ENVIRONMENTAL IMPACT ANALYSIS

Unit F
College of Pharmacy

Health Sciences
Phase I

University of Minnesota
Minneapolis, Minnesota

Attachment for grant application submitted April 1

THE FACILITY, HISTORY, AND BACKGROUND

The University of Minnesota began the planning process that led to the development of a long term program for the Health Sciences eight years ago.

A study supported by the Hill Family Foundation included the recommendations that the University should expand its entering Medical class to 200 students as rapidly as possible with a commensurate increase in the number of Dental students, increase the number of transfer students from the two-year medical schools in North and South Dakota, and strengthen the teaching skills and attitudes relevant to the responsibility of personal and family physicians.

The Regents of the University acting upon the Hill recommendations and preliminary reports of the University Long Range Planning Committee that was appointed by the President in September 1964 proposed physical facilities development program for the College of Medical Sciences and the School of Dentistry. This proposal included facilities essential to the maintenance of quality programs in the Health Sciences. In addition, it would make possible introduction of new programs and increases in enrollment recommended by the Hill Family Foundation study - entering classes in Medicine would be increased from 160 to 200, in Dentistry from 110 to 150, and there would be proportionate enrollment increases in related health professional programs.

Students, staff, and the faculty made significant contributions during the planning effort.

More than 100 faculty members participated in the planning effort. Most of their time has been devoted to programmatic study which includes expression of goals and objectives and definition of instructional, research, and service activities that are appropriate to the University's efforts to meet the needs of the state and nation.

The general criteria which established the basic planning framework are as follows:

1) Because of the great investment from public and private sources in existing facilities, the plan must conserve and enhance the desirable characteristics of the present Health Sciences Center.

2) The plan must be adequate in scale to serve all contemplated programs of the Health Sciences Center - programs that include substantial enrollment increases in all areas.

3) The plan must facilitate and, in fact, encourage interaction among persons in all Health Sciences programs.

4) The plan must provide maximum flexibility for adaptation to anticipated but unspecified changes in programs in the wake of social and scientific progress.

5) The plan must be compatible with other aspects of University development and enhance the involvement of the Health Sciences with the rest of the University and the community.

6) The plan must provide opportunity for development beyond any programs now contemplated.

In March, 1966, the new dean of the College of Pharmacy first involved his unit in the planning process initiated earlier by the other Health Sciences units. The faculty was able to complete sufficient review of College needs in the first six months to establish that future programs would require close participation with the other Health Science Professional schools if a needed health team were to become a reality. The faculty concluded that a high priority request for funds from the legislature for a new wing to its present facility should be withdrawn and planning initiated to bring Pharmacy into the developing Health Sciences Center. This request was supported by the University, and planning for the pharmacy facility integrated into the Health Sciences Center was begun.

After many cooperative studies with representatives of the other health professional units, the present plan has evolved. The detailed drawings for the College of Pharmacy facility are being developed. A great deal of space in the Health Sciences Center is planned for shared use with the other units including the classrooms in the pharmacy facility.

The College of Pharmacy will carry out a number of programs in the new facility. Presently the largest program is the undergraduate B.S. in Pharmacy, a five-year professional program. Also offered is the six-year Doctor of Pharmacy degree which is becoming more in demand as the role functions of this individual are defined. The Pharm.D. degree is also an undergraduate professional degree. The College also offers graduate programs leading to the M.S. and Ph.D. degrees in Medicinal Chemistry, Pharmacy Administration, Pharmacognosy, and Pharmaceutics. Further, they have an established M.S. program in Hospital Pharmacy. The program with the greatest growth potential is the professional Doctor of Pharmacy program -- it is the only one of its kind in the Upper Midwest.

The Health Sciences Expansion Project is bounded almost entirely by existing University dormitories, libraries, hospitals, and classroom buildings. The notable exception is the block to the east of the site along Washington Avenue. The block contains commercial and housing functions and has been considered a logical direction for long-range future expansion. The University is in contact with a community planning group and is developing a policy for future land acquisition in the area so that property holders are appraised of the time-table well in advance of any University acquisition.

With the exception of the aforementioned block, future expansion of the Health Sciences will involve the demolition of existing buildings. Therefore, future long-range expansion is expected to have minimal effects on the surrounding environment.

The site area for Unit F is currently occupied by three apartment buildings owned by the University. Current residents rent with a 30-day eviction notice arrangement. The situation is identical to that found in any University housing such as dormitories. Other University housing will be made available to these students upon initiation of the project.

Attachments I and II outline segments of the master plan.

ANALYSIS

The organization of the analysis is according to the format presented in Chapter 30-15 of the General Administration Manual (Environmental Affairs) as follows:

I. Natural Resource Use

Land Use
Mineral and Fuel Use
Water Use
Air Use
Compliance

II. Pollution

Air Pollution
Water Pollution
Soil Pollution
Land Pollution
Pollution of Wetland, Desert, Tundra and Alpine Environment
Energy
Wastes and Storage
Compliance

III. Populations

Human Populations
Animal Populations
Plant Populations
Compliance

IV. Services

Basic Services
Human Services
Intermediary Systems
Long-Range Services

V. Human Values

NATURAL RESOURCE USE

The building materials are non-renewable resources allocated to this building on a long-term basis. This building was designed with a concept of extending its life expectancy from the normal 20 or 30 year period to a longer 50 or 60 year life expectancy. This is the reason for the very durable exterior shell and structural system along with an elaborate utility system designed for flexibility. Internal partitions are removable without damaging floors or ceilings or interrupting activities in adjoining spaces. Thus, use of space in the building can be easily modified to accommodate future program needs. This concept of "design flexibility" is further discussed in Attachment III.

Land Use

The construction of the proposed building will represent a change in the traditional use of the parcel of land being directly affected by the action. However, the site for F is already owned by the University. The site is currently occupied by three apartment buildings and has the status of dormitories or other University housing. Students who live there rent on a 30-day eviction notice arrangement and at the time of initiation of construction other University housing will be provided. As was noted in the Facility, History, and Background statement, the site is surrounded by dormitories, libraries, hospitals, and classroom buildings and thus, the proposed plan for the site is consistent with its surroundings. See Attachment IV for title opinion.

Because of the adequacy of storm sewer design for the area, the proposed building will not change runoff patterns which affect adjacent land use.

The project is suitable for the physical characteristics of the site and requires no change in the traditional use of underground space.

Mineral and Fuel Use

The proposed project does not influence accessibility to known mineral deposits. The scope of the project is not sufficient to precipitate more than a five percent increase in the amount of mineral and fuel being mined in Minnesota, nor does it precipitate an increase of more than one percent in the amount of mineral and fuel consumed on a national basis. Further discussion of the impact of the proposed facility on fuel use is included under the topic of "Basic Services."

Water Use

The project will not bring about an identifiable change in volume of water in natural surface or underground water systems, nor will there by any change in the primary or traditional use of a body of water.

Ground Water

Ground water was observed in the borings at the levels and times indicated on the boring logs. The ground water information contained on the log of boring 3 is considered to be the most accurate since water was observed at a depth of 43' prior to introducing jetting water into the drill hole. The levels of the ground water observed in borings 1 and 2 may be affected somewhat by the fact that jetting water was introduced into these holes prior to the time ground water was observed. Ground water determinations made in relatively impervious soils as encountered in the borings may not be completely reliable even after several days of observation, and both yearly and seasonal fluctuations in the level of the ground water may be expected.

Air Use

This facility will not bring about any changes in the use of air space. Unit A, which is immediately adjacent to Unit F, is approximately three times as tall as Unit F. Thus, the construction of F will represent no change in air space.

The completion of Unit F will not introduce contaminants into the air which violate Federal, state and local emission standards. This includes emission to storm and sanitary sewers and to the air from hoods, the University incinerator and the heating plant. Emissions and control will be further discussed in the following paragraphs.

POLLUTION

Air Pollution

The concept of increase in existing sources of pollution is applicable to discharge from the stacks of the University incinerator and heating plant.

The proportionate increases are due to increased quantities of solid waste generation and increased use of energy in the form of steam. These increases are further elaborated upon in the section of this report related to energy consumption. Even though there are absolute increases, the University incinerator and heating plant will continue to be operated in accordance with the Minnesota Pollution Control Agency Rules and Regulations for Air Pollution Control, January 1971, and the USEPA "New Source Performance Standards for Steam Generators and Incinerators." Results of stack emission studies for particulates, sulfur dioxide, and heavy metals for the incinerator plant, and for sulfur dioxide and particulate content for the heating plant, have recently been shared with the Minnesota Pollution Control Agency. Further perspective on air discharges can be gained by referring to later sections in this report pertaining to solid wastes and basic services.

Water Pollution

With reference to water pollution, the proposed project will not change any natural water system, establish a waste treatment facility, discharge waste from human populations to natural surface water systems, discharge manufactured waste material directly to natural surface water systems, produce an identifiable change in the natural surface water system as a result of changing effluent quality from the Metropolitan Sewage Treatment Facility, cause or precipitate erosion into surface water, to identifiably alter turbidity, or permit leaching of foreign substances into underground water supplies.

Soil Pollution

There will be no change in the chemical composition of the soil at the site as a result of this project.

Site and Soil Conditions

Boring logs maintained by the University Office of Supervision and Construction indicate that the soil profile consists primarily of sand to a depth of approximately from 15' to 19', underlain by glacial till consisting primarily of silty sand with some boulders which extends to bedrock. From 4' to 7' of fill exists at the surface, with the grater depth being encountered in boring #3. A layer of silty sand from 7' to 9' was encountered in boring 3# and in boring #2, a layer of lean clay was encountered from 27 1/2' to 29 1/2'. Although boulders were encountered in the till below about 20', the borings were not obstructed by them. Bedrock was encountered and cored in each boring, and consists of thin layers of the Decorah, Shale and Limestone overlying Platteville limestone at a depth of approximately 50'. Detailed information pertaining to the bedrock is contained on the boring logs.

Land Pollution

Because the site is less than one acre, this action is excluded from the requirement relating to "change in the structure of land which would affect its structural stability" and "which would affect its capacity to absorb water.

There are no identified earthquake faults at this site.

There will be no identifiable change in runoff from this area as it relates to adjacent land, since all runoff will be directed to a storm sewer. It is predicted that the runoff coefficient for this area (120,000 square feet) will change from 0.5 to 0.9, with a peak discharge for a 25 year frequency storm of 6 CFS. This water is conducted from the site to a 3 by 6 1/2 foot diameter storm tunnel which discharges directly to the Mississippi River.

Pollution of Wetland, Desert, Tundra and Alpine Environment

There will be no pollution of wetland, desert, tundra, and alpine environment on the site of construction of this project.

Energy

The proposed project does not generate sufficient quantities of new energy sources or create changes in energy flow patterns which might cause permanent changes in the physiology and behavior patterns of populations, or would permanently alter natural or man-made structures. This statement applies to energy in the forms of heat, sound, electromagnetic waves, shock waves, and wind patterns. In making this statement, it is noted that shock waves and vibrations made in accordance with local construction or blasting regulations, and also sources of energy which cause only temporary effects, or affect a limited number of individuals are excluded. The latter exclusion includes the effect of an x-ray diffraction unit to be located on the 7th level of the building. The number of exposures to human populations is very limited (only to those researchers working with it) and applications will be carefully monitored through registration with the Minnesota Health Department and strict adherence to "Minnesota State Regulations Relating to Ionizing Radiation," 1971. To assure adherence, monitoring activities will be carried out by health physicists of the Department of Environmental Health and Safety of the University Health Service.

Wastes and Storage

The construction of Unit F will create an increase in materials used on a short-term basis (solid waste). Although some of the waste from a research facility (Unit F) cannot be recycled because of biological contamination, some recycling will occur where feasible.

The University of Minnesota has an active resource recovery program, spearheaded by the Physical Plant Department. First emphasis is on reuse of items, where medically and economically feasible, and secondly, on reclaiming materials for use in the production of raw products. These efforts currently include reclaiming of glass, waste chemicals, and corrugated paper. Initially corrugated materials will be recovered from the waste stream of F and be collected along with corrugated materials from other parts of the campus. It is estimated that corrugated material will be between 15% to 20% by weight of the solid waste stream from Unit F.

Where it is not feasible to recycle because of character of the waste, difficulty in separation or lack of market in the community, other waste treatment and disposal practices will be followed.

It is the policy of the University to incinerate the bulk of solid wastes from medical care and research facilities. The more popular and economical method of solid waste disposal would be to delivery it all to a sanitary landfill, and operate only a pathological incinerator, however, it is realized that disposing of unnecessarily large amounts of material by landfill will in the long run have a greater adverse effect on the environment. Also, if the wastes were deposited directly in a landfill, the heat capacity of the wastes used to aid in the destruction of animal carcasses, would be lost. Presently, hot gases from the primary chamber of the incinerator passes over the animal hearth, the heat being used to incinerate the carcasses.

The present incinerator does not incorporate heat recovery. However, the University is currently involved in the planning of a community thermal processing and heat recovery plant. This project, which is being coordinated by the Hennepin County Department of Public Works, is now in the preliminary design stage. The University and other area institutions with medical care facility wastes are actively involved in the planning of this project to assure that adequate facilities are provided for handling the special wastes from medical care and research facilities. This will include all wastes from the University Health Sciences Complex, including Unit F. Eventually a portion of the steam used to heat Building F will be supplied by the thermal energy recovery plant.

The present University incineration plant consists of two nominally rated 50 ton per day movable grate incinerators. The incinerators are equipped with over-fire and under-fire air, primary and secondary combustion chambers, and temperature sensors located in the secondary combustion chamber. A smoke indicator is located at the top of the 200 ft. stack. Presently, one of the two incinerators is operated six hours per day, five days per week, alternating units to allow for cool-down and clean-out of the unit. The incinerators are currently receiving 18 cubic yards per day from the Health Sciences Complex and 20 cubic yards per day of waste from other campus buildings. It is estimated that when Unit A is totally occupied, it will generate approximately 10 cubic yards per day, exclusive of cardboard (which is recovered). This total of 18 cubic yards per day is somewhat less than the 20 cubic yards per day now being brought to the University incinerator from other campus buildings. Thus, the incinerator could absorb, under its present operation schedule, the contributions of waste from Units A, B/C, and F by shifting other campus waste directly to landfill, or by operating an additional shift at the incinerator. Some of the solid waste from other campus buildings is now going directly to the transfer station, and from the transfer station to a Minnesota Pollution Control Agency licensed sanitary landfill.

There is a sufficient capacity for burning all animal carcasses during the period of time the incinerator is in operation. Since there will be minimal increase in capacity of animal quarters in the Health Sciences Complex resulting from construction of Unit F, there will be no change in the need for burning capacity of animal carcasses. If the present schedule of buring is maintained, shifting from burning of general campus waste to burning of medical facility waste will be helpful for the destruction of animal carcasses because medical/research facility wastes have a higher heat (BTU) content.

Wastes that are considered infectious or physically hazardous are separately collected in appropriately marked containers.

The University of Minnesota has a policy of preventing discharge of flammable and toxic waste to the sewers, including radioactive waste. A convenient service is provided within the Health Sciences Complex for routine collection of these wastes. The purpose of this collection system is to minimize impact on the water environment by preventing discharge directly to the sanitary sewer system.

Solvents and toxic wastes are disposed of using the best technology presently available. The procedures for collection, storage, transport, and disposal are critically reviewed on a frequent basis because of recent changes in procedures for management at the national, state and local levels. For example, at the local level the University's Department of Environmental Health and Safety and Physical Plant have been actively involved with the development of a recent report on "Hazardous Waste Generation, Twin Cities Metropolitan Area" which was prepared for the Metropolitan Inter-County Council for Minnesota Pollution Control Agency. The University provided input for the study, both in terms of the University's experience with the problem of hazardous waste management, and to assure that community systems be developed to accommodate the types of wastes generated at academic institutions, research facilities, and health care facilities throughout the Twin Cities Metropolitan Area.

Attachment V details the procedure for disposal of waste chemicals from laboratories. The materials which are collected are stored in specially designed rooms within the Health Sciences Complex (rooms designed with special ventilation, waste holding tanks to prevent discharge or spills to sewer, and fire-proof construction) before being removed from the building for transport to the site of ultimate disposal. Waste solvents and chemicals (where feasible) will be disposed of in a Minnesota Pollution Control Agency licensed incinerator operated by Pollution Controls, Incorporated. In the past, some of the waste chemicals and shock sensitive materials (after being detonated) were buried at a carefully monitored burial site at the University's Rosemount Research Center at Rosemount, Minnesota. Seven wells and several suction lysimeters have been installed at the site to routinely monitor ground water quality. To date, there has been no indication of contamination of ground water (water table at approximately 60 feet) resulting from the analysis of water samples taken from water table wells. Future plans for management of toxic wastes to further minimize the impact on the soil environment, include storage and reprocessing of chemicals for recycling either within the University or a larger community system. Materials from Unit F will enter this recycling system.

Attachments VI and VII give further information relating to handling of shock sensitive materials and the pickup procedure for hazardous chemical wastes.

In relation to radioactive wastes, Unit F will generate some materials requiring "the storage of contaminants when their ultimate dissolution is not part of the proposed action." This is necessary since much of the radioactive liquid and solid waste is collected in laboratories in special labelled containers for temporary storage and ultimate disposal by an Atomic Energy Commission (AEC) approved contractor. Much of the detail of the procedure for radioactive waste handling is included in Attachment VIII. Radioactive wastes are frequently removed from the University Health Sciences area to a temporary storage facility in an isolated area at the University of Minnesota Rosemount Research Center. This facility is a brick building, 36 feet long by 19 feet wide, by 50 feet high, protected by a Cyclone fence, and posted in accordance with Title 10, Part 20, Section 20.203 of the Federal Regulations. All procedures for storage, transport and disposal of radioactive waste are reviewed and monitored by the Department of Environmental Health and Safety Health Physicists.

In terms of impact on the environment from the release of radioactive waste, the Health Sciences Complex presently uses a fraction of a percent of available dilution capacity in sewage, based on discharge limits established by the Atomic Energy Commission. The air-borne release from the University incinerator is between 10% and 20% of the Maximum Permissible Concentration for Air, using the conservative assumption that all radioactive material incinerated goes out with the stack effluent. The ash from the University incinerator contains between 20% and 80% of the Maximum Permissible Concentration for Water, using the conservative assumption that all radioactive material incinerated remains in the ash. The ash is buried at a Minnesota Pollution Control Agency licensed sanitary landfill in compliance with Atomic Energy Commission Regulations for Burial of Solid Radioactive Waste. The University Health Physicists carefully monitor for change in quantities of radioactive waste, to determine that concentrations of radioisotopes are not allowed to exceed the level as specified by "AEC Regulations for Control of Radiation Exposure to Individuals in the General Public."

The other possible impact of the discharge of radioactive materials would be by air exhausted from radioisotope hoods. University policy is to separate air intakes from air exhausts by a distance of 100 feet. In radioisotope laboratories there is also a policy to provide for filtration of air from radioisotope hoods where necessary, and disposal of filters in accordance with radioactive waste disposal procedures.

Attachment IX gives a general overview of the radioactive waste handling procedure for the University and Attachment X provides a detailed description of determination of discharge of radioactive materials from the University incinerator as a result of incineration of low level radioactive materials.

Compliance

It is the University's policy to comply with local, state or federal statutes, standards, or regulations that pertain to pollution. These include the regulations of the Minnesota Pollution Control Agency for Air Quality, Solid Waste and Noise (as the latter standard evolves under the direction of that agency) and standards pertaining to medical care facilities of the Minnesota State Department of Health. Also, there will be compliance with the local regulations including the "City of Minneapolis Noise Control Ordinance," and "Metropolitan Sewer Board Regulations" and compliance with appropriate Federal regulations, including the "Clean Air Act," the "Federal Water Pollution Control Act," the "New Source Performance Standards for Steam Generators and Incinerators," the regulations of the "Occupational Safety and Health Act," and the regulations of the "Atomic Energy Commission."

POPULATIONS

Human Populations

In this instance the population considered is the total Metropolitan area consisting of seven counties and approximately two million people. This meets the criterion that a "human environment shall in no instance be less than 160 acres." It is concluded that further environmental consideration will not be required in regard to this action because the proposed project will not: 1) bring about more than five percent change in the density of human population; 2) bring about significant change in the distribution of human population; 3) bring about change in the age characteristics of the human population; 4) bring about a more than five percent change of density in the temporary human population (school year and vacation time populations); 5) bring about an identificble genetic change in the human population (because of careful control of the use of diagnostic and therapeutic radiation dose); and 6) create a change in the genetics of human population (there is no projected research in genetic engineering within this facility).

To address the specific problem of congestion in a smaller 297 acre area, the Minneapolis East and West Bank campuses, the completion of Unit F will not bring about a change of more than 5% in the transient population of the human environment. Considering the projected increases of Health Sciences students, faculty, and civil service research support personnel in reference to the current 50,000 per weekday population, the total impact will be an increase of less than 1%.

Animal Populations

The only animals related to this project are those used for research purposes. The animal quarters proposed for Unit F are minimal. It is intended that there will be the same general diversity of species within the animal population of the new quarters as will be present in the Research Animal Hospital to be located in Unit B/C. According to a June, 1970 report, prepared by staff of the University Department of Environmental Health and Safety, entitled "Ventilation and Lighting Survey of Animal Housing Facilities in the University Medical Complex" it was concluded that ventilation for the animal rooms in the Mayo Memorial Building and in parts of Diehl Hall is inadequate, and also the lighting levels within these buildings fall below recommended levels. Their recommendations will be taken into consideration in the planning of the new facility.

Other than the up dating of existing animal quarters, the project will not create any changes in population density of animals in their natural habitat or create any changes in the behavior patterns of animal populations. Animals used for research are excluded from the environmental analysis provisions relating to genetic changes in animal populations.

Plant Populations

In regard to plant populations, the project will not create any long-term change in diversity of species, long-term increase or decrease in population density of individual species within natural habitats, or create any identifiable genetic change in plant populations.

Compliance

The University operates its animal quarters under "Policy and Procedure for Animal Care and Use at the University of Minnesota," a policy which was developed and approved by the "All-University Animal Care Committee." This policy has also been approved by the University Senate Committee on Research and the Board of Regents. Attachment XI is a copy of this policy and procedure. Note that Item No. 10 also specifies that "the construction and use of housing, service, and surgical facilities will meet those standards described in the publication, "Guide for Laboratory Animal Facilities and Care," Public Health Service Publication No. 1024, or as otherwise required by the United States Department of Agriculture regulations established under the terms of the Laboratory Animal Welfare Act (PL 89-544) as amended December 24, 1970." The Director of the University Department of Environmental Health and Safety serves as a member of the All-University Animal Care Committee, and thus is in a position to review the environmental impact of changes in animal use.

SERVICE

As a result of this project there should be no complete disruption in any of the services of food, water, power (including gas, coal and oil), shelter, sewerage, solid waste disposal, or health services. Response to health service should be enhanced by completion of the proposed facility.

As with the construction of any new facility, there will be some alteration in the use of basic services. For Unit F, this will be minimal. It is obvious that the construction of this facility will not create a change of more than 5% in the capacity of the electrical system serving the entire human population of the TWin Cities Metropolitan Area. To lessen the effects stemming from water and sewage needs, a new 16 inch water line has been installed to serve Units A, B/C, and F (see Attachment XII) and attachment XIII indicates public announcement of the construction of a new 24 inch sanitary sewer from Unit A to the main interceptor for the City of Minneapolis. The sewer line, which has been installed along with the construction of Unit A, was liberally designed to include capacity for Units B/C and F.

For information relating to quantities of waste generated, refer to the previous section of this report on "Pollution." The rationale for handling of the waste from this facility is discussed in those paragraphs. The small amount of ash from the University incinerator which is disposed of in a Minnesota Pollution Control Agency licensed sanitary landfill site will have negligible impact (less than 5%) on the remaining capacity of the solid waste disposal system serving the Metropolitan area.

Storm and sanitary sewage from the building is separate. The storm sewage is conducted to a 3 x 6 1/2 foot tunnel which extends for a distance of approximately four blocks to the Mississippi River. The storm tunnel is more than adequate to handle the added flow based upon a runoff coefficient of 0.9 and a peak flow of 6.0 cfs.

Consumption of gas will be negligible compared to the amount of gas consumed in the Twin Cities Metropolitan area. Steam from the University heating plant will be used for heating and air conditioning of Unit F. Boiler capacity for Health Sciences Phase I, which includes F, was installed at the time of construction of Unit A. The amount of fuel, which will be used for heating and air conditioning of the proposed building, is a small percentage of the annual use of fuels in the Twin Cities Metropolitan Area.

Although F will have an impact on energy use, consideration for minimizing this impact has resulted in a number of specific planning steps.

1) Large portion of building below grade with virtually no heat loss or solar load.

2) Precast exterior design of panels backed with insulation.

3) Minimal amount of glass in exterior wall surfaces.

4) Exterior glazed shadow glass of double thickness with air space.

5) Small roof area in proportion to building square footage.

6) Service cores at perimeter providing buffer zone between building exterior and occupied space.

7) Solar shading provided by building overhangs and projections.

8) Air handling systems designed with economy cycles for utilization of outdoor air for natural cooling and ventilation when conditions permit.

9) Pick up of heat from exhaust air and return of energy to incoming air.

10) Separate air handling systems for classrooms and lecture halls for operation in accordance with space utilization.

11) Central data center control of heating, air conditioning and ventilating system for Units A ,B/C & F to provide efficient operation with minimum manpower.

12) Utilization of central campus boiler plant steam supply, and central steam absorption chillers for air conditioning. Distribution of high pressure steam to main equipment rooms.

13) Maximum use of fluorescent and mercury vapor lighting fixtures, three lamps, two ballast design in lieu of incandescent, providing a two to three times power consumption advantage.

14) Distribution of power at 480 volts with lighting at 277 volts to maintain feeder sizes.

The proposed project should not create any change in the availability of food for our human population.

For the construction of Unit F, three University owned apartment units housing approximately 120 people will be razed. Considering an enrollment of students on the Twin Cities campuses of approximately 40,000, housing for 120 persons amounts to less than 0.5% of the total student population or far less than 5% of the total human population.

With regard to the physically handicapped, plans for the building have been carefully reviewed by the University's Department of Environmental Health and Safety to assure that they conform with the "State of Minnesota, Fire Marshall Department, Rules and Regulations Relating to Public Buildings; Providing Accessibility and Usability Features for Physically Handicapped Persons Pursuant to Minnesota Statute Sections 73.57 et. seq. as amended."

Other than the above general application of human services criteria, the specific application of these criteria do not apply because the facility does not directly provide for: care of aging, including facilities and home services; care of mentally retarded, including facilities; support for handicapped, including facilities, home care services and services designed as assist the handicapped to participate in modern society; educational facilities and services for students through age 17; or day care facilities for children below the elementary level.

Since the project is not designed to increase the number of people in the Twin Cities Metropolitan human population, it is not anticipated that there will be a change of more than five percent of the number of messages delivered on an annual basis, an alteration of more than five percent in the number of professional educators required to serve the population, nor will there be an alteration of more than five percent in the number of health professionals required to serve the population.

Although there may not be a transportation change of five percent for the Metropolitan area, there is need for a discussion of the impact of this facility as it generates more trips and the need for more parking facilities in a limited University area.

The scope of the project is such that it will not create a change of more than five percent in the remaining capacity of an existing transportation service.

The figures used illustrate actual 1974 and projected 1980 population statistics for the entire University Health Sciences Complex, which includes Unit F. Utilizing the projected 1981 population statistics, Table 1 illustrates parking space demand for the Health Sciences Complex, based upon the "parking standards" method, which best represents true demand.

Parking resources within and immediately adjacent to the Health Sciences Complex total 5,800 spaces. This represents an increase of 1,800 spaces since 1970 and 1971, for which accurate population and parking demand statistics are available. Given the change in the number of parking spaces, it is not possible to determine whether the 1980 Health Sciences parking demand will create a change of more than five percent in the remaining parking capacity. However, given a demand of 5,400 spaces per day, an excess capacity of 400 spaces per day will exist.

TAB'

TABLE 1

1979 PARKING SPACE DEMAND FOR HEALTH SCIENCES COMPLEX FROM "PARKING STANDARDS" METHOD

Category	1979 Population	Parking Adjustment Factor: Walk Trips	Parking Adjustment Factor: Auto Passenger Trips	Parking Adjustment Factor: Peak Accumulation Factor	Transit: Existing %	Transit: Usage Trips	1979 Pkg. Space Demand w/Existing Transit Usage
Faculty 1/	1071	150	-	-	2.0	21	900
Staff 1/	6938	375	1135	60%	4.1	170	2470
Student 1/	4758	1750	545	80%	8.8	335	1180
Inpatient	52 2/	-	-	-	1.7	1	51
Outpatient	365 2/	-	-	-	1.7	6	359
Visitor	804 3/ beds	-	-	-	1.7	2	132
Dental Patient	276 4/	-	-	-	1.7	5	271
TOTALS		2275	1680			540	5363

1/ 1979 parking space demand = (1979 population x peak accumulation factor) - walk trips - auto passenger trips - transit trips
2/ peak daytime accumulation as derived from 1970 figures provided by University Hospital
3/ assumed that one parking space needed per six beds at time of peak parking demand in area
4/ peak daytime accumulation as derived from average daily number of dental patients

Available transit ridership figures indicate that ridership to the Health Sciences Complex in 1971 was 1,168 round trips per day. From Table 2, projected 1979 transit ridership to the Complex is 867 one-way trips or 1,734 round trips per day. This represents an increase of 566 round trips per day over the 1971 figure.

Utilizing Metropolitan Transit Commission figures, illustrated in Table 3, for existing (1974) ridership on the only University oriented route, ridership (this includes ridership to the Health Sciences Complex) represents 70.3% of seated capacity. While the number of transit trips to the Health Sciences Complex is undoubtedly higher at the present time due to Health Sciences population increases since 1971, the increase of 566 round trips will be used to project what effect the entire complex, of which Unit F is a portion, will have on remaining transit capacity. Adding the 566 trips to existing ridership figures, ridership increases to 75.0% of seated capacity, an increment of 4.7%.

While existing transit service to the University and the Health Sciences Complex is somewhat limited, the recently completed University Area Transit Study would help rectify this situation. The study was somewhat unique in that it was a joint venture of the University of Minnesota, Cities of Minneapolis and St. Paul, and the regional and state agencies involved in transportation planning, and the United States Department of Transportation.

The final report from the study has been approved by the Residential Advisory Committe, the Institutional and Commercial Advisory Committee meeting with the Technical Advisory Committee, the Project Management Board, the Transit Development Committee of the MTC, and the Metropolitan Transit Commission. It is currently being reviewed by the Urban Mass Transportation Administration of the United States Department of Transportation. See Attachment XIV.

Of particular importance to the Health Sciences development program of the University of Minnesota is the transportation planned for the immediate vicinity of Station #6, adjacent to the Health Sciences Complex. This station will accommodate several bus routes, the inter-campus guideway system, and the region's automated transit system when it is developed. The last two will be designed to accommodate the handicapped in accordance with state requirements.

The addition of Unit F will not necessitate any alteration in points of service delivery, thus it will not change access to a transportation service for more than five percent of the population it is designed to serve by altering the point of service delivery.

No specific systems or services will be altered as a result of the Unit F project, thus there will be no change of greater than five percent in the real cost of transportation.

TABLE 2

1979 DAILY TRIPS BY MODE TO HEALTH SCIENCES COMPLEX

		Existing Transit Usage			
Category	1979 Total Person Trips	Transit %	Transit Person Trips	Auto Person Trips	Auto Vehicle Trips
Faculty	1860	2.0	37	1823	1250
Staff	4270	4.1	175	4095	2800
Student	6750	8.8	595	6155	4200
Other	3560	1.7	60	3500	2400
Totals	16,440	5.0%	867	15,573	10,670

TABLE 3

Route 16 Capacity Downtown Minneapolis - U of M
Load checks taken at 7 Corners

6 a.m. - Noon, January 31, 1974

	Trips	Actual Load	Seated Capacity 47 Pass.	Standing Capacity 60 Pass.
Eastbound		2534	3055	3900
Westbound		1215	2914	3720
Noon - 6 p.m., Average of Load 1-28, 29, 30 & 31--74				
Eastbound		1455	2444	3120
Westbound		3225	3572	4560
TOTAL				
Eastbound	117	3989	5499	7020
Westbound	138	4440	6486	8280
GRAND TOTAL	255	8429	11,985	15,300

Could expand load 30% before reaching seated capacity.

HUMAN VALUES

The property is not known to be listed in the National Registry of Historic Places or the National Landmark Registry or any other similar local or state version thereof. The area proposed to receive Unit F is already urban and developed, and will have no direct effect on existing wildlife, fish or marine life; therefore, there could be no effect on individual members of species identified on the Endangered Species List or any similar list maintained by state or local government.

The addition of Unit F to Unit A will enhance the visual environment of the Health Sciences Complex.

The complex of new and remodeled existing buildings comprising the Health Sciences Facilities is the Architect's response to the University's goal of physical and curricular integration of the Health Sciences units with each other and the rest of the Minneapolis campus of the University.

The problem as defined by this goal was to develop a high density building system on a tight urban site with strong relationships to major existing facilities. This system needed to respond to the initial phase of expansion as well as to the continuing need for growth and change inherent in health sciences units.

The Architects initial effort was to develop a master plan which provided for short and long term expansion and responded to the integrated relationships called for in the program. This master plan serves as a framework for growth by establishing the major paths of circulation knitting together new and existing buildings.

The units designated by the master plan to be housed in new construction were analyzed for common systems criteria. These criteria generated one building system which, with appropriate variations, could respond to the requirements of teaching and research labs, dental clinics, hospital outpatient clinics, offices, classrooms, and auditorium. And in addition, could provide a high degree of flexibility and expandability.

As a three-dimension physical statement the building is a framework which is filled as space is required. The strongest visual elements of the frame in this case are the core element, stairs, elevators, and service cores, which are 12'4" square and are spaced 49'4" apart in two directions.

Depending upon the space requirements of the various floors the exterior envelope is located at (1) the back face of the cores, (2) flush with the front or, (3) cantilevered 12'4" in front of the exterior core face. The result is a highly articulated and interesting one.

The vertically introduced by the core elements is balanced by the horizontal lines created by continuous window bands. These bands are particularly evident where the envelope of the building cantilevers out from the face of the cores. As seen in the enclosed model photographs the number of levels comprising a cantilevered projection corresponds to the overall height and mass of the particular unit.

The massiveness of Unit A as an isolated entity will be softened by the addition of Units B/C and F.

Unit F is an extension of the scale of Unit A but greatly diminished in height. The resulting composition from low to medium to highest massing we feel is a harmonious one.

Due to the fact that the new development is of a much different scale and concept than the existing plant it was decided rather early to depart from the traditional brick masonry construction of adjacent buildings. Exposed aggregate pre-cast concrete panels were chosen for the envelope, the color of which relates to limestone cornices and banding on existing buildings. Plazas surround the new construction and are paved with brick resembling that of the adjacent buildings.

The primary public circulation level for the Complex is the Floor 2 Concourse, one level below grade. This level is reached in numerous points along its length by various exterior and interior stairway and escalator spaces, which also admit light to this level. All major assembly, admission and lounge facilities are located off this concourse. Exterior materials are used i.e. exposed aggregate concrete cladding on cores and brick pavers on floors to create an extension of exterior treatment of the interior "pedestrian street." Also, the treatment will help the visitor to understand the framework concept of the building.

An existing church located on the site, which in the 1920's won an architectural design award, is retained and will be incorporated into the total landscaping plan. Thus, old will be integrated with the new which will be advantageous to both.

Due to the tremendous demand for space in the complex almost all open spaces have occupied space below them. Great care was taken, however, to provide trees on these plaza areas by integrating tree planting pockets into the plaza structure. The softening and humanizing effect of the plantings in conjunction with seating areas was judged by the Client and Architects to be well worth the expense involved.

Several procedures will be taken to minimize the environmental effects of construction. The site will be fenced for security. Attempts will be made to minimize the effect of noise on the surrounding community and hospital patients. Pile driving, and other noisy construction, will be accomplished in accordance with the "City of Minneapolis Noise Control Ordinance" as published on October 25, 1972, which specifies that "no pile driver, jackhammer or other construction equipment shall be operated in the City of Minneapolis between the hours of 6:00 p.m. and 7:00 a.m. on weekdays or during any hours on Saturdays, Sundays and State and Federal holidays, except under specific permit from the Director of Inspections..." While the building is being constructed, equipment will be placed to minimize noise and substitution of less noisy construction procedures will be made where possible.

The contractor will be instructed to maintain a neat appearing and sanitary site. This will include prompt removal and disposition of construction waste. Construction waste will be hauled to a sanitary landfill licensed by the Minnesota Pollution Control Agency. Clean fill from the excavation may be used for reclamation projects. The contractor shall provide containment type toilet facilities for the construction personnel.

Because of the limited area of the site, there is very little potential for erosion during construction. Loose materials will be removed from the site promptly, and temporary stockpiling of loose soil will be in an area which is not in the direct pathway of runoff water. Prompt landscaping after the completion of the construction should further prevent any siltation. The contractor will be instructed to control dust from the project by wetting.

Non-asbestos type fire proofing materials will be used to prevent any exposure to workmen or the public.

Presently, negotiations are being carried on with the Lutheran church just adjacent to the proposed construction site to minimize impact on their parking facilities by providing alternate space within University parking facilities.

The apartment building located just adjacent to the site is owned and operated by the University and all occupants are on a month to month rental agreement with the University. Apartment dwellers are aware of the proposed construction.

The scope of the project is not of such a magnitude that it will decrease the availability of communications services for more than five percent of the population or precipitate a change of more than ten percent in the real money income of ten percent or more of the population, nor will the project create a change of more than five percent in the annual school enrollment on a national basis or alter by more than ten percent the number of individuals entering a profession on a national basis over a four year period.

ENVIRONMENTAL STANDARDS; PROJECT DESIGN AND DEVELOPMENT

The Department of Environmental Health and Safety in the University of Minnesota Health Service is the official agency responsible for surveillance of the physical environment. The Department is also the official representative of the University in relationship to the provisions of the Occupational

Safety and Health Act. This Department reviews all plans and specifications for new buildings and incorporates recommendations into the construction in both the internal and external portions of new structures. In this role, the Department will review the drawings in the latter stage of design to assure that features are incorporated to minimize disturbance to the surrounding environment. Also, the project will be reviewed to assure that appropriate environmental standards are met. Many of these standards have been referred to in the previous paragraphs of the envronmental analysis. Where there are not specific standards covering an environmental consideration relative to the project, subjective judgment of the Environmental Health and Safety Department team of specialists will be used to help determine the most appropriate course of action. The professional specialties included within this group are: occupational health, safety, general sanitation, microbiology, public health engineering, and health physics. Attachments XV and XVI describe this team.

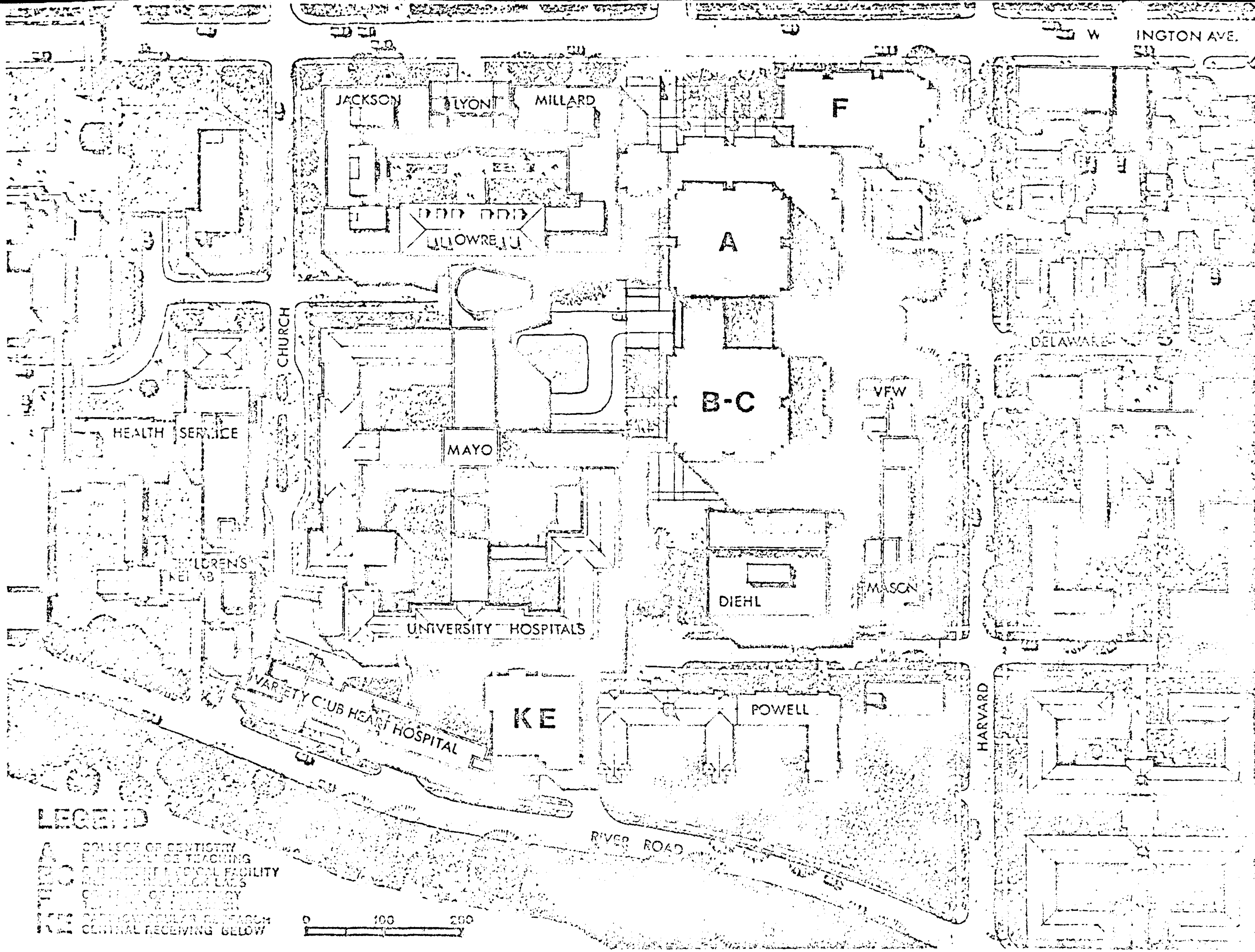
ALTERNATIVES TO THE PROPOSED PROJECT

Unit F is tied to a six year old Master Planning decision on Site location. The site for F evolved from an in-depth analysis that determined that the most ideal site, among those considered for the development of the Health Sciences Expansion program (related specifically to cost, efficient management and the desirability for interaction with other University programs and the major public and private investment in existing facilities, as well as environmental commitments), to be the area of the existing Health Sciences Complex. There are no significant adverse affects regarding the environment on these sites and, in fact, the present location will help to rectify many of the internal problems of a Health Sciences Center on a growing campus that has limited availability of land thus requiring critical decisions on land use programming.

ENVIRONMENTAL APPROVALS AND CONSULTATIONS

Many of the matters, including environmental consultations, have already been discussed in previous paragraphs as they relate to the consultations between the Minnesota Pollution Control Agency and the University regarding discharges from the incinerator and heating plant and the material contained in Attachment XII and XIII regarding hook-ups to sewer and water. In addition, the following agencies have reviewed the project at the termination of the design-development stage of the work: 1) State Fire Marshall's Office, 2) Minneapolis Fire Department, 3) Minnesota Society for Crippled Children and Adults, and the 4) Regional Office of Facilities, Engineering and Construction, Chicago, Illinois. All plans met with these agencies' approval.

Attachment I



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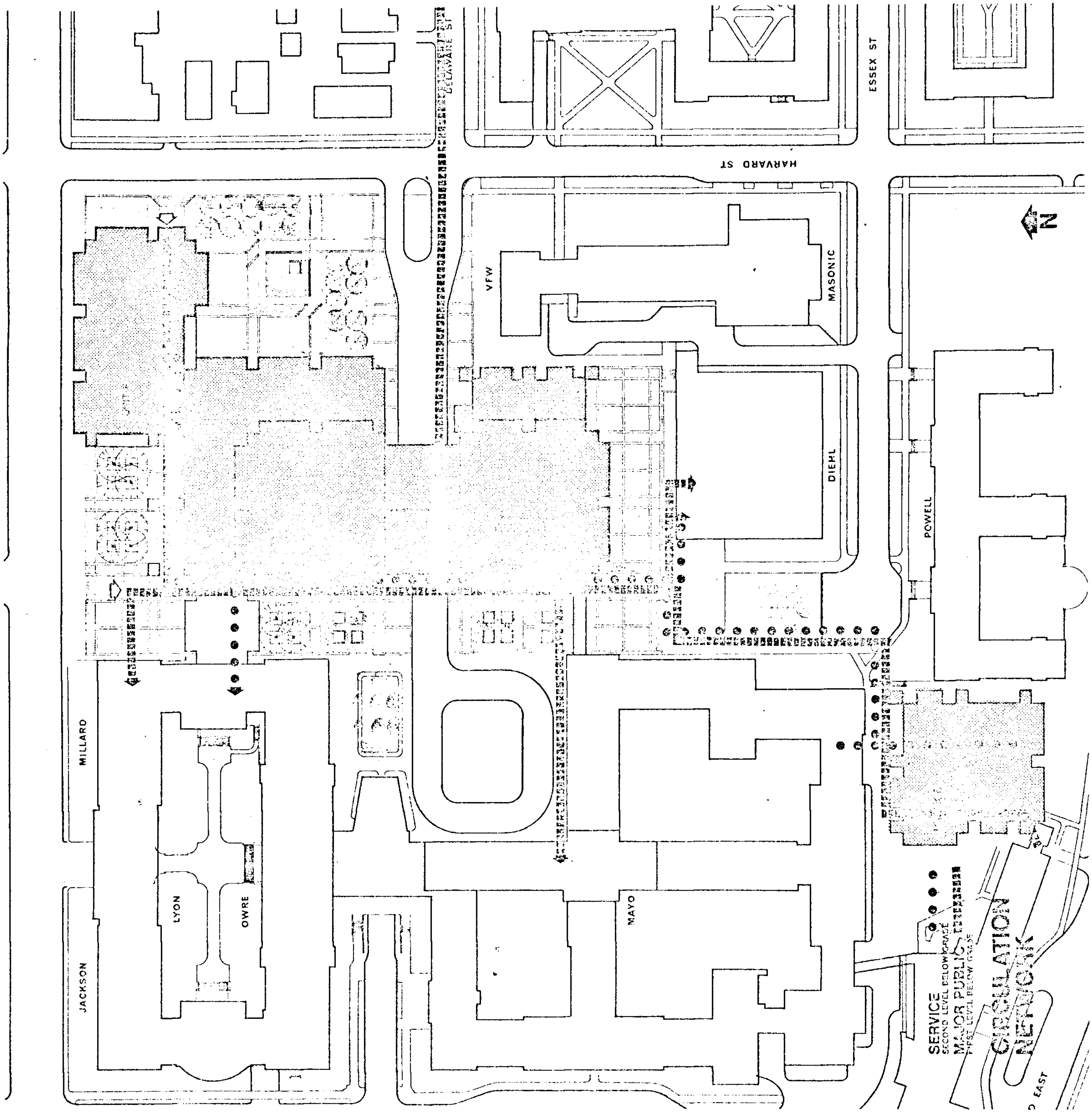
Attachment II

CIRCULATION NEWTWORK



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FIRST LEVEL BELOW GRADE
CIRCULATION NETWORK
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Attachment III

Design Flexibility

B. Design Flexibility

The complex of new and remodeled existing buildings comprising the Health Sciences Facilities is the Architect's response to the University's goal of physical and curricular integration of the Health Sciences units with each other and the rest of the Minneapolis campus of the University.

The problem as defined by this goal was to develop a high density building system on a tight urban site with strong relationships to major existing facilities. This system needed to respond to the initial phase of expansion as well as to the continuing need for growth and change inherent in health sciences units.

The Architects' initial effort was to develop a master plan which provided for short and long term expansion and responded to the integrated relationships called for in the program. This master plan serves as a framework for growth by establishing the major paths of circulation knitting together new and existing buildings.

The units designated by the master plan to be housed in new construction were analyzed for common systems criteria. These criteria generated one building system which, with appropriate variations, could respond to the requirements of teaching and research labs, dental clinics, hospital outpatient clinics, offices, classrooms, and auditoria. And, in addition, could provide a high degree of flexibility and expandability.

The building system employs a module of 12'-4" x 12'-4" throughout the site area. Service towers 12'-4" x 12'-4" (nominal) are spaced 49'-4" apart in two directions creating a tartan grid which is broken in one direction by a pair of columns placed midway between the towers. A one way structural system integral with the service shafts has steel girders spanning the 24'-8" direction and steel trusses spanning the 49'-4" direction (see Building Systems Framework Isometric and Dimensional Characteristics Diagram). Building services are distributed vertically through the service shafts and horizontally through the depth of the floor construction. The frequency of the service towers allowed a minimum of 4'-4" floor depth which is divided into separate strata for power and communication, mechanical, plumbing, and lighting. In general, for the entire complex, partitioning stops at a totally accessible continuous ceiling plan 9'-0" above the floor permitting the services above to be distributed without interference. Typical floor to floor height is 13'-4".

All sub-systems were developed and designed to accommodate the criteria generated by the program functions. A detailed description follows of several sub-systems which will establish the degree of thought that has gone into the development and coordination of the various sub-systems resulting in the overall building flexibility.

SUPER-STRUCTURE:

Typical floor slab construction is a composite cellular steel deck with a lightweight concrete topping. The selection of this floor construction is based on the economies inherent in the lightness of the floor itself as well as the supporting steel framing and foundations. The system provides electrical raceways within the floor construction both for present and future needs and provides the required 2-hour fire rating without the need for additional fireproofing on the under-side of the deck.

Open-web trusses are provided as floor supporting members to provide maximum flexibility for lateral distribution of the mechanical and electrical systems between the floor slab and ceiling below.

CEILING SYSTEM DESCRIPTION:

The ceiling system will facilitate a degree of planning flexibility equal to that afforded by the structural and mechanical system. The ceiling is conceived as a continuous suspended plane extending from exterior wall to exterior wall under which partitions can be located and relocated as necessary. Above the ceiling ducted mechanical services can be arranged and rearranged as required without interference from walls or other vertical barriers.

To accomplish this the ceiling has to embody the following characteristics:

1. The suspension system must be capable of supporting the head of all partitions and door frames and provide adequate lateral stability without additional bracing. Walls must be attached and detached without damage to the ceiling. Although most walls occur in modular locations, attachment at random locations must be possible.

2. The suspension system must provide a framework in which light fixtures, air supply and return elements, sprinklers, smoke detectors, speakers, laboratory service columns and infill panels can be located and rearranged in various combinations.

3. The ceiling must offer architectural characteristics suitable for small intermediate and large areas.

4. The ceiling must be accessible to allow routine maintenance and rearrangement of mechanical equipment at any location above the ceiling.

The proposed ceiling system is composed of continuous service strips and of infill. The service strips are oriented in an east-west direction and are located 6'-2" o.c. at the quarter points of the 12'-4" architectural grid. The infill closes the space between the all purpose strips and provides for access to the plenum and acoustical separation of rooms.

The service strip furnishes the location for all mechanical service penetrations in the ceiling system. It is made up of alternating 4'-0" fluorescent light fixture locations and 2'-2" service panel locations. The modular locations of a 4'-0" fluorescent fixture is centered on the quarter points of the architectural grid but such a fixture must be relocatable at any point in the strip to accommodate non-modular rooms.

The service panel provides locations for sprinklers, smoke detectors, speakers, laboratory service columns and down lights.

Linear supply air handling elements are located as required, perpendicular to the service strip astride the cross runners with point returns located as required at the service panels.

In order to insure that partitions can be freely moved without unnecessary difficulty or damage to the ceiling system mechanical services passing between partition and plenum above are minimized. Plumbing fixtures located in areas not subject to change, are loop-vented underfloor. We recommend low-voltage switch legs be used in these areas. In areas subject to extensive future change, piped services to laboratory benches shall be fed down from the plenum space in umbilical chases.

Detailed study of code requirements regarding fire rated walls indicates that each level be divided by only one partition which must interrupt the suspended ceiling plane. In each case the penetrating wall has been chosen as being the one least likely to be relocated.

PARTITIONING SYSTEM:

The partitioning system achieves the degree of economy and flexibility at the planning level provided by the basic mechanical and structural systems.

The total project was studied to find the basic sets of functions to be served by partitioning systems. Seen in conjunction with the ceiling system, the basic approach to the partitioning system is that it should be floor to ceiling light-weight space division. The partitions should be removable without damaging the floor or ceiling and without interrupting the activities in adjoining spaces. In this approach, doors and glass are treated as panels in the partitioning system and attached at the ceiling and floor in the same manner. The partitioning system must be locatable according to the module developed by the ceiling system - and the mechanical services provided by it, but it also must be able to adjust to non-modular conditions when functional requirements necessitate it. Prefabricated cold rooms, freezers and the like will be used and the partitioning system must accept them. There will be several spaces which require R-F shielding and partitioning systems must be able to provide this.

Several alternatives for each required basic type were proposed and studied. The cost of each proposal was compared to the requirements for adequate sound isolation, flexibility, durability and the particular requirements of each type. Resulting from this study a selection was made.

1. Gypsum plaster on gypsum lath screw attached to channel studs is proposed as the basic system on Floors 1 through 4. These floors contain most intensive teaching functions by large numbers of undergraduates, and therefore are subject to rather infrequent change.

2. Drywall on channel studs is proposed as the basic system for the laboratory and office functions located on Floors 5 through 7. These functions will require constant rearrangement of plan and will be used by a limited number of staff and graduate personnel.

3. Fireproof gypsum paneling is proposed to achieve the required fire rating around the floor to floor penetrations at stairs, mechanical cores, and elevator shafts.

4. Masonry is proposed for two applications:

   a. Masonry with acoustic treatment will be used for the auditoria.
   b. Both finished and unfinished masonry is proposed on mechanical floors and the animal room complex on Floor B, B1, 1.

In areas of high humidity and/or where a high degree of cleanliness is required, a glazed coating is proposed such as the animal room complex or the manufacturing suite. This application may be used on plaster, dry wall and masonry.

CASEWORK:

The flexibility afforded by the structural/mechanical system, interior partitions and ceilings will be matched by the system of casework. Elements will be dimensionally coordinated and capable of simple rearrangement to suit changing needs. The system used is the suspended or cantilevered type.

Dimensionally there has been a concerted effort to standardize the casework components. Typically units are either 2'-0" or 4'0" wide. Unit types are readily interchangeable without expensive modifications associated with floor mounted casework.

Work stations have been standardized by dimension as well as by services provided therefore are not bound to one discipline.

Attachment IV

Title Opinion

UNIVERSITY OF MINNESOTA
TWIN CITIES

Office of the University Attorney
330 Morrill Hall
Minneapolis, Minnesota 55455
(612) 373-3446

March 29, 1974

Regents of the University of Minnesota
Fourth Floor, Morrill Hall
Minneapolis, Minnesota 55455

Attention: Duane A. Wilson, Secretary

Re: Title Opinion
Health Science Expansion - Unit F

Gentlemen:

I have investigated and ascertained the location of the site or sites, rights-of-way, and easements being provided by the applicant for the facilities in its application for Federal Aid identified above to be constructed, operated and maintained thereon, described as follows:

All of the northerly 187.75 feet of "Barney's Subdivision of Block 30" City of St. Anthony as on file in the office of the Register of Deeds, Hennepin County, Minneapolis, Minnesota, lying south of the southerly right of way line of Minnesota Highway #12.

I have examined the records of ownership of said sites and the applicant holds fee simple title, free and clear of all liens and encumbrances except for the following:

The alley adjacent to the westerly property line of said Lots 1, 2, 3 and 4 which will be vacated.

The encroachment above ground elevation North of the South line of Washington Avenue, also known as Minnesota Highway #12. The easement for this encroachment is being obtained by the Minnesota Highway Department.

March 29, 1974

Regents of the University of Minnesota
Page Two

In my opinion, the applicant has and will have upon completion of vacated alley and air rights, sufficient legal interest in the said site, rights-of-way, and easements to permit the construction of such facilities thereon and to permit the operation and maintenance of such facilities thereon by the applicant for not less than seventy-five years from the date of the application.

Dated: March 29, 1974

R. JOEL TIERNEY, Attorney at Law
330 Morrill Hall
University of Minnesota
Minneapolis, Minnesota 55455

Attachment II

Disposal of Waste Chemicals

SAFETY STANDARD
DIVISION OF ENVIRONMENTAL HEALTH AND SAFETY
UNIVERSITY HEALTH SERVICE

Disposal of Waste Chemicals

This Standard applies to all chemical waste from University of Minnesota Laboratories.

I. Flammable Liquid Waste

A. The first disposal method, acceptable for all types and quantities of flammable liquid waste, is to return such waste to the original container in which the chemical was received from the Chemical Storehouse, and request that this be picked up by Physical Plant for final disposal. The individual laboratory should properly label and safely package the waste for truck transportation. Plant Services will advise of exact pick-up dock or area and time of pick up. The laboratory should take waste to this location on the day of pick up.

B. Small quantities of water miscible flammable liquid waste, not in excess of one liter, can be diluted and poured into the laboratory sink. This procedure requires pre-mixing to reduce to a 5% or less solution. One liter of liquid will require at least six gallons of water. The suggested procedure is, using a 5 gallon container, mix ½ liter of waste in 3 gallons of water, then empty into sink following this with copious amounts of water. Note: Adequate dilution is not provided by merely pouring undiluted waste into sink and flushing with tap water.

The following are some of the common water miscible flammable liquids which can be disposed of in this manner:

1. Acetaldehyde
2. Acetone
3. Acetonitrile
4. Allyl alcohol
5. Amyl alcohol - sec - n
6. Benzene or benzol
7. Butyl alcohol - n
8. Butyl alcohol - iso
9. Butyl alcohol - sec
10. Butyl alcohol - tert
11. Butylamine - n
12. Butylamine - iso
13. Crotonaldehyde
14. Denatured alcohol - 95%
15. Diethylamine
16. Diethyl cellosolve
17. Diethylene oxide
18. Diethyl ether
19. Di-isopropylamine
20. Dimethyl dioxane
26. Ethyl alcohol
27. Ethylamine
28. Ethyl ether
29. Ethyl formate
30. Ethyl morpholine
31. Isopropyl alcohol
32. Isopropylamine
33. Isopropyl cellosolve
34. Methacrolein
35. Methanol
36. Methyl acetate
37. Methylal
38. Methylamine - 30% solution
39. Methyl ethyl ether
40. Methyl ethyl ketone
41. Methyl formate
42. Methyl morpholine
43. Paraldehyde
44. Propyl alcohol - n
45. Propyl alcohol - iso

21. Dimethylethanolamine
22. p-Dioxane
23. Dipropylamine - iso
24. Dixolane
25. Ethyl acetate
46. Propylene oxide
47. Pyridine
48. Pyrrolidine
49. Tetrahydrofuran
50. Vinyl acetate

C. Certain other flammable liquids, although not water miscible, have relatively rapid rates of evaporation, and these can be allowed to vaporize if they are placed in an operating fume hood providing the quantity of all such liquids in the hood, at any one time, is not in excess of 100 cc. This method will depend somewhat upon what residue might remain after vaporization. If the residue is flammable or explosive, this method should not be used, and all such waste, regardless of the amount, must be returned to the original container. The method suggested is to place up to 100 cc of the chemical in a 500 cc beaker in an operating fume hood and allow them to vaporize.

The following list provides examples of some of the more common flammable solvents that can be handled in this way:

1. Carbon disulfide
2. Cyclohexane
3. 1, 2-Dichloroethylene
4. Ethyl chloride
5. Ethylidene chloride
6. Gasoline
7. n-Heptane
8. n-Hexane
9. Isopropyl ether
10. Methyl ethyl ketone
11. n-Pentane
12. N Propyl chloride

II. Chemical Waste (Other than Flammable Waste) Compatible With and Soluble In Water

Such chemicals--including acids, caustics, salts, and gases--should be diluted to a 10% or weaker solution. The diluted solution should then be poured into a chemical sink followed by a flushing with a copious amount of cold water.

III. Chemical Waste For Which There Are Known Neutralization Methods

Chemical waste--solid, liquid, or gas--should be first neutralized according to accepted methods to eliminate its hazardous properties. The neutralized waste--depending upon its physical state--may then be disposed of by pouring into a chemical sink, exhausting slowly into an operating fume hood, or placing in a non-combustible waste can. It is the responsibility of the laboratory to make every effort to dispose of waste in this manner before requesting other assistance.

IV. Non-Hazardous Chemical Waste

Such material, depending upon its physical state, may be flushed into a laboratory sink or exhausted slowly in an operating fume hood. If the waste is in the solid state and there is no danger of its reacting with other common waste, it may be discarded in the non-combustible waste container.

V. Other Hazardous Chemical Waste

Chemical waste not subject to neutralization should be properly labeled and safely packaged for truck transportation. The Division of Environmental Health and Safety, 373-3167, should be contacted and advised of quantity, hazardous properties and exact chemical names of such waste. They will advise of proper disposal.

Attachment VI

REMOVAL OF UNSTABLE OR SHOCK SENSITIVE CHEMICAL FROM UNIVERSITY BUILDINGS

Department of Environmental Health and Safety

RECOMMENDED PRACTICE

DEPARTMENT OF ENVIRONMENTAL HEALTH AND SAFETY

Removal of Unstable or Shock Sensitive Chemicals From University Buildings

Shock sensitive chemicals are those that are in themselves capable of explosive reaction or detonation and do not require either a strong initiating source or heating under confinement to detonate or explode.

1. Evaluate the degree of hazard, considering: normal instability, effects of aging, exposure to light, dehydration, etc.

2. Determine proper disposal procedure.

3. Determine proper personal protection relative to the hazard of the chemicals being removed, i.e., flak vests, additional eye and face protection, air supply needs, portable shield or barriers.

4. Shock sensitive chemicals are to be removed during non-working hours or on weekends, with all persons not directly associated with disposal out of the building. If the investigation of the chemical shows the necessity of immediate removal, building evacuation must take place along the entire disposal route in the building, i.e., if a building is constructed in wings, that particular wing housing the chemical shall be evacuated. Re-entry to the building will be permitted only after the "all clear" is given by authorized personnel.

5. All items considered to be highly hazardous shall be placed in the special vessel designed for explosive material prior to removal from the building and shall not be removed until at the disposal site. If the item will not fit in this vessel, other adequate confinement must be fabricated.

6. Chemicals that are readily capable of detonation, of explosive decomposition, or of explosive reaction at normal temperatures shall not be stored for disposal at a later date, but disposed of as soon as authorized personnel are available.

Attachment VII

HEALTH & SAFETY BULLETIN

March 1973 Vol. 15-No. 4

DIVISION OF ENVIRONMENTAL HEALTH AND SAFETY - UNIVERSITY HEALTH SERVICE

TELEPHONE 373-3167 EDITOR EDWARD J. DVORAK, Ph.D.

OSHA AT THE UNIVERSITY -

Personal protective equipment must be provided and worn if the work environment has the potential of injury from absorption, inhalation or physical contact with harmful concentrations of materials or agents. Such protective equipment shall not be used as a substitute for necessary engineering and administrative actions necessary to control a hazard.

Protective equipment shall be worn until necessary engineering and/or administrative controls have been accomplished. It should also be worn if procedures and activities do not lend themselves to such controls or if tasks are transient in nature. Protective equipment should always be available if required for emergency rescue activities.

Typical hazards requiring eye and/or face protection include sparks, harmful rays, molten metal, flying particles and chemical splash. Respiratory protection is needed where there are harmful concentrations of dusts, gases, mists or vapors and atmospheres that may be deficient in oxygen. Head protection is needed for such hazards as falling or flying objects, fixed or moving objects at head height and electrical conductors at head height. Foot protection should be provided where heavy objects may fall or be dropped or where there may be splash or molten metal or corrosive chemicals. Body protection i. e., gloves, aprons, boots, etc., is needed for such hazards as splash or contact with chemicals, molten metal, and harmful rays.

The seriousness of the exposure and the proper protective equipment will often require professional evaluation. The Division of Environmental Health and Safety is equipped to evaluate hazards and give advice regarding their seriousness and the proper means of providing effective protection.

HAZARDOUS CHEMICAL WASTE PICK-UP PROCEDURE CHANGE

Requests for pick-up of flammable liquid waste or other non-radioactive hazardous chemical waste should be made by calling 373-2320. Please be prepared to provide more information than you may have previously as to the type, quantity and condition of the waste. You will be advised of the packaging requirements and the date, time and location of pick-up.

As in the past, Physical Plant, Maintenance and Operations will provide this free pick-up service. The Division of Environmental Health is available for consultation regarding the potential hazards of waste chemicals.

Laboratory personnel and others in Health Sciences should call 373-4172, Laboratory Services, for pick-up of non-radioactive, hazardous chemical waste as they have in the past.

All requests for radioactive waste pick-up including liquid waste, should continue to be made from the Division of Environmental Health and Safety by calling 373-3167.

Attachment VIII

PROCEDURES IN THE HEANDLING AND DISPOSAL OF RADIOACTIVE WASTES

Radiation Protection

Division of Environmental Health and Safety

University Health Service
University of Minnesota
Minneapolis, Minnesota 55455

For Information on Radiation Protection call 373-3197

In case of Radiation Emergency dial "0" OPERATOR

PROCEDURES IN THE HANDLING AND DISPOSAL OF RADIOACTIVE WASTES

The Radiation Protection Program, Department of Environmental Health and Safety (DEHS), University of Minnesota, is concerned with all aspects of radiation health, one of which is radioactive waste disposal.

Radioactive waste is collected by Department of Physical Plant Maintenance and Operations under the supervision of the Radiation Protection Program, DEHS, to provide assistance and to insure uniformity in the safe handling and disposal of potentially hazardous radioactive materials. The four types of radioactive waste most commonly accumulated are: combustible solid waste, including paper and perishables such as animal carcasses; non-combustible solid waste, such as glassware and metal laboratory equipment; solvent waste such as benzene, alcohol and toluene; and water soluble liquid wastes. Special metal containers are available which are painted yellow and are appropriately marked with the universal three-bladed radiation caution symbol. Persons who have been approved by the University to possess and use radioactive materials must obtain appropriate waste containers for the work anticipated. The health physicist will order these containers under the budget number of the project director. The following are the guidelines and requirements necessary for safe handling and disposal of radioactive wastes.

1. Records must be kept by the approved user of the type and quantity of radioactive materials contained in each radioactive waste container.

2. Radioactive waste containers should be stored as close to the work area as possible to allow for convenient disposal of radioactive waste, and to minimize the possibility for spillage in transfer of waste to the containers. These containers must be stored in the laboratory and never in halls, corridors, stairwells, or other uncontrolled areas.

3. The containers must be kept covered at all times when not in use. When handling or transferring radioactive waste, a laboratory coat and disposable gloves should be worn.

4. Combustible and non-combustible solid waste must be kept separated in their respective containers. No liquids, even in bottles or other containers, will be allowed in the solid waste disposal container. Counting fluids and other liquid wastes must be poured into the liquid waste container, and the empty glass or metal container may then be disposed of in the non-combustible solid waste container. All such liquid transfer, especially the transfer of organic solvents which present a chemical toxicity hazard from inhalation, must be done in a hood that has adequate ventilation.

5. When the waste is collected, new plastic liners will be replaced in the solid waste containers. If this should be over-looked, please contact the health physicist for a plastic bag.

6. Powdered radioactive waste should never be placed in loose form in the waste container but should be disposed of only after having been placed in a bottle or some other type of sealed container.

7. No portions of animals or animal carcasses regardless of size shall be placed in radioactive waste containers in the laboratory. This type of solid waste must be kept refrigerated or frozen and the health physicist should be contacted for pickup. Animal droppings should be packaged and disposed of with the animal carcasses. Special cold rooms are provided throughout the Health Sciences Center where animal carcasses and animal droppings may be deposited in appropriately marked yellow solid waste containers provided in the cold rooms. Instructions and record sheets are provided on the wall of the cold rooms where type of radioisotope, activity disposed, and the project director's name must be recorded.

8. Care should be taken when pouring liquids into the liquid waste container to prevent spillage around the outside of the bottle. Water soluble and flammable solvent liquid waste must not be mixed, but must be put in their respective containers. Liquid waste containers must not be filled above two inches from the top of the container. This is required to minimize spillage in handling the liquid waste containers.

9. There are many special problems involved in the chemistry of liquid wastes. For example, the disposal of cyanides into acidic liquid waste will result in thr production of hydrogen cyanide, a very toxic gas. (Cyanides should only be disposed of in alkaline wastes.) Also special care should be taken in the disposal of tissue being digested in nitric acid. Oxides of nitrogen may be formed which can cause an explosion in the container, particularly if the cover has been put on tightly. It will be the responsibility of the laboratory director to insure that chemical reactions will not occur in disposed liquids.

10.. No solid materials should be placed in the liquid waste containers. Also, no radioactive waste may be poured or flushed down the laboratory drain. All liquid radioactive waste and the first rinsing from the container must be dumped in the liquid radioactive waste container. The washing from contaminated glassware and laboratory materials that have been rinsed once, may be released down the drain provided the sink where such materials are washed is designated and properly posted.

11. When the waste containers are near full, the health physicist should be notified by calling 373-3167 and the waste will be collected as soon as possible. At least three or four days should be allowed for the waste pickup. When a laboratory requests radioactive waste pickup, the approved radioisotope user must provide the health physicist with an accurate determination of the amount of each radioisotope contained in each radioisotope waste container. Radioactive waste cannot be picked up until this information has been recorded by the health physicist. Inform the health physicist if contaminated materials are too large to fit into the waste container. They will be collected separately.

If there are questions relative to waste handling, contact the health physicist. The above procedures are necessary to minimize hazards associated with the storage, handling and disposal of radioactive wastes.

Attachment IX

RADIOACTIVE WASTE DISPOSAL
AT A
LARGE UNIVERSITY

Reprinted from The Journal of The American College Health Association April 1969, Vol. 17 Number 4

Radioactive Waste Disposal at a Large University

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THE radiation protection program for the University of Minnesota operates as a part of the Division of Environmental Health and Safety of the University Health Service. The Health Service is the official health agency for the university and, consequently, has responsibility for the surveillance of the physical environment. The Division of Environmental Health and Safety is composed of a team of specialists in industrial health, sanitation, safety, microbiology, public health engineering, and health physics. All of these specialists work together to protect students and staff from the hazards of the physical environment.

Radioisotopes of various kinds have been used at the University of Minnesota since 1948. They are currently utilized by 225 approved users in approximately 325 laboratories on the Minneapolis, St. Paul, and Duluth campuses, and the Hormel Research Center in Austin, Minnesota, as well as at a number of University extension stations throughout the state.

In 1954, a full-time health physicist was employed to head an operating radiation protection program. Demands of the program since that time have made it necessary to employ two additional health physicists and several part-time students. In 1954, there were approximately 25 laboratories using radioisotopes in research at the University, which at that time had a full-time student body of 20,399 as compared to 46,088 in the fall of 1967.

The radiation protection program concerns itself with all aspects of radiation protection, including dosimetry, personnel monitoring, laboratory surveying, radioisotope laboratory design, waste disposal, and training of personnel. However, the purpose of this paper is to describe in detail the procedures used in the record keeping, handling, storage, and ultimate disposal of radioactive wastes which accumulate in a large university.

During the calendar year 1967, radioisotope central receiving in the University Health Service received approximately 1,500 shipments of radioactive material. The total activity contained in these shipments amounted to 81.94 curies, consisting of 33 different radioisotopes.

The majority of these radioisotopes have a short half-life and, consequently, most of the activity decays before actual disposal occurs. Listed below are a few of the frequently used short-lived materials and the quantities which were received during 1967.

Radioisotope	*Half-Life*	Quantity Received (*Curies*)
1. Xe-133	5.27 days	48.7
2. Mo-99	67 hours	15.9
3. I-131	8.05 days	2.78
4. Au-198	64.8 hours	1.8
5. P-32	14.3 days	1.11
	Total	70.29

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Because of the decay loss of the radioisotopes mentioned above, the actual activity disposed of as radioactive waste is a small portion of the total activity received.

Of the various methods of disposal mentioned in this paper, the largest quantities of radioactive material are contained in animal carcasses and water soluble waste. The smallest quantities of radioactive material are disposed of in the form of noncombustible materials.

The quantity of radioactive waste disposed of by the university varies from year to year; however, it will always be far less than the quantity received because many of the frequently used radioisotopes have short half-lives.

Over the past 25 years, procedures and techniques for the safe handling and ultimate disposal of radioactive waste have been continually studied and refined. Despite the considerable amount of attention given this problem, no simple blueprint has been developed to cover all aspects of the radioactive waste disposal problem. In terms of volume and radioactivity, even a large institution such as the University of Minnesota can in no way be compared to the reactor industry, where annually it is necessary to process and dispose of vast quantities of fission product wastes. However, the handling and disposal of smaller amounts of wastes containing millicurie quantities of radioactivity present a considerable potential hazard to personnel who may come in contact with them.

The radioactive waste disposal program has grown and changed over the years, as do most systems in such a rapidly growing technological age. This does not mean that methods used in waste disposal a few years ago were wrong, but rather that methods used today result from continuous revision and updating of techniques of some years ago. Health physics programs are changing and, as new and better methods of waste handling and disposal are established, they will become a part of the operating health physics program.

The problems of handling, collecting, and disposing of radioactive waste, toxic materials, explosive chemicals, flammable solvents, and other hazardous wastes are becoming increasingly acute at this institution, as they are at most other large universities. The safety engineer, the industrial health engineer, and the health physicist are joining forces to develop standards and a mechanism for the collection and final disposal of all hazardous wastes which emanate from the various laboratories and other facilities on the University of Minnesota campus. This joint effort, however, will not be discussed in this paper.

This paper defines the scope of the radioactive waste problem at the University of Minnesota and explains the procedures and techniques which are currently in effect to handle and dispose of waste resulting from radioisotopes used in the diagnosis and treatment of disease and in research. See the waste flow chart, Figure 1.

A number of different types of radioactive wastes are generated in the clinical and laboratory areas of the University of Minnesota, including radioisotope contaminated patient waste; solid-combustible and solid-noncombustible waste; water soluble liquid waste; flammable solvent waste; animal carcasses; and effluents from radioisotope hoods in research laboratories. Along with the fact that these wastes contain radioactive materials, must also go the consideration of other hazards, including the toxicity and flammability of some of the solvents. Some wastes may contain nonradioactive carcinogenic materials which may complicate the procedures needed to insure safety in collection, handling, and disposal of the waste.

This paper cannot possibly cover all of these aspects of waste handling, but they are mentioned to caution the reader about the need for a total environmental health look at radioactive waste handling, rather than just a concern for the radiation hazards.

The University of Minnesota Policy and Procedures Manual for Radiation Protection, written by the health physicists, includes methods for the safe disposal of radioisotopes by the

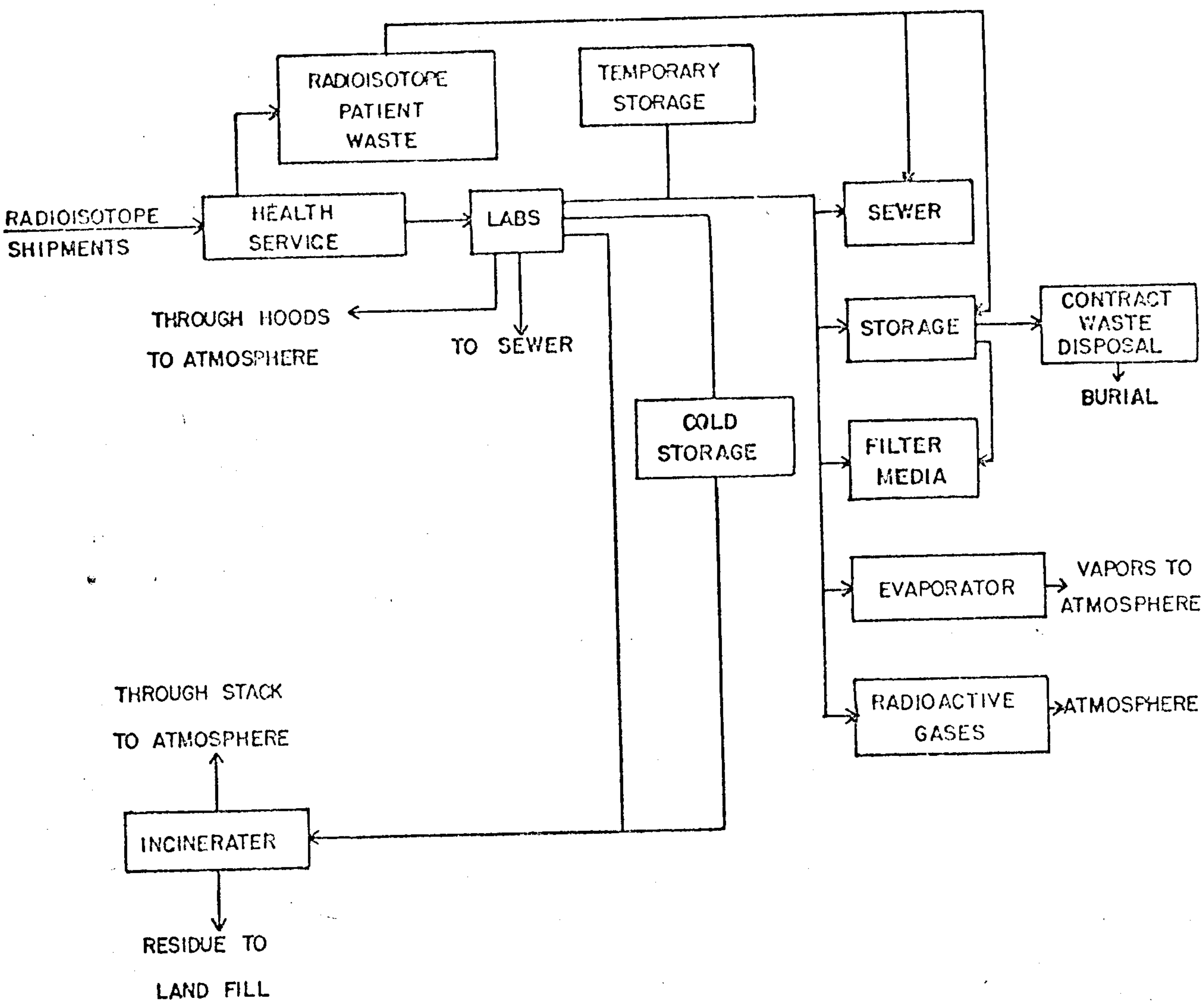

Figure 1. Waste flow chart*

user and the services provided by the radiation protection program.

All radioactive wastes are collected in the laboratory in yellow waste containers which are labeled, in magenta, to indicate the fact that the waste is either combustible or noncombustible, that is, flammable solvent, or water soluble. These containers are available from the university storehouse through the shops dispatcher, who writes the order for the containers and the work order for the paint and decals required. Specifications for these containers are written by the health physicist to insure uniformity in type of containers as well as color and markings, and to meet the standards established in Federal Regulations. All such containers are ordered by the health physicist, and charged to the user's budget, after a review of the radioisotope project with the project director. Records are kept in the health physics files of the location of all of these approved containers.

These approved waste containers are required in all laboratories where waste results from the use of radioactive materials. They are properly marked, as indicated above, to segregate completely radioactive from nonradioactive waste. The containers are never opened or their contents disposed of by building custodial

* On the line between Storage and Filter Media the arrow should be reversed and lead to Storage.

personnel, in compliance with written instructions to the Department of Buildings and Grounds, under whom they work.

Radioactive Solid Noncombustible Waste

Laboratory glassware comprises the largest volume of this category of waste. Counting vials and planchettes and radioisotope shipping bottles, as well as general laboratory equipment which cannot be decontaminated, make up the rest. Vials which are filled with counting fluid, such as toluene, are emptied into the liquid waste container before they are placed in a 20-gallon metal container for noncombustible waste, since liquids cannot be disposed of in the same manner as solids.

When the waste containers are full, the radioisotope user contacts the health physicist and requests disposal service. The user informs the collector of the type and quantity of radioactive material in each container.

Noncombustible wastes in a plastic bag are transferred in the laboratory from the metal laboratory waste container to a fiber drum prior to storage in the noncombustible waste storage facility. Radioactive material caution signs are placed on all such drums prior to storage. On the container is also posted the following: researcher's name, radioisotope, approximate quantity of activity, and the laboratory from which it was collected.

Waste shipping drums must meet the standards established by the Department of Transportation. Additional requirements may also be instituted by the commercial firms which provide the final disposal services. Consequently, care should be taken to store waste in approved containers to obviate the transfer of the waste to such containers prior to shipment.

The storage facility, used for temporary storage of radioactive waste, is located at the University Rosemount Research Center. This facility is a brick storage building, 36 feet long, by 19 feet wide, by 15 feet high, surrounded by a Cyclone fence and posted in accordance with Title 10, Part 20, Section 20.203, of the Federal Regulations. Stored waste is picked up periodically by a commercial waste disposal firm which transports it to an Atomic Energy Commission (AEC) approved burial ground for final disposal.

Radioactive Solid Combustible Waste

Absorbent paper is recommended for use in all areas where radioisotope spillage could occur. Such paper, along with rubber gloves and paper cartons, constitutes the greatest portion of combustible radioactive waste. Combustible waste contaminated with short half-life material (less than 30 days) is stored for decay to reduce the quantity of radioactive material which is burned in the incinerator. If the contamination results from longer half-life material, the combustible waste is stored prior to shipment to a commercial burial ground.

The plastic bag, which is always inserted in solid waste containers after each emptying, is tied shut at the top before the waste is transferred to the fiber or metal shipping container. External radiation hazards from such waste are minimal; however, contamination spread, as well as the airborne hazard to persons collecting the waste, can be eliminated by insuring that the waste is tightly sealed in plastic bags before this transfer is made.

Considerations have been given to baling contaminated paper to reduce decay storage space. The paper could then be incinerated, following a predetermined decay period, without special precautions. However, in order to do this in compliance with good health physics practice, the baler would need to be enclosed and vented. This would have to be done so that radioactive particulate matter released during this mechanical procedure would not produce an airborne hazard to the operator, or release contamination in the work area. The vented air stream would have to be filtered to prevent release of radioactivity to the outside air. Special procedures would also have to be established to load the baler and package the finished bales. The fire hazard involved in handling such combustibles would require special attention, as the particulate released in case of fire in the contaminated waste could defeat the hole purpose of the controlled waste handling program.

The cost of the above mentioned equipment alone would give reason for a very serious evaluation of this space-saving measure. One would also have to consider the manpower needed to operate such a facility, which would also be an added expense. Baling of radioactive contaminated waste paper is not a part of the waste disposal program of the University.

Radioactive Liquid Wastes

In the radioisotope laboratory, large quantities of liquids which contain radioisotopes may accumulate. These liquids may be contaminated water or water soluble solutions, or other liquids which present potential hazards because of their toxicity or their flammability.

The researcher stores liquid wastes in special three-gallon glass jugs which have a wide-mouth top and a wire handle. These jugs fit snugly into a protective metal container which has a metal cover. The protective metal container, which is painted yellow, has an appropriate decal to indicate the nature of the contents.

When the health physicist is called to provide waste pickup service for any type of radioactive waste, a required waste disposal card is filled out. On this card is listed the name of the approved user, the department, the laboratory location, the type of waste, the radioisotope, and the estimated activity in millicuries. This waste information is transferred to a master waste sheet as well as to the approved user's individual radioisotope waste sheet. The individual user's waste sheet indicates the quantity and type of radioisotopes ordered and received by the user, as well as all waste collected from that user's project. This record then is used to tally radioisotope disposition for each approved user.

Water Soluble Liquid Wastes

Water soluble liquid wastes are disposed of into the sewage flow through a disposal sink in either of two central liquid waste facilities. This sink is a flushing bedpan hopper under a ventilated hood which removes any contaminated aerosol which might be produced during disposal.

In these liquid disposal rooms are bottle washing facilities where waste bottles are washed to insure that noncontaminated waste containers are returned to the laboratory. The metal containers which house the glass bottles are also washed at this time to prevent transfer of contamination. Because some wastes may contain acids, protective clothing, such as rubber aprons, gloves, face shields, and rubber boots, are always worn when water soluble wastes are emptied into the disposal sink.

Permanent records are kept of the wastes which enter the sewerage system to insure compliance with Title 10, Part 20, Section 20.303d, that no more than one curie per year be disposed of into the sewerage system. The quantity of water available for dilution of radioactive waste at the university would allow for considerably more disposal based on the Maximum Permissible Concentration (MPC) method; however, at present it is not necessary to exceed the one curie limit at these facilities.

A considerable amount of nitric acid used for tissue digestion in the laboratory is disposed of in the above manner. Caution must be exercised when organic material and nitric acid are enclosed in a tight waste container, as oxides of nitrogen are likely to be produced. Not only are these gases highly toxic, but they can create a dangerous positive pressure in the waste container. Regurgitation can result when the waste bottle is opened, with the dangerous release of acid and oxides of nitrogen, which could cause serious injury to laboratory personnel or to persons collecting waste. It has been recommended that the organic material should not be disposed of in nitric acid until digestion is complete. This digestion should take place in smaller open containers in the hood. The waste container, in this case, should be kept in a ventilated hood and should not be kept tightly covered to allow for the release of accumulated pressure.

Certain water soluble radioative wastes may be introduced into the sewage flow through the individual sinks in radioisotope laboratories. These wastes, however, should not exceed a few microcuries of short half-life (less than 30 days) radioisotopes per laboratory per month. Disposal in this way should be done only following consultation with the health physicist. Contaminated liquids are poured into the waste container, including the first rinse water. After the initial rinsing of the test tube or beaker, it may be washed in the laboratory sink. All such waste sinks are posted with a three-inch square metal radiation caution sign wired to the sink trap. In case the sink should need the attention of a plumber, the plumber will note the sign and call the health physicist for a survey and evaluation of possible contamination of that sink.

Wastes contaminated with alpha emitters, as well as other highly toxic radioisotopes, such as Sr^{90}, are not allowed into the sewage flow. They are absorbed in vermiculite in a steel drum and shipped to a commercial waste disposal site. Arrangements are made by the health physicist to collect these special liquid wastes so that they are not introduced into the sewage flow. Project directors working with these highly toxic radioisotopes are made aware, before they receive purchase approval, of the need to handle the liquid waste with greater care and with closer cooperation with the health physicist.

Radioactive, Flammable, Organic, Immiscible Solvents

Though this heading seems overly descriptive, it is a title which adequately describes these types of wastes in relationship to the problems associated with their disposal.

If the solvent is flammable and immiscible, it cannot be disposed of into the sewerage system because of the explosion hazard it presents. If it is radioactive, it cannot be disposed of by burning, as is done with nonradioactive solvents at the University. Burning of radioactive, contaminated solvents requires special AEC approval as required by Title 10, Part 20, Section 20.302 of the Federal Regulations.

All radioactive contaminated solvents are collected in three-gallon containers, the same as water soluble liquids. However, the outer metal container for these materials is also labeled to indicate flammability. The three-gallon containers, which are collected on request throughout the University, are held in temporary storage in a metal building located outside of the University Health Service building. Periodically these containers are hauled to the Rosemount Solvent Evaporation Facility for disposal. This solvent evaporator contains removable trays lined with fiberglas into which the solvents are poured. The trays are housed in a metal enclosure four feet high by six feet square with openings on the sides to allow air to pass freely over the solvent trays for more rapid evaporation. These ventilation openings are under an overhang to keep out rain and snow which could inhibit the complete evaporation of the organic solvent. The solid radioactive residue remaining after the solvent has evaporated is placed in a container for the disposal of noncombustible waste. Only limited quantities of solvent can be evaporated in this type of facility, especially when the weather is not conducive to rapid evaporation. Because of the very limited quantities which can be evaporated with the present facility, and the upkeep costs of the equipment, this procedure is being discontinued.

In the future, contaminated flammable solvents will be stored in steel drums inside a second larger drum which contains vermiculite; this arrangement provides added safety in storage and transportation. These drums are furnished by a commercial waste disposal facility, which periodically collects and transports these solvents to a disposal ground. The handling and final disposition of the waste becomes the responsibility of the commercial firm once it has been loaded on their truck.

Because of the fire hazard associated with the pouring and storage of large quantities of flammable solvents, a special facility is being designed to meet both the health physics and the safety engineering standards for such a facility. In most cases the toxic and fire hazards associated with the handling of these materials present a greater potential personnel hazard than the radioisotope which is present in the solvent.

The new facility will provide a properly ventilated storage and transfer room for solvents, with approximately 20 air changes per hour. The air from this room will be ventilated through a stack to the roof. Because some of these flammable solvents are heavier than air, room vent ports will be located on the floor as well as in the ceiling of this room. During the process of pouring flammable solvents from the three-gallon laboratory storage container to the disposal drums, there exists the possibility of building up a static charge which could ignite these materials. As a precautionary measure, the floor will be made of a conducting material to equalize the potential between the storage container and the laboratory waste container, as well as the potential between the person doing the pouring and the storage drums. To reduce further the fire hazard in this building, which will also contain large quantities of temporarily stored solvents, an automatic CO_2 fire protection system will be installed to extinguish any fire which might occur. If the CO_2 system is activated, ventilation in the room will automatically be shut off so that the room will be held under a CO_2 atmosphere sufficiently long to insure complete fire control.

Incineration of Animal Carcasses and Other Contaminated Combustibles

The disposal of animal carcasses containing radioisotopes presents a number of problems in a radioactive waste disposal program.

Plastic bags are used to transport the carcasses from the research laboratory to the cold room where they are stored prior to final disposal. Properly posted cold rooms must be strategically located and contain properly labeled waste containers lined with plastic bags to hold all of the sacrificed animals collected between each routine pickup period. The radioisotopes in these animals are accounted for on a log sheet in the cold room. This record constitutes an accounting against the incineration license limits established by the AEC for the University incinerator. The log record includes the name of the approved radioisotope user, the type and quantity of radioisotope in the animals, as well as the laboratory from which they came. This information is kept on file as a record of the quantities of radioactive material in carcasses which are incinerated. The amounts indicated on the log are not the quantities injected or administered, but rather that quantity in the animal at the time of disposal. Animal droppings and contaminated cage bedding are also disposed of and logged in the same manner. The cold rooms themselves are posted in accordance with Federal Regulations.

Because of the AEC limits established on the incinerator, efforts are continuously being made to reduce the activity incinerated in animal carcasses. For example, rats which may contain millicurie amounts of short half-life radioisotopes can be kept in the freezer in the laboratory prior to disposal to allow for decay. This would obviously reduce the quantity of the radioisotope which would go to the incinerator when final disposal of the carcasses occurs.

The University Incineration Facility consists of two reciprocating grate stokers. Both units are of comparable size, with a loading capacity for each unit of 50 tons per day.

Grates are arranged in lateral rows, each overlapping its immediate forward neighbor, shingle like. Alternate rows are linked to a power source which reciprocates them forward and back across the faces of the intermediate or stationary rows. This moves the combustibles across the grate as burning takes place.

The combustion gases are conducted from the furnace to the 190-foot-high incinerator stack via a rectangular conduit 4 feet by 5 feet 9 inches, leading from the furnace area to the incinerator stack.

The two incinerator units are used alternately over approximately six-month intervals. This allows preventive maintenance and repair on one incinerator which is shut down while the other is in operation. Since both incinerators are of comparable capacity, it is assumed that the behavior of each is comparable to the other. Each incinerator is equipped with two forced air fans which deliver 8,500 cu ft of combustion air per minute. The larger of the two fans (7,150 cu ft per minute) delivers the combustion air supply below the grate; the smaller (1,350 cu ft per minute) supplies over-the-fire air. Each incinerator is also equipped with a gas jet to assist in animal carcass incineration.

Animal carcasses are collected by Plant Service personnel each morning and transported to the incinerator for burning after a consuming fire has been established. The animal carcasses are dumped onto the animal hearth through a manhole directly above. Contaminated combustible materials other than animal carcasses are burned on the moving grates because they are sufficiently combustible to be totally consumed before dropping off the end into the ash truck. Contaminated animal carcasses, however, are burned on an open top elevated hearth above and to one side of the moving grate area. Thus, the animals are exposed to the consuming fire from the grate as well as a gas jet burner directed to this hearth area. They are held in this hearth until completely consumed. After the furnace has cooled, the ash residue is dumped from the animal hearth onto the grate for removal to the waiting truck.

As a protective measure, dust respirators, approved by the U.S. Bureau of Mines for protection against toxic dust, are provided by Plant Services for incinerator personnel to be worn during ash removal. Periodic surveys of the incinerator have never given evidence of detectible contamination as measured with a portable Geiger survey meter with a thin-end window detector (1.4 mg/cm^2). These surveys are made by the health physicist on a spot-check basis.

Laboratory operations of many types lead to large amounts of low level radioactive wastes which are readily combustible, such as cleaning tissue, absorbent materials, gloves, rags, wooden articles, and plastic syringes. The logical step is to reduce the volume of such combustible wastes by incineration and dispose of the ashes by burial under health physics direction.

The total daily ash output from the incinerator facility is approximately 16 cubic yards, of which about one-half cubic yard comes from the animal hearth. Many research animals which contain no radioactivity are incinerated in the animal hearth, providing another dilution factor for the activity in the ash. The relatively small amount of radioactivity in the ash each day (a few millicuries) is therefore diluted by a large volume of nonradioactive ash. The dilution factor may be as high as 200 times.

The concentration of radioactivity in the total ash can be kept well below the concentrations prescribed for water, pursuant to Title 10, Part 20. The concentration of radioactivity in the effluent air stream at the stack exit can also be maintained within limits, pursuant to the above-mentioned code, based upon the dilution volume provided by air supply fans alone.

It was recommended by the health physicists that a record of velocity pressure of the stack gases be obtained, along with a record of the exhaust gas temperature. Arrangements are now being made through University Plant Services to incorporate such continuous monitoring equipment into the stack, along with a smoke detector to evaluate efficiency of combustion. This type of equipment will better describe the dilution volume by which limits can be set on quantities of radioactive material to be incinerated.

The health physicists appreciate a cordial relationship with the engineering supervisors of the Plant Services group of the University, and any digression from routine methods of waste disposal can well be attended by one of the health physicists according to strict radiological health objectives.

Maceration of Animal Carcasses

Maceration of animals prior to disposal into the sewage flow is being studied as a possible means of relieving the load on the University

Incinerator. There are problems associated with the mechanics of this procedure; however, the quantity of water available from the University for dilution in the sewerage system is considerable and, consequently, makes this method worthy of consideration.

Experimental work has been done by Moore and Fairbank on maceration as a means of disposal of dead poultry.[1] They considered the various principles of cutting, grinding, shredding, and shearing with respect to the heterogeneous nature of the macerated animal. Hart and associates found that meat grinding equipment does not work for maceration and that only partial success was achieved in using a simple hammer mill.[2] The only commercially available equipment that successfully handled bones, soft tissue, and feathers was a five horsepower commercial garbage grinder which required four pounds of water for each pound of waste. This system will work if the effluent is discharged directly to a sewerage system or some other liquid waste handling system.

However, in some instances there is a need or a desire to use a nonwater carriage system which requires dry maceration. First attempts at dry maceration made use of hashers (circular saw blades) which are used in the rendering industry. It was found, however, that the resulting pieces were too large to be disposed of into the sewerage system. This led to the development of a "chopper–type" machine which uses the concept of impact slicing, a combination of cutting and shredding. This machine uses a mower–type sickle blade for a chopping edge which is economical, rugged, and has a reasonable life. The maximum efficiency for maceration and the best result, with respect to a finely separated heterogeneous output, is obtained using a 28–inch blade rotor assembly which rotates at 3,500 rpm.

The resultant slurry obtained from the maceration of the animal carcasses may be disposed of by using the following methods: 1) dehydration and eventual disposal as solid waste 2) anaerobic digestion in holding tanks and eventual disposal as solid and liquid waste and 3) disposal by admitting the effluent into the sewerage system in a liquefied form.

The first two possibilities may be feasible, but are not practical at the University because of the extensive facilities needed for handling radioactive waste in this manner. Also, the problem of contamination throughout such a system could present a definite hazard to personnel and would make maintenance of the system much more difficult. The disposal of macerated carcasses directly into the sewerage would be the method preferred at the University of Minnesota. This would involve adding water to the effluent materials from the system and discharging it into a large volume of sewerage for dilution. This type of operation involves a minimum spread of contamination and less handling of the effluent.

Some of the disadvantages which arise from any high speed mechanical operation such as this, especially where radioactive material is involved, are as follows:

1. Maceration can cause the generation of an aerosol or airborne particulate material which, in the case of radioactive waste, would contain some of the radioactive material.

2. There would exist a problem of maintenance on such a machine, which will be contaminated when radioactive carcasses have been macerated. However, when maintenance is required, such as replacement of blades, provisions must be made for protection of personnel from the possible hazards of ingestion of radioactive contaminants.

Filtered Radioisotope Hoods

The last area of waste disposal to be considered in this paper deals with the release of

[1] J. A. Moore and W. C. Fairbank, Maceration for Disposal of Dead Poultry, Pub. SP–0366, Amer. Soc. Ag. Eng. (Davis, California: Agricultural Engineering, University of California).

[2] W. C. Fairbank, S. A. Hart, and W. W. Mitchell, Dead Bird Disposal, Pub. AXT–171, Agriculture Extension Service (Davis, California: University of California); and S. A. Hart and W. C. Fairbank, Disposal of Perished Poultry, *Proceedings of the Second National Symposium on Poultry Industry Waste Management*, University of Nebraska, Lincoln, Nebraska, May 1964.

radionuclides into the atmosphere through stack effluents from radioisotope hoods. It is not the purpose of this paper to discuss the design of radioisotope hoods or laboratories; however, it is felt important to mention the radioisotope hood in connection with radioactive waste disposal, since it is a facility which can concentrate radioisotope activity and release it to the environment if proper provisions are not made to remove the activity by filtration. The main purpose of a ventilated hood, however, is to protect the worker from the hazard of airborne radioactivity.

It has been a longstanding policy of the University Radiation Protection Program to encourage the construction of radioisotope hoods in new buildings or renovated buildings in which radioisotopes are likely to be used in research. A radioisotope hood should provide a filter system in the entrance to the stack; this system should include a pre-filter and a high efficiency (99.97% down to .3μ) filter to prevent the release of filterable radioisotopes into the atmosphere. All hoods in which radioisotopes are used at the University of Minnesota do not currently contain such filter housings. Because of this limitation, greater care and consideration must be given by the health physicist to the types of projects which may be performed in hoods without filters. Many projects use such low levels of activity that a filter in the hood may not be necessary. In installations with filter systems, supervision by a health physicist is provided when hood filters are changed by Plant Service personnel. Caution must be exercised because of the possible radioactivity of the accumulation on the filter. In addition, the air flow into the hoods must be checked periodically to insure that clogged filters are not restricting the air flow and consequently rendering the hood less effective. Contaminated filters are removed by putting them into a plastic bag. They are then stored prior to disposal at a commercial burial ground.

Summary

Radioactive waste disposal methods and procedures are continually being revised, and operating radiation protection programs must keep abreast of the latest developments.

There may be hazards associated with radioactive wastes other than just the radioisotopes, such as the flammability and toxicity of some solvents collected for disposal.

Radioactive waste from the University falls into five or six general categories. Methods and procedures for collection and disposal of wastes within each of these categories have been discussed. The greatest problems are confronted in the collection and disposal of animal carcasses and flammable and toxic solvents. The incineration of animal carcasses and other contaminated combustibles necessitates the continual evaluation of the incinerator effluent to insure control over the release of radionuclides to the atmosphere.

Though safe methods of handling and disposal have been discussed, it is strict compliance with such established methods that determines the quality of the radioactive waste disposal program.

Attachment X

Reprinted from the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION JOURNAL,
Volume 32, Number 9, September 1971

Disposal of Low-Level Radioactive Wastes at a Large University Incinerator

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The University of Minnesota incinerator is used for disposal of low-level combustible radioactive waste. Calculations have been made to determine the concentration of radioactive material in the air and ash effluent. Air dilution volumes are determined by continuous airflow and temperature monitoring devices. It is demonstrated that such an incinerator can be used to dispose of low-level radioactive waste within prescribed limits.

THE TOTAL MANAGEMENT of radioactive waste is a broad subject and is beyond the scope of this paper. The paper will deal only with one aspect of radioactive waste management—namely, the disposal of low-level radioactive wastes at a large University incinerator. The information presented may be applicable to other universities and institutions where a large incinerator is available.

According to Straub,[1] three concepts of radioactive waste handling widely used in waste disposal activities are: (1) dilute and disperse, (2) concentrate and contain, and (3) delay and decay. These three basic concepts have application in the incineration of radioactive waste, as follows:

1. Dilution and dispersal by release of volatile radioistopes and noxious gases along with the products of combustion into the exhaust volume of the incinerator.
2. Delay and decay by temporary holdup of the radioactive waste in storage areas reduces short-lived radioisotopes to levels which considerably decrease the radioactivity prior to incineration.
3. Concentration through reduction of bulk waste to ash residue and containment by storage in an ash-holding area prior to disposal in a landfill.

Disposal of low-level solid waste presents a considerable economic problem. The major expense of a waste disposal program is the service fee for shipment to and disposal of radioactive waste in an approved Atomic Energy Commission (AEC) burial ground. Through the process of incineration of low-level combustible radioactive wastes, the total volume of the solid waste to be transported can be greatly reduced. This reduces the total disposal cost. At the University of Minnesota a considerable savings is expected because incineration of radioactive waste is incidental to the primary use of the facility—that is, incineration of non-radioactive material.

The incineration of radioactive waste must be carried out within the accepted standards of good radiation health practice. Generalized waste disposal criteria have been developed by the National Committee on Radiation Protection and Measurements.[2] The principal criterion states: "Users of radioactive material shall release these materials only in such a manner that the radioactive material discharged, in combination with that discharged by other users, will not cause contamination of the

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environment which may result in a person or persons receiving an excessive radiation dose." According to AEC regulations, the average concentration of a radionuclide in air or water, as applied to individuals in the general public, should not exceed 10% of the maximum permissible levels recommended for radiation workers. These concentrations are listed in the Federal Regulations.[3]

Radioactive wastes at the University accumulate from a number of laboratory facilities and vary widely in quantity, physical form, and levels of radioactivity, as well as in the toxicity of extraneous chemicals or other materials combined with the waste. These nonradioactive chemicals in the wastes may be toxic and in some cases may present a greater hazard than the radioactivity.

Disposal of all radioactive waste at the University of Minnesota is the responsibility of the Radiation Protection Program of the Division of Environmental Health and Safety in the University Health Service. The wastes are categorized as combustible solids, contaminated animal carcasses, noncombustible solids, and liquids.[4]

Laboratory operations of many types lead to large quantities of low-level wastes which are readily combustible, such as cleaning tissue, absorbent materials, gloves, rags, wooden articles, and plastic syringes. The logical step is to reduce the volume of such combustible wastes by incineration and dispose of the ashes by burial under health physics direction.

The incineration of nonradioactive combustible waste and the airflow through the incinerator provide sufficient dilution volume to allow for low-level radioactive waste to be incinerated without exceeding permissible concentrations in air and ash. The requirements and regulations for incineration of radioactive waste are specified under the waste disposal criteria section of the Federal Regulations (Section 20.305).

The University of Minnesota Incineration Facility consists of two Detroit reciprocating grate stokers, manufactured by the Detroit Stoker Company, a subsidiary of United Industrial Corporation of Monroe, Michigan. The oldest of the units was put into operation in January of 1963, and the newest unit in February of 1966. Both units are of comparable size with a loading capacity for each unit of 50 tons per day or 4170 pounds per hour. This type of stoker performs four essential concurrent functions, each under suitable control as follows:

1. It coveys the refuse load through the incinerator furnace or chamber.
2. It agitates the refuse mass to provide optimum burning conditions with maximum aeration and flame exposure over the entire grate surface.
3. It uniformly distributes undergrate air to the refuse bed in supporting combustion.
4. It discharges ash and noncombustible residue for convenient disposal.

Grates are arranged in lateral rows, each overlapping its immediate forward neighbor in a shingle-like manner. Alternate rows are linked to a power source which reciprocates them forward and back across the faces of the intermediate or stationary rows.

Each reciprocal grate movement tends to tear and tumble the refuse mass, thus aerating its elements and providing maximum surface exposure to the flame without manual poking. Another advantage of this grate action lies in its ability to maintain a uniformly continuous refuse bed. Holes caused by the flash-burning of random spots of highly volatile refuse are promptly filled by material pushed from behind.

The grates are constructed in such a way that the air supply is forced through self-cleaning venturi openings which assure optimum distribution of air for complete combustion of the waste.

The low-level combustible radioactive waste (waste paper, plastics, wood, etc.) is collected throughout the campus in fiber drums and burned on the reciprocating grate. Contaminated animal carcasses, however, are burned on an adjacent elevated area inside the combustion chamber, designated as the animal hearth. The animals are collected and transported to the incinerator in plastic bags inside of 30-gallon metal cans painted yellow and properly labeled. Daily pickup, Monday through Friday, of radioactive and nonradioactive animal carcasses is made by University Plant Services personnel who transport the waste to the incinerator where it is emptied into the animal hearth and ashed over a 24-hour period. Each animal hearth is elevated two feet above the moving grate. The flames and combustion gases from the incinerator pass over the animals on the hearth and into the incinerator breeching. Each animal hearth is equipped with a gas jet burner to provide additional heat to the hearth which ensures complete combustion. (Figure 1).

Disposal of the ashes from the incinerator is accomplished by the moving grate which transports the ashes to a waiting dump truck outside the incinerator building. Each morning the cooled ashes from the animal hearth are transferred to the moving grate. The volume of this ash is approximately 20 to 35 gallons per day, and it is the first ash to be deposited in the truck. Total daily incinerator ash output is approximately 16 cubic yards, which is transported to a temporary storage area

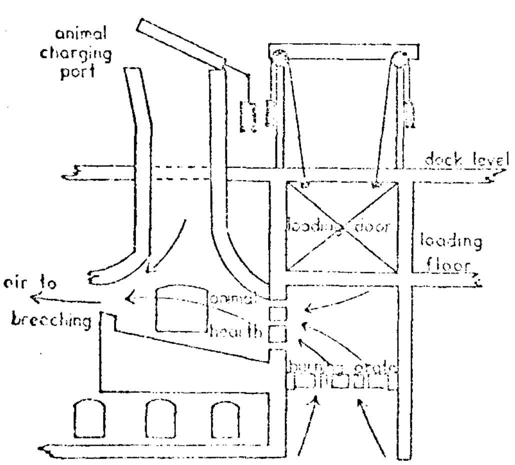

FIGURE 1. Cross section view of the University incinerator and animal hearth.

where the small amount of radioactive ash is greatly diluted by nonradioactive ash. Three times each year the ashes are transported from the storage area to an enclosed landfill and buried under dirt cover by bulldozer.

The total quantity of exhaust gases is the sum of natural stack draft, air from the supply fans (8500 cfm), and the combustion gases which result from the combustion of the solid waste. The exhaust gases are transported from the furnace to a 190-foot-high incinerator stack through a breeching with a cross section of 4′10″ × 6′6″.

To calculate radioisotope concentrations in the gaseous effluent from the incinerator stack, it was necessary to accurately determine the airflow at the point of release. Instrumentation has been installed in the incinerator breeching as well as at the top of the stack which provides a continuous record of velocity pressure and temperature of exhaust gases. The equipment installed is manufactured by the Hays Corporation of Michigan City, Indiana. The instrument used for airflow monitoring is a Hays #202C reverse pitot tube connected to a Hays differential air transmitter with output indicator and power supply. The output from the above unit is recorded on a Hays #771 universal recorder. The temperature at the point of airflow measurement in the breeching and at the effluent end of the stack is monitored with type KCA thermocouples (range 500° to 1500°F). The temperature indicated by these thermocouples is also recorded on the Hays universal recorder.

To calibrate the airflow monitor it was necessary to provide four access ports in the breeching at the site of the airflow monitor pitot tube (S-type pitot tube). The ports were placed at evenly spaced intervals to allow for a cross-sectional traverse of the breeching, they are 4 inches in diameter. To determine the airflow in the breeching, a standard pitot tube was used to obtain a complete traverse. An average airflow rate in cubic feet per minute was calculated from the traverse measurements. The S-type pitot tube was calibrated by obtaining velocity pressure readings at various airflow rates and comparing the readings to the velocity pressure measured with the Standard pitot tube. The Standard pitot tube velocity pressure readings were converted to airflow rates using the formula,

$$V = 4005\sqrt{VP}, \text{ for standard air}$$

where V = standard air velocity in feet per minute.

VP = velocity pressure in inches of water gage.

Figure 2 shows a plot of the calibration curve for the S-type pitot tube. This calibration and the data from the traverse of the breeching made it possible to accurately translate the data from the universal recorder. To determine the airflow at the point of release it was necessary to make a temperature correction to allow for temperature change which occurred between the location of the airflow measurement and the top of the stack.

Figure 3 is a graph showing the average

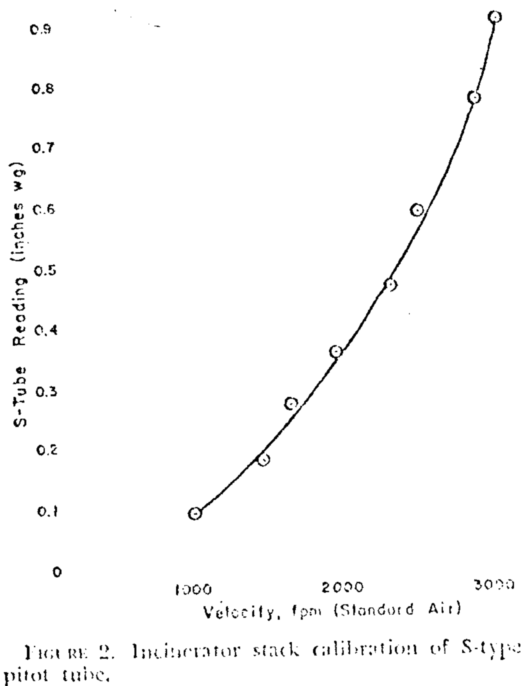

FIGURE 2. Incinerator stack calibration of S-type pitot tube.

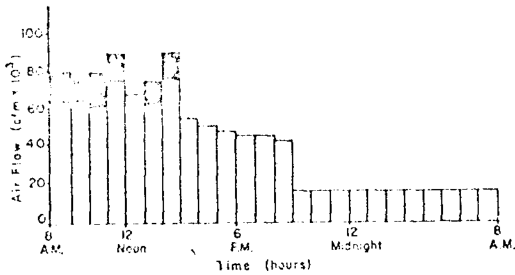

FIGURE 3. Average daily air flow from the University of Minnesota incinerator. Open bars represent actual effluent cfm, and closed bar areas represent temperature corrections. (Temperature correction equals absolute temperature at top of stack divided by absolute temperature at air monitor in breeching.)

airflow from the incinerator over a 24-hour period. Also shown is the correction in airflow due to temperature difference at the point of airflow measurement and the effluent end of the stack. Continuous chart recordings were used to determine average airflow.

The incinerator is operated between the hours of 8:00 A.M. and 4:00 P.M. daily. During nonoperational hours the fans remain on to cool the incinerator, which produces a minimum airflow of 8500 cfm.

The maximum allowable amount of a radioisotope that can be incinerated over a period of one calendar quarter can be calculated by using the average air dilution volume from the incinerator stack and the maximum permissible concentration in air (MPC_a) for the radioisotope. The MPC_a values to be used are those for the general public listed in Table II, Appendix B, 10 CFR 20.[3]

The average daily airflow from the incinerator stack is 34,500 cfm, and the dilution volume for a quarter in cubic centimeters is obtained as follows:

$$\text{Dilution volume} = 34{,}500 \text{ cfm} \times 60 \text{ min/hr} \times 24 \text{ hr/day} \times 91 \text{ days/quarter} \times 2.83 \times 10^4 \text{ cm}^3/\text{ft}^3$$
$$= 1.325 \times 10^{14} \text{ cm}^3/\text{quarter}$$

The maximum amount of a radioisotope

incinerated per quarter is then equal to the dilution factor per quarter × MPC_a for the radioisotope.

For example: For ^{131}I, $MPC_a = 1 \times 10^{-10}$ μCi/cm³

Maximum per quarter = (1.325 × 10¹⁴ cm³/quarter) (1 × 10⁻¹⁰ μCi/cm³)
= 1.325 × 10⁴ μCi/quarter

This calculation has been made for all the radioisotopes incinerated at the University. The results are listed in Table I. Also listed in Table I is the average quantity of each radioisotope incinerated during the year 1969.

If the maximum allowable activity of one of the above radioisotopes were released from the stack of the incinerator, the gaseous effluent concentration would be at MPC_a. If the maximum allowable activity of all ten radioisotopes were released from the stack, the gaseous effluent concentration would be at ten times the MPC_a.

Therefore, because all ten radioisotopes are incinerated, and MPC_a for the mixture of all the radioisotopes must be calculated. The equation for determining if the mixture of radioisotopes exceeds the MPC_a is as follows:

$$\frac{C_1}{MPC_1} + \frac{C_2}{MPC_2} + \frac{C_3}{MPC_3} + \ldots + \frac{C_N}{MPC_N} \leq 1$$

where C_1, C_2, C_3, C_N = the concentration in the gaseous effluent of radioisotopes 1 through N; N = number of radioisotopes.

$MPC_{1,2,3,N}$ = the maximum permissible concentration in air for radioisotopes 1 through N.

This equation can be modified to use maximum allowable activity (MAA) instead of MPC_a for each radioisotope and actual activity incinerated (A) instead of concentration for each radioisotope. The above equation then becomes:

$$\frac{A_1}{MAA_1} + \frac{A_2}{MAA_2} + \frac{A_3}{MAA_3} + \ldots + \frac{A_N}{MAA_N} \leq 1$$

This calculation has been made for each radioisotope in Table I and fraction of maximum:

$$0.00024 + 0.00077 + 0.0128 + 0.0056 + 0.0011 + 0.00019 + 0.09 + 0.61 + 0.00034 + 0.00047 = 0.722$$

This is ≤ 1; therefore, the concentration of the mixture of the radioisotopes is below the MPC_a. The major radioisotope contributors in the gaseous effluent are ^{125}I, ^{131}I, and ^{32}P. The concentration factor (0.722) calculated from MPC_a is a conservative one because it was assumed that 100%

TABLE I
Allowable Radioisotope Concentrations in Stack Effluent

	Radioisotope	MPC_a (μCi/cm³)	Maximum Allowable Activity (μCi/quarter)	1969 Actual Amount Incinerated (μCi/quarter)	Fraction of Maximum
1.	^{14}C	1×10^{-7}	1.325×10^{7}	3.2×10^{3}	2.42×10^{-4}
2.	^{3}H	2×10^{-7}	2.65×10^{7}	2.05×10^{4}	0.774×10^{-3}
3.	^{32}P	2×10^{-9}	2.65×10^{5}	3.4×10^{3}	1.28×10^{-2}
4.	^{45}Ca	1×10^{-9}	1.325×10^{5}	7.5×10^{2}	5.67×10^{-3}
5.	^{86}Rb	1×10^{-8}	1.325×10^{6}	1.4×10^{3}	1.06×10^{-3}
6.	^{95}Nb	2×10^{-8}	2.65×10^{6}	5.0×10^{2}	1.88×10^{-4}
7.	^{131}I	1×10^{-10}	1.325×10^{4}	1.2×10^{3}	0.9×10^{-1}
8.	^{125}I	8×10^{-11}	1.06×10^{4}	6.5×10^{3}	0.61×10^{0}
9.	^{35}S	9×10^{-9}	1.19×10^{6}	0.4×10^{3}	0.336×10^{-3}
10.	^{85}Sr	8×10^{-9}	1.06×10^{6}	6.5×10^{2}	0.47×10^{-3}

of the activity burned was discharged in the gaseous effluent.

The concentration of radioisotopes in the ash volume to the maximum permissible concentration in ash can be calculated in much the same way as the previous calculations for air. However, the dilution volume in this case is the quantity of ash discharged from the incinerator over the period of one quarter, and the maximum permissible concentrations are those specified for water (MPC_w) for the general public in Table II, Appendix B, CFR 20.[3] The MPC_w is used because it is assumed that the radioactivity in the ash might gain entrance to the water supply.

The average daily volume of ash from the incinerator is 16 yd^3. The following calculation gives ash volume in cubic centimeters per quarter.

$$\text{Ash volume} = 16\ \text{yd}^3/\text{day} \times 27\ \text{ft}^3/\text{yd}^3 \times 2.83 \times 10^4\ \text{cm}^3/\text{ft}^3 \times 91\ \text{days/quarter} = 1.115 \times 10^9\ \text{cm}^3/\text{quarter}$$

The allowable activity per radioisotope is then obtained by multiplying the dilution factor times the MPC_w for the radioisotope. Table II lists the maximum allowable activity that can be incinerated per quarter for each radioisotope.

To determine if the mixture of radioisotopes released in the ash is less than or equal to the MPC_w, the previously listed equation is used, summing the ratio between actual activity released and the maximum allowable.

$$0.0036 + 0.00612 + 0.152 + 0.7450 + 0.018 + 0.015 + 3.6 + 29.0 + 0.006 + 0.0045 = 33.50$$

Therefore, the overall ash concentration is 33.5 times the maximum permissible concentration for water. However, in making this calculation it was assumed that 100% of the activity remained in the ash. The major radioisotope contaminants are ^{125}I and ^{131}I. Geyer[2] evaluated the incineration of wastes containing ^{131}I and showed that approximately 91% of the radioactive iodine is discharged in the gaseous effluent. This would reduce the factor by which the ash is in excess of MPC_w to less than 4. Also, the ash is held in a fenced, locked storage area for approximately 120 days, and is then hauled to the University landfill where it is covered with earth. Considering the half-life of the radioisotopes present in the ash, the concentration in the ash is reduced to below the MPC_w before it is shipped to the landfill area.

The landfill is a fenced, restricted area accessible only to authorized personnel. Under Section 20.304, 10 CFR 20, the regulations pertaining to disposal by burial in soil allow for the burial of 10 mCi of ^{131}I per burial. This may be repeated twelve times per year provided the burials are no closer than 6 feet and at a depth of at least 4 feet.

The maximum amount of radioisotopes buried in the landfill by the University per year would not exceed 7.5 mCi even if

TABLE II
Allowable Radioisotope Concentrations in the Incinerator Ash

	Radioisotope	MPC_w (μCi/cm^3)	Maximum Allowable Activity (μCi/quarter)	1969 Actual Amount Incinerated (μCi/quarter)	Fraction of Maximum
1.	^{14}C	8×10^{-4}	8.92×10^{5}	3.2×10^{3}	0.36×10^{-2}
2.	^{3}H	3×10^{-3}	3.35×10^{6}	2.05×10^{4}	0.612×10^{-2}
3.	^{32}P	2×10^{-5}	2.23×10^{4}	3.4×10^{3}	1.52×10^{-1}
4.	^{45}Ca	9×10^{-6}	1.005×10^{4}	7.5×10^{3}	7.45×10^{-1}
5.	^{86}Rb	7×10^{-5}	7.8×10^{4}	1.4×10^{3}	0.18×10^{-1}
6.	^{95}Nb	1×10^{-4}	1.115×10^{5}	5.0×10^{2}	4.5×10^{-3}
7.	^{131}I	3×10^{-7}	3.35×10^{2}	1.2×10^{3}	0.36×10^{1}
8.	^{125}I	2×10^{-7}	2.23×10^{2}	6.5×10^{3}	2.9×10^{1}
9.	^{35}S	6×10^{-6}	6.7×10^{4}	4×10^{2}	0.6×10^{-2}
10.	^{85}Sr	1×10^{-4}	1.116×10^{5}	5×10^{2}	4.5×10^{-3}

we assume that there is no release in the gaseous effluent of the incinerator. Therefore, the radioisotopes buried in the University landfill are well within the amount specified in the Federal Regulations.

Facilities which handle millicurie or microcurie quantities may find that concentrations in the stack effluent and ash residues are below the MPC for air and water, respectively, as shown in the previous calculations for the University of Minnesota incinerator. Even though the release of radioactive materials from the incinerator facility to the environment may be below the MPC's (air and water), reconcentration of radioisotopes may occur in the environment and must be taken into account. For this reason consideration should be given to a program of environmental surveillance.

Environmental radioisotope concentration in the ambient air has been evaluated by obtaining data from an environmental monitoring station located on the roof of the Minnesota State Department of Health Building, which is on the University of Minnesota Minneapolis campus. This building is located about 250 yards southeast of the incinerator stack.

The Minnesota State Department of Health (MSDH)[5] has been collecting samples from the monitoring station for several years as part of the U.S. Public Health Service Radiation Surveillance Program to evaluate the concentration of particulate radioactive material in the air.

The sampling procedure, as outlined by the MSDH, consists in drawing an average of 12,000 ft^3 of air through a filter paper (Hollingsworth and Voss 70) over a period of a week. At the end of each week the filter paper is removed and replaced with a new one for the next week's sample. After a period of 48 hours (to allow for radon, thoron daughter product decay) the filter paper is counted in an internal gas flow proportional counter, which is calibrated with a ^{204}Tl standard.

The following table is a summary of the range of airborne concentration of particulate radioactive material in picocuries per cubic meter, listed as to collection period:

Concentration of Particulate Radioactive Material in Air (pCi/m^3)

Collection Period		Low	High
January through June	1965	0.1	1.2
July through December	1965	0.03	0.7
January through June	1966	0.02	0.5
July through December	1966	0.05	0.37
January through June	1967	0.02	0.49
July through December	1967	0.001	0.24
January through June	1968	0.07	0.63
July through December	1968	0.04	0.36
January through June	1969	0.03	0.29
June through December 8 (collected at new building)	1969[a]	0.03	0.37

[a]In June of 1969, the MSDH moved to a new building located on the opposite side of the campus from the old building. This new building is approximately ½ mile southeast of the incinerator stack.

When compared to a permissible level in air for individuals in the general public of 10 pCi/cm^3, it can be seen that even the highest level for each period does not approach this permissible level. Ten picocuries per cubic meter of air is the maximum permissible concentration in air for a mixture of radioisotopes, when no alpha-emitting radioisotopes and the radioisotopes ^{210}Pb, ^{227}Ac, ^{228}Ra, and ^{241}Pu are not present. This limit was established on the recommendations of the National Council on Radiation Protection (NCRP). Therefore, the contribution of airborne radioactive particulates from the University incinerator, combined with fallout and other sources of airborne radioactive particulates, is well within the permissible levels and presents no problems with respect to the health and safety of individuals living even in the vicinity of the incinerator facility.

Summary and Conclusions

A University incinerator which is used to incinerate nonradioactive refuse can be modified to safely reduce the volume of radioactive waste for ultimate disposal in the environment. However, each incinerator facility will have limitations on the quantity of radioisotopes that can be handled. These limitations are dependent on the volume of air dilution and the volume of nonradioactive refuse incinerated. The air volume can be accurately determined by the installation of calibrated airflow and temperature monitoring equipment.

In the event that the ash exceeds the MPC_w, it may be held in a controlled area for decay of the radioisotopes until the concentration falls below the MPC_w. This is feasible for the short half-life radioisotopes; however, if long half-lifes are present it will be necessary to restrict the amount of the radioisotopes incinerated to ensure that the ash concentration is below the MPC_w.

It has been demonstrated that a large general-purpose incinerator can be used to dispose of low-level combustible radioactive wastes safely and economically.

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Received February 16, 1971

Attachment XI

Policy and Procedures for Animal

Care and Usage at the University of Minnesota

(Statement Accepted by the Regents of the

University of Minnesota, July 12, 1973)

Outline

G. Physical Facilities

H. Complaints

I. Statement of Policy

The Regents of the University of Minnesota reaffirm their established policy with regard to the use of warm-blooded animals in scientific research and teaching:

1. To assure proper procurement, care, housing, and health services for all warm-blooded animals used in research and teaching;

2. To provide the most appropriate animals for the diverse requirements of the varied research and teaching activities of the University;

3. To minimize pain and distress through selection of experimental procedures or administration of adequate anesthetic, analgesic, or tranquilizing drugs, except where such measures would interfere with the purpose of the experiment;

4. To comply with all legal requirements established by the U.S. Department of Agriculture or other governmental agencies under authority of Public Laws 89-544 and 91-579 and any subsequent enactments; and to follow the guidelines in Section 4206 of the NIH "Guide for Grants and Contracts" and in Publication No. (NIH) 73-23, "Guide for the Care and Use of Laboratory Animals"; and

5. To accomplish these aims with supporting activities which will promote the advancement of scientific research and educational goals.

In order to accomplish these objectives, the University of Minnesota, through the Animal Services Unit of the Office of Sponsored Programs, will:

1. Establish a program for regular inspection of animal facilities to assure that acceptable standards are maintained with respect to cleanliness, feeding, cage size, and environmental conditions;

2. Employ veterinary staff to advise in the selection of appropriate animal species for research and education, make regular inspections of the health of the animals kept for research and teaching, provide medical consultation regarding prevention and treatment of animal diseases, advise regarding hazards and prevention of cross-infection between animals and man, contribute to training of animal care personnel, advise regarding use of pain-suppressing drugs, establish procedures for euthanasia and control of parasites and pests, and assist in planning of new construction or remodeling of animal care facilities; and

3. Establish a procedure for prior review of research and teaching protocols to assure that adequate anesthetics, analgesics, or tranquilizers are administered to prevent pain and distress, or authorize exceptions where use of such drugs would

interfere with the purpose of the experiment or teaching activity. A separate review of research and training grant proposals will be made to assure that adequate facilities (e.g., cages, space, etc.) are available or will be available.

II. Principles Governing the Use of Warm-blooded Animals in Research and Teaching

1. Experimentation and teaching involving live warm-blooded animals should be performed by/or under the immediate supervision of a qualified scientist.

2. The housing, care, and feeding of each project's experimental animals or each department's teaching animals must be supervised by a qualified veterinarian or other scientist competent in such matters.

3. Experimentation and teaching involving warm-blooded animals should be so conducted as to avoid all unnecessary suffering and should be terminated whenever it becomes clear that unnecessary suffering may result.

4. Post-experiment care of subject animals should be such as to minimize discomfort to animals in accordance with acceptable practices in veterinary medicine.

5. If it is necessary to sacrifice an experimental animal, the subject animal should be killed in such a way as to minimize pain and ensure prompt death, in accordance with procedures approved by the Director of Animal Services. No animal will be discarded until death is certain.

6. Anesthetics, analgesics, and tranquilizers used to alleviate pain or discomfort will be evaluated with respect to effectiveness and dose level by the veterinarians of the Animal Services Unit[1] in consultation with appropriate specialists as the need arises.

7. Before procedures causing pain or discomfort to conscious animals are initiated, they must be reviewed and approved by the Director of Animal Services[1] or a

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[1] The terms, "Animal Services Unit" and "Director of Animal Services," are provisional until a final decision has been made regarding the name of the administrative unit.

veterinarian on his staff. Questionable cases will be referred to appropriate specialists and/or the All-University Animal Care Committee.

III. Procedure for Implementation of Policy

A. Scope of Activities Covered

1. This statement of policy and procedures for animal care and usage applies to all species of mammals and birds used in research or teaching at the University of Minnesota or under its auspices when:

a. The procedures are performed on premises owned, leased, or rented by the University;

b. The procedures involve animals, facilities, or equipment owned by the University; or

c. The activity is financed by the University or by funds administered by the University.

B. Administrative Organization

1. All-University Animal Care Committee

a. The All-University Animal Care Committee shall be a University Committee reporting to the Senate Committee on Research as provided in Article IV of the Constitution and bylaws of the University Senate.

b. It shall consist of not more than ten (10) members, including 2 representatives of the Minneapolis Health Sciences and one each from the College of Veterinary Medicine, Institute of Agriculture, College of Liberal Arts, College of Biological Sciences, Division of Environmental Health and Safety, Duluth Campus, Morris Campus, and a student representative. Insofar as feasible, there should be broad representation of the various types of research that utilize animals and the basic scientific areas that are relevant for animal care and usage. The Committee will be encouraged to seek the consultation and advice of researchers in other units utilizing animals as well as specialists in areas relevant for animal care and usage. The Director of Animal Services shall be a non-voting member of the Committee and serve as Executive Secretary.

c. Members shall be appointed in accordance with University Senate procedures for staggered terms of three years.

d. The chairman shall be appointed in accordance with University Senate procedures.

e. The Committee shall meet at least quarterly.

f. The duties and responsibilities of the Committee shall include:

   1. Collaboration with the Director of Animal Services in formulation of recommendations to the Vice-President of Academic Administration regarding University policies and standards governing procurement, care, and use of animals employed in research and teaching activities;

2. Evaluation of the animal care program at regular intervals as required by Section 4205 of the NIH "Guide for Grants and Contracts";

3. Assistance to the Director of Animal Services in education of faculty in the need for good animal care, in the kinds of services offered by the Director and his staff, and in the research benefits attaching to use of quality animals;

4. Consultation with the Director of Animal Services regarding professional personnel needs of his department;

5. Mediation and review of appeals regarding the animal facilities inspection program or decisions of the Director of Animal Services regarding procedures involving pain or distress, with recommendations to the Vice-President for Academic Administration for final decision

in cases that cannot be resolved by mediation; and

6. Submission of reports to the Senate through the Senate Committee on Research in accordance with the Rules and Organizational Procedures of the Senate, U1.302.5.

g. Executive subcommittee

1. The executive subcommittee will be made up of the chairman and two other members appointed by the chairman, with one member of the subcommittee being a Doctor of Veterinary Medicine. If any members of the executive subcommittee are unavailable at a time when a decision must be made, the chairman may appoint temporary members. In this case, one member must still be a Doctor of Veterinary Medicine.

2. The purpose of the executive subcommittee is to act for the All-University Animal Care Committee

when, in the judgment of the chairman, a decision must be made that does not allow time for full committee consideration. Such actions shall be reported to the full committee no later than the next meeting.

2. Director of Animal Services

a. The Director of Animal Services will be a veterinarian with experience in Laboratory Animal Medicine and scientific investigation. He will have an administrative appointment in the Office of Sponsored Programs and an academic appointment in that department of the University to which he would best relate as a result of his training or anticipated long-term interest.

b. The Director of Animal Services will have full responsibility and authority for the activities of the Animal Services Unit in implementing the policies of the University, the directives of the Vice-President for Academic Administration, state and federal laws, and administrative regulations of government agencies.

c. The Director of Animal Services will be accountable to the office of the Vice-President for Academic Administration. He will submit a formal written report on the Animal Services Program at least once yearly to the All-University Animal Care Committee.

d. The duties and responsibilities of the Director of Animal Services will include:

   1. Collaboration with the All-University Animal Care Committee in formulation of recommendations to the Vice-President for Academic Administration regarding University policies and standards governing procurement, care, and use of animals employed in research and teaching activities;

2. Development and implementation of programs for disease prevention, euthanasia, parasite and pest control, and treatment of diseased animals; liaison with specialists and diagnostic laboratories at the College of Veterinary Medicine;

3. Consultation regarding species selection and animal procurement;

4. Supervision of a program for regular inspection of animal facilities to ensure compliance with standards of governmental agencies and the University;

5. Consultation with investigators and instructors regarding anesthetics, analgesics, and tranquilizers, and evaluation of their adequacy in procedures potentially involving pain or distress;

6. Review of protocols for research and teaching involving pain or distress in conscious animals, with referral to experts and/or the All-University Animal Care Committee, if necessary;

7. Assistance in planning of new construction and remodeling of animal care facilities;

8. Preparation of a manual of procedures for the guidance of animal users and caretakers;

9. Direction of a training program for animal technicians; and

10. Maintenance of liaison with regulatory agencies.

e. The Director of Animal Services will be assisted by additional veterinary personnel. Veterinarians employed to provide part-time services at facilities outside the Twin Cities will be under his general supervision, and their selection and continued employment must be acceptable to him.

C. Inspection of Animal Facilities

1. The Director of Animal Services or his representatives will make unannounced inspections of animal facilities at regular intervals.

2. The purpose of the inspection program is to ensure that all animal facilities are in compliance with the requirements of P.L. 89-544 as amended by P.L. 91-579, the administrative regulations of federal agencies, and the standards of the University. The inspections will be concerned with cleanliness, feeding, watering, cage size, room density, storage of supplies and waste, temperature, humidity, ventilation, lighting, and any other conditions that may be included in the requirements of government agencies or University standards.

3. Responsibility for the care of animals belonging to research projects rests with the principal investigator in all cases, even when direct supervision of the care has been delegated to another person or University service unit. Department chairmen are similarly responsible for care of animals used in teaching.

4. Reports of inspections will be sent to relevant investigators, department chairmen, and deans.

5. Cases of repeated noncompliance will be reported by the Director of Animal Services to deans or other appropriate executive officers, and if not corrected, to the office of the Vice-President for Academic Administration. In such cases, closure of the deficient animal facility may be recommended to the Vice-President for Academic Administration.

6. Whenever animals are to be moved into a room previously used for any other purpose, the room must be inspected and approved in advance by the Animal Services Unit.

7. Appeals regarding any aspect of the animal facilities inspection program may be made to the Director of Animal Services, then to the All-University Animal Care Committee. Appeals not resolved by mediation of the All-University Animal Care Committee will be forwarded with the Committee's recommendations to the Vice-President for Academic Administration for final decision.

D. Animal Health

1. All animals must be observed daily by the animal technician caring for them, or by the faculty member in charge of the animal facility.

2. Sick animals should be given early medical treatment appropriate for their condition or promptly and humanely destroyed.

3. Veterinarians on the staff of the Department of Animal Services or providing part-time services to the branch campuses or experiment stations will make periodic inspections of the state of health of animals in all facilities.

4. Consultation regarding animal health problems will be available on all campuses and experiment stations from the Animal Services Unit or local veterinarians hired on a part-time basis. The Animal Services Unit will serve as liaison with the College of Veterinary Medicine to arrange for consultation with specialists and diagnostic laboratory services.

E. Procedures Involving Potential Pain or Distress

1. Evaluation of pain-suppressing drugs and procedures.

The adequacy of the choice and dose levels of anesthetics, analgesics, and tranquilizers used to prevent pain or distress in research and teaching will be evaluated by the Director of Animal Services or veterinarians on his staff in consultation with appropriate specialists, when the need arises. As required by the Standards of P.L. 89-544 as amended by P.L. 91-579, information will be collected on current practices in the usage of such drugs at the University, and a list of standard minimum dosages by body weight, species, and route of administration will be compiled to provide general authorization for the majority of applications. Cases not covered by the standard list, and other methods for prevention of pain, such as cervical dislocation, decortication, or decerebration will be evaluated on an individual basis.

2. Pain and distress in conscious animals.

Protocols for research and teaching involving pain or distress in conscious animals will be reviewed by the Director of Animal Services or veterinarians under his supervision. Approval must be obtained before initiation of painful or distressful procedures. The protocols will be approved only if use of pain-suppressing drugs or less painful or distressful procedures would interfere with the purpose of the research or teaching. Difficult cases may be referred to the All-University Animal Care Committee by the Director of Animal Services, or investigators may appeal adverse decisions by the Animal Services Unit to the Committee. At quarterly intervals, the Director of Animal Services will submit to the All-University Animal Care Committee a summary of protocols involving pain or discomfort reviewed during the preceding three months.

F. Manual of Procedures

A manual will be prepared by the Director of Animal Services in consultation with specialists and regulatory agencies to contain the following information for investigators and instructors:

1. Acceptable methods of euthanasia;

2. Standards for cage sizes;

3. Standards for animal care procedures and cleanliness;

4. Minimum standard dose levels for commonly used anesthetics, analgesics, and tranquilizers by body weight and route of administration for commonly used species;

5. The currently applicable statement of Policy and Procedures for Animal Care and Usage at the University of Minnesota;

6. And such other information as the veterinary staff may desire.

G. Physical Facilities

1. The Division of Environmental Health and Safety will

measure the ventilation and illumination in all animal facilities. Temperature regulation and humidity may also require measurement in some facilities. The results of these determinations will be reported to individual investigators, department chairmen, deans, college animal committees, and the Director of Animal Services.

2. The Director of Animal Services will maintain a file on animal facilities having substandard environmental conditions for reference in decisions regarding renovation.

3. When new construction or remodeling includes animal facilities, the Director of Animal Services must be consulted, and must approve the design specifications for the animal facilities.

H. Complaints

Complaints regarding any aspect of animal care or usage should be addressed to the Director of Animal Services. If the complainant and the Director are unable to reach a mutually satisfactory agreement, either may refer the matter to the All-University Animal Care Committee.

Attachment XII

COPY

May 12, 1970

City Water Department
Minneapolis City Hall
Minneapolis, Minnesota

Attn: Jimmie F. Hayek
Acting Director

Re: Proposed Water Main for Health Sciences Building
Minneapolis Campus

Dear Sir:

During our meeting with you and Mr. Peterson of your water department and myself and Mr. Heck of Plant Services, on April 23, 1970, concerning the proposed water service to Health Sciences Complex, some questions were raised which required some additional thought. You requested that we state our proposals and questions on this project in a letter.

The University proposes to build a Health Sciences Complex between Washington Avenue and Essex and Between Union Street and Harvard Street with the early excavation contracts scheduled to begin this fall.

The University will shortly initiate vacation proceedings for Union Street S.E. from the south line of Delaware to the south line of Washington Avenue S.E. and for Delaware Street S.E. from the east line of Union Street to the west line of the east alley in Block 30, St. Anthony City, immediately adjacent on the north.

The 8" main in Union Street from Washington Avenue to Delaware will be removed during this contract and the University will cut off this main south of the south curb line of Washington Avenue and close the 8" valve inside our underground garage wall and remove the pipe through the wall. The 6" main in Delaware will be removed from the Union Street main to the building service into V.F.W. Hospital between Union and Harvard. The University will cut off the main in the manhole at this point and block it.

The building services to the buildings on the east side of Union Street, and the Kensington and Riverview Apartments will be shut off sometime after July 31, 1970, when wrecking of these buildings is now scheduled. We propose to shut the curb stops to these buildings and leave them and the services since the entire water main, services and buildings will be removed in the excavation contracts.

The new building complex for the Health Sciences requires a new 16" supply to the complex. The Architect requires an 1800 gpm supply at 65 psi at the main for the propsoed new building.

The University proposed to connect to your 48" main in Ontario with a 16" main at Essex Street and run west in Essex Street to Harvard. The 16" main will continue in Harvard Street northward and connect to the 12" main in Washington Avenue.

At the 48" main in Ontario, we ask that you will provide a 16" tap with gate valve and manhole for us to connect to. At the 12" in Washington we need a 16" x 12" cross with the north end capped and blocked for future extension of this 16" main to connect to the 24" main at 18th Avenue and University. We ask that you will provide the cross and a 16" gate valve and manhole on the south side of the 12" main in Washington Avenue.

The service into the Health Sciences building will be a single 16" line running approximately 155 feet west to our 10 feet diameter heat shaft. There it will enter the heat shaft and drop 45 feet to the basement level of the building and continue west inside the heat tunnel 25 feet to the meter room in the basement of the building. At this point the line will be split into 3 - 12" services, one to Unit A north of Delaware, one to Unit B south of Delaware and one to connect to the 8" main in the underground garage at Mayo Hospital, west of Union Street. Also, 2 - 8" fire lines would be taken off the 16" main in the meter room--one for Unit A and one for Unit B.

Because we need the utmost in reliability for this new 16" main and service we are considering installing welded steel pipe, concrete lined and bituminous coated with anode protection. Does this meet with your approval?

According to your policy you will furnish the two 12" domestic meters and the University will furnish the two 8" fire meters.

Fire protection will be furnished by providing three hydrants on the 16" main in Harvard. Two will be at Delaware on the west side of the Harvard Street, one on the north corner and one on the south corner; and one at the southwest corner of Washington and Harvard.

The existing hydrant at Union and Washington will have to be relocated. We assume your crews will be doing this work.

The installation of this 16" main is scheduled for completion by January 1, 1971. This is the Architect's schedule and we have questioned whether it will be needed by then.

The ownership of this main needs to be determined. If it is to be your main we must grant you an easement in Essex Street from Oak to Harvard since this was vacated a couple of years ago.

We also need an estimate for the 16" tap at Ontario at the existing 48" main and for the connection to the 12" main in Washington and Harvard. Also, we need an estimate for moving the hydrant at Union and Washington.

We will appreciate your comments and suggestions on this project as soon as possible. As you see, we have a tight schedule if we are to complete the work this year. If you have any questions, please call me.

Respectfully,

O. J. Nelson
Assistant Supervising Engineer

OJN:ADC: jar

Enclosure

cc: E. A. Kogl
Al Kemper
Howard Heck

P.S. I am enclosing a drawing marked up to show what is indicated in this letter. The green lines are water mains and services to be abandoned and/or removed. The blue lines are new water lines which we propose to install.

Attachment XIII

City of Minneapolis

OFFICE OF CITY CLERK
RICHARD JOHANSEN, CITY CLERK
307 CITY HALL 330-2215
MINNEAPOLIS, MINNESOTA 55415

ENG. — Your Committee recommends passage of the accompanying resolutions granting the following encroachments: 1) Univ. of Minn., within public r/ws of Washington Av. SE., Church, Union and Delaware Sts. SE., for tunnels for the Health Science Complex proposed at Washington Av. SE. and Union St. SE. (52755);

Alderman Christensen offered the following resolutions, as per above report: 1) Granting permission to the University of Minnesota to encroach within the public r/ws of Washington Av. SE., Church, Union and Delaware Sts. SE. for heat, storm and sanitary tunnels for the Health Sciences Complex to be located at Washington Av. SE. and Union St. SE.:

RESOLUTION

(By Alderman Christensen)

Granting permission to the University of Minnesota to encroach within the public r/w of Washington Av. SE., Church, Union and Delaware Sts. SE. [illegible] eat, storm and sanitary t[illegible]ls for the Health Sciences Complex to be located at Washington Av. SE. and Union St. SE.

Resolved by the City Council of the City of Minneapolis:

That permission be granted to the Regents of the University of Minnesota and their successors and assigns, to construct, maintain and use the following heat, storm and sanitary tunnels under certain City streets for the new Health Sciences Complex to be located at Washington Av. SE. and Union St. SE.; all of said tunnels to be constructed below the limestone ledge, approx. 80' to 90' below the street surface, which tunnels and appurtenances are described as follows:

(Continued on attached)

April 29, 1970

University of Minnesota
Minneapolis, Minnesota

Attention: Mr. R. V. Lund

Gentlemen:

The attached copy shows action taken by the City Council at a meeting held April 24, 1970, granting your application to encroach within the public right-of Washington Ave. SE., Church, Union and Delaware Sts. SE., for heat, storm and sanitary tunnels.

Please note that the enclosed acceptance form must be completed and filed in this office within 60 days after publication of the permit, which date was April 29, 1970.

The enclosed bill for $102.60 covers the cost of publication. Checks should be made payable to the City Treasurer.

Very truly yours,

Richard Johansen
City Clerk

rj:mf
e

A. The Health Science heat tunnel to cross under Washington Av. SE. approx. 23' W of and parallel with the centerline of 15th Av. SE.; also said heat tunnel to cross Church St. SE., Union SE. and the alley between Lots 16 and 17 of Barney's Subdivision of Block 39, St. Anthony City, said heat tunnel having its centerline 85' S and parallel with the centerline of Washington Av. SE.; also, said heat tunnel to cross under Delaware St. SE. having its centerline 211.5' E of and parallel with the centerline of Union St. SE.; said heat tunnel to be approx. 7.5' wide and 7.75' high and to be between elevations 740 and 760 (1912 MSL Datum) and to include various chambers and a vertical shaft with a diameter of approx. 10' and located 26' S of the centerline of Delaware St. SE. and approx. 123' W. of the W line of Harvard St. SE.; all as shown on sheets 2 to 5 inclusive of Drawing No. 13516.

B. The Health Science storm tunnel to begin at a point in Union St. SE. 32.5' SWly of a point on the E line of Union St. being 75' S of the S line of Delaware St. SE. and to continue through this point and crossing the N line of Block 35, St. Anthony City at a point 143.5' E of the E line of Union St. SE.; thence continuing NEly on this a distance of 60' and thence continuing SEly a distance of 8' to the heat tunnel shaft noted in section "A" of this resolution, and there terminating. The storm tunnel to be 7.5' high and 3' wide and to be located between elevations 740 and 750, 1912 MSL Datum; together with the branch line as shown on Drawing No. 13516, Sheet 6.

C. The Health Science sanitary sewer tunnel to be in Delaware St. SE. lying 26' S of the centerline of Delaware St. SE., beginning at the existing Twin City Interceptor Sanitary Tunnel which lies in Harvard St. SE. 10' E of and parallel with the W. line of Harvard St. SE.; thence W 134' and terminating at the heat tunnel shaft noted in section "A" of this resolution, said sanitary sewer tunnel to be 7.5' high and 3' wide and to be an unlined tunnel in the St. Peter Sandstone with a 24" cast iron pipe buried in the floor, and to be located between elevations 742 and 752, 1912 MSL Datum; as shown on Drawing No. 13516, Sheet 6;

all said encroachments to be in accordance with Drawing No. 13516, Sheets 2 through 6, [illegible] by University of Minnesota Dept. of Plant Services and attached to Petition No. [illegible] on file in the office of the City Clerk.

This permission is granted subject to the following conditions:

1. That all work done be subject to the approval and acceptance of the City Engineer and the Inspector of Buildings and that all necessary permits be obtained, including an excavation permit from the City Engineer for the vertical shaft to be located in Delaware St. SE. between Union and Harvard Sts. SE. Also, that no work which may involve encroachment upon the surface of said r/w shall commence without the prior written approval by the City Engineer of the contractor's work schedule and construction procedures, so as to minimize traffic problems resulting from this construction or work.

2. That said University of Minnesota shall pay all costs resulting from the alteration or relocation of any and all utilities, public or private made necessary in connection with the encroachments permitted herein; and the University of Minnesota shall forthwith after the completion of the said installation properly replace and repair the roadways, pavements, sidewalks, curbs, sewer catch basins and any other facilities in said streets which shall be in any manner removed, changed, interfered with or disturbed in connection with the construction of said tunnels and appurtenances thereto, across and under said r/w and restore said roadways to a safe condition for public travel, all to the satisfaction, approval and acceptance of the City Engineer.

3. That the rights or privileges herein granted shall at all times be subject to all ordinances of the City now existing or which may hereafter be passed relative to the use or maintenance of such areas under, on, or above streets, alleys and public places.

4. The City Council reserves the right to repeal or rescind this resolution and revoke the permission granted whenever in its opinion the public interest demands that said area of encroachment is needed for a public use, or for reasons of public health, safety or welfare, or for any other reasons; of which matters the City Council shall be the sole judge.

5. In case of such repeal, rescision or revocation, said University of Minnesota, its successors and assigns, shall promptly remove said encroachments and restore said public streets to a safe condition, all to the acceptance of the City Engineer.

6. The University of Minnesota, its successors, and assigns, agrees to secure, indemnify, and save harmless the City against any and all actions, proceedings, demands, claims, costs, damages, losses, and expenses which may be occasioned by reason of the construction, maintenance, use, existence, or removal of said encroachments and restoration of said public premises, and shall assume the defense of any and all suits and actions brought for recovery of the same, intervening therein if necessary for the purpose of defense, and shall wholly protect, relieve and save harmless the City from all liabilities of every kind and description on account of the acts or omissions of said University of Minnesota in connection with the construction, maintenance, use, existence or removal of said tunnels, shaft and appurtenances thereto, and said University of Minnesota shall faithfully observe, keep and perform all and singular the conditions and provisions of this resolution.

7. Any permission herein granted, and all rights of the permittee hereunder shall cease at any time that said encroachments shall be removed, and this permission shall in no way be considered a relinquishment by the City of that portion of said public streets, or to be of any force or effect beyond the time herein provided.

8. Within 60 days after the publication of this resolution, said University of Minnesota shall file with the City Clerk a written acceptance of this resolution and of the conditions and provisions thereof. Failure to file such acceptance within the time specified shall render the permission granted null and void.

Passed April 24, 1970. Richard M. Erdall, President of the Council.

Approved April 28, 1970. Charles Stenvig, Mayor

Attest: Richard Johansen, City Clerk.

Attachment XIV

TWIN CITIES AREA METROPOLITAN
TRANSIT COMMISSION 330 Metro Square Building, Saint Paul, Minnesota 55101 Phone 612/227-7343

February 26, 1974

Mr. David R. Preston
Assistant Vice President for
Health Sciences
University of Minnesota
Minneapolis, Minnesota 55455

Dear Mr. Preston:

Re: Public Transportation Serving the University of Minnesota East Bank Campus

In recent years, the Metropolitan Transit Commission has enjoyed an excellent working relationship with the University of Minnesota administration in the development of improved public transportation systems serving the University area. This has included extensive express bus operations into the University campuses and improved inner-campus bus service.

More recently, the University administration co-sponsored a University Area Transit Study to develop a long-range plan that focused on service in the immediate area. The University's planning staff contributed a substantial amount of effort to this project. The project was somewhat unique in that it was a joint venture of the University of Minnesota, Cities of Minneapolis and Saint Paul, and the regional and state agencies involved in transportation planning, and the U. S. Department of Transportation.

Enclosed is a draft copy of the final report. The report has been approved by the Residential Advisory Committee, the Institutional and Commercial Advisory Committee meeting with the Technical Advisory Committee, the Project Management Board, the Transit Development Committee of the MTC, and the Metropolitan Transit Commission. It is currently being reviewed by the Urban Mass Transportation Administration of the U. S. Department of Transportation.

Of particular importance to the Health Sciences development program of the University of Minnesota is the transportation planned for the immediate vicinity of Station [illegible] as identified in Figure 59 of the report. [illegible] several bus routes, the inter-campus guideway system, and the region's automated transit system when it is developed. The last two will be designed to accommodate the handicapped in accordance with state requirements.

Mr. David R. Preston
Page Two
February 26, 1974

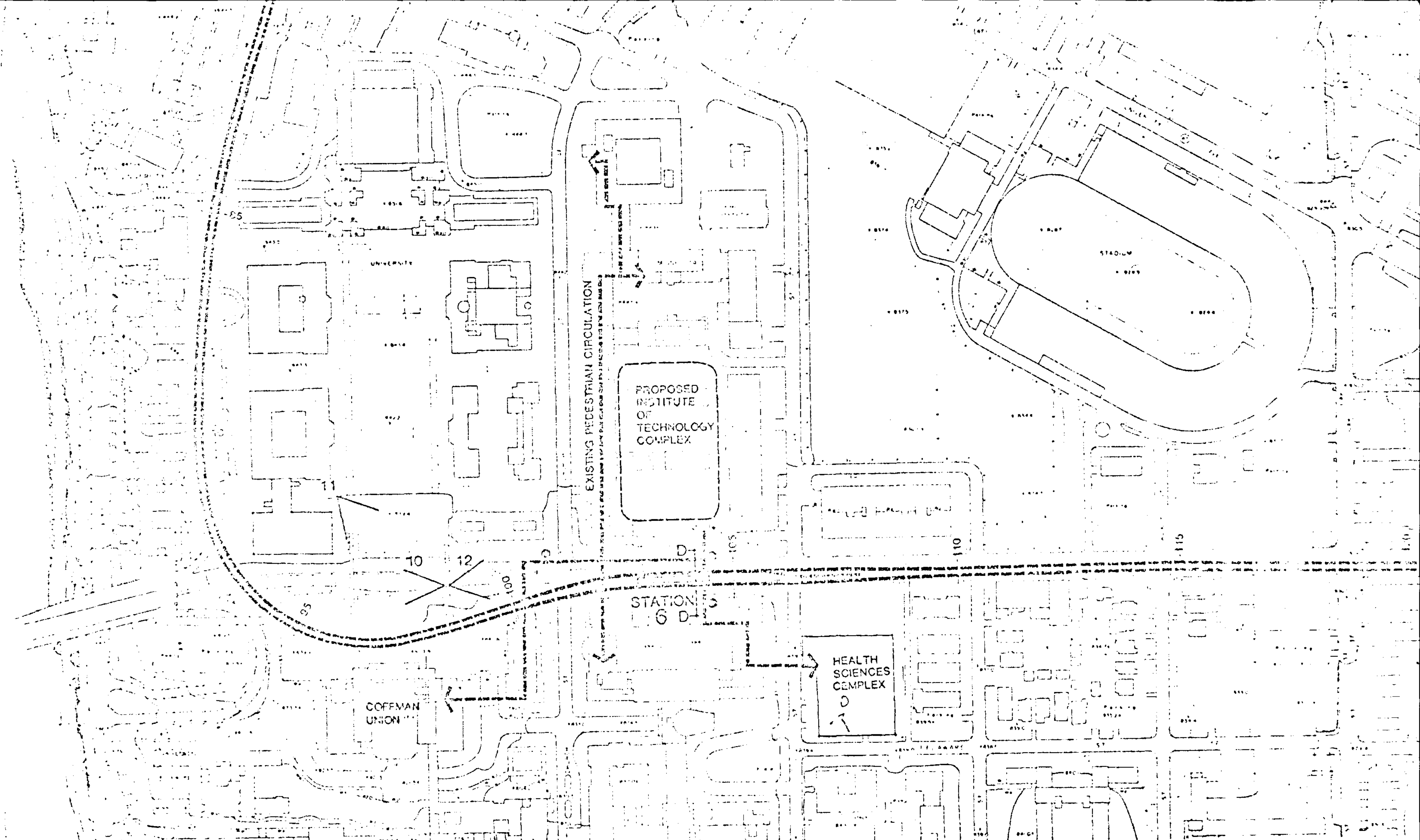
Mr. Greg Kittelsen, Assistant Director of Planning for the University of Minnesota, has represented the University's interests in this matter and has done an outstanding job in the management of the project. I am sure he will keep you informed as to the future steps of this project as it relates to the University of Minnesota.

Sincerely,

John R. Jamieson
Director of Transit Development

khf

cc: Greg Kittelsen



SECTION 4

SYSTEM REFINEMENTS

	STATION
	ELEVATED GUIDEWAY
	ON-GRADE GUIDEWAY
	SUB-GRADE GUIDEWAY

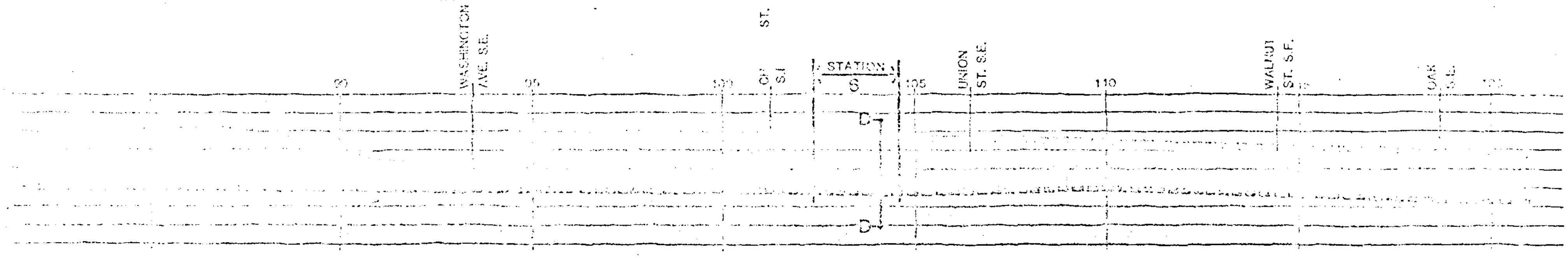
BICYCLE / PEDESTRIAN PATH

	EXPOSED
	ENCLOSED
	GREENWAY

	PEDESTRIAN VERTICAL ACCESS POINTS
	LOCATION OF IMAGE PHOTOS

UNIVERSITY TRANSIT STUDY

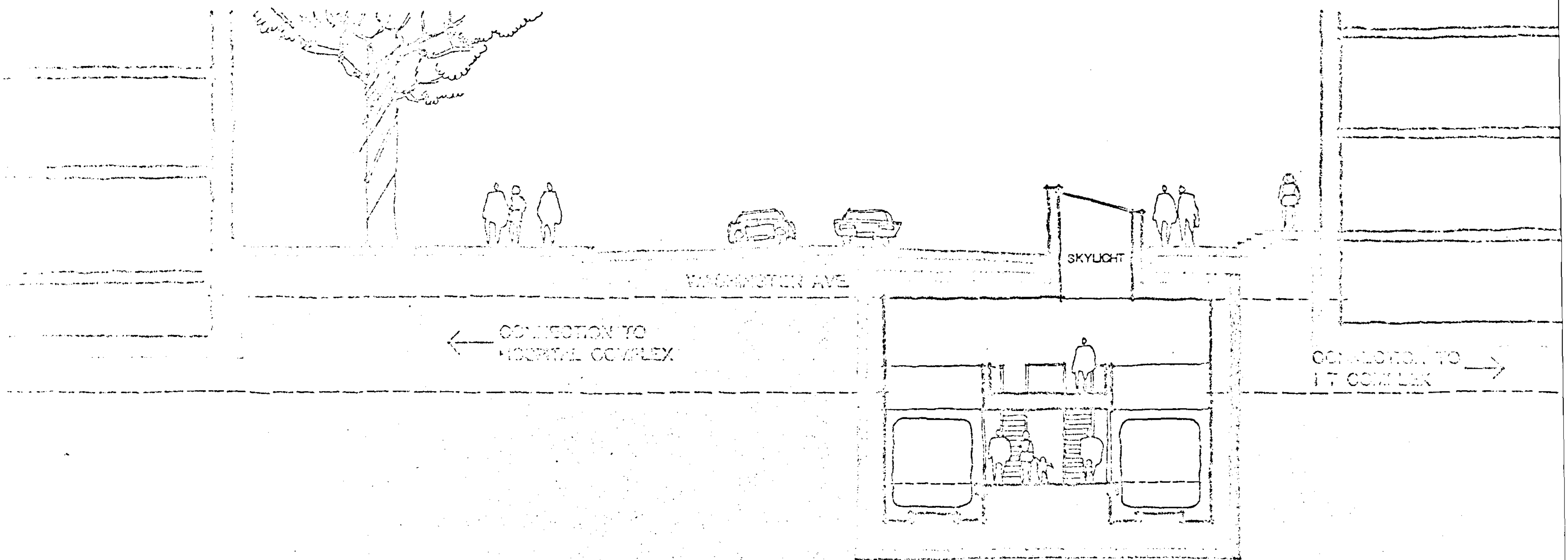
FIGURE 32



LONGITUDINAL SECTION

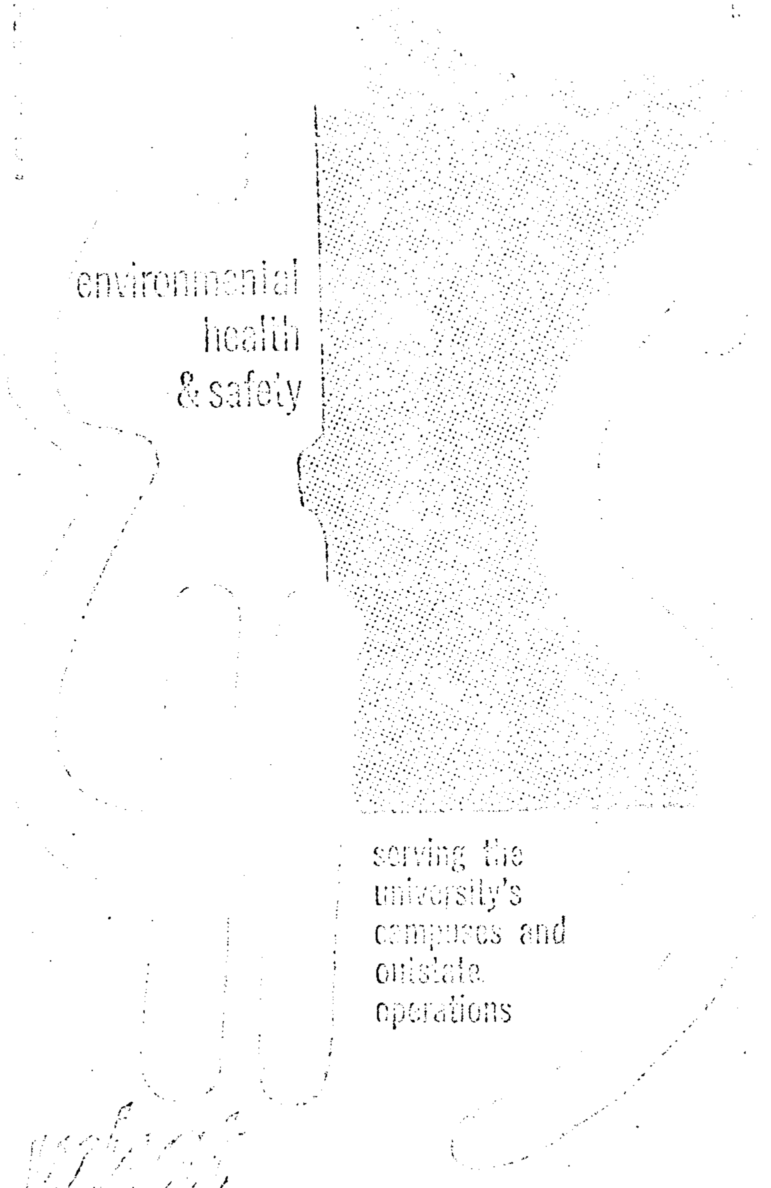
	GUIDEWAY
	ELEVATED
	ON-GRADE
	SUB-GRADE

INDICATES 12' REQUIRED CLEARANCE



SECTION D-D

Attachment XV

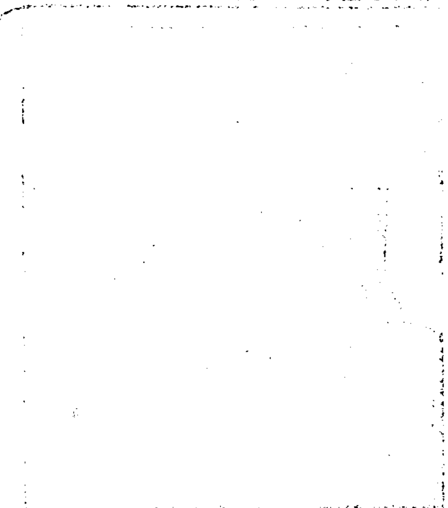


environmental health & safety

serving the university's campuses and outstate operations

what it's all about

university health service
minneapolis, minnesota



Validating ventilation hoods with a smoke tube and velometer is one way to determine whether ventilation hoods are keeping toxic vapors at safe levels in chemistry labs.

The occupational health section tries to find, then eliminate, all types of on-the-job health hazards to protect the health of students, faculty, and other employees at work on campus. Ventilation, illumination, noise, temperature, and air quality are frequent targets of occupational health services.

For example, by making analyses of air samples taken in organic chemistry labs, this division monitors student exposure to toxic agents—and necessary controls then prevent overexposure. Periodic inspection of microwave ovens used on campus protects students from leakage of dangerous non-ionizing radiation.

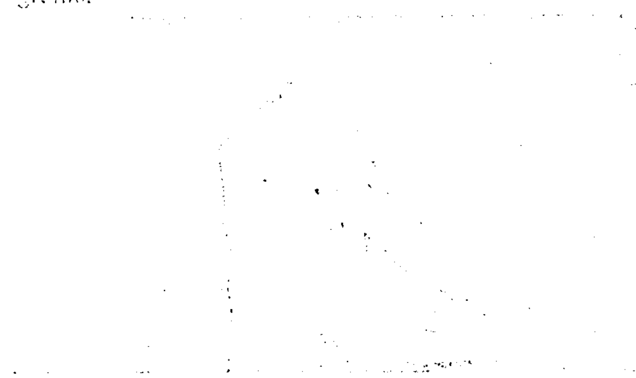
Such periodic investigations of occupational situations contribute to improved general health in the University community—and a University employee familiarized with safe working conditions here will carry this training to subsequent jobs outside the University too, contributing to the occupational health of the entire community.

General sanitation, a comprehensive service, results in healthier food, housing, and other features of your personal microcommunity within a cleaner, healthier University environment.

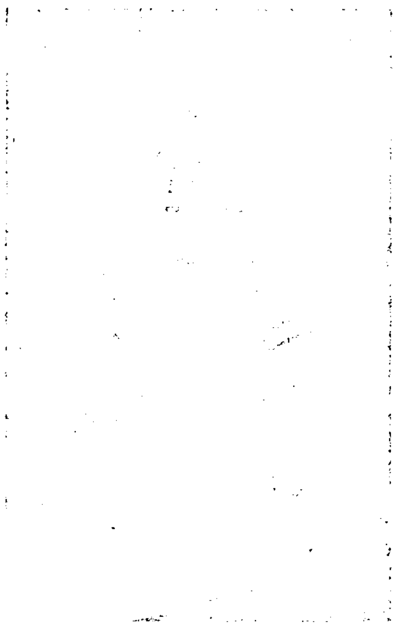
Usually this sanitation service recommends correction of physical conditions—conditions like rubbish piles that often are aesthetically unappealing—that might harbor or support biological health hazards such as insects, rodents, and disease-carrying organisms.

Housing, food, swimming pools, and pests are just some areas of sanitation services. For example, the division inspects University-owned or affiliated housing such as dormitories. Students can get advice on health-related off-campus housing problems from this division.

The division also reviews University food service sanitation for vending machines, cafeterias, the dairy plant commissary, and special events such as sports activities which serve food. In addition, the division tests the cleanliness of University swimming pools and reviews University insect and rodent control programs.



This [illegible] of food preparation and service helps [illegible] Cafeteria a safe place to eat.



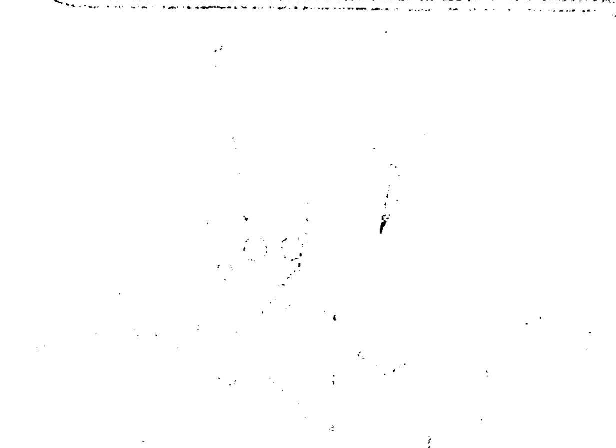
A health physicist evaluates radiation exposure from an X-ray machine to assure the safety of the patient and X-ray personnel.

Radiation protection assures the safety of students and employees who might be exposed to the University's many sources of ionizing radiation.

Medical use of X-radiation is the principal source of radiation exposure at the University, so this division recommends the use of protective shielding for patients and technicians during X-ray examinations to minimize that medical exposure.

In addition, the division routinely monitors personnel exposure, inspects all X-ray generators, and trains laboratory technicians and nurses in the safe handling of radioactive materials.

The division also keeps a close watch on all radioactive materials by approving all radioisotope orders, then receiving all shipments. Other division services include supervision of the handling and disposal of radioactive materials and surveillance of radioisotope laboratories.



The hospital sanitarian improves patient care by [illegible] inhalation therapy equipment to evaluate and reduce contamination.

The hospital sanitarian investigates health and safety problems of the hospital, acting as a technical consultant and liaison between the University Hospitals and other specialists in this division.

In addition, he works with several hospital committees--the Hospital Infection Control Committee, Inhalation Therapy Committee, and Foods Committee--to examine the problem of infections contracted during hospitalization.

When hospital-acquired infections are reported, the sanitarian tries to determine the cause, then recommend environmental resources for stopping the infection's spread and preventing its recurrence. How? The sanitarian makes comprehensive inspections in the hospital (especially of intensive care units), conducts laboratory analyses, plus improves techniques and develops quality control guidelines (for example, disinfection or sterilization methods).

The Environmental Health and Safety program of the University of Minnesota Health Service began over 35 years ago as a one-man part-time operation. Today a full-time staff of numerous professionals tackles the diverse environmental problems posed by a metropolitan university community and its outlying campuses.

Conceived to handle sanitary inspections, the division has grown to include occupational health, the hospital environment, safety, radiological health, and general sanitation—responsibilities requiring a staff of health physicists, public health engineers, occupational and industrial engineers, sanitarians, safety engineers and technicians, plus other environmental specialists.

Our long experience has made us environmentally wiser, too. Because the University's operations can pollute air, land, and water, this division reviews those operations and recommends ways to minimize the University's contribution to environmental degradation.

The University of Minnesota's environmental health and safety will keep improving with the continued growth of this vital environmental program, unique among the colleges and universities of this country.

General safety deals with the University environment—buildings, facilities, grounds, and activities—as a potential source of injury to students, faculty, and visitors.

Safety surveys, reviews of building plans, and analyses of on-campus accident reports indicate potential and actual physical dangers requiring safety control action. As a result, this division incorporates fire and personal safety controls into the University's environment and [illegible] students and employees [illegible] to potential [illegible] (for example, in lab[illegible]).

Safety programs [illegible] the [illegible] of protective clothing such as [illegible] and gloves, the [illegible] of hazardous machinery, and the [illegible] of [illegible] laboratories and buildings.

Anyone spotting an on-campus safety hazard should notify this division promptly.

A chemistry student—[illegible] clothed in [illegible] and lab [illegible] safety [illegible].

If you think environmental concern is something new at the University of [illegible], you're wrong.

For over 35 years, the Division of Environmental Health and Safety of the University's Health Service has been studying how your environment affects you in order to make the University campuses a safer, healthier, cleaner environment for you while you are working, studying, or teaching.

Yet you, as part of the University, affect the environment. Consequently, this environmental health program tries to maximize man's safety and comfort while minimizing the University's contribution to pollution—a dual purpose all to your advantage.

With your cooperation, you'll continue to benefit from this unique service. If you have any environmental problems or recommendations, come in and discuss them with us—we're located on the first floor of the Health Service Building.

Environmental concern? Right!

This brochure is printed on [illegible]% recycled paper.

Attachment XVI

ENVIRONMENTAL HEALTH AND SAFETY AT THE UNIVERSITY OF MINNESOTA

G. S. Michaelsen

The University of Minnesota was among the first in the nation concerned with the institutional environment in relation to the health, safety, and well-being of students, staff, and the visiting public. The beginnings of what is now the program of Environmental Health and Safety in the University Health Service are somewhat obscure. When the Health Service opened in 1918, only minor activity dealt with the environment. Then, in 1921, two students died when an epidemic of paratyphoid fever hit the campus. The cause, contaminated milk in the men's cafeteria, focused the attention of the Health Service on the critical necessity for supervised sanitation of student and staff eating facilities.

STUDENT HOUSING WAS THE BEGINNING

In 1932 the Board of Regents adopted the following regulation: "Students, whether graduate or undergraduate, while attending the University, must have their places of residence approved by the proper authorities of the University. If, in the opinion the Board of Regents, or its representative, the conditions at any such place are not conducive to study, health or morals, it may, at its discretion, insist that students vacate such residence and occupy rooms that are approved by the Board."

Despite this strong policy statement on student housing, a real program of off-campus housing inspection did not start until 1938, the result of a fire in a fraternity house which killed one student and severely injured two others. That incident brought intense public pressure from the metropolitan newspapers and the "Minnesota Daily," demanding that the University's administration do something about the critical housing conditions in the area surrounding the University. Clearly, the public expected the University to rectify its housing problems. Consequently, the administration delegated the technical health and safety inspection for the off-campus housing program to the University Health Service, while the Housing Bureau, under the Dean of Students, would process all student referrals, adjudicate complaints, and serve as liaison between the householder and the University.

Initially, part-time housing inspectors, under the supervision of a part-time 'lic health engineer, did that work. As the sanitary inspections and housing program increased in volume and scope, the need for some full-time personnel became increasingly apparent. Consequently, Mr. Richard Bond was employed in 1949 as the first full-time public health engineer to administer the environmental health and safety program. As the staff of part-time employees enlarged, the scope of the program expanded to include more work on food services, water supply, and waste disposal.

SANITARY CODE BROADENED THE PROGRAM

In order to strengthen the administration of the program, the Board of Regents adopted a sanitary code in 1951 as a University-wide and top level administrative policy emphasizing concern for environmental health and safety programs on the campus. This administrative recognition and concern provided the impetus for more requests for assistance on health and safety matters and, as a result, a sanitarian and an industrial health engineer were added to the staff in 1953. About that same time the administra- n asked the Health Service to handle industrial-type accident hazards and radiation hazards control.

By 1954 the increased use of radioisotopes and the installation of increased numbers of ionizing radiation producing pieces of equipment required the appointment of a full-time qualified health physicist. Upon the recommendation of the All-University Committee on Safety, a full-time safety supervisor was added to the staff in 1955.

The program's volume of work, the result of both increased student enrollment and staff as well as increased requests for assistance, necessitated employing a second health physicist and a second sanitarian in 1956. Two years later another physicist and sanitarian joined the staff.

In 1962 the Board of Regents amended the Sanitary Code, retitled as the Environmental Health and Safety Code, to reflect more accurately the additions and changes the environmental health and safety program during the preceding ten years. That same year a second safety engineer joined the staff, and a fourth sanitarian was employed in 1963.

Originally the Division's funding was allocated entirely from student fees. However, direct budgetary support shifted to the central administration when radiological health was added to the Division's responsibilities, a move prompted by recognition of the Division's progressive expansion into non-student related activities. Although the environmental health and safety program originally served only the Minneapolis and St. Paul campuses, the Division budget was increased a few years after the funding shift in order to provide environmental health and safety services to all parts of the University, regardless of the location.

Presently the University maintains some type of an operation at 15 geographical locations outside the Twin Cities area. This Division makes several visits a year to the larger out-state campuses and research facilities because there is considerable work of a general sanitation nature at the outlying facilities, the result of 36 well water supplies, four swimming pools, one natural bathing beach, seven food services, and a wide variety of individual sewage disposal systems. A wide variety of solid waste problems, particularly the proper disposal of agricultural chemicals, also exist at these facilities.

The environmental health and safety program is organized and staffed to meet the responsibilities assigned to the Health Service by the Board of Regents through the Environmental Health and Safety Code. The program is divided into five functional areas:(1) public health engineering, (2) occupational health, (3) safety, (4) radiological health, and (5) general sanitation.

PUBLIC HEALTH ENGINEERING

The engineering portion of the program handles water supply, sewage disposal, plumbing defects, and solid waste disposal. In addition to several municipal water supply systems serving University facilities, there are about 36 well water supplies owned and operated by the University. Sewage disposal installations at the University facilities vary from discharging into the Minneapolis and St. Paul municipal systems privies, a range including a septic tank, an imhoff tank, and a package sewage treatment plant. All of these situations must be evaluated from a public health perspective.

Consequently, this Division conducts surveys of the plumbing installations in Univer- / buildings, particularly looking for cross-connections and other plumbing defects which are potential hazards to the quality of the water supply---an especially trouble-some problem in laboratory buildings.

OCCUPATIONAL HEALTH

The goal of the occupational health program is to prevent adverse health effects from the environment of the occupation. (Being a "student" in terms of research or study is construed as an occupation.) Typical of such environmental problems are potential chemical hazards and physical stresses such as overexposure to toxic dusts, fumes, gases, vapors and mists, inadequate ventilation or illumination, noise and exposures to temperature extremes. Although these are problems usually associated with industry, a complex university exhibits all the occupational health hazards of industry; however, fewer people are likely to be exposed to any one material or condition at the University than in industry. For example, occupational hazards encountered the University by this Division include exposures to lead, a wide variety of solvents, mercury, noise, carbon monoxide, asphyxiation, insecticides, and welding fumes, in addition to a large variety of ventilation problems. The Division also evaluates the on-campus use of agricultural chemicals and monitors the use of lasers and microwave devices.

The Occupational Safety and Health Act, passed in 1970 by Congress, has far-reaching implications for all employers by its virtual assurance of adequate protection from occupational health and safety hazards for all employees. Although there is some legal question whether the University comes under the Act's provisions, this Congressional action leaves no question of the University's moral responsibility to recognize the Act's existence and to implement not less than the minimal mandatory requirements of other employers in the country. However, carrying out the letter of the Act will mand a greatly enlarged program of occupational health and safety.

POLLUTION PROBLEMS

The environmental health and safety program is concerned with the University as a polluter of the environment. The major activities in this area are in the public health engineering program for water and land pollution and occupational health for air pollution. Because the University's contribution to pollution is a result of its operations, the Health Service advises the Support Services and Operation Department in the technical evaluation of operational problems and makes recommendations for their solutions. The Support Services and Operations Department has been most cooperative in availing funds for special studies and the correction of pollution problems. Upon the strong recommendation and endorsement of the Health Service, that department employed an engineer to work full-time on minimizing the contribution the University makes to environmental degradation. One of the major considerations is the proper disposal of a wide variety of hazardous chemical wastes.

SAFETY

As the Division's name suggests, its safety efforts are directed at improving and controlling the environment to minimize the exposure of faculty, civil service staff, students, and the public to accidental injury. Activities are primarily of an engineering nature, whereas educational efforts are limited and intended for instruction in control of the environment or recognition of hazards, rather than safety education, per se. The responsibilities for safety education, clearly delineated in the president's letter on University safety policy, should be assumed by the faculty or civil service supervisor.

The scope of the safety program includes industrial, research, instructional, athletic, and recreational activities performed by students, faculty, and staff at the various campuses and stations. Public safety, of visitors and others attending public gatherings in University buildings, is another Division responsibility. In addition, the safety program considers fire as a life safety hazard to anyone on campus or at the various University stations. However, the program does not include traffic safety and considers the activities of outside contractors only to the extent that their activities may affect the safety of faculty, students, staff, and the visiting public.

An accident reporting system, developed in the early stages of the safety program, provides information on student, employee, and public injuries. Such records facilitate rapid investigation of individual accidents. In addition, information gleaned from the records indicates on-campus areas providing unusual exposures to safety hazards.

Several approaches are now being used to provoke greater interest in recognizing and correcting safety hazards. For example, the Division publishes a health and safety bulletin which outlines specific hazards associated with known University activities. Although the publication is irregular, averaging three issues per year, twenty-two such bulletins have been prepared to date. Labsafety News, a second publication issued monthly, deals specifically with laboratory safety. A second approach is the publication of safety standards which serve as guidelines in the purchase, use, storage and disposal of known hazardous items. Seven such standards have been issued to date. A third method, recently initiated to alert personnel to specific hazards, is the publication to date of five special hazard bulletins. Still another approach to increase the safety interest of staff and research personnel emphasizes individual participation in brief group meetings in the various departments to informally discuss safety problems directly related to each department's activities.

Some departments and divisions have appointed safety committees or single individuals to pay particular attention to the safety of that area's environment, then advise the safety engineers of unusual activities, hazards, or conditions which might develop.

Because incorporating safety controls into new buildings and new activities is especially important as a preventive safety effort, the safety engineers and other staff members of the Division of Environmental Health and Safety review plans for new buildings and major remodeling of existing structures. Suggestions and recommendations are forwarded to the University's Planning Office. In addition, the Division receives copies of all requests for new power equipment from the University Machine Shop Committee and schedules of changes in space use from Space Programming and Management.

RADIATION PROTECTION

Health physics, radiation protection, or radiological health are interchangeable phrases defined as the protection of people from the damaging effects of ionizing radiation. Despite that simple definition, the program necessary to achieve that objective is quite complicated.

The major sources of ionizing radiation and, consequently, radiation exposure at the University are: radioisotope use, diagnostic and therapeutic x-ray installations, x-ray diffraction units, electronmicroscopes, and particle accelerators. Presently 250 project directors use radioisotopes under the approval of two University AEC radioisotope broad licenses. Before a project director receives approval to use radioisotopes, a health physicist inspects the applicant's laboratory facilities, then reviews the applicant's understanding of radiation protection principles, to determine the applicant's qualifications. Health physicists must approve all requisitions for purchasing radioisotopes as well as receive all shipments, which are then monitored and logged before delivery to the user.

The health physics program offers a wide variety of services intended to minimize personnel exposure. The Division offers diverse radiation protection services. For example, the Division trains research personnel, as well as nurses who care for patients treated therapeutically with radioisotopes; provides film badges to approximately 550 persons to measure their exposure to beta, gamma, and neutron radiation; and makes periodic radiation surveys of radioisotope laboratories and x-ray facilities to evaluate and reduce both internal and external personnel exposure. Special service is provided in the design of facilities and equipment used in research with radiation emitters. In addition, the radiation protection program provides the technical expertise as well as the equipment to handle emergencies such as laboratory contamination or lost radioactive sources.

Unique radioisotope and radiation-producing facilities requiring special attention from the health physicists are in operation at the University. One of these special facilities is a Tandem Van de Graaff Generator in the Physics Department.

The Nuclear Engineering Gamma Irradiation Facility contains 10,000 curies of Cs-137 nd is available to all University personnel for high dose irradiation. The sources are stored under 17 feet of water in a shielded structure of concrete five feet thick.

The health physicist supervises the handling and disposal of radioactive wastes, an especially critical activity which prevents both the exposure of personnel and contamination of University facilities and the general environment. Waste collection and disposal is one of the most time-consuming and troublesome aspects of the health physics program. Three basic methods are used for waste collection and disposal: dilution in the sewage flow, incineration, and storage for land burial off-site. All disposal is done in strict compliance with the Atomic Energy Commission, the Minnesota State Board of Health, and the Minnesota Pollution Control regulations.

GENERAL SANITATION

The general sanitation program is divided into six major areas: (1) housing, (2) food, (3) water and sewage, (4) swimming pools, (5) hospital sanitation, and (6) insect and rodent control.

In 1970 the Board of Regents removed all requirements that students must live in University-approved housing units. Consequently, requests from the Housing Bureau for inspection of off-campus housing units have come to a complete standstill. Presently, inspection of off-campus housing units is done at the request of students, parents, householders, or a Health Service physician who has reason to believe that a student's health might be affected by his housing situation. However, these inspections, done with the full knowledge and consent of the householder, are only advisory in nature.

Those dissatisfied with this policy object that this almost complete lack of concern by the University for the quality of housing available to students is not in the best health or safety interests of the students. Because the housing agencies of both Minneapolis and St. Paul are inadequately staffed to complete the detailed inspections necessary for proper evaluation of housing quality, a regression to the unsatisfactory housing conditions of the 1930's is all too possible.

FOOD SANITATION

When the fraternities and sororities long ago requested that food and housing inspections be done by the Health Service rather than the city agencies, those houses made a cooperative arrangement with the Minneapolis Health Department to forego their license fee and accept inspections by the Health Service. Consequently, this Division makes annual inspections of fraternities and sororities, as well as cooperatives and religious foundations. All University-owned housing (whether single dwellings, multiple dwellings, married student housing, or dormitories) receives a minimum of one annual inspection.

The present food sanitation program consists of annual sanitary surveys of each of the 30 food service facilities operated by the University, including the dormitory food services, Coffman Union, Shevlin Hall, the Campus Club, the St. Paul Dining Center, the Hospital food services (including infant formula), the Kirby Food Center on the Duluth Campus, and the numerous concession stands at athletic events.

The Division also provides sanitary surveillance for special events such as the Campus Carnival, the Foreign Students Festival, and special banquets or picnics. The University-operated dairy plant and the food stores facility, as well as the food and drinks dispensed from 345 vending machines on the Minneapolis and St. Paul campuses, are also kept under sanitary observation.

The Division's sanitarians work closely with the Health Service physicians to investigate all suspected incidents of food or drink-borne disease. As a corollary effort, the Division emphasizes educational programs for student and civil service food workers.

OTHER SERVICES

The present sanitation of swimming pools includes semi-monthly bacteriological, chemical, and physical examination of five swimming pools on the Minneapolis and St. Paul campuses, as well as the pool at the president's residence. Pool operators submit daily operational reports to the Division which are used primarily as checks against major operational errors or as explanations for analytical results.

Division work on water supplies, plumbing, and sewage disposal systems includes sampling the water supplies of the St. Paul campus, Rosemount Research Center, and outlying stations for bacteriological examination. In addition, the Division supervises chlorination of new water mains, repaired mains, and extensive new water services in buildings.

The Health Service serves as a consultant to the insect and rodent control program operated by the Support Services and Operations Department by investigating reports of insect or rodent infestation and suggesting control measures.

The University's large teaching hospital and allied medical facilities provide a major background for environmental health and safety activity. All of the functional programs previously described also contribute significant effort on problems in the medical sciences facilities. In addition, budgetary support from the Hospital allows one senior sanitarian to work full-time on sanitation problems in the Hospital.

The present technical staff of the environmental health and safety program and the year each joined the staff are:

1. George S. Michaelsen, Professor and Director, 1953
2. Gustave L. Scheffler, Assistant Professor and Safety Engineer, 1957
3. John W. Teske, Instructor and Safety Engineer, 1965
4. Maurice W. Tipcke, Safety Technician, 1969
5. Walter H. Jopke, Assistant Professor and Senior Sanitarian, 1959
6. Knowlton J. Caplan, Assistant Professor and Occupational Health Engineer, 1969
7. Roger L. DeRoos, Instructor and Public Health Engineer, 1964
8. Jerome W. Staiger, Instructor and Health Physicist, 1966
9. Ronald Jans, Instructor and Health Physicist, 1971
10. Ralph O. Wollan, Assistant Professor and Health Physicist, 1954
11. Donald J. Wheeler, Senior Sanitarian, 1963
12. Russell F. Rhoades, Sanitarian, 1969
13. Michael Burkhart, Sanitarian, 1970
14. Gerald Ortiz, Sanitarian, 1970

15. Erland Brager, Sanitarian, 1971

This group, representing 95 man-years of experience and service to the University, offers a broad range of professional skills. Some key members offer considerable expertise in their specialized areas.

PRESENT STATUS AND PHILOSOPHY

The Environmental Health and Safety Division of the University of Minnesota is unique among the colleges and universities of this country, the nation's only comprehensive program where all the aspects of the over-all health and safety program are in one administrative setting. This latter feature, a major strength of the program, eliminates the confusion of overlapping interests when the program is divided into portions operated by different departments. For example, a not uncommon division at other universities finds general sanitation in one department, radiological health in another, and safety in still another.

Another strength of the program is its advisory nature. As the University's environmental advisor, the Division must be cognizant of all environmental health and safety matters of the University, take all necessary steps to evaluate possible hazards, and devise solutions to eliminate any hazardous conditions. The next responsibility is to keep the administration informed by advising the administration on the existence of hazards and control efforts necessary to minimize the hazards. However, action based on these recommendations rests on administrative decisions which must be made by an informed administration which can weigh the Division's technical advice against the mission of the University, its priorities, and budgetary constraints.

Obviously, environmental problems exist in many degrees of severity. Despite the basically advisory nature of its responsibilities, the Health Service feels a moral obligation to neither permit nor condone truly serious or hazardous conditions. In fact, the Board of Regents has empowered the Health Service to take direct emergency action in such situations. Fortunately, the cooperative reaction of the Administration to the advisory efforts of the Health Service has made it unnecessary to invoke such authority.