

UNITED STATES ATOMIC ENERGY COMMISSION
APPLICATION FOR BYPRODUCT MATERIAL LICENSE

INSTRUCTIONS.—Complete Items 1 through 16 if this is an initial application or an application for renewal of a license. Information contained in previous applications filed with the Commission with respect to Items 8 through 15 may be incorporated by reference provided *references are clear and specific*. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail two copies to: U.S. Atomic Energy Commission, Washington, D.C., 20545, Attention: Materials Branch, Directorate of Licensing. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30, and the Licensee is subject to Title 10, Code of Federal Regulations, Part 20, and the license fee provisions of Title 10, Code of Federal Regulations, Part 170. The license fee category should be stated in Item 16 and the appropriate fee enclosed. (See Note in Instruction Sheet).

1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital person, etc. Include ZIP Code and telephone number.) Wayne State University Health Physics-Radiation Control 645 Mullett Detroit, MI 48226	(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1(a). Include ZIP Code.) Wayne State University Department of Chemistry Chemistry Building Room 70 Detroit, MI 48201
2. DEPARTMENT TO USE BYPRODUCT MATERIAL Chemistry Department	3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.) Renewal of 21-00741-10
4. INDIVIDUAL USER(S). (Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in Items 8 and 9.) Dr. Lawrence Marnett (Assoc. Prof. Dept/ Chemistry) Richard D. Cummings (R.S.O.) (see Attachment #1)	5. RADIATION PROTECTION OFFICER. (Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in Items 8 and 9.) Richard D. Cummings (see Attachment #1)

6. (a) BYPRODUCT MATERIAL. (Elements and mass number of each.) Cobalt-60	(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MILLICURIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.) Sealed Source (solid) 511 Curies Housed in Picker Corporation Model P-3802-A
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By	COO
Orig. To	R/T
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7. **DESCRIBE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED.** (If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)

To be used in an irradiator custom designed by UCLA for the irradiation of various materials, excluding explosives or highly inflammable materials.
See previous information submitted and on file.

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21-00741-10 PDR

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CONTROL NO. 7 8 8 5 4

TRAINING AND EXPERIENCE OF EACH INDIVIDUAL NAMED IN ITEM 4 (Use supplemental sheets if necessary)

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	see Attachment #1		Yes No	Yes No
b. Radioactivity measurement standardization and monitoring techniques and instruments			Yes No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes No
d. Biological effects of radiation			Yes No	Yes No

9. EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience.)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
		see Attachment #1		

10. RADIATION DETECTION INSTRUMENTS (Use supplemental sheets if necessary.)

TYPE OF INSTRUMENTS (Include make and model number of each)	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE (mr/hr)	WINDOW THICKNESS (mg/cm ²)	USE (Monitoring, surveying, measuring)
		see Attachment #2			

11. METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE.

see Attachment #3

12. FILM BADGES, DOSIMETERS, AND BIO-ASSAY PROCEDURES USED. (For film badges, specify method of calibrating and processing, or name of supplier.)

R. S. Landauer Jr. & Company (see Attachment #4)

INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

13. FACILITIES AND EQUIPMENT. Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle answer) Yes No same as previously approved and on file

14. RADIATION PROTECTION PROGRAM. Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance and repair of the source. See Attachment #5

15. WASTE DISPOSAL. If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. N/A (see Attachment #6)

CERTIFICATE (This item must be completed by applicant)

16. THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

License Fee Category \$ Exempt

Fee Enclosed \$

Date April 30, 1985

Wayne State University

Applicant named in item 1

By: Richard D. Cummings
Radiation Safety Officer
Director, Health Physics-Radiation

Title of certifying official Control

Richard D. Cummings 4/30/85

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.

Attachment #1

Items 4,5,8,9 Individual(s) Responsible for Radiation Safety
Program and Their Training and Experience

1. Richard D. Cummings, Radiation Safety Officer,
Director, Health Physics-Radiation Control
(see attached)
2. Dr. Lawrence Marnett, Associate Professor,
Chemistry Department. (see attached)

CURRICULUM VITAE

Lawrence J. Marnett

Social Security Number: 511-52-1113

Campus Address: Department of Chemistry
Wayne State University
Detroit, MI 48202

Phone: 313-577-2777

Marital Status: Married, Two children

Birthdate: 11/22/47

Place of Birth: Kansas City, Kansas

Education:

Rockhurst College, B.S. cum laude, 1969
Duke University, Ph.D., 1973 Dissertation:
"The Thermal and Photochemical Decomposition of
Unsymmetric Azo Compounds" Professor Ned A. Porter, Advisor

Positions:

Research Associate, Karolinska Institute, in collaboration
with Professor Bengt Samuelsson, 1973-1974.

Research Associate, Wayne State University, in collaboration
with Professor A. Paul Schaap, 1974-1975.

Assistant Professor of Chemistry, Wayne State University,
1975-1980.

Associate Professor Chemistry, Wayne State University,
1980-1983.

Professor of Chemistry, Wayne State University, 1983-present.

Awards and Honors:

Probus Club Award for Academic Achievement (1980)

Wayne State University President's Award for Excellence in
Teaching (1980)

American Cancer Society Faculty Research Award (1982)

Scientific Societies:

American Chemical Society

American Society of Biological Chemists

American Association for the Advancement of Science

American Association for Cancer Research

Honorary Societies:

Alpha Sigma Nu

Phi Lambda Upsilon

Sigma Xi

Professional Activities:

Member, Species Comparison in Carcinogenesis Study Section
(ad hoc), National Institutes of Health, 1981.

Visiting Associate Professor of Biochemistry, University of
Texas Health Science Center at Dallas, 1981.

Member, Scientific Organizing Committee, International
Conference on Prostaglandins and Cancer, 1981, Washington, D.C.

Member, Chemical Pathology Study Section, National Institutes
of Health, 1982-1985.

Organizer, Symposium on Arachidonic Acid Metabolism,
American Chemical Society National Meeting, 1985, Chicago, Il.

Organizing Committee, International Conference on
Anticarcinogenesis and Radioprotection, 1986, Rockville, Md.

Organizing Committee, Gordon Conference on Oxygen Radicals in
Biology and Medicine, Santa Barbara, Ca 1987.

Editorial Activities:

Member, Editorial Board, The Journal of Biological Chemistry, 1983-1988

Member, Editorial Board, Archives of Biochemistry and Biophysics, 1984-1987.

Member, Editorial Board, Advances in Free Radical Biology and Medicine.

Series Co-Editor, "Prostaglandins, Leukotrienes, and Cancer," Martinus-Nyhoff Publishers

Volume Editor, "Arachidonic Acid Metabolism and Tumor Initiation", "Prostaglandins, Leukotrienes, and Cancer" Martinus-Nyhoff Publisher.

Administrative Activities:

Chairman, Education Committee, American Chemical Society, Detroit Section, 1976-1977.

Alternate Councilor, American Chemical Society, 1978-1980.

Graduate Recruiting Officer, 1980-1982,
Wayne State University, Department of Chemistry

Personnel Committee, 1981-present
Wayne State University, Department of Chemistry

Member, Chairman Search Committee, Biochemistry Department, Wayne State University School of Medicine, 1985.

External Program Review, Eppley Institute for Cancer Research, University of Nebraska, 1985.

Course Development:

Chem 762, Biochemistry
Chem 868, Enzyme Mechanism
Chem 869, Chemical Carcinogenesis

Consulting Activities:

Searle and Co., 1981

Warner-Lambert/Parke-Davis, 1982

Oxford Biomedical Research, 1984-present

Searle and Co., 1985

Present Research Support:

American Cancer Society, BC-244g, "The Role of Prostaglandin Synthetase in the Metabolic Activation of Chemical Carcinogens" 1/1/85-12/31/85. \$64,250; 1/1/85-12/31/86, \$132,355.

National Institutes of Health, GM 23642-09, "Studies on Prostaglandin Synthetase" 1/1/85-12/31/85 \$66,499; Renewal application submitted 2/1/85.

National Institutes of Health, CA 22206-07, "Studies on Malondialdehyde and Related Compounds" 5/1/85-4/30/86. \$102,062; 5/1/86-4/30/89, \$404,239.

National Institutes of Health, CA 32506-03, "Cancer Chemoprevention and Arachidonate Metabolism" 7/1/84-6/30/85 \$37,963.

Thomae Pharmaceuticals, "Studies on Metastasis" 1/1/85-12/31/85, \$60,000.

American Cancer Society, FRA 243 "Faculty Research Award" 9/1/84-8/30/85, \$30,000. 9/1/84-8/30/87, \$90,000.

Plenary Lectures:

American Society of Photobiology
Workshop on Chemiluminescence and Lipid Peroxidation
Colorado Springs, Colorado (February 22, 1980)

10th Linderstrom-Lang Conference, Skokloster, Sweden
(June 20-23, 1980)

Gordon Conference on Drug Metabolism, Plymouth, New Hampshire
(July 21-25, 1980)

Gordon Conference on Oxygen Radicals in Biology & Medicine
Ventura, California (January 12-16 1981)

Winter Prostaglandin Meeting, Clearwater, Florida
(March 1-5, 1981)

International Symposium on Metabolism and Pharmacokinetics of
Environmental Chemicals in Man, Sarasota, Florida (June 8-12,
1981)

National Cancer Institute Workshop on Chemoprevention of
Carcinogenesis, Bethesda, Maryland (June 25-26, 1981)

International Conference on Prostaglandins and Cancer, 1981
Washington, D.C. (August 31-September 3, 1981)

Symposium on Nafazatrom, Port Chester, New York
(October 1-2, 1981)

V International Conference on Prostaglandins, Florence, Italy
(May 18-22, 1982)
Also session chairman

Conference on Enzyme Chemistry, Northwestern University
Medical School, Evanston, Illinois (June 17, 1983)

Gordon Research Conference on Drug Metabolism, New Hampshire
(July 29, 1983)

Workshop on Eicosanoids, University of Michigan,
Ann Arbor, Michigan (October 20, 1983).

Symposium on Comparison of Radiation and Chemically-Induced Cancer
National Cancer Institute, Gaithersburg, Maryland
(December 6 - 8, 1983)

Chemoprevention Workshop, National Cancer Institute,
Bethesda, Maryland (May 4, 1984).

Mechanisms of Metastasis, Detroit, Michigan (June 2, 1984).

Ninth European Workshop on Drug Metabolism
Pont a Mousson, France (June 13, 1984)

Symposium on Polycyclic Hydrocarbons and Cancer, American Chemical
Society, Philadelphia, Pennsylvania (August 29, 1984).

Workshop on the Role of Cyclic Nucleic Acid Adducts in
Mutagenesis and Carcinogenesis, Lyon, France (September 18, 1984)

Kyoto Conference on Prostaglandins, Kyoto, Japan (November 27, 1984).

Prostaglandin Biochemistry Workshop, Otsuka Research Institute
Tokushima, Japan (November 29, 1984).

Workshop on Oxygen Radicals and Cancer
Berkeley, California (February 8-9, 1985).

Gordon Conference on Oxy-Radicals in Biology and Medicine
Santa Barbara, California (February 11-15, 1985).

Symposium on Non-Cytochrome P-450-Mediated Carcinogen Metabolism and Activation, American Association for Cancer Research, Houston, Texas (May 25, 1985) Also session chairman.

Gordon Conference on Free Radicals, Plymouth, New Hampshire, (June 10-14, 1985)

Symposium on Arachidonic Acid Metabolism, American Chemical Society, Chicago, Illinois (September 11, 1985) Also organizer.

Invited Lectures:

1980

University of Texas Health Science Center at Dallas, Biochemistry
University of Detroit, Chemistry
Wayne State University, Biochemistry
St. John Fisher College, Chemistry
Niagara University, Chemistry
Section on Pulmonary Function, NIEHS, Research Triangle Park

1981

Ford Motor Company
Mercy College, Chemistry
University of Texas, Health Science Center at Dallas, Biochemistry
North Texas State University, Chemistry
Wayne State University, Varian Instruments Chromatography
Symposium
McArdle Laboratory for Cancer Research, University of Wisconsin
New York Medical College, Pharmacology
Western Michigan University, Chemistry
Hope College, Chemistry
Detroit Physiological Society

1982

Warner-Lambert/Parke-Davis
The Upjohn Company
Hoffmann-LaRoche
Wayne State University, Biology
Wayne State University, Pharmacology
University of Chicago, Chemistry
Bayer Pharmaceuticals, Wuppertal, West Germany
Federal Cancer Research Center, Heidelberg, West Germany
Wayne State University Medical School, Biochemistry
Oakland University
Pfizer Central Research
Massachusetts Institute of Technology, Department of Nutrition
and Food Science

1983

University of California, San Francisco, Pharmaceutical
Chemistry
University of California, Berkley, Biochemistry
University of Rochester, Pharmacology
University of Rochester Cancer Center
University of Michigan, School of Public Health
Central Michigan University
University of Toledo
Frederick Cancer Research Institute

1984

National Institute of Environmental Health Sciences
Oakland University, Chemistry
Wayne State University, Chemistry
Northwestern University School of Medicine, Pharmacology
University of Virginia, Chemistry
University of Guelph, Chemistry
Ecole Normale Supérieure, Chemistry, Paris, France
University of Strasbourg, Molecular Biology
University of Michigan School of Public Health
American Cancer Society Workshop, Traverse City Workshop
Vanderbilt University School of Medicine, Biochemistry
University of Detroit, Chemistry
Kochi University School of Medicine, Biochemistry, Kochi, Japan
Keio University School of Medicine, Biochemistry, Tokyo, Japan
University of Philippines School of Medicine
Manila, The Philippines
University of Philippines, Chemistry, Quezon City, The Philippines

1985

University of Rochester, Chemistry
Harvard Medical School, Biological Chemistry
Wayne State University, School of Medicine, Physiology

PUBLICATIONS

Lawrence J. Marnett

Refereed Journals

1. N. A. Porter, M. E. Landis, and L. J. Marnett, "The Photolysis of Unsymmetric Azo Compounds," *J. Amer. Chem. Soc.*, **93**, 795-796 (1971).
2. N. A. Porter, L. J. Marnett, C. H. Lochmuller, G. L. Closs, and M. Shobataki, "Application of Chemically Induced Dynamic Nuclear Polarization to the Photolysis of Unsymmetric Azo Compounds," *J. Amer. Chem. Soc.*, **94**, 3664-3665 (1972).
3. N. A. Porter and L. J. Marnett, "The Photolysis of Unsymmetric Azo Compounds: *cis* Azo Compound Intermediates," *J. Amer. Chem. Soc.*, **94**, 4361-4367 (1973).
4. L. J. Marnett, P. Smith, and N. A. Porter, "An EPR Investigation of Hydrazyl Radicals Formed in Azo Compound Photolysis," *Tetrahedron Lett.*, 1081-1084 (1973).
5. L. J. Marnett, P. Wlodawer, and B. Samuelsson, "Light Emission During Prostaglandin Biosynthesis," *Biochem. Biophys. Res. Comm.*, **60**, 1286-1294 (1974).
6. L. J. Marnett, P. Wlodawer, and B. Samuelsson, "Cooxygenation of Organic Substrates by the Prostaglandin Synthetase of Sheep Vesicular Gland," *J. Biol. Chem.*, **250**, 8510-8517 (1975).
7. L. J. Marnett and C. L. Wilcox, "Stimulation of Prostaglandin Biosynthesis by Lipoic Acid," *Biochim. Biophys. Acta*, **487**, 222-239 (1977).
8. L. J. Marnett and M. J. Bienkowski, "Non-Enzymatic Reduction of Prostaglandin H by Lipoic Acid," *Biochemistry*, **16**, 4303-4307 (1977).
9. L. J. Marnett, G. A. Reed, and J. T. Johnson, "Prostaglandin Synthetase Dependent Benzo[a]pyrene Oxidation: Products of the Oxidation and Inhibition of Their Formation by Antioxidants," *Biochem. Biophys. Res. Comm.*, **79**, 569-576 (1977).
10. L. J. Marnett, G. A. Reed, and D. J. Denison, "Prostaglandin Synthetase Dependent Activation of 7,8-Dihydro-7,8-Dihydroxy-Benzo[a]pyrene to Mutagenic Derivatives," *Biochem. Biophys. Res. Comm.*, **82**, 210-216 (1978).
11. R. W. Egan, P. H. Gale, G. C. Beveridge, G. B. Phillips, and L. J. Marnett, "Radical Scavenging as the Mechanism for Stimulation of Prostaglandin Cyclooxygenase and Depression of Inflammation by Lipoic Acid and Sodium Iodide," *Prostaglandins*, **16**, 861-869 (1978).
12. K. V. Honn, J. R. Dunn, II, L. Morgan, M. J. Bienkowski, and L. J. Marnett, "Inhibition of DNA Synthesis in Harding-Passey Melanoma Cells by Prostaglandins A₁ and A₂: Comparison with Chemotherapeutic Agents," *Biochem. Biophys. Res. Comm.*, **87**, 795-801 (1979).

13. L. J. Marnett, M. J. Bienkowski, and W. R. Pagels, "Oxygen-18 Investigation of the Prostaglandin Synthetase Dependent Cooxidation of Diphenylisobenzofuran," *J. Biol. Chem.*, **254**, 5077-5082 (1979).
14. L. J. Marnett and G. A. Reed, "Peroxidatic Oxidation of Benzo[a]pyrene and Prostaglandin Biosynthesis," *Biochemistry*, **18**, 2923-2929 (1979).
15. L. J. Marnett, M. J. Bienkowski, M. Raban, and M. A. Tuttle, "Studies of the Hydrolysis of ^{14}C -labeled Tetraethoxypropane to Malondialdehyde," *Anal. Biochem.*, **99**, 458-463 (1979).
16. M. J. Bienkowski, M. A. Tuttle, and L. J. Marnett, "Synthesis of Malondialdehyde-1,2,3- $^{14}\text{C}_3$ Via Ethyl Vinyl-1,3- $^{14}\text{C}_2$ -Ether," *J. Label. Compds. Radiopharm.*, **17**, 605-611 (1980).
17. L. J. Marnett, J. T. Johnson, and M. J. Bienkowski, "Arachidonic Acid Dependent Metabolism of 7,8-Dihydroxy-7,8-Dihydro-Benzo[a]pyrene by Ram Seminal Vesicles," *FEBS Letts.*, **106**, 13-16 (1979).
18. H. Iida, T. Kimura, J. T. Johnson, and L. J. Marnett, "Microsomal Drug Hydroxylase Activity of *Tetrahymena Pyriformis*," *Comp. Biochem. Physiol.*, **63C**, 381-387 (1979).
19. L. J. Marnett and M. A. Tuttle, "Comparison of the Mutagenicities of Malondialdehyde and Side Products Formed During its Chemical Synthesis," *Cancer Res.*, **40**, 276-282 (1980).
20. N. A. Porter, R. A. Wolf, W. R. Pagels, and L. J. Marnett, "A Test for the Intermediacy of 11-Hydroperoxyeicosa-5,8,12,14-Tetraenoic Acid (11-HPETE) in Prostaglandin Biosynthesis," *Biochem. Biophys. Res. Comm.*, **92**, 349-355 (1980).
21. L. J. Marnett and M. J. Bienkowski, "Hydroperoxide-Dependent Oxygenation of 7,8-Dihydroxy-7,8-Dihydrobenzo[a]pyrene by Ram Seminal Vesicle Microsomes. Source of the Oxygen," *Biochem. Biophys. Res. Comm.*, **96**, 639-647 (1980).
22. A. Panthananickal and L. J. Marnett, "Arachidonic Acid-Dependent Metabolism of 7,8-Dihydroxy-7,8-Dihydrobenzo[a]pyrene to Polyguanylic Acid-Binding Derivatives," *Chem. Biol. Interactions*, **33**, 239-252 (1981).
23. L. J. Marnett, "Polycyclic Hydrocarbon Oxidation During Prostaglandin Biosynthesis," *Life Sci.*, **29**, 531-546 (1981).
24. A. Panthananickal and L. J. Marnett, "Comparison of Commercial Reversed-Phased HPLC Columns for the Separation of Benzo[a]pyrene Diol epoxide - Nucleic Acid Adducts," *J. Chrom.*, **206**, 253-265 (1981).
25. Kenneth V. Honn, Richard S. Bockman, and Lawrence J. Marnett, "Prostaglandins and Cancer: A Review of Tumor Initiation Through Tumor Metastasis," *Prostaglandins*, **21**, 833-864 (1981).
26. L. J. Marnett, A. Panthananickal, and G. A. Reed, "Metabolic Activation of 7,8-Dihydroxy-7,8-Dihydrobenzo[a]pyrene During Prostaglandin Biosynthesis," *Drug Metab. Rev.*, **13**, 235-247 (1982).

27. T. A. Dix and L. J. Marnett, "Free Radical Epoxidation of 7,8-Dihydroxy-7,8-Dihydrobenzo[a]pyrene by Hematin and Polyunsaturated Fatty Acid Hydroperoxides," *J. Amer. Chem. Soc.*, **103**, 6744-6746 (1981).
28. J. Capdevila, L. J. Marnett, N. Chacos, R. A. Prough, and R. W. Estabrook, "Cytochrome P-450-Dependent Oxygenation of Arachidonic Acid to Hydroxyeicosatetraenoic Acids (HETE's)," *Proc. Natl. Acad. Sci. USA*, **79**, 767-770 (1982).
29. L. J. Marnett, P. H. Siedlik, and L. W.-M. Fung, "Oxidation of Phenidone and BW755C by Prostaglandin Endoperoxide Synthetase," *J. Biol. Chem.*, **257**, 6957-6964 (1982).
30. G. A. Reed and L. J. Marnett, "Metabolism and Activation of 7,8-Dihydrobenzo[a]pyrene During Prostaglandin Biosynthesis: Intermediacy of a Bay-Region Epoxide," *J. Biol. Chem.*, **257**, 11368-11376 (1982).
31. A. Panthananickal, P. Weller, and L. J. Marnett, "Stereoselectivity of the Epoxidation of 7,8-Dihydrobenzo[a]pyrene by Prostaglandin H Synthase and Cytochrome P-450 Determined by the Identification of Polyguanylic Acid Adducts," *J. Biol. Chem.*, **258**, 4411-4418 (1983).
32. T. A. Dix and L. J. Marnett, "Metabolism of Polycyclic Aromatic Hydrocarbon Derivatives to Ultimate Carcinogens During Lipid Peroxidation," *Science*, **221**, 77-79 (1983).
33. A. Basu and L. J. Marnett, "Unequivocal Demonstration That Malondialdehyde Is A Mutagen," *Carcinogenesis*, **4**, 331-333 (1983).
34. A. W. Bull, L. J. Marnett, E. J. Dawe, and N. D. Nigro, "Stimulation of Deoxythymidine Incorporation in the Colon of Rats Treated Intrarectally with Bile Acids and Fats," *Carcinogenesis*, **4**, 207-210 (1983).
35. W. R. Pagels, R. J. Sachs, L. J. Marnett, D. L. Dewitt, J. S. Day, and W. L. Smith, "Immunochemical Evidence for the Involvement of Prostaglandin H Synthase in Hydroperoxide-Dependent Oxidations by Ram Seminal Vesicle Microsomes," *J. Biol. Chem.*, **258**, 6517-6523 (1983).
36. K. C. Morton, C. M. King, J. B. Vaught, C. Y. Wang, M.-S. Lee, and L. J. Marnett, "Prostaglandin H Synthase-Mediated Reaction of Carcinogenic Arylamines with tRNA and Homopolyribonucleotides," *Biochem. Biophys. Res. Comm.*, **111**, 96-103 (1983).
37. S. M. Fischer, S. Olge, L. J. Marnett, S. Nesnow, and T. J. Slaga, "The Lack of Initiating and/or Promoting Activity of Sodium Malondialdehyde on Sencar Mouse Skin," *Cancer Letts.*, **19**, 61-66 (1983).
38. M. D. Sevilla, P. Neta and L. J. Marnett, "Reaction of the Antithrombotic and Antimetastatic Agent, Nafazatrom, with Oxidizing Radicals," *Biochem. Biophys. Res. Comm.*, **115**, 800-806 (1983).
39. T. A. Dix and L. J. Marnett, "Hematin-Catalyzed Rearrangement of Hydroperoxy-linoleic Acid to Epoxy Alcohols via an Oxygen Rebound," *J. Amer. Chem. Soc.*, **105**, 7001-7002 (1983).

40. A. K. Basu, L. J. Marnett, and L. J. Romano, "Dissociation of Malondialdehyde Mutagenicity in *Salmonella typhimurium* from Its Ability to induce Interstrand DNA Cross-Links," *Mutat. Res.*, 129, 39-46 (1984)
41. L. J. Marnett, P. H. Siedlik, R. Ochs, M. Das, K. V. Honn, R. Warnock, B. Tainer, and T. Eling, "Mechanism of the Stimulation of Prostaglandin H Synthase and Prostacyclin Synthase by the Antithrombotic and Antimetastatic Agent, Nafazatrom," *Mol. Pharmacol.*, 26, 328-335 (1984)
42. A. K. Basu and L. J. Marnett, "Molecular Requirements for the Mutagenicity of Malondialdehyde and Related Acroleins," *Cancer Res.*, 44, 2848-2854 (1984).
43. D. E. Levin, L. J. Marnett, and B. N. Ames, "Spontaneous and Mutagen-Induced Deletions: Mechanistic Studies in *Salmonella* Tester Strain TA102," *Proc. Natl. Acad. Sci. USA*, 81, 4457-4461 (1984).
44. L. J. Marnett, H. Hurd, M. Hollstein, D. E. Levin, H. Esterbauer, and B. N. Ames, "Naturally Occurring Carbonyl Compounds are Mutagens in *Salmonella* Tester Strain TA104," *Mutat. Res.*, 148, 25-34 (1985).
45. A. W. Bull, N. D. Nigro, W. A. Golembieski, and L. J. Marnett, "In Vivo Stimulation of DNA Synthesis and Induction of Ornithine Decarboxylase in Rat Colon by Fatty Acid Hydroperoxides, Autoxidation Products of Unsaturated Fatty Acids," *Cancer Res.*, 44, 4924-4928 (1984)
46. V. M. Samokyszyn, B. F. Sloane, K. V. Honn, and L. J. Marnett, "Cooxidation of 13-Cis-Retinoic Acid by Prostaglandin H Synthase," *Biochem. Biophys. Res. Comm.*, 124, 430-436 (1984)
47. L. J. Marnett, J. Buck, M. A. Tuttle, A. K. Basu, and A. W. Bull, "Distribution and Oxidation of Malondialdehyde in Mice," *Prostaglandins*, in press.
48. T. A. Dix and L. J. Marnett, "Conversion of Linoleic Acid Hydroperoxide to Hydroxy, Keto, Epoxyhydroxy, and Trihydroxy Fatty Acids by Hematin," *J. Biol. Chem.*, in press.
49. T. A. Dix, R. Fontana, A. Panthani, and L. J. Marnett, "Hematin-Catalyzed Epoxidation of 7,8-Dihydroxy-7,8-Dihydrobenzo[a]pyrene (BP-7,8-Diol) by Polyunsaturated Fatty Acid hydroperoxides," *J. Biol. Chem.*, in press.
50. J. R. Battista and L. J. Marnett, "Prostaglandin H Synthase-Dependent Epoxidation of Aflatoxin B₁," *Carcinogenesis*, in press.
51. A. K. Basu and L. J. Marnett, "Synthesis of Mono- and Di-Deuteromalondialdehyde," *J. Label Compds. Radiopharm.*, in press.
52. K. V. Honn and L. J. Marnett, "Requirement of a Reactive α,β -Unsaturated Carbonyl for Inhibition of Tumor Growth and Induction of Differentiation by "A" Series Prostaglandins," *Biochem. Biophys. Res. Comm.*, in Press

Book Chapters

1. L. J. Marnett and A. P. Schaap, "Insolubilized Reagents and Syntheses on Insoluble Supports" in *Applications of Biochemical Systems in Organic Chemistry*, J. B. Jones, Ed., Wiley-Interscience, New York (1976) pp. 995-1044.
2. L. J. Marnett, M. J. Bienkowski, M. Leithauser, W. R. Pagels, A. Panthananickal, and G. A. Reed, "Prostaglandin Synthetase-Dependent Cooxygenation" in *Prostaglandins and Cancer: First International Conference*, T. J. Powles, R. S. Bockman, K. V. Honn, and P. Ramwell, Eds., Liss, New York (1982) pp., 97-111.
3. L. J. Marnett, T. A. Dix, R. J. Sachs, and P. H. Siedlik, "Oxidations by Fatty Acid Hydroperoxides and Prostaglandin Synthetase" in *Advances in Prostaglandin and Thromboxane Research*, Volume 11, B. Samuelsson, P. Ramwell, and R. Paoletti, Eds., Raven, New York (1983) pp. 79-86.
4. L. J. Marnett, "Hydroperoxide-Dependent Oxidations During Prostaglandin Biosynthesis" in *Free Radicals in Biology*, Volume 6, W. A. Pryor, Ed., Academic, New York, (1984) pp. 63-94.
5. L. J. Marnett and T. E. Eling, "Cooxidation During Prostaglandin Biosynthesis: A Pathway for the Metabolic Activation of Xenobiotics" in *Reviews in Biochemical Toxicology*, Volume 5, E. Hodgson, J. R. Bend, and R. M. Philpot, Eds., Elsevier/North-Holland, New York (1983) pp. 135-172.
6. R. A. Prough, M. I. Brown, C. A. Amrhein, and L. J. Marnett, "Metabolism of Azo and Hydrazine Derivatives to Reactive Intermediates" in *Extrahepatic Drug Metabolism and Chemical Carcinogenesis*, J. Rydstrom, J. Montelins, and M. Bengtsson, Eds., Elsevier Biomedical Press, (1983) Amsterdam, pp. 489-497.
7. K. V. Honn and L. J. Marnett, "Prostaglandin, Thromboxane, and Leukotriene Biosynthesis: Target for Antitumor and Antimetastatic Agents" in *Novel Approaches to Cancer Chemotherapy*, P. Sunkara, Ed., Academic Press, New York, (1984) pp.127-163.
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9. T. A. Dix and L. J. Marnett, "Detection of the Metabolism of Polycyclic Aromatic Hydrocarbon Derivatives to Ultimate Carcinogens During Lipid Peroxidation" in *Methods in Enzymology*, Vol. 105, L. Packer, Ed., Academic Press, New York, (1984) pp. 347-352.
10. L. J. Marnett, T. A. Dix, P. H. Siedlik, and P. Weller, "Hydroperoxide Metabolism and Oxidant Generation in Platelets" in *The Platelets: Physiological and Pharmacology*, G. Longenecker, Ed., Academic Press, New York, (1985) pp. 187-200.

11. L. J. Marnett, T. A. Dix, J. R. Battista, S. O. Neville, P. E. Weller, and C. M. Markey, "Lipid Hydroperoxide-Dependent Xenobiotic Metabolism," *Proceedings of Ninth European Workshop on Drug Metabolism* (G. Siest, ed.), in press.
12. Lawrence J. Marnett, "Hydroperoxide-Dependent Oxygenation of Polycyclic Aromatic Hydrocarbons and Their Metabolites," *American Chemical Society Advances in Chemistry Series* (R. G. Harvey, ed.), in press.
13. Lawrence J. Marnett, "The Role of Cyclic Nucleic Acid Adducts in the Mutational Specificity of Malondialdehyde and β -Substituted Acroleins in *Salmonella*," *IARC Monograph Series* (B. Singer and H. Bartsch, eds.), in press.
14. L. J. Marnett, "Arachidonic Acid Metabolism and Tumor Initiation," *Prostaglandins, Leukotrienes, and Cancer, Vol. 2, Arachidonic Metabolism and Tumor Initiation* (L. J. Marnett, ed.) Martinus-Nyhoff, New York, in press.

Training and Experience

Name Lawrence J. Marnett, Ph.D.

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	W.S.U.	9/1/76-Present	(Yes) No	Yes No Health Physics Lectures
b. Radioactivity measurement standardization and monitoring techniques and instruments	"	" "	(Yes) No	Yes No
c. Mathematics and calculations basic to the use and measurement of radioactivity	"	" "	(Yes) No	Yes No
d. Biological effects of radiation	"	" "	(Yes) No	Yes No

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
^{14}C	25 mCi	Wayne State University	9/1/76-Present	Research Tracer
^3H	500 mCi	Wayne State University		"
^{32}P	10 Ci	Univ/Calif., Berkeley	1/1/83-7/1/83	"
CONTROL NO. 78854				

CURRICULUM VITAE

RICHARD D. CUMMINGS

PLACE OF BIRTH: Lowell, Massachusetts
DATE OF BIRTH: May 2, 1947
MARITAL STATUS: Married, 2 Children
PRESENT ADDRESS: 8743 Holly Drive, Canton, MI 48187
HOME TELEPHONE: (313) 459-4939

EDUCATION:

1966-1970	Lowell Technological Institute, B.S. Nuclear Engineering
1979-Present	Wayne State University, M.S. Radiological Physics (expected 18/85)

PROFESSIONAL EXPERIENCE:

January 1975-Present	<p>Presently employed by Wayne State University as Radiation Safety Officer, Health Physicist, and Director of the Health Physics Department. In this capacity, I am responsible for the performance, coordination, and supervision of technical personnel and activities related to radiation protection and control. I am also responsible for all budgetary and administrative matters concerning this department.</p> <p>Some of the main duties include assurance of the health and welfare of the University's personnel, students, and the general public as applies to radiation protection. Also, to ensure that all rules and regulations are in complete compliance with applicable Federal, State, and Local regulations as they pertain to radiological health and general safety at the University and its affiliated institutions. Lastly, to present lectures and practical training sessions in radiation safety to students, radiation workers, and service personnel.</p>
January 1974-January 1975	<p>Employed by Cambridge Nuclear Corporation as Plant Health Physicist. In this capacity, I was responsible for the plant health and safety operations from a radiological viewpoint. Some of the main duties included furnishing consulting services on all aspects of radiation protection as well as general surveillance of radiological activities. Also, to ensure that all rules and regulations were in complete compliance with applicable Federal, State and Local regulations as they pertain to Radiological Health and General Safety.</p>

August 1973-December 1973	Employed by Combustion Engineering of Connecticut as a Nuclear Steam Supply System-II Engineer. In this capacity, I conducted a thermal margin analysis of the Gulf States' Blue Hills Nuclear Station. I also was involved in Product Engineering and Design in the Core Thermal Analysis Group.
June 1970-August 1973	<p>Employed by Public Service Electric and Gas Company of New Jersey as a Nuclear Engineer in the Nuclear Licensing and Fuel Management Group. In this capacity I analyzed radiological consequences of postulated accidents of the Salem Nuclear Generating Station (PWR) and included the results in the Final Safety Analysis Report. I also was responsible for conducting a portion of the radiation shielding analysis for the same plant.</p> <p>I had two main responsibilities associated with the analysis of the Salem cores. My first responsibility was the implementation of a three-dimensional PWR reactor simulator code used for core follow analysis as well as fuel shuffling and reload fuel analysis. My second responsibility was the Thermal Hydraulic analysis of the Salem cores.</p> <p>I received In-Core Thermal Hydraulics, Physics, Economics, and Accident Analysis training for both PWR and BWR reactors from Nuclear Associates International of Rockville, Maryland. In this capacity, I utilized various Thermal Hydraulics, Physics, Economics, and Transient computer codes to analyze core performance for primarily the Salem Nuclear Generating Station.</p> <p>Also, I assisted Public Services' Professional Placement personnel with on-campus college recruitment. In this capacity, I interviewed and selected young engineers for employment with Public Service.</p>
April 1969-July 1969	Employed by New England Nuclear Corporation where I acted as an assistant research and development technician on Indium, Molybdenum, and Yttrium Generators for medical purposes.
September 1968-June 1970	Employed at the Lowell Technological Institute Nuclear Center as a junior laboratory technician.
March 1968-August 1968	Employed by the Lowell Technological Institute Research Center where I acted as laboratory technician for the Radiation Physics Group. In this capacity, I operated a microdensitometer and obtained, analyzed, and graphed acceptable data to be printed in classified manuals for the United States Government.

SCIENTIFIC SOCIETIES AND ASSOCIATIONS:

National Health Physics Society (H.P.S.)
Great Lakes Chapter, Health Physics Society (GLCHPS)
Great Lakes Chapter, American Association of
Physicists in Medicine (GLCAAPM)
Michigan Energy and Resource Research Association
Metropolitan Nuclear Fuel Technology Group
American Nuclear Society

PROFESSIONAL OFFICES HELD:

1980-1982 President-Elect and President, Great Lakes Chapter
Health Physics Society
1982-1983 Councilperson, Great Lakes Chapter Health Physics Society
1982-1983 Newsletter/Editor, Great Lakes Chapter Health Physics Society

COMMITTEES

1975- Radiation Safety-Radioisotope Committee, W.S.U.
Sub-Committee on Human Use, W.S.U.
Radioactive Drug Research Committee, W.S.U.
1980-1982 Admissions Committee, National Health Physics Society
1980-1981 Spring Symposium, GLCHPS (Chairman)
1981- Membership Committee, GLCHPS (Chairman)
1981- Federal and State Legislation Committee, GLCHPS (Chairman)
1982 MERRA Committee on Low-Level Radioactive Waste Disposal
1983 Federal and State Legislation Committee, Health Physics
Society

PRESENTATIONS:

1981 Lecturer, Occupational Environmental Health, W.S.U.
1981 Spring Symposium, Great Lakes Chapter Health Physics Society
1982 Lecturer, Occupational Environmental Health, W.S.U.
1982 Spring Symposium, Great Lakes Chapter Health Physics Society
1982 Testimony, State Legislature, House Bill 5600, House
Committee on Conservation, Environment and Recreation

CONSULTANT:

Bendix Corporation, Southfield, Michigan
Ford Motor Company, Dearborn, Michigan

T.V. INTERVIEWS:

1978 Channel 2, Detroit "Radioactive Waste"
1983 Channel 7, Live Interview - "Low-Level Radioactive Waste"

MAGAZINE INTERVIEW:

1983 Business Week - "Regional Radioactive Waste Compacts"

Training and Experience :

Name Richard D. Cummings, B.S., Director Health Physics-Radiation Control and Radiation Safety Officer

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	Lowell Technological Inst., Lowell, Mass	4 years	(Yes) No	(Yes) No
b. Radioactivity measurement standardization and monitoring techniques and instruments	Formal course leading to B.S. Nuc.Eng. Wayne State University Health Physics-Radiation Control	8 years	(Yes) No	(Yes) No
c. Mathematics and calculations basic to the use and measurement of radioactivity	Wayne State Univ. Health Physics-Radiation Control	8 years	(Yes) No	(Yes) No
d. Biological effects of radiation	Wayne State Univ. Health Physics-Radiation Control	8 years	(Yes) No	(Yes) No

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
various calibration sources	10 μ Ci	Lowell Technological Inst. Lowell, Mass	3 years	Nuclear Laboratory Counting Instrumentation as formal course work
^{99}Mo	10 mCi	New England Nuclear Corp	3 months	Nuclear Medicine Generators
$^{99\text{m}}\text{Tc}$	10 mCi	Billerica, Mass		
^{99}Mo	2 Ci	Cambridge Nuclear Corp	1 year	Health Physics related activities
$^{99\text{m}}\text{Tc}$	2 Ci	Billerica, Mass. Health Physics Dept.		
^{125}I	50 mCi			
^{131}I	50 mCi			
^{14}C	10 mCi			
^{35}S	10 mCi			
^{51}Cr	30 mCi			
^{32}P	25 mCi			
Z-1 to Z-98	Various multi-curie and multi millicurie amounts	Wayne State University Health Physics-Radiation Control	1/20/75 to present	Health Physics related activities

ATTACHMENT #2

Item 10: Radiation Detection Instruments

See attached table.

Portable Survey Instrumentation

TYPE OF INSTRUMENTS	NUMBER AVAILABLE	RADIATION DETECTED	SENSITIVITY RANGE	WINDOW THICKNESS mg/cm ²	USE
Eberline Model E500B G.M. 180A End Window Probe H.P.-177B Side Window Probe Internal Probe	1	$\alpha \cdot \beta \cdot \gamma$ $\beta \cdot \gamma$ γ	0-200 mr/hr 0-200 mr/hr 0-2000 mr/hr	1.2 N/A N/A	Surveying
Eberline E-520 G.M. 190 & 180A End Window Probe Internal Probe	1	$\alpha \cdot \beta \cdot \gamma$ γ	0-200 mr/hr 0-2000 mr/hr		Surveying
Ludlum Model 3 G.M.	1	$\alpha \cdot \beta \cdot \gamma$	0-200 mr/hr	2.0	Surveying
Eberline Model E-120 G.M.	1	$\alpha \cdot \beta \cdot \gamma$	0-50 mr/hr	30	Surveying
Victoreen Model 470A Ionization Chamber	1	$\alpha \cdot \beta \cdot \gamma$	0-1000 mr/hr and R/hr	17	Surveying

CONTROL NO. 78854

ATTACHMENT #3

Item 11: Method, Frequency and Standards Used in Calibrating
Instruments

(see attached)

Calibration of Portable
Survey Instruments

1. All survey instruments that are utilized shall be calibrated at least annually or more often if necessary as well as after servicing.
2. Calibrations will be performed utilizing a Tech/Ops Model 773 Cesium-137 instrument calibrator that is accurate to within $\pm 3\%$ to the U.S. National Bureau of Standards (N.B.S.) calibrations.
3. Each scale of the survey instrument will be calibrated at two points such that one point is in each half of the scale and the two points are separated by 35-50% of full scale.
4. The exposure rate measured by the survey instrument shall differ from the true exposure by less than or equal to $\pm 10\%$.
5. If the survey instrument(s) cannot be adjusted to indicate readings within $\pm 10\%$ of the true exposure rate, but fall within $\pm 20\%$ of the true exposure rate, the instrument(s) will be returned to the owner with a recommendation for repair or a calibration chart will be attached to the instrument(s).
6. Calibrations will be performed by Richard D. Cummings, Radiation Safety Officer and Director, Health Physics-Radiation Control and/or Vincent R. Cytacki, Health Physicist, and/or James Barrows, Health Physics Technician II and/or by other Health Physics Technicians under the direct supervision of a Health Physicist. Training and experience of the above individuals have been obtained at Wayne State University.
See attached Training and Experience.
7. Instrument calibrations will be performed at Wayne State University, 645 Millelt, Detroit, MI (3rd Floor).
8. Instrument calibration procedures are presented on the attached.

CALIBRATION OF PORTABLE GAMMA DETECTION SURVEY INSTRUMENTS
UTILIZING SOURCES TRACEABLE TO THE NATIONAL BUREAU OF STANDARDS

1. All survey instruments that are utilized by Health Physics-Radiation Control and other Departments at the University shall be calibrated at least annually, after servicing, or more often if necessary.
2. Calibration shall be performed in as large a facility as is available in order to minimize error due to scatter radiation.
3. Equipment needed for calibration:
 - (a) Tech/Ops Model 773 Cesium-137 Instrument Calibrator
 - (b) Counter or table-top for mounting Calibration Kit.
 - (c) Portable counter, table, or cart (or approximately the same height as (b) for mounting survey meter.
 - (d) Ring stand and clamp for supporting G.M. tube.
 - (e) Screwdrivers.
 - (f) Masking tape.
 - (g) "Instrument Calibration" Form H.P.-10(a), H.P.-10(b).
 - (h) Table or calculated exposure rates for Cesium-137 Instrument Calibrator.
4. The procedure for calibration is as follows:
 - (a) Place the Cesium-137 Instrument Calibrator on counter or table top.
 - (b) Turn on survey meter (allow 10 minute warm-up time for ionization chambers). If instrument has a battery check setting, check battery response. If batteries are defective, replace before proceeding with calibration.
 - (c) Close shield on side window G.M. probes; place cap on end window G.M. tubes or ionization chambers.
 - (d) Place survey meter on portable table. If instrument is a G.M. type, mount the probe on the clamp and ring stand assembly as shown in Figure 1. If instrument is an ionization chamber, position the chamber as shown in Figure 2.

Figure 1



Figure 2



- (e) Using the tape measure on the side of the Cesium-137 Instrument Calibrator, measure the correct distance from source to probe for the applicable exposure rate and conduct a two point calibration on each scale with the two points separated by at least 35-50% of full scale.
- (f) If the survey instrument(s) can be brought into calibration with $\pm 10\%$ of the calculated or known values for each point checked, then the instrument is properly calibrated.

If the survey instrument(s) cannot be adjusted to indicate readings within $\pm 10\%$ of the true exposure rate, but fall within $\pm 20\%$ of the true exposure rate, the survey instrument(s) will be returned to the owner with a recommendation for repair, or a calibration chart will be attached to the instrument(s).

- 5. The appropriate "Instrument Calibration" Form H.P.-10(a), H.P.-10(b), is to be sent to the owner with the calibrated instrument. Any problems encountered with the instrument during calibration will be noted in the "Remarks or Comments" section of the form.

Training and Experience

Name Richard D. Cummings, Radiation Safety Officer

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	Lowell Technological Inst., Lowell, Mass. (Formal course leading to B.S. Nuc.Eng.)	4 years	(Yes) No	(Yes) No
b. Radioactivity measurement standardization and monitoring techniques and instruments	New Eng. Nuclear Corp., Billerica, Mass.	3 months	(Yes) No	(Yes) No
c. Mathematics and calculations basic to the use and measurement of radioactivity	Cambridge Nuclear Corp., Billerica, Mass.	1 year	(Yes) No	(Yes) No
d. Biological effects of radiation	Wayne State Univ. Health Physics-Radiation Control	1/20/75 to present	(Yes) No	(Yes) No

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Various calibration sources	10 mCi	Lowell Technological Inst. Lowell, Mass	3 years	Nuclear Laboratory Counting Instrumentation as formal course work
⁹⁹ Mo ^{99m} Tc	10 mCi 10 mCi	New England Nuclear Corp Billerica, Mass	3 months	Nuclear Medicine Generators
⁹⁹ Mo ^{99m} Tc ¹²⁵ I ¹³¹ I ¹⁴ I ³⁵ S ⁵¹ Cr ²² P	2 Ci 2 Ci 50 mCi 50 mCi 10 mCi 10 mCi 30 mCi 25 mCi	Cambridge Nuclear Corp. Billerica, Mass Health Physics Dept.	1 year	Health Physics related activities
Z-1 to Z-98	Various multi-curie and multi-milli-curie amounts	Wayne State University, Health Physics-Radiation Control	1/20/75 to present	Health Physics related activities

Training and Experience

Name Vincent R. Cytacki, B.S., Health Physicist, Health Physics-Radiation Control

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	Oakland University Henry Ford Hospital Wayne State Univ.	1 yr. 2.5 yrs 2.5 yrs	(Yes) No	(Yes) No
b. Radioactivity measurement standardization and monitoring techniques and instruments	Lawrence Inst. of Technology Oakland University Henry Ford Hospital Wayne State Univ.	4 yrs 1 yr 2.5 yrs 2.5 yrs	(Yes) No	(Yes) No
c. Mathematics and calculations basic to the use and measurement of radioactivity	Lawrence Inst. of Technology Oakland University Henry Ford Hosp.	4 yrs 1 yr 2.5 yrs	(Yes) No	(Yes) No
d. Biological effects of radiation	Oakland University Henry Ford Hosp. Wayne State Univ.	1 yr 2.5 yrs 2.5 yrs	(Yes) No	(Yes) No

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
I-131	200 mCi	Henry Ford Hospital, Detroit MI	2.5 yrs	Therapy
Co-60	1000 Ci			"
Tc-99m	1 Ci	Wayne State Univ., Detroit, MI	2.5 yrs	Scanning
Xe-133	100 mCi	plus all isotopes listed in	"	"
Ca-67	20 mCi	Wayne State University's		"
Mo-99	1 Ci	N.R.C. license		"
I-125	100 mCi	"		Therapy, scanning
C-14	300 mCi	"	"	Research
P-32	150 mCi	"		Therapy
H-3	200 mCi	"		Research
S-35	30 mCi	"	"	Scanning
Ca-45	50 mCi	"	"	Research
Cs-137	300 mCi	"	"	Therapy
Ra-226	200 mCi			Therapy
Au-198	100 mCi			Therapy
Ir-192	100 mCi	"	"	Therapy

Training and Experience

Name: James Lee Barrows, Health Physics Technician, Health Physics-Radiation Control

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
a. Principles and practices of radiation protection	Wayne State Univ. Dept. of Radiation Biology	1961 to 1962	(Yes) No	(Yes) No
b. Radioactivity measurement standardization and monitoring techniques and instruments	Wayne State Univ. Dept. of Radiation Biology	1961 to 1962	(Yes) No	(Yes) No
c. Mathematics and calculations basic to the use and measurement of radioactivity	Wayne State Univ. Health Physics-Radiation Control	1962 - present	(Yes) No	(Yes) No
d. Biological effects of radiation	Wayne State Univ. Health Physics-Radiation Control	1962 - present	(Yes) No	(Yes) No

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience)

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
^3H ^{131}I ^{14}C ^{32}P ^{60}Co Tele-therapy	10 mCi 10 mCi 10 mCi 10 mCi 700 Curies	Wayne State University, Dept of Radiation Biology	1961-1962	Radiation Biology Research
^{125}I - ^{90}Sr	Various multicurie and milli-curie amounts	Wayne State University, Health Physics-Radiation Control	1962 to present	Health Physics related activities

WAYNE STATE UNIVERSITY
Health Physics-Radiation Control
Form H.P. - 10(a)

INSTRUMENT CALIBRATION

Instrument _____

Mfgr. _____ Model No. _____ Serial No. _____

Owner _____

Calibration Source ¹³⁷Cs Tech/Ops Model 773 Activity _____ Assay Date _____

Calibrate at two points on each scale such that one point is in each half of the scale and the two points are separated by 35-60% of full scale.
Source calibration accuracy is $\pm 3\%$ traceable to N.B.S.

SCALE	SELECTION SETTING	DISTANCE (cm) **	TRUE MR/HR (CALCULATED)	CALIBRATION MR/HR	$\Delta\%$

COMMENTS: **Calibration attenuators of .25, .10 and combinations thereof were utilized to calibrate sequential points with reference to the initial calibration distance for each scale as noted above.

Calibration Certificate issued: YES _____ NO _____

CALIBRATED BY _____ DATE _____ INSPECTED BY _____ DATE _____

SURVEY METER CALIBRATION

(ION CHAMBER)

Form H.P. - 10(b)

te _____ Manufacture _____ Model _____ Serial No. _____
 lib. Source _____ Srce Calib. (S.C.) _____ mr/hr @ 1 meter Calib. Energy _____ KEV
 mperature _____ °C Pressure _____ mm Hg Air Density Correction Factor (A.D.C.) _____
 (Use A.D.C. Table)
 ergy Correction Factor (E.C.F.) _____ Other Correction Factor (O.C.F.) _____
 tal Correction Factor (T.C.F.) = A.D.C. x O.C.F. ÷ E.C.F. = _____
 rrected Source Calibration = S.C. @ 1 meter ÷ T.C.F. = _____ mr/hr @ 1 meter

PRE-CALIBRATION CHECK

eck battery potential _____ volts Date batteries were replaced _____
 o Meter Other Checks (Specify) _____
 ation of effective center of chamber volume _____
 librate the meter at two points on each scale with the two points separated by at least
 -50% of full scale.

CALIBRATION					
ile Range	Chamber Source Distance C.M.	Source Exposure mr/hr	Corrected Srce Exp= Srce Exp ÷ T.C.F. mr/hr	Observed Exposure mr/hr	Δ%

Check Source Identification _____

erence Check Source: Range _____ mr/hr Reading _____ mr/hr

ibrated by _____

pected by _____

arks: _____

CONTROL NO. 78854

Attachment #4

Item 12: Film Badges, Dosimeters

Personnel Monitoring

Film badges and TLD devices utilized are supplied and processed by the R. S. Landauer, Jr. & Company. The frequency of film badge evaluation is on a monthly basis. The type of radiation monitored includes beta, gamma, fast and slow neutrons, and x-rays.

Monitoring is conducted to evaluate both whole body and extremity exposure.

Attachment #5

Leak Test Procedures

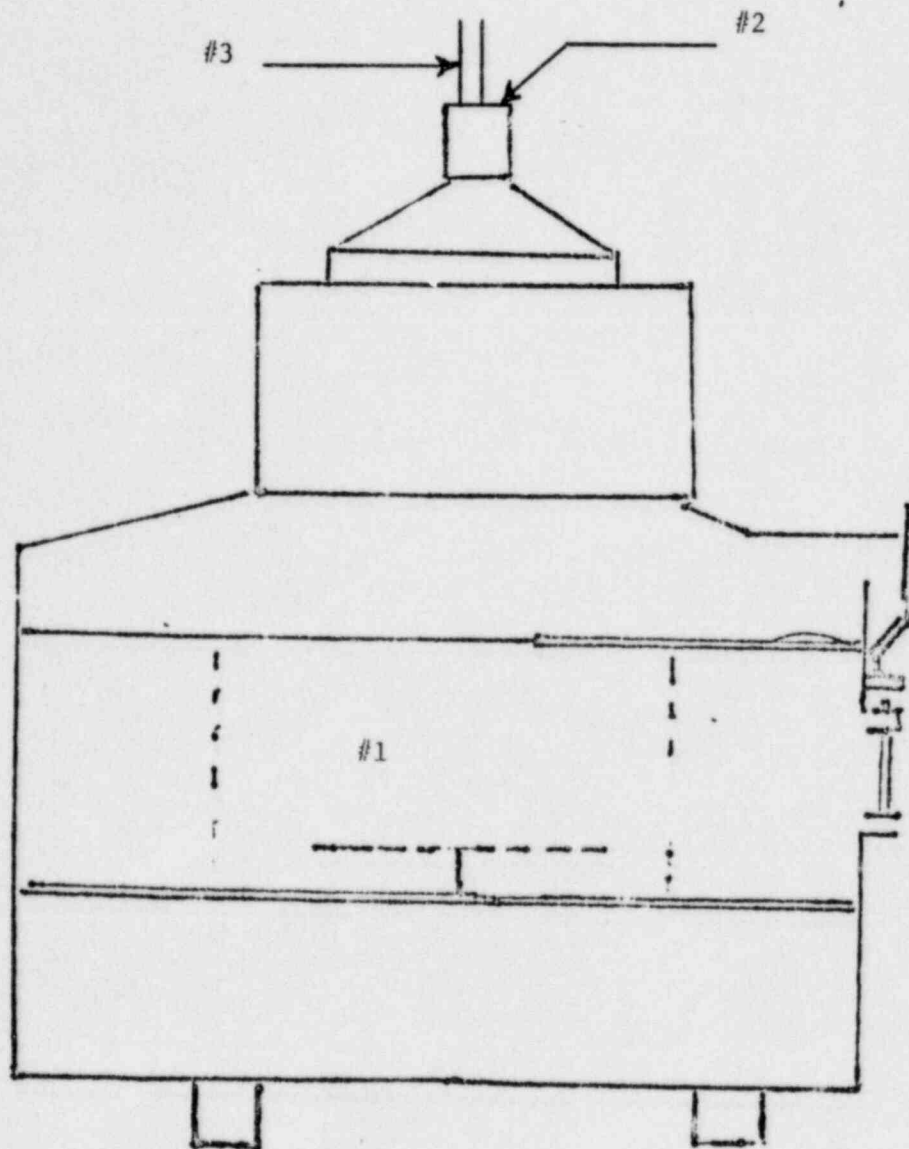
Leak tests are performed regularly at six month intervals by Health Physics-Radiation Control personnel re Richard D. Cummings, Vincent R. Cytacki, James L. Barrows.

METHOD OF LEAK TESTING ⁶⁰Co SEALED SOURCE INCLUDING ANALYSIS OF TEST SAMPLES:

Method of Leak Testing

1. Leak tests are performed regularly at six month intervals by Health Physics-Radiation Control personnel.
2. Wipe tests are made utilizing moistened Q Tips or filter paper at accessible points near the source.
3. The analysis of wipe tests will be conducted utilizing a Searle Analytics Isocap 300 Liquid Scintillation Counter and/or a Tracor Northern TN-1705 1024 Multichannel Analyzer.
4. Each instrument shall have the minimum capability of detecting .005 μ Ci activity of alpha, beta or gamma contamination.
5. Leak test locations are attached on the following sheet.
6. Calculations will be performed and reported in microcuries on the attached Form H.P.-9.

WIPE TEST LOCATIONS
MODEL P-3802-A IRRADIATOR
ROOM 70, CHEMISTRY



Legend

- #1 In Exposure Chamber, on surface of turntable
- #2 Top of irradiator at rod entry port
- #3 Exposed portion of control rod (taken with rod raised to highest position)

LEAK TEST RESULTS
Form H.P. - 9

Calculated by: _____ Date: _____

Attachment #5

Training for Individuals

Training for individuals working in or frequenting the controlled irradiator facility is conducted by either Dr. Lawrence Marnett (Principal Investigator) or by Health Physics-Radiation Control.

Training consists of the following items:

1. Emergency Procedures
2. Control measures
3. Use of Radiation Survey Meter(s)
4. Log-in/Log-out procedures
5. Review of Irradiator Operating Manual
6. Review of Health Physics Manual pertaining to those sections that are applicable (i.e. personnel monitoring, emergency procedures)

Attachment #5

Control Measures
for Irradiator Facility

Only those individuals authorized by Dr. Lawrence Marnett or Health Physics-Radiation Control shall be permitted to enter the irradiator facility (Room 70, Chemistry).

The entrance door to Room 70 shall be kept locked at all times and keys for the facility are limited to Dr. Lawrence Marnett as well as Health Physics-Radiation Control.

Health Physics-Radiation Control personnel, Wayne State University, shall conduct inspections and surveys to assure compliance with all applicable Federal Regulations.

Attachment #5

Emergencies

Emergency telephone numbers are posted on the access door leading to the irradiator.

Also, a copy of the attached emergency procedures are posted in the irradiator room.

VI. EMERGENCIES

Emergencies involving ionizing radiations may arise from a variety of situations; therefore, procedures cannot be established to cover all situations. Life saving procedures shall be the primary concern in any emergency. Following this shall be the protection of all personnel from exposure to ionizing radiation. All other deliberations shall be subsequent to these two major considerations.

A. General Responsibilities

1. Approved User

The Approved User shall:

- a. Report the details of the emergency situation immediately to Health Physics-Radiation Control.
- b. Utilize the emergency telephone numbers which are posted in all approved areas.

2. Health Physics-Radiation Control

In the event of any radiation emergencies occurring within the University complex, Health Physics-Radiation Control shall encompass all responsibilities not designated to the Approved Users. Health Physics-Radiation Control shall have the prime authority for all decisions regarding the handling of said emergencies.

B. Emergency Procedures

1. Accidents Involving the Release of Radioactive Materials

- a. Notify Health Physics-Radiation Control at once.
- b. Notify all persons in the area and isolate those involved. Simultaneously forestall further spillage and initiate isolation and decontamination procedures.
- c. Keep the number of persons dealing with the spill to a minimum.
- d. Monitor all persons involved in the spill and the clean-up operations, paying particular attention to the shoe soles.
- e. Decontamination of personnel and the area involved shall be undertaken only under the direction of Health Physics-Radiation Control.
- f. Occupancy of, or work in, the area shall not be resumed until approved by Health Physics-Radiation Control.

2. Sealed Source Rupture (also, Accidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapor, or Gases)

- a. Notify Health Physics-Radiation Control at once.
- b. Notify all persons to vacate the room immediately.
- c. If time permits, all windows should be closed, fans and air conditioners should be shut off, the door and all other openings should be sealed with wide masking or adhesive tape.
- d. Restrict the movements of potentially contaminated persons to a local zone just outside the spill area until the extent of contamination is ascertained.
- e. If no means are available for monitoring, it should be assumed that all personnel involved are contaminated.
- f. Decontamination of the area will be done only under the direction of Health Physics-Radiation Control.
- g. Occupancy of, or work in, the area shall not be resumed until approved by Health Physics-Radiation Control.

3. Injuries to Personnel Complicated by Radioactive Contamination

- a. All life-saving procedures should be carried out immediately; contact a physician at once if needed.
- b. Report all radiation accidents involving personnel (contaminated wounds, ingestion, inhalation) to Health Physics-Radiation Control as soon as possible.
- c. Wash minor wounds under running water immediately, while spreading the edges of the wound.
- d. Permit no person who has sustained a radiation injury to return to work without the approval of Health Physics-Radiation Control and the attending physician.
- e. A report shall be prepared by the individual injured and the Approved User in charge.

4. Overexposures and/or Suspected Overexposures

- a. Contact Health Physics-Radiation Control at once.
- b. A report shall be prepared by the individual exposed and the Approved User in charge.

5. Emergencies Involving Fires in Approved Areas and Adjacent Locations

- a. Notify, in order: all persons in the area, the Fire Department, Public Safety, and Health Physics-Radiation Control immediately. The caller must relate his name, location, and degree of any radiation hazard involved.

6. Emergencies Involving Motor Vehicles Acting as Carriers of Radioactive Materials

Because of the nature of these kinds of emergencies, the following is a completely self-contained set of instructions which shall be carried in every vehicle used while transporting radioactive substances. These instructions are to be read and followed by all personnel in the event of an emergency.

- a. Immediate notification is to be given by telephoning the following in order: Local Police and/or Highway Patrol, Local Health Authorities, Health Physics-Radiation Control, Wayne State University, at 577-1255. Caller must relate his name, location, what happened, when, where, who was involved, and what has been done to control or confine the radioactive materials. Have someone maintain security over the vehicle and radioactive material and keep by-standers away, while calls are being made.
- b. All traffic should be detoured around the scene of the accident. If this is not possible, vehicles should be moved the shortest distance necessary to clear right of way. If radioactive material is spilled, passage through area should be prevented unless absolutely necessary. If right of way must be cleared before radiological assistance has arrived, the spillage should be washed to shoulders of right of way with minimum dispersal of wash water, or covered with at least four inches of earth or sand.
- c. The nearest Nuclear Regulatory Commission Office should be notified as soon as possible.
- d. If the accident involves wreckage and a person is believed to be alive and entrapped, every possible effort should be made to rescue him.
- e. The area of the accident should be restricted. The public should be kept as far from the scene as is practical. Local authorities should make only necessary entries and investigations in the accident area. No attempt should be made to open or examine contained material. No attempt should be made to clean up any debris or material involved in the accident prior to the arrival of an Emergency Monitoring Team.

- f. Any persons who have had possible contact with the radioactive material should be segregated and confined until they can be examined further. The names and addresses of those involved should be obtained.
- g. The injured should be removed from the area of the accident with as little contact as possible and held at a transfer point. All life-saving measures should be performed promptly, but elective first aid and surgical procedures should be delayed until advice or help can be obtained from a physician familiar with radiation medicine. Except in extreme emergency, patients should not be moved to local hospital or doctor's office before a radiological survey has been made.
- h. If the accident involves fire, attempts to extinguish it should be made from as great a distance as possible. The fire should be treated as one involving toxic chemicals. Suspected material should not be handled until it has been monitored and released by monitoring personnel. Clothing and tools used at the fire should be segregated until they can be checked by emergency monitoring teams.
- i. Eating, drinking, or smoking in the area of the accident should be prohibited. Food or drinking water which may have been in contact with material from the accident should not be used.
- j. Careful attention and consideration should be given in matters of public relations to tactful handling of volunteers and crowds of curious onlookers. Transmission of information to the public by press, radio, and television shall be by the Radiation Safety Officer or designated individual from Health Physics.

7. Lost Sources

- a. Notify Health Physics-Radiation Control at once.
- b. If a source is lost, notify all personnel in the area, monitor each individual and evacuate the area.
- c. Restrict movement of personnel involved to a known and controlled area.
- d. Do not remove any articles, such as waste containers, laundry bags, soiled linens, from the areas involved.

8. Other Emergencies

If any question exists, call Health Physics-Radiation Control at 577-1255.

Attachment #6

The irradiator will be sold to another approved N.R.C. Licensee when a decision is made to dispose the unit.