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# Nuclear Ship Savannah and the Law

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## NUCLEAR SHIP SAVANNAH AND THE LAW

The world's first nuclear-powered merchant ship, the NS *Savannah,* is tentatively scheduled to make Jacksonville, Florida her third port of call, following sea trials which are expected to be completed in late July or early August of 1962.[1] The Jacksonville debut will follow visits to Savannah, Georgia and New York City, but will precede the *Savannah's* September 30th appearance in Seattle for the World's Fair, unless "test delays"[2] force schedule changes. The Washington news release which announced this schedule implied that both Jacksonville and the State of Florida should feel honored by the priority accorded them, and suggested that a gala event is in order.[3] The lawyer, long-trained to look beneath the roseate surface, may find his enthusiasm tinged with a trace of habitual tough-minded skepticism. His mind may range, computor-like, through myriad subconscious notations, linking a number of them into a chain of questions, answered, answerable, moot, routine, unique, applicable or remote to his homestead of practice. News items discussing SL-1, accidental criticality, Windscale, and Holy Loch may couple with professional articles and citations, such as *P.R.D.C. v. International Union,*[4] Price-Anderson,[5] NELIA,[6] MAELU,[7] and the Atomic Energy Act.[8] Periodic references to negotiations for the *Savannah's* entry into foreign ports,[9] indicating progress but less than rapid culmination, may suggest speculation not only as to the delay, but as to why negotiations are even necessary. The mere fact of the Price-Anderson Act,[10] its unique, prodigious indemnity figure of $500 million surmounting the greatest single risk coverage (itself an impressive $60

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1. As this note went to press it was announced that the *Savannah's* early visit to Jacksonville had been cancelled and that the ship would undergo two months of "intensive overhaul and investigation" at Galveston, Texas. Florida Times-Union, Sept. 1, 1962, p. 31, col. 1. Unintentional reactor shutdown by the automatic controls while underway, Florida Times-Union, Aug. 20, 1962, p. 1, col. 7, and malfunction of the ship's stabilizers, Florida Times-Union, Aug. 29, 1962, p. 6, col. 3, may have contributed to the schedule change.

2. Florida Times-Union, May 26, 1962, p. 23, col. 3.

3. *Ibid.*

4. Power-Reactor Dev. Co. v. International Union of Elect., Radio and Mach. Workers, AFL-CIO, 367 U.S. 396 (1961).

5. 71 Stat. 576 (1957), U.S.C. §2210 (1958).

6. Nuclear Energy Liability Insurance Association.

7. Mutual Atomic Energy Liability Underwriters.

8. 68 Stat. 919 (1954), 42 U.S.C. §§2011-2296 (1958).

9. *E.g.,* USAEC, MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAM, JAN.-DEC. 1961, 229 (1962) [hereinafter cited as 1961 USAEC MAJOR ACTIVITIES].

10. See note 5 *supra.* For an excellent discussion see Bangs, *The Price Anderson Act: A Half-Billion Dollars of Federal Indemnity,* 47 A.B.A.J. 1178 (1961)

million)[11] ever provided by the insurance industry, may shade in omnious portents the sober reflection it engenders. When the *Savannah* eases into port, the lawyer may speculate whether, among the signals whipping from her halyards, there should be those alerting to stand-by status practitioners in the fields of torts, admiralty, insurance, and conflicts. And he may wonder, as he must have done many times before, whether a challenge is emerging which may escape the undefined reaches of preventive law.

## Deliberations on Strategy

The emergence of the "Nuclear Age" has created enigmas great and small. While those great must be wrestled with by premiers and presidents, perhaps the ultimate solutions will be realized on a lower level of detail, through adaptation, study, testing, and the evolutionary processes of the law. There are those who claim, however, that the law cannot afford the continued luxury of progress by adaptation and counter-action to the extremities of human behavior. Some suggest that the law must be indexed, card-punched, and fed into computers, to arm it with a never-before available prescience requisite to keeping pace with scientific advancement. Respected scholars express attitudes of reappraisal. Professor Leo A. Huard, who wrote with Mr. Ralph E. Becker in 1955,[12]

> "The advent of the Atomic Age will scarcely cause a ripple on the even surface of the principles of tort liability. Lawyers can rely with confidence on all the familiar doctrines and precepts. These will remain unchanged."

had, through change which he "attributed to three years of self-education,"[13] revised his thinking by December of 1958 to the extent that he wrote:[14]

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[hereinafter cited as Bangs]. Some suggestion of the significance of Price-Anderson indemnity coverage is to be found in the estimate that the Chamizal section of El Paso, Texas, an area of 83 city blocks, has an approximate value of $500,000,000. U.S. News and World Report, July 16, 1962, p. 6.

11. *Hearings Before the Joint Committee on Atomic Energy*, 85th Cong., 1st Sess. 91 (1957) (statement of Charles J. Hough, Vice-Pres., Traveler's Ins. Co.).

12. Becker & Huard, *Tort Liability and the Atomic Energy Industry*, 44 Geo. L.J. 58, 76 (1955).

13. Huard, *The Lawyer's Duties and Responsibilities in the Nuclear Age*, 12 Vand. L. Rev. 1 (1958).

14. *Id.* at 2. In like vein, Robert B. Von Mehren cautioned the American Branch of the International Law Association: "[T]he human disciplines have not been able to keep pace with the acceleration of the scientific disciplines. . . . [W]hile science has gone forward on seven-league boots, law has lagged behind. Are we as a profession ready to deal with the complicated legal and institutional

> "We cannot shirk the task of accomodating nuclear industry and the law . . . . [W]e must abandon the professional smugness which has all too often characterized our ancient and honorable calling. . . . We will have to overcome the vast inertia of accumulated precepts and demonstrate a willingness to embark on new ways. We must conquer our regrettable tendency to force the new square peg into the old round hole, because in nuclear energy we have a square peg of hitherto unimagined dimensions. It simply will not fit into our pretailored round holes no matter how elastic such holes have proved in the past."

With more specific reference to maritime applications of nuclear energy, Mr. E. Robert Seavers, General Counsel for the Federal Maritime Board, has advised:[15]

> "The application of atomic power to the propulsion of ships has created a unique and challenging series of legal and economic issues. Existing legal principles do not supply all the answers. The field is unique in that it is not an area in which the customary development of case law can be permitted gradually to follow the development of technical progress. Instead, due to the special nature of the risks involved, the use by private industry of this great source of power for shipping will be impeded, if not prevented, until the broad legal principles governing responsibility for nuclear damage are established and made uniform among at least the major maritime nations. The welcome of nuclear vessels in foreign ports will be facilitated by agreement on these principles."

Discussing proceedings at the June 1960 London conference which developed revisions in SOLAS,[16] Mr. Seavers informed the ABA Committee on Marine and Inland Insurance Law that a new chapter, covering safety standards for nuclear-powered ships, had been accepted. The new chapter requires that nations that are to be visited by non-military nuclear ships must be furnished, within a time reasonably calculated to allow them to evaluate the safety of the vessels, both a particularized safety assessment and an operating manual

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problems created by nuclear energy? . . . I doubt . . . ." Von Mehren, *The Development and Use of Nuclear Power—Some Reflections on Legal Problems*, ATOMIC ENERGY L.J. 3, 12 (1959).

15. Seavers, *The Impact of Nuclear Propulsion of Ships on Admiralty and Shipping Laws*, ABA, PROCEEDINGS, SEC. OF INS., N. & C.L. 178 (1960) [hereinafter cited as Seavers].

16. International Convention for the Safety of Life at Sea, June 10, 1948, T.I.A.S. No. 2495, 164 U.N.T.S. 113.

covering each ship. It also authorizes "special control"[17] on the part of the host nation before the nuclear ship may enter port.

Mr. Seavers suggested that liability principles devised for nuclear shipping must satisfy not only the theoretically credible risks, but also those, which though only chimerical, are nonetheless real in the minds of those exposed to such ships, and indicated that until adequate risk distribution and coverage are developed by maritime nations, neither the public in the port cities nor private industry will welcome the hazards incident to nuclear propulsion of vessels. He reasoned:[18]

> "If multilateral agreement is needed on liabilities of shore-based reactors, then *a fortiori* it is needed in the field of nuclear ships. Reactors on land are located in remote areas with a view to minimizing the damage in the event of a nuclear incident. Merchant vessels must, by the nature of their use, call at congested port areas. . . ."

Mr. Seavers referred to the NS *Savannah* as a contrivance bearing inherent capacity to inflict catastrophic damage. He explained that such a catastrophe, though unlikely, could inflict injury and damage over a widespread and unsuspecting area, and that the unique nature of such injuries often might deny knowledge of exposure to the victim until the harmful effects occurred years later. Proof of causation consequently will present problems answerable only by special principles governing liability.[19]

In 1958, Congress revealed its concern by specifically extending to the *Savannah* the coverage provided by the Price-Anderson amendment[20] to the Atomic Energy Act of 1954. This indemnification, insofar as the *Savannah* is concerned, covers her designers, builders and operators, and extends to incidents occurring in foreign jurisdictions, but it has been specifically noted "that this legislation [is] not to be considered as precedent setting for later nuclear merchant ships."[21]

## TACTICAL CONSIDERATIONS

The Atomic Energy Act of 1954[22] has as one of its aims the encouragement of "widespread participation in the development and

17. Seavers 179.
18. Seavers 182.
19. Seavers 187.
20. 71 Stat. 576 (1957), 42 U.S.C. §2210 (Supp. 1959).
21. USAEC ADVISORY COMMITTEE ON REACTOR SAFEGUARDS, INDEMNIFICATION OF ATOMIC ENERGY ACTIVITIES, 1958-59, at 7 (1959) (report to J.C.A.E. on Operations under §170 of the Atomic Energy Act of 1954 [hereinafter cited as 1959 REACTOR SAFEGUARDS REPORT].
22. 68 Stat. 919 (1954), 42 U.S.C. §§2011-2296 (1958).

utilization of Atomic energy for peaceful purposes . . . ."[23] After some enthusiastic initial activity, private industry made a reappraisal. Some companies concluded that despite the considerable investment already made[24] and notwithstanding the private insurance pools of MAELU and NELIA,[25] which together provided $60,000,000 in single risk indemnity coverage, they would be obligated to suspend activity in the nuclear field unless massive additional liability protection was supplied by the federal government.[26] Against this background, Congress passed the Price-Anderson Act of 1957, designed to "encourage the development of the atomic energy industry" and to "protect the public" from the consequences of "nuclear incidents."[27]

Under this act reactor licensees are required to obtain certain private initial financial protection satisfactory to the AEC.[28] Once this prerequisite has been met, AEC obligations attach and, under indemnity agreements executed with the reactor licensees, provide an additional one-half billion dollars of protection.[29] This protection covers not only the licensees, but also their suppliers, subcontractors, designers, and any other persons who may be liable, against public liability claims which exceed the amount of private financial protection possessed by the licensee.[30] Expressly excluded from the definition of "public liability" are licensee reactor-site employees who are eligible to file claims under state or federal workmen's compensation acts, and claims arising out of acts of war.[31]

If, upon the occurrence of a major reactor disaster, it becomes apparent to the commission that the total damages will probably exceed the total indemnity coverage, the statute provides for apportionment of claims.[32] In such a situation, the AEC or any person

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23. 68 Stat. 922 (1954), 42 U.S.C. §2013 (d) (1958).

24. *Hearings Before the Joint Committee on Atomic Energy*, 85th Cong., 1st Sess. 147, 156 (1957) (testimony of Francis K. McCune, Vice-Pres. of Gen. Elec. Co.).

25. See Bangs 1178; MAELU will accept 22.5 per cent of the losses incurred up to its limit of $13,500,000, while NELIA will accept up to 77.5 per cent of the losses incurred up to its limit of $46,500,000. 1959 REACTOR SAFEGUARDS REPORT 3.

26. Bangs 1178; see note 24 *supra*, at 156.

27. 71 Stat. 576 (1957), 42 U.S.C. §2012 (i) (1958).

28. USAEC, MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAMS, JAN.-DEC. 1960, 399-403 (1961) [hereinafter cited as 1960 USAEC MAJOR ACTIVITIES]; see 10 C.F.R. §§140.11-.12 (Supp. 1962). The protection required will usually be acquired through one or both of the insurance pools, see note 25 *supra*; 1961 USAEC MAJOR ACTIVITIES 231.

29. See 71 HARV. L. REV. 750 (1958) (discussing some gaps and weak spots in this protection).

30. 71 Stat. 576 (1957), 42 U.S.C. §2210 (a), (c) (1958).

31. 71 Stat. 576 (1957), 42 U.S.C. §2014 (u) (1958).

32. 71 Stat. 577 (1957), 42 U.S.C. §2210 (e) (1958).

indemnified may apply to the appropriate United States district court, to have the claims apportioned.[33] The procedure then permits apportionment of payments to claimants, partial payment before settlement and setting aside part of the available funds for injuries discovered at a later time.[34] If it appears probable that the United States will be required to make any payments under the indemnity agreements, the AEC is authorized to settle claims on a "fair and reasonable basis."[35] The act requires the AEC to make maximum use of "the facilities and services of private insurance organizations"[36] if the disaster occurs. There is no attempt to take the determination of tort liability from the states, some of which may not recognize strict liability.[37] In actions which could arise simultaneously in several states from one nuclear accident, differing results might be determined, just as disparities would also appear under workmen's compensation treatment in various states. It has been suggested, therefore, that a federal compensation board be established for nuclear accidents, on the theory that atomic energy is a national asset, and its contingent liabilities are also national in scope. Under such a plan, the right of the injured party to recover would be based solely upon the test of whether the claimant was injured by radiation. Because of the extremely wide area which radiation risks can cover, no fine line can be drawn between employees of the user of atomic energy and third persons, and it has been recommended that recovery should be available to all those who are exposed and receive injuries, regardless of their physical relationship to the site of the accident.[38]

The effectiveness of such a plan might be tempered by the fact that the very scientific data on which it must be based are tentative and subject to reappraisal in the light of time and experience. The ABA Committee on International Control of Atomic Energy, reported in 1958:[39]

> "[N]o establishment of uniform standards on reactor design, construction and operation has yet proved possible. In the United States these questions are considered on a case-by-case basis, as a part of a system of licensing, and presumably

33. 71 Stat. 576 (1957), 42 U.S.C. §2012(i) (1958). The appropriate court is the court which has venue in bankruptcy over the site of the nuclear incident. Site is defined as the place where the mishap occurred, not where the damage was inflicted. See S. REP. No. 296, 85th Cong. 1st Sess. 22 (1957).

34. 71 Stat. 578 (1957), 42 U.S.C. §2210(e) (1958).

35. 71 Stat. 578 (1957), 42 U.S.C. §2210(h) (1958).

36. 71 Stat. 578 (1957), 42 U.S.C. §2210(g) (1958).

37. See 71 HARV. L. REV. 750, 752 (1958).

38. See Note, *Problems of Tort Liability Arising from Nuclear Reactors*, 27 U. CINC. L. REV. 415, 417 (1958).

39. ABA, PROCEEDINGS, SEC. OF INT'L & COMP. L. 9 (Supp. 1958).

the International Agency, Euratom, and O.E.E.C. will be constrained to follow the same procedure. . . . [T]he formulation of adequate and up to date . . . controls will necessitate striking a balance between standards so rigorous that daily operations and technological development will be unduly retarded and standards so limited or lax that the public safety will be jeopardized. . . . If established standards are not adequate, the actual occurrence of a nuclear incident may well lead to the imposition of far more stringent controls than if the regulations had been sufficient in the first place."

To meet the need to fashion adequate constraints while granting sufficient license, the Office of Atomic Development of the State of New York contracted with Ebasco Services, Inc., for a study of various aspects of dealing with radioactive sources and nuclear-propelled vessels in the New York ports. The first report of its type in the United States, the 169 page survey anticipates that about 65 naval and civilian nuclear vessels will probably be operating by 1975, requiring about 400 refuelings and other major servicings during the 1970-1975 period.[40] It predicts that about 70 per cent of the fueling, refueling and servicing of United States and foreign nuclear ships can be expected to be accomplished on the East Coast. The report indicates that construction and initial fuel loading of nuclear ships can be handled by any shipyard equipped to build and fit out conventional ships of comparable size. It advises that embarkation and debarkation of passengers and freight, and routine servicing normal to port operations will not require major modification of equipment or practice to accommodate nuclear ships. But it predicts that a substantial addition to port facilities would be required to handle refueling procedures.[41]

The Ebasco Report states that there is either little or no nuclear hazard associated with nuclear ships until reactor power levels are attained. As a result, the report concludes that,[42]

"Assuming a high quality of regulatory control, there appears to be no reason why the construction, initial fueling, start-up, in-port navigation, and routine servicing of nuclear vessels cannot readily be performed with due assurance of the public health and safety in any harbor . . . physically capable of handling these functions."

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40. EBASCO SERVICES INC., NUCLEAR PORT SURVEY OF THE STATE OF NEW YORK, 39, 43 (1961).

41. *Id.* at 46.

42. *Id.* at 5.

With certain precautionary methods, the report adds, nuclear ships of the power level of the NS *Savannah* and larger can receive major servicing and refueling in the State of New York, including the Port of New York, without undue hazard to health and property.

### TECHNOLOGICAL AND STATISTICAL CONSIDERATIONS OF RISK

To form a proper perspective from which to view the risks incident to the presence of a nuclear-powered ship in the midst of one's city, a passing contact with certain technological factors is necessary. Perhaps those who view these proposed experimental port visitations with increasing chagrin have ground to question whether the alleged benefits outweigh the possible hazards.

While it is generally recognized that power reactors are not capable of producing an explosion of the atom bomb type, either a nuclear runaway or a coolant failure, or other possible occurrences, can produce a mixing of chemicals in the reactor which could result in a violent explosion.[43] In spite of all precautions such an explosion can occur, in which event the reactor vessel may be disrupted, allowing dispersion of fission products outside the reactor. For this reason, the reactor itself is enclosed in a containment vessel or building which is designed to withstand whatever violent event may occur within the reactor, and to contain whatever radiation may escape from the reactor core.[44] Even if this containment is completely successful, however, there is some radiation "shine or leakage which can have deleterious effects on the outside of the structure," which is one of the reasons for considering reactor locations that are separated from neighboring populations by an "exclusion area belt."[45]

Dr. C. Rogers McCullough, while Chairman of the Advisory Committee on Reactor Safeguards of the AEC warned that "a discussion of the unknowns in reactor safety could be lengthy indeed,"[46]

43. Green, *The Law of Reactor Safety*, 12 VAND. L. REV. 115 (1958-59).

44. *Id.* at 118. For descriptions of the elaborate shielding and containment structures provided to house the *Savannah's* reactor, see Seavers *supra* note 15, at 181; Villiers, *Aboard the N.S. Savannah*, 122 NATIONAL GEOGRAPHIC 280, 291 (1962).

45. Green, *supra* note 43, at 118. The matter of reactor location was at issue in the case of *P.R.D.C. v. International Union, supra* note 4, which is the only adversary proceeding to arise in more than seventy licenses granted by the AEC since 1954. The decision settled only the relatively minor point that the AEC, in issuing a provisional permit for construction of a reactor for the generation of electric power, does not have to make the same definitive finding of safety of operation which it must make prior to licensing actual operation of the facility.

46. McCullough, *Reactor Safety*, Nucleonics, Sept. 1957, p. 136.

and, in 1956, he advised,[47] "We must recognize that the only way to be absolutely safe is not to build a reactor at all. . . . [L]et me warn you that we must expect accidents . . . ."

Similarly, in 1958, after pointing out that a large reactor's potential for release of radioactive content was "comparable to that of a hydrogen bomb," and perhaps more dangerous in that the reactor's discharge would be at ground level rather than lifted into the atmosphere by an explosion,[48] Dr. Edward Teller and Dr. Albert L. Latter wrote:[49]

> "In the extensive operation of many reactors in the United States no one has yet been killed by the radioactivity. This has been due to extremely careful operation and also to good luck. We must be prepared that sooner or later accidents will occur. On the other hand we must try to take sufficient precautions to avoid the . . . catastrophic accident . . . . In general a power station is less likely to give trouble than a moving power source. It is not probable that nuclear locomotives will ever be safe. In nuclear ships more room is available and more room permits more safety measures. But even so the safety of nuclear motors in ships will have to be considered particularly carefully because ships will have accidents in harbors."

In 1957, in connection with further Congressional consideration of indemnity legislation, the AEC sponsored a major study[50] of the probability and extent of a serious reactor accident. The report stated that in most of the theoretical accidents considered, the "total assumed losses would not exceed a few hundred million dollars." In addition, it was estimated that the probability of an accident which would significantly affect the public ranged from one chance in 100,000 to one chance in 1,000,000,000 per year for each large reactor.

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47. Atomic Energy Forum Inc., *A Forum Report: Management, Economics and Technology for the Atomic Industry*, No. 1, 169, 173 (1956).

48. "The nuclear explosive lifts most of its radioactive products to a high altitude and the poisonous activity gets dispersed and diluted before it descends. The activity from a reactor on the other hand will remain close to the ground and might endanger the lives of the people in an even greater territory." TELLER & LATTER, OUR NUCLEAR FUTURE 154 (1958).

49. TELLER & LATTER, *op. cit. supra* note 48, at 158. This was written prior to the SL-1 accident when three men died as the result of an explosion and radiation exposure which took place on January 3, 1961; see text at notes 66-68 *infra*.

50. USAEC, *Theoretical Possibilities and Consequences of Major Accidents in Large Nuclear Power Plants*, CCH ATOMIC ENERGY L. REP., ¶4036 (1957) [hereinafter cited as Brookhaven Report].

The report estimated that if 100 power reactors were operating in the United States, under the most pessimistic assumptions, there would be less than one chance in 50,000,000 of a given person being killed in any year by a reactor accident.

Just a brief consideration of these figures indicates that the probability basis used encompasses a spread in odds of one to 10,000 which, to say the least, does not provide a convincing basis on which to evaluate risks, particularly since it refers to one reactor for one year. If there are 100 reactors, then by these AEC estimates, one person in 1,000 *could* be "significantly affected" per year, which *could,* based on present United States population, cause the nation's lawyers to contemplate the additional work load which 180,000 nuclear accident claims per year would create. Admittedly this is playing fast and loose with figures. But the AEC appears to expect the public to be satisfied with such figures as a basis for accepting its judgment on the wisdom of placing the PRDC reactor within thirty miles of Detroit and Toledo, or on the advisability of berthing the *Savannah* in downtown Jacksonville.

When the report referred to the "100 reactors," it shifted comparison from "members of the public significantly affected" to the chance of a given person being killed in any year by a reactor accident. Based on present population, even this comparison assumes some deaths every year. Furthermore, there is never any assurance that the major occurrence against which the odds are predicated will take place at the end of the chain of probability. More likely, since we are still in the experimental stage, it will occur at the link of the chain where "inevitably, as more and more reactors are built and used, familiarity will breed some degree of contempt for the dangers."[51]

If, though chances are "exceedingly small" and "remote,"[52] a major reactor accident should occur, what could be the results? The AEC, in a hearing on the indemnity legislation question, presented figures in May 1956 indicating that in the event of a runaway reactor and consequent release of 100 per cent of the fission products therefrom, property damage alone could run as high as $900,000,000, while personal injuries would force the figure much higher. Such high estimates were predicated on the possible necessity of evacuating large cities or major watershed areas.[53]

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51. *Hearings Before Subcommittees of the House Committee on Appropriations on Second Supplemental Appropriation Bill for 1957,* 84th Cong., 2d Sess., 239 (1956).

52. Brookhaven Report ¶4036.

53. *Hearings Before the Joint Committee on Atomic Energy, Governmental Indemnity,* 84th Cong., 2d Sess., 53-54 (1956).

The AEC "Brookhaven Report" in 1957 included a detailed appraisal of the maximum damage which could credibly be caused by an accident in a typical power reactor. Under "pessimistic" assumptions, it was theorized that in such a single accident (1) as many as 3,400 persons might be killed, and 43,000 injured; (2) property damage might range from $500,000 to $7 billion; (3) people might be killed at distances up to 15 miles and injured at distances up to 45 miles; and (4) land contamination might extend even greater distances.[54] Such computations as these justify arguments for locating

54. Brookhaven Report ¶4036. See 27 CONSUMER REPORTS, 8, 11 (Jan. 1962) showing a chart indicating theoretical results of a 30,000 megaton nuclear attack on the United States, and indicating graphically the extent of Strontium 90 soil contamination which could be expected to result. The chart shows that 6,000 to 8,000 millicuries of Strontium 90 per square mile could be deposited on Florida. This would amount to from 10 to 12 microcuries per acre.

Dr. A. T. Wallace, Geneticist and Head, Plant Science Unit, Agricultural Experiment Station, University of Florida, appearing as guest lecturer on May 9, 1962 before a Seminar class in Peacetime Applications of Atomic Energy conducted by Professor K. Krastin, at the College of Law, used the *Consumer Reports* figures to illustrate the seriousness of soil contamination. Assuming that Florida has 1,000 pounds of exchangeable calcium per acre in its soil, Dr. Wallace showed that, given the *Consumer Reports* fallout figures, the ratio of Strontium 90 to calcium in the soil would be in the vicinity of 20,000 micromicrocuries to 1 gram of calcium. Disregarding the reduction created by the discriminating factors attributable to various plants and animals which would absorb the Strontium 90 initially from the soil, an ingestion of one gram of calcium per day per individual diet would result in 20,000 micromicrocuries of Strontium 90 becoming a part of the daily diet. Using a representative ratio of discrimination effect of 1/10 the secondary absorption by human beings of plant foods or milk originating in contaminated acreage, would still approximate 2,000 micromicrocuries of Strontium 90 per gram of ingested calcium. The theoretically permissible daily dietary limit of Strontium 90 has been established as 100 micromicrocuries.

Dr. Wallace stated that there is no known way to decontaminate soil, and that unless contamination is avoided through some dependable means of protective covering, the only safe way to reclaim contaminated soil is to remove the top two to four inches. Since this also removes most of the necessary minerals, an available supply of uncontaminated fertilizer would then have to be applied to regain fertility. The contaminated soils which would be removed, representing in the neighborhood of one million pounds per acre, would have to be relocated in such a way that washback could not recontaminate reclaimed land. Considering that the half-life of Strontium 90 is approximately 28 years, one is driven to the conclusion that natural decontamination offers few benefits over mechanical procedures. Survivors of such an attack would hardly be able to stretch stockpiled foods to the point of replenishment.

But other applications can be made with this information. The problem of land contamination assumes perspective when one reads Professor Leo A. Huard's statement, citing the Brookhaven Report at 35 that "the fission product inventory, in Strontium 90 alone, of a 100,000 ekw reactor has been described as comparable to 3.8 megatons of fission weapons." Huard, *The Lawyer's Duties and Responsibilities in the Nuclear Age,* 12 VAND. L. REV. 1, 11 (1958).

land-based reactors in sparsely populated areas[55] in spite of increased electric transmission costs.[56] But if isolation is necessary for a land-based reactor, *a fortiori* a marine reactor must be viewed askance while it is in a congested port area.

The Gomberg Report[57] submitted by PRDC as part of its case before the AEC also dealt with the effects of a maximum credible reactor accident, its subject being a 300 Megawatt[58] reactor at Lagoona Beach, Michigan. Certain factual data were assumed as a working hypothesis for this report, including the factor of all persons in the subject area being exposed without shelter on a hot summer night. Radiation levels considered were as follows:[59]

> (1) 25 roentgens: an emergency level which, while undesirable, may be justified for emergency rescue work or similar conditions.
>
> (2) 150 roentgens: at this level there will be some nausea and significant symptoms.
>
> (3) 450 roentgens: at this level one half of the exposed population can be expected to die.

Three basic weather conditions were considered, a weak lapse, a strong lapse, and a weather inversion.[60]

Under the relatively infrequent[61] inversion condition, the report indicated that with all fission products of a gaseous nature and with a 4.5 m.p.h. wind, a total integrated beta and gamma dose under a 100 per cent release would give twenty-four hour exposure results as follows:[62]

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55. Seavers 182.

56. ATOMIC INDUSTRIAL FORUM, INC., SITING OF NUCLEAR POWER REACTORS, DISCUSSION AND COMMENTS ON SAFETY CONSIDERATIONS 7 (1959).

57. GOMBERG, BASSETT & VELEZ, REPORT ON THE POSSIBLE EFFECTS ON THE SURROUNDING POPULATION OF AN ASSUMED RELEASE OF FISSION PRODUCTS INTO THE ATMOSPHERE FROM A 300 MEGAWATT NUCLEAR REACTOR LOCATED AT LAGOONA BEACH, MICHIGAN (Project No. 2506, Atomic Power Development Associates, Inc., Detroit, Michigan) (1957) [hereinafter cited as GOMBERG REPORT].

58. The *Savannah's* reactor is rated at 69 Megawatts. See 1961 USAEC Major Activities 23-25.

59. GOMBERG REPORT 3.

60. "Lapse rate: . . . Meteorological: The rate of decrease of atmospheric temperature with increase of elevation vertically above a given location; Inversion: A reversal in the normal temperature lapse rate, in which the temperature rises with increased elevation, instead of falling." AMERICAN COLLEGE DICTIONARY (1961).

61. GOMBERG REPORT 6. In the subject locale, the temperature inversion is said to exist from 4 to 8 cumulative days per year.

62. GOMBERG REPORT fig. 15.

| Approximate Radius from Site (Miles) | Approximate Total Dose (Roentgens per 24 Hours) |
|---|---|
| 45 | 1200 |
| 75 | 450 |
| 150 | 150 |
| 450 | 25 |

Under conditions of strong lapse, the radius downwind of the 400 roentgen dosage limit reaches ten miles from the site, while under weak lapse, it reaches three miles. Under conditions of only one per cent release, the inversion cycle would effect a 24 hour exposure of 400 roentgens over an area extending 7 miles from the site.

The inversion graph showing results from the more probable release of particles instead of gas indicated a 450 roentgen total dose per twenty-four hour exposure reaching a distance of 26.4 miles.[63] The report stated:[64]

> "In terms of the airborne cloud effect, fallout under strong inversion makes the problem of exposure due to airborne activity less severe by a substantial margin.
>
> "However, a new, longer range problem of cleanup is introduced since what is lost from the cloud is now on the ground. . . ."

The report in part revealed the following exposure results of fallout of 10 micron particles under conditions of inversion weather and 100 per cent release:[65]

| Radius from Site (Miles) | 24 Hour Exposure (Roentgens) | 7 Day Exposure (Roentgens) |
|---|---|---|
| 12 | 1000 | |
| 25 | 400 | 1000 |
| 50 | 100 | 400 |
| 100 | 25 | 100 |
| 175 | | 25 |

Even a one per cent particle release under inversion weather conditions would produce 24 hour doses of over 400 roentgens in areas within two miles of the reactor and could produce 7 day exposure of 400 roentgens in places 4 miles distant. Table I of the report

63. GOMBERG REPORT 38.
64. GOMBERG REPORT 40.
65. GOMBERG REPORT 38 & fig. 25.

shows that under 100 per cent gaseous dispersion with the accident occurring under inversion conditions, the city of Detroit, Michigan, nearly 30 miles away, could have 50,000 to 133,000 people with an exposure of at least 450 roentgens; 85,000 to 181,000 additional people with exposures ranging from 150 to 450 roentgens; and 112,000 to 245,000 more people with exposures of between 25 and 150 roentgens. Thus it becomes evident that *if* the allegedly extremely remote risk of a major reactor incident should occur, the results would be appalling.

Fortunately there are only a few relatively minor incidents from which the risk may be calibrated. Those few seem to illustrate the uncertainties incident to the science in its present state, and serve to indicate the more probable range of accident.

The SL-1 reactor accident at Idaho Falls National Laboratory involved a unit of "conventional design, and of well-advanced technology . . . believed to be an 'inherently safe nuclear power plant.' "[66] At the time of the accident, the reactor had been shut down for eleven days for maintenance. During the evening of January 3, 1961, while three technicians were engaged in pre-start-up activities the nuclear excursion occurred.[67] All three men were killed. Fifteen months after the fatal accident the official investigating Board could only state that the accident was "*probably* caused by the 'unusually rapid and extensive motion of the central control rod.' "[68]

On April 7, 1962, four men were hospitalized by a "criticality accident" in the plutonium scrap recovery building at the AEC's Hanford National Laboratory. "[*A*]*pparently* an overconcentration of fissionable material collected in one of the waste tanks."[69]

In an accident at Oak Ridge, Tennessee, several workmen were exposed to a heavy radiation dose when enriched uranium was accidentally transferred into a container of improper geometrical configuration and critical mass was thus achieved.[70]

In October 1957, at the Windscale installation in Cumberland, England, overheated uranium rods in the reactor were thought to have caused the release, despite stack filters, of a small quantity of radioactive Iodine 131, which has a half-life of eight days. Land approximately 20 miles downwind of the installation was contaminated. After a few days, it was found that milk from cows grazing in the affec-

66. BNA, ATOMIC INDUS. REP. No. 293 ¶7:12 (1961).
67. 1961 USAEC MAJOR ACTIVITIES 141.
68. BNA, ATOMIC INDUS REP. No. 358¶8:113-114 (1962) (emphasis added.).
69. BNA, ATOMIC INDUS. REP. No. 358 ¶8:115 (1962) (emphasis added.).
70. Atomic Industrial Forum, Inc., Forum Memo, Aug. 1958, pp. 39-40.

ted fields was contaminated to an extent "six times the permissible level." Corrective action included placing a "milk ban on some 1,000 dairy farms in the area" and the destruction of approximately 670,000 gallons of milk.[71] Although the contamination was discovered and apparently no one was harmed, the incident served to highlight the terrible consequences which could occur if farm products ever reached the market place with a radioactive content, without anyone perceiving of their dangerous propensities.[72] How little material is necessary to create serious disruption, was brought home forceably in the case of *American Alliance Insurance Co. v. Keleket*,[73] involving an unexplained emission of finely powdered radium salt and radon gas from a dosimeter calibration capsule the size of one's little finger during a routine calibration. The results of this "tiny explosion" have been described as follows:[74]

> "[T]he building where it took place could not be fully reopened for five months. For an even longer period certain businesses related to food, drink, or cosmetics could not operate within the building. Expenses for decontamination were nearly $250,000 and the city authorities would not allow the building to be remodeled for fear that more radioactive material might be uncovered."

Another example of the extent of possible damage was provided by the accident of November 20, 1959, at Oak Ridge, when an explosion in a processing vessel during a clean-up procedure released and spread about 6/10 of a gram of plutonium over buildings, vehicles and roads in an area of about four acres. The cost of clean-up was $350,000.[75]

### Opinions of Expert Witnesses

The most experienced unit in the world today in the field of nuclear marine propulsion is the AEC-United States Navy team. Certain of their experts have issued candid warnings of trouble

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71. Muldoon, *Alice in Nuclear Energy Land*, 42 Mass. L.Q., Dec. 1957, p. 9 (emphasis added.); see, 43 Mass. L.Q., March 1958, p. 38; Highton, *The Legal Aspects of the Development of Atomic Energy in the United Kingdom*, 12 Vand. L. Rev. 223, 227 (1958).

72. Muldoon, *supra* note 71. With reference to the Windscale incident, Muldoon suggests, "It is the foregoing type of situation which probably will provide the most fruitful field for employment of implied warranty theories by claimant's attorneys."

73. 248 F.2d 920 (6th Cir. 1957).

74. Note, 27 U. Cinc. L. Rev. 415, 416 (1958).

75. 1960 USAEC Major Activities 275.

areas which would be well to keep under surveillance. Chairman Chet Holifield, in his forward to the report of the JCAE meeting, held April 9 and 10, 1961, cautioned the Navy to meet AEC safety standards in all aspects of its nuclear safety program and to resist any pressures to force this new technology into an old system which may have sufficed for ordinary propulsion.[76] This admonition was purposeful, for there had been a festering area of conflict between the two authorities. The Navy tended towards allowing nuclear submarine operators the same complete local control exercised in conventional submarine operations. For example, Admiral Rickover testified before the JCAE at this meeting:[77]

> "When the time came to test the *Seawolf*, our second nuclear-powered submarine, we were faced with a more serious problem. The *Seawolf's* reactor was cooled with sodium, which was far more radioactive than the water coolant of the *Nautilus*. The Reactor Safeguards Committee *never did fully approve* operation of the ship into populous ports. They finally agreed, for military reasons, that the ship could operate out of Key West, which is a submarine base. But the operating forces objected to this limitation, and, on their own, decided to move the *Seawolf* into populated ports without referring the matter to us or to the Reactor Safeguards Committee.
>
> "It took a great deal of doing and a lot of argument before they finally realized they must not move these ships around the way they were accustomed to move conventional ships. We still have that fight, even though Admiral Burke has issued instructions to the Navy that nuclear-powered ships must be treated in a special way, and that there must be an actual military or national necessity before a nuclear ship can go into a populated harbor. In my opinion, the spirit of this order is not always being lived up to fully. That is, they write and say it is a 'military necessity'. And the argument I put up is, 'What if something happens and *you irradiate a city* . . .?' 'Well,' they answer, 'nothing is going to happen.' This is the sort of situation we are up against because the nuclear plants have operated so well to date. . . . [T]he more reactors there are operating, the more serious is the problem, because the chance of something happening multiplies with the number of reactors. . . . I am more concerned than ever because the

76. *Hearings on Naval Reactor Program and Polaris Missile System. Before The Joint Committee on Atomic Energy*, 86th Cong., 2d Sess., vi (1960) [hereinafter cited as *1960 Naval Reactor Hearings*].

77. *1960 Naval Reactor Hearings* 19-21 (emphasis added.).

more reactors there are, the more people are involved, and you can't keep as tight control as when there were only a few."[78]

The Chairman, Advisory Committee on Reactor Safeguards, wrote to the Chairman, AEC, on August 5, 1958:[79]

"The Advisory Committee . . . wishes to point out that nuclear-powered ships are not completely free from presenting a possible hazard to the public. There exists an ever-present low-level risk of release of radioactivity . . . . The problem assumes increasing importance as the number of nuclear-powered ships increases."

A further letter in the same vein was written on November 12, 1958, in which the Chairman, ACRS, stated:[80]

"The Navy's desire to bring nuclear submarines into various populous ports has resulted in considerably more of such operations than the Committee had envisioned when it first commented upon nuclear submarine operation. The Committee wishes to repeat the point which it has emphasized on previous occasions that the entry of nuclear ships into populous ports cannot yet be considered routine or entirely without risk."

Split responsibility similar to that which concerned the JCAE in connection with the Navy, is also present with the *Savannah,* for after a struggle for control among Congressional committees in 1955, the issue was settled in 1956 by parcelling out jurisdiction over the ship between the AEC and the Maritime Commission, and among the JCAE, the Senate Commerce, and the House Merchant Marine Committee.[81] One cannot but wonder if the pressure of political

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78. "The most dangerous element in all operations is the human element." TELLER & LATTER, OUR NUCLEAR FUTURE 51 (1958).

79. 1959 REACTOR SAFEGUARDS REPORT 71. "[I]nterest in nuclear propulsion . . . is being shown in: Japan, Germany, United Kingdom, Norway, France, Italy, The Netherlands, Sweden . . . [and] West Germany: The Federal Atomic Ministry announced its OMR prototype reactor would be installed in a tanker, the ESSO *Bolivar* . . . . The Warvow yard at Rostok is expected to have the first East German nuclear powered ship by 1965. It may be a smaller river craft . . . ." 5 USAEC, REVIEW OF THE INTERNATIONAL ATOMIC POLICIES AND PROGRAMS OF THE U.S. 1910 (1960). Volume one of this review indicates that the "Soviet icebreaker *Lenin* operates under nuclear power . . . ." The Soviet Union is also reportedly making plans for a 60,000 ton nuclear tanker. Florida Times-Union, April 23, 1962, p. 1A, col. 3.

80. *1960 Naval Reactor Hearings* 17.

81. See Note, 59 MICH. L. REV. 438, 440 (1961); Green & Rosenthal, *A Study of Fusion of Governmental Power,* JCAE Study Project (1961).

expediency and cold war maneuverings, abetted by a false confidence nurtured by an exemplary safety record, and stimulated by paternal pride in the prodigy *Savannah*, has thrust her prematurely upon the stage.

## SAVANNAH GOES "A'PORTING"

To develop in-port acceptance agreements for the NS *Savannah*, representatives of the AEC and the United States Maritime Administration have met with nuclear, maritime and public health officials of Belgium, Denmark, France, Germany, Greece, Italy, Norway, The Netherlands, Portugal, Spain, Sweden and the United Kingdom. Negotiations have been "progressing satisfactorily in matters related to general operating conditions, safety evaluation and inspection," but the conclusion of "acceptance indemnity arrangements continues to present problems which it is hoped can be resolved through mutual effort."[82]

Negotiations with the United Kingdom had reached a point where it was necessary for the United States negotiators to have authority to (1) submit to suit in the United Kingdom courts without an assertion of sovereign immunity from suit, and (2) to waive the conventional shipowner's limit of liability. Other areas of divergence arose from the desire of the United Kingdom representatives that the United States (3) admit absolute liability, (4) accept exclusive liability, and (5) agree not to assert the defense of the statute of limitations for a period of ten years after any nuclear incident involving the *Savannah* in United Kingdom waters.[83] After suggested solutions indicated promise, they proved unacceptable, and negotiations bogged down.[84]

The first in-port acceptance agreement for the *Savannah* was concluded with Greece on June 12, 1962.[85]

## LOCAL POWER TO REGULATE: THE CITY OF DETROIT CASE

The question of whether or not a domestic port authority may unilaterally deny entrance to a nuclear-powered ship has not been resolved. A somewhat allied question was recently adjudicated in *Huron Portland Cement Company v. City of Detroit*,[86] where a municipal smoke abatement ordinance was held to have been violated

82. 1961 USAEC MAJOR ACTIVITIES 229.

83. *Hearings Before the Subcommittee on Research and Development and the Subcommittees on Radiation of the JCAE*, 86th Cong., 2d Sess., pt. 2, at 276 (1960).

84. USAEC News Release, No. IN-198, April 13, 1961.

85. USAEC News Release, No. E-198, June 12, 1962.

86. 362 U.S. 440 (1960).

by appellant's ships. The United States Supreme Court affirmed the lower court's refusal to enjoin the city from prosecuting appellant for violation of the ordinance. The Court pointed out that in the exercise of the police power through legislation benefiting the health and welfare of their inhabitants, states and their instrumentalities may act concurrently with the federal government in many areas of interstate and maritime activities. It added that "even-handed local regulation to effect a legitimate local interest is valid unless preempted by federal action" or "unless unduly burdensome on maritime activities or interstate commerce . . . ."[87] The Court held that the purpose of federal inspection statutes is to insure the seagoing safety of vessels subject to inspection. The federal laws are clearly limited to protecting passengers and crews from the perils of maritime navigation.

"By contrast," said the Court, "the sole aim of the Detroit ordinance is elimination of air pollution to protect the health and enhance the cleanliness of the local community."[88] The Court held that there is no overlap between the federal ship inspection laws and the municipal ordinance, and asserted that the federal inspection legislation had not pre-empted local action.

The appellant also argued that the fact that the vessels were actually licensed and enrolled by the national government gave them a right to use the navigable waters of the United States free from the local impediment imposed by the Detroit ordinance. The Court answered that while a state could not exclude from its waters a ship operating under a federal license, nor require an additional local occupational license as a condition precedent to use of its waters, still "the mere possession of a federal license does not immunize a ship from normal incidents of local police power"[89] which of themselves do not constitute a direct regulation of commerce. Thus a ship is not exempted from local pilotage laws, local quarantine laws, local safety inspections, or local regulation of wharves and docks. Mr. Justice Stewart's majority opinion pointed out that the Detroit ordinance did not exclude a licensed vessel from the Port of Detroit, nor did it destroy the right of free passage. It merely required compliance with an orderly and reasonable scheme of community regulation not so burdensome either on the federal licensee or on interstate commerce as to be constitutionally invalid.

Disregarding for a moment any indications of Congressional intent evidenced by the Atomic Energy Act of 1954, as amended, and by the enabling legislation for the *Savannah,* it might appear possible

87. 362 U.S. 440, 443 (1960).
88. 362 U.S. 440, 445 (1960).
89. 362 U.S. 440, 447 (1960).

for a judiciously and generally worded municipal ordinance to so adapt the "air pollution" reasoning, and the Court's opinion on the purpose and limited thrust of the federal boiler inspection code, that the restrictions could apply to nuclear ships and still fall under the rule of the Detroit case. However, it would seem impossible to avoid the major pre-emption argument that by appropriating funds for the *Savannah* and extending Price-Anderson coverage to her, Congress indicated its desire that nuclear ships have access to domestic ports. Bilateral treaties for in-port acceptance of the *Savannah*, unless reciprocity was expressly denied, would further substantiate this allegation of intent. Furthermore, such an ordinance would be applied against a nuclear ship to prevent a theoretical condition from developing, while in the *City of Detroit* case there was a present violation causing actual damage. In acting against a mere potential risk, the theoretical ordinance would presumably land directly astride the federal safety inspection assessing the same risk and finding it tolerable. Consequently there seems to be little possibility that the holding of the *City of Detroit* case could be extended to permit local legislation to restrict entry of nuclear ships into domestic ports. Such ordinances also would probably run afoul of the constitutional priority given treaties, as nuclear ships under foreign flags visit us in consequence of bilateral agreements now being negotiated.

In the apparent absence of any legal means to bar nuclear ships from local ports, one is relegated to questioning legislators and administrators about the reasonableness of federal restrictions which tend to locate land-based reactors in areas of minimal population density, while denying to heavily-populated port areas the privilege of providing for themselves the same degree of protection against floating reactors. One might further question whether interstate commerce is not adequately served, at least for the present, by conventional shipping. Experimental development of nuclear propulsion does not demand the exposure of heavy population centers to even remote risks, and a better method could be found for conducting the necessary experiments than to perform them in the midst of congested port areas.

There has been some suggestion on the part of the AEC[90] that if nuclear ships are to achieve economic feasibility, their turn-around time must be greatly reduced. One method for accomplishing this would be to restrict cargoes to fast unloading products such as oil. A more speculative approach, which would help to solve the risk problem while it affects efficiencies is the "piggy-back" technique. Under this system, the nuclear engine would be installed in a power-

90. 1 USAEC, REVIEW OF THE INTERNATIONAL ATOMIC POLICIES AND PROGRAM OF THE U.S. 51 (1960).

unit, or "sea-tractor," which would shuttle back and forth between strategically and logistically located floating terminals, moving "trains" of surface or submarine barges designed to accommodate certain cargoes. By this method, maximum utilization of the propulsion unit could be achieved, through nearly continuous operation, while the cargo units could benefit by simplicity of design. At the same time, civilian population and property at port areas would not be jeopardized by the haunting shadow of nuclear excursion.

Perhaps the real solution was pointed out by Admiral Rickover, when he said: "It took a great deal of doing . . . before they finally realized they must not move these ships around the way they were accustomed to move conventional ships."[91]

## The Texas City Incident

When beset with perplexities, the law seeks answers in its precedents. The major problem with which all are concerned in connection with nuclear shipping is the accidental irradiation of a heavily populated area. While there has been no comparable peacetime situation, there is one recent actual case from which we can glean some concept of our reaction to such a catastrophe. This was the Texas City disaster in 1946, when supposedly inert fertilizer exploded while being loaded aboard the French Ship *Grandcamp*, causing, together with the resultant fires, 540 deaths, several thousand injuries, and millions of dollars worth of property damage. A number of claims from this tragedy were ultimately consolidated into a class suit filed against the United States under the Federal Tort Claims Act of 1946.[92] The claimants sought to connect the federal government through the twin facts that the fertilizer was manufactured by the United States and was being loaded by United States stevedores.

After seven years, final decision was reached, the United States Supreme Court, in *Dalehite v. U.S.*[93] affirming the lower court's decision that the United States was not liable because certain pertinent acts of the government were within the discretionary function exception of the Tort Claims Act.

As an aftermath of the *Dalehite* decision, Congress enacted in 1955 the Texas City Relief Act[94] pursuant to which payments were made to uninsured claimants in an amount not to exceed $25,000 per claim. The act reads in part:[95]

91. *1960 Naval Reactor Hearing* 19.
92. 28 U.S.C. §2671 (1958).
93. 346 U.S. 15 (1953). *But see* Rayonier v. United States, 352 U.S. 315 (1957).
94. 69 Stat. 707 (1955).
95. 69 Stat. 707 §1 (1955).

"Congress recognizes and assumes the compassionate responsibility of the United States for the losses sustained by reason of the explosions and fires at Texas City, Texas, and hereby provides the procedure by which the amounts shall be determined and paid. . . ."

Under the act, approximately $16 million was paid to victims of the disaster in exchange for assignment of their claims totaling nearly $70 million.

It appears obvious that the decision to pay the claims was not demanded by established law, but was felt to be morally necessary. Similar thinking, tinted in overtones of economics, politics, and diplomacy, gave rise to Price-Anderson, and seems to permeate the thinking of the various European and international groups concerned with nuclear power. Thus a pattern is emerging which overrides existing legal concepts and provides indemnity without fault, on a governmental level.

On the other hand, by the time the innocent victims of Texas City received initial payments, some eight years after the accident, many injured children had grown up, graduated from college, or married. To the injured victim there is little difference between a moral obligation ignored and one performed after the real need for help has passed. Consideration should be given to the question of settlement delays if the pro-rata clause of Price-Anderson should ever have to be invoked. And since, in such a case, funded settlements will be only proportional, thought should be given to other means by which the victims can be made whole. Basically involved will be the needs for food, clothing, shelter, medical care, and honest employment. Perhaps some other form of governmental relief will be required in addition to dollar payments, the traditional legal solution to "accidents." Accident-orientation and disaster-orientation are not to be confused, if each is to function effectively.

## International and Maritime Aspects

In recent years United States delegates have participated in a series of international panels and conferences having to do with nuclear shipping. In September 1959, the International Maritime Committee met in Rijeka, Yugoslavia, to draft conventions on liability of ship operators.[96] This preliminary work, together with a list of proposals developed by the British Minister of Transport

96. Berman & Hydeman, *International Control of the Safety of Nuclear-Powered Merchant Ships*, 59 MICH. L. REV. 233, 236 (1960) (hereinafter cited as Berman & Hydeman).

Committee in February 1960,[97] was in turn studied at the June 1960 London Conference, which met to develop revisions in the 1948 Convention for the Safety of Life at Sea.[98] Mr. Seavers, reporting on this meeting, stated:[99]

> "Our committee decided against recommending rules that would single out nuclear ships and restrict their movements. It was also decided that there was not a need to hang a 'leper's bell' on these vessels by requiring that they have a special identification such as a coat of red paint. Instead, it was concluded that prudent navigation by all ships, in accordance with the time-honored Rules of the Road, will provide protection at least as fully as could be done by special rules for nuclear ships that might inhibit progress in this field. . . ."

No coat of red paint would be necessary to enable any competent ship's officer to identify the *Savannah* or any other ship. Visual identification, if other means have not already accomplished recognition, would be made by recognizing a ship's silhouette long before its color would be visible. Nor would identifying marks of any kind have been nearly as adequate as simple restriction from heavily-trafficked shipping lanes, to prevent the collision which occurred on May 10, 1962, thirty miles off the Golden Gate, when the *Hawaiian Citizen* collided with the "sail" of the submerged nuclear-powered submarine *Permit*.[100] The submarine immediately surfaced and proceded to Mare Island Naval Base, refusing Coast Guard inspection enroute on the theory that the accident occurred outside Coast Guard jurisdiction. A Mare Island spokesman later announced that the submarine had incurred only slight damage, and that the reactor had not been affected. He also made what has come to be a virtually routine statement whenever reactors have been connected with endangering difficulties, a demulcent announcement that even under a more violent collision there would have been "no possibility of a nuclear explosion."[101] Given the Gomberg report circumstances of 100 per cent emission during inversion weather, one might suspect that the fine distinction between explosion and release would be somewhat academic to the area's inhabitants.

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97. See Berman & Hydeman 239; see Seavers 180.

98. Berman & Hydeman 239.

99. Seavers 179.

100. Florida Times-Union, May 11, 1962, p. 4A, col. 4. The *Savannah* escaped being rammed by the destroyer *Stickell* by a hairbreadth two feet in the narrow Hampton Roads channel on Aug. 30, 1962. Gainesville [Fla.] Daily Sun, Aug. 31, 1962, p. 1, col. 2.

101. *Ibid.*

In reporting on the International Maritime Committee's Rijeka draft, Mr. Seavers says:[102]

> "The imposition of strict liability on the operator, with the right of recourse severely restricted, and contributory negligence allowed as a defense only in case of wilful acts, if at all, is central to the pattern that has emerged from the various studies and debates. . . . Actually, a provision in the convention and implementing legislation imposing strict liability would, in the opinion of many, be a codification of what the courts would do in any case.
>
> ". . . .
>
> "[I]t is equally safe to predict that today the courts would not permit the owner the benefit of the admiralty doctrine which, in various countries, limits the liability of the shipowner to the value of the vessel, a sum based on the tonnage of the ship, or a combination of these. A prerequisite to the right to limit is the absence of privity with or knowledge of the cause of the damage, on the part of the owner. It is no secret to the owner that his ship is equipped with a nuclear reactor."

Various other organizations of recent origin are grappling with the problems of nuclear energy. As the result of work done by ENEA,[103] a specialized agency of the Organization for European Economic Cooperation, the OEEC committee members on July 29, 1960 signed, subject to ratification by all 18 member nations, an international convention regarding third party liability in the field of nuclear energy.[104] This convention provided for imposition of liability without fault on the operators of reactors and other nuclear facilities, required all operators to carry liability insurance and extended the statutes of limitations to ten years.[105] It also provided for abolition of any liability in excess of $15 million with any signatory nation given the discretion to reduce this amount to $5 million.[106] Under such limits national emergency relief measures would be an obvious necessity in the event of a major nuclear incident.[107]

In April 1961 a committee of the International Atomic Energy Agency (IAEA), which represents 82 nations, issued a number of

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102. Seavers 184.

103. European Nuclear Energy Agency (ENEA).

104. 1 USEAC, REVIEW OF THE INTERNATIONAL ATOMIC POLICIES AND PROGRAMS OF THE U.S. 11 (1960).

105. CCH ATOMIC ENERGY INT'L ACTIVITIES ¶7517 (Jan. 3, 1961).

106. *Ibid.*

107. See Cavers, *International Cooperation in the Peaceful Uses of Atomic Energy*, 12 VAND. L. REV. 17, 44 (1958).

recommended nuclear safety and liability policies, which included:[108]

> (1) the imposition of absolute liability for property damage or personal injury from nuclear incidents, without requiring proof of fault or negligence, but requiring proof of causation;
>
> (2) the concentration of liability in the operator of the installation responsible for the damage;
>
> (3) the requirement that all liability for nuclear damage should be covered by adequate insurance or other financial security, with each state to determine the distribution of indemnity responsibility between private coverage and state intervention;
>
> (4) a definite limitation on the amount of liability to be established by each state, of at least a minimum figure to be established by convention, the state to have discretion as to actual limits above this amount; and
>
> (5) the establishment of jurisdiction over actions regarding nuclear damage exclusively with the courts of the state in which the causative installation is located, or, as to goods in transit, of the state of incidence.

On April 17, 1962, the Diplomatic Conference of Maritime Law began in Brussels.[109] Mr. Sterling Cole, director general of IAEA suggested that the governments licensing nuclear ships be required to provide indemnity during the formative period of nuclear ship development, since it was improbable that nuclear ship operators could otherwise provide adequate indemnity coverage. A working paper report by IAEA's Panel on Liability for Nuclear Ships proposed that the operators of nuclear ships be held absolutely liable for damage attributable to such ship's nuclear character, and that fault or negligence on the part of the ship operator need not be established by the claimant. The panel agreed that liability should be limited in amount and that it should be shared in cases where damage derives from either two or more nuclear incidents, or from one incident involving the operators of two or more nuclear ships. The panel suggested that the liability limit be based on a theoretical public exposure risk rather than on the amount of insurance coverage available on the world market, and that the limit be uniform in all signatory states.[110] Although final action of the Brussels conference had not been announced when this note was written, proposals being

108. BNA, ATOMIC INDUS. REP. ¶7:127 (1961).
109. BNA, ATOMIC INDUS. REP. ¶7:136 (1961).
110. *Ibid.*

considered as to liability limits ranged from $100 million recommended by Euratom to $125 million which is approximately the same amount as that in the German nuclear energy legislation, and which figure seems favored by the United States.[111]

There is a marked spread between the Price-Anderson indemnity figure of $500 million and the figures being considered at Brussels. Apparently the larger figure is thought by many nations to be either unsound or unreachable. A situation could conceivably arise wherein a foreign treaty ship covered by only $100 million suffered a serious nuclear accident in a United States port, resulting in damages and injuries which would reach even the prorational levels under our act. In this case our citizens would be submitted to the greater risk incident to visitation of a ship over the safety of which we exercise little control but they would be protected by only one-fifth the security provided for risks attendant to our own ships, concerning which complete information is available. It seems improbable that such a condition would be tolerated.

If such shipping is to be readily accepted in the major ports of all nations, adequate indemnity protection must be assured. Rather than to pursue the arduous and problematical effort to achieve bilateral or multilateral agreement on satisfactory indemnity procedures and limits between negotiating states, with the variances which could develop and with the objections which might well be voiced by nonsignatory states which stood to incur risks which they were not willing to accept directly for themselves, it would seem that a different approach might be in order. Perhaps the solution most sound, most fair, and most easily attainable would be the formation of an international indemnity pool, with each participating nation assigned by formula a percentage of responsibility for any claim which developed. This would give the opportunity for participation to even those nations which, though not maritime states themselves, would be exposed to risks and therefore entitled to indemnity. Thus any catastrophic occurrence, regardless of where it took place, would be handled on the basis of actual needs rather than funding capacity, with the advantage of spreading the costs to the world economy, which in turn would tend to make nuclear shipping an international asset, rather than an exclusive possession of the larger powers. No major funds would be required for such a venture, and conceivably arrangements could be made for participation of the insurance industry on an international level.

## CONCLUSION

Vice or virtue, we have embraced the risks of nuclear propulsion.

111. BNA, ATOMIC INDUS. REP. ¶7:136 (1961); Seavers 185-86.

Efforts should now be bent toward enjoying the benefits as soon as possible, but by means that soberly take into account the attendant risks. Pressures exist which tend to emphasize the similarities and to neglect the distinctions between nuclear and conventional methods of propulsion. Those pressures, if not countered by continued evaluation and adaptation, and if not buffered by far-sighted thinking, may result ultimately in delay in achieving the very goals desired. There seems to be no imperative peacetime need to plunge into the everyday operation of nuclear-propelled merchant shipping with an urgency which might increase unnecessarily the risks to the citizens of our port cities. Had the ordinary citizen his say in the matter, he might just as soon wait a bit, and gauge his acceptance of this new force on proven reliability and necessity. But if he is to be a pawn to progress, he at least has the right to expect that if he should be injured, or his property denied him or destroyed, compensation and aid commensurate with his needs will be made available. The civic leaders and officials to whom he entrusts his security owe him the obligation not themselves to be lulled into docility by reassuring pronouncements or tempted by promotional enticements. The advantages should be weighed against the risks, and the conclusions arrived at soberly. The long-run solutions may be found in such possibilities as nuclear-shipping industrial parks situated to minimize the hazards to the state's population,[112] off-shore terminals, and nuclear sea-tractors. Until such solutions are perfected, thought should be given to just what procedures will be followed if a ship does "irradiate a city."[113]

JAMES MILTON BROWN

112. One location which might be considered for such an enterprise is the Suwannee River sector of the Florida Gulf Coast.

113. *1960 Naval Reactor Hearings* 19.