Applicants Statement
of
Environmental Assessment
for
University of Minnesota - Health Sciences
Medical School

Application
for
Basic Sciences Replacement Space
in
Jackson-Owre-Millard Complex

Submitted: March 17, 1975

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THE FACILITY, HISTORY, AND BACKGROUND

In 1964 the University of Minnesota began the planning process that led to expansion of the scale and scope of its programs in the health disciplines.

The Regents of the University, acting on preliminary reports of the University Long Range Planning Committee that was appointed by the President in September 1964, proposed physical 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.

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.

After many cooperative studies with representatives of the other health professional units, the present plan has evolved. Much of the space in the Health Sciences Center is designed for shared use with the other units.

The Health Sciences Center 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 commerical 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 for the location of the Basic Sciences, the subject of this application, is the Jackson-Owre-Millard Complex, located at the central point within the Health Sciences Center and connected by tunnel and/or bridges to all adjacent buildings. Attachments I and II outline this segment of the Master Plan.

The space within the Jackson-Owre-Millard complex was originally occupied by the School of Dentistry and vacated by that School's move to Health Sciences Unit A in the fall of 1974.

Following the sequential steps of the Health Sciences Master Plan, the space vacated by Dentistry was assigned to the Medical School for the Basic Sciences departments of Anatomy, Biochemistry, Microbiology, Pathology, Pharmacology and Physiology.

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

All construction to be completed by this project will be interior re-design and remodeling. Impact on external resources is minimal.

Land Use

The remodeling of the Jackson-Owre-Millard complex will not represent a change in the use of the parcel of land being directly affected by the action.

Because of the adequacy of storm sewer design for the area, the project 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 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 be any change in the primary or traditional use of a body of water.

Ground Water

The project will not cause a change in the volume of water in natural or underground water systems.

Air Use

This facility will not bring about any changes in the use of air space.

The completion of this project 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

As a total project of internal remodeling, no impact on the site and soil conditions will occur.

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 is directed to a storm sewer. 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.

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. Those researchers working within the complex are 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 new use of this facility will not alter the amount of solid waste. Some of the materials cannot be recycled because of contamination however, recycling will occur where feasible.

The University of Minnesota has an active resource recovery program spearheaded by the Phyical 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 the project and be collected along with corrugated materials from other parts of the campus.

Where it is not feasible to recycle because of character of waste, 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 deliver 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 in the 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.

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 of waste from campus buildings. Unit A, the first unit of the Health Sciences Center to be completed, generates 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 can absorb, under its present operation schedule, the contributions of waste 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, there will be no change in the need for burning capacity of animal carcasses. If the present schedule of burning is maintained, shifting from burning of general campus waste to burning of medical facility waste will be helpful for the destruction of animal carcasses becuase 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 III 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 the Basic Sciences enter this recycling system.

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

In relation to radioactive wastes, the project will generate some materials requiring "the storage of contiminants 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 VI. 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 VII gives a general overview of the radioactive waste handling procedure for the University and Attachment XIII 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 identifiable genetic change in the human population (because of careful control of the use of diagnostic and therapeutic radiation dose); or 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 interior remodeling project 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, 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. 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 IX is a copy of this policy and procedure. Note that Item No. 10 also specifics 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.

As with the construction of any new facility, there will be some alteration in the use of basic services. This project 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.

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.

Consumption of gas will be negligible compared to the amount of gas consumed in the Twin Cities Metropolitan area.

The proposed project should not create any change in the availability of food for our 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 facilitiies 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 5% of the number of messages delivered on an annual basis, an alteration of more than 5% in the number of health professional educators required to serve the population, nor will there be an alteration of more than 5% in the number of health professionals required to serve the population.

There will not be a transportation change of 5% for the Metropolitan area. The scope of the project is such that it will not create a change of more than 5% 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. 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 5% 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.

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 X.

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.

This project 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.

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

		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	Trips			
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 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 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.

The scope of the project is not of such a magnitude that it will decrease the availability of communications services for more than 5% of the population or precipitate a change of more than 10% in the real money income of 10% or more of the population, nor will the project create a change of more than 5% in the annual school enrollment on a national basis or alter by more than 10% 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 environement. 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 and incorporates recommendations into the construction. In this role, the Department will review the plans. The project will be reviewed to assure that appropriate environemntal standards are met. Many of these standards have been referred to in the previous paragraphs of the environmental assessment. 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 XI and XII describe this team.

ALTERNATIVES TO THE PROPOSED PROJECT

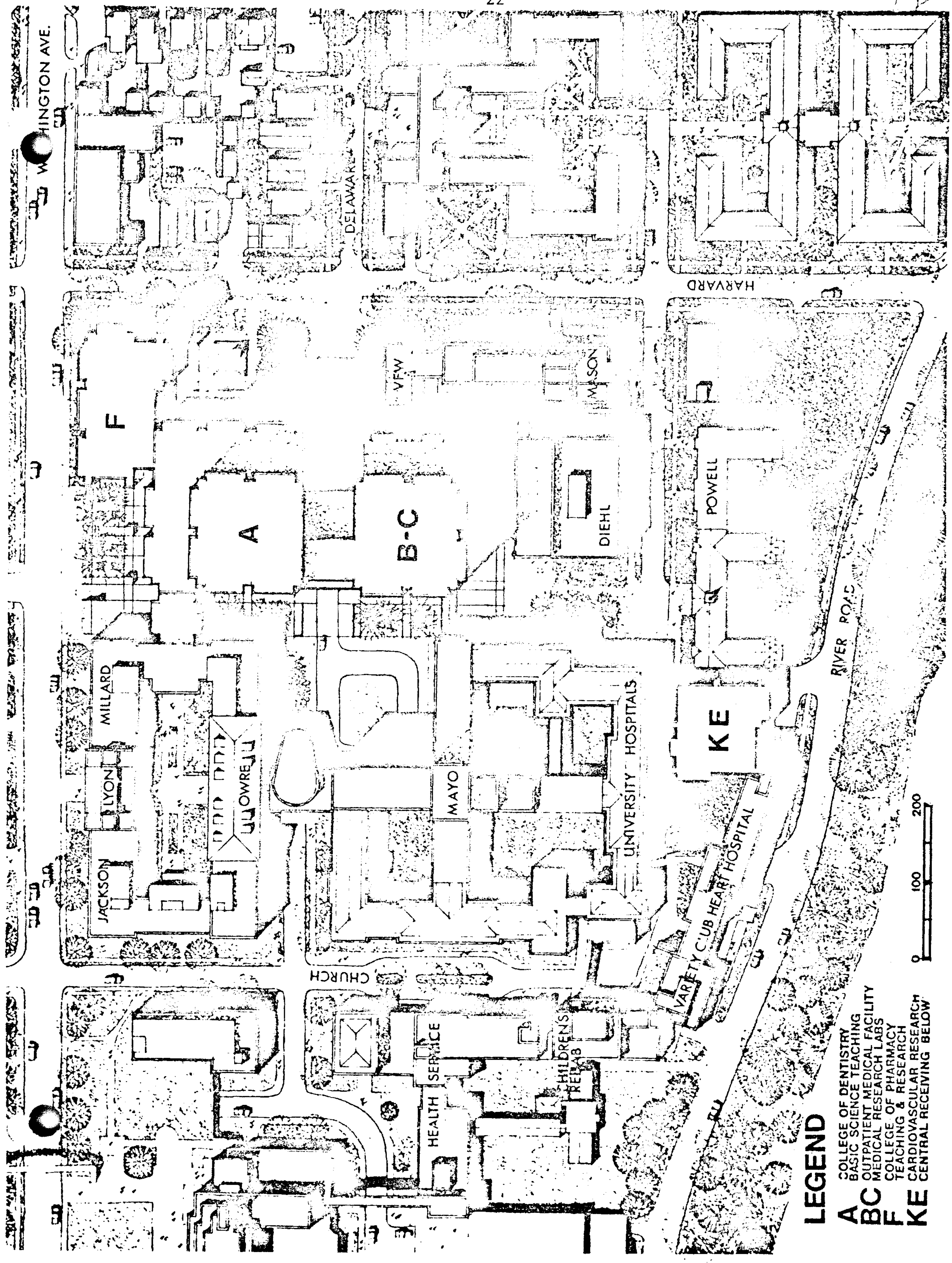
Remodeling of this facility is part of a six year old master planning decision on site location. The location of the Medical School's Basic Sciences departments evolved from an in-depth analysis that determined that the most ideal site, among those considered for the development of the Health Sciences 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.

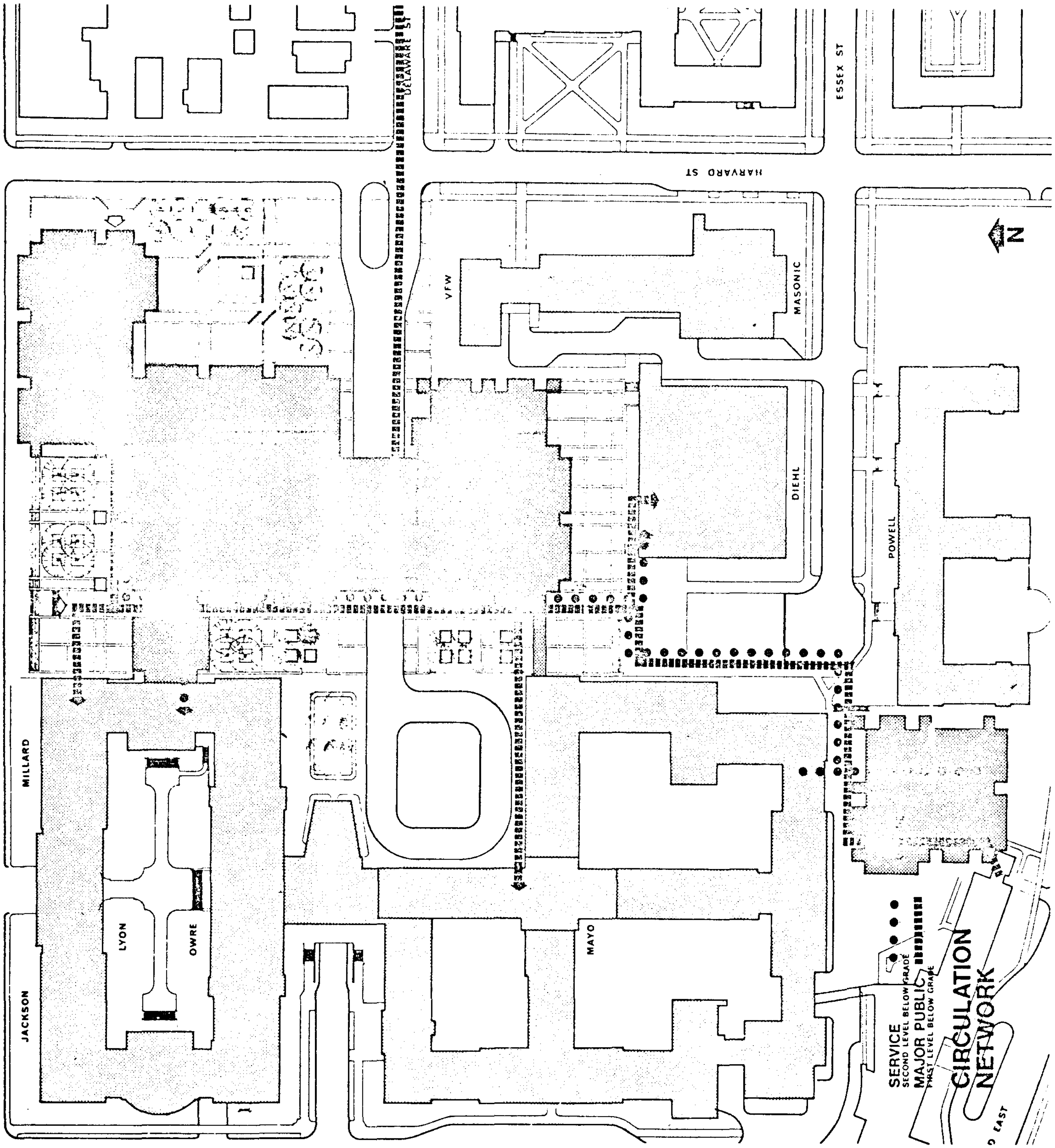
Attachment I

MASTER PLAN


WASHINGTON AVE.
DELAWARE
HARVARD
F
A
B-C
VFW
MASON
DIEHL
POWELL
RIVER ROAD
MILLARD
LYON
JACKSON
OWRE
MAYO
UNIVERSITY HOSPITALS
KE
VARIETY CLUB HEART HOSPITAL
CHURCH
HEALTH SERVICE
CHILDRENS REHAB
0
100
200
LEGEND
A COLLEGE OF DENTISTRY
BASIC SCIENCE TEACHING
BC OUTPATIENT MEDICAL FACILITY
MEDICAL RESEARCH LABS
F COLLEGE OF PHARMACY
TEACHING & RESEARCH
KE CARDIOVASCULAR RESEARCH
CENTRAL RECEIVING BELOW

Attachment II

CIRCULATION NETWORK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ESSEX ST
HARVARD ST
VFW
MASONIC
DIEHL
POWELL
N
MILLARD
JACKSON
LYON
OWRE
MAYO
SERVICE
SECOND LEVEL BELOW GRADE
MAJOR PUBLIC
FIRST LEVEL BELOW GRADE
CIRCULATION
NETWORK

Attachment III

DISPOSAL OF WASTE CHEMICALS

Safety Standard
Division of Environmental Health and Safety

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 IV

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 V

HEALTH & SAFETY BULLETIN

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 VI

PROCEDURES IN THE HANDLING 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 373-3167
In case of Radiation Emergency dial "0" OPERATOR

Department of Environmental Health and Safety • University Health Service

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 VII

RADIOACTIVE WASTE DISPOSAL AT A LARGE UNIVERSITY

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Radioactive Waste Disposal at a Large University

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University of Minnesota

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

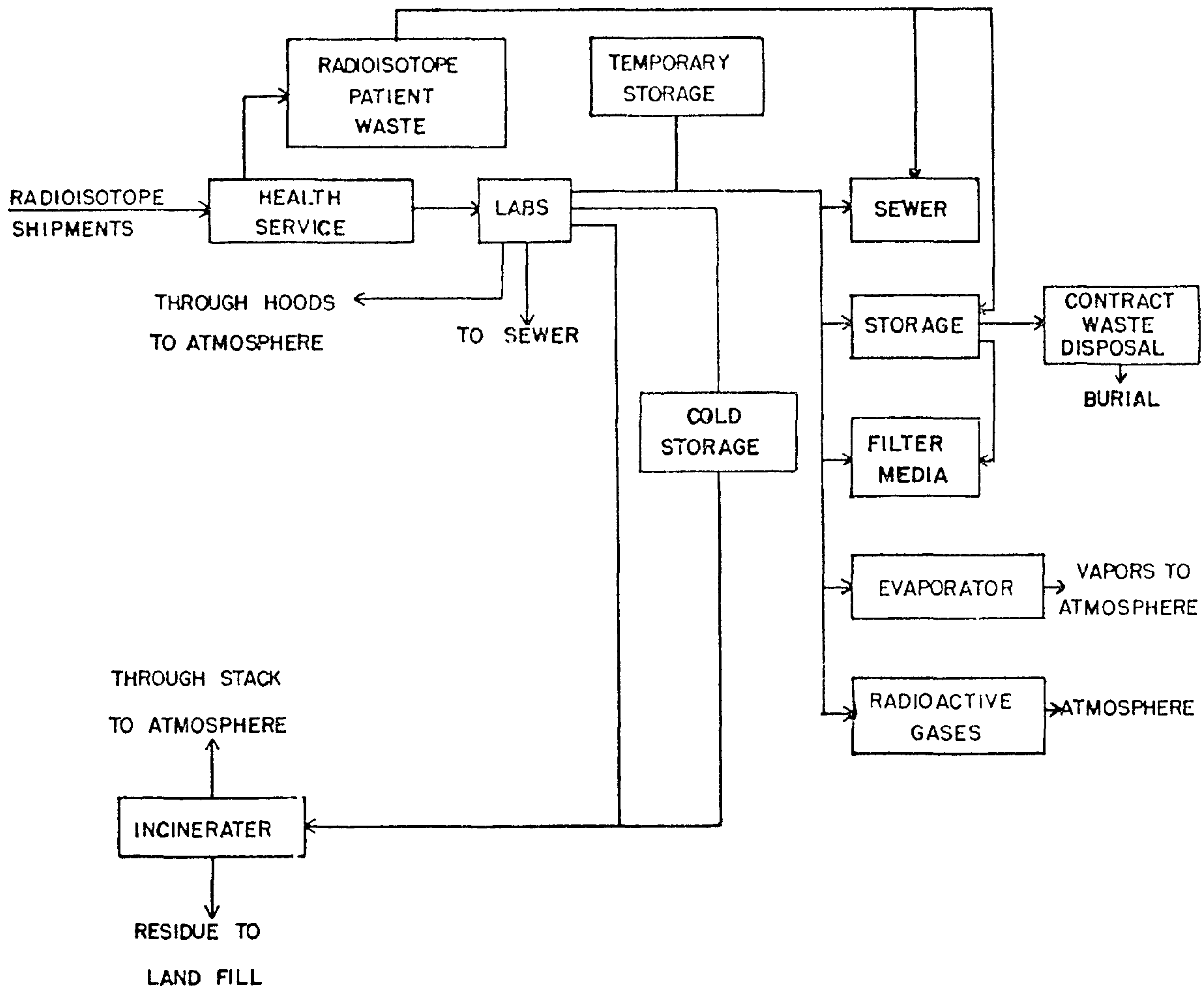

Figure 1. Waste flow chart*

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 whole 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 li juid 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

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[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 VIII

DISPOSAL OF LOW-LEVEL RADIOACTIVE WASTES
AT A LARGE UNIVERSITY INCINERATOR

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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 nonradioactive 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

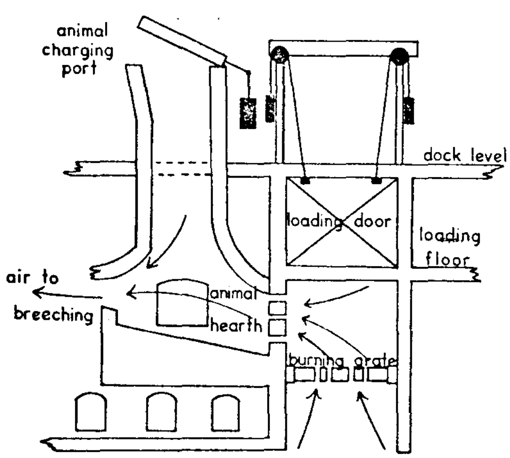

FIGURE 1. Cross section view of the University incinerator and animal hearth.

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,

$V = 4005 \sqrt{VP}$, 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

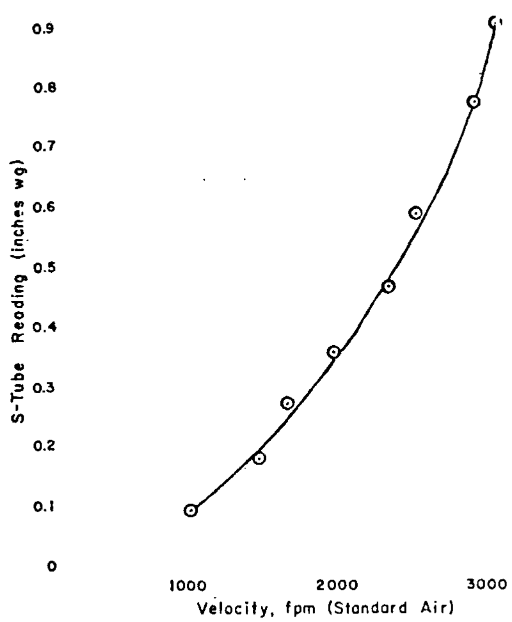

FIGURE 2. Incinerator stack calibration of S-type pitot tube.

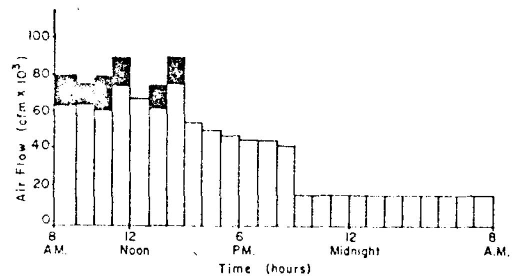

FIGURE 3. Average daily air flow from the University of Minnesota incinerator. Open bars represent actual effluent cfm. and closed bar areas represent temperature corrections. (Temperature correction equals absolute temperature at top of stack divided by absolute temperature at air monitor in breeching.)

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

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

For example: For ^{131}I, $MPC_a = 1 \times 10^{-10}$ $\mu Ci/cm^3$

Maximum per quarter $= (1.325 \times 10^{14} cm^3/quarter)\ (1 \times 10^{-10}\ \mu Ci/cm^3)$
$= 1.325 \times 10^4\ \mu Ci/quarter$

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:

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

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:

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

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

$$0.00024 + 0.00077 + 0.0128 + 0.0056 + 0.0011 + 0.00019 + 0.09 + 0.61 + 0.00034 + 0.00047 = \mathit{0.722}$$

This is $\leqslant 1$; 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 ($\mu Ci/cm^3$)	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.	^3H	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	5.65×10^{-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}	1.06×10^5	0.5×10^3	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.

$$\text{Ash volume} = 16\ \text{yd}^3/\text{day} \times 27\ \text{ft}^3/\text{yd}^3 \times \text{t}.83 \times 10^4\ \text{cm}^3/\text{ft}^3 \times 91\ \text{days/quarter}$$
$$= 1.115 \times 10^9\ \text{cm}^3/\text{quarter}$$

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.

$$0.0036 + 0.00612 + 0.152 + 0.7450 + 0.018 + 0.045 + 3.6 + 29.0 + 0.006 + 0.0045 = \mathit{33.50}$$

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^{3}	7.5×10^{2}	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^{-5}	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	0.03	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.

References

1. Straub, C. B.: *Low-Level Radioactive Waste, Their Handling, Treatment and Disposal.* Division of Technical Information, U. S. Atomic Energy Commission, Washington, D. C. (1964).
2. Geyer, J. C., L. C. MacMurray, A. P. Talboys, and H. W. Brown: Low-Level Radioactive Waste Disposal. *Proc. First Intern. Conf. Peaceful Uses At. Energy, Geneva 1955* Vol. 9, p. 19, United Nations, New York (1956).
3. U. S. Atomic Energy Commission Rules and Regulations, *Code of Federal Regulations, Title 10, Part 20* (Dec. 31, 1968).
4. Wollan, R. O., R. J. Boge, and J. W. Staiger: Radioactive Waste Disposal at a Large University. *J. Amer. College Health Assoc. 17:* 315 (April 1969).
5. *Survey of Environmental Radioactivity.* Minnesota Department of Health and Rural Cooperative Power Association, C00-651-81 (Nov. 1969).

Received February 16, 1971

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Attachment IX

POLICY AND PROCEDURES FOR ANIMAL
CARE AND USAGE AT THE UNIVERSITY OF MINNESOTA

May 10, 1974

Statement accepted by the
Regents of the University of
Minnesota

ANIMAL CARE AND USAGE

AT THE UNIVERSITY OF MINNESOTA

Outline

I. Statement of Policy

A. 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/or undue 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 of 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.

B. 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 other environmental conditions;

2. Employ veterinary staff to 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 corss-infection between animals and man, contribute to train-

ing of animal care personnel, advise regarding use of pain-suppressing drugs, establish procedures for euthanasia and control of parasites and pests, and advise 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.

4. It is assumed that existing procedures under B.A. Form 23 will be utilized at the time of the grant application 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 individual. Warm-blooded animals should not be subjected to uses involving serious risk of pain, discomfort, injury or death unless there is a prior expectation that the anticipated results would justify the use to a peer group of reasonable and prudent investigators.

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 individual competent in such matters.

3. Experimentation and teaching involving warm-blooded animals should be so conducted as to avoid all unnecessary suffering.
4. Care of subject animals subsequent to an experiment should be such as to minimize discomfort to animals.
5. If it is necessary to kill an animal, this should be done 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 veterinarian on his staff. Questionable cases will be referred to appropriate specialists and/or the All-University Animal Care Committee.
8. It should be understood that the principal investigator has the right to appeal his case in person to the All-University Animal Care Committee, hear all arguments against his procedure or proposal, present arguments for his procedure or proposal and obtain a decision from the committee.

III. Procedure for Implementation of Policy

A. Scope of Activities Covered

---

[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.

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 relevent 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 for 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 4206 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 unit;

5. Mediation and review of appeals regarding the program of inspection of animal facilities or decision 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, Ul.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 Aponsored 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 for 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 government 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, when necessary;
7. Advise in planning of new facilities and in the remodeling of existing 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 from time to time

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, the number and kind of animals in a given room, 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. In their administrative capacity, 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. When animals are to be moved into a room previously used for another purpose, the room must conform to the requirements of the species for which the room will be used.

7. Appeals regarding any aspect of the program of inspection of animal facilities 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 or the principal investigator, or by the faculty member responsible for the specific animals involved.

2. Sick animals shall be given prompt medical treatment appropriate for their condition or promptly and humanely destroyed, except that this section shall not be construed as requiring the premature abandonment of research involving induced medical problems.

3. Veterinarians on the staff of the Animal Services Unit 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.

5. Acceptable existing arrangements for such consultation, especially for large animals, are not abrogated by the provisions of III.D.4., above.

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 standards 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 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 containing the following information will be prepared by the Director of Animal Services in consultation with specialists and regulatory agencies:

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. In some facilities it may be necessary to measure the adequacy with which temperature and humidity are controlled. 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 all animal facilities to be used for reference in decisions regarding renovation or changes in the function to be served by the faculty.

3. When new construction or remodeling includes animal facilities, the Director of Animal Services must approve the design specifications to assure that applicable minimum standards are being met.

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 X

UNIVERSITY AREA TRANSIT STUDY

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 #6 as identified in Figure 59 of the report. 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.

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

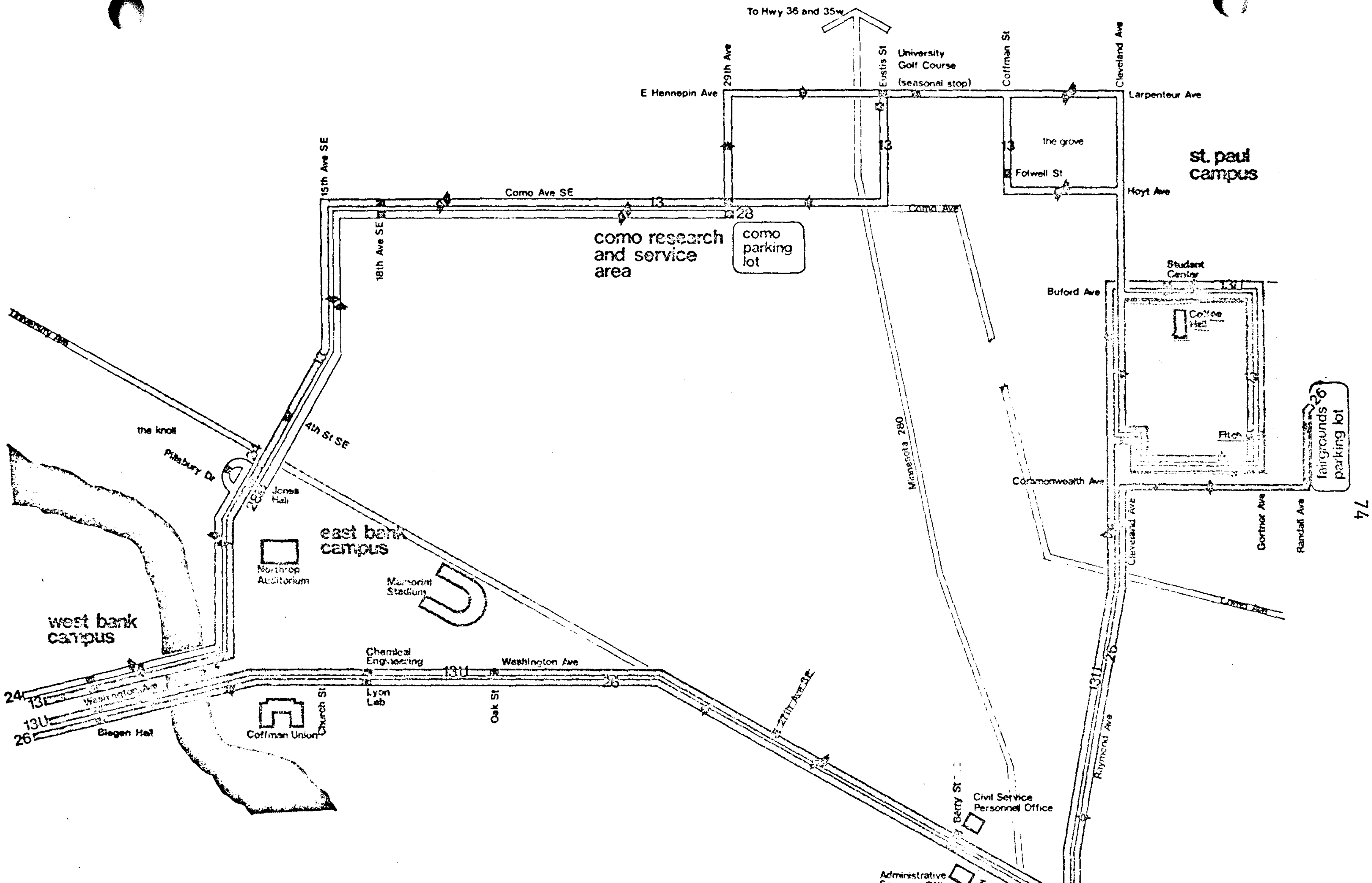
Mr. Greg Kittelsen, Assistant Director of Planning for the University of Minnesota, has represented the University's interests in this matter and has done an outstanding job in the management of the project. I am sure he will keep you informed as to the future steps of this project as it relates to the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

Sincerely,

John R. Jamieson
Director of Transit Development

khf

cc: Greg Kittelsen



campus transit system

- ■ fare stop
- ● free stop

schedules posted at stops

schedule information available at information windows in: CMU, WBU, Morrill Hall, St. Paul Student Center, 224 NMA, or call 373-0374

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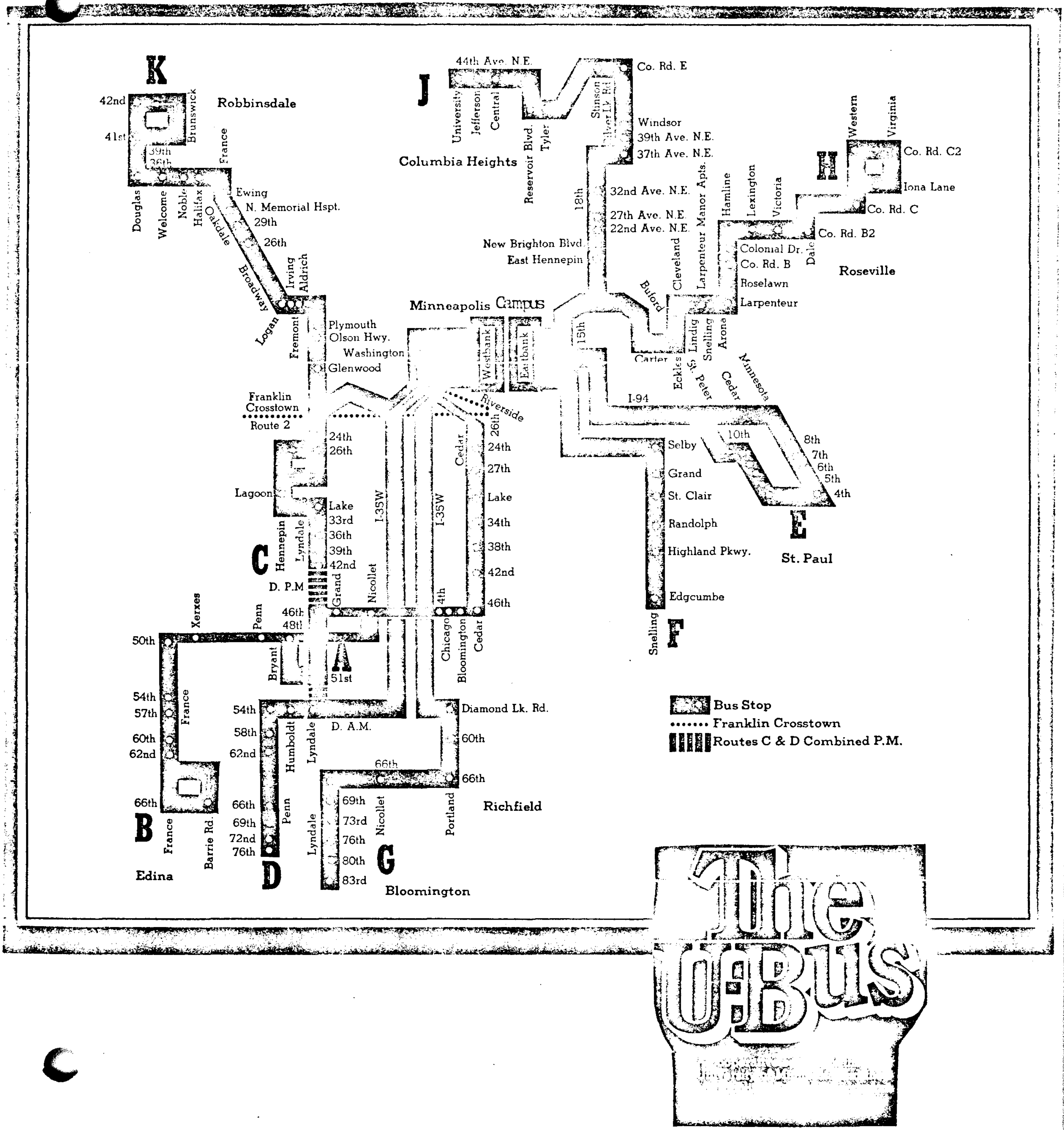

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41st
39th
36th
Brunswick
France
Douglas
Welcome
Noble
Halifax
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Ewing
N. Memorial Hspt.
29th
26th
Broadway
Irving
Aldrich
Logan
Fremont
Plymouth
Olson Hwy.
Washington
Glenwood
Franklin
Crosstown
Route 2
J
44th Ave. N.E.
University
Jefferson
Central
Reservoir Blvd.
Tyler
Columbia Heights
Co. Rd. E
Stinson
Windsor
39th Ave. N.E.
37th Ave. N.E.
18th
32nd Ave. N.E.
27th Ave. N.E.
22nd Ave. N.E.
New Brighton Blvd.
East Hennepin
Minneapolis Campus
Westbank
Eastbank
15th
Riverside
H
Western
Virginia
Co. Rd. C2
Iona Lane
Co. Rd. C
Co. Rd. B2
Hamline
Lexington
Victoria
Cleveland
Larpenteur Manor Apts.
Colonial Dr.
Co. Rd. B
Dale
Roseville
Roselawn
Larpenteur
Buford
Carter
Lindig
Snelling
Arona
Eckles
St. Peter
Cedar
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10th
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7th
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St. Paul
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Grand
St. Clair
Randolph
Highland Pkwy.
Edgcumbe
Snelling
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Lagoon
Lake
33rd
36th
39th
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Lyndale
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D. P.M.
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Nicollet
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Cedar
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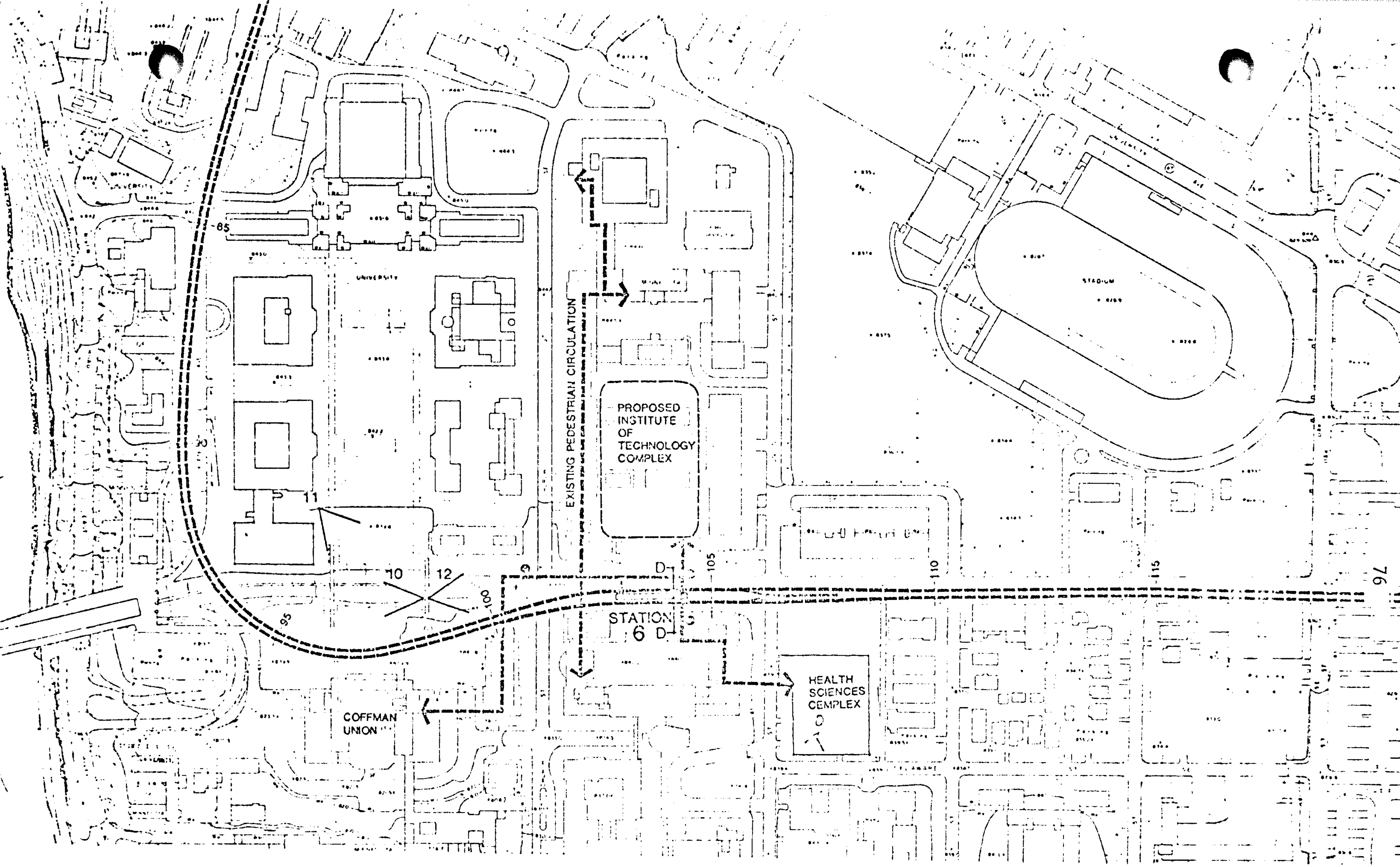
D. A.M.
Diamond Lk. Rd.
60th
66th
66th
Richfield
Portland
69th
73rd
76th
80th
83rd
Lyndale
Nicollet
G
Bloomington
Bus Stop
Franklin Crosstown
Routes C & D Combined P.M.
The U-Bus



SECTION 4

SYSTEM REFINEMENTS

STATION

ELEVATED GUIDEWAY

ON-GRADE GUIDEWAY

SUB-GRADE GUIDEWAY

BICYCLE / PEDESTRIAN PATH

EXPOSED

ENCLOSED

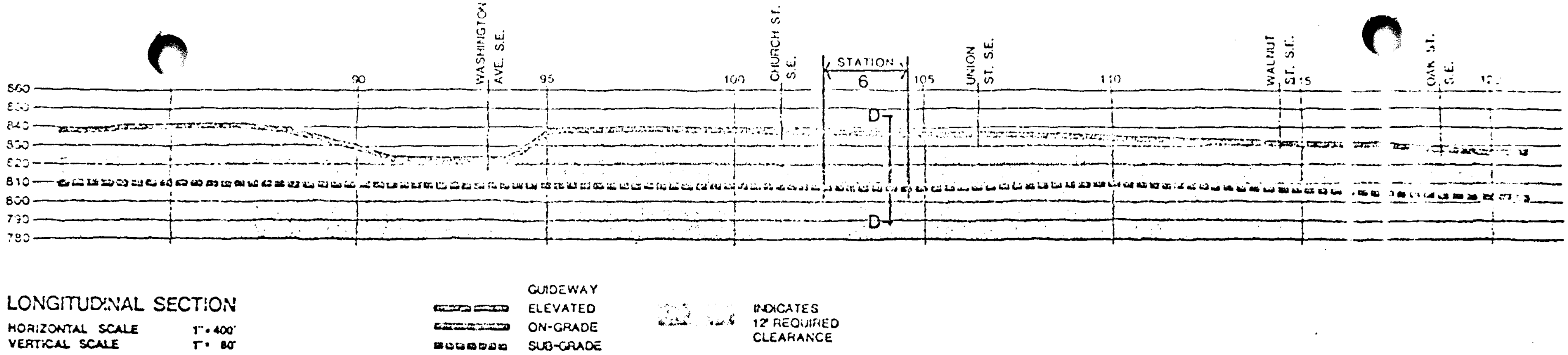
GREENWAY

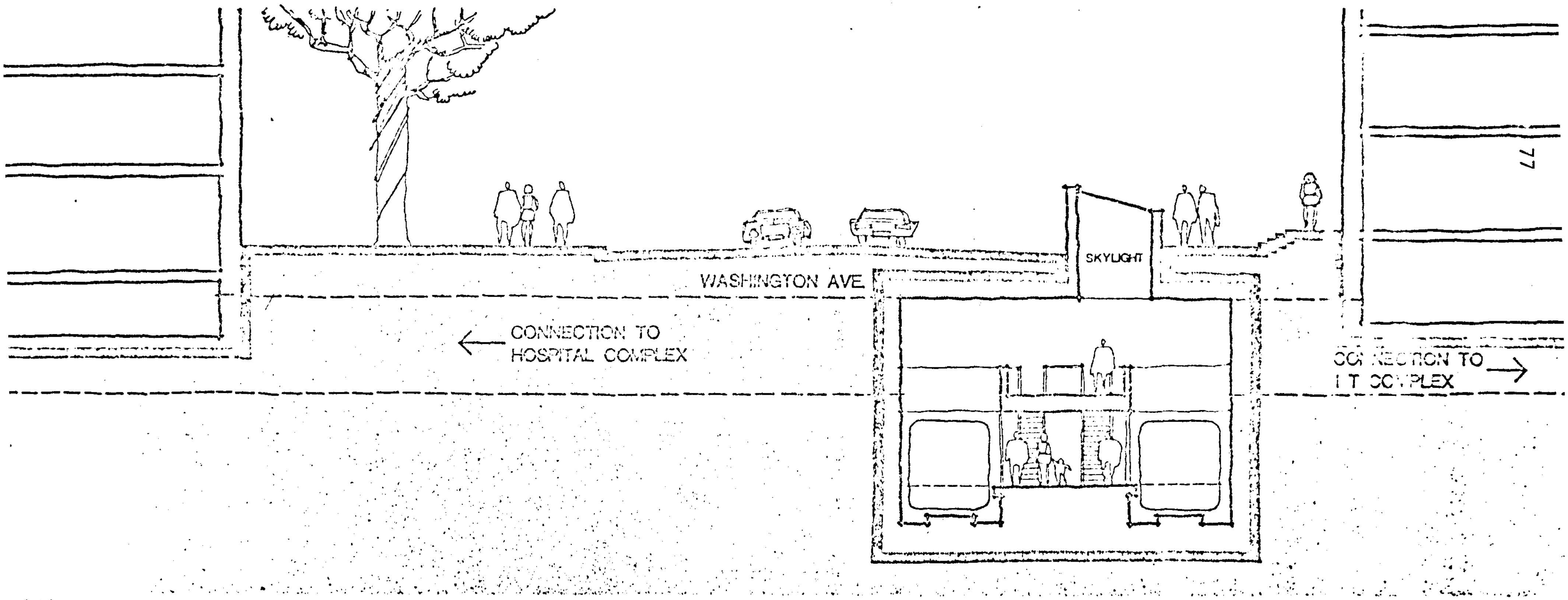
PEDESTRIAN VERTICAL ACCESS POINTS

LOCATION OF IMAGE PHOTOS

FIGURE 32

UNIVERSITY AREA TRANSIT STUDY





SECTION D-D

FIGURE 33
SECTIONS

Attachment XI

ENVIRONMENTAL HEALTH AND SAFETY

Attachment XII

ENVIRONMENTAL HEALTH AND SAFETY
AT THE UNIVERSITY OF MINNESOTA

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 of 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 public 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 administration 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 in 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 to 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 University buildings, particularly looking for cross-connections and other plumbing defects which are potential hazards to the quality of the water supply---an especially troublesome 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 at 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 demand 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 and 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 degress 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.