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Thomas P. Billings
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April 6, 2001

Clerk, U.S. Court of Federal Claims
717 Madison Place, NW
Washington, DC 20005

Attention: Addison Berry

Re: William H. Sweet, M.D. v. United States of America

Dear Ms. Berry:

Thank you for speaking with me today. As we discussed, I enclose an original and two copies of the following:

1. Motion Of William H. Sweet, M.D. To Substitute Brief; and

2. Plaintiff William H. Sweet's Memorandum of Law in Opposition to Defendant's Motion To Dismiss, In Part And For Partial Summary Judgment.

Also enclosed is the following:

3. Suggestion of Death.

Thank you for your attention to this matter.

Very truly yours,

Thomas P. Billings

TPB/am
Enclosures

cc: Counsel of record

BLIND P.S. TO COUNSEL:

In making yesterday's filing, I omitted to serve the NRC (Cordes/Nordlinger) and the DOE (Jiran). I am remedying this by enclosing copies with this package. My apologies for the omission.

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UNITED STATES COURT OF FEDERAL CLAIMS

WILLIAM H. SWEET, M.D., Plaintiff, v. UNITED STATES OF AMERICA, Defendant.	)	Case No. 00-274C

SUGGESTION OF DEATH

Plaintiff hereby suggests upon the record that William H. Sweet, M.D., the named plaintiff in this action, died on January 22, 2001. A petition for probate has been filed in the Norfolk (Massachusetts) Probate Court. No executor(s) have yet been appointed. When this occurs, the undersigned will file a motion to have the executor(s) substituted as the party plaintiff in this action.

By his attorneys,

Thomas P. Billings (BBO #043040)
SALLY & FITCH
225 Franklin Street
Boston, Massachusetts 02110
(617) 542-5542

Dated: April 6, 2001

CERTIFICATE OF SERVICE

I, Thomas P. Billings, hereby certify that on this date I served the within document by causing a copy to be delivered by first class mail, postage prepaid, to all counsel of record.

Thomas P. Billings

Dated: April 6, 2001

UNITED STATES COURT OF FEDERAL CLAIMS

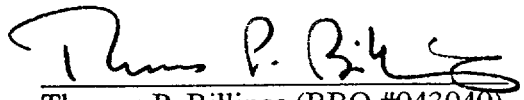
WILLIAM H. SWEET, M.D., Plaintiff, v. UNITED STATES OF AMERICA, Defendant.	Case No. 00-274C (Judge Firestone)

MOTION OF WILLIAM H. SWEET, M.D. TO SUBSTITUTE BRIEF

Plaintiff William H. Sweet, M.D. hereby moves, with the apologies of his undersigned counsel, that the accompanying Memorandum of Law in Opposition to Defendant's Motion To Dosmiss, In Part And For Partial Summary Judgment be substituted for the Memorandum Of Law In Opposition To Defendant's Motion For Summary Judgment filed on April 6, 2001.

Counsel respectfully states that he overlooked the provisions of Rule 83.1 and therefore filed a brief which was nonconforming, in that it lacked a Table of Contents and Table of Authorities and was bound in the corner rather than the left margin. The brief accompanying this Motion cures these defects.

By his attorneys,



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Dated: April 6, 2001

CERTIFICATE OF SERVICE

I, Thomas P. Billings, hereby certify that on this date I served the within document by causing a copy to be delivered by first class mail, postage prepaid, to all counsel of record.

Thomas P. Billings

Dated: April 6, 2001

Nos. 00-274C, 00-292C
(Judge Firestone)

IN THE UNITED STATES COURT OF FEDERAL CLAIMS

WILLIAM H. SWEET, M.D.,

and

MASSACHUSETTS INSTITUTE OF TECHNOLOGY,

Plaintiffs,

v.

THE UNITED STATES,

Defendant.

PLAINTIFF WILLIAM H. SWEET, M.D.'s MEMORANDUM OF LAW IN OPPOSITION TO DEFENDANT'S MOTION TO DISMISS, IN PART AND FOR PARTIAL SUMMARY JUDGMENT

Thomas P. Billings (BBO #043040)
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225 Franklin Street
Boston, Massachusetts 02110
(617) 542-5542

Counsel for Plaintiff William H. Sweet, M.D.

Dated: April 5, 2001

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The following definitions are compared among the Price-Anderson Act as originally enacted; the Price-Anderson Act in its present form; the Atomic Energy Commission regulations in effect in 1961; and Indemnity Agreement E-39:

- "Person Indemnified"
- "Public Liability"
- "Nuclear Incident"

STATEMENT OF THE CASE

As more fully set forth in the Proposed Findings of Fact submitted by the parties, this is a case brought against the United States under an indemnity agreement.

Dr. Sweet, the Massachusetts Institute of Technology ("MIT"), and others were sued by the survivors of four plaintiffs who underwent boron neutron capture therapy ("BNCT") for brain cancer in the 1950s and 1960s. Two were treated at MIT's nuclear reactor, and two at a reactor at Brookhaven National Laboratory on Long Island. The case is Heinrich v. Sweet, United States District Court for the District of Massachusetts Civil Action No. 97-CV-12134-WGY.

After a lengthy trial in the fall of 1999, the *Heinrich* jury returned verdicts of negligence and wrongful death against Dr. Sweet and co-defendant Massachusetts General Hospital "MGH"), but in favor of defendant MIT. Presently, there is a judgment totalling $830,000 against Dr. Sweet and MGH. The judgment is on appeal to the United States Court of Appeals for the First Circuit.

In this proceeding, Dr. Sweet seeks indemnity against the judgment, and reimbursement of his defense costs. MIT, in a consolidated case, seeks its defense costs.

The indemnity agreement in question is titled Indemnity Agreement E-39, between the Atomic Energy Commission and MIT.[1] It was consummated pursuant to the Price-Anderson Act of 1957, amending the Atomic Energy Act of 1946. Price-Anderson constructed a system of "financial responsibility" (private insurance or self-insurance) and government indemnity, accomplished by means of agreements such as Indemnity Agreement E-39. The indemnity

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[1]This agreement provides indemnity as to the two *Heinrich* plaintiffs (Heinrich and Sienkewicz) who recovered judgments against Dr. Sweet. The other two (Mayne and Van Dyke) were treated at Brookhaven, not MIT, and so do not fall under Indemnity Agreement No. E-39. There is believed to be a similar agreement(s) covering the Brookhaven treatments, however. Dr. Sweet will seek the Brookhaven agreement(s) through discovery following the Court's decision on summary judgment and the lifting of the stay on discovery imposed by the Court's October 26, 2000 order, and asks the Court, in the menatime, to assume that such an agreement exists.

agreement is broad, as Congress intended it be, and on its face, it covers Dr. Sweet's liability for the judgment and for defense costs in the *Heinrich* case.

The government, attempting to look behind the plain language of the indemnity agreement, has presented three issues in its motion for summary judgment:

1. Whether the United States is obligated to indemnify Dr. Sweet under Indemnity Agreement E-39. This boils down to a single question of statutory and contract construction: whether BNCT constituted a "nuclear incident" as that term is used in the Price-Anderson Act and the indemnity agreement.

2. Whether the United States' indemnity obligation extends to defense costs. Originally (and at the time of the nuclear incident in this case), it clearly did; however, the United States contends that a 1975 amendment to Price-Anderson removed defense costs from the indemnity obligation.

3. Whether Dr. Sweet's request for declaratory relief, ancillary to the monetary relief he principally seeks, in within the jurisdiction of this Court.

Dr. Sweet submits that all three issues must be answered in the affirmative; in fact, none is even a close question.

ARGUMENT

I. Under The Plain Language Of The Price-Anderson Act, The AEC's Regulations, And Indemnity Agreement E-39, The United States Must Indemnify Dr. Sweet.

Whether the United States is obligated to indemnify Dr. Sweet depends on the meaning of three terms: "**person indemnified**," "**public liability**," and — most especially — "**nuclear incident**." This is because under the Price-Anderson Act and Indemnity Agreement E-39, Dr. Sweet is a "person indemnified" if he is liable for "public liability," which is "legal liability arising out of a nuclear incident."

The three terms are defined in the Price-Anderson Act, in the AEC regulations prescribing the form of indemnity agreement to be executed to carry out the Price-Anderson mandate, and in the indemnity agreement between the AEC and MIT. The definitions differ in minor respects as between the statute, on the one hand, and the regulations and the agreement on the other,[2] and they have evolved over time,[3] but not in ways that are material to this case. Insofar as the terms apply to this case:

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[2]Because the regulations prescribe *verbatim* the form of indemnity agreement, the definitions in Indemnity Agreement E-39 are identical with those in the regulations. In general, these differ from the statutory definitions in matters of drafting convenience only; the meanings are the same. An exception is the provision in the regulations and the agreement that certain related occurrences can constitute a single "nuclear incident." This has ramifications for the upper limit of liability (which is not a factor in this case) and for the $250,000 deductible (which will be). See also Part III, below.

[3]For example: although Price-Anderson originally applied only to "nuclear incidents" occurring on U.S. soil, it has been amended to cover certain extraterritorial incidents. The AEC's form agreement, designed for domestic reactors, naturally omits this language. Additionally, the regulations and the agreement have language which the statute does not, defining when a series of "occurrences" constitutes a single "nuclear incident." In all respects affecting the issues presently before the Court, however, the three sets of definitions are identical.

> "Person indemnified" means the licensee[4] and any other person who may be liable for public liability. (42 U.S.C. §2014(t))
>
> "Public liability" means any legal liability arising out of a nuclear incident [with exceptions not here relevant]. (42 U.S.C. §2014(w))
>
> "Nuclear incident" means any occurrence or series of occurrences[5] at the location[6] or in the course of transportation causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material. (42 U.S.C. §2014(q))

The Appendix to this Memorandum sets out the full definitions of the three terms in each of these sources, with citations.

A. Dr. Sweet Is A "Person Indemnified."

The United States has "assum[ed] but not conced[ed]" that Dr. Sweet is a "person indemnified." Defendant's Brief at 26. Plainly, he is — provided his liability in the *Heinrich* case arises out of a "nuclear incident." The statute and the agreement give "person indemnified" the broadest possible meaning, and there can be no doubt that Congress meant what it said: the indemnity obligation embraces the potential liability of licensees, contractors, subcontractors, and complete strangers to contract — literally, "any ... person who may be liable for public liability."

This expansive approach reflected a considered judgment by Congress that indemnity should not be restricted to licensees, or even to persons in contractual privity with licensees, but

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[4]In the statute, "the person with whom an indemnity agreement is executed."

[5]The statute omits the words "or series of occurrences" and adds limitations on the extraterritorial application of the Act.

[6]Originally, the statute restricted "nuclear incidents" to occurrences "within the United States." Amendments have given the statute limited extraterritorial effect but do not, of course, affect this case.

should extend to "any person who might be found liable, regardless of the contractual relation."[7] Dr. Sweet plainly comes under this very broad umbrella.

B. The *Heinrich* Case And Judgment Constitute "Public Liability."

Nor should there be any dispute concerning the first prong of the definition of "public liability"; Dr. Sweet unquestionably has incurred a "legal liability" in the *Heinrich* case.

C. The *Heinrich* Case Arose Out Of A "Nuclear Incident."

The only real dispute — and the one to which the United States devotes its energy — is whether the use of the MIT research reactor in connection with the 1961 BNCT trials constitutes a "nuclear incident." It does, if it was an "occurrence or series of occurrences at the location ...

---

[7]The Senate Report on the original enactment explained:

> The definition of "person indemnified" means more than just the person with whom the indemnity agreement is executed. ... The phrase "person indemnified" also covers any other person who may be liable. For a licensee for a reactor, this would mean in addition to the licensee that the indemnification extends to such persons as the subcontractors of the licensee ... However, it is not meant to be limited solely to those who may be found liable due to their contractual relationship with the licensee. ... The proposed AEC limitation to those in privity with the licensee was reconsidered by the Commission, and the Commission decided to accept the premise of the original bills which would make the person indemnified *any person who might be found liable, regardless of the contractual relation.*

S. Rep. 85-296, 1957 U.S. CODE CONG. & ADMIN. NEWS 1803, 1818 (emphasis supplied). This approach effectuates the overarching purpose of the Price-Anderson scheme: protecting the public.

> The indemnification contracts are to protect the public by means of providing funds to the licensee and to any of those who might be found liable with him for the payment of public damages.

Id. at 1810.

causing bodily injury, sickness, disease, or death ... arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material."

Congress made the definition of "nuclear incident" intentionally broad, because it believed this was the best way to protect the public. In the words of the Senate Report accompanying the original enactment:

> The definition of "nuclear incident" is designed to protect the public against *any* form of damage arising from the special dangerous properties of the materials used in the atomic energy program. It includes *any* damage which may result from any hazardous property of source, special nuclear, or byproduct material. It includes bodily injury or death, loss of or damage to property, and loss of use of property. While most incidents will be happenings which will be pinpointed in time — such as a runaway reactor or an inadvertent exposure to radiation — it was not thought that an incident would necessarily have to occur within any relatively short period of time. For instance, the steady exposure to radiation, such as from an undetected leak of radio-active materials from a storage bin, could constitute an incident.

S. Rep. 85-296, 1957 U.S. CODE CONG. & ADMIN. NEWS 1803, 1817 (emphasis supplied).

1. The *Heinrich* Case Arose From A "Nuclear Incident" Within The Plain Language Of The Statute, The Regulations, And The Agreement.

The events giving rise to the *Heinrich* case unquestionably meet the broad statutory and contractual definition of a "nuclear incident." The plaintiffs allege, in the plainest possible terms, that their decedents suffered "bodily injury, sickness, disease [and] death" as a direct result of exposure to neutron beams generated by the MIT and Brookhaven reactors. Specifically, all four plaintiffs are alleged to have grown ill and died following, and because of, their BNCT. This was the finding on autopsy for Heinrich and Sienkewicz (the other two apparently were not autopsied). More importantly, it was also the jury's finding.

Moreover, the neutron beam and the resulting effects (both therapeutic and destructive) of BNCT were produced by the "radioactive properties of the radioactive material."[8] As the Affidavit of John Bernard (submitted by MIT) explains:

> At MIT, the neutron beam used to initiate boron neutron capture therapy was generated from a radioactive isotope of uranium, Uranium-235, licensed to the MIT reactor by the Nuclear Regulatory Commission. (¶32)
>
> The neutron beam produced by the MIT reactor is caused by the radioactive properties of the nuclear source material that the MIT reactor is licensed to hold and use originally by the Atomic Energy Commission and subsequently by the Nuclear regulatory Commission. (¶40)

Thus, although the *Heinrich* complaint is lengthy (79 pages) and multifarious (eleven counts asserting different legal theories), its thrust is simple: the plaintiffs allege that their decedents were fatally injured by nuclear radiation generated by the uranium core ("radioactive material") of the MIT and Brookhaven reactors. Their claims thus fit squarely within the statutory and contractal definition of a "nuclear incident."

The Court's analysis could — and should — stop there. When construing a statute, the Court's

> analysis begins with "the language of the statute." Where the statutory language provides a clear answer, the analysis ends there as well.... Ordinarily, an unambiguous statute, or one in which the plain meaning is clear from the words themselves, is conclusive. ... The plain meaning rule "tells a court what not to look at — legislative debates, committee reports, newspaper commentary.... The meaning of the law is what the words say it is."

---

[8]"Radioactive material" is also a defined term, though one whose meaning, refreshingly, does not appear to be in dispute in this case. "'The radioactive material' means source, special nuclear, and byproduct material which (1) is used or to be used in, or is irradiated or to be irradiated by, the nuclear reactor or reactors subject to the license or licenses designated in the Attachment hereto, or (2) is produced as a result of the operation of said reactor(s)." The enriched uranium 235 which makes up the reactor core and generated the neutron beam used in BNCT is "special nuclear material." See 42 U.S.C. §2014(aa); License R-37 (Exhibit A to the Sweet Complaint), ¶1; Affidavit of John Bernard, ¶¶32, 40.

Sullivan v. United States, 46 Fed. Cl. 480, 486 (2000) (citations omitted) (Horne, J.).

Applying unambiguous contract language is a similarly straightforward task:

> The court's examination begins with the plain language of the contract. If the contract language is unambiguous, the court's inquiry is at an end, and the plain language of the contract is controlling.

Input/Output Technology, Inc. v. United States, 44 Fed. Cl. 65, 70 (1999) (Firestone, J.), citing Textron Defense Systems v. United States, 143 F.3d 1465, 1469 (Fed. Cir. 1998) ("We ... first consider the language of the contract. Because the language is sufficiently clear, our inquiry ends there as well."). "The ordinary meaning of the language in contractual documents governs, and not a party's subjective but unexpressed intent. ... Moreover, the mere fact that the parties disagree upon the meaning of a contract does not render the language ambiguous." PCL Const. Services, Inc. v. United States, 47 Fed. Cl. 745, 785 (2000) (Horn, J.). "If a contract term is unambiguous, the court cannot assign it another meaning, no matter how reasonable it may appear." Cray Research, Inc. v. United States, 41 Fed. Cl. 427, 435 (1998) (Weinstein, J.).

The language chosen by Congress and used in the indemnity agreement — "*any* occurrence or series of occurrences ..." — admits of no exception. If Congress had intended to limit indemnity to cases involving reactor malfunction, or to except injuries resulting from medical applications or other purposeful uses of a reactor, as the United States now suggests, it could readily have done so. It did not, and as discussed below, there is no reason to think that Congress meant anything other than what it said.

2. The BNCT Trials Were Not Just "Any Type Of Incident Somehow Related To The Operations Of A Licensed Facility."

The United States observes that "under the plain terms of the agreement, Price-Anderson indemnification requires that the liability in question arise out of or result from a "*nuclear* incident, and not simply any type of incident somehow related to the operations of a licensed facility." (Defendant's Brief at 27-28; emphasis in original)

It would be hard to argue with this statement, as far as it goes. If the *Heinrich* plaintiffs had alleged a slip and fall on a wet floor at a nuclear plant, or a forklift accident, or a ceiling collapse, or an assault by a plant worker, or some other injury not caused by the "radioactive, toxic, explosive, or other hazardous properties of the radioactive material," there plainly would be no nuclear incident, and the statute and the agreement would not apply.

The United States takes a fanciful view of the facts, however, when it goes on to assert that "[t]he fact that a portion of the challenged conduct took place at a licensed nuclear facility was entirely inconsequential to the merits of the claims presented in *Heinrich*." (Defendant's Brief, p. 29) Quite the contrary: all four plaintiffs' decedents received boron neutron capture therapy, which requires a slow neutron beam, which can *only* be generated by a nuclear reactor. None of the plaintiffs, in other words, found him/herself at a nuclear reactor by chance. And just as the reactor was integral to the treatment they were to receive, it is alleged to have been the cause of the injuries they suffered. It would be hard to envision a clearer case of alleged "bodily injury, sickness, disease, or death ... arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material" — in short, a nuclear incident.

3. The Price-Anderson Compensatory Scheme Is Not Limited To "Unexpected Nuclear Reactor Failures."

The United States, citing committee reports pertaining to Price-Anderson and various of its amendments, argues that Congress's paramount concern was the potentially vast liability that could

result from "unexpected nuclear reactor failures, malfunctions, and the like." Because the reactors in this case performed as intended ("without incident"), the government argues, there was no "nuclear incident" and therefore no indemnity.

To be sure, the legislative history of Price-Anderson and its amendments refers frequently to the possibility of a catastrophic reactor accident, and it was the possibility of such an event, and the fact that the potential damages exceeded the private insurance then available, which prompted Congress to pass the Act. By attempting to confine Price-Anderson indemnity to such incidents, however, the United States does violence to the statutory language, the most fundamental tenets of statutory construction, and a substantial body of caselaw applying Price-Anderson to minor incidents, single-plaintiff cases, and cases where reactors performed as the operators intended and as federal regulations required.

a. Statutory Language.

The language of the statute is discussed above. Here, it bears repeating only that a "nuclear incident" occurs *whenever* a person or property is injured by "the radioactive, toxic, explosive, or other hazardous properties of the radioactive material." That is what the statute says, and it nowhere requires that a "nuclear incident" be catastrophic, large, or even unexpected, for there to be indemnity.

Indeed, beginning with the 1966 amendments to Price-Anderson, Congress made special provision for "extraordinary nuclear occurrences," or "ENOs." An ENO is

> any event causing a discharge or dispersal of source, special nuclear, or byproduct material from its intended place of confinement in amounts offsite, or causing radiation levels offsite, which the Nuclear Regulatory Commission or the Secretary of Energy, as appropriate, determines to be substantial, and which the Nuclear Regulatory Commission or the Secretary of Energy, as appropriate, determines has resulted or probably will result in substantial damages to persons offsite or to property offsite.

42 U.S.C. §2014(j). The 1966 amendments provided federal jurisdiction and removal power for cases arising out of ENOs. See In re TMI Litigation Consolidated Cases II, 940 F.2d 832, 853 n.18 (3d Cir. 1991), *cert. denied,* 503 U.S. 906 (1992). The 1988 amendments — passed in response to the Three Mile Island incident — further extended federal jurisdiction and removal to *all* nuclear incidents. See id.

Even now, the Act continues to distinguish between ENOs, in which certain defenses are waived, 42 U.S.C. §2210(n), and all other "nuclear incidents." Significantly, however, while Congress has thus made special provision for the sort of large-scale nuclear catastrophe that members feared might overtax the available insurance pool, it has never *limited* Price-Anderson indemnity to such disasters. To the contrary: "The term 'nuclear incident' means *any* occurrence, *including an extraordinary nuclear occurrence,*" which meets the definitional requirement of injury or damage caused by "the radioactive, toxic, explosive, or other hazardous properties of the radioactive material." 42 U.S.C. §2014(q) (emphasis supplied).

Had Congress wanted, as the United States now suggests, to limit Price-Anderson indemnity to catastrophic reactor accidents, it certainly had the tools and the vocabulary to accomplish this. It did not do so, however, and neither should the Court.

b. Statutory Construction.

As noted above, the statutory definition of "nuclear incident" is clear on its face, and clearly covers the present case. "The meaning of the law is what the words say it is." Sullivan v. United States, 46 Fed. Cl. at 486. Committee reports and other legislative history are not needed to clarify what is already clear. Id.

The importance of *reading the statute* is well illustrated by the United States' argument that because Committee reports express concern about catastrophic nuclear accidents, the much broader statutory and contract definition of "nuclear incident" must not mean what it says. This is a bit like

an insurance company claiming that because a person purchased a homeowner's insurance policy primarily to cover a disaster (such as a fire), it must not cover minor claims (such as the theft of a camera), even if the policy says otherwise. The obvious, and correct, reply is — don't speculate as to what was in the insured's mind; read the insurance policy!

Of course, the words of a statute, *if* they are ambiguous, are to be interpreted in light of the statute's purpose. "But statutory prohibitions often go beyond the principal evil to cover reasonably comparable evils, and it is ultimately the provisions of our laws rather than the principal concerns of our legislators by which we are governed." Oncale v. Sundowner Offshore Services, Inc., 523 U.S. 75, 79 (1998). Where the language chosen for the statute is broad, it is not the Court's function "to restrict the unqualified language of a statute to the particular evil that Congress was trying to remedy — even assuming that it is possible to identify that evil from something other than the text of the statute itself." Brogan v. United States, 522 U.S. 398, 403 (1998).

The bottom line is that Congress legislates by passing statutes, not by writing committee reports. While the possibility of a catastrophic accident may have been what animated the industry and members of Congress to do something, *what* it did was to pass comprehensive legislation whose meaning is plain, and which reaches the facts of this case. There simply is no reason not to do what the statute says.

c. Cases

Finally, any suggestion that only Chernobyl- or Three Mile Island-type accidents can be "nuclear incidents" under Price-Anderson is belied by the numerous reported cases under the Act. A few of these cases, in fact, *did* arise out of the Three Mile Island accident.[9] Many others, however, have applied Price-Anderson to far more contained instances of environmental

[9]See the reported decisions at In re TMI, 89 F.3d 1106 (3d Cir. 1996), *cert. denied,* 519 U.S. 1077 (1997); In re TMI, 67 F.3d 1119 (3d Cir. 1995); and In re TMI Litigation Consolidated Cases II, *supra*, and the various decisions cited therein.

contamination[10] or occupational exposure.[11] In none of these cases (Three Mile Island excepted) was there a "major nuclear accident" (Defendant's Brief at 33), and none except TMI posed the threat of "extraordinarily extensive and, thus, uninsurable damage to the public" (Id. at 32) — yet Price-Anderson applied to all.

Nor must a "nuclear incident" be an accident at all. For example, several cases have held that a complaint by a nuclear plant worker, alleging occupational exposure to radiation, is governed by Price-Anderson because it involves a nuclear incident, *even where the plaintiff does not allege a reactor accident, or even that his exposure exceeded the maximum levels permitted by federal regulations.* E.g., Roberts v. Florida Power & Light Co., 146 F.3d 1305 (11th Cir. 1998), *cert. denied,* 525 U.S. 1139 (1999); O'Conner v. Commonwealth Edison Co., 13 F.3d 1090, 1094-

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[10]E.g., El Paso Natural Gas Co. v. Neztsosie, 526 U.S. 473 (1999) (suit by two members of Navajo tribe alleging injuries from drinking water in open pit uranium mines); Nieman v. NLO, Inc., 108 F.3d 1546 (6th Cir. 1997) (landowner sued former operator of uranium processing facility for trespass resulting from alleged leak of uranium onto his property); Lujan v. Regents of Univ. of California, 69 F.3d 1511 (10th Cir. 1995) (single-plaintiff case alleging injuries and wrongful death from exposure to toxic and radioactive substances in air, soil and water near Los Alamos National Laboratory); Carey v. Kerr-McGee Chemical Corp., 60 F. Supp. 2d 800 (N.D. Ill. 1999) (action by landowners alleging improper disposal of radioactive thorium tailings).

[11]E.g., Kennedy v. Southern Cal. Edison Co., 219 F.3d 988 (10th Cir. 2000) (estate of nuclear power plant worker claimed his leukemia resulted from occupational exposure to radiation at plant); Acuna v. Brown & Root, Inc., 200 F.3d 335 (5th Cir.), *cert. denied,* 120 S. Ct. 2658 (2000) (consolidated cases involving occupational exposure of uranium workers); Corcoran v. New York Power Auth., 202 F.3d 530 (2d Cir. 1999), *cert. denied,* 529 U.S. 1109 (2000) (similar to Kennedy); Roberts v. Florida Power & Light Co., 146 F.3d 1305 (11th Cir. 1998) (similar to Kennedy); O'Conner v. Commonwealth Edison Co., 13 F.3d 1090 (7th Cir.), *cert. denied,* 512 U.S. 1222 (1994) (nuclear power plant worker alleged radiation-induced cataracts); Building & Construction Dept., AFL-CIO v. Rockwell Int'l Corp., 7 F.3d 1487 (10th Cir. 1993) (claim for medical monitoring by employees of nuclear weapons plant who alleged occupational exposure to radioactive materials); McLandrich v. Southern Cal. Edison Co., 942 F. Supp. 457 (S.D. Cal. 1996) (similar to Kennedy); Smith v. General Electric Co., 938 F. Supp. 70 (D. Mass. 1996) (similar to Kennedy); Sawyer v. Commonwealth Edison Co., 847 F.Supp. 96 (N.D. Ill. 1994) (similar to Kennedy); Coley v. Commonwealth Edison Co., 768 F. Supp. 625 (N.D. Ill. 1991) (birth defects allegedly caused by occupational exposure of their fathers, workers in a nuclear power plant, to ionizing radiation).

97, 1105 (7th Cir.), *cert. denied*, 512 U.S. 1222 (1994); Coley v. Commonwealth Edison Co., 768 F. Supp. 625 (N.D. Ill. 1991) (each holding that Price-Anderson conferred jurisdiction on the federal court and preempted contrary state law; because the plants complied with the standard of care supplied by federal regulation, the complaints were dismissed). In each of these cases the "reactor performed *without incident*" (to borrow the United States' pun at page 28 of its brief), yet a "nuclear incident" occurred within the meaning of 42 U.S.C. §2014(q), and Price-Anderson therefore applied.

These holdings do what the United States' brief does not: they follow faithfully the plain language of the statute. In each case, the plaintiff alleged injury, sickness and/or death resulting from the radioactive properties of the nuclear material used in the reactor — in short, a "nuclear incident" as the statute defines the term — and so Price Anderson applied. The *Heinrich* complaint likewise alleges injury, sickness and/or death resulting from the radioactive properties of the nuclear material used in the reactor, and so Price-Anderson applies here as well.

4. The BNCT Trials, And The *Heinrich* Plaintiffs' Alleged Injuries, Constituted An "Occurrence" As That Term Is Used In The Statute And The Agreement.

The United States points to the word "occurrence" in the statute's and the agreement's definitions of "nuclear incident," and argues that this is "a term of art used in the insurance industry to specify an unexpected cause of loss," a synonym of "accident." Defendant's Brief at 30-31. Dr. Sweet's supposed "knowing decision to continue BNCT treatments after their therapeutic value had ended," the government says, was not an "accident" or "occurrence," and so could not be a "nuclear incident."

The first difficulty with this argument is that it ignores the clear record that Congress intended that Price-Anderson indemnity should extend even to intentional acts. In fact, Congress

expressly *rejected* a proposal by the AEC that intentional conduct be excepted from the indemnity provisions. The Senate Report explained:

> The suggestion which was contained in the original draft legislation of the [Atomic Energy] Commission that willful damages be excluded was not accepted since the damage to the public is the same, whether caused by any means — willful or nonwillful.

S. Rep. 85-296, 1957 U.S. CODE CONG. & ADMIN. NEWS at 1819. As with the definition of "person indemnified" (see pp. 4-5, *supra)*, then, Congress opted for a very broad definition of "nuclear incident" — extending even to intentional acts — so that an injured person's right to compensation would not be dependent on happenstance beyond that person's control. See Gilberg v. Stepan Co., 24 F. Supp. 2d 325, 335 (D.N.J. 1998) ("Price-Anderson guaranteed that compensation would be available to the public regardless of fault ....").

The government's "occurrence" argument is also wrong as a matter of simple historical fact. When Congress passed Price-Anderson in 1957, the word "occurrence" was not used in the insurance industry's standard form of liability policy; instead, the triggering event for insurance coverage under that form was an "accident." In Price-Anderson, however, Congress eschewed the term "accident" in favor of the term "occurrence." In ordinary English usage, an "occurrence" is something that happens, irrespective of cause; "*occurrence* has a meaning much broader than *accident.*"[12] 16 E. Holmes, Holmes' Appleton on Insurance 2d §117.4 at 304 (2000).

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[12]A noted commentator on insurance law elaborates:

> To the average person as well as the legal/judicial mind, the word *occurrence* has a meaning much broader than *accident.* As these words are generally understood, *accident* means something that must have come about or happened in a *certain* way, while *occurrence* means something that happened or came about in *any* way. Therefore, accident is a special type of occurrence, but occurrence goes beyond such special confines and, while including accident, occurrence encompasses many other situations as well. In summary, the liability policy's definition that *occurrence means an accident* usually means that occurrence is much broader than the

Congress's choice of words thus suited exactly its avowed intention to indemnify incidents "caused by any means — willful or nonwillful." (S. Rep. 85-296, *supra.*)

In 1966 — *nine years* after the passage of Price-Anderson — the insurance industry modified the standard form liability policy, so that henceforth the triggering event was an "occurrence." R. Russ, et al., Couch on Insurance 3rd §126.25 at 126-48 to 126-49 (3d ed. 1999). This form also crafted the definition of "occurrence" that the United States quotes at p. 31 of its brief ("an accident, including a continuous or repeated exposure to conditions, which results in bodily injury or property damages neither expected nor intended from the standpoint of the insured").

Needless to say, the government's use of an industry term which (a) is narrower than ordinary English usage, and (b) came into being nine years after the statute being construed, is illogical, unhistorical, and completely unhelpful in determining what Congress meant in 1957.

Finally, the government's intimation that the unsuccessful BNCT trials were no "accident"[13] mistakes what was actually determined in the *Heinrich* case. The jury found for the plaintiffs on counts for negligence and for wrongful death (and found for the defendants on a claim for failure to obtain informed consent). Defendant's Appendix, pp. 80-82. In Massachusetts law, negligence is a failure to use due care. Toubiana v. Priestly, 402 Mass. 84, 88, 520 N.E.2d 1307 (1988). The jury's finding of negligence, moreover, precludes any suggestion that Dr. Sweet's liability is the result of an intentional act: under Massachusetts law, "intentional conduct cannot be

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word accident.

16 E. Holmes, Holmes' Appleton on Insurance 2d §117.4 at 304 (2000) (italics in original).

[13]Even the United States does not seem to be fully committed to this argument. It variously refers to the *Heinrich* case as involving "[Dr. Sweet's] own medical malpractice," "medical malpractice claims related to the practice of nuclear medicine," "general malpractice claims related to the practice of nuclear medicine," and "misjudgments or malpractice in the medical uses of radiological materials." Defendant's Brief, pp. 29, 31-32, 34.

negligent conduct and negligent conduct cannot be intentional conduct." Waters v. Blackshear, 412 Mass. 589, 590, 591 N.E.2d 184 (1992).

Nor did the jury's award of punitive damages imply a finding that Dr. Sweet acted intentionally. Punitive damages may be awarded on a finding of gross negligence or, alternatively, of malicious, willful, wanton or reckless conduct. Id. "[G]ross negligence is something less than ... willful, wanton and reckless conduct," Roiko v. Aijala, 293 Mass. 149, 155, 199 N.E. 484 (1936), and even wanton and reckless conduct is not the same as intentional conduct. Preferred Mut. Ins. Co. v. Gamache, 42 Mass. App. Ct. 194, 202, 675 N.E.2d 438, *aff'd*, 426 Mass. 93, 686 N.E.2d 989 (1997) (construing the term "occurrence" and exclusion for "intentional act[s]" in insurance policy).

Even under the government's erroneous understanding of the statutory term "occurrence," therefore, there would be indemnity. "The definition of occurrence is generally met where the insured's conduct was reckless and not intentional," or where liability arises from the unintended consequences of an intentional act. 16 E. Holmes, Holmes' Appleton on Insurance 2d §117.4 at 311 (2000).

> It is only the intended injuries flowing from an intentional act that are excluded. ... If the consequences consisting of damages from intentional acts are not intended and are unexpected they are *accidental* within a policy of liability insurance.

Id. at 337, 339 (italics in original); see also the examples at pp. 339-40.

Recognizing, perhaps, that the jury's verdict of negligence creates difficulties for its theory, the United States quotes at pp. 29 of its brief from Judge Young's of MGH's charitable immunity defense. To be sure, certain of the language used ("actual knowledge ... Sweet well knew ... experimentation on dying patients") looks, at first blush, like a finding of intentional misconduct. Review of the decision as a whole, however, reveals that this is *not* what the judge found. He found, as the jury had, that Dr. Sweet was negligent.

> While Dr. Sweet may have informed the Plaintiffs that the treatment was risky and uncertain, he failed to disclose that performing the experiments on human beings was *negligent.* This is what the jury found, and it is consistent.
>
> In short, there has to be evidence that Mass General had control or the right of control over Sweet's actual conduct which is alleged to be *negligent*, namely the radiation experiments.
>
> Thus, this Court rules that the evidence presented was more than sufficient for Mass General to be held liable for the *negligent* actions of Sweet.
>
> [H]is conduct with respect to the patients involved here was, as the jury found, *negligent.*
>
> Vicarious *negligence* on the part of Mass General ....
>
> [I]nformed consent has never operated as a defense to a claim of *negligence* in Massachusetts.
>
> [A] patient does not assume the risk that the physician, as Sweet did here, would administer the boron-neutron doses *negligently*, well after any hoped-for therapeutic value was manifestly absent. In short, the jury findings of *negligence* and informed consent are neither inconsistent nor mutually exclusive.
>
> Mass. General was thus *negligent* along with Sweet ....
>
> Here, by *negligently* persisting with boron injections ....
>
> The *negligent* harm done by Sweet ....

Heinrich v. Sweet, 118 F. Supp. 2d 73, 83, 84, 85, 90, 91, 92 (D. Mass. 2000) (emphasis supplied). The findings of negligence, by the jury and by Judge Young, are absolutely antithetical to the United States' suggestion of intent. Waters v. Blackshear, *supra; accord,* Sabatinelli v. Butler, 363 Mass. 565, 567, 296 N.E.2d 190 (1973) ("Under the law of the Commonwealth, the difference between intentional and negligent conduct is a difference in kind and not in degree. If conduct is negligent it cannot also be intentional."); Gamache, 42 Mass. App. Ct. at 202 ("Negligent conduct cannot be intentional conduct.").

5. Price-Anderson Does Not Exempt "Nuclear Medicine."

As the government interprets the legislative history, "it was Congress' intent to provide indemnification for uninsurable risks related to unexpected nuclear reactor failures, malfunctions, and the like, rather than general medical malpractice claims related to the practice of nuclear medicine." (Defendant's Brief at 33)

Nowhere in Price-Anderson, its legislative history, or the regulations and indemnity agreements implementing it is there any exemption for medical uses of reactors. As noted above at pages 14-15, moreover, the legislative history confirms that even injuries that result from purposeful uses of reactors ("willful damages") — not just "unexpected nuclear reactor failures, malfunctions, and the like" — are indemnified.[14]

This is not, of course, to say that most malpractice claims involving nuclear medicine[15] will be indemnified under Price-Anderson. Clearly, most are not, because medical procedures rarely take place on the premises of a licensed nuclear reactor ("at the location") as the regulations and indemnity agreement require, and they do not involve "radioactive material" as the statute defines the term. Such claims are therefore outside Price-Anderson, not because of some tacit "nuclear medicine" exemption, but because they fall outside the *express* definition of a "nuclear incident." See Gilberg v. Stepan Co., 24 F. Supp. 2d 325, 340-46 (D.N.J. 1998), discussed further below (application of Price-Anderson does not require that the release of radioactivity be accidental, but does require "an 'event ... [at] "the location" or "the contract location" as defined in [an] indemnity

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[14]The Roberts, O'Conner and Coley cases cited at pages 13-14, above, in which Price-Anderson was applied to cases of occupational exposure within the permissible limits for radiation exposure, further put the lie to the government's argument that Price-Anderson only covers "unexpected nuclear reactor failures, malfunctions, and the like."

[15]Examples of nuclear medicine would be x-rays and other radiologic imaging techniques, conventional radiation therapy for cancer, radionuclide scans, and the like. These are administered in a doctor's office, hospital, or medical center, not at a reactor.

agreement entered into pursuant to section 2210'"; nuclear medicine practiced in a hospital setting therefore is not subject to Price-Anderson).

The BNCT treatments that form the basis of the *Heinrich* case, on the other hand, *did* take place at a reactor ("location") covered by an indemnity agreement, and it resulted (the plaintiffs alleged, and the jury found) in injury, sickness and death caused by the radioactive properties of the nuclear material used in the reactor.

What is more: medical research and therapy, and BNCT in particular, were squarely within the parties' contemplation when the AEC issued the license for MIT-R, and when the parties entered into Indemnity Agreement E-39. In fact, research into medical applications of nuclear energy was an integral part of the post-war atomic energy program.

- Sections 31, 104(a) and 104(c) of the Atomic Energy Act, 42 U.S.C. §§2051, 2134(a) and 2134(c), explicitly authorized the Atomic Energy Commission (now the Nuclear Regulatory Commission) to issue licenses "for utilization facilities for use in medical therapy" and for research and development activities in various fields, including "medical, biological, agricultural, health, or military purposes."
- MIT's application materials to the AEC disclosed prominently the intended use of its reactor for medical research, particularly BNCT. (Sweet Request for Supplemental Findings, No. 1)
- The AEC, in the licensing process, received reports and made findings which establish its awareness that the MIT reactor was to be used for "neutron beam therapy experiments" and would include a "medical therapy radiation facility." (Id., nos. 2-6)

- The license issued by the AEC for the MIT reactor recited that "[e]xperimental facilities are provided for use in ... neutron beam therapy experiments" — apparently an explicit reference to BNCT. (Id., No. 7)
- MITR-I was specially constructed with a surgical operating room on the premises, directly beneath the reactor. (*Heinrich* Complaint, ¶56)

Use of the MIT reactor for experimental medicine, in other words, was not something the parties forgot about, or overlooked, or failed to anticipate, when they entered into the indemnity agreement. Given this fact and the facially broad definition of "nuclear incident," the failure to exempt medical applications explicitly in the indemnity agreement is striking — unless, of course, the intent was to make the agreement's coverage as broad as the record shows Congress intended it should be.

6. Caselaw Supports Application Of Price-Anderson To Medical Use Of A Reactor.

The Court has the benefit of several reported decisions that bear on Price-Anderson's application to medical uses of a reactor, beginning with Judge Young's thoughtful opinion in the private-party litigation that brings the parties to this Court. Heinrich v. Sweet, 62 F. Supp. 2d 282 (D. Mass. 1999) (referred to by the judge and counsel in that case as "Heinrich III").[16]

While the issue of indemnity *per se* was not before Judge Young, he *did* have to decide what law applied to the case of each plaintiff, two of whom received their BNCT in Massachusetts and two in New York. Because the case was originally filed in the Eastern District of New York, and because the transfer from that court to the District of Massachusetts was permissive under 28 U.S.C. §1404(b) rather than mandatory under §1406(a), Judge Young initially held that the law of

[16]There ultimately were five reported decision, all under the name of Heinrich v. Sweet. They are: 44 F. Supp. 2d 408 (1999); 49 F. Supp. 2d 27 (1999); 62 F. Supp. 2d 282 (1999); 83 F. Supp. 2d 214 (2000); and 118 F. Supp. 2d 73 (2000).

the transferor forum (New York) applied to all claims, and ordered further briefing on New York limitations rules. Heinrich v. Sweet, 49 F. Supp. 2d 27, 33-36 (D. Mass. 1999) (Heinrich II).

Judge Young subsequently reconsidered this holding, however, in light of Price-Anderson's dictate that in a "'public liability action,' ... the substantive rules for decision ... shall be derived from the law of the State in which the nuclear incident occurs, unless such law is inconsistent with the provisions of [42 U.S.C. §2210]." 42 U.S.C. §2014(hh). *If* this was a suit for public liability — i.e., if it arose out of a "nuclear incident" (see 42 U.S.C. §2014(w) and (hh)), then the claims of two plaintiffs — Heinrich and Sienkewicz — were governed by the law of Massachusetts, where they received their BNCT; the other two (Mayne and Van Dyke) were governed by the law of New York, where they received theirs. If the case was *not* covered by Price-Anderson, the usual rules governing choice of law in a transferred action would apply.

To resolve the choice-of-law issue, therefore, Judge Young first had to determine whether or not Price-Anderson applied to the case. He held that it did, while noting that he was acting on "a preliminary record" and that his ruling was

> intended in no way to bind any subsequent tribunal faced with determining whether the United States in fact must indemnify a judgment rendered against the private defendants. Instead, the Court is simply treating the issue as one of threshold importance: does an indemnification agreement exist between the United States and the various private defendants that presumptively applies to the challenged conduct in this litigation? If so, the Act will apply in this case, regardless of whether or not the indemnification agreement is later interpreted to reach the conduct of the private defendants.
>
> With that proviso in mind, the Court rules that the challenged conduct in the instant litigation (with the exception of the alleged boron injections ...) is subject to an indemnification agreement with the United States.

Heinrich III, 62 F. Supp. 2d at 298.

The district court's ruling, whether or not binding on this Court (see pp. 26-27 below), is at least highly persuasive in that (a) it dealt with the facts of this case on a record which, while

"preliminary," was nonetheless thoroughly developed on the facts that matter, and (b) the court thoughtfully addressed, and rejected, the arguments now asserted by the United States against indemnification. It did so, moreover, in a vigorously adversarial context: the plaintiffs, at that stage of the litigation, were arguing forcefully that Price-Anderson did not apply. In particular, the plaintiffs argued, as the United States does here, "that 'nuclear incident' should only be interpreted to mean an unintended escape or release of nuclear energy." 62 F. Supp. 2d at 297.

In rejecting this argument, Judge Young cited four cases brought by or on behalf of employees or contractors, who alleged occupational exposure to radiation in the course of their work at nuclear power plants. Id., citing Day v. NLO, Inc., 851 F. Supp. 869, 876 (S.D. Ohio 1994) (Price-Anderson applies because "the Plaintiffs' intentional tort and negligence claims both arise from their alleged exposure to dangerous levels of radiation"); Sawyer v. Commonwealth Edison Co., 847 F. Supp. 96, 99-100 (N.D. Ill. 1994) (Act applies to claim for injuries resulting from alleged ongoing occupational exposure); Coley v. Commonwealth Edison Co., 768 F. Supp. 625 (N.D. Ill. 1991) (same); Building and Constr. Trades Dep't v. Rockwell Int'l, 756 F. Supp. 492, 494 (D. Colo. 1991), *aff'd,* 7 F.3d 1487 (10th Cir. 1993) (Act applies to intentional and negligent tort claims related to occupational exposure).

Also persuasive to Judge Young was Gilberg v. Stepan Co., 24 F. Supp. 2d 325 (D.N.J. 1998). There, the plaintiff alleged that his property was contaminated by a chemical plant that processed thorium, a radioactive metal used in the defendant's manufacture of iridescent gas mantles. The Gilberg court held that Price-Anderson did not apply to the facts before it, since the torts alleged did not involve a licensed reactor that was subject to an indemnity agreement with the United States -- the touchstone of Price-Anderson coverage.

> To summarize, Price-Anderson sweeps broadly to include any claim alleging "public liability;" that is, "any legal liability arising out of or resulting from a nuclear incident." [42 U.S.C.] §2014(w). For there to be a nuclear incident, however, there must be an

> "occurrence," and an occurrence under the Act can only be an "event ... [at] 'the location' or 'the contract location' as defined in the applicable ... indemnity agreement, entered into pursuant to section 2210." [42 U.S.C.] §2014(j) & (q). No such agreement covers the Maywood chemical tailings.

24 F. Supp. 2d at 345-46. In the course of a lengthy discussion of Price-Anderson and its implications (procedural and preemptive) for private-party litigation, the Gilberg court considered and rejected the argument that Price-Anderson applies only to the "unintended escape or release of nuclear energy."

> Price-Anderson ... neither requires that a nuclear source be used as intended nor requires that the escape or release of nuclear material be unintended. What Price-Anderson does require is that the escape or release occur in connection with indemnified activity.

Id. at 340. The court reached this conclusion based on the language of the statute, which contains no "unintentionality" requirement, and its legislative history — specifically, the fact that Congress in 1957 explicitly considered and rejected an exclusion for willfully caused releases. Id. at 335 & n. 9, 339-40, 345-46; see pp. 14-15, *supra.*

Both Heinrich III and Gilberg considered and rejected the Price-Anderson analysis of In re Cincinnati Radiation Litigation, 874 F. Supp. 796 (S.D. Ohio 1995), discussed at page 35 of the United States' brief. In Cincinnati, the plaintiffs alleged that cancer patients at Cincinnati General Hospital were exposed, without their knowledge or consent, to high doses of radiation in order to study the likely effects of radiation on military personnel in the event of a nuclear attack. The court rejected the plaintiffs' count asserting an implied cause of action under Price-Anderson, holding that the Act did not apply to the facts of the case. A "nuclear incident," it held, occurs only when there is an "unintended escape or release of nuclear energy." 874 F. Supp. at 832.[17]

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[17]The Cincinnati court was also influenced by Congress's rejection, in 1988, of an amendment that would have extended the Act's indemnity provisions to "persons operating hospital pharmacies of hospital medicine department[s]," in addition to persons operating licensed reactors. Id. at 832 & n.33. This it saw as proof that "Price-Anderson was never intended to

If the Cincinnati court's analysis were correct, the United States' motion in this case would have merit. As Gilberg pointed out, however, the Cincinnati court, in straying from the clear language of the statute, managed to "reach[] the correct result ... for the wrong reasons." The result was correct, not because Price-Anderson excludes intended releases, or nuclear medicine — both the statutory language and the legislative history say otherwise — but because Cincinnati did not involve "indemnified activity," i.e., the use of a licensed reactor that was the subject of an indemnity agreement with the United States. 24 F. Supp. 2d at 340.

Heinrich, however, is the case that Cincinnati was not: a nuclear incident resulting from the medical use of a licensed reactor which had a Price-Anderson indemnity agreement in place.

The government's obfuscatory efforts notwithstanding, this is at bottom a simple case. The statutory and contract definitions of "nuclear incident" are unambiguous, and they reach the facts of the case. There is no evidence that Congress meant to exclude medical or other intended uses of reactors from Price-Anderson indemnity; indeed, there is ample evidence to the contrary. The statute and the agreement mean what they say and say what they mean, and should be given effect.

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create a federal claim for the contained application of nuclear medicine." Id. This, however, is, a red herring, as the Gilberg court recognized. In rejecting the proposal to extend Price-Anderson's financial protection requirements to licenses for radiopharmaceuticals, Congress noted that the NRC already had discretion to subject such licenses to the requirements of the Act, but had not. It directed the agency to reconsider this decision through a negotiated rulemaking proceeding. The NRC did so, and again declined to extend the Act to hospital pharmacies. Nothing in the legislative history, however, suggests that Congress intended to create a *new* exclusion for medical use of licensed, financially-protected reactors — not hospitals — whose licensing scheme already placed them within the Price-Anderson system. Id. See Gilberg at 340.

7. Judge Young's Finding That Price-Anderson Applies To The *Heinrich* Case Is Dispositive Of Whether A Nuclear Incident Occurred, And May Not Be Collaterally Attacked In This Court.

Finally, there is what is actually a threshold matter: Judge Young's decision in Heinrich III may not have settled *every* issue relating to indemnity[18] (as the judge's own disclaimer makes clear), but it *did* settle an important issue: that BNCT, conducted at a licensed nuclear reactor, constitutes a "nuclear incident."

This was a determination which the Price-Anderson scheme assigned to the district court. The 1988 amendments to Price-Anderson created a new species of civil action, arising under federal law and called a "public liability action":

> The term "public liability action," as used in section 2210 of this title, means any suit asserting public liability. A public liability action shall be deemed to be an action arising under section 2210 of this title, and the substantive rules for decision in such action shall be derived from the law of the State in which the nuclear incident involved occurs, unless such law is inconsistent with the provisions of such section.

42 U.S.C. §2014(hh).

Price-Anderson, as amended, thus confers "arising under" jurisdiction on a district court, *and* specifies the law to be applied, in suits "asserting public liability." This means "legal liability *arising out of a nuclear incident.*" (42 U.S.C. §2014(w)) (emphasis supplied). Judge Young needed to decide whether there had been a "nuclear incident" in order to determine the applicable law. He ruled that the *Heinrich* plaintiffs' BNCT constituted a "nuclear incident" subject to the MIT indemnity agreement, and that Price-Anderson therefore applied. Heinrich III, 62 F. Supp. 2d at 297-98.

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[18]For example, Heinrich III left unsettled whether indemnity extends to defense costs.

A district court, of course, has jurisdiction to determine its own subject matter jurisdiction, United States v. United Mine Workers, 330 U.S. 258, 290-92 & n. 57 (1947), and to determine the law applicable in a case before it. By the 1988 amendments, and specifically by making federal jurisdiction and choice of law dependent on whether a case was "a suit asserting public liability" — i.e., asserting "legal liability arising out of a nuclear incident" — Congress committed to the district court the task of determining whether a "nuclear incident" occurred.

The United States was a party to the *Heinrich* case. Under familiar principles of collateral estoppel and res judicata, therefore, it is bound by Judge Young's finding that there was a "nuclear incident" (to which, so far as appears, it made no objection at the time). See Federated Dep't Stores, Inc. v. Moitie, 452 U.S. 394, 398 (1981) ("[a] judgment merely voidable because based upon an erroneous view of the law is not open to collateral attack, but can be corrected only by a direct review and not by bringing another action"). Its assertion before this Court that there was *no* "nuclear incident" is an impermissible collateral attack on the contrary finding in *Heinrich*, and should be rejected for this reason — as well as because it is wrong on the merits.

II. Under The Price-Anderson Act, The United States Is Obligated To Indemnify Dr. Sweet For His Attorneys' Fees And Costs Of Defense.

Even if the *Heinrich* case arises out of a "nuclear incident," the United States argues, Dr. Sweet's attorneys' fees and other costs of defense in the *Heinrich* case are not indemnified because of the tortured history of Price-Anderson on this subject. The applicable subsection is section 170k(1) of the Atomic Energy Act, codified at 42 U.S.C. §2210(k) ("Exemption from financial protection requirement for nonprofit educational institutions"). Presently, the subsection provides:

> The Commission shall agree to indemnify and hold harmless the licensee and all other persons indemnified, as their interests may appear, from public liability in excess of $250,000 arising from nuclear incidents. The aggregate indemnity for all persons indemnified in connection with each nuclear incident shall not

> exceed $500,000,000, including such legal costs of the licensee as are approved by the Commission.

The history of this subsection is as follows:

1. The original 1957 enactment directed the AEC to enter into contracts for indemnity with all reactor licensees, without distinguishing between nonprofits and others. Licensees were to "maintain financial protection" (i.e., private liability insurance) in an amount determined by the AEC. Indemnity agreements were to

> indemnify the persons indemnified against claims above the amount of the financial protection required, in the amount of $500,000,000 including the reasonable costs of investigating and settling claims and defending suits for damage in the aggregate for all persons indemnified in connection with such contract and for each nuclear occurrence.

P.L. 85-256 §4(d), 1957 U.S. CODE CONG. & ADMIN. NEWS 629, 631; see also §4(e).

2. In 1958, Congress added a new subsection (Atomic Energy Act §170k, 42 U.S.C. §2210(k)), in order to exempt universities from the financial protection requirements applicable to for-profits. The pertinent portion, subsection (1), read as follows:

> [T]he Commission shall agree to indemnify and hold harmless the licensee and other persons indemnified, as their interests may appear, from any public liability in excess of $250,000 arising from nuclear incidents. The aggregate indemnity for all persons indemnified in connection with each nuclear incident shall not exceed $500,000,000, *including the reasonable cost of investigating and settling claims and defending suits for damage.*

P.L. 85-743, 72 Stat. 837 (emphasis supplied).

3. In 1975, Congress passed the "Hathaway Amendment" to Price-Anderson. In each reference to costs of defense — including that in section 170k (42 U.S.C. §2210(k)) — the amendment substituted the word "excluding" for the words "including the reasonable." Now, the United States' indemnity obligation was $560,000,000 (an increased ceiling), "*excluding* costs of investigating and settling claims and defending suits for damage." (Emphasis supplied.) The

amendment was silent as to its effective date, or whether it was meant to apply retroactively. P.L. 94-197, 89 Stat. 1111 (1975).

4. In 1988, as discussed above, Congress again amended Price-Anderson extensively. Among many other changes, the amendments affected section 170k

> by striking "excluding cost of investigating and settling claims and defending suits for damage" in paragraph (1) and inserting "including such legal costs of the licensee as are approved by the Commission."

P.L. 100-408, 102 Stat. 1066, section 8. "Legal costs" was elsewhere defined to include the cost of defending public liability actions. Id., section 11(d)(2) (amending 42 U.S.C. §2014(jj)). Finally — and here, according to the government, is the rub — the 1988 amendments (with the exception of those in section 11) were to "become effective on the date of enactment of this Act *and shall be applicable to nuclear incidents occurring on or after such date.*" Id., section 20 (emphasis supplied).

According to the United States, then, defense costs arising out of a 1961 nuclear incident were indemnified until 1975, when Congress took indemnity away. When it restored indemnity in 1988, Congress did so only prospectively, for future nuclear incidents. Therefore, 1990s defense costs arising from a 1961 nuclear incident are not indemnified, even though they would have been had the claim been brought and defended prior to 1975.

The flaw in this argument is the lack of any indication that Congress meant, in 1975, to take away indemnity rights pertaining to nuclear incidents *which had already occurred* (in this case, had occurred more than a decade earlier). The government's position is especially anomalous in view of the fact that Indemnity Agreement E-39 is in substance an "occurrence" policy, a species of

liability insurance covering losses arising from "occurrences" during the policy period.[19] The Agreement provides:

> The Commission agrees to indemnify and hold harmless the licensee and other persons indemnified, as their interests may appear, from the reasonable costs of investigating, settling and defending claims for public liability. (Art. III, ¶3)
>
> The obligations of the Commission under this agreement shall apply only with respect to nuclear incidents occurring during the term of this agreement. (Art. III, ¶5)
>
> Termination of the term of this agreement shall not affect any obligation of the licensee or any obligation of the Commission under this agreement with respect to any nuclear incident occurring under the term of this agreement. (Art. VII)

Amendments to an insurance policy, as a matter of basic contract law, apply prospectively: "The acceptance of an alteration or modification of the original contract, to be effective, must precede loss." R. Russ, et al., Couch on Insurance 3rd §25.8 at 25-9 (3d ed. 1999). This rule protects the expectations of the parties, and particularly the insured's reliance on coverage of a particular type and in a particular amount, against *post hoc* alterations, particularly in case of a loss which may already have occurred, but may not yet be known.

There is absolutely no indication that Congress, when it enacted the Hathaway Amendment in 1975, intended to depart from this well-settled principle of insurance law, or from the equally well-settled rule that statutes, like insurance policies, normally operate prospectively. As this Court has said, "it is well settled that statutes are presumed to operate prospectively unless express language in the statute provides otherwise." Ford v. United States, 33 Fed. Cl. 560, 565 (1995) (Robinson, J.), citing Bowen v. Georgetown University Hospital, 488 U.S. 204, 208-09 (1988)

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[19]The other major type of liability policy is the "claims made" policy, which covers claims made during the policy period. There are variations among occurrence and claims-made policies and even hybrids between the two. See generally R. Russ, et al., Couch on Insurance 3rd §102.20. (3d ed. 1999).

and United States v. Security Industrial Bank, 459 U.S. 70, 79-80 (1982). Where "nothing in the statute or legislative history suggests it was intended to be applied retroactively," therefore, a statute is to be applied prospectively. Id. *Accord,* People of the State of California ex rel. Department of Transportation v. United States, 27 Fed. Cl. 130, 138 (1992), *aff'd,* 11 F.3d 1071 (Fed. Cir. 1993) ("Because retroactivity is not favored in the law, congressional enactments and administrative rules will not be construed to have retroactive effect, absent specific mandatory language").

The United States' argument — that Congress intended by the Hathaway Amendment to legislate retroactively and abrogate existing contractual rights pertaining to a nuclear incident which had occurred fourteen years earlier — thus contravenes basic rules of contract and statutory construction. The government's motion for summary judgment as to defense costs should be denied, and the plaintiffs permitted to offer evidence of what those costs have been.

III. This Court Has Jurisdiction To Enter The Requested Declaratory Judgment.

The United States argues that this Court lacks jurisdiction over Dr. Sweet's and MIT's claims for declaratory relief. While it is certainly true that this Court does not have jurisdiction to issue a free-standing declaratory judgment, it *does* have authority to issue declaratory relief where such relief is "tied and subordinate to a monetary award." McKeel v. Islamic Republic of Iran, 722 F.2d 582, 591 (9th Cir. 1983), *cert. denied,* 469 U.S. 880 (1994); Alaska v. United States, 15 Cl. Ct. 276, 282-83 (1988); Ellis v. United States, 610 F.2d 760, 762 (Ct. Cl. 1979); Austin v. United States, 206 Ct. Cl. 719, 723, *cert. denied,* 423 U.S. 911 (1975).

In this case, Dr. Sweet seeks indemnity — i.e., a monetary award — first and foremost. He seeks as well a declaration that the United States is obligated to indemnify him from future

liability in cases arising out of the MIT or Brookhaven BNCT trials. Such relief is "tied and subordinate to [the] monetary award" that Dr. Sweet primarily seeks, because:

- The *Heinrich* case is on appeal. The money judgment entered by the District Court could be affirmed, increased, or set aside, or the Court of Appeals could order a new trial. A declaration of the parties' rights under the indemnity agreement(s) enable the parties to know their rights and obligations when the dust finally settles in *Heinrich,* without requiring the Court to venture beyond the legal and factual issues presented by the monetary award.
- So long as *Heinrich* is subject to further proceedings, defense costs continue to accrue. These are not different in kind from those already accrued, so that here again, the Court can establish the parties' rights and obligations solely on the basis of legal and factual issues decided in connection with the damages claims.
- Dr. Sweet's interpretation of the MIT indemnity agreement is that the Heinrich and Sienkewicz claims against Dr. Sweet and MIT together constitute a "common occurrence," with a single $250,000 deductible and a single $500,000,000 cap on damages. See Indemnity Agreement E-39 (Sweet Cmplt. Ex. C), Art. I ¶2(b) and Art. III, ¶4(b). The Court will need to agree or disagree with this contract interpretation in order to compute the damages awarded on Dr. Sweet's and MIT's monetary claims. The Court's holding on this and other issues raised by the damage claims will have implications for any other plaintiffs who may come forward with claims related to the 1960-61 BNCT trials at MIT (for example, the *Joseph* case, see Sweet Cmplt. ¶18), whose claims would also arise out of the same "common occurrence." A declaration as to these matters, applicable to all claims arising out of the 1960-61 trials, will serve the cause of judicial economy

without requiring the Court to venture beyond the issues that are squarely before it on the damage claims. (The same is true of the Brookhaven trials and claimants.)

CONCLUSION

For the reasons stated, the government's Motion for Summary Judgment should be denied in its entirety.

By his attorneys,

Thomas P. Billings (BBO #043040)
SALLY & FITCH
225 Franklin Street
Boston, Massachusetts 02110
(617) 542-5542

Dated: April 5, 2001

CERTIFICATE OF SERVICE

I, Thomas P. Billings, hereby certify that on this date I served the within document by causing a copy to be delivered by first class mail, postage prepaid, to all counsel of record.

Thomas P. Billings

Dated: April 6, 2001

APPENDIX

Definitions of "Person Indemnified," "Public Liability," and "Nuclear Incident" in the Price-Anderson Act (1961 and currently), AEC regulations, and Indemnity Agreement No. E-39

"Person Indemnified"

Price-Anderson (1961) [P.L. 85-256, sec. 3]	Price-Anderson (currently) [42 U.S.C. §2014(t)]	AEC regulations (1961) [26 F.R. 3457, reprinted in USA App. 6]	Indemnity Agreement E-39 [Article I, ¶4]
"Person indemnified" means the person with whom an indemnity agreement is executed and any other person who may be liable for public liability.	The term "person indemnified" means (1) with respect to a nuclear incident occurring within the United States or outside the United States as the term is used in section 2210(c) of this title, and with respect to any nuclear incident in connection with the design, development, construction, operation, repair, maintenance, or use of the nuclear ship Savannah, the person with whom an indemnity agreement is executed or who is required to maintain financial protection, and any other person who may be liable for public liability or (2) with respect to any other nuclear incident occurring outside the United States, the person with whom an indemnity agreement is executed and any other person who may be liable for public liability by reason of his activities under any contract with the Secretary of Energy or any project to which indemnification under the provisions of section 2210(d) of this title has been extended or under any subcontract, purchase order, or other agreement, of any tier, under any such contract or project.	"Person indemnified" means the licensee and any other person who may be liable for public liability.	"Person indemnified" means the licensee and any other person who may be liable for public liability.

"Public Liability"

Price-Anderson (1961) [P.L. 85-256, sec. 3, amended by P.L. 87-206, sec. 2]	Price-Anderson (currently) [42 U.S.C. §2014(w)]	AEC regulations (1961) [26 F.R. 3457, reprinted in USA App. 6; 27 F.R. 2885, reprinted in USA App. 13]	Indemnity Agreement E-39 [Article I, ¶5]
Until September 6, 1961) The term "public liability" means any legal liability arising out of or resulting from a nuclear incident, except claims under State or Federal Workmen's Compensation Acts of employees of persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs, and except for claims arising out of an act of war. "Public Liability" also includes damage to property of persons indemnified, *Provided*, That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs. *(On/after September 6, 1961)* The term "public liability" means any legal liability arising out of or resulting from a nuclear incident, except (i) claims under State or Federal workmen's compensation acts of employees of persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs; (ii) claims arising out of an act of war; and (iii) whenever used in subsections a., c., and k., claims for loss of, or damage to, or loss of use of property which is located at the site of and used in connection with the licensed activity where the nuclear incident occurs. "Public liability also includes damage to property of persons indemnified: *Provided,* That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs.	The term "public liability" means any legal liability arising out of or resulting from a nuclear incident or precautionary evacuation (including all reasonable additional costs incurred by a State, or a political subdivision of a State, in the course of responding to a nuclear incident or a precautionary evacuation), except: (i) claims under State or Federal workmen's compensation acts of employees of persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs; (ii) claims arising out of an act of war; and (iii) whenever used in subsections (a), (c), and (k) of section 2210 of this title, claims for loss of, or damage to, or loss of use of property which is located at the site of and used in connection with the licensed activity where the nuclear incident occurs. "Public liability" also includes damage to property of persons indemnified: Provided, That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs.	*Until September 6, 1961)* "Public liability" means any legal liability arising out of or resulting from a nuclear incident, except (1) claims under state or Federal workmen's compensation acts of employees of persons indemnified who are employed (a) at the location or, if the nuclear incident occurs in the course of transportation of the radioactive material, on the transporting vehicle, and (b) in connection with the licensee's possession, use, or transfer of the radioactive material; and (2) claims arising out of an act of war. *(On/after September 6, 1961)* Above, with the addition of: and (3) claims for loss of, or damage to, or loss of use of property which is located at the location and used in connection with the licensee's possession, use, or transfer of the radioactive material, and (b) if the nuclear incident occurs in the course of transportation of the radioactive material, the transporting vehicle, containers used in such transportation, and the radioactive material.	*(Until September 6, 1961)* "Public liability" means any legal liability arising out of or resulting from a nuclear incident, except (1) claims under state or Federal workmen's compensation acts of employees of persons indemnified who are employed (a) at the location or, if the nuclear incident occurs in the course of transportation of the radioactive material, on the transporting vehicle, and (b) in connection with the licensee's possession, use, or transfer of the radioactive material; and (2) claims arising out of an act of war. *(On/after September 6, 1961)* Above, with the addition of: and (3) claims for loss of, or damage to, or loss of use of property which is located at the location and used in connection with the licensee's possession, use, or transfer of the radioactive material, and (b) if the nuclear incident occurs in the course of transportation of the radioactive material, the transporting vehicle, containers used in such transportation, and the radioactive material.

"Nuclear Incident"

Price-Anderson (1961) [P.L. 85-256, sec. 3, amended by P.L. 85-602]	**Price-Anderson (currently)** [42 U.S.C. §2014(q)]	**AEC regulations (1961)** [26 F.R. 3457, reprinted in USA App. 6]	**Indemnity Agreement E-39** [Article I, ¶2]
The term "nuclear incident" means any occurrence within the United States causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material: *Provided, however,* that as the term is used in subsection 170 l., it shall mean any occurrence outside of the United States rather than within the United States.	The term "nuclear incident" means any occurrence, including an extraordinary nuclear occurrence, within the United States causing, within or outside the United States, bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material: Provided, however, That as the term is used in section 2210(l) of this title, it shall include any such occurrence outside the United States: And provided further, That as the term is used in section 2210(d) of this title, it shall include any such occurrence outside the United States if such occurrence involves source, special nuclear, or byproduct material owned by, and used by or under contract with, the United States: And provided further, That as the term is used in section 2210(c) of this title, it shall include any such occurrence outside both the United States and any other nation if such occurrence arises out of or results from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material licensed pursuant to subchapters V, VI, VII, and IX of this division, which is used in connection with the operation of a licensed stationary production or utilization facility or which moves outside the territorial limits of the United States in transit from one person licensed by the Nuclear Regulatory Commission to another person licensed by the Nuclear Regulatory Commission.	3(a) "Nuclear incident" means any occurrence or series of occurrences at the location or in the course of transportation causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material. (b) Any occurrence or series of occurrences causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of i. The radioactive material discharged or dispersed from the location over a period of days, weeks, months or longer and also arising out of such properties of other material defined as "the radioactive material" in any other agreement or agreements entered into by the Commission under subsection 170 c or k of the Act and so discharged or dispersed from "the location" as defined in any such other agreement; or ii. The radioactive material in the course of transportation and also arising out of such properties of other material defined in any other agreement entered into by the Commission pursuant to subsection 170 c or k of the Act as "the radioactive material" and which is in the course of transportation shall be deemed to be a common occurrence. A common occurrence shall be deemed to constitute a single nuclear incident.	(a) "Nuclear incident" means any occurrence or series of occurrences at the location or in the course of transportation causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material. (b) Any occurrence or series of occurrences causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of i. The radioactive material discharged or dispersed from the location over a period of days, weeks, months or longer and also arising out of such properties of other material defined as "the radioactive material" in any other agreement or agreements entered into by the Commission under subsection 170 c or k of the Act and so discharged or dispersed from "the location" as defined in any such other agreement; or ii. The radioactive material in the course of transportation and also arising out of such properties of other material defined in any other agreement entered into by the Commission pursuant to subsection 170 c or k of the Act as "the radioactive material" and which is in the course of transportation shall be deemed to be a common occurrence. A common occurrence shall be deemed to constitute a single nuclear incident.

UNITED STATES COURT OF FEDERAL CLAIMS

WILLIAM H. SWEET, M.D., Plaintiff, v. UNITED STATES OF AMERICA, Defendant.	Case No. 00-274C

PLAINTIFF WILLIAM H. SWEET, M.D.'s MEMORANDUM OF LAW IN OPPOSITION TO DEFENDANT'S MOTION FOR SUMMARY JUDGMENT

Plaintiff William H. Sweet, M.D.[1] ("Dr. Sweet") respectfully submits this Memorandum of Law in opposition to the Motion for Summary Judgment filed by the defendant United States.

STATEMENT OF THE CASE

As more fully set forth in the Proposed Findings of Fact submitted by the parties, this is a case brought against the United States under an indemnity agreement.

Dr. Sweet, the Massachusetts Institute of Technology ("MIT"), and others were sued by the survivors of four plaintiffs who underwent boron neutron capture therapy ("BNCT") for brain cancer in the 1950s and 1960s. Two were treated at MIT's nuclear reactor, and two at a reactor at Brookhaven National Laboratory on Long Island. The case is Heinrich v. Sweet, United States District Court for the District of Massachusetts Civil Action No. 97-CV-12134-WGY.

After a lengthy trial in the fall of 1999, the *Heinrich* jury returned verdicts of negligence and wrongful death against Dr. Sweet and co-defendant Massachusetts General Hospital "MGH"),

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[1]Dr. Sweet was living at the time this case was filed, but died on January 22, 2001. See the Suggestion of Death filed herewith. His executors not been appointed as yet; when this occurs, they will move to be substituted as the party plaintiff. For convenience, this Memorandum refers throughout to Dr. Sweet, rather than to his estate or his executors.

but in favor of defendant MIT. Presently, there is a judgment totalling $830,000 against Dr. Sweet and MGH. The judgment is on appeal to the United States Court of Appeals for the First Circuit.

In this proceeding, Dr. Sweet seeks indemnity against the judgment, and reimbursement of his defense costs. MIT, in a consolidated case, seeks its defense costs.

The indemnity agreement in question is titled Indemnity Agreement E-39, between the Atomic Energy Commission and MIT.[2] It was consummated pursuant to the Price-Anderson Act of 1957, amending the Atomic Energy Act of 1946. Price-Anderson constructed a system of "financial responsibility" (private insurance or self-insurance) and government indemnity, accomplished by means of agreements such as Indemnity Agreement E-39. The indemnity agreement is broad, as Congress intended it be, and on its face, it covers Dr. Sweet's liability for the judgment and for defense costs in the *Heinrich* case.

The government, attempting to look behind the plain language of the indemnity agreement, has presented three issues in its motion for summary judgment:

1. Whether the United States is obligated to indemnify Dr. Sweet under Indemnity Agreement E-39. This boils down to a single question of statutory and contract construction: whether BNCT constituted a "nuclear incident" as that term is used in the Price-Anderson Act and the indemnity agreement.

2. Whether the United States' indemnity obligation extends to defense costs. Originally (and at the time of the nuclear incident in this case), it clearly did;

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[2]This agreement provides indemnity as to the two *Heinrich* plaintiffs (Heinrich and Sienkewicz) who recovered judgments against Dr. Sweet. The other two (Mayne and Van Dyke) were treated at Brookhaven, not MIT, and so do not fall under Indemnity Agreement No. E-39. There is believed to be a similar agreement(s) covering the Brookhaven treatments, however. Dr. Sweet will seek the Brookhaven agreement(s) through discovery following the Court's decision on summary judgment and the lifting of the stay on discovery imposed by the Court's October 26, 2000 order, and asks the Court, in the menatime, to assume that such an agreement exists.

however, the United States contends that a 1975 amendment to Price-Anderson removed defense costs from the indemnity obligation.

3. Whether Dr. Sweet's request for declaratory relief, ancillary to the monetary relief he principally seeks, in within the jurisdiction of this Court.

Dr. Sweet submits that all three issues must be answered in the affirmative; in fact, none is even a close question.

ARGUMENT

I. Under The Plain Language Of The Price-Anderson Act, The AEC's Regulations, And Indemnity Agreement E-39, The United States Must Indemnify Dr. Sweet.

Whether the United States is obligated to indemnify Dr. Sweet depends on the meaning of three terms: "**person indemnified**," "**public liability**," and — most especially — "**nuclear incident**." This is because under the Price-Anderson Act and Indemnity Agreement E-39, Dr. Sweet is a "person indemnified" if he is liable for "public liability," which is "legal liability arising out of a nuclear incident."

The three terms are defined in the Price-Anderson Act, in the AEC regulations prescribing the form of indemnity agreement to be executed to carry out the Price-Anderson mandate, and in the indemnity agreement between the AEC and MIT. The definitions differ in minor respects as between the statute, on the one hand, and the regulations and the agreement on the other,[3] and they

[3]Because the regulations prescribe *verbatim* the form of indemnity agreement, the definitions in Indemnity Agreement E-39 are identical with those in the regulations. In general, these differ from the statutory definitions in matters of drafting convenience only; the meanings are the same. An exception is the provision in the regulations and the agreement that certain related occurrences can constitute a single "nuclear incident." This has ramifications for the upper limit of liability (which is not a factor in this case) and for the $250,000 deductible (which will be). See also Part III, below.

have evolved over time,[4] but not in ways that are material to this case. Insofar as the terms apply to this case:

> "Person indemnified" means the licensee[5] and any other person who may be liable for public liability. (42 U.S.C. §2014(t))
>
> "Public liability" means any legal liability arising out of a nuclear incident [with exceptions not here relevant]. (42 U.S.C. §2014(w))
>
> "Nuclear incident" means any occurrence or series of occurrences[6] at the location[7] or in the course of transportation causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material. (42 U.S.C. §2014(q))

Appendix A to this Memorandum sets out the full definitions of the three terms in each of these sources, with citations.

A. Dr. Sweet Is A "Person Indemnified."

The United States has "assum[ed] but not conced[ed]" that Dr. Sweet is a "person indemnified." Defendant's Brief at 26. Plainly, he is — provided his liability in the *Heinrich* case arises out of a "nuclear incident." The statute and the agreement give "person indemnified" the

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[4]For example: although Price-Anderson originally applied only to "nuclear incidents" occurring on U.S. soil, it has been amended to cover certain extraterritorial incidents. The AEC's form agreement, designed for domestic reactors, naturally omits this language. Additionally, the regulations and the agreement have language which the statute does not, defining when a series of "occurrences" constitutes a single "nuclear incident." In all respects affecting the issues presently before the Court, however, the three sets of definitions are identical.

[5]In the statute, "the person with whom an indemnity agreement is executed."

[6]The statute omits the words "or series of occurrences" and adds limitations on the extraterritorial application of the Act.

[7]Originally, the statute restricted "nuclear incidents" to occurrences "within the United States." Amendments have given the statute limited extraterritorial effect but do not, of course, affect this case.

broadest possible meaning, and there can be no doubt that Congress meant what it said: the indemnity obligation embraces the potential liability of licensees, contractors, subcontractors, and complete strangers to contract — literally, "any ... person who may be liable for public liability."

This expansive approach reflected a considered judgment by Congress that indemnity should not be restricted to licensees, or even to persons in contractual privity with licensees, but should extend to "any person who might be found liable, regardless of the contractual relation."[8] Dr. Sweet plainly comes under this very broad umbrella.

B. The *Heinrich* Case And Judgment Constitute "Public Liability."

Nor should there be any dispute concerning the first prong of the definition of "public liability"; Dr. Sweet unquestionably has incurred a "legal liability" in the *Heinrich* case.

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[8]The Senate Report on the original enactment explained:

> The definition of "person indemnified" means more than just the person with whom the indemnity agreement is executed. ... The phrase "person indemnified" also covers any other person who may be liable. For a licensee for a reactor, this would mean in addition to the licensee that the indemnification extends to such persons as the subcontractors of the licensee ... However, it is not meant to be limited solely to those who may be found liable due to their contractual relationship with the licensee. ... The proposed AEC limitation to those in privity with the licensee was reconsidered by the Commission, and the Commission decided to accept the premise of the original bills which would make the person indemnified *any person who might be found liable, regardless of the contractual relation.*

S. Rep. 85-296, 1957 U.S. CODE CONG. & ADMIN. NEWS 1803, 1818 (emphasis supplied). This approach effectuates the overarching purpose of the Price-Anderson scheme: protecting the public.

> The indemnification contracts are to protect the public by means of providing funds to the licensee and to any of those who might be found liable with him for the payment of public damages.

Id. at 1810.

C. The *Heinrich* Case Arose Out Of A "Nuclear Incident."

The only real dispute — and the one to which the United States devotes its energy — is whether the use of the MIT research reactor in connection with the 1961 BNCT trials constitutes a "nuclear incident." It does, if it was an "occurrence or series of occurrences at the location ... causing bodily injury, sickness, disease, or death ... arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material."

Congress made the definition of "nuclear incident" intentionally broad, because it believed this was the best way to protect the public. In the words of the Senate Report accompanying the original enactment:

> The definition of "nuclear incident" is designed to protect the public against *any* form of damage arising from the special dangerous properties of the materials used in the atomic energy program. It includes *any* damage which may result from any hazardous property of source, special nuclear, or byproduct material. It includes bodily injury or death, loss of or damage to property, and loss of use of property. While most incidents will be happenings which will be pinpointed in time — such as a runaway reactor or an inadvertent exposure to radiation — it was not thought that an incident would necessarily have to occur within any relatively short period of time. For instance, the steady exposure to radiation, such as from an undetected leak of radio-active materials from a storage bin, could constitute an incident.

S. Rep. 85-296, 1957 U.S. CODE CONG. & ADMIN. NEWS 1803, 1817 (emphasis supplied).

1. The *Heinrich* Case Arose From A "Nuclear Incident" Within The Plain Language Of The Statute, The Regulations, And The Agreement.

The events giving rise to the *Heinrich* case unquestionably meet the broad statutory and contractual definition of a "nuclear incident." The plaintiffs allege, in the plainest possible terms, that their decedents suffered "bodily injury, sickness, disease [and] death" as a direct result of exposure to neutron beams generated by the MIT and Brookhaven reactors. Specifically, all four plaintiffs are alleged to have grown ill and died following, and because of, their BNCT. This was

the finding on autopsy for Heinrich and Sienkewicz (the other two apparently were not autopsied). More importantly, it was also the jury's finding.

Moreover, the neutron beam and the resulting effects (both therapeutic and destructive) of BNCT were produced by the "radioactive properties of the radioactive material."[9] As the Affidavit of John Bernard (submitted by MIT) explains:

> At MIT, the neutron beam used to initiate boron neutron capture therapy was generated from a radioactive isotope of uranium, Uranium-235, licensed to the MIT reactor by the Nuclear Regulatory Commission. (¶32)
>
> The neutron beam produced by the MIT reactor is caused by the radioactive properties of the nuclear source material that the MIT reactor is licensed to hold and use originally by the Atomic Energy Commission and subsequently by the Nuclear regulatory Commission. (¶40)

Thus, although the *Heinrich* complaint is lengthy (79 pages) and multifarious (eleven counts asserting different legal theories), its thrust is simple: the plaintiffs allege that their decedents were fatally injured by nuclear radiation generated by the uranium core ("radioactive material") of the MIT and Brookhaven reactors. Their claims thus fit squarely within the statutory and contractal definition of a "nuclear incident."

The Court's analysis could — and should — stop there. When construing a statute, the Court's

> analysis begins with "the language of the statute." Where the statutory language provides a clear answer, the analysis ends there as well.... Ordinarily, an unambiguous statute, or one in which the

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[9]"Radioactive material" is also a defined term, though one whose meaning, refreshingly, does not appear to be in dispute in this case. "'The radioactive material' means source, special nuclear, and byproduct material which (1) is used or to be used in, or is irradiated or to be irradiated by, the nuclear reactor or reactors subject to the license or licenses designated in the Attachment hereto, or (2) is produced as a result of the operation of said reactor(s)." The enriched uranium 235 which makes up the reactor core and generated the neutron beam used in BNCT is "special nuclear material." See 42 U.S.C. §2014(aa); License R-37 (Exhibit A to the Sweet Complaint), ¶1; Affidavit of John Bernard, ¶¶32, 40.

> plain meaning is clear from the words themselves, is conclusive. ... The plain meaning rule "tells a court what not to look at — legislative debates, committee reports, newspaper commentary.... The meaning of the law is what the words say it is."

Sullivan v. United States, 46 Fed. Cl. 480, 486 (2000) (citations omitted) (Horne, J.).

Applying unambiguous contract language is a similarly straightforward task:

> The court's examination begins with the plain language of the contract. If the contract language is unambiguous, the court's inquiry is at an end, and the plain language of the contract is controlling.

Input/Output Technology, Inc. v. United States, 44 Fed. Cl. 65, 70 (1999) (Firestone, J.), citing Textron Defense Systems v. United States, 143 F.3d 1465, 1469 (Fed. Cir. 1998) ("We ... first consider the language of the contract. Because the language is sufficiently clear, our inquiry ends there as well."). "The ordinary meaning of the language in contractual documents governs, and not a party's subjective but unexpressed intent. ... Moreover, the mere fact that the parties disagree upon the meaning of a contract does not render the language ambiguous." PCL Const. Services, Inc. v. United States, 47 Fed. Cl. 745, 785 (2000) (Horn, J.). "If a contract term is unambiguous, the court cannot assign it another meaning, no matter how reasonable it may appear." Cray Research, Inc. v. United States, 41 Fed. Cl. 427, 435 (1998) (Weinstein, J.).

The language chosen by Congress and used in the indemnity agreement — "*any* occurrence or series of occurrences ..." — admits of no exception. If Congress had intended to limit indemnity to cases involving reactor malfunction, or to except injuries resulting from medical applications or other purposeful uses of a reactor, as the United States now suggests, it could readily have done so. It did not, and as discussed below, there is no reason to think that Congress meant anything other than what it said.

2. The BNCT Trials Were Not Just "Any Type Of Incident Somehow Related To The Operations Of A Licensed Facility."

The United States observes that "under the plain terms of the agreement, Price-Anderson indemnification requires that the liability in question arise out of or result from a "*nuclear* incident, and not simply any type of incident somehow related to the operations of a licensed facility." (Defendant's Brief at 27-28; emphasis in original)

It would be hard to argue with this statement, as far as it goes. If the *Heinrich* plaintiffs had alleged a slip and fall on a wet floor at a nuclear plant, or a forklift accident, or a ceiling collapse, or an assault by a plant worker, or some other injury not caused by the "radioactive, toxic, explosive, or other hazardous properties of the radioactive material," there plainly would be no nuclear incident, and the statute and the agreement would not apply.

The United States takes a fanciful view of the facts, however, when it goes on to assert that "[t]he fact that a portion of the challenged conduct took place at a licensed nuclear facility was entirely inconsequential to the merits of the claims presented in *Heinrich*." (Defendant's Brief, p. 29) Quite the contrary: all four plaintiffs' decedents received boron neutron capture therapy, which requires a slow neutron beam, which can *only* be generated by a nuclear reactor. None of the plaintiffs, in other words, found him/herself at a nuclear reactor by chance. And just as the reactor was integral to the treatment they were to receive, it is alleged to have been the cause of the injuries they suffered. It would be hard to envision a clearer case of alleged "bodily injury, sickness, disease, or death ... arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material" — in short, a nuclear incident.

3. The Price-Anderson Compensatory Scheme Is Not Limited To "Unexpected Nuclear Reactor Failures."

The United States, citing committee reports pertaining to Price-Anderson and various of its amendments, argues that Congress's paramount concern was the potentially vast liability that could

result from "unexpected nuclear reactor failures, malfunctions, and the like." Because the reactors in this case performed as intended ("without incident"), the government argues, there was no "nuclear incident" and therefore no indemnity.

To be sure, the legislative history of Price-Anderson and its amendments refers frequently to the possibility of a catastrophic reactor accident, and it was the possibility of such an event, and the fact that the potential damages exceeded the private insurance then available, which prompted Congress to pass the Act. By attempting to confine Price-Anderson indemnity to such incidents, however, the United States does violence to the statutory language, the most fundamental tenets of statutory construction, and a substantial body of caselaw applying Price-Anderson to minor incidents, single-plaintiff cases, and cases where reactors performed as the operators intended and as federal regulations required.

a. Statutory Language.

The language of the statute is discussed above. Here, it bears repeating only that a "nuclear incident" occurs *whenever* a person or property is injured by "the radioactive, toxic, explosive, or other hazardous properties of the radioactive material." That is what the statute says, and it nowhere requires that a "nuclear incident" be catastrophic, large, or even unexpected, for there to be indemnity.

Indeed, beginning with the 1966 amendments to Price-Anderson, Congress made special provision for "extraordinary nuclear occurrences," or "ENOs." An ENO is

> any event causing a discharge or dispersal of source, special nuclear, or byproduct material from its intended place of confinement in amounts offsite, or causing radiation levels offsite, which the Nuclear Regulatory Commission or the Secretary of Energy, as appropriate, determines to be substantial, and which the Nuclear Regulatory Commission or the Secretary of Energy, as appropriate, determines has resulted or probably will result in substantial damages to persons offsite or to property offsite.

42 U.S.C. §2014(j). The 1966 amendments provided federal jurisdiction and removal power for cases arising out of ENOs. See In re TMI Litigation Consolidated Cases II, 940 F.2d 832, 853 n.18 (3d Cir. 1991), *cert. denied,* 503 U.S. 906 (1992). The 1988 amendments — passed in response to the Three Mile Island incident — further extended federal jurisdiction and removal to *all* nuclear incidents. See id.

Even now, the Act continues to distinguish between ENOs, in which certain defenses are waived, 42 U.S.C. §2210(n), and all other "nuclear incidents." Significantly, however, while Congress has thus made special provision for the sort of large-scale nuclear catastrophe that members feared might overtax the available insurance pool, it has never *limited* Price-Anderson indemnity to such disasters. To the contrary: "The term 'nuclear incident' means *any* occurrence, *including an extraordinary nuclear occurrence,*" which meets the definitional requirement of injury or damage caused by "the radioactive, toxic, explosive, or other hazardous properties of the radioactive material." 42 U.S.C. §2014(q) (emphasis supplied).

Had Congress wanted, as the United States now suggests, to limit Price-Anderson indemnity to catastrophic reactor accidents, it certainly had the tools and the vocabulary to accomplish this. It did not do so, however, and neither should the Court.

b. Statutory Construction.

As noted above, the statutory definition of "nuclear incident" is clear on its face, and clearly covers the present case. "The meaning of the law is what the words say it is." Sullivan v. United States, 46 Fed. Cl. at 486. Committee reports and other legislative history are not needed to clarify what is already clear. Id.

The importance of *reading the statute* is well illustrated by the United States' argument that because Committee reports express concern about catastrophic nuclear accidents, the much broader statutory and contract definition of "nuclear incident" must not mean what it says. This is a bit like

an insurance company claiming that because a person purchased a homeowner's insurance policy primarily to cover a disaster (such as a fire), it must not cover minor claims (such as the theft of a camera), even if the policy says otherwise. The obvious, and correct, reply is — don't speculate as to what was in the insured's mind; read the insurance policy!

Of course, the words of a statute, *if* they are ambiguous, are to be interpreted in light of the statute's purpose. "But statutory prohibitions often go beyond the principal evil to cover reasonably comparable evils, and it is ultimately the provisions of our laws rather than the principal concerns of our legislators by which we are governed." Oncale v. Sundowner Offshore Services, Inc., 523 U.S. 75, 79 (1998). Where the language chosen for the statute is broad, it is not the Court's function "to restrict the unqualified language of a statute to the particular evil that Congress was trying to remedy — even assuming that it is possible to identify that evil from something other than the text of the statute itself." Brogan v. United States, 522 U.S. 398, 403 (1998).

The bottom line is that Congress legislates by passing statutes, not by writing committee reports. While the possibility of a catastrophic accident may have been what animated the industry and members of Congress to do something, *what* it did was to pass comprehensive legislation whose meaning is plain, and which reaches the facts of this case. There simply is no reason not to do what the statute says.

c. Cases

Finally, any suggestion that only Chernobyl- or Three Mile Island-type accidents can be "nuclear incidents" under Price-Anderson is belied by the numerous reported cases under the Act. A few of these cases, in fact, *did* arise out of the Three Mile Island accident.[10] Many others, however, have applied Price-Anderson to far more contained instances of environmental

[10]See the reported decisions at In re TMI, 89 F.3d 1106 (3d Cir. 1996), *cert. denied,* 519 U.S. 1077 (1997); In re TMI, 67 F.3d 1119 (3d Cir. 1995); and In re TMI Litigation Consolidated Cases II, *supra*, and the various decisions cited therein.

contamination[11] or occupational exposure.[12] In none of these cases (Three Mile Island excepted) was there a "major nuclear accident" (Defendant's Brief at 33), and none except TMI posed the threat of "extraordinarily extensive and, thus, uninsurable damage to the public" (Id. at 32) — yet Price-Anderson applied to all.

Nor must a "nuclear incident" be an accident at all. For example, several cases have held that a complaint by a nuclear plant worker, alleging occupational exposure to radiation, is governed by Price-Anderson because it involves a nuclear incident, *even where the plaintiff does not allege a reactor accident, or even that his exposure exceeded the maximum levels permitted by federal regulations.* E.g., Roberts v. Florida Power & Light Co., 146 F.3d 1305 (11th Cir. 1998), *cert. denied,* 525 U.S. 1139 (1999); O'Conner v. Commonwealth Edison Co., 13 F.3d 1090, 1094-

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[11]E.g., El Paso Natural Gas Co. v. Neztsosie, 526 U.S. 473 (1999) (suit Nieman v. NLO, Inc., 108 F.3d 1546 (6th Cir. 1997) (landowner sued former operator of uranium processing facility for trespass resulting from alleged leak of uranium onto his property); Lujan v. Regents of Univ. of California, 69 F.3d 1511 (10th Cir. 1995) (single-plaintiff case alleging injuries and wrongful death from exposure to toxic and radioactive substances in air, soil and water near Los Alamos National Laboratory); by two members of Navajo tribe alleging injuries from drinking water in open pit uranium mines); Carey v. Kerr-McGee Chemical Corp., 60 F. Supp. 2d 800 (N.D. Ill. 1999) (action by landowners alleging improper disposal of radioactive thorium tailings).

[12]E.g., Kennedy v. Southern Cal. Edison Co., 219 F.3d 988 (10th Cir. 2000) (estate of nuclear power plant worker claimed his leukemia resulted from occupational exposure to radiation at plant); Acuna v. Brown & Root, Inc., 200 F.3d 335 (5th Cir.), *cert. denied,* 120 S. Ct. 2658 (2000) (consolidated cases involving occupational exposure of uranium workers); Corcoran v. New York Power Auth., 202 F.3d 530 (2d Cir. 1999), *cert. denied,* 529 U.S. 1109 (2000) (similar to Kennedy); Roberts v. Florida Power & Light Co., 146 F.3d 1305 (11th Cir. 1998) (similar to Kennedy); O'Conner v. Commonwealth Edison Co., 13 F.3d 1090 (7th Cir.), *cert. denied*, 512 U.S. 1222 (1994) (nuclear power plant worker alleged radiation-induced cataracts); Building & Construction Dept., AFL-CIO v. Rockwell Int'l Corp., 7 F.3d 1487 (10th Cir. 1993) (claim for medical monitoring by employees of nuclear weapons plant who alleged occupational exposure to radioactive materials); McLandrich v. Southern Cal. Edison Co., 942 F. Supp. 457 (S.D. Cal. 1996) (similar to Kennedy); Smith v. General Electric Co., 938 F. Supp. 70 (D. Mass. 1996) (similar to Kennedy); Sawyer v. Commonwealth Edison Co., 847 F.Supp. 96 (N.D. Ill. 1994) (similar to Kennedy); Coley v. Commonwealth Edison Co., 768 F. Supp. 625 (N.D. Ill. 1991) (birth defects allegedly caused by occupational exposure of their fathers, workers in a nuclear power plant, to ionizing radiation).

97, 1105 (7th Cir.), *cert. denied*, 512 U.S. 1222 (1994); Coley v. Commonwealth Edison Co., 768 F. Supp. 625 (N.D. Ill. 1991) (each holding that Price-Anderson conferred jurisdiction on the federal court and preempted contrary state law; because the plants complied with the standard of care supplied by federal regulation, the complaints were dismissed). In each of these cases the "reactor performed *without incident*" (to borrow the United States' pun at page 28 of its brief), yet a "nuclear incident" occurred within the meaning of 42 U.S.C. §2014(q), and Price-Anderson therefore applied.

These holdings do what the United States' brief does not: they follow faithfully the plain language of the statute. In each case, the plaintiff alleged injury, sickness and/or death resulting from the radioactive properties of the nuclear material used in the reactor — in short, a "nuclear incident" as the statute defines the term — and so Price Anderson applied. The *Heinrich* complaint likewise alleges injury, sickness and/or death resulting from the radioactive properties of the nuclear material used in the reactor, and so Price-Anderson applies here as well.

4. The BNCT Trials, And The *Heinrich* Plaintiffs' Alleged Injuries, Constituted An "Occurrence" As That Term Is Used In The Statute And The Agreement.

The United States points to the word "occurrence" in the statute's and the agreement's definitions of "nuclear incident," and argues that this is "a term of art used in the insurance industry to specify an unexpected cause of loss," a synonym of "accident." Defendant's Brief at 30-31. Dr. Sweet's supposed "knowing decision to continue BNCT treatments after their therapeutic value had ended," the government says, was not an "accident" or "occurrence," and so could not be a "nuclear incident."

The first difficulty with this argument is that it ignores the clear record that Congress intended that Price-Anderson indemnity should extend even to intentional acts. In fact, Congress

expressly *rejected* a proposal by the AEC that intentional conduct be excepted from the indemnity provisions. The Senate Report explained:

> The suggestion which was contained in the original draft legislation of the [Atomic Energy] Commission that willful damages be excluded was not accepted since the damage to the public is the same, whether caused by any means — willful or nonwillful.

S. Rep. 85-296, 1957 U.S. CODE CONG. & ADMIN. NEWS at 1819. As with the definition of "person indemnified" (see pp. 4-5, *supra)*, then, Congress opted for a very broad definition of "nuclear incident" — extending even to intentional acts — so that an injured person's right to compensation would not be dependent on happenstance beyond that person's control. See Gilberg v. Stepan Co., 24 F. Supp. 2d 325, 335 (D.N.J. 1998) ("Price-Anderson guaranteed that compensation would be available to the public regardless of fault ....").

The government's "occurrence" argument is also wrong as a matter of simple historical fact. When Congress passed Price-Anderson in 1957, the word "occurrence" was not used in the insurance industry's standard form of liability policy; instead, the triggering event for insurance coverage under that form was an "accident." In Price-Anderson, however, Congress eschewed the term "accident" in favor of the term "occurrence." In ordinary English usage, an "occurrence" is something that happens, irrespective of cause; "*occurrence* has a meaning much broader than *accident*."[13] 16 E. Holmes, Holmes' Appleton on Insurance 2d §117.4 at 304 (2000).

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[13]A noted commentator on insurance law elaborates:

> To the average person as well as the legal/judicial mind, the word *occurrence* has a meaning much broader than *accident*. As these words are generally understood, *accident* means something that must have come about or happened in a *certain* way, while *occurrence* means something that happened or came about in *any* way. Therefore, accident is a special type of occurrence, but occurrence goes beyond such special confines and, while including accident, occurrence encompasses many other situations as well. In summary, the liability policy's definition that *occurrence means an accident* usually means that occurrence is much broader than the

Congress's choice of words thus suited exactly its avowed intention to indemnify incidents "caused by any means — willful or nonwillful." (S. Rep. 85-296, *supra.*)

In 1966 — *nine years* after the passage of Price-Anderson — the insurance industry modified the standard form liability policy, so that henceforth the triggering event was an "occurrence." R. Russ, et al., Couch on Insurance 3rd §126.25 at 126-48 to 126-49 (3d ed. 1999). This form also crafted the definition of "occurrence" that the United States quotes at p. 31 of its brief ("an accident, including a continuous or repeated exposure to conditions, which results in bodily injury or property damages neither expected nor intended from the standpoint of the insured").

Needless to say, the government's use of an industry term which (a) is narrower than ordinary English usage, and (b) came into being nine years after the statute being construed, is illogical, unhistorical, and completely unhelpful in determining what Congress meant in 1957.

Finally, the government's intimation that the unsuccessful BNCT trials were no "accident"[14] mistakes what was actually determined in the *Heinrich* case. The jury found for the plaintiffs on counts for negligence and for wrongful death (and found for the defendants on a claim for failure to obtain informed consent). Defendant's Appendix, pp. 80-82. In Massachusetts law, negligence is a failure to use due care. Toubiana v. Priestly, 402 Mass. 84, 88, 520 N.E.2d 1307 (1988). The jury's finding of negligence, moreover, precludes any suggestion that Dr. Sweet's liability is the result of an intentional act: under Massachusetts law, "intentional conduct cannot be

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word accident.

16 E. Holmes, Holmes' Appleton on Insurance 2d §117.4 at 304 (2000) (italics in original).

[14]Even the United States does not seem to be fully committed to this argument. It variously refers to the Heinrich case as involving "[Dr. Sweet's] own medical malpractice," "medical malpractice claims related to the practice of nuclear medicine," "general malpractice claims related to the practice of nuclear medicine," and "misjudgments or malpractice in the medical uses of radiological materials." Defendant's Brief, pp. 29, 31-32, 34.

negligent conduct and negligent conduct cannot be intentional conduct." Waters v. Blackshear, 412 Mass. 589 , 590, 591 N.E.2d 184 (1992).

Nor did the jury's award of punitive damages imply a finding that Dr. Sweet acted intentionally. Punitive damages may be awarded on a finding of gross negligence or, alternatively, of malicious, willful, wanton or reckless conduct. Id. "[G]ross negligence is something less than ... willful, wanton and reckless conduct," Roiko v. Aijala, 293 Mass. 149, 155, 199 N.E. 484 (1936), and even wanton and reckless conduct is not the same as intentional conduct. Preferred Mut. Ins. Co. v. Gamache, 42 Mass. App. Ct. 194, 202, 675 N.E.2d 438, *aff'd*, 426 Mass. 93, 686 N.E.2d 989 (1997) (construing the term "occurrence" and exclusion for "intentional act[s]" in insurance policy).

Even under the government's erroneous understanding of the statutory term "occurrence," therefore, there would be indemnity. "The definition of occurrence is generally met where the insured's conduct was reckless and not intentional," or where liability arises from the unintended consequences of an intentional act. 16 E. Holmes, Holmes' Appleton on Insurance 2d §117.4 at 311 (2000).

> It is only the intended injuries flowing from an intentional act that are excluded. ... If the consequences consisting of damages from intentional acts are not intended and are unexpected they are *accidental* within a policy of liability insurance.

Id. at 337, 339 (italics in original); see also the examples at pp. 339-40.

Recognizing, perhaps, that the jury's verdict of negligence creates difficulties for its theory, the United States quotes at pp. 29 of its brief from Judge Young's of MGH's charitable immunity defense. To be sure, certain of the language used ("actual knowledge ... Sweet well knew ... experimentation on dying patients") looks, at first blush, like a finding of intentional misconduct. Review of the decision as a whole, however, reveals that this is *not* what the judge found. He found, as the jury had, that Dr. Sweet was negligent.

> While Dr. Sweet may have informed the Plaintiffs that the treatment was risky and uncertain, he failed to disclose that performing the experiments on human beings was *negligent*. This is what the jury found, and it is consistent.
>
> In short, there has to be evidence that Mass General had control or the right of control over Sweet's actual conduct which is alleged to be *negligent*, namely the radiation experiments.
>
> Thus, this Court rules that the evidence presented was more than sufficient for Mass General to be held liable for the *negligent* actions of Sweet.
>
> [H]is conduct with respect to the patients involved here was, as the jury found, *negligent*.
>
> Vicarious *negligence* on the part of Mass General ....
>
> [I]nformed consent has never operated as a defense to a claim of *negligence* in Massachusetts.
>
> [A] patient does not assume the risk that the physician, as Sweet did here, would administer the boron-neutron doses *negligently*, well after any hoped-for therapeutic value was manifestly absent. In short, the jury findings of *negligence* and informed consent are neither inconsistent nor mutually exclusive.
>
> Mass. General was thus *negligent* along with Sweet ....
>
> Here, by *negligently* persisting with boron injections ....
>
> The *negligent* harm done by Sweet ....

Heinrich v. Sweet, 118 F. Supp. 2d 73, 83, 84, 85, 90, 91, 92 (D. Mass. 2000) (emphasis supplied). The findings of negligence, by the jury and by Judge Young, are absolutely antithetical to the United States' suggestion of intent. Waters v. Blackshear, *supra; accord,* Sabatinelli v. Butler, 363 Mass. 565, 567, 296 N.E.2d 190 (1973) ("Under the law of the Commonwealth, the difference between intentional and negligent conduct is a difference in kind and not in degree. If conduct is negligent it cannot also be intentional."); Gamache, 42 Mass. App. Ct. at 202 ("Negligent conduct cannot be intentional conduct.").

5. Price-Anderson Does Not Exempt "Nuclear Medicine."

As the government interprets the legislative history, "it was Congress' intent to provide indemnification for uninsurable risks related to unexpected nuclear reactor failures, malfunctions, and the like, rather than general medical malpractice claims related to the practice of nuclear medicine." (Defendant's Brief at 33)

Nowhere in Price-Anderson, its legislative history, or the regulations and indemnity agreements implementing it is there any exemption for medical uses of reactors. As noted above at pages 14-15, moreover, the legislative history confirms that even injuries that result from purposeful uses of reactors ("willful damages") — not just "unexpected nuclear reactor failures, malfunctions, and the like" — are indemnified.[15]

This is not, of course, to say that most malpractice claims involving nuclear medicine[16] will be indemnified under Price-Anderson. Clearly, most are not, because medical procedures rarely take place on the premises of a licensed nuclear reactor ("at the location") as the regulations and indemnity agreement require, and they do not involve "radioactive material" as the statute defines the term. Such claims are therefore outside Price-Anderson, not because of some tacit "nuclear medicine" exemption, but because they fall outside the *express* definition of a "nuclear incident." See Gilberg v. Stepan Co., 24 F. Supp. 2d 325, 340-46 (D.N.J. 1998), discussed further below (application of Price-Anderson does not require that the release of radioactivity be accidental, but does require "an 'event ... [at] "the location" or "the contract location" as defined in [an] indemnity

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[15]The Roberts, O'Conner and Coley cases cited at pages 13-14, above, in which Price-Anderson was applied to cases of occupational exposure within the permissible limits for radiation exposure, further put the lie to the government's argument that Price-Anderson only covers "unexpected nuclear reactor failures, malfunctions, and the like."

[16]Examples of nuclear medicine would be x-rays and other radiologic imaging techniques, conventional radiation therapy for cancer, radionuclide scans, and the like. These are administered in a doctor's office, hospital, or medical center, not at a reactor.

agreement entered into pursuant to section 2210'"; nuclear medicine practiced in a hospital setting therefore is not subject to Price-Anderson).

The BNCT treatments that form the basis of the *Heinrich* case, on the other hand, *did* take place at a reactor ("location") covered by an indemnity agreement, and it resulted (the plaintiffs alleged, and the jury found) in injury, sickness and death caused by the radioactive properties of the nuclear material used in the reactor.

What is more: medical research and therapy, and BNCT in particular, were squarely within the parties' contemplation when the AEC issued the license for MIT-R, and when the parties entered into Indemnity Agreement E-39. In fact, research into medical applications of nuclear energy was an integral part of the post-war atomic energy program.

- Sections 31, 104(a) and 104(c) of the Atomic Energy Act, 42 U.S.C. §§2051, 2134(a) and 2134(c), explicitly authorized the Atomic Energy Commission (now the Nuclear Regulatory Commission) to issue licenses "for utilization facilities for use in medical therapy" and for research and development activities in various fields, including "medical, biological, agricultural, health, or military purposes."
- MIT's application materials to the AEC disclosed prominently the intended use of its reactor for medical research, particularly BNCT. (Sweet Request for Supplemental Findings, No. 1)
- The AEC, in the licensing process, received reports and made findings which establish its awareness that the MIT reactor was to be used for "neutron beam therapy experiments" and would include a "medical therapy radiation facility." (Id., nos. 2-6)

- The license issued by the AEC for the MIT reactor recited that "[e]xperimental facilities are provided for use in ... neutron beam therapy experiments" — apparently an explicit reference to BNCT. (Id., No. 7)
- MITR-I was specially constructed with a surgical operating room on the premises, directly beneath the reactor. (*Heinrich* Complaint, ¶56)

Use of the MIT reactor for experimental medicine, in other words, was not something the parties forgot about, or overlooked, or failed to anticipate, when they entered into the indemnity agreement. Given this fact and the facially broad definition of "nuclear incident," the failure to exempt medical applications explicitly in the indemnity agreement is striking — unless, of course, the intent was to make the agreement's coverage as broad as the record shows Congress intended it should be.

6. Caselaw Supports Application Of Price-Anderson To Medical Use Of A Reactor.

The Court has the benefit of several reported decisions that bear on Price-Anderson's application to medical uses of a reactor, beginning with Judge Young's thoughtful opinion in the private-party litigation that brings the parties to this Court. Heinrich v. Sweet, 62 F. Supp. 2d 282 (D. Mass. 1999) (referred to by the judge and counsel in that case as "Heinrich III").[17]

While the issue of indemnity *per se* was not before Judge Young, he *did* have to decide what law applied to the case of each plaintiff, two of whom received their BNCT in Massachusetts and two in New York. Because the case was originally filed in the Eastern District of New York, and because the transfer from that court to the District of Massachusetts was permissive under 28 U.S.C. §1404(b) rather than mandatory under §1406(a), Judge Young initially held that the law of

[17]There ultimately were five reported decision, all under the name of Heinrich v. Sweet. They are: 44 F. Supp. 2d 408 (1999); 49 F. Supp. 2d 27 (1999); 62 F. Supp. 2d 282 (1999); 83 F. Supp. 2d 214 (2000); and 118 F. Supp. 2d 73 (2000).

the transferor forum (New York) applied to all claims, and ordered further briefing on New York limitations rules. Heinrich v. Sweet, 49 F. Supp. 2d 27, 33-36 (D. Mass. 1999) (Heinrich II).

Judge Young subsequently reconsidered this holding, however, in light of Price-Anderson's dictate that in a "'public liability action,' ... the substantive rules for decision ... shall be derived from the law of the State in which the nuclear incident occurs, unless such law is inconsistent with the provisions of [42 U.S.C. §2210]." 42 U.S.C. §2014(hh). *If* this was a suit for public liability — i.e., if it arose out of a "nuclear incident" (see 42 U.S.C. §2014(w) and (hh)), then the claims of two plaintiffs — Heinrich and Sienkewicz — were governed by the law of Massachusetts, where they received their BNCT; the other two (Mayne and Van Dyke) were governed by the law of New York, where they received theirs. If the case was *not* covered by Price-Anderson, the usual rules governing choice of law in a transferred action would apply.

To resolve the choice-of-law issue, therefore, Judge Young first had to determine whether or not Price-Anderson applied to the case. He held that it did, while noting that he was acting on "a preliminary record" and that his ruling was

> intended in no way to bind any subsequent tribunal faced with determining whether the United States in fact must indemnify a judgment rendered against the private defendants. Instead, the Court is simply treating the issue as one of threshold importance: does an indemnification agreement exist between the United States and the various private defendants that presumptively applies to the challenged conduct in this litigation? If so, the Act will apply in this case, regardless of whether or not the indemnification agreement is later interpreted to reach the conduct of the private defendants.
>
> With that proviso in mind, the Court rules that the challenged conduct in the instant litigation (with the exception of the alleged boron injections ...) is subject to an indemnification agreement with the United States.

Heinrich III, 62 F. Supp. 2d at 298.

The district court's ruling, whether or not binding on this Court (see pp. 26-27 below), is at least highly persuasive in that (a) it dealt with the facts of this case on a record which, while

"preliminary," was nonetheless thoroughly developed on the facts that matter, and (b) the court thoughtfully addressed, and rejected, the arguments now asserted by the United States against indemnification. It did so, moreover, in a vigorously adversarial context: the plaintiffs, at that stage of the litigation, were arguing forcefully that Price-Anderson did not apply. In particular, the plaintiffs argued, as the United States does here, "that 'nuclear incident' should only be interpreted to mean an unintended escape or release of nuclear energy." 62 F. Supp. 2d at 297.

In rejecting this argument, Judge Young cited four cases brought by or on behalf of employees or contractors, who alleged occupational exposure to radiation in the course of their work at nuclear power plants. Id., citing Day v. NLO, Inc., 851 F. Supp. 869, 876 (S.D. Ohio 1994) (Price-Anderson applies because "the Plaintiffs' intentional tort and negligence claims both arise from their alleged exposure to dangerous levels of radiation"); Sawyer v. Commonwealth Edison Co., 847 F. Supp. 96, 99-100 (N.D. Ill. 1994) (Act applies to claim for injuries resulting from alleged ongoing occupational exposure); Coley v. Commonwealth Edison Co., 768 F. Supp. 625 (N.D. Ill. 1991) (same); Building and Constr. Trades Dep't v. Rockwell Int'l, 756 F. Supp. 492, 494 (D. Colo. 1991), *aff'd,* 7 F.3d 1487 (10th Cir. 1993) (Act applies to intentional and negligent tort claims related to occupational exposure).

Also persuasive to Judge Young was Gilberg v. Stepan Co., 24 F. Supp. 2d 325 (D.N.J. 1998). There, the plaintiff alleged that his property was contaminated by a chemical plant that processed thorium, a radioactive metal used in the defendant's manufacture of iridescent gas mantles. The Gilberg court held that Price-Anderson did not apply to the facts before it, since the torts alleged did not involve a licensed reactor that was subject to an indemnity agreement with the United States -- the touchstone of Price-Anderson coverage.

> To summarize, Price-Anderson sweeps broadly to include any claim alleging "public liability;" that is, "any legal liability arising out of or resulting from a nuclear incident." [42 U.S.C.] §2014(w). For there to be a nuclear incident, however, there must be an

> "occurrence," and an occurrence under the Act can only be an "event ... [at] 'the location' or 'the contract location' as defined in the applicable ... indemnity agreement, entered into pursuant to section 2210." [42 U.S.C.] §2014(j) & (q). No such agreement covers the Maywood chemical tailings.

24 F. Supp. 2d at 345-46. In the course of a lengthy discussion of Price-Anderson and its implications (procedural and preemptive) for private-party litigation, the Gilberg court considered and rejected the argument that Price-Anderson applies only to the "unintended escape or release of nuclear energy."

> Price-Anderson ... neither requires that a nuclear source be used as intended nor requires that the escape or release of nuclear material be unintended. What Price-Anderson does require is that the escape or release occur in connection with indemnified activity.

Id. at 340. The court reached this conclusion based on the language of the statute, which contains no "unintentionality" requirement, and its legislative history — specifically, the fact that Congress in 1957 explicitly considered and rejected an exclusion for willfully caused releases. Id. at 335 & n. 9, 339-40, 345-46; see pp. 14-15, *supra.*

Both Heinrich III and Gilberg considered and rejected the Price-Anderson analysis of In re Cincinnati Radiation Litigation, 874 F. Supp. 796 (S.D. Ohio 1995), discussed at page 35 of the United States' brief. In Cincinnati, the plaintiffs alleged that cancer patients at Cincinnati General Hospital were exposed, without their knowledge or consent, to high doses of radiation in order to study the likely effects of radiation on military personnel in the event of a nuclear attack. The court rejected the plaintiffs' count asserting an implied cause of action under Price-Anderson, holding that the Act did not apply to the facts of the case. A "nuclear incident," it held, occurs only when there is an "unintended escape or release of nuclear energy." 874 F. Supp. at 832.[18]

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[18]The Cincinnati court was also influenced by Congress's rejection, in 1988, of an amendment that would have extended the Act's indemnity provisions to "persons operating hospital pharmacies of hospital medicine department[s]," in addition to persons operating licensed reactors. Id. at 832 & n.33. This it saw as proof that "Price-Anderson was never intended to

If the Cincinnati court's analysis were correct, the United States' motion in this case would have merit. As Gilberg pointed out, however, the Cincinnati court, in straying from the clear language of the statute, managed to "reach[] the correct result ... for the wrong reasons." The result was correct, not because Price-Anderson excludes intended releases, or nuclear medicine — both the statutory language and the legislative history say otherwise — but because Cincinnati did not involve "indemnified activity," i.e., the use of a licensed reactor that was the subject of an indemnity agreement with the United States. 24 F. Supp. 2d at 340.

Heinrich, however, is the case that Cincinnati was not: a nuclear incident resulting from the medical use of a licensed reactor which had a Price-Anderson indemnity agreement in place.

The government's obfuscatory efforts notwithstanding, this is at bottom a simple case. The statutory and contract definitions of "nuclear incident" are unambiguous, and they reach the facts of the case. There is no evidence that Congress meant to exclude medical or other intended uses of reactors from Price-Anderson indemnity; indeed, there is ample evidence to the contrary. The statute and the agreement mean what they say and say what they mean, and should be given effect.

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create a federal claim for the contained application of nuclear medicine." Id. This, however, is, a red herring, as the Gilberg court recognized. In rejecting the proposal to extend Price-Anderson's financial protection requirements to licenses for radiopharmaceuticals, Congress noted that the NRC already had discretion to subject such licenses to the requirements of the Act, but had not. It directed the agency to reconsider this decision through a negotiated rulemaking proceeding. The NRC did so, and again declined to extend the Act to hospital pharmacies. Nothing in the legislative history, however, suggests that Congress intended to create a *new* exclusion for medical use of licensed, financially-protected reactors — not hospitals — whose licensing scheme already placed them within the Price-Anderson system. Id. See Gilberg at 340.

7. Judge Young's Finding That Price-Anderson Applies To The *Heinrich* Case Is Dispositive Of Whether A Nuclear Incident Occurred, And May Not Be Collaterally Attacked In This Court.

Finally, there is what is actually a threshold matter: Judge Young's decision in Heinrich III may not have settled *every* issue relating to indemnity[19] (as the judge's own disclaimer makes clear), but it *did* settle an important issue: that BNCT, conducted at a licensed nuclear reactor, constitutes a "nuclear incident."

This was a determination which the Price-Anderson scheme assigned to the district court. The 1988 amendments to Price-Anderson created a new species of civil action, arising under federal law and called a "public liability action":

> The term "public liability action," as used in section 2210 of this title, means any suit asserting public liability. A public liability action shall be deemed to be an action arising under section 2210 of this title, and the substantive rules for decision in such action shall be derived from the law of the State in which the nuclear incident involved occurs, unless such law is inconsistent with the provisions of such section.

42 U.S.C. §2014(hh).

Price-Anderson, as amended, thus confers "arising under" jurisdiction on a district court, *and* specifies the law to be applied, in suits "asserting public liability." This means "legal liability *arising out of a nuclear incident.*" (42 U.S.C. §2014(w)) (emphasis supplied). Judge Young needed to decide whether there had been a "nuclear incident" in order to determine the applicable law. He ruled that the *Heinrich* plaintiffs' BNCT constituted a "nuclear incident" subject to the MIT indemnity agreement, and that Price-Anderson therefore applied. Heinrich III, 62 F. Supp. 2d at 297-98.

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[19]For example, Heinrich III left unsettled whether indemnity extends to defense costs.

A district court, of course, has jurisdiction to determine its own subject matter jurisdiction, United States v. United Mine Workers, 330 U.S. 258, 290-92 & n. 57 (1947), and to determine the law applicable in a case before it. By the 1988 amendments, and specifically by making federal jurisdiction and choice of law dependent on whether a case was "a suit asserting public liability" — i.e., asserting "legal liability arising out of a nuclear incident" — Congress committed to the district court the task of determining whether a "nuclear incident" occurred.

The United States was a party to the *Heinrich* case. Under familiar principles of collateral estoppel and res judicata, therefore, it is bound by Judge Young's finding that there was a "nuclear incident" (to which, so far as appears, it made no objection at the time). See Federated Dep't Stores, Inc. v. Moitie, 452 U.S. 394, 398 (1981) ("[a] judgment merely voidable because based upon an erroneous view of the law is not open to collateral attack, but can be corrected only by a direct review and not by bringing another action"). Its assertion before this Court that there was *no* "nuclear incident" is an impermissible collateral attack on the contrary finding in *Heinrich*, and should be rejected for this reason — as well as because it is wrong on the merits.

II. Under The Price-Anderson Act, The United States Is Obligated To Indemnify Dr. Sweet For His Attorneys' Fees And Costs Of Defense.

Even if the *Heinrich* case arises out of a "nuclear incident," the United States argues, Dr. Sweet's attorneys' fees and other costs of defense in the *Heinrich* case are not indemnified because of the tortured history of Price-Anderson on this subject. The applicable subsection is section 170k(1) of the Atomic Energy Act, codified at 42 U.S.C. §2210(k) ("Exemption from financial protection requirement for nonprofit educational institutions"). Presently, the subsection provides:

> The Commission shall agree to indemnify and hold harmless the licensee and all other persons indemnified, as their interests may appear, from public liability in excess of $250,000 arising from nuclear incidents. The aggregate indemnity for all persons indemnified in connection with each nuclear incident shall not

> exceed $500,000,000, including such legal costs of the licensee as are approved by the Commission.

The history of this subsection is as follows:

1. The original 1957 enactment directed the AEC to enter into contracts for indemnity with all reactor licensees, without distinguishing between nonprofits and others. Licensees were to "maintain financial protection" (i.e., private liability insurance) in an amount determined by the AEC. Indemnity agreements were to

> indemnify the persons indemnified against claims above the amount of the financial protection required, in the amount of $500,000,000 including the reasonable costs of investigating and settling claims and defending suits for damage in the aggregate for all persons indemnified in connection with such contract and for each nuclear occurrence.

P.L. 85-256 §4(d), 1957 U.S. CODE CONG. & ADMIN. NEWS 629, 631; see also §4(e).

2. In 1958, Congress added a new subsection (Atomic Energy Act §170k, 42 U.S.C. §2210(k)), in order to exempt universities from the financial protection requirements applicable to for-profits. The pertinent portion, subsection (1), read as follows:

> [T]he Commission shall agree to indemnify and hold harmless the licensee and other persons indemnified, as their interests may appear, from any public liability in excess of $250,000 arising from nuclear incidents. The aggregate indemnity for all persons indemnified in connection with each nuclear incident shall not exceed $500,000,000, *including the reasonable cost of investigating and settling claims and defending suits for damage.*

P.L. 85-743, 72 Stat. 837 (emphasis supplied).

3. In 1975, Congress passed the "Hathaway Amendment" to Price-Anderson. In each reference to costs of defense — including that in section 170k (42 U.S.C. §2210(k)) — the amendment substituted the word "excluding" for the words "including the reasonable." Now, the United States' indemnity obligation was $560,000,000 (an increased ceiling), "*excluding* costs of investigating and settling claims and defending suits for damage." (Emphasis supplied.) The

amendment was silent as to its effective date, or whether it was meant to apply retroactively. P.L. 94-197, 89 Stat. 1111 (1975).

4. In 1988, as discussed above, Congress again amended Price-Anderson extensively. Among many other changes, the amendments affected section 170k

> by striking "excluding cost of investigating and settling claims and defending suits for damage" in paragraph (1) and inserting "including such legal costs of the licensee as are approved by the Commission."

P.L. 100-408, 102 Stat. 1066ff., section 8. "Legal costs" was elsewhere defined to include the cost of defending public liability actions. Id., section 11(d)(2) (amending 42 U.S.C. §2014(jj)). Finally — and here, according to the government, is the rub — the 1988 amendments (with the exception of those in section 11) were to "become effective on the date of enactment of this Act *and shall be applicable to nuclear incidents occurring on or after such date.*" Id., section 20 (emphasis supplied).

According to the United States, then, defense costs arising out of a 1961 nuclear incident were indemnified until 1975, when Congress took indemnity away. When it restored indemnity in 1988, Congress did so only prospectively, for future nuclear incidents. Therefore, 1990s defense costs arising from a 1961 nuclear incident are not indemnified, even though they would have been had the claim been brought and defended prior to 1975.

The flaw in this argument is the lack of any indication that Congress meant, in 1975, to take away indemnity rights pertaining to nuclear incidents *which had already occurred* (in this case, had occurred more than a decade earlier). The government's position is especially anomalous in view of the fact that Indemnity Agreement E-39 is in substance an "occurrence" policy, a species of

liability insurance covering losses arising from "occurrences" during the policy period.[20] The Agreement provides:

> The Commission agrees to indemnify and hold harmless the licensee and other persons indemnified, as their interests may appear, from the reasonable costs of investigating, settling and defending claims for public liability. (Art. III, ¶3)
>
> The obligations of the Commission under this agreement shall apply only with respect to nuclear incidents occurring during the term of this agreement. (Art. III, ¶5)
>
> Termination of the term of this agreement shall not affect any obligation of the licensee or any obligation of the Commission under this agreement with respect to any nuclear incident occurring under the term of this agreement. (Art. VII)

Amendments to an insurance policy, as a matter of basic contract law, apply prospectively: "The acceptance of an alteration or modification of the original contract, to be effective, must precede loss." R. Russ, et al., Couch on Insurance 3rd §25.8 at 25-9 (3d ed. 1999). This rule protects the expectations of the parties, and particularly the insured's reliance on coverage of a particular type and in a particular amount, against *post hoc* alterations, particularly in case of a loss which may already have occurred, but may not yet be known.

There is absolutely no indication that Congress, when it enacted the Hathaway Amendment in 1975, intended to depart from this well-settled principle of insurance law, or from the equally well-settled rule that statutes, like insurance policies, normally operate prospectively. As this Court has said, "it is well settled that statutes are presumed to operate prospectively unless express language in the statute provides otherwise." Ford v. United States, 33 Fed. Cl. 560, 565 (1995) (Robinson, J.), citing Bowen v. Georgetown University Hospital, 488 U.S. 204, 208-09 (1988)

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[20]The other major type of liability policy is the "claims made" policy, which covers claims made during the policy period. There are variations among occurrence and claims-made policies and even hybrids between the two. See generally R. Russ, et al., Couch on Insurance 3rd §102.20. (3d ed. 1999).

and United States v. Security Industrial Bank, 459 U.S. 70, 79-80 (1982). Where "nothing in the statute or legislative history suggests it was intended to be applied retroactively," therefore, a statute is to be applied prospectively. Id. *Accord,* People of the State of California ex rel. Department of Transportation v. United States, 27 Fed. Cl. 130, 138 (1992), *aff'd,* 11 F.3d 1071 (Fed. Cir. 1993) ("Because retroactivity is not favored in the law, congressional enactments and administrative rules will not be construed to have retroactive effect, absent specific mandatory language").

The United States' argument — that Congress intended by the Hathaway Amendment to legislate retroactively and abrogate existing contractual rights pertaining to a nuclear incident which had occurred fourteen years earlier — thus contravenes basic rules of contract and statutory construction. The government's motion for summary judgment as to defense costs should be denied, and the plaintiffs permitted to offer evidence of what those costs have been.

III. This Court Has Jurisdiction To Enter The Requested Declaratory Judgment.

The United States argues that this Court lacks jurisdiction over Dr. Sweet's and MIT's claims for declaratory relief. While it is certainly true that this Court does not have jurisdiction to issue a free-standing declaratory judgment, it *does* have authority to issue declaratory relief where such relief is "tied and subordinate to a monetary award." McKeel v. Islamic Republic of Iran, 722 F.2d 582, 591 (9th Cir. 1983), *cert. denied,* 469 U.S. 880 (1994); Alaska v. United States, 15 Cl. Ct. 276, 282-83 (1988); Ellis v. United States, 610 F.2d 760, 762 (Ct. Cl. 1979); Austin v. United States, 206 Ct. Cl. 719, 723, *cert. denied,* 423 U.S. 911 (1975).

In this case, Dr. Sweet seeks indemnity — i.e., a monetary award — first and foremost. He seeks as well a declaration that the United States is obligated to indemnify him from future

liability in cases arising out of the MIT or Brookhaven BNCT trials. Such relief is "tied and subordinate to [the] monetary award" that Dr. Sweet primarily seeks, because:

- The *Heinrich* case is on appeal. The money judgment entered by the District Court could be affirmed, increased, or set aside, or the Court of Appeals could order a new trial. A declaration of the parties' rights under the indemnity agreement(s) enable the parties to know their rights and obligations when the dust finally settles in *Heinrich,* without requiring the Court to venture beyond the legal and factual issues presented by the monetary award.
- So long as *Heinrich* is subject to further proceedings, defense costs continue to accrue. These are not different in kind from those already accrued, so that here again, the Court can establish the parties' rights and obligations solely on the basis of legal and factual issues decided in connection with the damages claims.
- Dr. Sweet's interpretation of the MIT indemnity agreement is that the Heinrich and Sienkewicz claims against Dr. Sweet and MIT together constitute a "common occurrence," with a single $250,000 deductible and a single $500,000,000 cap on damages. See Indemnity Agreement E-39 (Sweet Cmplt. Ex. C), Art. I ¶2(b) and Art. III, ¶4(b). The Court will need to agree or disagree with this contract interpretation in order to compute the damages awarded on Dr. Sweet's and MIT's monetary claims. The Court's holding on this and other issues raised by the damage claims will have implications for any other plaintiffs who may come forward with claims related to the 1960-61 BNCT trials at MIT (for example, the *Joseph* case, see Sweet Cmplt. ¶18), whose claims would also arise out of the same "common occurrence." A declaration as to these matters, applicable to all claims arising out of the 1960-61 trials, will serve the cause of judicial economy

without requiring the Court to venture beyond the issues that are squarely before it on the damage claims. (The same is true of the Brookhaven trials and claimants.)

CONCLUSION

For the reasons stated, the government's Motion for Summary Judgment should be denied in its entirety.

By his attorneys,

Thomas P. Billings (BBO #043040)
SALLY & FITCH
225 Franklin Street
Boston, Massachusetts 02110
(617) 542-5542

Dated: April 5, 2001

CERTIFICATE OF SERVICE

I, Thomas P. Billings, hereby certify that on this date I served the within document by causing a copy to be delivered by first class mail, postage prepaid, to all counsel of record.

Thomas P. Billings

Dated: April 5, 2001

APPENDIX A

Definitions of "Person Indemnified," "Public Liability," and "Nuclear Incident" in the Price-Anderson Act (1961 and currently), AEC regulations, and Indemnity Agreement No. E-39

"Person Indemnified"

Price-Anderson (1961) [P.L. 85-256, sec. 3]	Price-Anderson (currently) [42 U.S.C. §2014(t)]	AEC regulations (1961) [26 F.R. 3457, reprinted in USA App. 6]	Indemnity Agreement E-39 [Article I, ¶4]
"Person indemnified" means the person with whom an indemnity agreement is executed and any other person who may be liable for public liability.	The term "person indemnified" means (1) with respect to a nuclear incident occurring within the United States or outside the United States as the term is used in section 2210(c) of this title, and with respect to any nuclear incident in connection with the design, development, construction, operation, repair, maintenance, or use of the nuclear ship Savannah, the person with whom an indemnity agreement is executed or who is required to maintain financial protection, and any other person who may be liable for public liability or (2) with respect to any other nuclear incident occurring outside the United States, the person with whom an indemnity agreement is executed and any other person who may be liable for public liability by reason of his activities under any contract with the Secretary of Energy or any project to which indemnification under the provisions of section 2210(d) of this title has been extended or under any subcontract, purchase order, or other agreement, of any tier, under any such contract or project.	"Person indemnified" means the licensee and any other person who may be liable for public liability.	"Person indemnified" means the licensee and any other person who may be liable for public liability.

"Public Liability"

Price-Anderson (1961) [P.L. 85-256, sec. 3, amended by P.L. 87-206, sec. 2]	Price-Anderson (currently) [42 U.S.C. §2014(w)]	AEC regulations (1961) [26 F.R. 3457, reprinted in USA App. 6; 27 F.R. 2885, reprinted in USA App. 13]	Indemnity Agreement E-39 [Article I, ¶5]
Until September 6, 1961) The term "public liability" means any legal liability arising out of or resulting from a nuclear incident, except claims under State or Federal Workmen's Compensation Acts of employees of persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs, and except for claims arising out of an act of war. "Public Liability" also includes damage to property of persons indemnified, *Provided*, That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs. *(On/after September 6, 1961)* The term "public liability" means any legal liability arising out of or resulting from a nuclear incident, except (i) claims under State or Federal workmen's compensation acts of employees of persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs; (ii) claims arising out of an act of war; and (iii) whenever used in subsections a., c., and k., claims for loss of, or damage to, or loss of use of property which is located at the site of and used in connection with the licensed activity where the nuclear incident occurs. "Public liability also includes damage to property of persons indemnified: *Provided,* That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs.	The term "public liability" means any legal liability arising out of or resulting from a nuclear incident or precautionary evacuation (including all reasonable additional costs incurred by a State, or a political subdivision of a State, in the course of responding to a nuclear incident or a precautionary evacuation), except: (i) claims under State or Federal workmen's compensation acts of employees of persons indemnified who are employed at the site of and in connection with the activity where the nuclear incident occurs; (ii) claims arising out of an act of war; and (iii) whenever used in subsections (a), (c), and (k) of section 2210 of this title, claims for loss of, or damage to, or loss of use of property which is located at the site of and used in connection with the licensed activity where the nuclear incident occurs. "Public liability" also includes damage to property of persons indemnified: Provided, That such property is covered under the terms of the financial protection required, except property which is located at the site of and used in connection with the activity where the nuclear incident occurs.	*Until September 6, 1961)* "Public liability" means any legal liability arising out of or resulting from a nuclear incident, except (1) claims under state or Federal workmen's compensation acts of employees of persons indemnified who are employed (a) at the location or, if the nuclear incident occurs in the course of transportation of the radioactive material, on the transporting vehicle, and (b) in connection with the licensee's possession, use, or transfer of the radioactive material; and (2) claims arising out of an act of war. *(On/after September 6, 1961)* Above, with the addition of: and (3) claims for loss of, or damage to, or loss of use of property which is located at the location and used in connection with the licensee's possession, use, or transfer of the radioactive material, and (b) if the nuclear incident occurs in the course of transportation of the radioactive material, the transporting vehicle, containers used in such transportation, and the radioactive material.	*(Until September 6, 1961)* "Public liability" means any legal liability arising out of or resulting from a nuclear incident, except (1) claims under state or Federal workmen's compensation acts of employees of persons indemnified who are employed (a) at the location or, if the nuclear incident occurs in the course of transportation of the radioactive material, on the transporting vehicle, and (b) in connection with the licensee's possession, use, or transfer of the radioactive material; and (2) claims arising out of an act of war. *(On/after September 6, 1961)* Above, with the addition of: and (3) claims for loss of, or damage to, or loss of use of property which is located at the location and used in connection with the licensee's possession, use, or transfer of the radioactive material, and (b) if the nuclear incident occurs in the course of transportation of the radioactive material, the transporting vehicle, containers used in such transportation, and the radioactive material.

"Nuclear Incident"

Price-Anderson (1961) [P.L. 85-256, sec. 3, amended by P.L. 85-602]	Price-Anderson (currently) [42 U.S.C. §2014(q)]	AEC regulations (1961) [26 F.R. 3457, reprinted in USA App. 6]	Indemnity Agreement E-39 [Article I, ¶2]
The term "nuclear incident" means any occurrence within the United States causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material: *Provided, however,* that as the term is used in subsection 170 l., it shall mean any occurrence outside of the United States rather than within the United States.	The term "nuclear incident" means any occurrence, including an extraordinary nuclear occurrence, within the United States causing, within or outside the United States, bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material: Provided, however, That as the term is used in section 2210(l) of this title, it shall include any such occurrence outside the United States: And provided further, That as the term is used in section 2210(d) of this title, it shall include any such occurrence outside the United States if such occurrence involves source, special nuclear, or byproduct material owned by, and used by or under contract with, the United States: And provided further, That as the term is used in section 2210(c) of this title, it shall include any such occurrence outside both the United States and any other nation if such occurrence arises out of or results from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material licensed pursuant to subchapters V, VI, VII, and IX of this division, which is used in connection with the operation of a licensed stationary production or utilization facility or which moves outside the territorial limits of the United States in transit from one person licensed by the Nuclear Regulatory Commission to another person licensed by the Nuclear Regulatory Commission.	3(a) "Nuclear incident" means any occurrence or series of occurrences at the location or in the course of transportation causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material. (b) Any occurrence or series of occurrences causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of i. The radioactive material discharged or dispersed from the location over a period of days, weeks, months or longer and also arising out of such properties of other material defined as "the radioactive material" in any other agreement or agreements entered into by the Commission under subsection 170 c or k of the Act and so discharged or dispersed from "the location" as defined in any such other agreement; or ii. The radioactive material in the course of transportation and also arising out of such properties of other material defined in any other agreement entered into by the Commission pursuant to subsection 170 c or k of the Act as "the radioactive material" and which is in the course of transportation shall be deemed to be a common occurrence. A common occurrence shall be deemed to constitute a single nuclear incident.	(a) "Nuclear incident" means any occurrence or series of occurrences at the location or in the course of transportation causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of the radioactive material. (b) Any occurrence or series of occurrences causing bodily injury, sickness, disease, or death, or loss of or damage to property, or loss of use of property, arising out of or resulting from the radioactive, toxic, explosive, or other hazardous properties of i. The radioactive material discharged or dispersed from the location over a period of days, weeks, months or longer and also arising out of such properties of other material defined as "the radioactive material" in any other agreement or agreements entered into by the Commission under subsection 170 c or k of the Act and so discharged or dispersed from "the location" as defined in any such other agreement; or ii. The radioactive material in the course of transportation and also arising out of such properties of other material defined in any other agreement entered into by the Commission pursuant to subsection 170 c or k of the Act as "the radioactive material" and which is in the course of transportation shall be deemed to be a common occurrence. A common occurrence shall be deemed to constitute a single nuclear incident.

UNITED STATES COURT OF FEDERAL CLAIMS

WILLIAM H. SWEET, M.D.,	)	
	)	
Plaintiff,	)	
	)	Case No. 00-274C
v.	)	
	)	
UNITED STATES OF AMERICA,	)	
	)	
Defendant.	)	
	)	

PLAINTIFF WILLIAM H. SWEET, M.D.'s STATEMENT OF GENUINE ISSUES AND SUPPLEMENTAL PROPOSED FINDINGS OF UNCONTROVERTED FACTS

I. Controverted Issues.

Plaintiff Sweet accepts the United States' Proposed Findings of Uncontroverted Facts with the following exception:

PROPOSED FINDING NO. 5:

The defendant's proposed finding is correct, with the clarification that (as stated in the defendant's Proposed Finding No. 14) the agreement had an effective date of June 9, 1958.

II. Supplemental Uncontroverted Facts.

Dr. Sweet respectfully submits the following proposed findings of fact, in addition to those proposed by the United States.

A. Contemplated Medical Use Of The MIT Reactor

PROPOSED SUPPLEMENTAL FINDING NO. 1

MIT's application to the Atomic Energy Commission stated in part:

> A facility is included in the MIT Reactor for irradiation of biological specimens, or patients. The main feature of this facility is a surgical operating room beneath the reactor. An opening in the concrete shielding allows a neutron and gamma ray beam to stream downward into the operating room. ... The neutron beam will be utilized in several different ways. Its most important use will be as a

thermal neutron source for studies of cancer treatment in human patients.

(Exhibit 8 from the *Heinrich* trial, submitted by MIT with its opposition to the defendant's motion for summary judgment)

PROPOSED SUPPLEMENTAL FINDING NO. 2

In January 1956, a Final Hazards Summary Report to the Commission's Advisory Committee on Reactor Safeguards stated that the proposed MIT reactor facilities will be used to perform many types of experiments including, "The development of neutron beam therapy as a method of treatment of cancer, and other medical research." (*Heinrich* Trial Exhibit 2, submitted by MIT).

PROPOSED SUPPLEMENTAL FINDING NO. 3

Prior to the issuance of the facility license to MIT, the Commission made Findings and Conclusions. The proposed findings and conclusions were posted in the Federal Register on April 4, 1958. (Submitted with MIT's opposition.)

PROPOSED SUPPLEMENTAL FINDING NO. 4

In its Findings and Conclusions, the Commission found that: "The reactor is to be used for the conduct of research. Experimental facilities are provided for use in neutron diffraction work, horizontal beam experiments, neutron beam therapy experiments, exponential assembly experiments, and neutron irradiation studies. ... The experimental facilities ... consist of horizontal ports ... and a medical therapy radiation facility." (Id.)

PROPOSED SUPPLEMENTAL FINDING NO. 5

Further, the Commission found, "MIT has submitted data describing the control and safety instrumentation and the administrative procedures relating to the use of the facility for neutron beam therapy experiments and medical therapy. The instrumentation and procedures appear to

provide adequate protection for the health and safety of the public and personnel participating in the use of the facility for these purposes." (Id.)

PROPOSED SUPPLEMENTAL FINDING NO. 6

On June 19, 1959, a task force from the Commission toured the MIT reactor with Dr. Sweet in connection with Commission contracts supporting his work. James F. Haggerty of the Commission's Medical Research Branch Division of Biology and Medicine reported to the Commission as follows:

> Dr. Sweet's work with boron in relation to brain tumor therapy has had some rough going. He has been pushing hard on the chemical side or boron containing organic compounds and Dr. Soloway brought us up to date on the compounds he has been working with. ... Dr. Sweet took us through the MIT reactor which has a medical port at the base of the reactor. We detected considerable disappointment with respect to ultimate functioning of the port for Dr. Sweet indicated it would be several months before he could treat his first patient in the reactor. Though the first patients will be brain tumor patients he mentioned he is thinking toward the possibility of irradiating the pituitary .... We completed our visit here with the feeling that this is an excellent research program and deserving of Commission support at the present level or possibly at an increased level.

(Trial Exhibit 36, submitted by MIT).

PROPOSED SUPPLEMENTAL FINDING NO. 7

The license issued by the AEC for the MIT reactor referred explicitly to its intended medical use, specifically for neutron capture therapy:

> The reactor is a one megawatt (thermal) heavy water-cooled and -moderated, heterogeneous, enriched uranium reactor. Experimental facilities are provided for use in neutron diffraction work, horizontal beam experiments, *neutron beam therapy experiments,* exponential assembly experiments, and neutron irradiation studies.

Sweet Cmplt. Ex. A, ¶2) (emphasis supplied).

PROPOSED SUPPLEMENTAL FINDING NO. 8

The MIT reactor, known as "MITR-I," is powered by uranium enriched in the isotope 235. It was constructed with facilities — including an operating room directly beneath the reactor — designed to facilitate its use in medical research and treatment. (Sweet Cmplt. ¶5 and Ex. D, ¶57)

B. Boron Neutron Capture Therapy and the *Heinrich* Case

PROPOSED SUPPLEMENTAL FINDING NO. 9

The theory of boron neutron capture therapy ("BNCT") is as follows. Boron-10, an isotope of the element boron that is neither radioactive nor (in the doses used) toxic to man, is injected into the blood supply to the brain. It is taken up selectively by, and concentrates in, tumor tissue. The brain is then subjected to a slow neutron beam generated by a nuclear reactor. Slow neutron radiation normally passes harmlessly through human tissue. When a neutron encounters a boron-10 atom, however, the boron-10 atom absorbs or "captures" the neutron and becomes boron-11, an unstable atom that then undergoes a high-energy fission reaction. The products of the reaction are highly destructive, but travel only ten microns (.0004 inches), about the width of a single cell. BNCT therefore offers the promise of delivering a deadly dose of radiation to tumor tissue, while sparing normal tissue. (Asbury, Ojemann, Nielsen and Sweet, "Neuropathic Study of Fourteen Cases of Malignant Brain Tumor Created by Boron-10 Slow Neutron Capture Radiation," JOURNAL OF NEUROPATHOLOGY AND EXPERIMENTAL NEUROLOGY, Vol. XXXI, No. 2 (April 1972) 278, 278-81 (attached as Exhibit A to the Affidavit of Barbara L. Drury, submitted herewith); Affidavit of John Bernard, Ph.D., submitted by MIT)

PROPOSED SUPPLEMENTAL FINDING NO. 10

The use of a nuclear reactor is an integral and necessary part of BNCT, since the reactor is the source of the neutron beam. According to the Heinrich complaint (Exhibit D to Dr. Sweet's complaint in this proceeding) :

> The procedure [as performed at Brookhaven] involved injection of a boron compound followed as quickly as possible by exposure to the neutron flux from the reactor. Each patient was lowered into a special room created by removing some of the shielding above the reactor. There was an aperture in the top of the reactor and the patient lay with his or her head placed over the aperture. The reactor was then powered up, which took 8-10 minutes (coinciding with Dr. Sweet's estimate of maximum boron concentration in the tumor) and the patient was irradiated for an indefinite period of time (30-40 minutes). Radiation was administered with the skull closed. (¶47)
>
> The experiments at MIT involved new surgery on each patient following their craniotomy and used the reactor at MIT which had been specifically designed by Dr. Sweet and MIT to include an operating room directly beneath the reactor. All patients had their skull reopened at the site of their previous craniotomy. They were then injected with the boron compound. What happened next was:
>
> > Following administration of the boron, the patient was elevated to the beam aperture by a hydraulic lift built into the floor. Once the patient was secured, everyone left the room and the built-in shutters were opened, allowing an intense beam of thermal neutrons to irradiate the open brain. The patients were irradiated for 45 min to 90 min for a total neutron fluence of 5×10^{12} to 2×10^{13} n/cm^3. (¶56; citation omitted)

PROPOSED SUPPLEMENTAL FINDING NO. 11

The neutron beam and the resulting effects (both therapeutic and destructive) of BNCT were produced by the "radioactive properties of the radioactive material," as those terms are used in the Price-Anderson Act. At MIT, the neutron beam used to initiate boron neutron capture therapy was generated from a radioactive isotope of uranium, Uranium-235, licensed to the MIT reactor by the Nuclear Regulatory Commission. The neutron beam produced by the MIT reactor is caused by the radioactive properties of the nuclear source material that the MIT reactor is licensed to hold and use originally by the Atomic Energy Commission and subsequently by the Nuclear regulatory Commission. Affidavit of John Bernard, Ph.D. (submitted by MIT), ¶¶25, 40.

PROPOSED SUPPLEMENTAL FINDING NO. 12

Of the *Heinrich* plaintiffs: Mayne and Van Dyke participated in separate BNCT trials at Brookhaven National Laboratory on Long Island in 1951 and 1957, respectively. Heinrich and Sienkewicz were part of a 1961 trial at MGH and MIT. In each case, the patient was injected with a boron compound and, shortly afterward, subjected to slow neutron radiation at a licensed nuclear reactor. All four patients died, between two and one-half and eleven and one-half months after their BNCT treatments. (Heinrich Complaint, Ex. D, ¶¶8-19)

PROPOSED SUPPLEMENTAL FINDING NO. 13

A retrospective study of the 1961 trial at MIT, published in 1972, noted that survival times approximated those of patients treated with the usual combination of surgery and conventional radiation. (Asbury, et al. (Drury Aff. Ex. A), p. 299)

PROPOSED SUPPLEMENTAL FINDING NO. 14

The Heinrich complaint alleges that all four patients were injured by the radiation they were given as part of their BNCT, and that radiation necrosis of the brain was the cause of death at least as to Heinrich and Sienkewicz:

> On the fourth day after irradiation, [Joseph] Mayne became lethargic and the lethargy rapidly increased thereafter. .... Following the experiment at Brookhaven, Mr. Mayne's condition became progressively worse. He was transferred from Brookhaven to his home and eventually to Chelsea Old Soldiers Home in Chelsea, Massachusetts, where he died on November 3, 1951. (¶14)
>
> At Brookhaven, on March 6, 1957, Walter Carmen Van Dyke was injected in the carotid artery with approximately 17.9 grams of pentoborate, containing approximately 3.1 grams of boron^{10}. Almost immediately thereafter he was laid on the top of an operating nuclear reactor and his head was placed inside the reactor where it was exposed to neutron radiation. This process is called BNCT. ... After the BNCT, Mr. Van Dyke never improved enough to be discharged. In fact, his deterioration increased steadily and he died on June 10, 1957. From and after the use of BNCT,

> Mr. Van Dyke had severe bouts of nausea and vomiting. There is no evidence of such conditions prior to the use of BNCT. (¶¶18-19)
>
> At the autopsy it was discovered that [George Heinrich] had no residual tumor but his brain showed "massive radiation necrosis with swelling; herniation of left hemisphere." The cause of death was "extensive radiation necrosis of brain" which was caused by the BNCT. (¶9)
>
> The cause of [Eileen Sienkewicz's] death was "extensive radiation necrosis of brain" which was caused by the BNCT. The BNCT also caused Mrs. Sienkewicz to suffer excruciating pain which she would not have suffered had she not been subjected to it. (¶12)
>
> (As to all patients in the MIT series) There was extensive radiation necrosis with attendant severe vascular damage ... consistent with radiation injury. (¶57)

PROPOSED SUPPLEMENTAL FINDING NO. 15

The Heinrich complaint asserted eleven theories of liability, as follows:

1. Violation of Constitutional and Civil Rights - *Bivens* Rule
2. Civil Fraud - Deceit
3. Intentional Infliction of Bodily Harm - Battery
4. Intentional Infliction of Emotional Distress
5. Strict Liability for Inherently Dangerous Activities
6. Personal Injury Caused by Exposure to Toxic Substances
7. Absence of Consent
8. Wrongful Death
9. Civil Responsibility for Crimes Against Humanity
10. Negligence
11. Negligent Misrepresentation

There was a claim against the United States under the Federal Tort Claims Act. (Sweet Cmplt., Ex. D)

PROPOSED SUPPLEMENTAL FINDING NO. 16

In a series of pretrial rulings, however, Chief Judge Young of the U.S. District Court for the District of Massachusetts whittled the case down to its essentials. Eight of the eleven counts were dismissed for failure to state a claim or on summary judgment; submitted to the jury were Counts 7 ("Absence of Consent"); 8 ("Wrongful Death"); and 10 ("Negligence"). Most significantly, Judge Young ruled that the Price-Anderson Act applied to the case, which was therefore governed by the law of the state in which the "nuclear incident" occurred. Mayne and Van Dyke were dismissed as time-barred because their BNCT occurred in New York, which has stricter tolling rules than Massachusetts. Heinrich v. Sweet, 62 F. Supp. 2d 282 (D. Mass. 1999).

PROPOSED SUPPLEMENTAL FINDING NO. 17

As the United States notes in its Proposed Finding No. 41, the jury in the *Heinrich* case found that Dr. Sweet was negligent. Judge Young likewise found that Dr. Sweet was negligent:

> While Dr. Sweet may have informed the Plaintiffs that the treatment was risky and uncertain, he failed to disclose that performing the experiments on human beings was *negligent.* This is what the jury found, and it is consistent.
>
> In short, there has to be evidence that Mass General had control or the right of control over Sweet's actual conduct which is alleged to be *negligent*, namely the radiation experiments.
>
> Thus, this Court rules that the evidence presented was more than sufficient for Mass General to be held liable for the *negligent* actions of Sweet.
>
> [H]is conduct with respect to the patients involved here was, as the jury found, *negligent.*
>
> Vicarious *negligence* on the part of Mass General ....

> [I]nformed consent has never operated as a defense to a claim of *negligence* in Massachusetts.
>
> [A] patient does not assume the risk that the physician, as Sweet did here, would administer the boron-neutron doses *negligently*, well after any hoped-for therapeutic value was manifestly absent. In short, the jury findings of *negligence* and informed consent are neither inconsistent nor mutually exclusive.
>
> Mass. General was thus *negligent* along with Sweet ....
>
> Here, by *negligently* persisting with boron injections ....
>
> The *negligent* harm done by Sweet ....

Heinrich v. Sweet, 118 F. Supp. 2d 73, 83, 84, 85, 90, 91, 92 (D. Mass. 2000) (emphasis supplied).

By his attorneys,

Thomas P. Billings (BBO #043040)
SALLY & FITCH
225 Franklin Street
Boston, Massachusetts 02110
(617) 542-5542

Dated: April 5, 2001

CERTIFICATE OF SERVICE

I, Thomas P. Billings, hereby certify that on this date I served the within document by causing a copy to be delivered by first class mail, postage prepaid, to all counsel of record.

Thomas P. Billings

Dated: April 5, 2001

UNITED STATES COURT OF FEDERAL CLAIMS

WILLIAM H. SWEET, M.D., Plaintiff, v. UNITED STATES OF AMERICA, Defendant.	Case No. 00-274C

AFFIDAVIT OF BARBARA L. DRURY

Barbara L. Drury, being duly sworn, hereby deposes and says:

1. I am a paralegal with the Boston, Massachusetts law firm of Sally & Fitch.

2. On April 2, 2001 I went to the Sackler Library of the Tufts University medical School in Boston, to obtain a copy of the following journal article: Asbury, Ojemann, Nielsen and Sweet, "Neuropathic Study of Fourteen Cases of Malignant Brain Tumor Created by Boron-10 Slow Neutron Capture Radiation," JOURNAL OF NEUROPATHOLOGY AND EXPERIMENTAL NEUROLOGY, Vol. XXXI, No. 2 (April 1972) 278.

3. I located the Journal of Neuropathology and Experimental Neurology in the library's collection, and copied the article from Volume XXXI.

4. Exhibit A hereto is a true and correct copy of the Asbury, et al. article.

Signed under the pains and penalties of perjury this 5th day of April, 2001.

Barbara L. Drury

Barbara L. Drury

EXHIBIT
A

NEUROPATHOLOGIC STUDY OF FOURTEEN CASES OF MALIGNANT BRAIN TUMOR TREATED BY BORON-10 SLOW NEUTRON CAPTURE RADIATION*

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ROBERT G. OJEMANN, M.D.,
SURL L. NIELSEN, M.D.‡,
AND
WILLIAM H. SWEET, M.D., D.Sc.
(*Boston, Mass.*)

INTRODUCTION

Between 1951 and 1961 a systematic attempt to utilize the special advantage of boron 10-slow neutron capture radiation to treat primary malignant brain tumors was made at the Massachusetts General Hospital and at Brookhaven National Laboratories (1–6). Clinical experience at these two institutions has been reported previously (7-9). No patients have been radiated for brain tumor by this technique since 1961 because the method as utilized offered no advantage over standard methods of therapy already available.

The present communication is a neuropathologic study of fourteen brains from the series of patients at the Massachusetts General Hospital who were irradiated at the Massachusetts Institute of Technology nuclear reactor between 1959 and 1961. In addition to standard neuropathologic study of these brains, a topographic analysis of tissue change was carried out in relation to local neutron flux. It is uncertain how closely neutron flux corresponds to actual local tissue dosage of radiation because the exact boron-10 levels at each site are not known. With this qualification in mind, neutron flux is taken as a first approximation of radiation dose.

Historical Background

Theoretical and experimental work on the possible utilization of boron-slow neutron capture therapy in the treatment of brain tumors has been summarized in a number of previous reports (1–5, 7–10). While the possibility of treating neoplasms by the technique of neutron capture radiation was realized as early as 1936, it was not until 1951 that the use of a boron-neutron interaction was suggested for the treatment of brain tumors (11).

The rationale for this type of therapy rests upon the fact that two distinct moieties, boron-10 and thermal neutrons, each innocuous by itself in the doses used, interact to pro-

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Supported in part by U.S.P.H.S. Training Grant NS 05393 and A.E.C. contract AT (30-1)-1093.

* Presented in part at the 40th annual meeting of the American Association of Neuropathologists, Atlantic City, New Jersey, June 13–14, 1964.

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...a high energy nuclear reaction with the resulting fragments sharing between them 2.4 million electron volts (Mev):

$$^{10}_{5}B + ^{1}_{0}n \rightarrow [^{11}_{5}B] \rightarrow ^{7}_{3}Li + ^{4}_{2}He + 2.4\ Mev$$

The mass and the charges of the particles evolved in this fission (despite their enormous energy) preclude their travel for more than a short distance, therefore, the radiation injury is confined to that distance, a radius of roughly ten microns from the site of the capture reaction (Fig. 1). The requirement of two components, boron-10 and thermal neutrons, to produce this destructive radiation and the short range of the emitted particles are attractive features possessed by no other current form of radiation therapy. Neutron capture offers the potential advantage of delivering a much higher radiation dose selectively to tumor cells if they contain large concentrations of boron-10.

The utilization of boron compounds in the treatment of cancer has revolved about the unique nuclear property of the nonradioactive boron-10 isotope to absorb thermal neutrons. The two boron isotopes, ^{10}B and ^{11}B, differ greatly in this property. Whereas ^{11}B, with a normal abundance of 80.4 per cent, has a capture cross section for thermal neutrons of 0.05 barns, boron-10, with an abundance of 19.6 per cent, has a capture cross section of 3850 barns. It

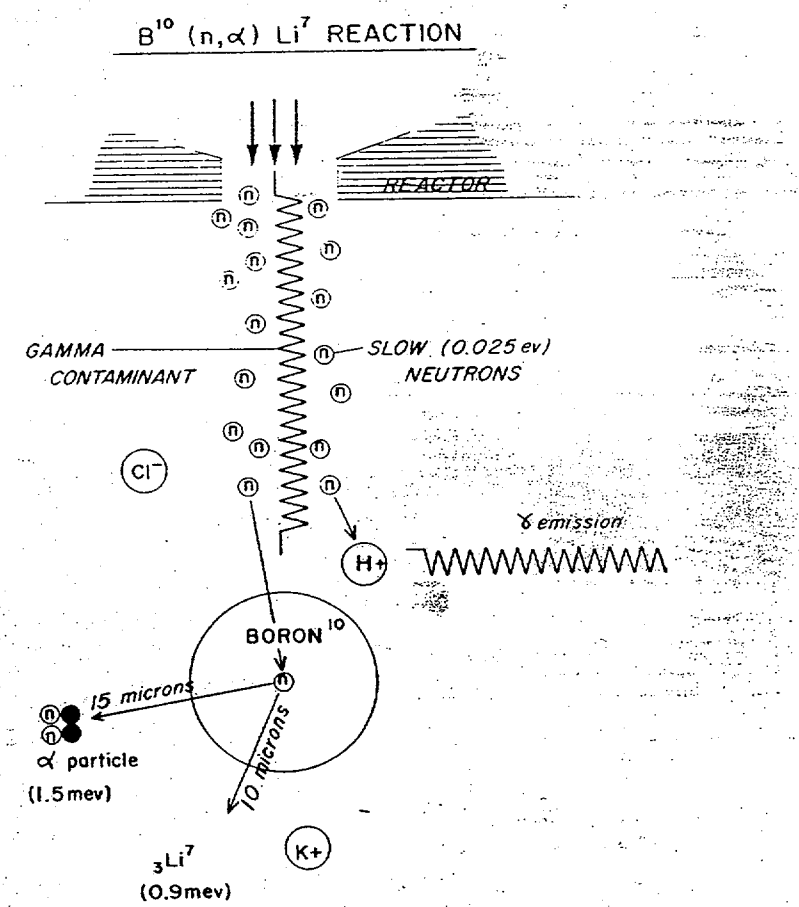


FIG. 1. Schematic diagram of nuclear and radiational events during boron 10-slow neutron capture radiation.

TABLE I

Clinical Data

Case no.	Age	Sex	Tumor type	Location	Onset to 1st op. (mos.)	1st Op. to neut. Rx (mos.)	Course prior to neut. Rx	Boron dose† mg/kg	Route	Neutron flux at brain surface ($\times 10^{12}$/cm²)	Radiation time in minutes	Course after neutron Rx	Neutron Rx to death (mos.)	Onset to death (dur. of illness, mos.)	Other rad.
1	14	M	Astrocytoma low grade	Right cerebellar hemisphere	1½	10	2 prior resections, still functioning	20	IV	1.0	15	Obtunded, febrile, CSF fistula	1½	13	2000 r/port × 3 ports
2	51	F	Glioblastoma	Right frontal lobe	6	12	Did well for first year, then rapid decline	15	IV	1.4	75	Rapidly declining course continued	2	20	None
3	20	F	Amelanotic melanoma	Right temporal lobe	5	3	Headache & diplopia the major problems	21	IV	2.0	90	Headache mainly, until final months, then rapid decline	1	12	L-phenylalanine mustard 1 mo. prior to death
4	35	M	Glioblastoma	Left temporal lobe	6	3	Mainly incr. pressure symptoms, even after 2 craniotomies	25	IV	1.1	15	Sank into stupor after 4 weeks & remained so	1	13	1000 r
5	64	M	Glioblastoma	Left frontal lobe	5	1	Rapidly progressive hemiparesis from outset	26	IV	3.3	105	Continued decline	4	10	None
6	48	F	Glioblastoma	Right parietal lobe	2	1	Progressive hemiplegia & mental defect	31	IV	3.3	105	Sank into coma & remained so	5	8	None
7	14	M	Medulloblastoma	Posterior fossa	4	1	Increased pressure, papilledema & ataxia	30	IV	1.3	90	Normal for 4 mos. Then progressive cervical myelopathy	7	12	2600 r in final mo. of life
8	39	F	Glioblastoma	Left parietal lobe	1	5½	Headache, seizures & inc. aphasia	20	IV	1.5	45	Relatively intact for 10 mos. Then rapid decline	11½	18	None
9	18	F	Glioblastoma	Left frontal lobe	1	¾	Rapidly progressive impairment	30*	IC	2.5	60	Comatose in 2 weeks & remained so	2½	4	None
10	59	F	Glioblastoma	Left temporo-parietal lobe	27	2	Rare seizure & mild aphasia with slow acceleration in course	30	IV	2.6	75	Slow decline continued until final weeks	6	35	None
11	34	M	Glioblastoma†	Left frontal lobe	81	20	Occasional seizure for 7 years, then accelerating course with operations	30	IV	1.9	60	Accelerating course with seizures, aphasia and stupor	1	108	5000 r and L-phenylalanine mustard
12	57	M	Glioblastoma	Right parieto-occipital lobe	12	1	Gradually accelerating non-dominant parietal syndrome	30	IV	1.8	60	Immediate course unchanged (rest unknown)	7	20	None
13	24	F	Glioblastoma	Left parietal lobe	½	¾	Weak right arm with focal seizures only	30*	IC	2.0	30	Comatose with increased pressure	¼	1½	None
14	45	M	Glioblastoma	Left temporal lobe	1	½	Rapidly progressive aphasia and torpor	30	IV	2.8	60	Unimproved. Died of bacterial meningitis	2	3½	None

was on the basis of this unusual property that the use of boron-10 and other nuclides with high capture cross section was proposed as a means of selectively destroying brain tumors. Capture cross section refers to the apparent area presented by an atom for thermal neutrons and is expressed in barns, whereby 1 barn is defined as being equal to 1×10^{-24} cm^2.

The feasibility of this procedure is also based upon the fact that normal elements of tissue have low capture cross-section values for thermal neutrons H = 0.32, C = 0.0045, O = 0.001, N = 1.7, Na = 0.45, K = 2.05 and Cl = 32.5 barns (5). While the cross section values are small by comparison with boron-10, these atoms are present in such large concentration that their absorption of neutrons does contribute to the total radiation dose. The two major sources of such radiation are from the hydrogen and nitrogen atoms:

$$^{1}_{1}\mathrm{H} + {}^{1}_{0}\mathrm{n} \rightarrow [{}^{2}_{1}\mathrm{H}] \rightarrow {}^{2}_{1}\mathrm{H} + \gamma$$

$$^{14}_{7}\mathrm{N} + {}^{1}_{0}\mathrm{n} \rightarrow [{}^{15}_{7}\mathrm{N}] \rightarrow {}^{1}_{1}\mathrm{P}^{+} + {}^{14}_{6}\mathrm{C}$$

However, with a boron-10 concentration in the tumor of 50 mg/kg of tissue and a neutron flux of 1.25×10^9 neutrons/cm^2/sec, 86 per cent of the total radiation dose would result from the boron-10 capture reaction. Thus, the destructive radiation would predominate in those areas having high boron-10 concentrations (8). Thermal neutrons themselves are sub-ionizing since they carry a charge of 0.024 electron volts. No appreciable effect from direct thermal neutron radiation has been reported (3).

In 1954 Farr, Sweet and co-workers (2) reported the results of treatment in a series of patients with glioblastoma multiforme at the nuclear reactor at the Brookhaven National Laboratory. After intravenous administration of a boron-10 compound, irradiation of the tumor was carried out through intact scalp. Ten patients received a total of 21 treatments. Both by clinical and pathological criteria (6) the radiation had a negligible effect on tumor and brain, with the exception of the first patient in whom massive necrosis of the temporal lobe tumor might have been partially a radiation effect. It did suggest to us the advisability of considering suction removal of tissue debris some weeks after treatment. However, radiation had a devastating effect on the overlying scalp. The reason for this differential effect between scalp and deeper-lying tumor was the high neutron flux in the superficial tissue, combined with a high concentration of boron.

Review of Clinical Aspects of the Present Series

A total of 18 patients received 19 irradiations. Table I summarizes the clinical and radiational details. The preradiation diagnosis in all patients with a supratentorial tumor was glioblastoma multiforme, although one of these was subsequently shown to be an amelanotic melanoma. Two posterior fossa tumors were treated, one a medulloblastoma and the other an astrocytoma, Grade II. In all cases a craniotomy was performed sometime prior to the irradiation to establish the diagnosis and to resect as much gross tumor mass as possible. An interval of at least 3 weeks was then allowed for the blood-brain barrier in the surrounding normal tissue to reconstitute (12). Each patient was then taken to the operating room beneath the MIT reactor and the craniotomy wound reopened with reflection of scalp, bone, and dura. The surrounding scalp was protected with boron-free plastic and small bags containing lithium fluoride; an air-filled balloon was placed in the operative cavity to keep normal brain from collapsing into the wound. Continuous suction kept the cavity dry. Fine gold wires (5–6 cm. in length) and small gold foils were then placed on the surface of the dura and brain and within its substance, and the position of each was recorded. After these preliminary preparations a lithium fluoride collimator was attached over the operative area. Following radiation the gold wires and foils were removed and the neutron flux in the area was determined from the neutron activation of the gold.

Sixteen patients were given an intravenous injection of paracarboxybenzene boronic acid containing boron-10 and two patients received sodium perhydrodecaborate via intracarotid injection. These two compounds were selected after testing of numerous boron compounds for their ability to localize in mouse glioma tumors, their toxicity, and, finally, their selec-

tive uptake by malignant human brain tumors. Previous reports have summarized these investigations (8, 13, 14).

METHODS

Brains were fixed by immersion in 10% formalin, although in several instances specimens were received from other institutions already fixed. When the brains were sectioned, an attempt was made to cut them in the same planes in which the fine gold wires had been placed during neutron exposure. Large blocks, usually hemispheral in size, were embedded in celloidin, cut at 12 to 18 microns, and stained with hematoxylin and eosin, cresyl violet, and Lovez method for myelin. Where indicated, smaller tissue blocks were made for frozen sections, and stained for astrocytes by the Cajal gold sublimate method, for axons by the Cajal silver technique, for sudanophilic lipids using Scharlach R, and for glial fibrils by the Holzer method. Selected celloidin sections were stained with phosphotungstic acid-hematoxylin, with the silver method of Foot for reticulin, with the Verhoeff-van Giesen stain for elastic tissue, with periodic acid-Schiff reagent for aldehyde groups, and with Congo red for amyloid.

Topographic analysis of neutron flux was carried out in the following manner. Neutron flux in different areas and at specific tissue depths was calculated after measurement of the activation of the gold wires and foils. Points of known neutron flux were plotted directly on hemispheral microscopic sections which were intentionally cut in the planes in which the gold wires and foils had been placed at craniotomy (see Review of Clinical Aspects for details). Allowance was made arbitrarily for 15% shrinkage of tissue during preparation.

As control material, four cases of glioblastoma multiforme, either untreated or treated by partial surgical excision only, were comparably processed and surveyed. In addition, one of us (AKA) examined the pathologic material from twenty cases of intracranial neoplasm treated by boron-10 neutron capture through the intact scalp; these cases were reported in 1962 by Farr et al (9). An extensive series of "control" glioma specimens prepared at the Warren Anatomical Museum was surveyed at the same time.

RESULTS

Clinical Features

Pertinent facts concerning the course of each patient are listed in Table I. Eleven of the fourteen patients had a malignant glioma (glioblastoma multiforme) by all criteria. Each had had one or more previous craniotomies, at which the tissue diagnosis was established. In case three, whose tumor type is listed as an amelanotic melanoma, the clinical diagnosis was believed to be malignant glioma until late in the course of the illness when the true nature of the tumor became evident. The primary source was never determined. Single cases of medulloblastoma (case 7), and of grade II astrocytoma (case 1), both posterior fossa neoplasms, were also radiated.

All of the patients were dead within a year after neutron capture treatment, and eleven of the fourteen were dead after six months. The clinical course was generally well-advanced when this therapy was undertaken. In every instance, the cause of death at post mortem examination was cerebral in nature, specifically extensive radiation necrosis of brain in nine (cases 4–10, 12 & 13), and a combination of extensive tumor infiltration and radiation necrosis in one (case 11), recurrent tumor in two (cases 2 & 3), massive intracranial hemorrhage in one (case 1), and acute bacterial meningitis in one (case 14).

Histopathological Observations

In the interest of simplicity, pathological description has been divided into four groups according to the major brain lesions observed, which in all cases was the presumptive cause of death. A summary of the neuropathological

findings in each case may be found in Table 1. In the illustrations (Figs. 2–11, 13), a major emphasis has been placed upon the histopathological nature of the radiation necrosis encountered in group I. Figs. 12, 14–17 depict the extent and distribution of residual neoplasm and radiation necrosis in cases in group I.

I. Radiation necrosis (cases 4-13). In the gross state, every brain showed evidence of swelling, either generally or limited to one cerebral hemisphere, with flattening of gyri and compression against the free edges of the dura mater. Some of the specimens showed significant distortion of the midbrain. Where most of the tumor, and hence the beam of radiation, was localized to one cerebral hemisphere, it was the more swollen, usually with subfalcine herniation of the cingulate gyrus and transtentorial herniation of the medial temporal lobe (Fig. 2). Evidence of previous surgical excision of cerebral tissue was obvious, often with gelatinous coagulum filling the residual cavity. Zones of radiation damage were usually well demarcated, and were characterized by coagulation necrosis with no tendency towards liquefaction. In the more acutely evolving cases (cases 9, 13), brain swelling was more prominent, and the necrotic areas had a pink coloration due to diffuse extravasation of red blood cells. The consistency of acutely necrotic areas was slightly softer than normal with a gritty friability and a tendency to crumble when cut. In those instances in which survival following radiation was 4 months or more, areas of necrosis were yellow-gray in color, and sometimes were less well demarcated. The general shape and outline of necrotic tissue was retained, but tissue markings of cortex and white matter tracts and nuclei were lost and replaced by a mottled grainy appearance. These zones were less friable than normal and had a tougher, leathery consistency with no evidence of liquefaction.

On microscopic examination, a stereotyped pattern of pathological changes was observed (Fig. 3–10). Broad fields of coagulation necrosis were noted with disappearance of all recognizable parenchymal elements save for the skeletons of thickened blood vessels and the gnarled remains of astrocytic processes (Fig. 4). Myelin stains showed broad zones of pallor, sometimes homogeneously pale (Fig. 11), but more often with a mottled pallor with rings of clearing around blood vessels producing both a punctate and coalescent pattern (Fig. 3, 13A). Generously sprinkled throughout were the hematoxyphilic fragments of innumerable cell nuclei, primarily polymorphonuclear leucocytes (Fig. 4). Only minor phagocytic activity was noted, and almost no sudanophilia was detectable in frozen sections exposed to fat stains (Fig. 7). Near the edges of necrotic zones, heavy astrocytic gliosis was apparent on Holzer and Cajal gold stains (Fig. 10), and frequent swollen distorted astrocytic processes were present throughout the areas of necrosis.

Changes in the blood vessels were distinctive, and are worthy of special comment. At the earliest time following radiation at which radiation effect could be seen (case 13, Fig. 5), an acute necrotizing lesion of vessels of all sizes was prominent. The vessel walls were smudged by fibrin impregnation, and a brisk polymorphonuclear response was evident. Endothelial nuclei were plump and swollen, and frequently thrombosed vessels were found. In later stages (case

TABLE II

Summary of Neuropathological Observations

Case no.	Final diagnosis	Features of previous biopsies	Residual tumor extent and character	Radiation necrosis extent and character	Other processes
1	Astrocytoma	Grade II astrocytoma	None discovered	None discovered	Massive midbrain hemorrhage. Meningitis over left cerebellar hemisphere
2	Glioblastoma	Large zones gemistocytic in character	Extensive infiltration of entire left hemisphere, corpus callosum, and remaining right frontal lobe	Mild vascular thickening and perivascular lymphocytic infiltration in right frontal lobe	
3	Amelanotic melanoma	Melanoma in cervical node	Extensive tumor nodules on dura and surface of hemispheres; tumor encased brainstem and spinal cord	Non-specific vessel changes, mostly in residual temporal lobe	Scattered small infarcts
4	Glioblastoma	Extreme anaplasia and necrosis	None discovered	Massive necrosis with swelling; herniation of left hemisphere	
5	Glioblastoma	Necrosis and palisading	Islands of tumor posterior to op. site, and in opposite frontal lobe	Extensive necrosis of exposed medial surface of right frontal lobe; also for 5 cm. posterior to left frontal resection margin	
6	Glioblastoma	Necrosis and palisading	Several islands of tumor	Extensive necrosis up to 6 cm. from op. bed involving both hemispheres. Severe swelling	
7	Medulloblastoma	No atypical features	A half-dozen nests of tumor cells near resection margins, over medulla, and in adjacent meninges	Swelling and softening of upper cervical cord and lower medulla, presumably related to radiation. Gray columns most severely affected	Pyramidal tract degeneration lower in spinal cord
[illegible]	[illegible]	Typical with giant cells	Satellite tumor nests in left hemisphere, one directly [illegible]	Widespread necrosis of [illegible] hemisphere, spreadi[illegible]	Calcification of [illegible] de[illegible]

			adjacent meninges	lated to radiation. White columns most severely affected	
8	Glioblastoma	Typical with giant cells	Definite tumor nests in left hemisphere, one directly in op. site	Widespread necrosis of left hemisphere spreading into corpus callosum. Extreme vessel changes	Calcification of necrotic debris deep in
9	Glioblastoma	Severe anaplasia and pleomorphism	Mod. extensive tumor infiltration in inferior portions of both frontal lobes	Severely swollen, widespread necrosis of anterosuperior left frontal lobe. Discrete demarcation	Ant. cerebral arteries occluded by rad. lesion
10	Glioblastoma	Cellular but not undifferentiated.	Infiltration of fornix and adjacent medial thalamus	Necrosis of much of inferior left hemisphere extending to thalamus, also in upper pontine tegmentum and left cerebellar hemisphere	Secondary degeneration of pyramidal tract in brain-stem
11	Glioblastoma	All grades of glioma	Extensive infiltrate in left hemisphere and right frontal lobe	Severe necrosis in frontal lobes, left greater than right. Up to 5 cm. extent from op. cavity	
12	Glioblastoma	No atypical features	Tumor with giant cells in medial occipital lobe near resection margin	Severe necrosis of posterior right hemisphere extending 7–8 cm. anterior from occip. pole. Also necrosis in midbrain	
13	Glioblastoma	No atypical features	Subpial tumor layer adjacent to resection margin extending into op. site	Massive swelling and necrosis of left hemisphere with widespread necrotizing lesion of vessels	Necrosis not coagulative as in other cases
14	Glioblastoma	None available	Glioma cells in left temporal resection margin	None discovered	Acute purulent meningitis. Cocci in leucocytes

FIG. 2. Coronal sections of brain (case 9) showing extensive radiation necrosis of left frontal lobe with swelling. The cavity filled with gelatinous material in the slice at lower left represents the operative defect.

6, Fig. 6), the inflammatory reaction and fibrin exudation were even more prominent, and an adventitial proliferative response began to thicken the vessel walls. Plump, swollen endothelial and perithelial nuclei persisted. As the process evolved, medial and adventitial proliferation of connective tissue continued to thicken vessel walls, and the acute inflammatory response was replaced by a more indolent, primarily lymphocytic, infiltrate (Figs. 7, 8). In the patient surviving the longest (case 8, Fig. 9), blood vessels showed extreme degrees of thickening and fibrosis of their walls. PAS stains were strongly positive in such vessel walls, but no congophilia was present. Veins as well as arteries were involved, and all sizes of vessels from capillaries to major named arteries were affected if they lay within the field of radiation necrosis.

Some residual tumor infiltrate was demonstrable in every instance in this group except one (case 4), and its relationship to zones of radiation necrosis is shown in the topographic diagrams (Fig. 12, 14–17). Fairly extensive tumor was present in two specimens (cases 9, 12), and definite islands of glioma cells were found in the others (cases 5–8, 10, 13). These were at times directly in the path of the radiation beam and close to previous resection margins.

Radiation necrosis was generally more visible in white matter than gray, and was more intense at the brain surface where the highest neutron flux was measured. In some instances, however, the process extended deep within the brain and to distant structures (Fig. 11, 13A).

case 11, it was not possible to decide which of two processes was preeminent, radiation necrosis or residual tumor (see Fig. 17). The features of radiation necrosis observed were identical to those described in the preceding section. All grades of glioma were present, from well-differentiated, low-grade astrocytoma to anaplastic pleomorphic zones typical of glioblastoma multiforme. From the long clinical course and the histological appearance of the neoplasm as seen in the biopsy taken at craniotomy and in the autopsy specimen, it is likely that this patient had a low-grade astrocytoma which underwent progressive malignant degeneration.

Special mention should be made of case 7, in which the posterior fossa was irradiated for medulloblastoma. Severe softening of the upper cervical cord and lower medulla was striking, but did not exhibit the degree of coagulation necrosis of parenchyma or the extent of vessel changes which were so prominent in the cerebral hemispheres of other cases (Fig. 13B). The anterior spinal artery showed significant endothelial swelling and fibrosis of its wall, although the

FIG. 3. Low power view of a horizontal section of the right parieto-occipital lobe (case 12) showing extensive radiation necrosis, primarily of white matter. Note the mottled character of the lesion with more pronounced zones of myelin pallor surrounding blood vessels. (Loyez stain; 2.5×)

FIG. 4. Low power view of coagulation necrosis due to radiation. All tissue elements are devitalized, and large amounts of undigested cellular debris are present. Hematoxylin and eosin stain; 30×; case 9).

vessel was not found to be occluded at any of the levels examined. Nevertheless, the pattern of the lesion did suggest that ischemia played an important role.

Comment: The prominence and extent of radiation change in this group was the most striking feature of the whole series. The pathological material spans a post-radiation interval of 10 days to 11½ months, and gives a clear indication of the temporal evolution of the lesion from acute radiation necrosis (case 13) to typical delayed radiation necrosis (case 8), particularly in terms of blood vessel changes.

II. Residual tumor (*cases 2, 3*). In two cases, the predominent finding was residual tumor; nests of tumor were found in most of the cases in the other groups, but were not considered to be the major pathological process.

In case 2, the right frontal lobe was absent to a coronal level approximately 2 cm. posterior to the temporal tip, and the resection margin was yellow-brown and smooth. The brain was not swollen grossly, and there was little evidence of tumor infiltration upon naked eye inspection; however, by microscopic examination there was extensive infiltration of typical glioblastoma multiforme in the remaining right frontal lobe, the corpus callosum, and the entire left frontal lobe with a thick shell of tumor partially encircling the left lateral ventricle extending posteriorly as far as the left occipital lobe. Moderate thickening of blood vessel walls with some perivascular infiltration of lymphocytes was pre

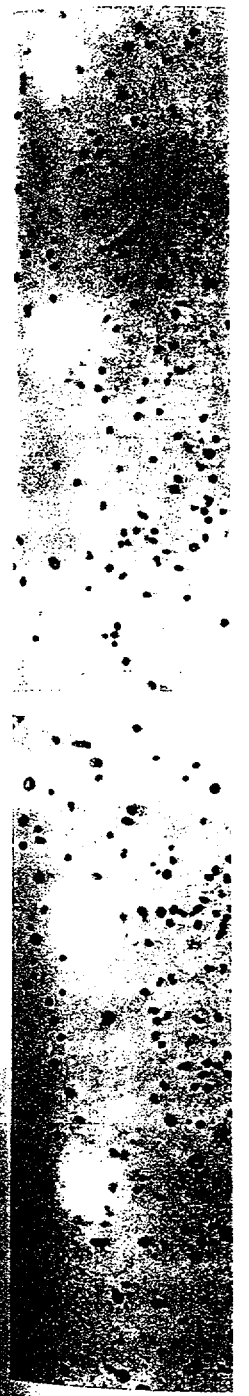


FIG. 5. Acute blood
filling and polymorpl
eosin stain; 100×;
FIG. 6. Acute vascula
beginning to thicker
ense is seen in the s

FIG. 5. Acute blood vessel necrosis and thrombosis with prominent endothelial nuclear swelling and polymorphonuclear leucocytic response 10 days after radiation (Hematoxylin and eosin stain; 100×; case 13).

FIG. 6. Acute vascular and perivascular reaction 5 months after radiation. The vessel wall is beginning to thicken, and fibrin exudation as well as a polymorphonuclear leucocytic response is seen in the surrounding tissue, (Hematoxylin and eosin stain; 110×; case 6).

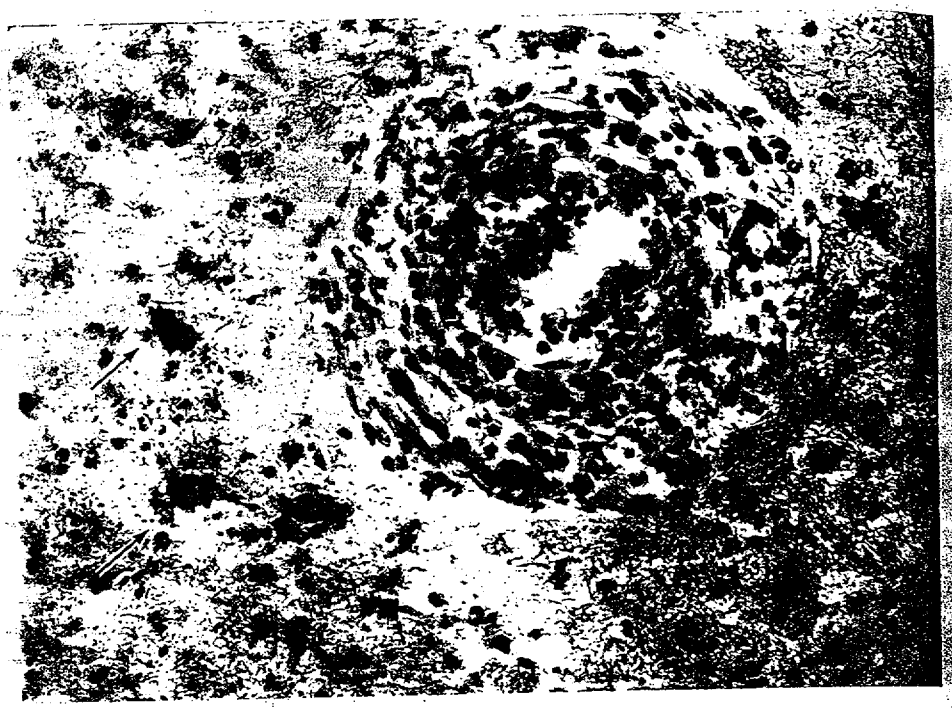


FIG. 7. Extensive proliferation and infiltration in blood vessel wall 5 months after radiation in an almost completely necrotic field. Some sudanophilic material is seen in cells at left (arrows). (Scharlach R stain; 280×; case 6).

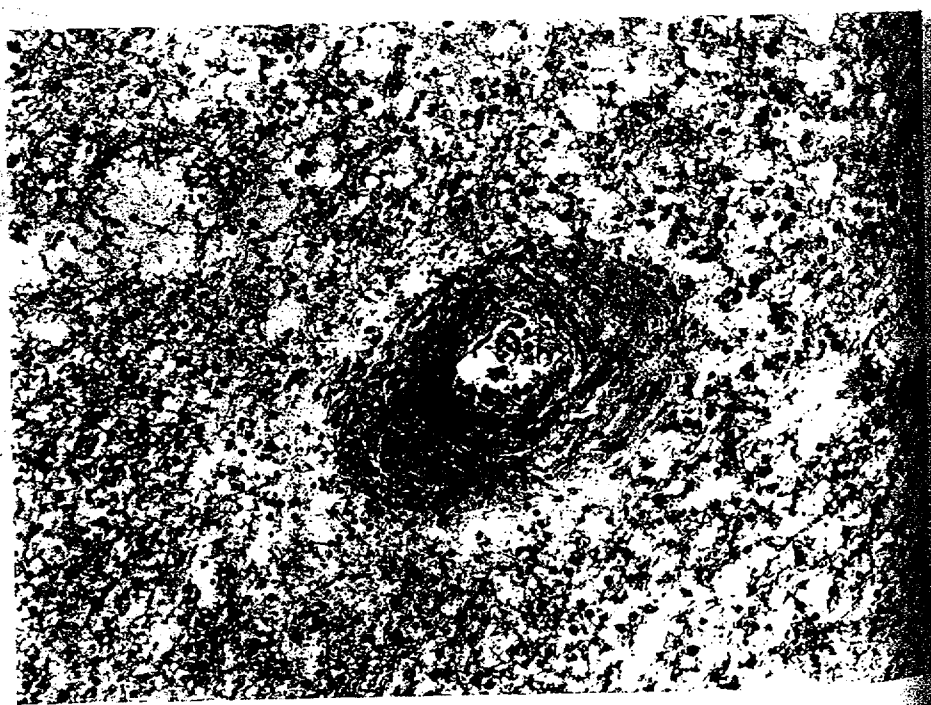


FIG. 8. Blood vessel thickening 11½ months after radiation with minimal perivascular lymphocytic infiltrate. (Phosphotungstic acid hematoxylin stain; 150×; case 8).

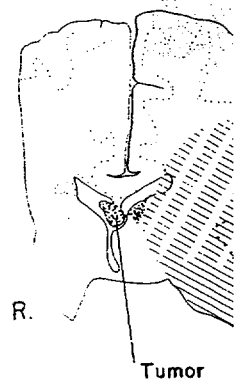
FIG. 9. Extreme dec
din eosin stain; 220×

FIG. 10. Fibrillary
es of zones of con

FIG. 9. Extreme degree of vascular reaction 11½ months following radiation. (Hematoxylin eosin stain; 220×; case 8).

FIG. 10. Fibrillary astrocytosis which was prominent in incomplete lesions and at the edges of zones of complete tissue destruction. (Cajal gold chloride sublimate stain; 400×).

FIG. 11. Large sections of cerebral hemispheres (upper) and brain-stem and cerebellu
(lower) stained for myelin showing the extent of myelin pallor. Note the relatively sh
border of demarcation in the lateral thalamus and in the cerebellum. Tract degeneration
the left pyramid is evident. The hemispheral section (upper) corresponds to the diagram
Fig. 12A. (Loyez stain; upper 1.0×; lower 1.4×; case 10).



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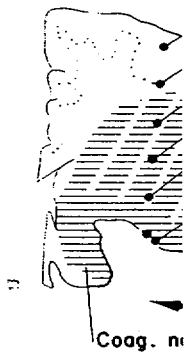

B

FIG. 12. Line diagra
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(D) attitude of neutr
represent the edge of t
areas represent incomp
are residual tumor.

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In case 3, innum
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occasionally penetr
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umor tissue which
nd the olfactory l
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umor sheets up to

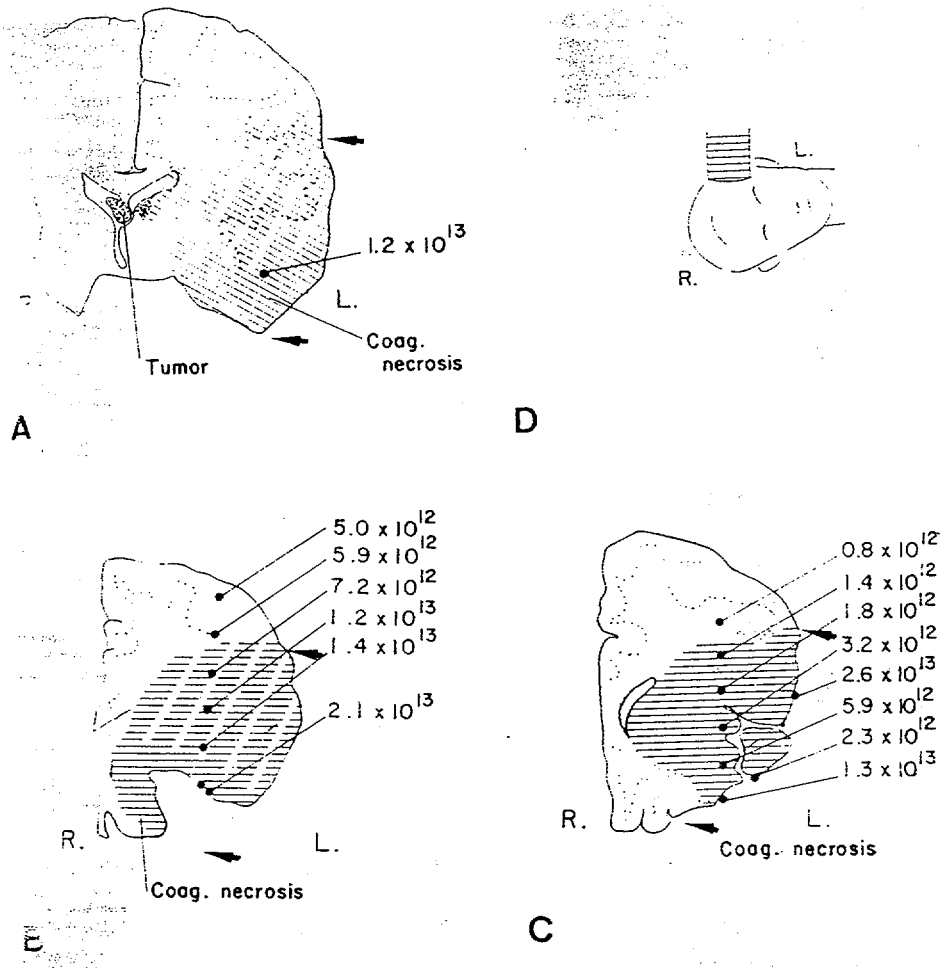


FIG. 12. Line diagrams of sections from case 10 with neutron flux determinations as indicated. Tissue boron levels are uncertain. (A) temporo-parietal lobe; (B&C) left frontal lobe; (D) attitude of neutron collimator with respect to the head. Arrows at brain surface represent the edge of the collimator. Hatched areas are radiation necrosis, and semi-hatched areas represent incomplete radiation damage. Stippled areas in fornix and left thalamus (A) are residual tumor.

ent near the right frontal resection margin, but this change could not be ascribed to radiation with any certainty.

In case 3, innumerable lobulated nodules of gray-white fleshy tumor were adherent to the inner surface of the dura mater bilaterally; these indented and occasionally penetrated the underlying cortical surface, in places to a depth of a centimeter or more. The base of the brain was encased in a 3–4 mm. layer of tumor tissue which engulfed the optic nerves and chiasm, the pituitary stalk, and the olfactory lobes, and extended posteriorly over the surface of the pons and medulla. The walls of the third ventricle were studded with tumor nodules. Tumor sheets up to 4 mm. in thickness enveloped almost the entire spinal cord

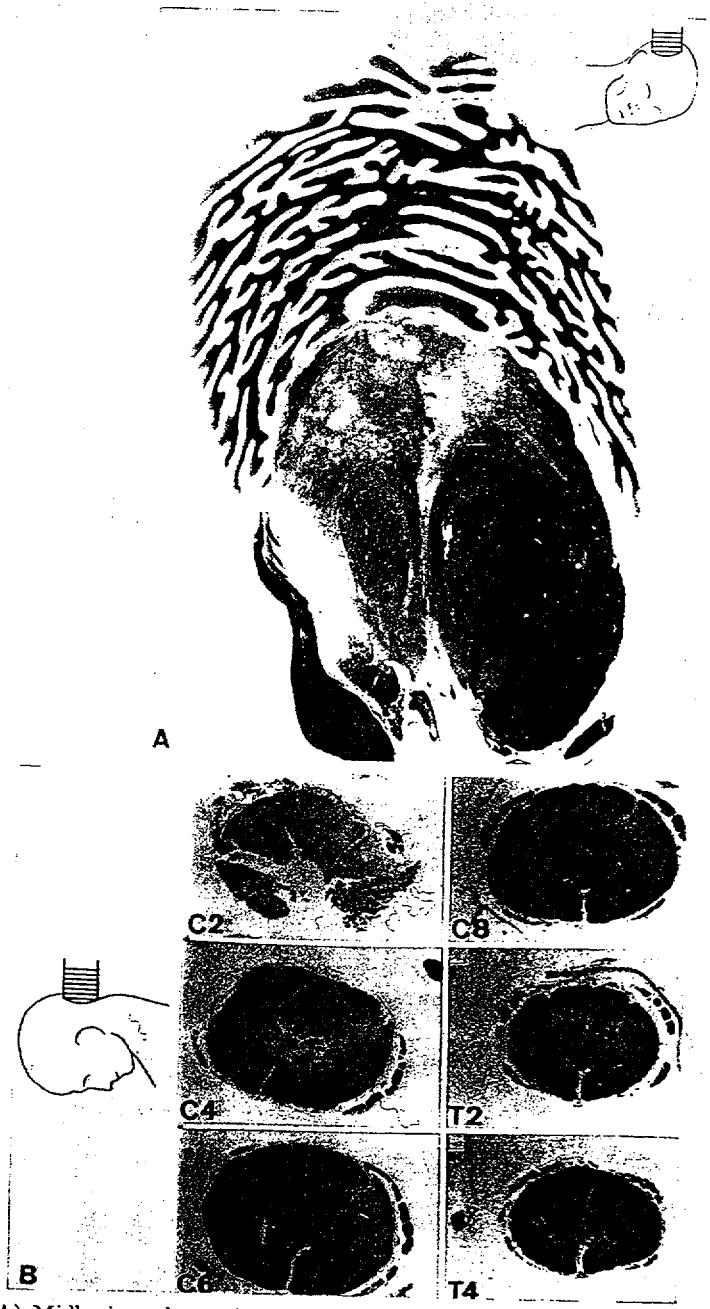


FIG. 13. (A) Midbrain and superior pole of cerebellum stained for myelin showing mo
tled coagulation necrosis due to radiation in the tectum. This is at some distance from th
origin of the neutron beam (see insert). The cerebral peduncle at left has been distorted b
compression. (Loyez stain; 3.5×; case 6). (B) Extensive softening of upper cervical cord
months following posterior fossa radiation. The insert at left indicates the positioning
the neutron beam collimator. See Table II and Results section. Group I for detai
(Heindenhain stain for myelin; 2.5×; case 7).

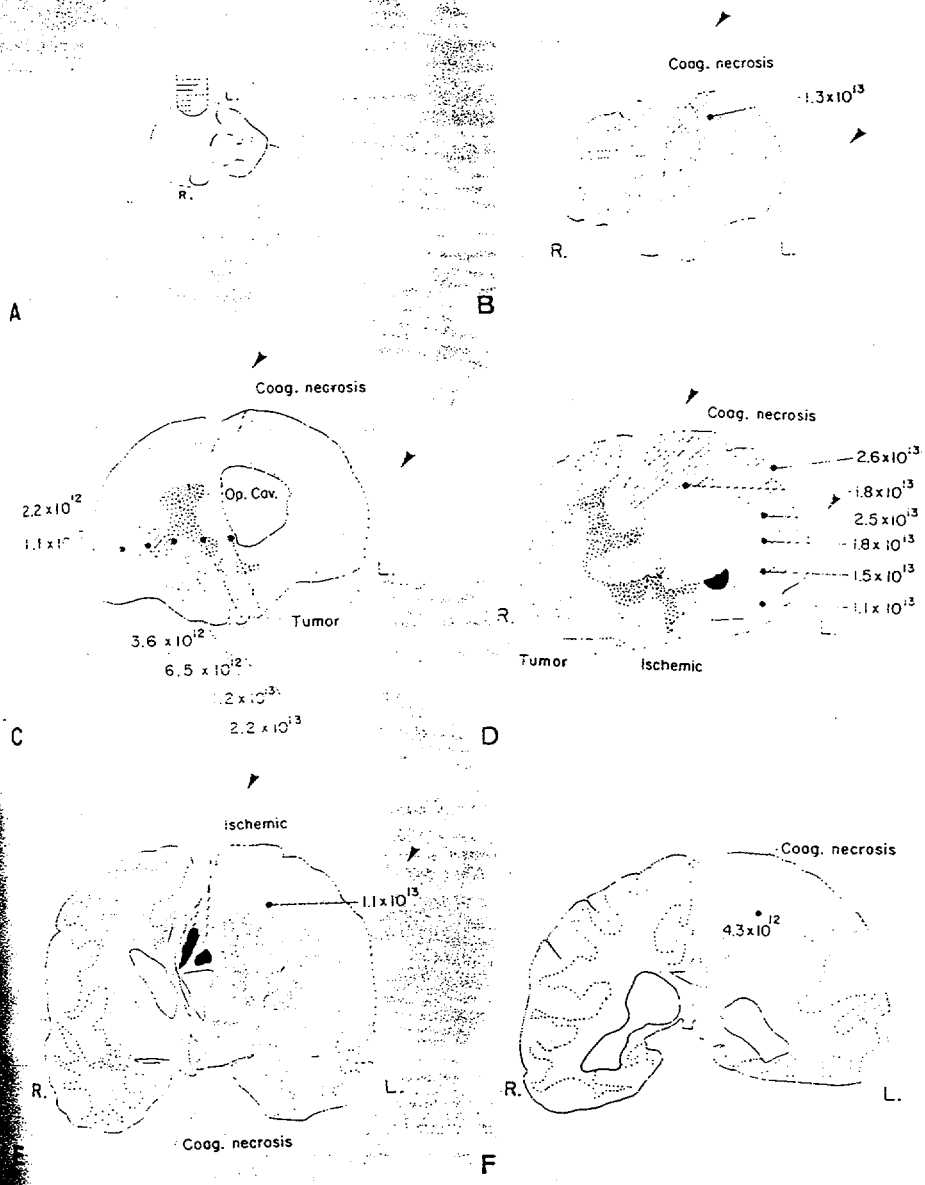
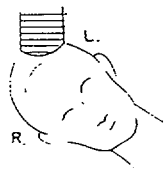
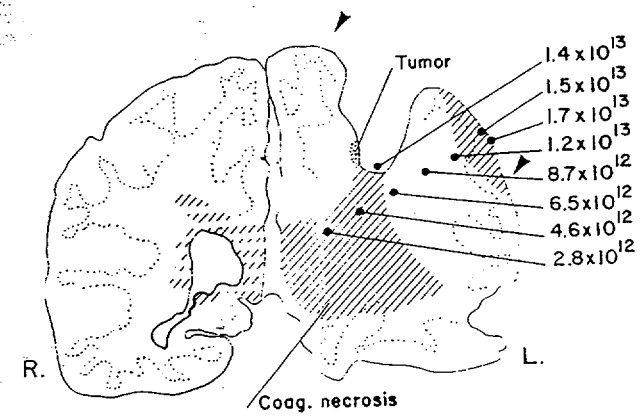


FIG. 14. Line diagrams of five coronal sections from case 9 showing relationship between radiation necrosis, residual tumor, and neutron flux. (A) Position of collimator; (B, C, D, F) anterior to posterior hemispheral sections. The arrows at the brain surface indicate edge of the collimator.

most of the spinal roots as far as the cauda equina. Two small areas of linear infarction were identified in the right posterior thalamus. Microscopically the tumor was composed of large round or polygonal sharply outlined cells with marked pleomorphism and hyperchromatophilia. Mitotic figures, often





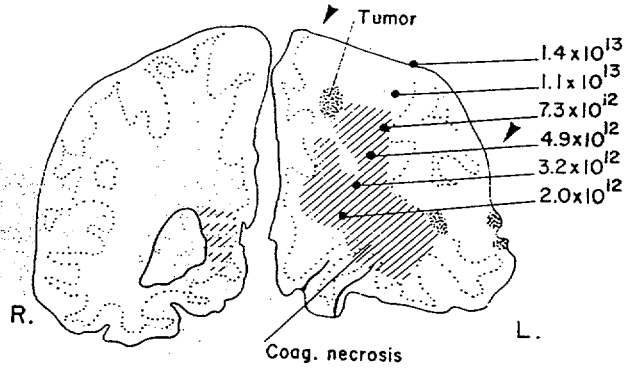


FIG. 15. Line diagrams of two coronal sections from case 8 showing relationship betwe... radiation necrosis, residual tumor, and neutron flux. The position of the collimator is ind... cated at top. Semi-hatched areas represent incomplete necrosis, and the arrows at brain s... face mark the edges of the collimator. The upper section is through the operative site an... the lower section is approximately 1.5 cm. posterior.

bizarre, and multinucleated tumor giant cells were frequently seen. Examin... tion of the other body organs showed metastatic tumor in liver, spleen, lu... ovary, spine, bone marrow, and bronchial lymph nodes. No definite chan... could be attributed to radiation effect.

Comment: The first patient (case 2) was approaching the final stages of h... illness when radiated, and died two months later of the primary brain tu...

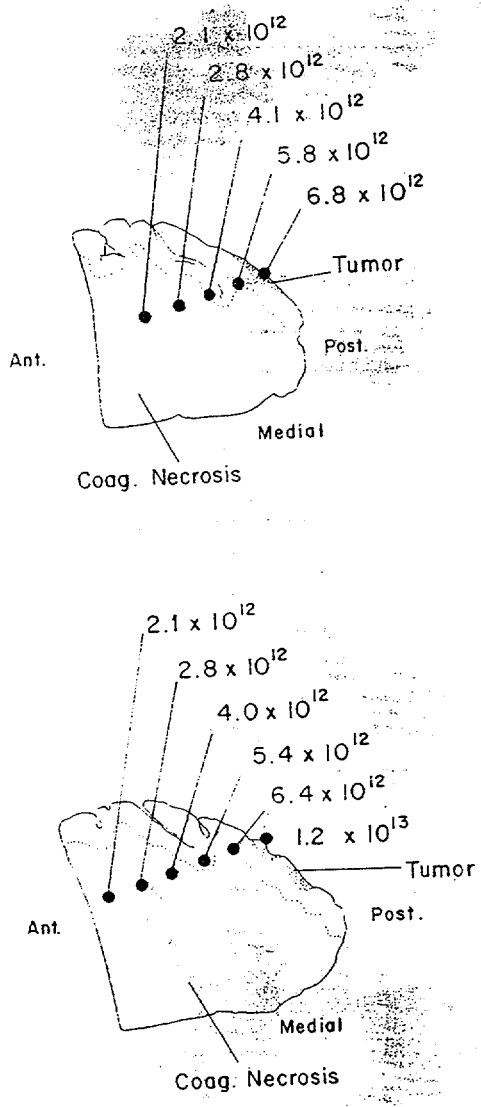


FIG. 16. Line diagrams of two horizontal sections of right parieto-occipital lobe from case 12 showing relationship between radiation necrosis, residual tumor, and neutron flux.

without alteration of the clinical decline. In the second patient in this group (case 3), extensive seeding of amelanotic melanoma over the surface of the entire neuraxis resulted in death, and no signs of radiation effect could be identified with confidence.

III. Intracranial hemorrhage (*case 1*). The cerebral hemispheres were severely swollen and compressed against the dura with flattening of convolutions. Below the tentorium, a massive hematoma filled the right side of the posterior cranial fossa with almost total destruction of the midbrain and right thalamus, and severe distortion and softening of the remaining brain stem and left cere-

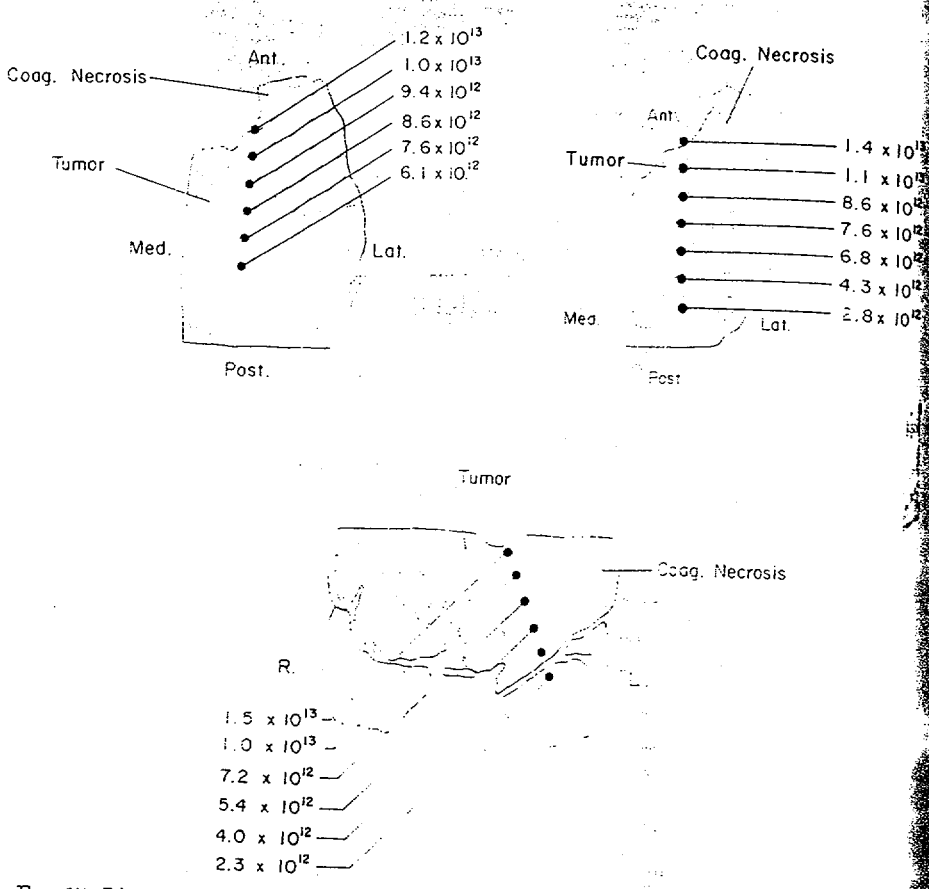


FIG. 17. Line diagrams from case 11 of two horizontal sections through left superior fronto-parietal lobe and a single coronal section at the level of the optic chiasm showing the relationship between radiation necrosis, extensive residual tumor, and neutron flux.

bellar hemisphere. Fresh blood had dissected into the left cerebellar hemisphere, pontine tegmentum, left thalamus and occipital lobe, and right lenticular nucleus; a cast of blood filled the lateral ventricles. Microscopic examination of pons, medulla, cerebellum, and remaining diencephalon disclosed normal vessels with no evidence of the type of radiation changes in blood vessel walls which were prominent in group I. Resolving purulent meningitis was observed between the folia and over the surface of the remaining left cerebellar hemisphere.

Comment: This patient did poorly following radiation with poor wound healing and a persistent cerebrospinal fluid fistula. One week prior to death staphylococcal meningitis was diagnosed, and appeared to be under control when death due to massive hemorrhage supervened. Although the violence of the midbrain hemorrhage destroyed critical portions of the pathological specimen, the parts that remained and were examinable revealed no explanation for the hemorrhage. The characteristic blood vessel changes observed in many of the other longer surviving cases were not found here. This brain was one of two in which no residual tumor was detected.

IV. *...te bacterial meningitis (case 14).* An extensive surgical defect of the inferior half of the left temporal lobe began 2.5 cm. behind the temporal tip and extended 8 cm. posteriorly. A thick, purulent exudate coated the surfaces of both cerebral hemispheres and the basal structures. Microscopically, an acute polymorphonuclear exudate was present in the subarachnoid spaces; a necrotizing inflammatory lesion of many of the pial vessels was observed. Innumerable cocci were present in the cytoplasm of leucocytes, primarily within the ventricular cavities and near the choroid plexus. Small zones of glioma were found in the l... ferior temporal resection margin. No definite radiation changes were detec...

Comment: This patient died of an intercurrent meningitis two months after radiation. It is presumed that the atrium of the infection was related to the previous craniotomies.

DISCUSSION

The neuropathologic features of fourteen cases of malignant brain tumor treate... radiation at open craniotomy using boron 10-slow neutron capture were ...ved. From the clinical standpoint, no therapeutic advantage was gained ... this technique, because all of the patients were dead within a year. The average survival from the time of diagnosis (not the time of neutron capture radiation) was nine months, which was roughly the same average survival for a similar large series treated by partial surgical resection and conventional radiation, as reported by Taveras, Thompson, and Pool (15).

Pathologically, the outstanding feature in ten of the fourteen brains, and putative cause of death in nine, was radiation necrosis. The process was marked by coag...lation necrosis of all parenchymal elements and striking blood vessel change... which became more prominent with the passage of time following radiation. From a qualitative standpoint, the changes due to radiation in these brains are distinctive, and would not be mistaken for the liquefactive events which characterize infarct necrosis. In a cerebral infarct, a predictable series of autolytic, reactive, and reparative events takes place, which includes softening of devitalized tissue, autolysis of tissue debris, migration of phagocytic cells into the area of necrosis, and neovascularization. These events seemed to be suspended in the radiation necrosis demonstrated in this material, with the result th... the tissue retained its shape, if not its architecture, and softening did not pro... to any extent. Fragments of destroyed cells, both parenchymal and reactive, remained undigested, giving the characteristic appearance of broad fields of finely granular chromatin debris and bits of astrocytic processes. Phagocytic activity and sudanophilia were almost absent, and proliferation and migration of microglia appeared to be suppressed. Neovascularization did not occur, but fibrin impregnation of damaged vessels was striking. Changes evolving with the passage of time included gradual subsidence of the chronic perivascular inflammatory exudate and progressive thickening of blood vessel walls, ultimately to an extreme degree. Ablation of the reactive and reparative processes ordinarily encountered in most crude cerebral lesions probably accounts

for the easily recognizable picture of large coagulated devitalized areas strewn with undigested fragments of cellular debris.

This severity of necrotizing change has not often been described in humans following radiation (16), but has been seen following attempts to excise radiosurgically a series of inoperable intracerebral tumors using the Bragg peak effect of the proton beam (17). The acute radiation necrosis found in case 13 (10 days), and perhaps in case 9 (2½ months), resemble most closely the effects produced experimentally by gamma radiation in primates (18, 19). The remainder of the material showing radiation effect probably fits best in the category of delayed radiation necrosis (20). In any event, there is no evidence to suggest that the quality of pathological change we observed is peculiar to neutron capture radiation, but rather is a function of the intensity of radiation, regardless of its source.

Blood vessel changes were striking at all stages of the evolution of the radiation lesion. Although damage to the vascular network may be prominent secondary to radiation from any source, the pattern observed in our material at least raises the suspicion that boron may have sequestered in vessel walls, resulting in selectively high doses of radiation to those structures. This possibility must remain speculative until more is learned about boron distribution in tissues. We do know that there were higher levels of ^{10}B in the circulating blood than in the tumor at the time of radiation. In those patients given paracarboxybenzene boronic acid, the tumor : blood ratio in determinations during the first operation for gross removal of tumor averaged 0.50: in those given sodium perhydrodecarborate the average of 101 determinations was 0.79. Hence there were enough ^{10}B atoms in the blood stream near the endothelial linings to give a dangerous dose of radiation to these sensitive cells. It was the unequivocal realization of the need for a carrier for the ^{10}B which is largely cleared from the blood stream by the time of neutron radiation which led to cessation of the therapeutic trials.

In the present series, the extent of radiation damage and interval of delay following radiation correlated only in an approximate way with systemic boron-10 doses and neutron flux, and normal brain elements appeared to be as radiosensitive as neoplastic cells. A reasonably accurate measurement of neutron flux was possible, but obtaining an estimate of boron levels was less satisfactory. Blood and urine boron levels were determined before and after irradiation in many of the patients, and the concentration of boron in tumor and adjacent brain was obtained in a few instances immediately before and after irradiation. Although much is known experimentally of the relative boron levels of many tissues following injection of boron-10 (8, 13, 14, 21), the actual distribution within any given tissue is less well known. The isotope is thought to distribute equally in body water, but radiographic investigations aimed at deciding this point were inconclusive (22, 23).

Terao (24) has studied autoradiographically the distribution of the $B_{12}H_{11}S$ and of $B_{12}H_{11}S\ SH_{11}B_{12}$ using a tritium label, stably incorporated into the boron hydride cage structure. In his animal model, the transplantable mou

ependymoblastoma, the neoplastic cells grow in solid clusters with large loosely textured extracellular spaces between. It was disconcerting to find the labelled compounds strikingly confined to the latter spaces so that many of the neoplastic cells would escape the capture radiation. In studies with transplantable rat glioblastomas developed by Benda et al (25), Amano (26), has used alpha-autoradiography to trace the disposition of $Na_2B_2H_{11}SH$. In highly preliminary results it looks tentatively as though this compound in these tumors concentrates within the neoplastic cell proper. This is the more encouraging since the histologic appearance of these tumors is similar to that of the human glioblastoma.

In the human case material, only rough estimates of average boron-10 concentrations in tumor and adjacent brain could be made, and variation from site to site within these tissues was completely unknown. The irregular character of radiation lesions led us to suspect that boron levels varied greatly.

Another aspect concerns the ability of thermal neutrons to penetrate tissue. Sweet and Javid (4) have calculated the diffusion length of thermal neutrons, the distance at which the beam will be reduced to 1/e (1/2.178) of its original intensity, as 2.3 cm. for brain containing 12 mg. % of ^{10}B. Roughly then the neutron flux halved with each 2-cm. increment of depth within the brain, resulting in a reduction of surface neutron flux by almost an order of magnitude at a tissue depth of 6 or 7 cm. As pointed out previously, the relationship of local neutron flux to radiation change was variable, both from case to case and within a given case.

Residual tumor was discovered in all but two cases, and perhaps failure to find tumor in two represents a failure to carry out extensive enough sampling for microscopic examination. In those cases in which residual tumor was identified, it often occurred just distant to the furthermost zone of radiation necrosis (see Figs. 12, 14, and 17). In others, residual tumor was found in or near the operative site (see Figs. 15 and 16), an area that had presumably received heavy radiation. There are several possible explanations for such disparate observations. Tumor cells might have reinfiltrated the operative sites in the months since operation, or certain glioma cells may be so radioresistant that even the presumptive high doses encountered in the tumor bed could not eradicate them. A third possibility concerns unequal cellular distribution of boron-10, so that some cells even in the tumor bed might escape radiation. Recent work of Amano (26) involving autoradiographic studies in rat glioblastomas revealed relatively homogeneous uptake of $B_{12}H_{11}SH$ throughout the viable cells, tending to exclude the discouraging third possibility.

SUMMARY

Neuropathologic observations on fourteen cases of malignant brain tumor treated by boron 10-slow neutron capture radiation at open craniotomy are presented. Extensive radiation necrosis was the major finding in nine, residual tumor in two, a combination of radiation necrosis and tumor in one, massive intracerebral hemorrhage in one, and acute bacterial meningitis in one. Varying

amounts of residual neoplasm were detected in all instances except two, in which none could be found. Radiation necrosis was characterized by coagulation of devitalized tissue with failure of the usual liquefactive chain of events and by striking blood vessel affection. The relationship between radiation necrosis, residual tumor, and neutron flux is demonstrated topographically in several cases.

Acknowledgment: The guidance and advice of Dr. E. P. Richardson, Jr. are gratefully acknowledged.

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