MATERIALS LICENSE

Amendment No. 01

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 39, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Columbia University	In accordance with letter dated August 21, 1992, 3. License number SNM-1995 is amended in its entirety to read as follows:
2. 289 Engineering Terrace 500 West 120th Street New York, New York 10027	4. Expiration date August 31, 1997
	5. Docket or Reference No. 070-03074; 070-00882

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Uranium enriched in Uranium 235 isotope to less than 99.99% Uranium 235	A. Plated electrodes in two fission counters	A. 2.37 grams
B. Uranium enriched ...ium 235 isotope to less than 99.99% Uranium 235	B. Foils	B. 286 grams
C. Plutonium 239	C. Sealed neutron sources	C. Not to exceed 80 grams per source and 363 grams total
D. Plutonium 239	D. Plated detector sources	D. 0.81 grams
E. Uranium 233	E. Liquid	E. 0.035 grams

9. Authorized use

A. For storage only.
B. For storage only.
C. For use in teaching and training of students; calibration of instruments.
D. For storage only.
E. For storage only. 120175

CONDITIONS

10. Licensed material may be used only at licensee's facilities at Columbia University in the City of New York bounded by 114th Street and 120th Street between Broadway and Amsterdam Avenues, New York, New York, Barnard College bounded by 116th Street and 120th Street between Broadway and Riverside Drive, New York, New York, and Nevis Cyclotron Laboratory, Irvington, New York.

11. A. Licensed material shall be used by, or under the supervision of, individuals designated by the Radiation Safety Committee, David Brenner, Ph.D., Chairman.

B. The Radiation Safety Officer for this license is Neil Wotherspoon, Ph.D.

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MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number
SNM-1995
Docket or Reference number
070-03074
Amendment No. 01

(Continued) CONDITIONS

12. A. Sealed sources and detector cells shall be tested for leakage and/or contamination at intervals not to exceed 6 months or at such other intervals as are specified by the certificate of registration referred to in 10 CFR 32.210, not to exceed 3 years.

B. Notwithstanding Paragraph A of this Condition, sealed sources designed to emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed 3 months.

C. In the absence of a certificate from a transferor indicating that a test has been made within six months prior to the transfer, a sealed source or detector cell received from another person shall not be put into use until tested.

D. Each sealed source fabricated by the licensee shall be inspected and tested for construction defects, leakage, and contamination prior to any use or transfer as a sealed source.

E. Sealed sources and detector cells need not be leak tested if:

(i) they contain only hydrogen 3; or

(ii) they contain only a gas; or

(iii) the half-life of the isotope is 30 days or less; or

(iv) they contain not more than 100 microcuries of beta and/or gamma emitting material or not more than 10 microcuries of alpha emitting material; or

(v) they are not designed to emit alpha particles, are in storage, and are not being used. However, when they are removed from storage for use or transfer to another person, and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source or detector cell shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

F. The test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. Records of leak test results shall be kept in units of microcuries and shall be maintained for inspection by the Commission. If the test reveals the presence of 0.005 microcurie or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission and the source shall be removed from service and decontaminated, repaired, or disposed of in accordance with Commission regulations. The report shall be filed within 5 days of the date the leak test result is known with the U.S. Nuclear Regulatory Commission, Region I, ATTN: Chief, Nuclear Materials Safety Branch, 475 Allendale Road, King of Prussia, Pennsylvania 19406. The report shall specify the source involved, the test results, and corrective action taken.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number: SNM-1995
Docket or Reference number: 070-03074
Amendment No. 01

(12. continued) CONDITIONS

G. The licensee is authorized to collect leak test samples for analysis by the licensee. Alternatively, tests for leakage and/or contamination may be performed by persons specifically licensed by the Commission or an Agreement State to perform such services.

13. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders or detector cells by the licensee.

14. The licensee shall conduct a physical inventory every 6 months to account for all sources and/or devices received and possessed under the license. Records of inventories shall be maintained for 5 years from the date of each inventory.

15. The licensee is exempted from the requirements of 10 CFR 70.24.

16. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated November 6, 1991
B. Letter dated June 30, 1992
C. Letter dated August 21, 1992

For the U.S. Nuclear Regulatory Commission

Date NOV 24 1992

By Original Signed By:
Elizabeth Ullrich
Nuclear Materials Safety Branch
Region I
King of Prussia, Pennsylvania 19406

NOV 24 1992

License No. SNM-1995
Docket No. 070-03074
Control No. 117138

Columbia University
ATTN: Neil Wotherspoon, Ph.D.
Radiation Safety Officer
289 Engineering Terrace
500 West 120th Street
New York, New York 10027

Dear Dr. Wotherspoon:

Please find enclosed an amendment to your NRC Material License.

Please review the enclosed document carefully and be sure that you understand all conditions. If there are any errors or questions, please notify the Region I Material Licensing Section, (215) 337-5093, so that we can provide appropriate corrections and answers.

Please be advised that you must conduct your program involving licensed radioactive materials in accordance with the conditions of your NRC license, representations made in your license application, and NRC regulations. In particular, please note the items in the enclosed, "Requirements for Materials Licensees."

Since serious consequences to employees and the public can result from failure to comply with NRC requirements, the NRC expects licensees to pay meticulous attention to detail and to achieve the high standard of compliance which the NRC expects of its licensees.

You will be periodically inspected by NRC. A fee may be charged for inspections in accordance with 10 CFR Part 170. Failure to conduct your program safely and in accordance with NRC regulations, license conditions, and representations made in your license application and supplemental correspondence with NRC will result in prompt and vigorous enforcement action against you. This could include issuance of a notice of violation, or in case of serious violations, an imposition of a civil penalty or an order suspending, modifying or revoking your license as specified in the General Policy and Procedures for NRC Enforcement Actions, 10 CFR Part 2, Appendix C.

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We wish you success in operating a safe and effective licensed program.

Sincerely,

Original Signed By:
Elizabeth Ullrich

for John D. Kinneman, Chief
Research, Development and
Decommissioning Section
Division of Radiation Safety
and Safeguards

Enclosures:
1. Amendment No. 01
2. Requirements for Materials Licensees

DRSS:RI
Weidner/cmm
11/18/92

for DRSS:RI
Kinneman
11/24/92

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Columbia University in the City of New York | New York, N.Y. 10027

ENVIRONMENTAL HEALTH AND SAFETY

744 S.W. Mudd
500 West 120th Street

August 21, 1992

070-03074
SNM-1995

Ms. Sherri Arredondo
US Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

Dear Ms. Arredondo:

This is to inform you that effective August 31, 1992, Dr. Leon Lidofsky will no longer Chair the Radiation Safety Committee. His successor will be Dr. David Brenner. His curriculum vitae is enclosed for your review.

We are, therefore, requesting the appropriate amendment to our license be made.

If your have any questions regarding this matter, please feel free to contact me at 212 854-8749.

Sincerely,

Neil Wotherspoon

Neil Wotherspoon
Radiation Safety Officer

RECEIVED BY LFDCB
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cc: L. Greenholtz
P. Carter

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Curriculum Vitae

DAVID JONATHAN BRENNER

Date of Birth: 9 June 1953

Place of Birth: Liverpool, England

Nationality: British

Status: Permanent Resident of U.S.A.

Education: 1963-1970 Merchant Taylors' School
Crosby, Liverpool, England.

Examinations passed:

GCE A-levels: Mathematics (grade A), Physics(A)
Chemistry (A), General Studies (A)

GCE S-level: Physics (distinction)

1971-1974 Oxford University, St. Edmund Hall
reading Physics and Philosophy

Awarded Carter Physics Prize, 1974.

Degrees obtained: B.A., M.A. (II-1)

1975-1976 Medical College of St. Bartholomews Hospital,
University of London.

Degree obtained: M.Sc. in Radiation Physics
(Distinction)

1976-1979 University of Surrey, Physics Department
Degree obtained: Ph.D
Thesis Topic: Pion Interactions with Light Nuclei
and Applications to Radiotherapy.

APPOINTMENTS

1992- Associate Professor, Department of Radiation Oncology, College of Physicians & Surgeons, Columbia University

1986-92 Assistant Professor, Department of Radiation Oncology, College of Physicians & Surgeons, Columbia University

1983-86 Associate Research Scientist, Radiological Research Laboratory, College of Physicians & Surgeons, Columbia University

1981-83 Staff Member, Los Alamos National Laboratory

1979-81 Postdoctoral Fellow, Los Alamos Scientific Laboratory.

AWARDS

Winner, 1992, NCRP Moseley Prize.

Winner, 1991 Radiation Research Society Annual Research Award

P.I. of American Cancer Society Research Grant "On the Problem of High vs Low Dose Rate for Cervical Carcinoma", 1991-1994.

P.I. of NIH grant "Radon, Bronchial Morphometry and Occupational Health", 1991-1993.

P.I. of NCI New Investigator Research Grant 1985-1989: "Early Effects of Radiation-Induced Radicals"

Oxford University Carter Physics Prize, 1974.

MEMBERSHIPS and COMMITTEES

Associate Editor, International Journal of Radiation Biology.

Consultant, ICRP/ICRU Committee on the Quality Factor, 1984-

Member, IAEA Advisory Group on Nuclear and Atomic Data for Radiotherapy and Radiobiology (1985)

Consultant, Los Alamos National Laboratory, 1987-

Member, NCI Site Review Committees, University of Rochester, 1983, University of Wisconsin, 1990; Memorial Sloan-Kettering, 1991.

Member, Radiation Research Society Membership Committee, Awards Committee

Member of Program Committees for 34th and 36th Annual Meetings of Radiation Research Society, 1986, 1988.

Member of Program Committee for 9th International Congress of Radiation Research, Toronto, 1991.

Member of Program Committee for World Space Congress, 1992.

COLUMBIA UNIVERSITY ACTIVITIES

Teaching

Teacher of undergraduate course C1450 Radiation and Life -- Columbia University Biology Department, 24 lectures, annually. (jointly with H. Lieberman).

Teacher of graduate course P9321, Current Perspectives on the biological Effects of Radiation -- Columbia University School of Public Health, 24 hours, annually (jointly with M. Zaider).

Lecturer in Radiobiology for Residents in Radiation Oncology (Columbia-Presbyterian Medical Center).

Lecturer in core graduate course P6300 Environmental Sciencss -- Columbia University School of Public Health.

Lecturer in graduate course P8308 Molecular Toxicology -- Columbia University School of Public Health.

Lecturer in graduate course P8312 Systemic Toxicology -- Columbia University School of Public Health.

Academic advisor to A. Ong, doctoral student in the School of Public Health.

Other teaching

Course Faculty for Annual UCSF (University of California, San Francisco) Radiation Oncology Course: Approaches to Radiation Oncology, Biology and Physics.

Teacher of Radiation Biology for Residents in Radiation Oncology (St. Barnabas Hospital, New Jersey)

Teacher of course Scattering Theory, Surrey University, 1978-1979

Columbia University Committees

Member, Columbia University Senate, 1985-1987.

Member, Senate Libraries and Computing Committee, 1985-1987.

Member, Columbia University Comprehensive Cancer Center Computer Committee.

Co-Chair, Howard Hughes Medical Institute Computing Advisory Committee.

Selected Invited Conference Talks

Workshop on the Interface Between Radiation Chemistry and Radiation Physics (Argonne, 1982)
"Analysis Techniques and Results of Monte-Carlo Simulation of Proton and Electron Tracks"

31st Radiation Research Society Annual Meeting (San Antonio, 1983)
"Looking Inside the Black Box: Monte-Carlo Transport Codes"

International Symposium on Science With Soft X Rays (Brookhaven, 1983)
"Soft X rays revisited"

Workshop on Electronic and Ionic Collision Cross Sections Needed in the Modelling of Radiation Interactions with Matter (Argonne, 1983)
"The Transport of Low-Energy Electrons in Water and Some Physico-Chemical Implications"

IAEA Advisory Meeting on Nuclear and Atomic Data for Radiotherapy and Related Radiobiology (Rijswijk, 1985)
"Cross Sections for Neutron Interactions with Carbon and Oxygen above 14 MeV"

Gordon Conference on Radiation Chemistry (New Hampshire, 1986)
"Stochastic Effects in early Radiation Chemistry"

35th Radiation Research Society Annual Meeting (Atlanta, 1987)
"Hard Facts from Soft X rays"

International Symposium on X-ray Microscopy (Brookhaven, 1988)
"The Use of Soft X rays to Probe Mechanisms of Radiobiological Science"

NATO Advanced Research Workshop: Early Effects of Radiation on DNA (San Miniato, Italy, 1990)
"Links Between Track Structure, Radiochemical Species and Cell Survival"

38th Radiation Research Society Annual Meeting (New Orleans, 1990)
"Death Under the Floorboards? An Overview of the Radon Problem"

Second International Brachytherapy and Remote Afterloading Symposium (St. Louis, 1990)
"The Application of Radiobiological Principles to Brachytherapy"

Ninth American Statistical Association Conference on Radiation and Health (Colorado, 1990)
"Modifying factors in Biological Response: Radiation Quality and Dose Rate"

Ninth International Congress on Radiation Research (Toronto, 1991)
"Biological Effects of Highly-Fractionated Effects of Protons in the South-Atlantic Anomaly"

World Space Congress (Washington DC, 1992)
"Radiations in Space"

BOOK

"Radon, Risk and Remedy", D. J. Brenner (W. H. Freeman, New York, 1989).

PEER-REVIEWED PAPERS

1. Brenner, D. J. and Smith, F. A. Dose and LET Distributions due to Neutrons and Photons Emitted from Stopped Negative Pions. Phys. Med. Biol. 22, 451-465 (1977).

2. Brenner, D. J. and Reading, D. H. A Method for Measuring Neutron Spectra in a Stopping Pion Field, Nucl. Instr. Meth. 153, 137-144 (1978).

3. Jackson, D. F. and Brenner, D. J. Nuclear Interactions for Medical Purposes, Prog. Part. Nucl. Phys. 5, 143-204 (1981).

4. Brenner, D. J. Monte Carlo Self-Shielding Corrections for Use with Neutron Spectrum Unfolding Codes, Nucl. Sci. Eng. 78, 175-177 (1981).

5. Zaider, M., Dicello, J. F., Brenner, D. J., Takai, M., Raju, M. R. and Howard, J. Microdosimetry of Range-Modulated Beams of Heavy Ions I. Determination of the Yield of Projectile Fragments from Microdosimetric Spectra for Neon Beams. Radiat. Res. 87, 511-520 (1981).

6. Brenner, D. J., Dicello, J. F. and Zaider, M. An Interpretation of Some Biological Results Obtained in Range-Modulated Negative Pion Beams, Int. J. Radiat. Oncol. Biol. Phys. 8, 121-126 (1982).

7. Brenner, D. J. Calculation of Ionization Distributions in a Tissue-Equivalent Cloud Chamber Gas Mixture. Radiat. Res. 89, 194-202 (1982).

8. Zaider, M., Brenner, D. J., Hanson, K. and Minerbo, G. N. An algorithm for determining the proximity distribution from dose-averaged lineal energies. Radiat. Res. 91, 95-103 (1982).

9. Zaider, M., Brenner, D. J. and Wilson, W. E. The application of track calculations to radiobiology. I. Monte Carlo simulation of proton tracks. Radiat. Res. 95, 231-247 (1983).

10. Atari, N., Malik, S. R., Brenner, D. J., Hilko, R. and Bradbury, J. N. A Lyoluminescent tissue-equivalent dosemeter for pion therapy beams. Phys. Med. Biol. 28, 493-502 (1983).

11. Brenner, D. J. and Zaider, M. Soft x-rays as a tool to investigate radiation-sensitive sites in mammalian cells. Proc. SPIE 47, 172-179 (1983).

12. Goodhead, D. T. and Brenner, D. J. Estimation of a single physical property of low LET radiations which correlates with their biological effect. Phys. Med. Biol. 28, 485-492 (1983).

13. Subramanian, T. S. , Romero, J. L. , Brady, F. P. , Watson, J. W. , Fitzgerald, D. H. , Garrett, R. , Needham, G. A. , Ullman, J. L. . Zanelli, C. I. , Brenner, D. J. and Prael, R. E. Double differential inclusive hydrogen and helium spectra from neutron induced reactions on carbon at 27.4, 39.7, and 60.7 MeV. Phys. Rev. C28, 521 (1983).

14. Brenner, D. J. and Zaider, M. The application of track calculations to radiobiology.-II. Calculations of microdosimetric quantities. Radiat. Res. 98, 14-25 (1984).

15. Zaider, M. and Brenner, D. J. The application of track calculations to radiobiology.--III. Analysis of the molecular beam experiment results. Radiat. Res. 100, 213-221 (1984).

16. Zaider, M. and Brenner, D. J. On the stochastic treatment of fast chemical reactions. Radiat. Res. 100, 245-256 (1984).

17. Brenner, D. J. and Prael, R. E. The C(n,n')3α Cross-Section up to 60 MeV. Nucl. Sci. Eng. 88, 97-101 (1984).

18. Brenner, D. J. Neutron kerma values above 15 MeV calculated with a nuclear model applicable to light nuclei. Phys. Med. Biol., 29, 437-441 (1984).

19. Brenner, D. J. and Zaider, M. A computationally convenient parameterisation of experimental angular distributions of low energy electrons elastically scattered off water vapour. Phys. Med. Biol., 29, 443-447 (1984).

20. Zaider, M. and Brenner, D. J. Comments on 'V79 Survival following simultaneous or sequential irradiation by 15-MeV neutrons and Co photons' by Higgins et al. [Radiat. Res. 95, 45-56 (1983)]. Radiat. Res. 99, 438-441 (1984).

21. Zaider, M. and Brenner, D. J. Modification of the theory of dual radiation action for attenuated fields.--I. Basic formalism. Radiat. Res. 99, 484-491 (1984)

22. Brenner, D. J. and Zaider, M. Modification of the theory of dual radiation action for attenuated fields.--II. Appplication to the analysis of soft x-ray results. Radiat. Res. 99, 492-501 (1984).

23. Zaider, M. and Brenner, D. J. On the Microdosimetric Definition of Quality Factors. Radiat. Res. 103, 302-316 (1985).

24. Brenner, D. J. and Zaider, M. Stochastic and Deterministic Treatments of the Time Decay of Species Created by Heavy-Charged Particle Interactions. Radiat. Prot. Dosimetry 13, 127-131 (1985)

25. Hoshi, M., Goodhead, D. T., Brenner, D. J., Bance, D. A., Chmielewski, J. J., Paciotti, M. A. and Bradbury, J. N. Dosimetry Comparison and Characterisation of an Al K Ultrasoft x-ray Beam from an MRC Cold-cathode Source. Phys. Med. Biol., 30, 1029-1041 (1985)

26. Zaider, M. and Brenner, D. J. Evaluation of a Specific Quality Function for Mutation Induction in Human Fibroblasts. Rad. Prot. Dosim., 15, 79-82 (1986).

27. Subramanian, T. S. , Romero, J. L. , Brady, F. P. , Watson, J. W. , Fitzgerald, D. H. , Garrett, R. , Needham, G. A. , Ullman, J. L. , Zanelli, C. I. , Brenner, D. J. and Prael, R. E. Double Differential Inclusive Hydrogen and Helium Spectra from Neutron-Induced Reactions at 27.4, 39.7, and 60.7 MeV II. Oxygen and Nitrogen. Phys. Rev. C 34, 1580-1586 (1986)

28. Brenner, D. J., Zaider, M., Coyne, J. J., Menzel, H. G. and Prael, R. E. The Evaluation of Non-Elastic Neutron Cross-Sections on Carbon above 14 MeV. Nucl. Sci. Eng. 95, 311-315 (1987)

29. Brenner, D. J., Bird, R. P., Zaider, M., Goldhagen, P., Kliauga, P. J. and Rossi, H. H. Inactivation of Synchronized Mammalian Cells with Low-Energy X rays-- Results and Significance. Radiat. Res. 110, 413-427 (1987)

30. Brenner, D. J., Geard, C. R., Zaider, M. and Georgsson, M. A. Cell Survival and Plating Efficiency. Radiat. Res. 111, 572-576 (1987)

31. Brenner, D. J. Concerning the Nature of the Initial Damage Required for the Production of Radiation-Induced Exchange Aberrations. Int. J. Radiat. Biol. 52, 805-809 (1987)

32. Miller, R. C., Brenner, D. J., Geard, C. R., Komatsu, K., Marino, S. A., and Hall, E. J. Oncogenic Transformation by Fractionated Doses of Neutrons. Radiat. Res. 114, 589-598 (1988)

33. Brenner, D. J. On the Probability of Interaction Between Elementary Radiation-Induced Chromosomal Injuries. Rad. Environ. Biophys. 27, 189-199 (1988)

34. Brenner, D. J. Stochastic Calculations of the Fast Decay of the Hydrated Electron in the Presence of Scavengers -- Tests of Model Consistency. Rad. Phys. Chem. 32, 157-162 (1988)

35. Zaider, M., Brenner, D. J., Hall, E. J. and Kliauga, P. J. The link between physics and biology. Am. J. Clin. Oncol. 11, 212-219 (1988).

36. Hei, T. K., Chen, D. J., Brenner, D. J. and Hall, E. J. Mutation induction by charged particles of defined LET. Carcinogenesis 9, 1233-1236 (1988).

37. Brenner, D. J. Precision and Accuracy in Radiotherapy. Radiotherapy & Oncology 14 159-162 (1989)

38. Miller, R. C. , Geard, C. R., Brenner, D. J., Komatsu, K., Marino, S. A. and Hall, E. J. Neutron-energy-dependent oncogenic transformation of C_3H 10T1/2 cells. Radiat. Res. 117, 114-127 (1989)

39. Brenner, D. J., Comments on "It is Time to Reopen the Question of Thresholds in Radiation Exposure Responses" by J. R. Totter [Rad. Res. 114, 1-2 (1988)]. Radiat. Res. 116, 172-174, (1988).

40. Brenner, D. J. and Prael, R. E. Calculated differential secondary-particle production cross sections after non-elastic neutron interactions with carbon and oxygen between 10 and 60 MeV. Atomic Data Nucl. Data Tables 41, 71-130 (1989)

41. Brenner, D. J., Appropriate uses of the proposed ICRU-40 quality factor, Q(y). J. Radiol. Prot. 9, 51-52 (1989)

42. Worgul, B. V., Merriam, G. R., Jr., Medvedovsky, C. and Brenner, D. J., Accelerated heavy particles and the lens: III. Cataract enhancement by dose fractionation. Rad. Res. 118 93-100 (1989).

43. Brenner, D. J. and Amols, H. I. Enhanced risk from low-energy screen-film mammography x rays. Brit. J. Radiol. 62, 910-914 (1989).

44. Brenner, D. J. The effectiveness of single alpha particles. In Low Dose Radiation: Biological Bases of Risk Assessment (Ed. Lancashire, J.) pp 477-480, Taylor and Francis, London and New York (1989)

45. Hoshi, M. Yokoru, K., Sawada, S., Shizuma, K., Iwatani, K., Hasai, H., Oka, T., Morishima, H. and Brenner, D. J. Europium-152 activity induced by Hiroshima atomic-bomb neutrons: Comparison with the ^{32}P, ^{60}Co and ^{152}Eu activities in Dosimetry System 1986 (DS86). Health Physics 57, 831-837 (1989).

46. Brenner, D. J., Geard, C. R. and Hall, E. J. Mossbauer Cancer Therapy Doubts. Nature 339, 185-186 (1989).

47. Hall, E. J., Brenner, D. J., Hei, T. R. and Miller, R. C. The Microdosimetric link between oncogenic transformation data with neutrons and with charged particles. Radiat. Prot. Dosim., 31, 275-278 (1990).

48. Marchese M.J., Goldhagen, P.E., Zaider, M., Brenner, D.J. and Hall, E. J. The relative biological effectiveness of encapsulated iodine-125 photon radiation in human cells. I. Normal diploid fibroblasts. Int. J. Radiat. Oncol. Biol. Phys. 18, 1407-1413 (1990).

49. Marino, S. A., Harvey, J. R., Brenner, D. J. and Rossi, H. H. Measurements of the distribution of the separations between paired ions after passing through mylar. Radiat. Prot. Dosim., 31, 77-80 (1990).

50. Brenner, D. J. and Quan, H. Confidence Limits for Low Induced Frequencies of Oncogenesis in the Presence of a Background. Int. J. Radiat. Biol., 57, 1031-1046 (1990).

51. Geard, C. R. and Brenner, D. J. Chromosomal changes per cell nucleus per charged particle. Radiat. Prot. Dosim., 31, 285-290 (1990).

52. Brenner, D. J. The microdosimetry of radon daughters and its significance. Radiat. Prot. Dosim., 31, 399-404 (1990).

53. Brenner, D. J. and Hall, E. J., The Inverse Dose-Rate Effect for Oncogenic Transformation by Neutrons and Charged Particles: A Plausible Interpretation Consistent with Published Data. Int. J. Radiat. Biol 58, 745-758 (1990).

54. Miller, R.C., Brenner, D. J., Randers-Pehrson, G., Marino, S.A. and Hall, E. J., The Effects of the Temporal Distribution of Dose on Oncogenic Transformation by Neutrons and Charged Particles of Intermediate LET. Radiat. Res. 124, S62-68 (1990)

55. Brenner, D. J. Track Structure, Lesion Development and Cell Survival. Radiat. Res. 124, S29-37 (1990)

56. Brenner, D. J. and Quan, H. Graphs of Confidence Limits for Binomial Proportions - Pearson and Hartley Revisited. The Statistician 39 391-397 (1990).

57. Brenner, D. J. On the use of distributions of stopping pions as an indicator of the spatial distribution of the high-LET dose in negative pion radiotherapy. Phys. Med. Biol., 35, 1585-1591 (1990).

58. Geard, C.R., Brenner, D. J., Randers-Pehrson, G. and Marino, S.A., Single-Particle Irradiation of Mammalian Cells at the Radiological Research Accelerator Facility: Induction of Chromosomal Changes. Nucl. Instr. Meth. B54, 411-416 (1991).

59. Brenner, D. J. and Hall, E. J., Conditions for the Equivalence of Continuous to Pulsed Low Dose Rate Brachytherapy. Int. J. Radiat. Oncol. Biol. Phys. 20, 181-190 (1991).

60. Brenner, D. J. The Contribution of Neutrons to the Health Effects at Hiroshima. Health Physics 60, 439-442 (1991).

61. Brenner, D. J. and Hall. E. J. Fractionated high dose rate versus low dose rate regimens for intracavitary brachytherapy of the cervix. I. General considerations based on radiobiology. British Journal of Radiology 64, 133-141 (1991).

62. Brenner, D. J., Martel, M. K. and Hall, E. J. Fractionated Regimes for stereotactic radiotherapy of recurrent tumors in the brain. International Journal of Radiation Oncology, Biology, Physics 21, 819-824 (1991).

63. Hall, E. J., Miller, R. C. and Brenner, D. J. Neoplastic transformation and the inverse dose rate effect for neutrons. Radiat. Res. 127, S75-80 (1991).

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BETWEEN:

LICENSE FEE MANAGEMENT BRANCH, ARM
AND
REGIONAL LICENSING SECTIONS

(FOR LFMS USE)
INFORMATION FROM LTS

PROGRAM CODE: 22120
STATUS CODE: 0
FEE CATEGORY: _____
EXP. DATE: 19970831
FEE COMMENTS: 170.11(a)(4)
DECOM FIN ASSUR REQD: N

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
APPLICANT/LICENSEE: COLUMBIA UNIVERSITY
RECEIVED DATE: 920910
DOCKET NO: 7003074
CONTROL NO.: 117138
LICENSE NO.: SNM-1995
ACTION TYPE: AMENDMENT

2. FEE ATTACHED
AMOUNT: $ 0.00
CHECK NO.: ---

3. COMMENTS

SIGNED Rebecca J. Brown
DATE 9/16/92

B. LICENSE FEE MANAGEMENT BRANCH (CHECK WHEN MILESTONE IS ENTERED √)

FEE EXEMPT
170.11(a)(4)

1. FEE CATEGORY AND AMOUNT: EXID

2. CORRECT FEE PAID. APPLICATION MAY BE PROCESSED FOR:
AMENDMENT √
RENEWAL ---
LICENSE ---

3. OTHER ---

SIGNED B Brown
DATE 10/21/92