue. The proposed OHS program would lack credibility if it did not provide opportunity for students to see first hand how health and safety problems are managed in actual work environments. This course makes available such opportunity by arranging for students to associate with occupational health and safety professionals in the field as they carry out their activities. The course therefore will enable students to complement the academic program with practical experience in the field.

TEXT:

No text is needed

COURSE OUTLINE:

There is no fixed outline. Arrangements will be made with occupational health and safety professionals in business, labour, and government to supervise students in the field. Placement possibilities in business include utilities, forest industries, oil companies, foundries, mines, and construction firms. In labour, cooperation with members of health and safety committees will be possible. In government, the health or labour ministries at the federal or provincial level offer the best opportunity for a field practicum. Students will be expected to work upon a project or activity chosen or agreed to by the supervisor, and to submit a report at the end of the semester. Personal evaluations of students by their supervisors also will be elicited. Students should spend two days per week on the field practicum.

II. REFERENCES

General and specific references for the five new courses specified in the preceding section are given below.

A. General principles

B. Sampling methods and analytical techniques

C. Toxicology

D. Medical

E. Dermatitis

F. Physical

G. Ergonomics

H. Biological

I. Chemical

J. Control

K. Encyclopedias and handbooks

The intent of this section is to provide the safety professional with brief descriptions of the basic reference books and publications in the field of occupational health and industrial hygiene.

A. General principles

Allen, R. W.; Ells, M.D.; and Hart, A. W. *Industrial Hygiene.* Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1976.

This comprehensive book contains detailed information on safety and medical programs in industry for both large and small companies and for those who wish to revamp existing programs or instigate new ones. The book also contains important information on federal regulations such as the Occupational Safety and Health Act standards, and on procedures and forms that have been tested and proven in actual working conditions.

With numerous illustrations, graphs, and discussion questions, *Industrial Hygiene* should be a valuable aid to the professional and those studying to become industrial hygienists or safety directors, medical or laboratory directors, or others planning to enter related fields.

Ashford, N. A. *Crisis in the Workplace: Occupational Disease and Injury.* Cambridge, Mass.: MIT Press, 1974.

Baetjer, A. M. *Women in Industry.* Philadelphia, Pa.: W. B. Saunders Company, 1961.

Brief, R. S. *Basic Industrial Hygiene: A Training Manual.* Linden, N.J.: Medical Department, Exxon Corporation, 1975.

Caldwell, J., ed. *Amphetamines and Related Stimulants: Chemical, Biological, Clinical, and Sociological Aspects.* Cleveland, Ohio: CRC Press, Inc., 1978.

The aim of this volume is to explore historical, chemical, biological, clinical, and sociological aspects of the amphetamines and related stimulants with reference both to legitimate medical use and to their abuse.

There is at the present time an enormous literature on the amphetamines and related stimulants, particularly in the area of neuropsychopharmacology, but it is extremely difficult to distill from this the information of relevance to the problem of the abuse of these compounds. The aim of this volume is to draw together those aspects of the chemical, biological, clinical, and sociological studies that have the maximum impact on the abuse problem.

Cralley, L. V., ed. *Industrial Environmental Health: The Worker and the Community.* New York, N.Y.: Academic Press, 1972.

This book covers both basic research and field studies dealing with all aspects of environmental health, including industrial air and water pollution. It centers attention, however, on evaluating the specific health hazards covered by the Occupational Safety and Health Act of 1970.

This book will be of value to industrial hygienists, engineers, chemists, physicists, toxicologists, and physicians in industry, universities, and governmental agencies.

——. *Industrial Hygiene Highlights.* New York, N.Y.: Academic Press, 1968.

Volume I reviews developments in a wide range of subjects. Volume II, titled *Industrial Environmental Health: The Worker and the Community,* updates the subjects discussed in volume I and also includes sections on agricultural products and off-the-job environmental health stresses.

Daubenspeck, W. G. *Occupational Health Hazards.* Hicksville, N.Y.: Exposition Press, 1974.

A complete and updated rewrite of a Bureau of Labor Standards Bulletin, this book should be of help to safety professionals and others who are concerned with the recognition, evaluation, and control of occupational health hazards.

Environmental Health Monitoring Manual. Pittsburgh, Pa.: U.S. Steel Corp., 1973.

A loose-leaf manual designed to train plant personnel to conduct the monitoring of the exposure of workers to toxic hazards and harmful physical conditions.

Firenze, R.H. *The Process of Hazard Control* Dubuque, Iowa: Kendall/Hunt Publishing Co., 1978.

This guide has been specifically prepared to be used by both instructor and student in courses and seminars in order to guide discussion, stimulate interest and direct the study of occupational safety, occupational health, and industrial hazard control. It will explore areas of engineering, management, occupational health, hazard analysis, and fire protection as they relate to effective hazard reduction. The term *hazard control* is used throughout to familiarize management more thoroughly with the full dimension of hazards occurring from failures in techniques, equipment, systems, and operations that are responsible for dollar and manpower losses, repair or replacement of tools, equipment, litigation expenses, and the like.

Gafafer, W. M., ed. *Occupational Diseases: A Guide to Their Recognition.* Washington, D.C.: U.S. Government Printing Office, 1964. (Public Health Service Publication No. 1097)

Discusses toxic agents, occupational dermatoses and pneumoconioses, chemical hazards, physical hazards, biologic hazards, and wood and plant hazards. For each hazard, the harmful effects, special diagnostic tests, recommended TLV, and potential occupational exposures are discussed. (Also see M.M. Key in this section.)

Harvey, B., and Murray, R. *Industrial Health Technology.* New York, N.Y.: Appleton-Century-Crofts, 1958.

Hricka, A., and Brunt, M. *Working for Your Life—A Woman's Guide to Job Health Hazards.* Washington, D.C.: Labor Occupational

Health Program and Public Citizen's Health Research Group, June 1976.

This handbook is a much-needed addition to the small but growing number of books and booklets that accurately explain job health hazards in a nontechnical way. It is written for those who most need to know—the workers themselves.

Writing for women workers, the authors discuss key questions such as

- What are the conditions or substances in the workplace that are harmful during pregnancy?
- Do pregnant women have the legal right to a job that is safe for their unborn children?
- Do chemicals that endanger human reproduction also affect men?
- What are the health hazards in jobs that mostly employ women?
- What can workers and unions do about job hazards?

The Industrial Environment, Its Evaluation and Control. 3rd ed. Rockville, Md.: NIOSH, 1973.

An industrial hygiene textbook, rather than a syllabus, covering a broad range of subjects from mathematics to medicine.

Key, M.M. *et al.*, eds., *Occupational Diseases: A Guide to Their Recognition*, Revised. Washington, D.C.: U.S. Dept. of Health, Education, and Welfare, June 1977.

Occupational diseases are discussed in terms of occupational health hazards as a means to recognition of the disease. The text covers routes of entry and modes of action, chemical hazards, physical hazards, biological hazards, dermatoses, airway diseases, wood and plant hazards, chemical carcinogens, and pesticides. Sources of consultation and a list of references are included.

Mayers, M. R. *Occupational Health: Hazards of the Work Environment.* Baltimore, Md.: Williams & Wilkins, 1969.

Discusses varieties of occupational hazards to health, including chemical, physical, mechanical, and infective agents found in industry, agriculture, mining, aviation, and laboratories. Also covers biological and medical perspectives, control and prevention, industrial medical services, and diagnosis.

Occupational Health Practices: Iron and Steel Industry. New York, N.Y.: American Iron and Steel Institute, 1965.

Parmeggiani, L., ed. *Encyclopedia of Occupational Health and Safety*, 2nd ed. New York, N.Y.: McGraw-Hill Book Co., 1971-1972.

Reference work containing 900 articles prepared by 700 specialists in more than 70 countries and 10 international organizations. Covers all aspects of occupational safety and health. Emphasizes the safety precautions to be taken against the main hazards encountered in each branch of industry. Examples are quoted from international standards rather than national legislation. Articles are arranged alphabetically and each article includes bibliographic references. The second volume contains nine appendixes, a list of authors, and a comprehensive analytic index.

Patty, F.A., ed. *Industrial Hygiene and Toxicology*, Vol. I, General Principles, 3rd Rev. Ed., 1978; Vol.II, Toxicology, 2nd rev. ed., 1963; Vol.III, Industrial Environmental Analysis (to be published). New York, N.Y.: Interscience.

Peterson, J. E. *Industrial Health.* Englewood Cliffs, N.J.: Prentice Hall, Inc., 1977.

Focusing on immediate concerns of the field, this text stresses occupational hazards ranging from chemical toxins to those of various energy forms, and considers many of today's most pressing environmental and ecological problems. *Industrial Health* stresses principles that underlie various facets of the field—and highlights the generalizations that emerge with practical examples. By purposely avoiding specific data pertaining especially to legal and quasilegal limits and standards, obsolescence of the text's information will be slow.

Sax, N. J. *Dangerous Properties of Industrial Materials*, 4th ed. New York, N.Y.: Van-

Nostrand Reinhold, 1975.

Primarily consists of a list of chemicals with entries giving synonym(s), description, formula, hazard and first aid information, and data on storage and handling. The text also provides information on pollution, radiation hazards, food additives, allergic reaction, and shipping regulations.

Schilling, R.S.F., ed. *Occupational Health Practice.* London, England: Butterworths, 1973.

Scott, R. *Muscle and Blood, The Massive, Hidden Agony of Industrial Slaughter in America.* Fresh Meadows, N.Y.: Alsyl/Alexander, 1974.

A popular work written in the style of an expose.

Stellman, J.M., and Daum, S.M. *Work in Dangerous to Your Health: A Handbook of Health Hazards in the Workplace and What You Can Do About Them.* New York, N.Y.: Vintage, 1973.

This is a book written in the popular vein and addresses itself to the worker.

U.S. Coast Guard, Cargo and Hazardous Materials Division. *Chemical Data Guide for Bulk Shipment by Water.* Washington, D.C.: U.S. Government Printing Office. (Stock No. 5012-00068.)

Provides guidance for Rescue Coordination Center watch officers, port safety personnel, Merchant Marine safety personnel, and others whose duties may require decisions in situations involving bulk chemical shipment.

Wallick, F. *The American Worker: An Endangered Species.* New York, N.Y.: Ballantine Books, 1972.

B. Sampling

Adams, D. F., ed., *Air Pollution Instrumentation.* Pittsburgh, Pa.: Instrument Society of America, 1966.

This monograph, containing a collection of papers, panel discussions, and audience questions and comments, presents the proceedings of the Instrument Society of America's Air Pollution Instrumentation Symposium held in conjunction with the 20th Annual ISA Conference and Exhibit in Los Angeles, October 5, 1965.

American Conference of Governmental Industrial Hygienists. *Air Sampling Instruments For Evaluation of Atmospheric Contaminants,* 5th ed. Cincinnati, Ohio: ACGIH, 1978.

Describes uses, principles, physical and performance data, operating and maintenance instructions, and commercial sources for air sampling instructions. Includes a technical discussion of the principles of air sampling and the use of instruments for the evaluation of airborne contaminants.

American Public Health Association. *Methods of Air Sampling and Analysis.* Washington, D.C., 1972.

Brenchley, D.L., Turley, C.D., and Yarmac, R F. *Industrial Source Sampling.* Ann Arbor, Mich.: Ann Arbor Science Publishers, Inc., 1973.

Concerns practical aspects of source sampling, including reasons for sampling, problems involved, methodology, sampling train components, conducting tests, preparing reagents, calibrating field equipment, analytical procedures, and handling and evaluation of data.

Hanson, N. W., Reilly, D. A., and Staff, H. E., eds. *The Determination of Toxic Substances in Air: A Manual of ICI Practice.* Cambridge, England: W. Heffer & Sons, 1965.

Includes some procedures not given elsewhere.

Intersociety Committee. *Methods of Air Sampling and Analysis.* Washington, D.C.: American Public Health Association, 1972.

Represents the first published volume of the methods adopted as "tentative" by The Committee for a Manual of Methods of Air Sampling and Analysis, according to its established procedures.

Jacobs, M. B. *The Analytical Toxicology of Industrial Inorganic Poisons, Chemical Analysis*. Vol. 22. New York, N.Y.: Interscience. Supersedes *Analytical Chemistry of Industrial Poisons, Hazards, and Solvents, Chemical Analysis*, Vol. 1, 1949.

Jacobs, M.D., and Scheflan, L. *Chemical Analysis of Industrial Solvents, Chemical Analysis*, Vol. 7. New York, N.Y.: John E. Wiley & Sons, Inc., 1958.

Katz, M. *Measurement of Air Pollutants: Guide to* Selection of Methods. Geneva, Switzerland: World Health Organization, 1969.

Leith, W. *The Analysis of Air Pollutants*. Ann Arbor, Mich.: Ann Arbor Science Publishers, 1970.

Linch, A.L. *Biological Monitoring for Industrial Chemical Exposure Control*. Cleveland, Ohio: CRC Press, 1973.

——. *Evaluation of Ambient Air Quality by Personnel Monitoring*. Cleveland, Ohio: CRC Press, Inc., 1974.

Personnel monitoring is a term designating the determination of the inhaled dose of an airborne toxic material or of an air-mediated hazardous physical force by the continuous collection of samples in the breathing or auditory zone, or other appropriate exposed body area, over a finite period of exposure time. A personnel monitor is a self-powered device worn by the monitored individual to collect a representative sample for laboratory analysis, or to provide accumulated dose or instantaneous warning of immediately hazardous conditions by visible or auditory means while being worn.

Manual of Analytical Methods Recommended for Sampling and Analysis of Atmospheric Contaminants. Cincinnati, Ohio: Committee on Recommended Analytical Methods, American Conference of Governmental Industrial Hygienists, 1958.

Developed by the ACGIH to provide industrial hygienists with the methods which this Committee and its predecessors have approved for the sampling and analysis of atmospheric contaminants.

Mercer, T. T. *Aerosol Technology in Hazard Evaluation*. New York, N.Y.: Academic Press, 1973.

Produced by the American Industrial Hygiene Association under contract with the former U.S. Atomic Energy Commission. Theoretical and practical reference text relating to the science of aerosol technology. Discusses the nature, behavior, and properties of aerosols that predict whether they will become a biological hazard. Includes collecting methods, methods of establishing toxic level criteria, and monitoring atmospheres.

Miller, S. S., ed., *Environmental Monitoring*. Washington, D.C.: ACS Reprint Collection, 1976.

A collection of 48 articles and four editorials that appeared in *ES&T* Magazine from 1972 to mid-1976. Listings of 43 books and 38 news leads are also included. Topics cover international and U.S. activity, business associations, organizations, monitoring trends, air and water instrumentation, techniques, and applications, minicomputers, filters, and pesticides.

NIOSH Manual of Analytical Methods. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1974.

A compilation of 38 procedures covering about 130 different chemicals which chemists in the Physical and Chemical Analysis Branch of NIOSH have used for industrial hygiene analyses.

NIOSH Manual of Sampling Data Sheets. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1974.

This edition includes 28 sampling data sheets proposing methods to sample the industrial environment for contaminants.

Ruch, W.E. *Chemical Detection of Gaseous Pollutants*. Ann Arbor, Mich.: Ann Arbor Science Publishers, 1966.

Annotated bibliography of references to

means of detecting airborne contaminants lists general references to various methods and techniques, as well as references to the detection of specific compounds.

—. *Quantitative Analysis of Gaseous Pollutants.* Ann Arbor, Mich.: Ann Arbor Science Publishers, 1970.

For various gaseous pollutants, information provided consists of a basic outline of a method of analysis, sampling equipment and procedure, interferences, and approximate time required to complete a single analysis of the contaminant. Cites sources for each method.

Silverman, L., Billings, C. E., and First, M. W. *Particle Size Analysis in Industrial Hygiene.* New York, N.Y.: Academic Press, 1971.

Produced by the American Industrial Hygiene Association under contract with the U.S. Atomic Energy Commission. Describes methods used in industrial hygiene, health physics, and air pollution control for particle sampling and size analysis of solid and liquid airborne matter, fine bulk powders, and particle deposits in tissues.

Yaffe, C.D., Byers, D.H., and Hosey, A.D., eds. *Encyclopedia of Instrumentation for Industrial Hygiene.* Ann Arbor, Mich.: University of Michigan, Institute of Industrial Health, 1956.

In May 1954, a symposium on instrumentation for industrial hygiene was held at the University of Michigan, Institute of Industrial Health and School of Public Health. As a result of this meeting and through the cooperative efforts of many people and groups, this encyclopedia was published two years later. Seven sections contain descriptive information of all instruments exhibited at this symposium.

C. Toxicology

Albert, R.E. *Thorium: Its Industrial Hygiene Aspects.* New York, N.Y.: Academic Press, 1966.

Summarizes the major technical uses of thorium, the hazards common to the various industrial processes, the techniques and objectives for the control of those hazards, and the biological and medical foundations on which the hazard controls are based. Also gives the physical, chemical, and radioactive properties of thorium and thoron.

American Conference of Governmental Industrial Hygienists. *Documentation of the Threshold Limit Values for Substances in Workroom Air,* 4th rev. ed. Cincinnati, Ohio: ACGIH, 1971.

Contains the basis of TLVs for more than 475 substances. Includes discussions, limitations, and cautions for understanding and application of TLVs.

Arena, J. M. *Poisoning: Toxicology, Symptoms, Treatments,* 3rd ed. Springfield, Ill.: Charles C. Thomas, 1973.

Topics include—general considerations of poisoning; insecticides, rodenticides, and herbicides; industrial hazards; occupational hazards; drugs; soaps and detergents; poisonous plants, insects, and fish; and miscellaneous compounds and topics, including radioactive isotope poisoning, rocket fuels, and welding hazards. Appendix of normal laboratory values used in the diagnosis and treatment of poisoning.

Braker, W., and Mossman, A. L. *Effects of Exposure to Toxic Gases.* East Rutherford, N.J.: Matheson Gas Products, 1970.

Browning, E. *Elsevier Monographs on Toxic Agents.* Amsterdam, The Netherlands: Elsevier Publishing Company, 1959-1964.

A series of 10 separately authored monographs on specific toxic substances.

—. *Toxicity and Metabolism of Industrial Solvents.* New York, N.Y.: Elsevier Publishing Company, 1965.

Most people who work in industrial health or who are responsible for people working with solvents will find this manual to be very useful. The bibliography is quite comprehensive in both the European and the American literature. The material is presented, not as individual case reports but as summaries, that are clearly written so that it is one of the easiest books of its type for the non-professional reader to understand. For the professional reader, it is a painstaking summary of the work that has been done on these solvents; the

book should be classed as essential.

Toxicology of Industrial Metals, 2nd ed. New York, N.Y.: Appleton-Century-Crofts, 1969.

Discusses the occurrence, preparation, physical and chemical properties, and toxicology of the principal metals used in industry. Potential toxic effects and methods of treatment of poisoning are included.

Casarett, L. J., and Doull, J., eds. *Toxicology. The Basic Science of Poisons*. New York, N.Y.: Macmillan Publishing Co., 1975.

Committee on Fire Research, Commission on Sociotechnical Systems, National Research Council. *Physiological and Toxicological Aspects of Combustion Products: International Symposium*. Washington, D.C.: National Academy of Sciences, 1976.

The project that is the subject of this report was approved by the Governing Board of the National Research Council, whose members are drawn from the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The members of the Committee responsible for the report were chosen for their special competences and with regard for appropriate balance.

Committee on Medical and Biologic Effects of Environmental Pollutants. *Nickel*. Washington, D.C.: National Academy of Sciences, 1975.

This document was written by the Panel on Nickel under the chairmanship of Dr. F. William Sunderman, Jr. Although each section was prepared initially by a member of the Panel or an invited contributor, some material was later combined, and the total document was reviewed and approved by the entire Panel and thus represents its cooperative effort. Dr. Sunderman was responsible for the introduction, large parts of the sections on nickel metabolism in man and animals and on nickel toxicity, and most of the sections on nickel carcinogenesis and nickel in the reproductive system.

Corone, P. A., and Krinsky, L. W. *Drug Abuse in Industry*. Springfield, Ill.: Charles C Thomas, 1973.

Deichmann, W. B., ed. *Pesticides and the Environment: A Continuing Controversy*. New York, N.Y.: Intercontinental Medical Book Corporation, 1973.

Selected papers presented and papers reviewed at the eighth Inter-American Conference on Toxicology and Occupational Medicine, University of Miami, School of Medicine, Miami, Florida, July 1973.

Deichmann, W. G., and Gerarde, H. W. *Toxicology of Drugs and Chemicals*, 4th ed. New York, N.Y.: Academic Press, 1969.

Designed as a ready reference on the side effects of drugs, the toxicity of industrial chemicals, and includes recommendations for treatment of undesirable effects and overdoses. The books discusses common uses of each substance, suggests treatment, and cautions against side effects or harmful dosage. Arranged alphabetically by substance for easy reference.

Dinman, B. D. *The Nature of Occupational Cancer: A Critical Review of Present Problems*. Springfield, Ill.: Charles C Thomas, 1974.

This small volume treats the nature of occupational cancer, industrial agents associated with human carcinogenic risk, as well as prevention and control of occupational carcinogenesis.

Dominguez, G. S., ed. *Guidebook: Toxic Substances Control Act*. Cleveland, Ohio: CRC Press, Inc., 1977.

The book is not only a complete guide to the law, but it is also a source on how to prepare for and respond to the many newly instituted federal requirements. The book provides practical and clear advice on anticipated compliance approaches, as well as suggestions for early organizational preparation and planning.

Dreisbach, R.H. *Handbook of Poisoning: Diagnosis and Treatment*, 8th ed. Palo Alto, Calif.: Lange Medical Publications, 1974.

A concise summary of the diagnosis and treatment of clinically important poisons including those encountered in industry and agriculture.

Drinker, P., and Hatch, T.F. *Industrial Dust*, 2nd

ed. New York, N.Y.: McGraw-Hill Book Co., 1954.

Both of the authors, well-known authorities in the field, use their wealth of experience to give very practical suggestions for handling the types of situations which one finds in practice and which are more amenable to the art than to the science of industrial hygiene.

The treatment of such subjects as the motions of particles in the air and the design of exhaust systems and other subjects are theoretical and mathematical as well as practical. This manual can be of great value to the engineer and chemist, and probably to physicians and others interested in the subject.

Eckhardt, R. E. *Industrial Carcinogens: Modern Monographs in Industrial Medicine.* New York, N.Y.: Grune & Stratton, 1959.

Elkins, H. B., ed. *The Chemistry of Industrial Toxicology.* New York, N.Y.: John Wiley & Sons, 1959.

Written for the chemist and engineer, this manual emphasizes harmful substances themselves, rather than presenting a complete physiological characterization of their effects. The nature of injuries from various industrial poisons is mentioned, primarily in relation to the probable seriousness of their effects. The first two chapters on fundamentals and evaluation of hazards set the stage for a further discussion of the chemical and industrial phases of industrial toxicology.

Essays in Toxicology. New York, N.Y.: Academic Press, 1969-1974.

Five volumes have thus far been issued in this continuing series treating a wide range of subjects in the field of toxicology.

Fairhall, L. T. *Industrial Toxicology,* 2nd ed. Baltimore, Md.: Williams & Wilkins, 1957.

Lists organic and inorganic substances and describes for each: characteristics, industrial uses, toxicity or industrial injury, analysis, and references.

Flury, F., and Zernik, F. *Schadliche Case, Dampfe, Nebel, Rauch und Staubarten.* Berlin, Germany: Verlag von Julius Springer, 1931.

Forney, R. B., and Huges, F. W. *Combined Effects of Alcohol and Other Drugs,* Springfield, Ill.: Charles C Thomas, 1968.

Fort, J. *Alcohol: Our Biggest Drug Problem.* New York, N.Y.: McGraw-Hill Book Co., 1973.

Gerade, H. W. *Toxicology and Biochemistry of Aromatic Hydrocarbons.* New York: N.Y. Elsevier Publishing Co., 1960.

This manual contains information of interest to those who are concerned with the prevention, detection, and treatment of exposure to aromatic hydrocarbons of industrial importance. Although it is intended primarily for physicians, industrial hygienists, and toxicologists, the safety professional who desires to understand the problems which face these specialists will find it a valuable addition to his library. Understanding the book requires a prerequisite knowledge of basic organic chemistry and the fundamental concepts of toxicology.

Of great interest are the generalizations given throughout the first part regarding the relationship between toxicity and hydrocarbon structure. The discussion focuses specifically on the metabolic effects of the monocyclic and dicyclic aromatic hydrocarbons. The very often misunderstood terms, "Toxicity *vs.* Hazard" and "Threshold Limit Values," are thoroughly discussed.

Gleason, M.N., Gosselin, R.E., Hodge, H.C., and Smith, R.P. *Clinical Toxicology of Commercial Products,* 4th ed. Baltimore, Md.: The Williams & Wilkins Co., 1976.

This book assists the physician in dealing quickly and effectively with acute chemical poisonings in the home and on the farm, arising through misuse of commercial products. It provides a list of trade-name products together with their ingredients when these have been revealed, addresses and telephone numbers of companies for use when ingredients are not listed, sample formulas of many types of products with an estimate of the toxicity of each formula, toxicological information including an estimate of the toxicity of individual ingredients, recommendations for treatment, names and addresses of

manufacturers, and a system of standard nomenclature for the clarification of poisonings. Medical libraries, pharmacies, industrial medical departments, public health nursing centers, and any other agency frequently called upon for emergency help should also find it helpful as a quick source of information on first aid, treatment procedures, and other questions.

Grant, W. M. *Toxicology of the Eye*, 2nd ed. Springfield, Ill.: Charles C Thomas, 1974.

Grover, P. L., ed. *Chemical Carcinogens and DNA*. Cleveland, Ohio: CRC Press, Inc., 1978.

This volume deals with the chemical modification of the DNA molecule and the ways these modifications may be detected.

Halpern, S. *Drug Abuse and Your Company*. New York, N.Y.: American Management Association, 1972.

Hamilton, A., and Hardy, H. L. *Industrial Toxicology*, 3rd ed. Acton, Mass.: Publishing Sciences Group, 1974.

Hardin, J. W., and Arena, J. M. *Human Poisoning From Native and Cultivated Plants*. Durham, N.C.: Duke University Press, 1969.

Most of the existing literature on poisonous plants deals with those that are poisonous to livestock. A real need exists for a source of information on just those plants poisonous to humans—particularly children. Physicians, health officers, nurses, scout leaders, camp counselors, teachers, parents, and many others should not only know the dangerous plants of their area but have a ready reference in case of emergencies. This book has been written with these people in mind and has grown out of a number of years' experience with poisonous plants accumulated by both of the authors in the field, laboratory, and clinic.

Hatch, T. F., and Gross, P. *Pulmonary Deposition and Retention of Inhaled Aerosols*. New York, N.Y.: Academic Press, 1964.

The authors explore at length the intermediate factors that operate between the contaminated atmosphere and internal tissue damage or disease caused by the gas or dust. These important but neglected factors include site of deposition of a dust or absorption of a gas, plus particle size, shape, density, and airflow pattern; the clearance mechanisms, knowledge of which is limited as compared with our understanding of initial deposition; and knowledge of where in the body the aerosol will produce injury.

Helmer, J., and Victoriz, T. *Drug Abuse, The Labor Market and Class Conflict*. Washington, D.C.: Drug Abuse Council, 1974.

Henderson, Y., and Haggard, H. W. *Noxious Gases and the Principles of Respiration Influencing Their Action*, 2nd rev. ed., New York, N.Y.: Reinhold Publishing Corporation, 1943.

A treatise of continuing value in the field of gas toxicology.

Holt, P. F. *Pneumoconiosis: Industrial Diseases of the Lung Caused by Dust*. London, England: E. Arnold, 1957.

Horvath, M. *Adverse Effects of Environmental Chemicals and Psychotrophic Drugs*. Amsterdam, The Netherlands: Elsevier Scientific Publishing Company, 1973.

Hueper, W. C. *Occupational Tumors and Allied Diseases*. Baltimore, Md.: Charles C Thomas, 1942.

Jacobs, M. B. *Analytical Toxicology of Industrial Inorganic Poisons*. New York, N.Y.: Wiley-Interscience, 1967.

Textbook of chemical analytical methods in industrial hygiene application. Major topics include: sampling; measurement of gas volume, velocity, and quantity; absorbers; dusts; silica; lead; mercury and arsenic; harmful metals; radiochemical determinations; sulfur compounds; phosphorus compounds; nitrogen compounds; oxygen and ozone; detector tubes; and clinical chemistry and industrial toxicology.

Lanza, A. J. *The Pneumoconiosis*. New York, N.Y.: Grune & Stratton, 1963.

Largent, E. J. *Fluorosis: The Health Aspects of Fluorine Compounds*. Columbus, Ohio: Ohio State University Press, 1961.

Lee, D. H. K., ed. *Metallic Contaminants and Human Health.* New York, N.Y.: Academic Press, 1972.

Lefaux, R. *Practical Toxicology of Plastics.* Cleveland, Ohio: CRC Press, 1968.

Loomis, T. A. *Essentials of Toxicology,* 2nd ed. Philadelphia, Pa.: Lea & Febiger, 1974.

Malten, K. E., and Zielhuis, R. L. *Industrial Toxicology and Dermatology in the Production and Processing of Plastics.* New York, N.Y.: Elsevier Publications Co., 1964.

Nordberg, G. F., ed. *Effects and Dose-Response Relationships of Toxic Metals.* Amsterdam, The Netherlands: Elsevier, 1976.

Paget, G. E., ed. *Methods in Toxicology.* Philadelphia, Pa.: F. A. Davis Co., 1970.

Patty, F. A., ed. *Industrial Hygiene & Toxicology,* vol. 2. New York, N.Y.: John Wiley & Sons, 1963.

Plunkett, E. R. *Handbook of Industrial Toxicology.* New York, N.Y.: Chemical Publishing Co., 1966.

Randolph, T. G. *Human Ecology and Susceptibility to the Chemical Environment.* Springfield, Ill.: Charles C Thomas, 1962.

Most illnesses were originally throught to have arisen within the body—only recently has this age-old concept been challenged. The importance of the outside environment as a cause of sickness was first demonstrated in respect to infectious diseases about eighty years ago and to allergic diseases approximately fifty years ago. Although the general principles of infectious disease are now fully accepted and applied, the medical profession has been slow in learning and applying the necessary techniques to demonstrate cause-and-effect relationships between the nonmicrobial environment and ill health.

Registry of Toxic Effects of Chemical Substances, Vol.II, Edited by E.J. Fairchild, *et al.* Cincinnati, Ohio: NIOSH.

Annual list of known toxic substances that may exist in the environment, or that are manufactured, processed, or synthesized, such as drugs, food additives, preservatives, ores, pesticides, dyes, detergents, lubricants, soaps, or plastics. Information on each substance includes primary name of chemical substance, Chemical Abstracts Service registry number, molecular weight and formula, Wiswesser Line Notation, synonyms, toxic dose data, units of dose measurement, notations descriptive of the toxicology, cited reference, U.S. Occupational Standards, and NIOSH Criteria Documents.

Searle, C. E., ed. *Chemical Carcinogens.* Washington, D.C.: American Chemical Society, 1976.

In this single volume is a wealth of information which will be invaluable to scientists working on all aspects of cancer research and occupational health. The most recent advances in cancer research are presented in over 800 pages with more than 750 structural formulas.

Cancer-causing agents are now known to exist throughout the environment—in polluted air and tobacco smoke, in various plants and foods, and in many chemicals that are used in industry and laboratories.

This timely monograph contains comprehensive accounts of the latest theories of cancer chemistry and biology and of the major hazards identified so far. Authorities from the United States, United Kingdom, France, and West Germany have contributed 16 chapters.

Stokinger, H. E., ed. *Beryllium: Its Industrial Hygiene Aspects.* New York, N.Y.: Academic Press, 1966.

Detailed account of how beryllium and its compounds may be handled safely and the engineering controls needed. Treats the chemical, biological, and medical aspects of beryllium, including sampling and analysis of atmospheric and biological specimens. Also reviews its toxicology and pathology.

——. *The Metals in Industrial Hygiene and Toxicology,* 2nd ed. New York, N.Y.: John Wiley & Sons, 1963.

Sunshine, I., ed. *Methodology for Analytical Toxicology.* Cleveland, Ohio: CRC Press, Inc. 1975.

This book provides detailed instructions on the performance of tests in the area of analytical toxicology and should be made available to all analysts in laboratories where drugs, poisons, and toxic substances are analyzed. The volume will be exceedingly valuable to all involved or interested in analytical toxicology.

Thoma, J.J., and Bondo, P. B., eds. *Guidelines for Analytical Toxicology Programs.* Cleveland, Ohio: CRC Press, Inc., 1978.

This two-volume work provides physicians and laboratory directors with practical guidelines for development of a reliable toxicology service for their community. It also features detailed information on instrumentation for various toxicological testing procedures. Emphasis is placed on defining proper technique in the use of instrument and establishing routine maintenance schedules to assure optimum performance. This work is prepared by 25 leading toxicologists, physicians, and pharmacologists.

D. Medical

Behrens, C. F., *et al. Atomic Medicine.* 5th ed. Baltimore, Md.: Williams & Wilkins Co., 1969.

Brown, M. L., and Meigs, J. W. *Occupational Health Nursing.* New York, N.Y.: Springer-Verlag, 1956.

Brown R. C. *The Chemistry and Therapy of Industrial Pulmonary Diseases.* Springfield, Ill.: Charles C Thomas, 1960.

Collins, R. T. *Occupational Psychiatry.* Boston, Mass.: Little, Brown, and Co., 1969.

Committee on Hyperbaric Oxygenation. *Fundamentals of Hyperbaric Medicine.* (Pub. No. 1298.) Washington, D.C.: National Academy of Sciences, National Research Council, 1966.

This book will be helpful not only to physiologists, clinical investigators and oxygen therapists but also to engineers who design and operate equipment and to those who are responsible for the management of diving and caisson operations.

Copplestone, J. F. *Preventive Aspects of Occupational Health Nursing.* London, England: Edward Arnold, 1967.

Featherstone, D. E. *Industrial Injuries, Their Prevention and Treatment.* Baltimore, Md.: Williams & Wilkins, 1964.

Discusses causes of injuries in various types of body actions, such as lifting, falling, and pushing. Describes recommended treatment for such injuries and strains, sprains, contusions, lacerations, fractures, dermatoses, and injuries to various parts of the body.

Fleming, A. J., D'Alonzo, C. A., and Zapp, J. A., eds. *Modern Occupational Medicine.* Philadelphia, Pa.: Lea & Febiger, 1960.

Contains chapters contributed by various authors in the subject areas of industrial medicine programs and services, industrial preventive medicine, environmental hazards, psychiatry, toxicology, and allied services of nursing, safety, and nutrition.

Flint, T., Jr. *Emergency Treatment and Management,* 3rd ed. Philadelphia Pa.: W. B. Saunders Company, 1964.

Guides to the Evaluation of Permanent Impairment. Chicago, Ill.: American Medical Association, Committee on Rating of Mental and Physical Impairment, 1971.

With the publication in this single volume of the entire series of updated "Guides," which cover all the body systems—the whole man, the Association is providing authoritative material to assist physicians and others in discharging a responsibility to their patients, clients, or applicants who are seeking benefits from the various agencies and programs serving the disabled.

Hayes, W. J. *Clinical Handbook on Economic Poisons—Emergency Information for Treating Poisoning,* rev. ed. (PHS Publication No. 476.) Atlanta, Ga.: Communicable Disease Center, Toxicology Section, 1963.

Hoover, H. C., and Hoover, L. H. *Georgius Agricola: De Re Metallica,* translated from the First Latin Edition of 1556. New York, N.Y.: Dover

Publications, Inc., 1950.

Hunter, D. *The Diseases of Occupations.* 5th ed. London, England: The English Universities Press, 1975.

Includes a historical outline of occupational diseases and their treatment. Discusses hazardous materials, such as metals and noxious gases, describes the processes that led to their being recognized as hazards, symptoms, preventive methods, treatment, and some case histories.

Johnstone, R. T., and Miller, S. E. *Occupational Diseases and Industrial Medicine.* Philadelphia, Pa.: W. B. Saunders, 1960.

Textbook discussing diseases caused by gases, vapors, and dusts; diseases caused by physical agents, such as vibration, noise, and extremes of temperature and pressure; photoactinic diseases; other hazards; and protective measures and devices.

Kessler, H. H. *Disability: Determination and Evaluation.* Philadelphia, Pa.: Lea and Febiger, 1970.

Key, M. M., *et al. Occupational Diseases: A Guide to Their Recognition,* rev. ed. Washington, D.C.: U.S. Department of Health, Education, and Welfare, Public Health Service, 1977.

King, F. J., and Fletcher, C. M., eds. *Industrial Pulmonary Diseases.* Boston, Mass.: Little, Brown, and Co., 1960.

Klein, S. M. *Workers Under Stress: Impact of Work Pressure on Croup Cohesion.* Lexington, Ky.: University Press of Kentucky, 1971.

Kornhauser, A. W. *Mental Health of the Industrial Worker: A Detroit Study.* New York, N.Y.: John Wiley & Sons, 1965.

Lee, D. H. K., and Kotin, P., eds. *Multiple Factors in the Causation of Environmentally Induced Disease,* Fogarty International Center Proceedings, No. 12. New York, N.Y.: Academic Press, 1972.

Levinson, H. *Emotional Health in the World of Work.* New York, N.Y.: Harper and Row, 1964.

Lieber, E. E. *Occupational Health.* London, England: Business Publications, Ambassador, 1964.

Magi, S. Z. *Disability and Rehabilitation: Legal, Clinical, Self-Concepts, and Measurements.* Columbus, Ohio: Ohio State University Press, 1969.

McBride, E. D. *Disability, Evaluation and Principles of Treatment of Compensable Injuries,* 6th ed. Philadelphia, Pa.: J. B. Lippincott and Co., 1963.

McGee, L. C. *Manual of Industrial Medicine,* 3rd ed. Philadelphia, Pa.: J.B. Lippincott and Co., 1963.

Brief discussions of various toxic agents, their effects, symptoms, and recommended treatment. Includes a discussion of nonoccupational disability—sickness absenteeism—and workers' compensation.

McKiever, M. F. *The Health of Women Who Work.* (PHS Publication No. 1314.) Washington, D.C.: Public Health Service, CPO, 1965.

McLean, A., ed. *Occupational Stress.* Springfield, Ill.: Charles C Thomas, 1974.

Merewether, E. R. A. Industrial Medicine and Hygiene. London, England: Butterworths, 3 vols., 1954-1956.

Muir, D. C. F. *Clinical Aspects of Inhaled Particles.* Philadelphia, Pa.: F. A. Davis and Co., 1972.

Occupational Safety and Health Series. CH 1211, Geneva 22, Switzerland: International Labour Office.

Proceedings of symposia organized by the ILO and other agenices covering many important topics in the field of occupational safety and health.

Page, R. C. *Occupational Health and Man-talent Development.* Berwyn, Ill.: Physicians' Record Company, 1963.

Parkes, W. R. *Occupational Lung Disorders.* London, England: Butterworths, 1974.

Discussion of occupational diseases of the lung; written for the practicing physician. Topics include—inhaled particles and their fate in the lung, fundamentals of pathogenesis and pathology, the chest radiograph, inert dusts, diseases due to free silica, pneumoconiosis due to coal and carbon, diseases due to asbestos and other silicates, and beryllium disease.

Pemberton, D. *Essentials of Occupational Health Nursing.* London, England: Arlington Books, 1965.

Ramazzini, B. *De Morbis Artificum (Diseases of Workers,* text of 1713, revised), translation from the Latin with notes by W. C. Wright. University of Chicago Press, 1940. Reprint: Hafner Publishing Company, New York, N.Y., 1964.

The historical work by the "Father of occupational medicine."

Rogan, J. M., ed. *Medicine in the Mining Industries.* Philadelphia, Pa.: F. A. Davis Company, 1972.

An account of some of the hazards encountered in mining and also some of the ways employed to minimize the risks.

Rusk, H. A. *Rehabilitation Medicine,* 2nd ed. St. Louis, Mo.: C. V. Mosby Company, 1964.

Safety Guide for Health Care Institutions. Chicago, Ill.: National Safety Council and the American Hospital Association, 1972.

This guide is intended to recognize and identify hazards in health care facilities, provide information for their elimination, and stimulate each hospital's personnel to improve its safety program. To be most effective, this book should be used in conjunction with other safety books from the NFPA, NSC, and the AHA.

Sappington, C. O. *Essentials of Industrial Health.* Philadephia, Pa.: Lippincott, 1943.

Schilling, R. S. F., ed. *Modern Trends in Occupational Health.* London, England: Butterworths, 1960.

——. *Occupational Health Practice.* London, England: Butterworths, 1973.

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

Shepard, W. P. *The Physician in Industry.* New York, N.Y.: McGraw-Hill Book Co., 1961.

A Guide to industrial medicine, for the practicing physician. Topics include the role of the physician and the nurse, environmental effects and control, industrial toxicology, radiation hazards, accidents, care for disabled workers, and mental health in industry.

Sunderman, E. W., and Sunderman, F. W., Jr., eds. *Laboratory Diagnosis of Diseases Caused by Toxic Agents.* St. Louis, Mo.: Warren H. Green, 1970.

Von Oettingen, W. F. *Poisoning: A Guide to Clinical Diagnosis and Treatment,* 2nd ed. Philadelphia, Pa.: W. B. Saunders Co., 1958.

Organized to aid the general practitioner and the internist in diagnosis and treatment of poisoning.

Wampler, F. J., ed. *The Principles and Practice of Industrial Medicine.* Baltimore, Md.: Williams & Wilkins, 1943.

Wolff, H. G. *Stress and Disease,* 2nd ed. Springfield, Ill.: Charles C Thomas, 1968.

Zenz, C., ed. *Occupational medicine: Principles and Practical Applications.* Chicago, Ill.: Year Book Medical Publishers, 1975.

E. Dermatitis

Adams, R. M. *Occupational Contact Dermatitis.* Philadelphia, Pa.: Lippincott, 1969.

The author analyzes genetic, metabolic, immunologic, and other factors which influence susceptibility to dermatitis; and he describes chemical and physical irritants, and allergens as-

sociated with various occupations. There are lists of classes of ingredients of industrial products and lists of chemicals for patch testing common contact allergens.

Fisher, A. A. *Contact Dermatitis.* Philadelphia, Pa.: Lea and Febiger, 1967.

Although this book is intended as a text for teaching medical practitioners the subject of contact dermatitis, it might be a good reference for the safety professional working in an industry where contact is made with many different materials.

Fitzpatrick, T., ed. *Dermatology and General Medicine.* New York, N.Y.: McGraw-Hill Book Co., 1971.

Gellin G. A. *Occupational Dermatoses.* rev. ed. Chicago, Ill.: American Medical Association, Council on Occupational Health, 1972.

Describes causes, prevention, and control of dermatoses, as well as legal aspects.

Great Britain Department of Employment. *Industrial Dermatitis: Precautionary Measures.* London, England: H. M. Stationery Office, 1972.

Describes industrial dermatitis, its causes, and the substances commonly responsible. Advises such preventive measures as environmental protection, personal protection, and supervision.

Rees, R. B. *Dermatoses Due to Environmental and Physical Factors.* Springfield, Ill.: Charles C Thomas, 1962.

Schwartz, L., Tulipen, L., and Birmingham, D. J. *Occupational Diseases of the Skin,* 3rd ed. Philadelphia, Pa.: Lea & Febiger, 1961.

Discusses in detail the causes, symptoms, prevention, and treatment of various dermatoses, arranged in chapters by the agents causing them, for example, inorganic and organic acids, metals, coal tar products, petroleum, fabric dyeing, explosives, furs, insecticides, and parasites.

Schwartz, L. *The Prevention of Occupational Skin Diseases.* New York, N.Y.: McGraw-Hill Book Co., 1964.

Guide to the causation and prevention of occupational dermatoses. Suggests methods of preemployment testing and discusses types of protective clothing and classes of protective creams and ointments.

F. Physical

Attix, F. H., and Roesch, W. C., eds. *Radiation Dosimetry,* 2nd ed. New York, N.Y.: Academic Press, 1968.

This second edition has been prepared to fill the need for a comprehensive treatise which brings together the major part of today's knowledge of this field. It has been written primarily as a reference work for radiation workers, and to this end many useful tables, curves, illustrations, formulas, and references to the literature have been included. On the other hand, every effort has been made to present the material as clearly as possible, so that the book will also be useful to those just entering the field.

Beranek, L. L., ed. *Noise and Vibration Control* New York, N.Y.: Academic Press, 1970.

The practical treatment of noise control design and construction.

Brotherton, M. *Masers and Lasers—How They Work, What They Do.* New York, N.Y. McGraw-Hill Book Company, 1964.

An article entitled, "Amplifying with Atoms," published in the *Bell Laboratories Record,* proved of such wide interest among science teachers, science students, writers, and others that it was necessary to provide nearly 30,000 reprints.

These events revealed a lively need for science writing in such a less technical vein and at such a level of understanding, and this book developed virtually as a response to that need. The author has tried to portray the laser and maser against their common generic background.

Burns, W. *Noise and Man,* 2nd rev. ed. London, England: Murray, 1973.

A standard text and reference of benefit to hygienists, engineers, physicians, and scientists in

volved in acoustics.

Burns W. and Robinson, D. W. *Hearing and Noise in Industry.* London, England: Her Majesty's Stationery Office, 1970.

Cember, H. *Introduction to Health Physics.* New York, N.Y.: Pergamon, 1969.

Contents deal with: a review of physical principles, atomic and nuclear structure, radioactivity, interaction of radiation with matter, radiation dosimetry, biological effects of radiation, radiation protection guides, health physics instrumentation, external and internal protection, criticality, and evaluation of protective measures.

Cheremisinoff, P. N. and P. P., eds. *Industrial Noise Control Handbook.* Ann Arbor, Mich.: Ann Arbor Science Publishers, Inc., 1977.

This volume was designed for use by engineers faced with industrial noise problems. It should also be of use to consultants and planners, as well as the student. It is written in general technical language aimed to facilitate its use and stresses the practical rather than the theoretical. The Occupational Safety and Health Act requires that employers provide a noise control program whenever employees work in an environment exposing them to such hazards. The authors have tried to give information necessary to meet OSHA requirements, thus making possible a safer and more productive work environment.

Clarke, A. M. *Ocular Hazards from Lasers and Other Optical Sources.* Cleveland, Ohio: CRC Press, 1970.

Cleary, S. F. *The Biological Effects of Microwave and Radio-frequency Radiations.* Cleveland, Ohio: CRC Press, 1970.

Davies, C. N., Davis, P. R., and Tyrer, F. H., eds. *The Effects of Abnormal Physical Conditions at Work;* the proceedings of a meeting held jointly by the British Occupational Hygiene Society, the Ergonomics Research Society, and the Society of Occupational Medicine on January 5-6, 1967. Baltimore, Md.: Williams & Wilkins, 1967.

Fitzgerald, J. J. *Applied Radiation Protection and Control,* 2 vols. New York, N.Y.: Gordon and Breach, Science Publishers, 1969-1970.

Topics include—a historical review of concepts, radiation protection and control guides, instruments for radiation detection and measurement, design of nuclear facilities, air sampling, environmental analysis and bioassay, assessment of reactor safeguards, radiation dosimetry formulas, emergency planning, radioactive waste management, and radiological problems associated with high-level radioisotope sources.

Harris, C. M., ed. *Handbook of Noise Control.* New York, N.Y.: McGraw-Hill Book Co., 1957.

In general, the material presented relates to properties of sound, effects of noise on man, vibration control, instrumentation and noise measurement, techniques of noise control, noise control in buildings, sources of noise and examples of noise control of machinery and electrical equipment, noise control in transportation, community noise, and the legal aspects of noise problems.

This manual is a handy reference source because of the large number of references given. It is of high quality, both in physical makeup and material content, and should prove helpful to those concerned with almost any kind of noise problem, legal or technical.

Heating and Cooling for Man In Industry. Akron, Ohio: AIHA, 1970.

Written with the working industrial hygienist and heating and ventilation engineer in mind, this manual contains information designed to be as complete as possible to obviate the need for extensive research when attempting to solve a problem. It has been written with one objective—that of describing the means of controlling the working environment to permit carrying out a variety of operations with fluctuating outdoor conditions. Included are methods of varying temperature, air motion and humidities within the work space. The space occupied by the industrial employee is the primary area of interest to the authors of this manual.

Henry, H. F. *Fundamentals of Radiation Protection.* New York, N.Y.: John Wiley & Sons, 1969.

Topics include—effects of radiation on cells, physical aspects of radiation exposure, background exposures, acute total-body exposures, long-term somatic effects, genetic effects, detection and measurement, personnel monitoring, environmental monitoring, practical protective measures, and plant emergencies.

Industrial Noise—A Guide to Its Evaluation and Control. Publication No. 1572. Washington, D.C.: Public Health Service, Government Printing Office, 1967.

This manual was designed to supplement the instruction offered in the USPHS training course on Industrial Noise. It presents lecture outlines and reference material that would be very useful to individuals having problems in this area.

Industrial Noise Manual. 2nd ed. American Industrial Hygiene Association, Akron, Ohio, 1966.

Physics of sound, instruments for sound measurement, technique of sound measurement, noise surveys, vibration, anatomy and physiology of the ear, effects of noise on man, hearing measurement, medical aspects of industrial hearing conservation, personal protection, engineering control and legal aspects of the industrial noise problem are covered in this second edition. Ample references have been provided for those who may desire to inquire more deeply into the medical, scientific, technical, and legal considerations in a comprehensive hearing conservation program.

International Atomic Energy Agency. *Radiation Protection Procedures.* Vienna, Austria, 1973. Available from UNIPUB, Inc., P.O. Box 433, New York, N.Y. 10016. Order No. STI/PUB-257.

Text reviews the fundamentals of nuclear physics and interactions of ionizing radiations with matter and living cells; the basic concepts governing the formulation of units for the measurement of radiations; methods used for measurements of radiations; selection, calibration, and maintenance of instruments used for monitoring; shielding; protective clothing; decontamination measures; radioactive waste management; the transport of radioactive materials; and emergency procedures for radiation accidents.

Discusses various administrative and technical measures which could form the basis for establishing a successful radiation protection program.

Kiefer, H., and Manshort, R. *Radiation Protection Measurements.* Oxford/New York: Pergamon Press, 1972.

Kinsman, S., *Radiological Health Handbook,* 3rd ed. Washington, D.C.: U.S. Bureau of Radiological Health, 1970.

Koller, L. R. *Ultraviolet Radiation,* 2nd ed. New York, N.Y.: John Wiley and Sons, 1965.

This book is intended to answer some of the questions that confront physicists (and specialists in fields other than physics) when they find it necessary to work in the ultraviolet portion of the spectrum. Its preparation was prompted by many inquiries from physicists, biologists, medical personnel, chemists, and laymen through the years. There is no lack of information in the scientific and technical literature covering every aspect of ultraviolet radiation; however, it is often difficult for one who is not a specialist to find the information he requires.

Kryter, K. D. *The Effects of Noise on Man.* New York: Academic Press, 1970.

Treats auditory system responses, subjective responses, and nonauditory system responses to noise; includes an extensive set of references.

LeBlanc, J. *Man in the Cold.* Springfield, Ill.: Charles C Thomas, 1975.

This volume should serve as a summary statement of our present understanding of human functional responses to cold exposure. It should help the reader tie into the overall pattern of human responses to cold such observations as local changes in fat composition, changes in amounts and distribution of isoenzymes, modifications of gluconeogenesis—all observed in man exposed to cold.

Leithead, C. S., and Lind, A. R. *Heat Stress and Heat Disorders.* Philadelphia, Pa.: F. A. Davis Co., 1964.

Miller, D. G. *Radioactivity and Radiation Detec-*

tion. New York, N.Y.: Gordon and Breach, 1972.

Moe, H. J., Lasuk, S. R., Schumacher, M. C., and Hunt, H. M. *Radiation Safety Technician Training Course.* rev. ed. Argonne, Ill.: U.S. Atomic Energy Commission, 1972.

A text intended to complement on-the-job monitoring training for health physics technicians. Deals with basic information concerning atomic structure and physical quantities, radiation units and external dose determinations, shielding, radiation protection standards, internal dose calculations, radiation-detection principles, instrument operation and counting statistics, health physics instruments, personnel monitoring devices, air sampling, reactors, hot cells, and accelerators. All sections contain reference lists, questions relating to the text material, and problems.

Morgan, K. Z., and Turner, J. E., eds. *Principles of Radiation Protection: A Textbook of Health Physics.* New York, N.Y.: John Wiley and Sons, 1967.

Contents include—history of health physics; passage of heavy charged particles, gamma rays, and X rays through matter; radiation quantities and units; physical basis of dosimetry; detection and measurement of ionization; dose from electrons and beta rays; dose from external sources; internal exposure; and radiation biology and biophysics.

National Council on Radiation Protection and Measurements. *Basic Radiation Protection Criteria.* (NCRP Report No. 39.) Bethesda, Md., 1971.

Includes chapters on radiation and man, radiation exposure conditions that may require consideration, basic biological factors, specific radiation effects, manifestations of overexposure in adults, bases for radiation protection standards, specific protection concepts or standards, dose limiting recommendations, and guidance for special cases.

Norwood, W. D. *Health Protection of Radiation Workers.* Springfield, Ill.: Charles C Thomas, 1975.

Olishifski, J. B., and Harford, E. R. *Industrial Noise and Hearing Conservation.* Chicago, Ill.: National Safety Council, 1975.

Okress, E. C., ed. *Microwave Power Engineering.* New York, N.Y.: Academic Press, 1968.

This book introduces the electronics technology of microwave power and its applications. This technology emphasizes microwave (and eventually quantum) electronics for direct power utilization and transmission purposes rather than exclusively for information and communications applications. Essentially, microwave power can be divided into microwave heating, microwave processing, microwave dynamics, and microwave power transmission involving generation and power amplification, direct power utilization, and closed waveguide or radiation beam propagation for remote utilization and rectification.

Permissible Levels of Toxic Substances in the Working Environment, sixth session of the Joint ILO/WHO Committee on Occupational Health, Geneva, 4-10 June, 1968; Occupational Safety and Health Series, Geneva 22, Switzerland: International Labour Office, Occupational Safety and Health Branch, 1970.

The Committee's report on reaching an international agreement on the basic principles for defining permissible limits; lists various countries; MAC's.

Peterson, A. P. G., and Gross, E. E., Jr. *Handbook of Noise Measurement.* West Concord, Mass.: General Radio Co., 1974.

This handbook was written for those individuals who are faced, possibly for the first time, with the necessity of making sound and noise measurements. It attempts to clarify the terminology and definitions used in sound measurement to describe the measuring instruments and their use; to aid the prospective user in selecting the proper equipment for measurements he must make; and to show how these measurements can be interpreted to solve typical problems. Plant managers, safety professionals, and others upon whom falls the responsibility of evaluation and control of excessive exposure to noise should add this worthwhile publication to their library.

Radiation Safety and Protection in Industrial Application, No. 73-8012, edited by Herbert F. Klein. Washington, D.C.: HEW, Dept. of Radiological Health, 1972.

Rees, D. J. *Health Physics: Principles of Radiation Protection*. Cambridge, Mass.: MIT Press, 1967.

RCA Service Co., Inc. *Atomic Radiation*. Camden, N.J.: 2 vols. 1957-60.

Part I: Theory, Biological Hazards, Safety Measures, Treatment of Injury (1957). Part II: Monitoring, Radiation Protection, Radioactive Shipment, Waste Disposal (1960).

Saenger, E. L. *Medical Aspects of Radiation Accidents—A Handbook for Physicians, Health Physicists, and Industrial Hygienists*. Washington, D.C.: US. Atomic Energy Commission, 1969.

Information for radiation emergency. Gives basic instructions for immediate care, followed by more detailed explanations of procedures, and the reasons for following them. Topics include—the first 12 hours after the accident and later emergency period; clinical features of acute radiation accidents; therapy and long term followup; problems of psychological upset; and legal requirements. Appendix of techniques, methods, calculations.

Sataloff, J. *Hearing Loss*. Philadelphia, Pa.: Lippincott, 1966.

Sataloff, J. and Michael, P. L. *Hearing Conservation*. Springfield, Ill.: Charles C Thomas, 1973.

An excellent book on noise for the occupational physician.

Shapiro, J. *Radiation Protection: A Guide for Scientists and Physicians*. Cambridge, Mass.: Harvard University Press, 1972.

Provides the radiation user with information needed to protect himself and others, and to understand and comply with governmental and institutional regulations regarding the use of radionuclides and radiation sources. Designed to obviate the need for reviews of atomic and radiation physics; the mathematics has been limited to elementary arithmetical and algebraic operations.

Taylor, L. S. *Radiation Protection Standards*. Cleveland, Ohio: CRC Press, 1971.

Summarizes and gives background information for various standards, including those of the ICRP, and NCRP, and the National Bureau of Standards. Arranged chronologically, 1925-1970.

Thumann, A., and Miller, R. *Secrets of Noise Control*. Atlanta, Ga.: The Fairmont Press, 1976.

Regulatory activity is reaching record proportions at all governmental levels. The desire to restrict occupational noise exposure has resulted in the promulgation of federal and state laws. Amendments to the Walsh Healey Public Contracts Act and the subsequent passage of the Occupational Safety and Health Act have given considerable impetus to controlling occupationally related noise.

U.S. Bureau of Radiological Health, Training Institute. *Radiological Health Handbook*, 9th rev. ed. Rockville, Md., January 1970.

Basic reference to physical, chemical, and mathematical data; radioisotope, decay, and radioassay data; and radiation protection data. Includes a chart of the nuclides, a universal decay table, microwave and laser glossaries, a film-speed chart, depth-dose tables, and table of isotopes. Some consider this book as the "Bible" in health physics.

Wasserman, D. E. *Vibration and the Workers' Health and Safety*, Technical Report No. 77. Cincinnati, Ohio: NIOSH, Division of Laboratories and Criteria Development, 1973.

G. Ergonomics

Astrand, P.O., and Rodahl, K. *Textbook of Work Physiology*. New York, N.Y.: McGraw-Hill Book Co., 1970.

Barnes, R. *Motion and Time Study*, 5th ed. New York, N.Y.: John Wiley and Sons, 1964.

Bartley, S. H. *Fatigue Mechanism and Management.* Springfield, Ill.: Charles C Thomas, 1965.

Bennett, E., Degan, J., and Spiegel, J., eds. *Human Factors in Technology.* New York, N.Y.: McGraw-Hill Book Co., 1963.

Biastronautics Data Book, 2nd ed. NASA SP 3006, Washington, D.C., 1973.

Blum, M., ed. *Readings in Experimental Industrial Psychology.* Englewood Cliffs, N.J.: Prentice Hall, Inc., 1952.

Broer, M. R. *Efficiency of Human Movement.* Philadelphia, Pa.: W.B. Saunders Co., 1960.

Brouha, L. *Physiology in Industry,* 2nd rev. ed. New York, N.Y.: Pergamon Press, 1967.

Concerns three aspects of physiology and industry—the worker, his physiological aspects of muscular activity and factors influencing physiological reactions to work at moderate temperature; the environment, including heat stress, and the chemical environment; and the job, including physiological requirements, reducing stress and fatigue, and selection, placement, and supervision of workers.

Boulnys, A. *Breathing: Physiology, Environment, and Lung Disease.* New York, N.Y.: Grune & Stratton, 1974.

Chapanis, A. *Man-Machine Engineering.* Belmont, Calif.: Wadsworth Publishing Company, 1965.

— *Research Techniques in Human Engineering.* Baltimore, Md.: Johns Hopkins Press, 1959.

Chapanis, A., Garner, W., and Morgan, C. *Applied Experimental Psychology: Human Factors in Engineering Design.* New York, N.Y.: John Wiley and Sons, 1949.

Chaney, F., and Harris, D. *Human Factors in Quality Assurance.* New York, N.Y.: John Wiley and Sons, 1969.

Consolazio, C. F., Johnson, R. E., and Pecora, L. J. *Physiological Measurements of Metabolic Functions in Man.* New York, N.Y.: McGraw-Hill Book Co., Inc., 1963.

Damon, A., Stoudt, H. W., and McFarland, R. A. *The Human Body in Equipment Design.* Cambridge, Mass.: Harvard University Press, 1966.

Applies principles of physical anthropology to the design of equipment for human use. Major areas of discussion include anthropometry and human engineering; biomechanics and equipment design; human body composition and tolerance to physical and mechanical force; and design recommendations.

Edholm, O. F. *The Biology of Work.* World University Library, New York, N.Y.: McGraw-Hill Book Co., 1967.

Fitts, P. M., and Posner, M. J. *Human Performance.* Belmont, Calif.: Wadsworth, 1967.

Fleishman, E. *Studies in Personal and Industrial Psychology.* Rev. ed. Homewood, Ill.: Dorsey Press, 1967.

Fogel, L. *Biotechnology: Concepts and Applications.* Englewood Cliffs, N.J.: Prentice Hall, Inc., 1963.

Geldard, F. *The Human Senses.* New York, N.Y.: John Wiley and Sons, 1953.

Grandjean, E. *Fitting the Task to the Man—An Ergonomic Approach.* London, England: Taylor & Francis, Ltd., 1969.

These changes and the continuing development in our knowledge of ergonomics have paved the way for this second edition. This is also the reason for the new subtitle "An Ergonomic Approach." Characteristic of these trends in emphasis are completely new chapters on man-machine systems and the questionnaire for controlling working conditions. This edition also includes consideration of a number of topical factors such as seating at work, heart rate as an indication of physical stress, monotony, daytime lighting, environmental climate in offices, and

some recent advances in the assessment of heat stress.

This second edition is presented with the hope that it may be a basis for a proper appraisal of human working conditions and that it will be of help to works engineers, works managers, industrial medical officers, and architects.

Hertig, B. A. "Ergonomics in the Practice of Industrial Hygiene." *Industrial Hygiene Highlights*, vol. I (Lester V. Cralley, ed.). Pittsburgh, Pa.: Industrial Hygiene Foundation of America, Inc., 1968.

Ittelson, W., Proshansky, H., and Rivlin, L., eds. *Environmental Psychology: Man and His Physical Setting*. New York, N.Y.: Holt, Rinehart and Winston, 1970.

Jacob, S. W., and Francone, C. A. *Structure and Function in Man*. Philadelphia, Pa.: W.B. Saunders Company, 1970.

Jokl, E., ed. "Biomechanics—Technique of Drawings of Movement and Movement Analysis." *Medicine and Sport*, vol. 2. Basel, Switzerland/New York: S. Karger, 1968.

Karpovich, P.V. *Physiology of Muscular Activity*, 6th ed. Philadelphia, Pa.: W.B. Saunders Co., 1965.

Kellerman, F. Th., Van Wely, P., and Willems, P., eds. *Vademecum Ergonomics in Industry*. Eindhoven, Netherlands: N.V. Philips Gloeilampenfabrieken, 1963.

Krick, E. *Methods Engineering—Design and Measurement of Work Methods*. New York, N.Y.: John Wiley and Sons, 1962.

McCormick, E. J. *Human Factors Engineering*, 3rd ed. New York, N.Y.: McGraw-Hill Book Co., 1970.

This text deals with some of the problems and processes that are involved in efforts to achieve fairly simple and clear-cut objectives—designing things so people can use them effectively and creating environments that are suitable for human living and work.

The impetus of the current attention to human factors engineering stems primarily from the development of elaborate military, space, and electronics systems and the recognized necessity of taking human factors into account in their design. The "systems" approach to the design of such equipment frequently embodies systematic attention to both engineering and human factors considerations toward the objective of developing integrated systems that consist of optimum combinations of physical and human components.

Meister, D., and Rabideau, G. F. *Human Factors Evaluation in System Development*. New York, N.Y.: John Wiley and Sons, 1965.

This book stems from the practical application of combined experience in attempting to solve human factors problems. Although it is a book about and for the practicing human engineer, it should be of use to anyone interested in examining the processes by which complex man-machine systems are developed and evaluated. It will be of special interest to those human engineers, whatever their background, who have only recently entered the profession.

Morgan, C. T., Cook, J. S., III, Chapanis, A., and Lund, M. W. *Human Engineering Guide to Equipment Design*. New York, N.Y.: McGraw-Hill Book Co., 1963.

The primary purpose is to provide a guide in human engineering that the designer can use in the same manner as handbooks in other areas to assist in solving design problems as they arise. The primary emphasis in the Guide will be on recommended design principles and practices in relation to general design problems rather than on the compilation of research data. However, research data may, if necessary, be included as a means of supporting or clarifying the design recommendations.

Murrell, K. F. H. *Ergonomics—Man in His Working Environment*. London, England: Chapman and Hall, 1969.

——. *Human Performance in Industry*. New York, N.Y.: Reinhold Publishing Co., 1965.

Parson, H. M. *Man-Machine System Experi-*

ments. Baltimore, Md.: Johns Hopkins Press, 1972.

Proceedings of Conference on Ergonomics in Industry. Dept. of Scientific and Industrial Research. London, England: Her Majesty's Stationery Office, 1961.

Proceedings of the Second International Congress on Ergonomics. (Supplement to the journal, *Ergonomics*) Dortmund, Germany/London, England: Taylor and Francis, Ltd., 1964.

Quastler, H., ed. *Information Theory in Psychology Problems and Methods*. Glencoe, Ill.: Free Press Publishers, 1955.

Rodahl, K., and Horvath, S. H. *Muscle as a Tissue*. New York, N.Y.: McGraw-Hill Book Co., 1962.

Ryan, T. *Work and Effort--The Psychology of Production*. Ronald Press, 1947.

Shelly, M. H and Bryan, G., eds. *Human Judgments and Optimality*. New York, N.Y.: John Wiley and Sons, 1964.

Shephard, R. J. *Men at Work: Applications of Ergonomics to Performance and Design*. Springfield, Ill.: Charles C Thomas, 1973.

Survey of the physiology and psychology of work, biomechanics, and human factors engineering, with problems from industry, the home, teaching, and urban planning.

Singleton, W. T., Fox J. F., and Whitfield, D., eds. *Measurement of Man at Work*. New York, N.Y.: VanNostrand Reinhold Company, 1969.

This book began with a comment by A. Chapanis at a meeting of the Council of the International Ergonomics Association. He thought that it would be interesting to take a serious look at the differences between American "human factors engineering" and European "ergonomics"; in particular their relative emphasis on, and utilization of, physiological and psychological methods and techniques. The proposal was accepted that a Symposium should be held in 1969 on the topic "Psychological versus physiological criteria in man-machine systems." The results are reported in this book.

Sommer, R. *Personal Space: The Behavioral Basis of Design*. Prentice Hall, 1969.

Steindler, A. *Kinesiology: Of the Human Body under Normal and Of Pathological Conditions*. Springfield, Ill.: Charles C Thomas, 1977.

Thompson, C. W. *Kranz Manual of Kinesiology*, 5th ed. St. Louis, Mo.: C.V. Mosby Co., 1965.

Tichauer, E. R. "Human Factors Engineering." *1971 McGraw-Hill Yearbook of Science and Technology*. New York, N.Y.: McGraw-Hill Book Co., 1971.

Tichauer, E. R., and Dudek, R. A. *Introduction to Industrial Engineering for Physicians*, (Monograph). Lubbock, Texas: Texas Technological College, 1965.

Van Cott, H., and Kinkade, R., eds. *Human Engineering Guide to Equipment Design*, rev. ed. Washington, D.C.: American Institutes for Research, 1972.

Williams, M., and Lissner, H. R. *Biomechanics of Human Motion*. Philadelphia, Pa.: W. B. Saunders Co., 1962.

Woodson, W. E., and Conover, D. W. *Human Engineering Guide for Equipment Designers*. Berkeley, Calif.: University of California Press, 1966.

The greatest expansion in this new revision has occurred in the first parts of the Guide. The first chapter, "Design Philosophy," is entirely new, having replaced the former introductory section. Chapter 2 is a considerably expanded version of the original material; however, an attempt has been made to retain the original direct format, which seems to have been appreciated by most designers.

The chapter on "Body Measurement" has been revised appreciably and made more practical from the designer's point of view. This change is a reflection of the application experience of the writers in working very closely with aerospace

and weapon system designers since the beginning of the Jet Age. Revisions in the remaining parts of the book are less extensive, but reflect many of the changes brought about by more recent research—especially in the area of man-in-space and in industrial applications.

H. Biological

Biohazard Control and Containment in Oncogenic Virus Research. Washington, D.C.: Dept. of Health, Education, and Welfare, National Institutes of Health, U.S. Public Health Service, 1969.

Biohazards Manual, LA-5267-M. Los Alamos, N.M.: Los Alamos Scientific Laboratory, University of California, 1974.

Biological Hazards Control--Environmental Health and Safety Manual. Davis, Calif.: Office of Environmental Health and Safety, University of California, 1973.

Biosafety Procedure Guide. San Francisco, Calif.: Office of Environmental Health and Safety, University of California, 1974.

Classification of Etiological Agents on the Basis of Hazard. Washington, D.C.: Center for Disease Control, Dept. of Health, Education, and Welfare, 1974.

Design Criteria for Viral Oncology Research Facilities. Bethesda, Md.: National Cancer Institute, April 1975.

Guide for the Care and Use of Laboratory Animals, Publication No. NIH 73-23 (formerly PHS Publication No. 1024), rev. Washington, D.C.: Dept. of Health, Education, and Welfare, 1972.

Hall, T. G. *Diseases Transmitted from Animals to Man,* 4th ed. Springfield, Ill.: Charles C Thomas, 1956.

Laskin, A. I., and Lechevalier, H., eds. *CRC Handbook of Microbiology,* 2nd ed. Vol. I: Bacteria; Vol. II: *Fungi, Algae, Protozoa, and Viruses.* Cleveland, Ohio: CRC Press, Inc., 1978.

These two volumes feature information on organismic microbiology and present data of taxonomic value on bacteria, fungi, algae, protozoa, and viruses. Also presented are products of microorganisms—succinct information is given about such compounds as antibiotics, enzymes, toxins, and a multitude of chemicals belonging to various chemical families, as well as data pertaining to microbial metabolism, genetics, and immunology.

National Cancer Institute Safety Standards for Research Involving Oncogenic Viruses. Publication No. NIH 75-790. Washington, D.C.: Department of Health, Education, and Welfare October 1974.

National Institutes of Health. *Biohazards Safety Guide.* Washington, D.C.: Dept. of Health, Education, and Welfare, Public Health Service, 1974.

Safety Standards for Research Involving Oncogenic Viruses. Bethesda, Md.: National Cancer Institute, 1975.

I. Chemical

American Mutual Insurance Alliance. *Handbook of Organic Industrial Solvents* (Technical Guide No. 6), 3rd ed. Chicago, Ill.: AMIA, 1966.

This handbook was developed to assist the safety professional in his analysis of problems involving the use of solvents. A list of common solvents was compiled along with pertinent data needed in evaluating hazards.

Cloyd, D. R., and Murphy, W. J. *Handling Hazardous Materials.* Washington, D.C.: Technology Utilization Division, National Aeronautics and Space Administration, September 1965.

Describes hazards that have restricted the use of various materials, and the procedures by which they have been handled and stored safely. Materials include—liquid hydrogen, pentaborane, fluorine, chlorine trifluoride, ozone, nitrogen tetroxide, and hydrazine and its derivatives.

Compressed Gas Association. *Handbook of Compressed Gases.* New York, N.Y.: VanNostrand Reinhold, 1966.

Discusses 49 widely used compressed gases in terms of their properties, methods of manufacture, commerical uses, and physiological effects. Includes data relative to the materials of construction required for all types of compressed gas installations, equipment, and containers. Also includes a chapter on safe handling of compressed gases, as well as information on hazardous materials regulations.

Cryogenics Safety Manual--A Guide to Good Practice. London, England: British Cryogenics Council, 1970.

The guide is aimed at all levels of operational supervisory staff and is not intended for the designer except to refresh his memory on operational safety. It is anticipated that this document can be handed to a supervisor and with little or no other instruction he can be expected to perform his job safely provided that (*a*) the installation has been correctly designed, (*b*) company standing instructions have been properly drawn up, and (*c*) the plant is operated normally within prescribed limits.

Fawcett, H. H., and Wood, W. S. *Safety and Accident Prevention in Chemical Operations.* New York, N.Y.: Interscience Publishers, 1965.

An excellent description of the hazards and respiratory protective devices available is presented. In the 31 chapters which constitute this volume, 24 writers, knowledgeable in the field of chemistry, have organized and presented their experiences. This volume is a source book or guide, rather than a mere tabulation of hazardous materials. Comprehensive treatment is enhanced by many photographs and authoritative references. It should be included in the libraries of schools and colleges where chemistry and chemical engineering are taught. In addition, the small user of chemicals, who frequently has had no orientation in chemical safety, should welcome the availability of this knowledge.

Disposal of Process Wastes. A report of a symposium presented at the ACHEMA meeting, Frankfurt, Germany. Translated by M.Wulfing Hoff. 1964.

This monograph presents 17 reports describing the state of the art and suggests fresh departures. The reports deal with the specific toxic agents and with methods, including catalytic combustion for removing undesirable components of gases.

McKinnon, G. P., and Tower, K. eds. *Fire Protection Handbook,* 14th ed. Boston, Mass.: National Fire Protection Association, 1976.

Much new material has been added in recognition of the many advances made in fire protection technology since the Thirteenth Edition was published in 1969. New fire problems, and the solutions to them, that in the last decade were only then beginning to make themselves known, are now deserving of extensive attention. (High-rise buildings, for example, received only passing mention in the last edition with no direct reference to their potential as a source of hazard to life.)

Manufacturing Chemists' Association. *Guide for Safety in the Chemical Laboratory,* 2nd ed. New York, N.Y.: VanNostrand Reinhold Company, 1972.

The second edition of this manual has been completely rewritten by the Safety and Fire Protection Committee of the Manufacturing Chemists' Association. The latest methods and equipment for protection of laboratory workers have been incorporated and modern facilities and procedures have been illustrated.

The book is quite properly called a Guide since it is intended to offer only a starting point in the solution of laboratory safety problems. However, it will be found of considerable assistance in setting up safety programs for schools and industrial or institutional laboratories.

Manufacturing Chemists' Association. *Laboratory Waste Disposal Manual.* Washington, D.C.: MCA.

This manual will be of help in developing an awareness of chemical hazards and providing knowledge on methods to dispose of chemical wastes without personal injury, without hazardous and excessive contamination of ground, air, or water supplies.

National Fire Protection Association. *Fire Protection Guide on Hazardous Materials.* Boston, Mass.: NFPA.

Pilborough, L. *Inspection of Chemical Plant.* Cleveland, Ohio: CRC Press, 1971.

This book endeavors to help with the inspection of chemical and process plants. In so doing, it, of necessity, deals with principles and techniques of inspection that may be applied in many fields of industrial technology.

Powers, P. W. *How To Dispose of Toxic Substances and Industrial Wastes.* Park Ridge, N.J.: Noyes Data Corp., 1976.

This book discusses all recognized and allowed ultimate disposal methods in detail and contains a long list of specific recommendations for specific substances plus alternative disposal or recovery methods.

In this book are condensed vital data that are scattered and often difficult to assemble. Important techniques are interpreted and explained by actual case histories. This condensed information will enable you to establish a sound background for action towards disposal of toxic and hazardous materials with safety.

Ross, E. D. *Industrial Waste Disposal.* New York, N.Y.: Reinhold Book Corp., 1968.

This book presents a systems approach to the evaluation and solution of waste disposal problems. The various control processes are described, emphasis is placed on solving the problem at its source rather than after one process waste has become combined with many others.

Schieler, L. *Hazardous Materials.* New York, N.Y.: Van Nostrand Reinhold Company, 1976.

The reader is introduced to the laws and principles governing the behavior of hazardous materials as a background for learning to control the behavior. Frequently encountered materials which have hazardous properties are identified, both chemically and practically, rationale for fire prevention and firefighting is based on both their chemical reactivity and their physical properties. Nationally accepted procedures for identifying hazardous chemicals and methods for the crisis-handling of them are summarized.

Shreve, R. H. *Chemical Process Industries,* 3rd ed. New York, N.Y.: McGraw-Hill Book Co., 1967.

Deals with the entire range of industries engaged in the conversion of raw materials into consumer products.

Turk, A., Johnson, J. W., Jr., and Moulton, D. G. eds. *Human Responses to Environmental Odors.* New York, N.Y.: Academic Press, 1974.

The purpose of this volume is to bring together some of the more recent approaches to the study of the human olfactory response in which both sensory and physico-chemical aspects are presented.

Zabetakis, M. G. *Safety with Cryogenic Fluids.* New York, N.Y.: Plenum Press, 1967.

This monograph was prepared in an effort to present in concise form the principles of safety that are applicable to the field of cryogenics. Thus, while it includes safety rules, design data, first aid and hazard control procedures, emphasis has been placed on basic principles. An appreciation of these principles permits an individual to conduct a safe operation under a wider variety of conditions than is possible if he is familiar only with a list of safety rules.

Zimmerman, O.T., and Lavine, I. *Handbook of Material Trade Names.* Supplements I-IV (1956-1965). Dover, N.H.: Industrial Research Service, 1953.

J. Control

Alden, J. L., and Kane, J. M. *Design of Industrial Exhaust Systems,* 4th ed. New York, N.Y.: Industrial Press, 1970.

American Conference of Governmental Industrial Hygienists. *Air Pollution Control Process Flow Sheets.* Cincinnati, Ohio: ACGIH, 1961.

This publication contains flow diagrams, process descriptions, and control methods for asphalt paving plant, cement plant, ferrous foundry operations, iron and steel making

rendering plants, coffee roasting, alfalfa dehydrating, and milling asbestos ore.

Air Pollution Reference Library. Cincinnati, Ohio: ACGIH, 1964.

This is a compilation of references on air pollution and includes lists of books, handbooks, journals, periodicals, and other references.

Industrial Ventilation. Lansing, Mich.: Committee on Industrial Ventilation, ACGIH, 1977.

This authoritative, up-to-date source of practical design information is an ideal factual reference work for all who design, install, or maintain industrial exhaust systems. It has been widely used as a design standard by ventilation engineers, designers, and contractors. It is especially valuable to the industrial hygienists and safety professionals who are responsible for the evaluation and performance of exhaust ventilation systems.

The general principles of ventilation, dilution ventilation, ventilation for heat control, hood design, specific operations, duct design, makeup and recirculated air, construction specifications, testing of ventilation systems, fans, air cleaning devices are discussed quite extensively.

American Foundrymen's Society. *Engineering Manual for Control of In-Plant Environment in Foundries*. Des Plaines, Ill.: AFS, 1956.

An extremely well-organized and informative book covering foundry ventilation and foundry hygiene problems. Section 2, "Exhaust Hoods and Exhaust System Design," contains some excellent information on designing exhaust systems. A step-by-step explanation of the nomograph methods of designing exhaust system is covered; also a step-by-step procedure for using the widely accepted friction chart for designing exhaust systems is covered.

American Industrial Hygiene Association. *Air Pollution Manual*. Akron, Ohio: AIHA, 1960-1967.

Volume 1 treats atmospheric contaminants which affect health, livestock, and vegetation of community property. It covers legislative and administrative procedures, community relations, air sampling, chemical procedures, odors, radioactivity, and meteorology.

Volume 2 concerns the equipment for control of air pollution sources. It provides sufficient information for the practicing plant or process engineer to understand the collection mechanisms used in the equipment and thus make an appropriate selection for a particular problem.

Buonicore, A. J., and Theodore, L. *Industrial Control Equipment for Gaseous Pollutants, Volume I*. Cleveland, Ohio: CRC Press, Inc., 1975.

It is the intent of this book to offer the reader the fundamentals and principles of control equipment for gaseous pollutants with appropriate practical applications and to serve as an introduction to the specialized and more sophisticated texts in this area.

Deitz, V. R., ed. *Removal of Trace Contaminants from the Air*. (Symposium Series No.17.) Washington, D.C.: American Chemical Society, 1975.

Sixteen chapters provide critical and in-depth coverage of air pollution characterization and removal. This compendium stresses interaction among particulates and gas phase contaminants, pesticides, occupational contaminants, cigarette smoke and aerosol filtration, sulfur dioxide, trace gas adsorption, nitrogen oxides, and high ozone concentrations.

Davies, C. N., ed. *Design and Use of Respirators*. New York, N.Y.: Pergamon Press, 1962.

Although modern filters and absorbers are wonderfully effective, this book shows clearly that the main limitations of a respirator are facepiece leakage, breathing resistance, poor speech and vision, and discomfort. It is easier to improve such deficiencies for the operator of a machine, sitting quietly at his controls, than it is for an active laborer, though carefulness on the part of the wearer of breathing equipment will always be required.

Dorman, R. G. *Dust Control and Air Cleaning*. New York, N.Y.: Pergamon Press, June 1974.

Deals with the hazards of industrial dusts, the dynamics and sampling of airborne particles, and

methods employed in industry for their removal, such as settlement, wet scrubbing, cyclonic action, electric precipitation, and filtration.

Handbook of Occupational Safety and Health, 5th ed. Chicago, Ill.: National Safety Council, 1974.

This book, formerly the "Handbook for Accident Prevention for Business and Industry," is meant for owners, managers, and supervisors of small companies. Although the text is designed to be self-teaching, it can also be used in a basic safety course. (Because this book is only meant as a compact introduction to the person with little safety and health experience, it does not go into a great detail on any one subject.)

Heating, Ventilating, and Air Conditioning Guide. New York, N.Y.: Society of Heating, Ventilating, and Air-Conditioning Engineers, Inc., Published annually.

Hemeon, W., ed. *Plant and Process Ventilation*, 2nd ed. New York, N.Y.: Industrial Press, Inc., 1963.

This book was written to assist those individuals charged with the responsibility of designing exhaust ventilation systems. The first half is concerned with methods for analyzing a factory ventilation problem and explains the dynamics of the air-polluting process to determine in what manner the air is to be channeled through the space in question.

McDermott, H. J. *Handbook of Ventilation for Contaminant Control*. Ann Arbor, Mich.: Ann Arbor Science Publishers, Inc., 1976.

The goal of this author was to provide enough information so anyone who must use ventilation to protect employee health can meet his responsibilities. Hopefully, the information is complete enough so safety professionals, plant engineers, industrial hygienists, and others with limited background in exhaust ventilation will understand what ventilation can accomplish, how it works, and how to make it work properly for them. At the same time, the author has included results of recent research studies so the book will be helpful to those industrial hygienists and others with backgrounds in traditional ventilation design.

Pfeiffer, J. B., ed. *Sulfur Removal and Recovery from Industrial Processes*, Washington, D.C.: American Chemical Society, 1975.

Advances in Chemistry Series No. 139. Sixteen chapters form a consolidated reference source of sulfur removal and recovery methods concentrating on recovery techniques from sources other than power plant stacks. Emissions from smelter gas streams and Claus units are discussed, and seven scrubbing processes are described. Companion volume is No. 140 *New Uses of Sulfur*.

Respiratory Protective Devices Manual. Lansing, Mich.: Committee on Respirators, 1963.

Prepared by the joint AIHA-ACGIH Committee on Respirators, this manual consists of thirteen chapters covering such topics as absorption of gases and vapors, specific types of respirators approved for various hazards, as well as physiological factors involved in respiratory protection programs. Respiratory protection of workers is a problem common to many industrial operations, and management and scientific personnel should be well informed about suitable protective devices for every type of hazardous exposure.

Ruch, W. E., and Held, B. J. *Respiratory Protection—OSHA and the Small Businessman*. Ann Arbor, Mich.: Ann Arbor Science, 1975.

This volume was designed for use by the small businessman to provide a respiratory-protection program for his employees. The Occupational Safety and Health Act requires that the employer provide a respiratory protection program for the employees whenever they must work in a hazardous atmosphere which cannot be controlled by engineering methods. This volume should provide the necessary information to aid the employer in meeting OSHA requirements, thereby providing a safer workplace for the employee.

Sittig, M. *How to Remove Pollutants and Toxic Materials From Air and Water: A Practical Guide*. Park Ridge, N.J.: Noyes Data Corporation, 1977.

III. BUDGETARY AND SPACE REQUIREMENTS

Requirements for the five new courses are broken down into two categories: (1) start-up requirements; and (2) sustaining requirements.

OHS 300-3 Introduction to Occupational Health Science

	Requirement	
	Start-up	Sustaining
Faculty	None	None
Staff	½ Secret./Clerical	
Library	See Separate Evaluation	
Audiovisual	$200	$ 50
Space	---	150 seat lecture theatre
Equipment	None	None
Supplies/Guest Speakers	$200	$600

OHS 480-3 Ergonomics/Human Factors in Working Environments

Faculty	None	None
Staff	None	None
Library	See Separate Evaluation	
Audiovisual	$200	$ 50
Space	---	75 seat classroom
Equipment	None	None
Supplies/Guest Speakers	$200	$300

OHS 481-3 Principles of Industrial Hygiene

Faculty	½ Faculty	
Staff	None	None
Library	See Separate Evaluation	
Audiovisual	$200	$ 50
Space	---	75 seat classroom
Equipment	None	None
Supplies/Guest Speakers	$200	$300

OHS 482-2 Occupational Health Sciences Laboratory

Faculty	None	None
Staff	½ Lab. Tech.	None
Library	See Separate Evaluation	
Audiovisual	$200	$ 50
Space	---	Laboratory - 25 benches
Equipment	$28,500 *	$1000
Supplies	$ 1,000 *	$ 500

OHS 370-3 Epidemiology and Biostatistics

Faculty	¼ Faculty	
Staff	¼ Secretarial	
Library	See Separate Evaluation	
Audiovisual	None	None
Space	None	75 seat classroom
Supplies/Guest Speakers	$200	$200

Budgetary and Space Requirements (continued)

OHS 489-3 Occupational Safety and Hazard Management

	Requirement	
	Start-up	Sustaining
Faculty	½ Faculty	
Staff	None	None
Library	See Separate Evaluation	
Audiovisual	$200	$ 50
Space	---	75-seat classroom
Equipment	None	None
Supplies/Guest Speakers	$200	$300

OHS 490-3 Field Practicum in Occupational Health Science

Faculty	None	None
Staff	None	None
Library	See Separate Evaluation	
Audiovisual	$100	$ 50
Space	None	None
Equipment	None	None
Supplies	$100	$ 50

*New equipment needed for the laboratory is as follows. Start-up supplies include items such as chart-paper, tubes, adaptor plugs, electronic supplies, etc.

Item	Cost
Integrating sound level meter - impact/continuous	$4500
Electronic WBG thermometer	1500
Portable gas chromatograph system	8000
Field H_2S/CO monitor	2500
Radiation leakage detector	5000
Dust particle counter	5000
Personal protective equipment samples (respirators, clothing, etc.)	2000
TOTAL	$28,500

SUMMARY OF BUDGETARY AND SPACE REQUIREMENTS FOR NEW OHS COURSES

	Requirement	
	Start-up	Sustaining
Total Faculty	1¼ Full Time	
Total Staff	0.75 Secretary/Clerical ; ½ Laboratory Tech.	
Total Library	See Separate Evaluation	
Total Audiovisual	$1100	$300
Total Space	----	1 Lecture Theatre (150 seats) 4 Classrooms (75 seats each) 1 Laboratory (25 spaces)
Total Equipment	$28,500	$1000
Total Supplies	$ 2,100	$250

and one-quarter

One/new faculty member, with expertise in industrial hygiene and safety, is needed for implementation of the program. Secretarial/clerical help (0.75 position) is requested to handle typing, copying, etc. related to the five new courses, and to help coordinate the field practicum. A ½ time laboratory technician is needed for the laboratory. A variety of equipment is required for mounting a meaningful laboratory course in industrial hygiene.

IV. LIBRARY RESOURCES

(In preparation)