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NRC FORM 313 U.S. NUCLEAR REGULATORY COMMISSION

(10-94)
10 CFR 30, 32, 33
34, 35, 36, 39 and 40

APPLICATION FOR MATERIAL LICENSE

APPROVED BY OMB: NO. 3150-0120
EXPIRES 6-30-96

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 9 HOURS. SUBMITTAL OF THE APPLICATION IS NECESSARY TO DETERMINE THAT THE APPLICANT IS QUALIFIED AND THAT ADEQUATE PROCEDURES EXIST TO PROTECT THE PUBLIC HEALTH AND SAFETY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0120), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON DC 20503.

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATION FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
OFFICE OF NUCLEAR MATERIALS SAFETY AND SAFEGUARDS
U.S. NUCLEAR REGULATORY COMMISSION
WASHINGTON, DC 20555-0001

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS:

IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

LICENSING ASSISTANT SECTION
NUCLEAR MATERIALS SAFETY BRANCH
U.S. NUCLEAR REGULATORY COMMISSION, REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406-1415

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION II
101 MARIETTA STREET, NW, SUITE 2900
ATLANTA, GA 30323-0199

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION III
801 WARRENVILLE RD.
LISLE, IL 60532-4351

ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, COLORADO, HAWAII, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEVADA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, OREGON, PACIFIC TRUST TERRITORIES, SOUTH DAKOTA, TEXAS, UTAH, WASHINGTON, OR WYOMING, SEND APPLICATIONS TO:

NUCLEAR MATERIALS LICENSING SECTION
U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
611 RYAN PLAZA DRIVE, SUITE 400
ARLINGTON, TX 76011-8064

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S.NUCLEAR REGULATORY COMMISSION JURISDICTIONS.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 45-25116-01

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip code)*

ARCTECH, Inc.
14100 Park Meadow Dr.
Suite 210
Chantilly, VA 22021

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

ARCTECH, Inc.
14100 Park Meadow Dr.
Suite 210
Chantilly, VA 22021

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Joseph J. Stashick

TELEPHONE NUMBER
703-222-0280

SUBMIT ITEMS 5 THROUGH 11 ON 8-1/2 X 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL.
a. Element and mass number; b. chemical and/or physical form; and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*
FEE CATEGORY 3M
AMOUNT ENCLOSED $ 1700

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, 36, 39 AND 40, AND THAT ALL INFORMATION CONTAINED HEREIN IS TRUE AND CORRECT TO THE BEST OF THEIR KNOWLEDGE AND BELIEF.

WARNING: 18 U.S.C. SECTION 1001 ACT OF JUNE 25, 1948 62 STAT. 749 MAKES IT A CRIMINAL OFFENSE TO MAKE A WILLFULLY FALSE STATEMENT OR REPRESENTATION TO ANY DEPARTMENT OR AGENCY OF THE UNITED STATES AS TO ANY MATTER WITHIN ITS JURISDICTION.

CERTIFYING OFFICER – TYPED/PRINTED NAME AND TITLE	SIGNATURE	DATE
DAMAN S. WALIA/PRESIDENT & CEO	Daman S. Walia	January 19, 1996

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	AMOUNT RECEIVED	CHECK NUMBER	COMMENTS
				DATE	

9610010159 960926
PDR ADOCK 03032959
C PDR

Renewal of Application for Material License from the U.S. Nuclear Regulatory Commission
License # 45-25116-01

5. A. Element and mass number; B. chemical and/or physical form; C. maximum amount which will be possessed at any one time.

Element and Mass Number	Form	Maximum Amount
Carbon 14	Any	80 millicuries
Sulfur 35	Any	20 millicuries
Hydrogen 3	Any	10 millicuries
Nickel 63	Foils or plated sources in Hewlett-Packard Model 19202A detector cells	3 sources; not to exceed 15 millicuries per foil or source

6. Purpose(s) for which licensed material will be used.

Carbon 14, Sulfur 35, and Hydrogen 3 will be used in laboratory tracer studies. Nickel 63 is used in the Hewlett-Packard gas chromatograph for sample analysis.

7. Individual(s) responsible for radiation safety program and their training experience.

The Radiation Safety Program Officer for the activities authorized by this license is Joseph J. Stashick. Back-up RSO is Dr. Kailash Srivastava. Training of Mr. Stashick has been in the form of experience/training in the handling/disposing of radioactive material at ABC Laboratories in Columbia, MO (2 years) (see attachment).

8. Training for individuals working in or frequenting restricted areas.

Licensed material shall be used by, or under the direct supervision of, Joseph J. Stashick.

9. Facilities and equipment.

ARCTECH, Inc. is equipped with a Geiger Counter and a Beckman LS 7500 Liquid Scintillation Counter to monitor all radioactive substances applied for in this application.

10. Radiation Safety Program.

The nickel sources specified in section 5 shall be tested for leakage and/or contamination at intervals not to exceed 6 months. Any source received from another person which is not accompanied by a certificate indicating that a test was performed within 6 months before the transfer shall not be put into use until tested.

Any source in storage and not being used need not be tested. When the source is removed from storage for use or transfer to another person, it shall be tested before use or transfer.

The test shall be capable of detecting the presence of 0.005 microcuries of radioactive material on the test sample. If the test reveals the presence of 0.005 microcuries or more of removable contamination, the source shall be removed from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. A report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region II, Division of Radiation Safety and Safeguards, Nuclear Material Safety Section, 101 Marietta Street, Suite 2900, Atlanta, Georgia 30323. The report shall specify the source involved, the test results, and the corrective action taken. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. Records may be disposed of following Commission inspection.

Tests for leakage and/or contamination shall be performed by the licensee or by other persons specifically licensed by the Commission or an Agreement State to perform such services.

Detector cells containing licensed material shall not be opened or the sources removed from the detector cell by the licensee.

In lieu of using the conventional radiation caution color (magenta or purple on yellow background) as provided in 10 CFR 20.203(a)(1), the licensee is hereby authorized to label detector cells and cell baths, containing licensed material and used in gas chromatography devices, with conspicuously etched or stamped radiation caution symbols without a color requirement.

11. Waste management.

When using radioactive material, the licensee shall conduct a physical inventory every 6 months to account for all sources and/or devices received and possessed under this license. Records of inventories shall be maintained for 2 years from the date of each inventory.

Disposal of any radioactive substance will be in adherence to all regulatory guidelines.

Radiation Safety Procedures

These procedures will be followed when radioactive work is being conducted at ARCTECH, Inc. research laboratory. If a leakage is found, the Radiation Safety Officer (RSO) will be notified and a report filed.

All personnel directly using radioactive materials and those that work in restricted areas where radioactive materials are used or stored are required to read and understand the following instructions. These instructions are intended to provide an outline for radioactive materials receipt and handling techniques, proper monitoring and surveying procedures, waste disposal procedures, radiation safety practices, emergency procedures, and legal responsibilities and rights of the NRC licensee (ARCTECH, Inc.) and laboratory workers. Individuals will not be permitted to receive or handle radioactive materials nor work in areas where radioactive materials are presently in use unless they have read and understood these instructions and have completed the radiation safety course, or have demonstrated having adequate previous training and/or experience in radioactive materials use and safety practices. The adequacy of previous training will be determined by the ARCTECH, Inc. RSO.

I. Radioactive Materials in Use

Currently, the only radioactive-labeled chemicals present within the laboratory is Carbon-14, a beta emitter. Beta radiation from Carbon-14 has a very low potential for penetration (0.156 MeV). As such, little danger exists in being near small amounts (e.g. 10 mCi) of unshielded Carbon-14 for short periods of time. Ingestion, inhalation, or the absorption of Carbon-14 into the body does expose tissue to potentially harmful radiation and is not permitted.

Other radiation sources currently in the laboratories are Nickel-63 in the electron capture detectors of the Hewlett-Packard gas chromatograph and the Cesium-137 in the liquid scintillation counter. These sources are sealed and shielded by the instruments in which they are installed. Removal of the shielding of any source is not permitted. Removal of the sealed Nickel-63 source from the gas chromatograph can only be done by experienced laboratory personnel. The Cesium-137 source should never be removed by any laboratory personnel; only a certified technician from the manufacturer can remove this source.

II. Laboratory Apparel and Safety-Related Equipment

Protective clothing and equipment commensurate with the exposure hazard to radioactive materials must be worn at all times in areas where radioactive work is being conducted. At a minimum, a lab coat and protective eye glasses (goggles or shield) must be worn. Medical style protective gloves (disposable) must be worn at all times when handling radioactive material. A suggestion of two pairs of gloves per hand is recommended. This is recommended for protection of contamination by disposing the outer pair of gloves before touching any laboratory supplies or equipment (i.e. the possible contaminant will be adhered to the outer glove which is disposed of properly prior to handling other equipment/materials). All use of radioactive materials must be

performed over plastic lined absorbent paper to soak up and contain spills. All work areas (bench, hood, containers, etc.) in which radioactive materials are being stored or handled must be appropriately labeled with signs or tape.

Currently, all radioactive materials are non-volatile solids or liquids. Therefore, no special precautions for air monitoring or scrubbing are needed to use these materials. However, all biodegradation studies and some chemical reactions using radiolabeled materials can potentially release the radioactive element as a radioactive gas. Therefore, no use of radioactive materials is permitted until reviewed and approved by the RSO. Chemical/biological reactions in which radiolabeled materials are to be used will be researched for all safety considerations, including losses of volatile radioactive materials. To minimize possible contamination, all radioactive work will be performed in the radioactive-labeled hood in the chemistry laboratory.

III. Good Radiation Safety Practices

Radiation can not be detected by human senses. Therefore, the key to radiation safety practices is good house keeping and constant monitoring. General rules to follow are:

No smoking
No food, beverage, nor containers or utensils used for food consumption
No pipetting by mouth
Always wear gloves, lab coat and safety glasses
Change gloves frequently to avoid contamination
Remove gloves when leaving a radioactive work area
Always work over fresh absorbent paper
All contaminated glass must be marked
Always wash your hands before leaving a radioactive work area
Avoid practices that can potentially contaminate monitoring equipment

IV. Material Receipt and Records

Radioactive material receipt procedures shall conform to requirements set forth in 20 CFR 20.205. Packages may be received by the RSO or designate. All packages will be checked for external contamination prior to opening. Once opened, the contents of the package will be checked for leakage by using the Geiger Counter. If removable radioactive contamination in excess of 0.01 μCi (22,000 DPM) per 100 square centimeters of package surface area is found, the licensee shall immediately notify the final delivering carrier and, by telephone, telegraph, mailgram or facsimile, the appropriate Nuclear Regulatory Commission Office. The RSO shall assure the performance of this procedure.

Records of all incoming radioactive materials, use of all materials, accumulated wastes, waste disposal of such material, and radiation survey monitoring data must be maintained. The RSO will be responsible for maintaining these records. These records will be kept in the same file as the NRC license.

V. Labeling and Storage

All radioactive materials are to be stored in the chemistry laboratory work area designated for such work (see attached diagrams). All samples/supplies deemed radioactive will be labeled as such using appropriate labels. All radioactive materials will be stored in appropriate containers with tight fitting caps or stoppers to prevent accidental spillage.

All materials which contain or have been contaminated with radioactive materials will be clearly labeled with commercially obtained tape or sign and the isotope present clearly identified. Large groups of small containers such as a rack of culture tubes need have only one radiation label to identify the entire rack. If individual samples from such a group are removed, each sample must be labeled with tape bearing the radiation caution symbol and the isotope(s) identified. Labels on containers or other paraphernalia must be removed when such items are decontaminated.

VI. Waste Storage and Disposal

A radioactive waste trash can is located under the radiation hood in the chemistry laboratory. Only place dry solid waste in this trash can. If solids contain any liquid, the liquid must be evaporated off or separated from the solid prior to disposal. If disposing of a solid with more than 1 μCi of activity, notify the RSO.

Barreled radioactive waste will be stored in a locked, limited access room located in the chemistry laboratory. All liquid waste will be stored under the radioactive fume hood (Hemco Corp, Independence, MO 64050, Model 30603). The hood has an opening of 67" x 36.5" and an air flow rate maintained between 90 and 125 linear feet per minute.

Disposal of liquid wastes will be determined by the RSO. Generally, solvent wastes will be evaporated to dryness (if non-volatile) then disposed of as solid waste in the designated 55 or 30-gallon drum labeled for such material. Aqueous waste will be brought to a neutral pH before disposal. Procedures for evaporation or neutralization must be approved by the RSO. Samples in scintillation cocktail will be combined in a suitable container for disposal at a later date.

VII. Radiation Survey/Monitoring Procedures

Each worker will be responsible for maintaining their work space in a clean and safe environment. Each worker will check their work area with the Geiger Counter and report any contamination to the RSO as soon as possible.

Swipe test will consist of swiping areas of the laboratory where known radioactive work has been performed with clean styrofoam "peanuts". The entire "peanut" will be placed in a 20-mL scintillation vial and scintillation cocktail added. The entire contents are then counted on the Liquid Scintillation Counter. All areas must maintain a CPM level of less than 100 to be certain that no contamination has occurred. Reports of all swipe tests will be reported to the RSO upon completion. If contamination has occurred, the RSO will direct the clean up and the work area will be re-swiped until clean (less then 100 CPM).

The RSO or designate will be responsible for monthly monitoring of all active radioactive work areas using a Geiger counter and swipes.

VIII. Transfer of Radioactive Materials

No radioactive material may be moved from the laboratory without prior consent from the RSO. The RSO will be responsible for reporting the permanent removal of radioactive materials (i.e. return of ECD sources, disposal of radioactive materials).

IX. Emergency Procedures

In the event of a fire, evacuate the immediate vicinity of the fire, pull the fire alarm, call the fire department, and evacuate the building. The RSO will be responsible for informing the fire fighters if any leakage of radioactive material is suspected.

In the event of a spill, move away from the spill to avoid personal contamination. If possible, contain the spill with absorbent paper. Notify the RSO of the spill. While waiting for guidance, make sure that no other person comes into contact with the spill.

In the event of personal contamination and if contamination involves toxic or caustic materials, flush with water immediately if the contaminate is in the eyes or an open wound. Remove contaminated clothing and place in radioactive work area. Continue to wash contaminated areas with soap. Have a coworker call the RSO for guidance. In cases of probable internal contamination, seek medical service as soon as possible. The RSO is responsible for documenting all spills/contaminations. Contaminated clothing must be disposed of as radioactive waste.

X. Facilities and Equipment

The radiation detection instruments are:

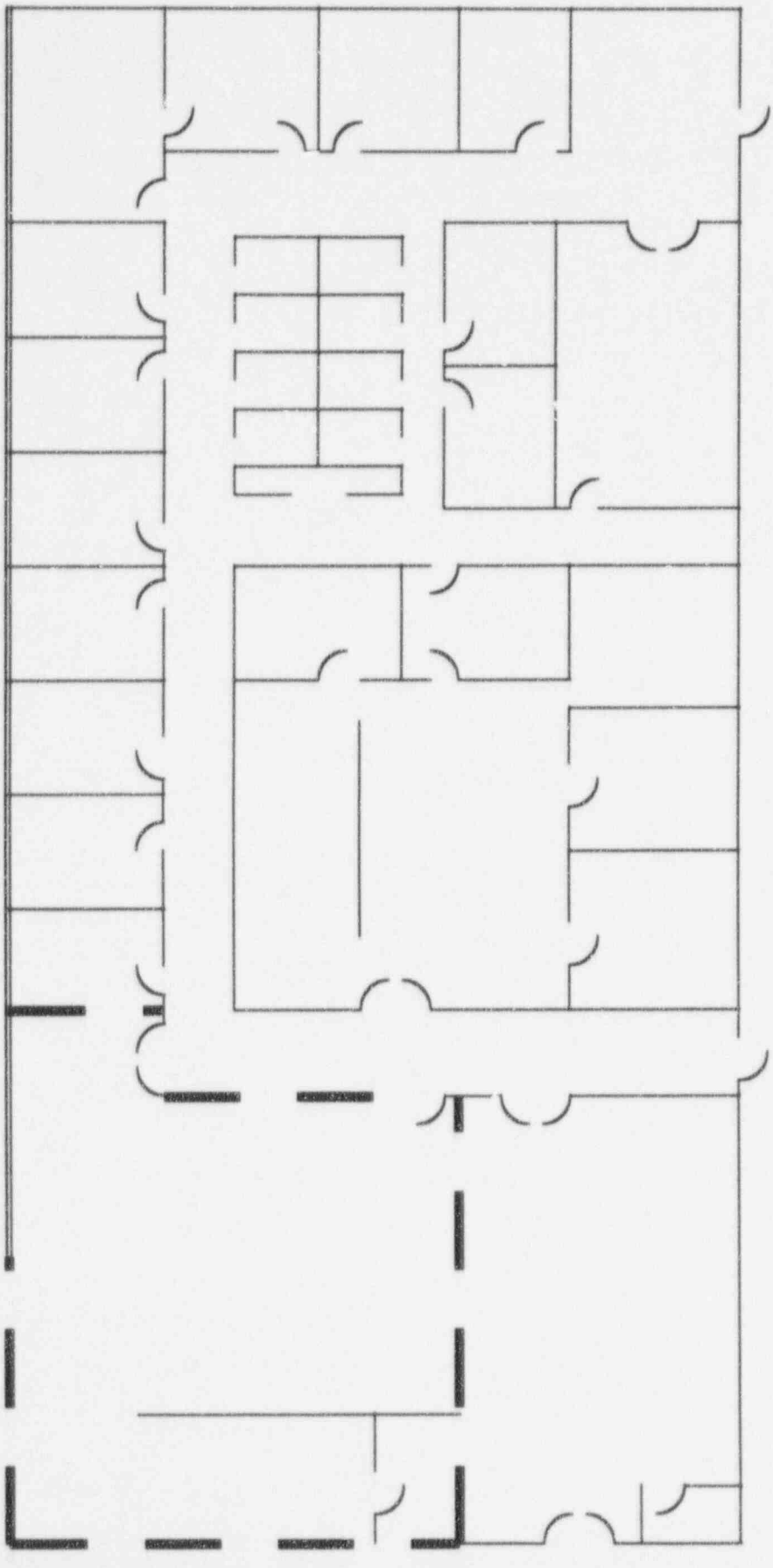
Beckman LS 7500 Liquid Scintillation Counter able to detect alpha and beta emissions
Two Geiger Counters, Eberline Model E120E, window thickness of 1.4-2.0 mg/cm^2, and a sensitivity of 0-200 mr/hr.

Specific Training and Experience of Joseph J. Stashick as Radiation Safety Officer

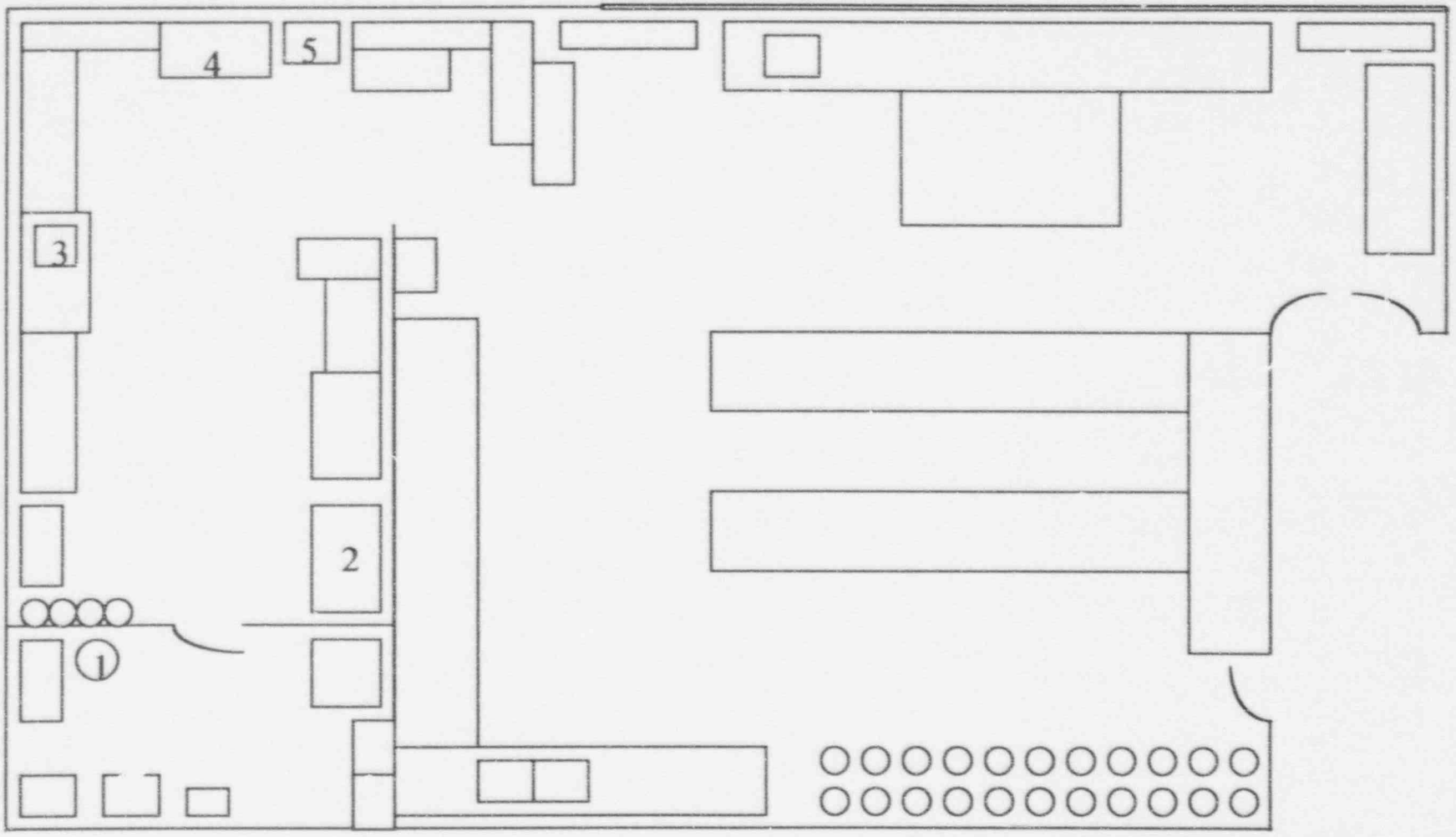
Training: In-house radiation safety training by personnel of ABC Laboratories, Columbia, MO. In-house radioactive substances disposal by personnel of ABC Laboratories, Columbia, MO. Radioactive spill clean-up, on-the-job training due to a carbon 14 spill that I contained and decontaminated. Detection of radioactive substances given by Beckman Industries at ABC Laboratories, Columbia, MO. Responsible for approximately six liquid scintillation counters (maintenance, calibration, data reduction, and surveying).

Experience: Two years experience in the use of radioactive substances (mostly pesticides) used to determine the environmental impact of these substances using EPA, FDA, and OECD guidelines under the GLP program (environmental fate studies).

Isotopes: Carbon-14 and Tritium (Hydrogen-3).



Chemistry Laboratory Floorplan/Radiation Work Area



List of Radioactive Work Areas

1) Locked room where a 55 gallon drum containing solid radioactive waste (gloves, absorbent paper, pipette tips, etc.) is stored.

2) Liquid Scintillation Counter

3) Sink where biologically safe scintillation cocktail is disposed

4) Radioactive fume hood. Underneath this hood is where scintillation vials and radioactive waste is maintained until disposal.

5) Radioactive refrigerator used to store radioactive substances. The freezer portion is the only compartment that at present has any kind of radioactive substances.

JOSEPH J. STASHICK
CHEMIST

EDUCATION:

B.S., Biochemistry, University of Maryland, 1988

PROFESSIONAL ORGANIZATIONS AND AFFILIATIONS:

Member of the American Chemical Society
Member of the International Union of Pure and Applied Chemists
Member of Alpha Chi Sigma Professional Chemistry Fraternity

RADIATION SAFETY AND RELATED TRAINING:

Radiation Safety Training	ABC Laboratories Columbia, MO	1991-92
Radioactive Substance Disposal	ABC Laboratories Columbia, MO	1991-92
Radioactive Spill Clean-up/ Decontamination Procedures	ABC Laboratories Columbia, MO	1992
Detection of Radioactive Substances	Beckman Instruments, Inc. ABC Laboratories Columbia, MO	1992

PROFESSIONAL EXPERIENCE:

Research Scientist, ARCTECH, Inc., Chantilly, Virginia, 1992 - Present. Mr. Stashick currently acts as the Study Director/Principal Investigator for the company. He is responsible for monitoring/running Environmental Fate analyses and writing Standard Operating Procedures (SOPs) and Protocols. Mr. Stashick is also versed in the use of the GC-ECD, GC-FID, GC-TCD, HPLC, UV-VIS, and Beckman Scintillation Counters to analyze various products/compounds (both radioactive and non-radioactive) Isotope: Carbon-14.

Chemist, ABC Laboratories, Maryland, 1991 - 1992. Mr. Stashick was responsible for analyzing various compounds for various clients utilizing HPLC, GC, TLC, and LSC techniques to determine the environmental impact of these compounds following various governing bodies' methods/GLP methods. Isotopes: Carbon-14 and Tritium (Hydrogen-3).

Chemist, Spectralytix, Inc., Maryland, 1990 - 1991. Mr. Stashick performed extraction and analysis of EPA controlled compounds utilizing GC and HPLC techniques using CLP methods (Superfund compounds).

Research Assistant, Dynamic International, Inc., Maryland, 1988 - 1990. Mr. Stashick searched and retrieved journal articles, as well as writing and proofreading the environmental fate, regulations/standards, and general information sections of all reports generated for the EPA. He was also trained in NUS data validation.

Library Aid/Data Transcriber, National Agricultural Library, 1984 - 1988. Mr. Stashick performed light indexing of chemical journals.

TECHNICAL PUBLICATIONS:

Health Assessment Document for Acrolein. (1989)
Summary Review for Health Effects Associated with Exposure to Styrene Vapor. (1989)
Co-author of nineteen (19) Toxicological Profiles.

HONORS/AWARDS/SCHOLARSHIPS:

Certificate of completion of a four-day seminar on HPLC separations given by Waters.

KAILASH SRIVASTAVA

VICE PRESIDENT & DIRECTOR OF BIOPROCESSING RESEARCH

EDUCATION:

Ph.D., Microbiology, University of London, 1975
M.S., Microbiology, Seton Hall University, 1971
B.Sc., Biology, Punjab University, India, 1968

PROFESSIONAL ORGANIZATION AND AFFILIATIONS:

American Society for Microbiology
Society for Industrial Microbiology
United States Federation of Culture Collections (Chairman, Membership Committee)

RADIATION SAFETY AND QA/QC RELATED TRAINING:

Certificate of Completion Biotechnology QA/QC Regulatory Concerns and Common Sense	PDA, VA	1993
Tracer Studies for Methanotrophs Using ^{14}C Methanol	Michigan State University/MBI East Lansing, Michigan	1986-88
Radiation and Chemical Training	Michigan State University Department of Radiation, Chemical and Biological Safety	1986
Quality Control and Assurance in the Food Industry	Institute Adolf Lutz Cumprinas/Sao Paulo, Brazil	1979
Radiation Biology, 2 Credit Course	Graduate School, Seton Hall University, NJ	1970

PROFESSIONAL EXPERIENCE:

Vice President and Director of Bioprocessing Research, ARCTECH, Inc., Chantilly, Virginia, February 1994 - Present. Dr. Srivastava is responsible for the management of company-wide R&D projects. The main thrust of this research has and is leading to novel technology(ies) for the production of clean fuel and the treatment of environmentally hazardous and toxic wastes. Dr. Srivastava manages a group of 6 research scientists and chemists in microbiological, chemical, and process engineering laboratory experiments. He also develops new business opportunities in his areas of expertise.

Director Bioprocessing Research, ARCTECH, Inc., Chantilly, Virginia, March 1992 - January 1994. Dr. Srivastava was responsible for all personnel, project and financial management of the Bioprocessing Division. He was the PI on various government and industrial contracts. Six of these projects were successfully completed during 1992-1993, leading to either commercialization of the technologies or creation of a product. Two of the projects provided the proof of concept. These projects included bioprocessing of fossil fuels, bioconversion of coal to added value products and biomimetic desulfurization of Green Coke. Dr. Srivastava also developed several new business opportunities for ARCTECH.

Adjunct Assistant Professor, Department of Food Science and Human Nutrition, Michigan State University, E. Lansing, Michigan, 1990 - 1992. Dr. Srivastava developed graduate curricula in Food Microbiology.

He also researched biosensor development for the detection of hazardous chemicals such as dichlor, benzene, phenols and 2,4-D.

Commercial Development Scientist, Michigan Biotechnology Institute, Lansing, Michigan, 1987 - 1990. Dr. Srivastava was involved with the development of novel products, such as biofilters and thermostable enzymes with novel characteristics, for commercialization. He enhanced the Institution's proprietary position with patents, know-how and proprietary microbial cultures. Several projects under Dr. Srivastava entailed the economic evaluation of industrial fermentation processes; the isolation, characterization and development of microbial populations for the treatment of hazardous wastes for laboratory, pilot and field scale reactors; the development of consortia of microorganisms for engineered biofilter systems for the control of VOCs from a wide variety of industries; determination of the kinetic properties of VOC degradation by novel microbial consortia; and the determination of the kinetic properties of biodegradability of industrial sorbents as well as of starch and cellulose based graft copolymers by specially developed microorganisms in composters. While with the Michigan Biotechnology Institute, Dr. Srivastava acted in a Co-Principal Investigator capacity for several government and industrial contracts.

Research Associate, Department of Biochemistry, Michigan State University, E. Lansing, Michigan, 1986 - 1987. Dr. Srivastava carried out large scale production, purification and characterization of novel thermostable industrial enzymes from newly isolated aerobic microorganisms.

Research Associate, Forest Products Laboratory, Madison, Wisconsin, 1984 - 1986. Dr. Srivastava developed purification methods, characterized and determined kinetics of key enzymes in xylose metabolism of yeasts.

Professor, Food Microbiology, Universidade Estadual de Londrina, Brazil, 1978 - 1984. As a Principal Investigator, Dr. Srivastava managed one international R&D project; 4 nationally funded projects and 15 university funded research projects. He established QC programs for food industries. Developed microbial consortia for decaffeination and treatment of Coffee Processing Plant Wastes. Established quality control tests for the major Coffee Processing Plant which were within 5% of those conducted by 5 independent QC laboratories in U.S.A., Britain and Holland. Taught courses to undergraduate and graduate students. Thesis advisor to graduate students. Developed yeast cultures for the production of ethanol from the renewable agricultural residues.

Director of Lab Operations, Ivy Medical Laboratories, Inc., New York, 1975 - 1978. Established microbiology, parasitology and serology laboratories. Supervised overall daily operations of a diagnostic laboratory.

PATENTS:

Shen, G.J., Srivastava, K.C., Wang, Y. and Wang, H. 1990. Thermostable lipase and its production. European Patent #EP0384717 A, August 29, 1990.

Shen, G.J., Srivastava, K.C., Wang, Y. and Wang, H. 1991. An essentially purified, thermostable and alkalophilic lipase from Bacillus Sp. A30-1 ATCC 53841. U.S. Patent #5,093,256.

Shen, G.J., Srivastava, K.C., Wang, Y. and Wang, H. 1991. An essentially purified, thermostable and alkalophilic lipase from Bacillus Sp. ATCC 53841. U.S. Patent #5,166,069.

TECHNICAL PUBLICATIONS AND PRESENTATIONS (Selected)

Walia, D.S., Srivastava, K.C. Development of MicGAS Process. IGCC. METC, June 1994.

Srivastava, K.C. and Manolov, R.J. Joint Annual Meeting, Society for Industrial Microbiology and Canadian Society for Microbiology, August 1-6, 1993.

Srviastava, K.C. and Manolov, R.J. Fourth International Symposium on Biological Processing of Fossil Fuels, Alghere, Italy, September 20-23, 1993.

Srivastava, K.C. and Manolov, R.J. Sixteenth Symposium on Biotechnology of Chemicals and Fuels, Gatlinburg, TN, May 9-13, 1994.

Walia, D.S., Srivastava, K.C., and Barik, S., 1992. Development of Biological Coal Gasification. Proc. 12th Ann. Gasification and Gas Stream Cleanup Systems Contractors Review Meeting, USDOE, Morgantown, WV, pp.535-549.

Srivastava, K.C., Biodegradation of styrene by thermophilic *Bacillus* isolates. In "Opportunities in Biotransformations." Copping, L.G., Martin, R.E., Pickett, J.A., Bucke, C. and Bunch, A.W. (Eds.). Elsevier Applied Science, London and New York, pp.53-58, 1990.

Srivastava, K.C., Li Nie, Zhang, L-M, and Narayan, R. 1990. Degradation studies on cellulose/Starch-polystyrene graft Copolymers. Annual Meeting, American Institute of Chemical Engineers, Chicago, IL, November 11-16.

Srivastava, K.C., L. Nei, and R. Narayan. Engineering and Biodegradation studies of starch based graft copolymer and alloys. Third Corn Growers Meeting, St. Louis, Missouri, 1990.

Shen, G-J, K.C. Srivastava, B.C. Saha, and J. G. Zeikus. Physiological and enzymatic characterization of a novel pullulan degrading thermophilic *Bacillus* strain 3183. Appl. Microbiol. Biotechnol., 33:340-344, 1990.

Srivastava, K.C., Shen, G-J., and Zeikus, J.G. 1990. Production and Characteristics of Thermostable Collagenase from a Newly isolated Thermophilic *Bacillus*, Strain A-9. Annual Meeting, Society for Industrial Microbiology, Orlando, Florida. August 1990. P3.

Srivastava, K.C. Saccharification of lignocellulosic biomass by actinomycetes: A comparative study with meso- and thermophiles. Proc. 1989 International Symposium on Wood and Pulping Chemistry, N.C. State University, Raleigh, N.C. pp.227-232, 1989.

Treatment of Coffee processing plant solid wastes (CPSW) by some lignocellulolytic microorganisms cultured in solid state fermentation. 1989. Pacifichem '89, Honolulu, Hawaii, U.S.A.

Saha, B., Shen, G.J., Srivastava, K.C., LeCereux, L., and Zeikus, J.G. A new thermostable pullulanase- like alpha amylase from thermophilic *Bacillus* Sp. 3183. Enz. Microb. Technol., 11:760-764, 1989.

Jeffries, T.W., Dax, C., Lachke, A.H., and Srivastava, K.C. Effect of carbon and nitrogen sources on levels of pentose phosphate pathway enzymes in xylose fermenting yeasts. Proc. XI Internat'l. Specialized Symposium on Yeasts. pp.49:85, 1986.

Analise do potencial energetica entre Brasil e India atraves de producao alcoolica (Comparison of energy potential between Brazil and India as a function of alcohol production). Federal University of Minas Gerais, Belo Horizonte, MG, Brazil, 1981.

Srivastava, K.C. and DaSilva, R.S.S.F. Cellulase production from soybean seed coat: Study of the culture conditions through response surface methodology. Biotech. Bioeng. Symposium, 15:491-499, 1985.

Cordenunsi, B.R., DaSilva, R.S.F., Srivastava, K.C., Fabre-Sanches, S. and Perre, M. A mathematical model for the alcoholic fermentation in batch culture: Comparison between complete and incomplete factorial (3^3) designs. J. Biotechnol., 2:1-12, 1985.

Effect of temperature on *Trichosporon pullulans* isolated from Antarctica. Second International Symposium on Microbial Ecology, Warwick, Coventry, U.K. 1980.

Srivastava, K.C. and Smith, D.G. Growth and survival studies on psychrophillic and mesophilic yeasts. Microbios, 25:45-62, 1979.

Srivastava, K.C. and Smith, D.G. Ultrastructure of psychrophillic strains of *Cryptococcus albidus*. Microbios Letters, 3:175-178, 1976.

Srivastava, K.C. and Smith, D.G. Electron microscopy of psychrophillic yeast. *Candida gelida*. Micron. 5:191-199, 1974.

Smith, D.G., Wilkie, D. and Srivastava, K.C. Ultrastructural changes in mitochondria of zygotes of *Saccharomyces cerevisiae*. Microbios. 6:231-238, 1972.

AWARDS/HONORS/SCHOLARSHIPS:

Member, Editorial Board, Letters in Applied Microbiology, a publication of Society for Applied Bacteriology.
Certificate of appreciation from USDA for significant contribution toward better understanding of biochemistry of xylose fermenting yeast Candida shehatae.
National Research Scientist, Brazilian National Research Council.
Fellow, The New York Academy of Sciences.
British Council Award.
Edwina Mountbatten Grant to Commonwealth students.
University of London Convocation Grant to postgraduate students.
Nominated in Marqui's "Who's Who in Science and Engineering."
"Who's Who of Business Leaders."