DERSE & SCHROEDER ASSOCIATES, LTD.
DEVELOPMENTAL SCIENCE

PHILIP H. DERSE
COLLIN H. SCHROEDER

979 JONATHON DRIVE
MADISON, WI 53713
(608) 273-2494

November 9, 1984

Applicant
Check No. 2495
Amount/Fee Category 150
Type of Fee 3M and
Date Check Received 11/21/84
Received By RLP

Mrs. B.J. Holt
Region III Licensing Section
Material Licensing Branch
Division of Fuel Cycle and Material Safety
Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Il 60137

Re: Amendment of NRC license number 48-20213-01

Dear Mrs. Holt:

Please consider this letter and the enclosed documents in support of our request for amendment of our NRC license. The item numbers referred to here are the same as those found in the application/license form. We now have approval of the Department of Natural Resources, state of Wisconsin for burning limited amounts of radioisotopes. In addition, there have been some operational changes at Derse & Schroeder Assoc.

Item 6., d. Individuals supervising use of licensed material

Add: Richard J. Lechnir, Senior Research Associate

Item 7. Radiation Protection Officer

Delete: Collin H. Schroeder

Add: Richard J. Lechnir

Item 8. Licensed material

Add:

Element	Form	Manufacturer & Model No.	Max. Number of Sealed Sources & Activ./Source
Nickel-63	Sealed Source	Varian Instr. No. 02-001972-00	5 8 mCi/source

RECEIVED BY LFMB
Date 11/27/84
Log No. Nov 15 A-16
By CB
Orig To RLP
Action Compl. (W)

8506030455 850510
REG3 LIC30
48-20213-01 PDR

CONTROL NO. 77774

RECEIVED 39-18104
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REGION III
NOV 13 1984

LIC. FEE MGMT. BRANCH
U.S. N.R.C.
'84 NOV 21 P12:25
RECEIVED

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Item 9. Storage of sealed sources

Delete: Not Applicable

Add:

Device in which Source will be Stored	Name of Manufacturer	Model Number
Gas Chromatographs	Varian Instr.	3700

Item 11., a. Calibration of instruments by service company

Delete: Packard Instrument Co.; under service contract; 2 times/yr

Item 11., b. Calibration of instruments by applicant

Add: Calibrated by applicant (see attachment no. 11)

Item 14, a. Transfer to properly licensed firm

Delete: Not applicable

Add: Sealed sources will be returned to the properly licensed manufacturer for disposal or exchange in conformance with paragraph 20.301(a) of 10 CFR Part 20. Presently, the sealed sources we have would be returned to Varian Instruments, Walnut Creek, Ca.

Item 14, e. Incineration

We request authorization to dispose of small amounts of radioactive wastes by incineration. We have received state approval for such disposal and that documentation is included in this amendment.

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The following numbers correspond to paragraphs in Information Required for Commission Approval of Treatment or Disposal by Incineration, Revised October 3, 1979.

Add: (1) The isotopes to be incinerated are ^{14}C and ^{3}H in the form of assorted combustible waste materials. We request an incineration limit of 1000 microcuries of ^{14}C and 1000 microcuries of ^{3}H per incineration. The stack opening where concentrations of radioactivity temporarily exceed the specifications in Table II, Appendix B, Column 1, 10CFR20 is 36 feet above the ground and is not accessible without taking extreme measures. The concentrations of airborne radioactivity during incineration at any point of human occupancy at ground level will be less than 0.9% of the limits specified in Table II, Appendix B, Column 1, 10CFR20 as calculated from Sutton's Model of Diffusion. Point of human occupancy shall be defined as any point easily accessible without resorting to extreme measures. The incinerator operator will be instructed to ensure that no personnel are on the roof before initiating incineration. See attachment 14 and attachment 14, e, (1) for calculations.

(2) The incinerator to be employed is housed separately in a 9 x 12 ft. cement block room, attached but separate from the laboratory. This room has its own air inlet vent. The exhaust stack is 12 in. in diameter and extends above the ground by 36 ft.

The incinerator is designed to combust biological materials such as animal carcasses including small primates, although we are not applying for animal incineration at this time. The incinerator consists of two burner chambers each supplied with a burner.

The chambers have the following specifications:

Upper Chamber: Manufactured by Plibrico Co., Chicago, IL
Internal dimensions - 3x3x3 ft.
Burner - Eclipse Burner series JIB (Eclipse Fuel Engineering Co.,Rockford, Il)
Cat # 100D-2731
600,000 BTU/hr
7,500 cfh air flow

Lower Chamber: Manufactured by Plibrico Co., Chicago, IL
Internal dimensions - 3x6x1 ft.
Burner - Eclipse
400,000 BTU/hr
4,500 cfh air flow

In normal operation the air flow is 12,000 cfh (3.4×10^8 ml/hr) which does not include the natural stack flow.

This laboratory is located in a small business, non-residential area. This building and all buildings in the immediate area (within 2 blocks) are one-story with a roof height of about 15 ft. The nearest building is about 80 ft. distant and is an auto rebuilder employing 8 to 10 people. There are other small businesses in the vicinity farther away. See attachment 14, e, (2) for a map of the area.

(3) Our state permit allows us to burn radioactive wastes for 1 hour per day. The requested incineration limit of 1000 uCi ^{14}C and 1000 uCi ^{3}H will restrict airborne radioactivity at any point of human occupancy, averaged over 24 hours, to 0.03% of the specified concentration limits in Table II, Appendix B, Column 1, 10CFR20. See attachment 14 and attachment 14, e, (3) for calculations.

(4) The maximum concentrations of airborne radioactivity at any point of human occupancy, averaged over one year, will be 0.03% of the limits specified in Appendix B, Table II, Column 1, 10CFR20. This is within 10% of the limits in keeping with the ALARA philosophy. See attachment 14 and attachment 14, e, (4) for calculations.

(5) When the initial batch of each isotope is incinerated, the resulting ash will be collected and the radioactivity present will be determined by suspending 1 gm in a liquid scintillation solution. Five such samples will be prepared and counted. The average content of radiocarbon or tritium will be calculated from this data. A similiar survey of the ash radioactivity will be conducted whenever ash is to be removed. A permanent record of ash analysis will be maintained.

(6) If the ash does not exceed the radioactivity concentration specified for water in Table II, Appendix B, Column 2, 10CFR20 (^{14}C - 8×10^{-4} uCi/mL; ^{3}H - 3×10^{-3} uCi/mL) it will be considered non-radioactive for purposes of disposal. The ash will be placed in double, heavy-duty plastic bags which will be sealed before disposal. This ash will be disposed of by the municipal sanitation department.

Ash containing radioactivity concentrations greater than those specified for water will be separated and stored in an approved metal container for burial. The container will be stored in a controlled area for radioactive materials.

(7) Procedures Limiting Exposure

The maximum single incineration limit of 1000 uCi of ^{14}C and 1000 uCi of ^{3}H limits the hazard.

The material to be burned will be isolated from personnel as follows:

A. Scintillation solutions will be burned in closed vials in partitioned cardboard cartons or enclosed in sealed plastic bags. Occasionally, scintillation solutions will be absorbed on an absorbent such as wood chips. Such waste will be enclosed in sealed plastic bags before incineration.

B. Waste paper, wipes, and other combustible radioactive materials will be sealed in plastic bags before incineration.

C. All radioactive materials to be burned will be clearly marked identifying the isotope and the amount of activity (estimated when necessary).

D. Any special toxicological or chemical hazards will also be indicated.

E. Dr. Collin Schroeder or Richard Lechnir will supervise the securing and storing of bags of waste for incineration.

Instructions for Handling Combustibles for Incineration

All radioactive combustibles will be placed in plastic bag-lined trash containers which will be labeled with the international symbol for radioactive materials. The bags will be sealed and clearly marked with the isotope and amount of radioactivity. No more than the approved amount of radioactivity for incineration in one day will be stored in one sealed bag. The sealed bags will be stored in a controlled area until they can be incinerated.

Mr. Dale Fredrickson will perform the incineration under the supervision of Dr. Schroeder or Richard Lechnir. He will be instructed to notify the radiation protection officer immediately in case of spill or body exposure so that immediate decontamination can be conducted.

A permanent record of the isotope and amount incinerated will be maintained.

(8) Local governments defer their authority over environmental matters to the Department of Natural Resources, state of Wisconsin. The enclosed permit for incineration from the state of Wisconsin constitutes our local and state approval. See attachment 14, e, (8).

(9) Each incineration will be approximately 1 hour in duration. The maximum number of incinerations per week will be five. The yearly maximum number of incinerations will be 260.

Item 15, Radiation protection program

Add: Sealed sources will be monitored every six months for leaks by an NRC-licensed tester. If radioactivity from the wipe test is >0.005 uCi the unit will be returned to the manufacturer for decontamination and/or repair.

Derse & Schroeder Assoc. Ltd.
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Item 16/17 Training and experience of individuals (item 6&7)

Add: Training resume´ - Richard J. Lechnir

1. Principles and practices of radiation protection.

   Hazleton/Raltech/WARF Inst., Madison, Wi
   15 yrs. on-the-job

2. Radioactivity measurements, standardization, and monitoring techniques and instruments.

   Packard Instruments, Downers Grove, Il
   3-day formal workshop

   University of Wisconsin, Madison, Wi
   2-day formal seminar

   Hazleton/Raltech/WARF Inst., Madison, Wi
   15 yrs. on-the-job

3. Mathematics and calculations basic to the use and measurement of radioactivity.

   Packard Instruments, Downers Grove, Il
   3-day formal workshop

   University of Wisconsin, Madison, Wi
   2-day formal seminar

   Hazleton/Raltech/WARF Inst., Madison, Wi
   15 yrs. on-the-job

4. Biological effects of radiation

   Hazleton/Raltech/WARF Inst., Madison, Wi
   15 yrs. on-the-job

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Experience resume´ - Richard J. Lechnir

1. Assisted RPO, Raltech Scientific Services/WARF Institute, Madison, Wi (NRC license 48-04150-03) from 1970 to May 1981 in: maintaining inventory and disposal records; supervising use and maintenance of scintillation counter and sample oxidizer; monitoring waste disposal.

2. About 15 years of on-the-job training and experience with ^{3}H and ^{14}C labeled compounds. Handled levels of ^{3}H up to approximately 100 mCi per experiment and ^{14}C up to approximately 25 mCi per experiment. Conducted and/or supervised radiolabeled studies under the above license including plant, animal, soil, and chemical studies.

We believe the information in our amendment request is complete, however, we will be happy to answer any further questions you may have.

Sincerely,

Richard J. Lechnir

Richard J. Lechnir

CONTROL NO. 77774

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Attachment No. 11

Calibration of Radiation Detection Instruments

The proper operation of the scintillation counter will be verified at least weekly by determining counting efficiency using a purchased, unquenched, sealed standard and by counting a purchased, unquenched, sealed background standard. The verification will be recorded in the counter operation log. The Packard Instrument Co. will make adjustments or repair if the counting background exceeds 35 cpm or it the counting efficiency of the unquenched carbon-14 standard is less than 80%. Prior to each survey use, the instrument will be calibrated by counting at least 3 quenched sealed standards, described below, which will encompass the quench level of the samples to be counted. If these points fall on the current quench curve the instrument will be considered to be in calibration. If these points are off the curve more than 3%, a new quench curve will be constructed from the 10 sealed standards and used.

Carbon-14 standards, set of 10 (1 unquenched, 9 quenched)
Packard Instrument Co., Inc., Downers Grove, Il
catalog no. 6008502
serial no. 50
assay date 21 Oct 1983
radioactivity 134,700 dpm $\pm$3.2%/vial
calibrated against National Bureau of Standards source reference number 4222

Background standard
Packard Instrument Co., Inc., Downers Grove, Il
normalization standard

Tritium standards; if ^{3}H labeled compounds are used, the instrument will be calibrated with ^{3}H standards containing 500,000 to 1,000,000 dpm/vial.

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Attachment No. 14

Calculation of Airborne Radioactivity Concentrations at any Point of Human Occupancy

All calculations of radioactivity concentrations in the air except at the stack opening were made based on Sutton's Model of Diffusion. The definitions, assumptions, and equations follow:

Definitions:

Q - recommended maximum quantity of each radionuclide to be incinerated per day; quantity in microcuries.

C - maximum concentration of a radionuclide in air for the time period given at any point of human occupancy which could result from the incineration of the quantity Q of that radionuclide on a given day; expressed in uCi/mL.

MPC - Maximum permissable concentration of a radionuclide in air for unrestricted areas as specified in Appendix B, Table II, Column 1, 10CFR20; expressed in uCi/mL.

%C/MPC - Percentage of MPC for the time period given which could result at any point of occupancy from the incineration of the quantity Q of a radionuclide on any given day.

Assumptions for the Calculation of C:

1. 100% of the incinerated radionuclide is released to the atmosphere resulting in a volatile fraction of 1.

2. The windspeed is uniform with a mean of 3 mph.

3. There is no rising of effluent due to buoyancy.

4. The effluent particles do not fall out.

5. The effluent leaves the stack isotropically at a height 11 meters above ground level.

6. The vertical distance from the stack opening to the nearest point of human occupancy is 9 meters, assuming individuals in the area will be $\leq$ 2 meters tall.

7. The concentration of airborne radioactivity of interest is the maximum concentration at any point of human occupancy.

Equations:

Sutton's Diffusion Equation for an elevated source of airborne radioactivity gives the maximum concentration of a radionuclide in air, averaged over time t:

Equation 1.
$$C = \frac{2\ f\ Q}{e \pi\ u\ t\ h^2}$$

when f = volatile fraction
u = mean wind speed
t = time in hours
h = vertical distance between point of effluent discharge and nearest point of human occupancy

Substituting values from the assumptions stated above into Equation 1. yields:

Equation 2.

$$C = \frac{(2)\ (1)\ (Q)}{e \pi (3\ \text{mph})(1.61 \times 10^5\ \text{cm/hr/mph})(t)(9 \times 10^2\ \text{cm})^2}$$

Equation 2. gives the maximum concentration of a given radionuclide in air averaged over time at any point of human occupancy which could result from the incineration of the quantity Q (in microcuries) of that radionuclide in one given day. C is given in uCi/mL.

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Attachment 14, e, (1)

Maximum Radioactivity Concentration in Air at Inaccessible Stack Opening During Incineration

Incineration time: 1 hour
Air flow from burners: 12,000 ft^3/hour

$$12{,}000\ ft^3/hour \times (28.3 \times 10^3\ mL/ft^3) = 3.4 \times 10^8\ mL/hr$$

Radioactivity concentration at the stack opening:

$$^{14}C\quad 1000\ uCi/3.4 \times 10^8\ mL = 2.9 \times 10^{-6}\ uCi/mL$$

$$^{3}H\quad 1000\ uCi/3.4 \times 10^8\ mL = 2.9 \times 10^{-6}\ uCi/mL$$

Percentage of max. permissable concentration (MPC) at the stack opening:

$$^{14}C\ (2.9 \times 10^{-6}\ uCi/mL)/(1 \times 10^{-7}\ uCi/mL) \times 100 = 2900\%$$

$$^{3}H\ (2.9 \times 10^{-6}\ uCi/mL)/(2 \times 10^{-7}\ uCi/mL) \times 100 = 1450\%$$

Maximum Radioactivity Concentration in Air at any Point of Human Occupancy During Incineration (Based on Sutton's Diffusion Model)

Isotope	Q (uCi)	C (uCi/mL)	MPC (uCi/mL)	% C/MPC
^{14}C	1000	6.0×10^{-10}	1×10^{-7}	0.6
^{3}H	1000	6.0×10^{-10}	2×10^{-7}	0.3

(Sum of % C/MPC = 0.9)

$$C = \frac{(2)\ (1)\ (Q)}{\pi\,(3\ mph)(1.61 \times 10^5\ cm/hr/mph)(1\ hr)(9 \times 10^2\ cm)^2}$$

Q = requested maximum quantity of radionuclide to be incinerated on any given day.

C = maximum concentration of radionuclide in air averaged over the given time period at any point of human occupancy resulting from the incineration of the quantity Q.

MPC = maximum permissable concentration of radionuclide in air for unrestricted areas as specified in Appendix B, Table II, Column 1, 10CFR20.

% C/MPC = Percentage of MPC averaged over the given time period which could result at any point of human occupancy from the incineration of the quantity Q of a radionuclide on any given day.

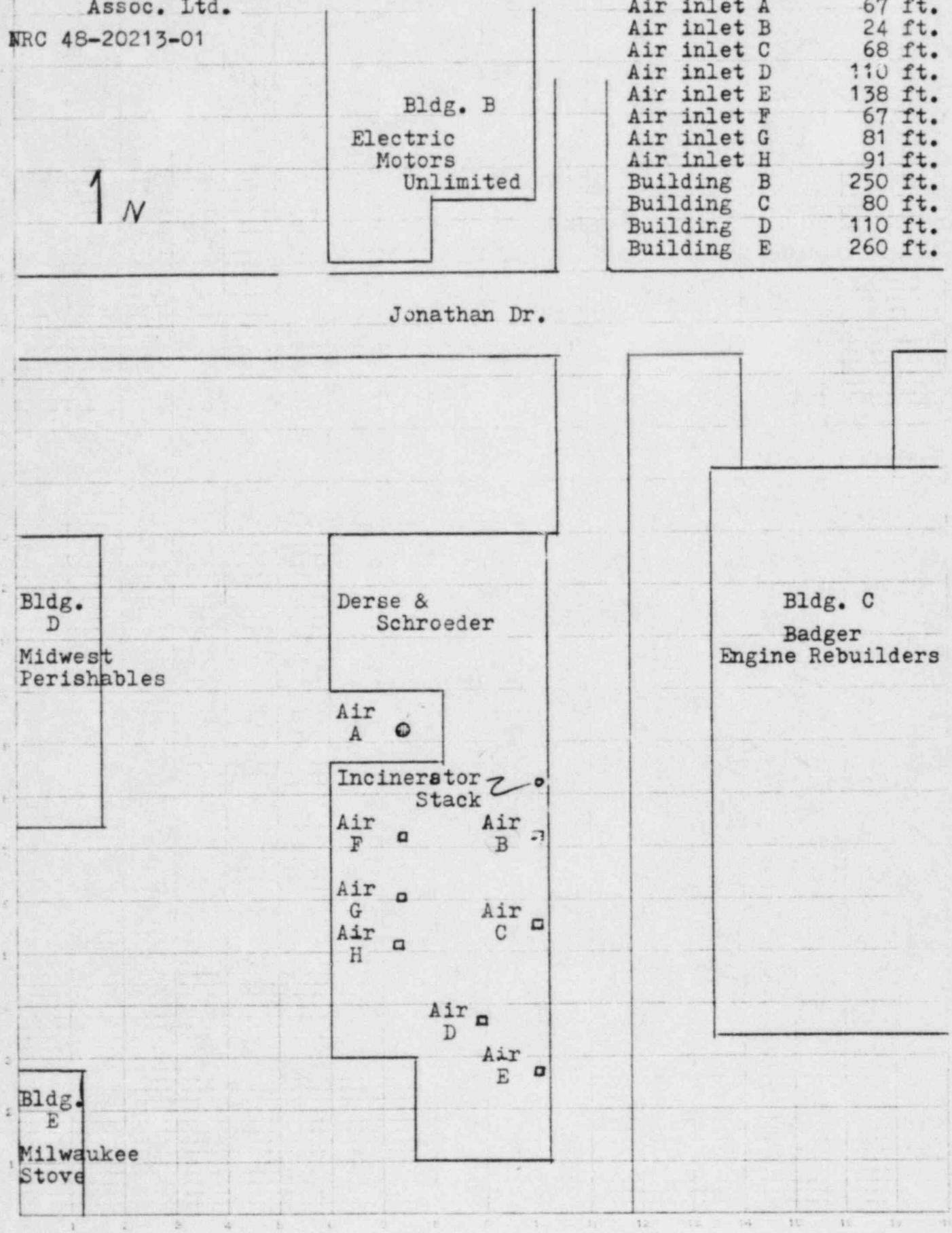
Attachment 14, e, (2)

Map of the Immediate Area

Attachment 14, e, (2)

Derse & Schroeder
Assoc. Ltd.

NRC 48-20213-01



Distance from stack to:

Air inlet A	67 ft.
Air inlet B	24 ft.
Air inlet C	68 ft.
Air inlet D	110 ft.
Air inlet E	138 ft.
Air inlet F	67 ft.
Air inlet G	81 ft.
Air inlet H	91 ft.
Building B	250 ft.
Building C	80 ft.
Building D	110 ft.
Building E	260 ft.

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Attachment 14, e, (3)

Maximum Radioactivity Concentration in Air
at any Point of Human Occupancy, Averaged Over 24 Hours
(Based on Sutton's Diffusion Model)

Isotope	Q (uCi)	C (uCi/mL)	MPC (uCi/mL)	% C/MPC
^{14}C	1000	2.5×10^{-11}	1×10^{-7}	0.02
^{3}H	1000	2.5×10^{-11}	2×10^{-7}	0.01

(Sum of % C/MPC = 0.03)

$$C = \frac{(1)\ (2)\ (Q)}{e\pi(3\ \text{mph})(1.61\text{x}10^{5}\ \text{cm/hr/mph})(24\ \text{hrs})(9\text{x}10^{2}\ \text{cm})^{2}}$$

Q = requested maximum quantity of radionuclide to be incinerated on any given day.

C = maximum concentration of radionuclide in air averaged over the given time period at any point of human occupancy resulting from the incineration of the quantity Q.

MPC = maximum permissable concentration of radionuclide in air for unrestricted areas as specified in Appendix B, Table II, Column 1, 10CFR20.

% C/MPC = Percentage of MPC averaged over the given time period which could result at any point of human occupancy from the incineration of the quantity Q of a radionuclide on any given day.

Attachment 14, e, (4)

Maximum Radioactivity Concentration in Air
at Any Point of Human Occupancy, Averaged Over 1 Year
(Based on Sutton's Diffusion Model)

Isotope	Q (uCi)*	C (uCi/mL)	MPC (uCi/mL)	% C/MPC
^{14}C	2.6×10^{5}	1.8×10^{-11}	1×10^{-7}	0.02
^{3}H	2.6×10^{5}	1.8×10^{-11}	2×10^{-7}	0.009

(Sum of % C/MPC = 0.03)

$$C = \frac{(1)\ (2)\ (Q)}{e\pi(3\ \text{mph})(1.61\text{x}10^{5}\ \text{cm/hr/mph})(8760\ \text{hrs})(9\text{x}10^{2}\ \text{cm})^{2}}$$

Q = requested maximum quantity of radionuclide to be incinerated over a year.

C = maximum concentration of radionuclide in air averaged over the given time period at any point of human occupancy resulting from the incineration of the quantity Q.

MPC = maximum permissable concentration of radionuclide in air for unrestricted areas as specified in Appendix B, Table II, Column 1, 10CFR20.

% C/MPC = Percentage of MPC averaged over the given time period which could result at any point of human occupancy from the incineration of the quantity Q of a radionuclide on any given day.

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* 260 incinerations maximum per year x maximum quantity of radionuclide incinerated on any given day (1000 uCi ^{14}C; 1000 uCi ^{3}H).

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Attachment 14, e, (8)

State Permit for Incineration of Radioisotopes

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Southern District
3911 Fish Hatchery Road
Fitchburg, WI 53711-5397

Carroll D. Besadny
Secretary

August 8, 1984

4500

Mr. Collin H. Schroeder
Derse & Schroeder Associates, Ltd.
979 Jonathon Drive
Madison, WI 53713

Dear Mr. Schroeder:

Re: Release for Permanent Operation

On March 19, 1982, the Air Management Section, Department of Natural Resources issued permit number MIA-10-POY-81-13-208 to modify and operate a pathological incinerator to burn animal carcasses and radiolabeled waste solvents containing the isotopes carbon-14 and tritium.

A recent investigation by Department staff indicates that construction of the sources(s) covered under said permit is now complete and is consistent with the approved plans and permit conditions.

In accordance with the condition specified under Part I, Section B.2 of said permit, the Department hereby authorizes the release for operation of the source(s) covered under the permit. This operating permit is permanent unless altered, suspended, or revoked.

All conditions set forth in Parts I and II of the permit will continue to apply unless modified by the Department.

Certain changes in the operation of the source(s) covered in this permit may be prohibited. Please contact Jon Heinrich of the Air Management Section at (608) 266-0586. prior to changing or modifying an operation.

Sincerely,

Douglas Morrissette

Douglas Morrissette
District Director

JH:ps
cc: Dale Ziege - AIR/3
SD Air Management Section
Madison Area Office

CONTROL NO. 77774