GOVERNMENT REGULATION OF ATOMIC INDUSTRY*

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Atomic progress in the United States has evolved under three types of government control. The first, lasting from 1942-1946, was imposed by the military and continued the control by secrecy which had been initiated by scientists after their recognition of fission in early 1939. The objective of this control was production of the atomic bomb. In 1946 the first United States Atomic Energy Act1 was adopted, transferring control of atomic matters to a civilian agency but still retaining a tight government monopoly over most atomic endeavors. The accent under this act was the stockpiling of nuclear materials and weapons, but some studies of nuclear power were made, and in the last days of the act a governmental program of power reactor experimentation was inaugurated. The current act is the Atomic Energy Act of 1954.2 This act was intended to enable private industry to participate in peaceful employment of the atom; in fact, industry

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was encouraged to enter as much of the field as it desired. Regulation of industry is part of the function of the Atomic Energy Commission, the five-member civilian agency administering the statute. This commission functions under the close scrutiny of the eighteen-member congressional Joint Committee on Atomic Energy.

Unlike most legislation, the act was drafted to cover private activities and arrangements which had no precedent in practice, facing problems which could only be speculated about. The field still remains one in which predictions become obsolete before they can be put into print. Virtually no amendment has been made to the act, nor does the Commission currently recommend any, although regulations supplementing it continue to be promulgated, thereby aiding adjustment of the law to changing circumstances.

It is believed that it would be interesting and informative at this time, two years after passage of the act, to see how it has been applied, to see what problems have arisen through this application, and to conjecture as to the course future amendments might take. In the ensuing discussion, the intention has been to honor the philosophy followed by Robert McKinney in organizing his panel report—what nobody needs is a long scholarly post mortem of the atomic field.

THE BASIS OF GOVERNMENT CONTROL

A critical survey of the Atomic Energy Act of 1954 might begin by asking why there is any need for a law on this subject at all. Why should not the Government be expected to limit its concern with atomic energy to the military aspects, leaving domestic peaceful atomic development to industry, in accordance with the tradition of private enterprise? One of the primary explanations is an historical one—control once imposed is hard to abandon. Atomic fission was discovered in a wartime atmosphere when regulation was accepted naturally and, in large part, unknowingly, since even Congress was mostly uninformed and unaware as to what was in progress. Following the war, it took a bitter struggle to pry the atom out of military control. Even the Atomic Energy Act of 1946 was drafted to cover a program that was primarily concerned with building an atomic arsenal. As nuclear research advanced in other countries and as nuclear materials became more widely available, the justification for strict government control


became progressively less. Considerable relaxation was embodied in the present act, the Atomic Energy Act of 1954, and private industry got its first real chance at participation. Government control continues very much in the fore, nevertheless, although the emphasis is shifting more to public health and safety rather than common defense and security.

A reason still given for continued control is that of security—that the Government must retain tight control over special nuclear material, that is, the fissionable energy-releasing material (currently defined as uranium-233, uranium-235 and plutonium) which is vital to both military and civilian usages, so that it does not fall into enemy hands. The concept is a carryover from the days when many persons visualized this country as being the only country possessing significant amounts of such material. The soundness of the objective stressed by this argument might yet be conceded as to weapons-grade material. Even though some other countries are obviously quite competent in producing this material and probably have little or no interest in furtive acquisition of ours, it still may be wise to control our weapons-grade material by not making it generally available, especially to smaller, impulsive nations. It is interesting to note, in this connection, that possession of this material by domestic private industry is no longer attended by requirements for security, the assumption being that the high cost of loss is sufficient incentive for safeguarding.  

An offer was made recently by our government to sell or lease to foreign nations 20,000 kilograms of the special nuclear material U-235 (over twenty tons—enough for the operation of several millions of kilowatts of electrical capacity or for 4,000 minimal size bombs). Although the Commission has stated that the material will not be exported in weapons-grade form (that is, the artificial enrichment of natural uranium with U-235 will not exceed twenty per cent), that it must be confined to the originally stated peaceful purposes and must be reprocessed in commission-designated facilities, it is difficult to see how the latter measures can be enforced if the material is sold. Furthermore, in the course of operation, many reactors create appreciable amounts of the special nuclear material plutonium or U-233 in "blanket" material which would not be part of the fuel element, material which would in fact be owned by the foreign country. Recovery of this newly-formed material in highly pure form would be well within

the capacity of almost any country and no provision seemingly is to be made that this material be reprocessed under commission surveillance. The United Kingdom and Russia also should be in a position to make offers of material in the near future, perhaps of highly enriched weapons quality if they so desire. Accordingly, within a few years, either by purchase or by the interim use of non-weapons grade U-235 or even natural uranium, foreign countries will be enabled to amass weapon amounts of special nuclear material. The security basis for continued government domestic control thus fades as quantities of plutonium, U-233 and U-235 become generally available.

Another argument, also centering on special nuclear material, has been that while this commodity remains scarce, while civilian demand exceeds supply, the Government should be the party to decide what uses are permitted and under what conditions. As has been suspected by many, a fallacy in this argument now lies in its premise of material shortage. This was amply demonstrated by the recently announced availability of 40,000 kilograms of special nuclear material for private use, 20,000 by domestic industry and 20,000, as already mentioned, for sale or lease abroad.9 A minimal size research reactor uses two to three kilograms of such material,10 one 100,000 kilowatt prototype power reactor now nearing completion requires only fifty-two kilograms of such material,11 while two others, each of about 150,000 kilowatt capacity, will individually consume approximately 200 kilograms of such material each year.12

In making a fair estimate of the apparent material surplus, it must be recognized that the 40,000 kilogram allocation probably is expected to cover a period of several years and thus may not be in surplus at the present time. However, three large gaseous diffusion plants under government ownership are producing U-235; thirteen breeder piles, also under government ownership, are producing Pu-239. This output has been continuous for several years and it would seem that stocks of material must be appreciable, probably much in excess of military demands. The supply of ores from which special nuclear materials are prepared is expanding rapidly; although the United States continues to support ore prices through 1966, Canada finds its reserves now sufficient to justify termination of its government buying program. The Commission has stated that it believes "... peaceful uses will

not be limited by the availability of materials under any foreseeable circumstances." This material availability simultaneously weakens another major reason for control which is manifested throughout the 1954 Act—that is, as a prerequisite for prompt recall of special nuclear material for military purposes should the need arise.

A necessity to keep vital information from foreign powers is also given as a reason for continued control. The extent and desirability of restriction of information will be considered later. Suffice it to say, at this point, that if a person is willing to undertake atomic ventures on the basis of information which is unclassified, or which is available to him by virtue of his satisfaction of personal security investigations, then control over his activities, other than enforcement of precautionary measures for protection of restricted information, contributes nothing to this aspect of our national security.

Another important and often asserted reason for justifying continued government control is that achievements in atomic progress paid for by the vast amounts of money spent by the Government to date must not be made the subject of a giveaway to private industry. By the end of 1956 these expenditures exceeded $15 billions. While it should be pointed out that this money has also bought us military strength and national defense, and that it has not succeeded in progressing science and engineering to the point of providing competitive power, it must be admitted that almost any private atomic venture would draw heavily on government-sponsored research in the past. The immediate reaction of many persons is that this must vest a public interest in all significant atomic ventures. One answer to this attitude should be that the government program itself was founded on the vast scientific knowledge which was acquired through the efforts of innumerable scientific predecessors and subsequently made available for unrestricted public use. Thus, the Government might similarly dedicate its findings to the public domain without feeling that such a contribution warranted retention of control over the activities of those who thereafter utilize it. Also, it may well be that the public can recoup its outlay by some means short of extending restriction of enterprise into the indefinite future. Perhaps a fair share of public investment could be recouped by charging industry royalties for patented information which it utilizes and which has been collected by government expenditures. The British apparently contemplate such a measure. If further progress in civilian application continues to be financed by the Government, then public investment indeed may be-
come so heavy that the Government will be in control of the atomic industry ad infinitum. At present, this appears a not unlikely prospect.

Any atomic project must involve more or less serious health and safety hazards. These will be considered in detail later, but it is here that the soundest reasons exist for moderate continued government control. The Commission is virtually the only organization in this country qualified by experience to dictate health and safety standards for private atomic enterprise. It is fair and reasonable to require any private venture to concern itself with the safety of its operation, although this may well be done by regulation which falls somewhat short of the degree of control that now obtains. Many other fields of endeavor offer potential harm to the public, and their supervision either by federal or state agency has not required detailed official intervention into the business itself.

**Government Sponsorship**

A problem closely related to that of government control over the utilization of atomic energy is that of government sponsorship of such utilization. During the period prior to the 1954 Act, wherein the Government reserved essentially all atomic power activities to itself, vast public expenditures were made, primarily on projects in furtherance of national defense but with appreciable application to peaceful power. It is conceded that the knowledge and skills obtained by government expenditures to date, although sufficient to generate appreciable amounts of electricity from atomic reactors, are inadequate to enable the production of power competitive with conventional sources.15

The status of the atomic power program is such that most, if not all, of the fundamental theoretical work has been done. The remaining and most expensive part is the construction of actual reactors, so that the unpredictable engineering and technical difficulties found only in large scale operation may be encountered and solved. Government and industry are currently performing this function in several rather distinct ways.16

Under the Five Year Reactor Development Program, initiated in March 1954, prior to the 1954 Act, five different reactor prototypes were selected by the Commission and are being constructed for it.17

15. *Hearings*, supra note 3, at 323.


The five types include pressurized water, boiling water, fast breeder, sodium-graphite and homogeneous reactors. A sixth type, the organic moderated reactor, and a seventh, the liquid metal fuel reactor, have recently been contracted for under conditions of financing essentially the same as for the first five types. An eighth type, a high temperature, gas-cooled reactor, is contemplated. For reasons escaping many members of industry, no natural uranium power reactor is being undertaken in this country. It is felt by many that such a reactor offers the most attractive economics for the near future. Reactors under the five-year program are being financed primarily by the government; the basic purpose is to ascertain more definitely what reactor types may prove commercially feasible and to make acquired information available to everyone on equal terms. Accordingly, most of these reactors are of small electrical kilowatt capacity.

With the passage of the 1954 Act, Congress indicated its intent that industry should be allowed, in fact expected, to participate more fully in this development of power. Probably the expectation of many was that private industry would then forge ahead with power development primarily at its own expense. However, soon after passage of the act and before any private projects were proposed, the Commission evolved the somewhat controversial Power Demonstration Reactor Program. This program was designed to assist private development, under the anticipation that progress would thereby be appreciably expedited. Basically, the program solicited bids for reactors having electrical capacity in excess of 75,000 kilowatts. Construction and ownership of the reactors were to be vested with industry, but for those projects which the Commission believed would provide technical and economic information not available theretofore, it offered moderate aid in the form of a lump sum, waivers of charge for the use (not consumption) of special nuclear material, and assistance by government laboratories in certain research and development work. Such

information as is obtained through this assistance is to belong to the Commission. The program initially received some criticism, which ultimately subsided, on the grounds that it represented an illegal subsidy of private projects.  

Four proposals were submitted under this first program, of which three will apparently culminate in the construction of reactors using the promised government assistance. During the period covered by the first such program, a single private proposal also was made for the construction of a reactor entirely with private funds. In addition, one of the four applications under the demonstration program requested aid only as to insurance and therefore was regarded merely as an application for license. Interestingly, the first two construction permits for large-scale private reactors, representing a combined electrical capacity of 320,000 kilowatts of nuclear power, have gone to these two applicants for reactors sponsored wholly by private capital. At least four additional proposals are now under submission to the Commission for smaller wholly private projects, one having been issued the third construction permit. A "conditional" construction permit for a major reactor under the first program has recently been issued.  

Shortly after the closing date of the first demonstration program, a second program was announced, offering the same aid as the first plus an alternative of commission financing of, and retention of title to, all or part of the reactor system. This program was for reactors in the 5,000-40,000 electrical kilowatt capacity range, thereby offering assistance to smaller groups who were financially unsuited for projects under the original program. Seven proposals were made under the second program. The interest in taking advantage of that assistance which entails commission financing of the reactor system was quite pronounced and, to advocates of privately-supported endeavor, rather disappointing. This type of government aid strongly resembles the original five-year program and unavoidably creates an air of hesitation on the part of industry. Such assistance also falls squarely within that part of the act which gives preference for power so produced to public

27. AEC News Release, No. 620, April 7, 1955.
bodies, cooperatives and private bodies operating in high cost areas.35

A third program has recently been announced by the Commission. No cut-off date for proposals was prescribed but all proposed reactors are required to be completed by June 30, 1963. No limitations as to reactor type or size were made but the Commission indicated its readiness to undertake federal construction of some particular types if private bids thereon are not forthcoming.35a

As of early 1956, the Commission's five-year program involved the proposed expenditure of $222 millions of government money, $20 millions of private capital; the power demonstration program, $55 millions of government money, $110 millions of private capital; the independent private projects, $145 millions of private capital.36 Unquestionably, a major deterrent to private investment has been a realization that nuclear power will not be competitive with power from conventional sources for many years. Electrical power generation costs range from four to seven mills per kilowatt-hour over most of this country. In contrast, nuclear-powered electricity from the first completed reactor will cost fifty-two mills;37 from a subsequent reactor by the same manufacturer, fifteen to eighteen mills.38 Other reactors, still in the planning stage, are expected to have costs of about nine to ten mills.39 Predictions that nuclear power costs will drop to a competitive level by 1965 or 1970 do not suggest that nuclear power ever is likely to appreciably undersell that from conventional sources.40 In light of such economics, it is understandable that industry proceeds with deliberation. Such motivation as exists is probably primarily a desire to retain the atomic power program in private hands. The pace is accordingly slower than many would like and leads to such comments as that "the United States has no civilian atomic energy program worthy of the name. . . ." 41

Many feel that, with its already vast investment and in light of the slow private progress, the Government should complete the quest for competitive atomic power, or at least undertake a public power

36. Hearings, supra note 3, at 341.
41. Hearings, supra note 3, at 217.
program concurrently with that of industry. One of the most influential and outspoken advocates of renewed public power development is Commissioner Murray:

"The prospect of getting industrial atomic power in the near future is very gloomy. The Government has prematurely abdicated to private industry the primary responsibility for building large power reactors. Important reactor types have been 'staked out' by individual companies or groups. Yet there is no firm assurance that these and other power reactors will be built in the near future. Repeating a recommendation made last February, I again urge the Government to assume the primary responsibility for large reactor construction." 42

This attitude was largely submerged in the 1954 Act, but it surfaced briefly in that section which precludes the Commission from engaging in the sale or distribution of power for commercial use 43—the proviso is there made that power sold from commission research facilities shall go preferentially to public bodies and cooperatives or to utilities serving high cost areas—and in that section which gives commercial facility license preferences in essentially the same manner. 44 Private power proponents have attacked even these provisions. However, the act specifically states that other government agencies authorized to produce, market or distribute electric energy for ultimate public consumption shall not be barred by the act from obtaining commercial facility licenses. 45

Others feel that, with its military purposes largely accomplished, the Government should no longer compete in the power field but should release as much of it to private enterprise as the latter is willing to undertake. 46 Of these, some would hold the Government in readiness to push forward immediately on whatever experimental fronts the

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Commission deems promising but in which industry lags. This latter view summarizes the current position of the Commission.

Although the pendulum is currently on the side of private power development, it may very well have several swings left in it—the issue between public and private atomic power is far from settled and will be much influenced by the political tides. One proposal, passed by the Senate but rejected by the House during the last session of Congress, was the Gore bill, a proposal for the public construction of prototype power reactors in this country and abroad. The opinion of many is that such a bill still may result in legislation in the near future. If such a program materializes, further expenditure of private funds for prototype reactor development almost certainly will be curtailed.

Under government-sponsored research, the cost is borne by the taxpayer and all licensees are free to take advantage of the resultant progress. Under privately-sponsored research, the cost of progress is borne by limited groups—i.e., the cost of private power development would fall largely on the utility companies and, depending upon the attitude of state regulatory agencies, ultimately would be shifted to consumers or shareholders. The consumer seems destined to sustain most of the loss, whether the extra cost of nuclear power is incorporated into the rate base of the utility or itemized as an expense, the latter decreasing shareholder profits temporarily but supporting a claim for rate increases if the residual return on the rate base is not fair. Even that part which is temporarily charged to shareholder profits probably would be reduced fifty-two per cent by decreased income taxes. It cannot be expected, of course, that private groups will be anxious to pay for developments which thereafter can be exploited freely by others. Thus, interest in private development unquestionably suffers from the absence of a satisfactory means for eventually shifting a fair proportion of the development cost to other groups which later desire to take advantage of the knowledge so obtained.

47. See 1 PANEL ON THE IMPACT OF THE PEACEFUL USES OF ATOMIC ENERGY, PEACEFUL USES OF ATOMIC ENERGY 249 (Report to the Joint Committee on Atomic Energy 1955); Hearings, supra note 3, at 323.
50. See Hearings, supra note 3, at 246-47.
51. See U.S. TREAS. REG. § 1.11-1.
In view of the relatively inexpensive power already available in the United States from conventional sources, it would be satisfactory domestically to let private enterprise develop atomic power at a rate set only by the pressure of competition. However, the international consequences of atomic power, i.e., the prestige which will go to the country which first can provide economic nuclear reactors on an international market, seemingly demand an accelerated and artificial rate of progress. With a few exceptions, and with described justification, industry has been markedly conservative in placing its own capital into prototype nuclear reactors, the consequence being relatively retarded power development. This reticence undoubtedly is heightened by threat of the re-entry of a public power program. Industry will be hard pressed to find logical objection if the proposed government return to public atomic power materializes.

Access to Atomic Information

Any person who intends to participate in activities concerning atomic energy has a natural and sensible desire to know as much as possible of the information already available in his field of interest. However, he will find the availability of much of his needed information complicated to an extent wholly different from almost anything in his prior experience. It is an international tradition in the physical sciences that every scientist who makes an appreciable advance in his art will report his findings in some appropriate periodical. The system of reporting is not unlike that which is undertaken in the field of law on a national scale. The lawyer has his Shepard's Citations, the scientist has his Chemical Abstracts; the lawyer has his regional reporters, the scientist has his Physical Review; the list of counterparts runs on extensively. Thus, within the few weeks' delay required for publication, or perhaps a somewhat longer delay required for patent application, workers in science are kept abreast of the latest developments throughout the world. This tradition doubtless contributes greatly to the rapid technical progress of modern industry.

It was precisely this system which brought word of uranium nuclear fission from Europe to America in the late 1930's. If this discovery had been made in a peaceful world, atomic energy now still might be a science as open and free from restriction as any other. However, because of the impending war in Europe, leading scientists from many countries congregated in the United States. Realizing the strategic military importance of their work, they initially imposed upon themselves a voluntary censorship as to publication of their subsequent work. Later, as the Government began to finance this research and
development, secrecy became a contractual imposition. In addition, successive governmental censorship bodies achieved the co-operation of editors of American scientific journals in suppressing reports of work in the nuclear area. Thus, all developments in this field rapidly came under government control and the output of published scientific reports concerning fission, uranium and plutonium dwindled to essentially nothing.

Under the 1946 and 1954 Acts, scientific data is born restricted if it concerns atomic weapons, production of special nuclear material or its utilization in the production of energy—although properly denoted as "restricted data," this is often referred to as classified data. The hallmark of restricted data denotes that it is available only to persons having governmental approval. The Commission has only that right to control information which is given to it by the act. Declassification of restricted data, that is, putting it into the public domain, is permitted, is in fact required, when the Commission determines that it may be done without "undue risk to the common defense and security." This mandate is generally conceded to indicate a congressional intent that information should be more freely circulated than was the case under the 1946 Act, which permitted declassification only when it would not adversely affect the common defense and security; however, disagreement still exists as to the degree intended.

Any prospective contract, arrangement with, or license from, the Commission must be preceded by a written promise that the recipient of restricted data shall not permit access of any person thereto until such person has a security clearance according to standards prescribed by the Commission and administered by the Civil Service Commission. Except by special authorization of the Commission or the General Manager, the recipient himself must have a similar clearance. The Commission has the power to adopt such regulations as it deems necessary to protect restricted data.

In practice, taking a statutory hint, the Commission has designed a system for distributing restricted data which categorizes it into several

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degrees of secrecy, thereafter making it available only to persons having a commission-issued access permit together with an appropriate security clearance.68 Top-secret data has high military significance and is unavailable to anyone for private enterprise purposes. Secret data is of intermediate importance and can be received by anyone having a corresponding access permit and a “Q” security clearance, the most stringent clearance given for private purposes. Confidential data is the lowest grade restricted data and can be received by anyone having an access permit and an “L” clearance, the latter involving a relatively cursory security investigation of the individual.69 Restricted data may also be made available to cleared licensees; normally, however, a person will require an access permit so as to investigate the pertinent information in advance of any request for license.60

To get an access permit, the applicant must first promise to comply with all provisions of the act and regulations; he must waive all claims for the just compensation which the statute otherwise offers him should the Commission divulge to another nation information contained in certain of his patent applications; he must waive statutory provisions for damages if a secrecy order is imposed upon his patent applications; and he must waive all claims against the Government that might arise in connection with the use of information obtained pursuant to the permit.61 Justification for such mandatory waiver of statutory damages and just compensation seems noticeably lacking; elimination of these requirements, which are not designed to advance security of the information, reasonably may be suggested. In some cases they may present a serious obstacle to acquisition of information by an interested person, i.e., permits granting access for members of companies or partnerships must be issued to the companies or partnerships;62 these latter entities may balk at making such waivers, thereby defeating the individual’s access.

Access permits for confidential data are being granted for any reasonable purpose or potential use outlined by the applicant, including a mere survey of the information to see if the applicant later might desire to enter the field actively. For an access permit to secret data,
however, the Commission also exercises its own judgment as to the applicant’s "need for such data." 63 Although this might seem to exceed a mere security measure, it probably represents only a realization of the fact that every permittee constitutes a potential loss of secrecy; if this risk is to be assumed for the more vital information, it should have more than casual interest to the recipient. Both secret and confidential data can be exchanged directly between persons holding the appropriate permit and clearance.64

Once a person has passed into the inner sanctum of access-permit holders, he receives extensive information disseminated by the Commission and intended to enable him to locate that data of most interest to him.65 In general, this aid makes it at least as easy to find pertinent information as if it had been published in the customary scientific literature.

The dissemination system adopted by the Commission has received some commendation from outside the Commission; it has also received an appreciable amount of criticism,66 including that from the chairman of the Joint Committee,67 both as representing a delay in the more desirable declassification and as being inherently impractical. There is probably no one who would seriously advocate total declassification of all data concerning atomic energy. Publication of some information peculiar to atomic weapons or military usage could lead to highly detrimental consequences. But with this premise, of course, the problem arises as to where and how a line must be drawn. Obviously it cannot be drawn by statute; discretion must be given the Commission. In essence, the gradating scheme of top-secret, secret, confidential and declassified information follows from the inability to draw a sharp distinction. It also must be remembered that this scheme was originally envisaged by Congress, not the Commission. Inasmuch as the scheme accomplishes appreciable declassification and permits access to all but top-secret data by persons who can justify their inquiry, it seems designed to carry out the spirit of the act to a satisfactory extent.

Some dissension must naturally arise as to the basis for placing particular information in any selected category. Inspections of the wealth of restricted data recently downgraded or declassified (i.e., 31,000 documents reviewed in eleven weeks) make it quite apparent

63. Ibid. (10 C.F.R. § 25.15(b)).
64. Id. at 719 (10 C.F.R. § 95.31).
65. See Hearings Before the Joint Committee on Atomic Energy, 84th Cong., 2d Sess. 54-57, 75-77 (1956).
66. See, e.g., Green, supra note 58.
that such relaxation was long overdue in many instances. The better share of the data declassified is of a kind which any competent worker could acquire, given the time and equipment. No revolutionary concepts seem to have been divulged. It probably may be fairly assumed that downgrading within the restricted categories has much the same characteristics. It has been said, as may in fact be the case, that most, if not all, the basic fundamentals of science known today lie in the declassified area.

Further declassification is permitted pursuant to recent relaxation of the *Tripartite Declassification Guide* used by the United States, Canada and the United Kingdom.\(^{68a}\)

The obvious justification for restricting data is to retard the military progress of unfriendly countries. Doubtless some restricted information would be immensely valuable to an unfriendly power; yet, much of it has unquestionably been developed independently by other countries, as was clearly evident at Geneva when the United States, the United Kingdom and the Soviet Union found themselves each harboring secret data which agreed almost to the letter.\(^{69}\) We also handicap ourselves to an appreciable extent by anything less than free disclosure. Scientists universally agree that restriction of data leads to duplication and retarding of domestic research. The atom and fission were discovered in an academic atmosphere of virtually free publication of research results. Governmental regulation of scientific publication in a few key countries probably could have postponed these discoveries far into the future. Analogously, our present day secrecy may very well deprive many of our own scientists of basic facts which would serve them as stepping stones to future discoveries. Basic advances in science frequently stem from university faculty members; yet some leading universities in this country, justifiably or not, refuse to traffic in restricted data, thus depriving themselves of information and the country of valuable progress.\(^{70}\) This adverse consequence of secrecy may well be one of the most critical.

Other practical bases suggested for the secrecy program have been less concerned with security. One of these is the use of classified data as a political tool—to be apportioned out at times and places and to selected recipients, primarily foreign countries, in ways designed to strengthen this country's political advantage. If this is the case, such

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a philosophy should be publicly aired and opened for discussion of the merits. Still another alleged use of secrecy has been to deny information to persons who otherwise might oppose projects undertaken—or who might instigate embarrassing investigations into supposed commission mismanagement.

A further criticism of the secrecy program is that whenever information is selectively disseminated, someone is going to be treated unfairly. Perhaps the most forceful demonstration of this lies in the area of top-secret information which is not available for private purposes of any kind. A select group out of private industry has been in a contractual relationship with the Commission for many years, in the course of which top-secret data was necessarily imparted to, and developed by, them. When persons from within this group compete with non-members for private business, it is inevitable that they may profit to some extent by virtue of this inside experience with the Commission. Of course, it often may be that this is the only real profit they secure by their contractual projects, many of which are undertaken for only a token fee. The problem is as serious as it is unanswerable. It is complicated by the fact that these insiders are generally the large corporations which already have an edge in pioneering because of their size. One maneuver of self-help by outsiders has been the raiding of employees, both from within the Commission and from the insiders of industry. Presumably nothing but total abandonment of secrecy would completely alleviate this situation.

The general tone of public opinion, including many former commission staff members, seems to be that declassification of information should be expanded. Yet, while the statutory standard continues to emphasize the potential harm from declassification rather than potential benefit to peaceful utilization, it does not seem that much fault can be found in the basic approach of the Commission. Even the scientists disagree among themselves as to which direction any change in the status quo should take. So long as the present scheme permits access, by persons showing legitimate need, to all data which could be made public under the most extreme declassification proposals, any chafing by those who are unable to satisfy idle curiosity seems a slight price to pay for whatever security the plan may provide.

71. 1 PANEL ON THE IMPACT OF THE PEACEFUL USES OF ATOMIC ENERGY, op. cit. supra note 47, at 108; Green, supra note 58, at 100.
72. See Hearings, supra note 65, at 452-54.
74. See, e.g., 12 BULL. ATOMIC SCIENTISTS 23, 135 (1956); 11 BULL. ATOMIC SCIENTISTS 275 (1955).
OBTAINING NUCLEAR MATERIALS

An industry which has procured adequate information to embark on a desired program must then adjust to operation under the government licensing program. A unique aspect of the atomic business is that the Government owns or controls the energy-producing chemical elements upon which the industry is founded and dependent. Private possession can be only under license. Two of the pertinent elements involved in the production of power—thorium and uranium—occur in nature in the customary form of ores. A third, plutonium, is a synthetic element which is made from uranium. The consequences of this government ownership and control of nuclear materials are directly imposed upon a private undertaking in two critical ways—availability and price.

Source Material

Thorium and uranium are defined by statute as "source material"—so named because they are the source of special nuclear materials, those materials releasing energy by nuclear fission.

"The term 'source material' means (1) uranium, thorium, or any other material which is determined by the Commission pursuant to the provisions of section 61 to be source material; or (2) ores containing one or more of the foregoing materials, in such concentration as the Commission may by regulation determine from time to time." 76

Power is given the Commission to add materials to this definition with assent of the President. 77 The open-end definition is intended to correspond with possible expansion of the special nuclear material category. Although the definition of the statute is technically ambiguous, it presumably means natural thorium (which is 100% isotope 232) and natural uranium (which is 99.28% isotope 238, 0.71% isotope 235 and 0.006% isotope 234). While these elements are left in their place of deposit in nature, no government control is imposed. Although private ownership of source material may be permitted at any stage,

"unless authorized by a general or specific license issued by the Commission, . . . no person may transfer or receive in interstate commerce, transfer, deliver, receive possession of or title to,

or import into or export from the United States any source material after removal from its place of deposit in nature, except that licenses shall not be required for quantities of source material which, in the opinion of the Commission, are unimportant." 78

Privately owned source material, moreover, is always subject to condemnation and acquisition by the Commission, 79 albeit with a provision for just compensation.80

The statute authorizes the Commission to become a buyer of source material at prices which it may guarantee for a specified time—upon which the statute sets no limit.81 This authorization is being used by extension of regulations adopted under the 1946 Act and the current price for most domestic raw source material, or ore, is guaranteed through March 31, 1962.82 Also, under these regulations, some guaranteed minimum prices exist for domestic refined uranium, high grade ores and mechanical concentrates through 1958. This departure from competitive price setting is asserted to be required to stimulate development of adequate supplies of material—perhaps the striking success in uranium exploration is, in fact, appreciably due to such policy.

A major criticism of the current policy, interestingly, has urged guaranteed prices for longer periods of time as a further incentive to continued prospecting and exploration. In response to the criticism and with the intention of further encouraging prospecting for new uranium deposits, the Commission has announced that it will continue its domestic uranium procurement program with a guaranteed price for domestic-milled concentrates of uranium oxide for the period from April 1, 1962 through December 31, 1966.83 The Commission recognizes, however, that this extension is a prelude to an eventual transition to a free market.

Once the ore has been mined, the next process is to mill and refine it so as to place it in a form suitable for utilization. This utilization


may either be of the refined form in natural uranium reactors or it may involve still further processing into feed material for isotopic separation processes. Private industry, as well as the Government, could perform this milling and refining if the appropriate material license were obtained, i.e., industry could buy the ore at the government-determined price and then offer milled and refined source material for competitive sale to licensed users. However, in current practice, the ore is milled and refined almost exclusively in government-owned or contracted-for facilities. As has been mentioned, the procurement plan from 1962-1966 will shift from ores to concentrates prepared by private domestic mills. At present, the Government is the only important market for the refined material, which it then uses in plutonium breeding reactors or converts into feed material. The latter also has been prepared only in government facilities thus far. Recent developments indicate that private industry also may eventually become a supplier of both refined metals and feed material.

The process thus described sets a somewhat artificial floor on the price of fuel for atomic power, whether the source material be used in its purified form or enriched to make special nuclear material. The effect will be essentially the same under the extended fixed prices for concentrates or under a potential scheme of set prices for the refined metals. While fuel prices may prove to be one of the lesser components of the cost of nuclear power, continued examination ought to be given to a government buying policy which helps determine the economics of nuclear power and which subsidizes an element of the mining industry in a manner which could make "the silver buying program . . . look like a church sale." The day ought to come when there need be no price guarantee for any nuclear material and when the continuation of any government buying program would no longer dictate the market price.

The statute directs the Commission to make a "reasonable charge" for source material to be "distributed" for commercial uses but allows it discretion as to whether it will make such a charge for research


and development type usage. The price, where charged, is to

"be established on such a nondiscriminatory basis as, in the opinion of the Commission, will provide reasonable compensation to the Government for such material . . . and will not discourage the development of sources of supply independent of the Commission." 88

The latter clause, if taken at face value, seemingly would preclude any sale at materially less than the cost of production. The Commission has indicated that it would charge the price quoted by industry, if such a situation arises, where this is higher than the Commission's cost of production. 89

Special Nuclear Material

A problem of more importance to industry than the use of source material is that of use of the government-owned "special nuclear material." 90

"The term 'special nuclear material' means (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of section 51, determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material." 91

Possession or transfer of this material likewise is forbidden except under general or special license.

"It shall be unlawful for any person to—

(1) possess or transfer any special nuclear material which is the property of the United States except as authorized by the Commission . . . ;

(2) transfer or receive any special nuclear material in interstate commerce except as authorized by the Commission . . . or export from or import into the United States any special nuclear material. . . ." 92

89. See Hearings, supra note 65, at 85.
The term "enrichment," as applied to special nuclear material, is of ambiguous definition but is commonly used to denote absolute content of these three isotopes. That is, a fuel of 2% enriched uranium would be comprised of 98% U-238 and 2% U-235, achieved by the addition of approximately 1.3% U-235 to the 0.7% U-235 already present in natural uranium.

Special nuclear materials are the only known materials which have properties sufficient to merit practical consideration for controlled energy production (even the use of natural uranium depends upon its content of U-235). Provision is made for classification by the Commission, with assent of the President, of other materials as special nuclear material—a classification left open-ended in anticipation of including fusionable materials at some future date. Private owners must be paid just compensation at the time of such deprivation of ownership.

The production of special nuclear material from source material legally could be done in privately-owned facilities under government license. As a practical matter, however, it is highly difficult and expensive as a primary undertaking and, aside from incidental production in private reactors, is being done today only in government-owned facilities. Uranium-235 is separated from the much more abundant U-238, with which it occurs in natural uranium, by a gaseous diffusion process—the Government currently operating three such diffusion plants. Plutonium-239 is produced from U-238 in breeder reactors—chemical separation of these different elements being relatively simple—the Government currently operating thirteen of these reactors. Uranium-233 is similarly produced from Th-232, although no facilities are yet known to be devoted primarily to its production.

The Commission is required to make a "reasonable charge" for use of the material for commercial purposes and is given discretion, to be exercised in accordance with established written criteria, as to whether it will make such a charge for research and development purposes. Use of material is distinguished from consumption of material because only a small part of the material held in inventory by the licensee will be consumed before it is returned for reprocessing. In calculating this reasonable charge for use, several factors other than

the cost of production are to be considered, centering primarily on the
nature of the proposed usage. Only for commercial usage is the
charge required to be uniform and nondiscriminatory, insofar as is
practicable. In addition, special nuclear material actually consumed
by the commercial user must be compensated for by a further charge,
based on the lower of the Commission’s estimate of its own cost of
production or the “average fair price” paid to private producers of
such material. Charges for consumption by research and develop-
ment licensees, like charges for use, are left to the discretion of the
Commission. In using its rather broad powers, the Commission has
said that prices for all uses or consumption of nuclear materials will
be uniformly applied, except where ad hoc waiver of charges for
research and development purposes may be made. For research
reactors operated by nonprofit institutions, the Commission may waive
both use and consumption charges, as well as offering free fabrication
of fuel elements and reprocessing of spent fuel.

In the course of using either source or special nuclear material in
his reactor, the private owner will find that he inevitably produces
other special nuclear material, either U-233 or Pu-239. Since the
Government instantly becomes the owner of this material, he must deal
with it as the Government prescribes. The act states that he shall
receive a “fair price” for it (not “just compensation”):

“All rights, title, and interest in or to any special nuclear
material within or under the jurisdiction of the United States, now
or hereafter produced, shall be the property of the United States.
. . . Any person owning any interest in any special nuclear
material . . . shall be paid just compensation therefor. Any
person who lawfully produces any special nuclear material . . .
shall be paid a fair price . . . for producing such material.”

This fair price shall apply to all licensed producers of the same material
but is to be determined primarily with regard for its intended use by
the Government and secondarily with regard for its cost of produc-

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99. Joint Committee on Atomic Energy, Amending the Atomic Energy Act of
16 (1954).
10, 1955; Hearings, supra note 84, at 74, 180; Marks & Trowbridge, Framework for
101. AEC News Release, No. 883, Sept. 5, 1956; AEC News Release, No. 684,
1955).
Some of the material produced may be fissioned itself before recovery—for this consumption there is no charge and, of course, no fair price payment. This fair price for produced material may have a guaranteed minimum for a period of time not to exceed seven years from the date it is set—under this authorization the Commission has set prices currently guaranteed through 1963. This seven-year period has been criticized as too short in light of the three or four-year period required for construction of the reactor. The price has also been assailed as too low to permit immediate profitable production of nuclear power. Some had expected it to contribute a revenue approximately equivalent to that of the power produced, at least in the case of a breeder reactor.

Whether an industry is using source material or special nuclear material, the material is subject to a gradual depletion and contamination, at a stage far short of total consumption, after which it must either be chemically reprocessed and rejuvenated or else replaced entirely. Reprocessing, like original fabrication of the fuel element, may be done by private persons if they obtain a license. However, the Government now owns all reprocessing facilities and all but a few fabricating facilities—again subjecting the user to the government pricing scheme. The Commission is authorized to provide processing, separating, fabricating or refining of nuclear material used by licensees at a nondiscriminatory price which will provide reasonable compensation to the Government without discouraging the development of sources of supply independent of the Commission. In fact, the Commission has said it will charge the same prices as may later be set by private industry for these services, even though its cost may be lower.

By-Product Material

By-product materials, those radioactive materials prepared in the course of production or utilization of special nuclear material, also

104. Hearings, supra note 65, at 86.
107. Hearings, supra note 84, at 255.
109. Id. at 85.
require either a general or special license for transfer or receipt of possession or title, unless exempted therefrom by the Commission. Charges for such material supplied by the Commission may be waived by the Commission, but if levied, must be nondiscriminatory and must provide reasonable compensation to the Government without discouraging development of sources of supply independent of the Government, and yet must be such as to encourage research and development. Present Commission policy is to supply some users (medical, agricultural and biological) of such materials at twenty per cent of their established price. Fission products produced in private reactors are a species of by-product material and are created from material that was government property before it fissioned. Nevertheless, the Government apparently intends to assert no title to such fission products—it is still indeterminate whether this will provide a source of revenue to the private owner through sale of a desired commodity or a source of expense through costs of disposal as waste.

**Consequences of Material Control**

In an industry so affected by conditions of government ownership and control, it may be anticipated that objections and difficulties will arise. An evaluation of government ownership of special nuclear material closely parallels that of government regulation of the atomic area. The reason most commonly asserted is that government ownership was imposed to assure the simplest possible mode of re-acquisition in case of need for military purposes. Special nuclear material is made subject to recapture by the Government in case of war or national emergency. This justification may now be dated. The recent allocation by the President of 40,000 kilograms of U-235 for peaceful purposes for the next several years was somewhat higher than many persons expected, but it was generally felt that the years of


114. Hearings, supra note 65, at 94.


intensified production since about 1950 had enabled the accumulation of a material supply more than adequate for military needs.

Another proposed justification for federal ownership has been that it will give the Government an advantage in dealing with the subject of international atomic controls.118 This reasoning also may be dated since it stems from a period when ownership of all the world's fissionable material was expected to pass to an international organization—a now remote possibility.

A reason of more current basis is that government ownership may strengthen the constitutional basis for continued regulation of the atomic field.119 Regulating the use of government property is well within the federal power. However, the constitutional basis for federal ownership ought to be equally valid grounds for federal regulation under private ownership. Psychologically, government ownership probably makes industry more willing to accept regulation, as well as providing a safety check which eases the minds of Congress when broadening the rights of industry.

Suggestions have been made that ownership of such material eventually should be permitted for private persons.120 However, very little agitation for private ownership seems to come from those most active in the field. The Commission has not taken any position as to whether private ownership should be permitted.121 Government ownership has the disadvantage that the reactor owner is tied closer to the need for government approval of his continued operation and it precludes the growth of a free market in the material. The unwillingness of some foreign countries to base their atomic programs on an uncertain supply of such material undoubtedly underlies, at least in part, their decisions to concentrate on natural uranium reactors. On the other hand, the Government is making the material available on a lease charge of four per cent of its value,122 thereby saving industry the need to invest to the extent of total value of the material were it to be bought for private ownership.

The statute prescribes no length of time during which a material license shall extend. However, the Commission's regulations indicate that a material license shall be coextensive with the duration of a

118. 1 PANEL ON THE IMPACT OF THE PEACEFUL USES OF ATOMIC ENERGY, PEACEFUL USES OF ATOMIC ENERGY 131 (Report to the Joint Committee on Atomic Energy 1956).
119. Hearings, supra note 65, at 513.
120. See 1 PANEL ON THE IMPACT OF THE PEACEFUL USES OF ATOMIC ENERGY, op. cit. supra note 118, at 13, 134.
121. Hearings Before the Joint Committee on Atomic Energy, 84th Cong., 2d Sess. 393 (1956).
122. Id. at 86; Hearings, supra note 84, at 74.
facilities license, in cases where the latter is also required. Of even more consequence is the assurance of a material supply while the license is in effect. The Commission is authorized, but not required, to make special nuclear material available for the period of the license. The total amount of special nuclear material to be made available for private use is to be determined at least annually by the President— for domestic use, as mentioned, this is currently 20,000 kilograms, an amount which apparently is to cover activities for several years. The first two construction permits issued contained allocations totalling over 14,000 kilograms of U-235 for forty-year periods of operation. A third major construction permit has allocated 4,000 kilograms for a twenty-five-year period of operation. The Commission has indicated that, so long as such material is available, it will make long term commitments for the supply thereof, i.e., for the life of the facility license, apparently setting aside at the time enough material out of existing allocations to enable it to back up its promise.

"[The licensee] will, of course, need to have assurance at the beginning that this material which the Government has to own is going to be available to him as he needs it. So we propose to set up allocations to each of the reactor owners and distribute the material to them as needed."

If this is the procedure, then over ninety per cent of the current 20,000 kilogram domestic allocation has been earmarked for the first three licensees; if it is not, then the licensees apparently have only a paper allocation with no tangible assurance of material availability as needed. Either way, the inference must be that the Commission expects each presidential allocation to represent a permanent contribution of material to domestic availability, that is, until consumed. Nevertheless, the legal enforceability of such promises of material supply, lacking legislative clarification, must rest with the courts. If the Commission does not, or cannot, guarantee a supply of material for periods of time sufficiently long to justify private investment in atomic activities, private development may well be retarded. Facilities con-

123. 21 Fed. Reg. 359, 766 (1956) (10 C.F.R. §§ 50.60, 70.31(b)(1)); see Hearings, supra note 121, at 86.
129. Hearings, supra note 121, at 115.
structed today may be obsolete within a few years; government reluctance to continue supplying material to such facilities can be imagined if no commitment exists to do so.

The Commission has used its power to waive costs for the use of special nuclear material for certain projects adopted under the Power Demonstration Reactor Program. This discrimination has been the subject of considerable attack by some members of the Joint Committee and by representatives of small business. Otherwise, however, the Commission has sagely avoided criticism by imposing uniform prices for everyone.\textsuperscript{130} Uranium-235 was formerly priced at twenty-five dollars per gram for lease and use in foreign research reactors;\textsuperscript{131} however, the United States now makes this fuel available for foreign research and power uses at the identical prices charged domestic nuclear uses.\textsuperscript{131a}

Domestic prices for U-235 only recently have been declassified.\textsuperscript{132} The base charge varies slightly, according to the percentage of U-238 which is also present, but is roughly about seventeen dollars per gram of U-235. The charge per gram of U-235 is largely independent of the degree of enrichment due to the fact that partially enriched uranium cannot be "bled" satisfactorily from the isotopic separation diffusion process. Thus, enrichments of less than about 100 per cent are normally achieved by re-diluting separated U-235 with natural uranium.

The prices to be paid by the Commission for the private production of special nuclear material are to be uniform and fair, but this is not to say that they must constitute just compensation for the expense of production. Apparently, the privilege of private participation in this field precludes a claim of condemnation and the attendant standard of reimbursement. The setting of government prices for materials consumed and produced could have an economic effect on nuclear power, \textit{i.e.}, a subsidy.\textsuperscript{133} If, as appears likely, fuel consumption costs will constitute only about ten per cent of the cost of generating power from most reactors, the effect could not be gross except for reactors specially designed to breed new special nuclear material and then only if the prices were markedly rigged. However, the Commission has elected not to encourage economic reliance on income from government purchase of material and it purports to have set a

\textsuperscript{130} AEC News Release, No. 590, Jan. 10, 1955.
\textsuperscript{131} AEC News Release, No. 675, Aug. 8, 1955.
\textsuperscript{131a} AEC News Release, Nov. 18, 1956.
fair price for such produced material based according to its fuel value, just as it charges for the consumption of fuel material. Only a slightly inflated price may still be paid for some of the produced material in view of its weapons value. However, fair prices during 1962-1963 have been disclosed recently as twelve dollars for plutonium and fifteen dollars for U-233. Thus, for similar compositions of special nuclear material, the reasonable charge for consumption closely approximates the fair price for production. This approach has been said to produce a fair price about one-half that which some industry members had expected.

One question of some interest is the disposition of the "fair price" proceeds from such material production by a utility; the decision will lie with the state regulatory agency. One possibility is that the proceeds will be applied as a credit to reduce the cost of fuel. Another alternative is that the proceeds, together with the cost of producing the material, will be treated as a separate venture by the utility and thus separate from rate considerations. Precedent is unclear as to which alternative is more apt to be followed; the question is not critical in any event.

Accountability for nuclear fuel is a major concern of the private user, since he must pay a lease charge of four per cent while he has it plus a consumption charge for all that he consumes or loses. In this connection, it is interesting to note that the nuclear material allotment for the reactor owner will be given him as bulk material by the Government and he remains the person financially responsible for the material until it is returned to the Commission—unless other arrangements are made with the Commission. Fabrication of the bulk fuel into fuel elements suitable for use may be done for him either by the Government or private industry. Either way, the fabrication process is such that about forty to sixty per cent of the material may be converted into scrap. That is, it will not appear in the finished fuel elements. The disposition of this scrap is currently a matter of some concern. Since the reactor owner cannot use it for fuel, he will not want to continue paying four per cent lease charge on it; the fabricator certainly has no use for it. Yet, because the scrap material will have been alloyed or otherwise contaminated so as to be downgraded in purity, the Government has no schedule for buying it back other than

134. See Hearings, supra note 84, at 74.
136. Hearings, supra note 84, at 249.
by making a charge for downgrading which will cover the expense of reprocessing it into fuel grade material again. One suggestion has been that the Government instead set up a "bank" of such contaminated material, on the assumption that someone will eventually want such material at a future date. Thus, the reactor owner might be saved at least part of the charge for total reprocessing. The entire problem recurs every time fuel must be reprocessed and refabricated.

Another problem of accountability concerns the ascertainment of weight and composition of special nuclear material as it changes hands, i.e., from the Government to the fabricator, to the reactor owner, to the reprocessor, to the fabricator and so on. One possibility is an assay-umpiring scheme like that now used for private transfers of precious metals such as gold and platinum. With material seven times as valuable as platinum, twenty-one times as valuable as gold, accountability will require highly precise methods; a gram of special nuclear material, having a value of approximately twenty-five dollars per gram, is about the size of a BB shot used in a child's air rifle.

The initial requirement of a license for any activity involving nuclear material involves an implicit requirement of some government sanction for the proposed activity. Licensing of both special nuclear and source materials is to be decided with regard to the importance of the proposed use to the common defense and security and to the health and safety of the public. Furthermore, for licenses for special nuclear material, in case the availability of material does not meet the demand, the Commission is directed to prefer projects which, in its opinion, will contribute the most to basic research, peacetime usage and the nation's economic and military strength. Discrimination from the latter directive seems unlikely to materialize at present in view of the apparent adequacy of material supply. Nevertheless, no business is likely to savor the necessity for governmental approval of its projects.

**PRODUCTION AND UTILIZATION FACILITIES**

Commission sanction is required for many activities in the atomic field in addition to licenses for possession of nuclear materials and permits for access to information. Private ownership of facilities for the production or utilization of special nuclear material is permitted.
under the act. However, except for the smaller research facilities, "it shall be unlawful . . . for any person within the United States to transfer or receive in interstate commerce, manufacture, produce, transfer, acquire, possess, import, or export any utilization or production facility except under and in accordance with a license issued by the Commission. . . ." 142 Individual licenses are also required for persons who are to operate such facilities. 143

Production and utilization facilities are defined in the act to mean any equipment or device determined by rule of the Commission to be capable of producing, or making use of, special nuclear material in such quantity as to be of significance to the common defense and security or in such manner as to affect the health and safety of the public. 144 The utilization facility definition further encompasses similar use of any form of energy released in the course of nuclear fission or transformation. Although these determinations could be very broad, they have, in fact, been quite narrow. The regulations define production facility to mean:

"(1) any nuclear reactor designed or used primarily for the formation of plutonium or uranium-233; or

(2) any facility designed or used for the separation of the isotopes of uranium or the isotopes of plutonium, except laboratory scale facilities designed or used for experimental or analytical purposes only; or

(3) any facility designed or used for the processing of irradiated materials containing special nuclear material, except laboratory scale facilities designed or used for experimental or analytical purposes only." 145

Utilization facility means "any nuclear reactor other than one designed or used primarily for the formation of plutonium or uranium-233." 146 Important component parts of such facilities may likewise be designated by the Commission as such facilities; no such designation has yet been made.

Thus, licensed facilities are those engaged quite directly in the operation of nuclear reactors for power, namely, the reactor itself and


146. Ibid. (10 C.F.R. § 50.2(b)).
the facilities used to supply or process its fuel. The first licensees will be the reactor owners. As the reactors near completion, they will require fuel containing the energy-producing special nuclear material; the bulk material supplied by the Government must be fabricated into fuel elements for heterogeneous reactors or put into the appropriate liquid phase for homogeneous reactors. While the act permits the Government to perform this function for the reactor owner, it is hoped and expected that private industry will also participate. Later, as fuel materials are partially burned and contaminated beyond the point of continued use, they must be reprocessed and returned to fuel grade purity. This activity may likewise be done by the Government but with expectation that private industry will eventually take over. Following such reprocessing, fabrication may again be necessary if the fuel is returned to the reactor.

For reasons attributed to the absence of health and security problems, one of these facilities vital in the fuel cycle of atomic power has been left unlicensed—this is the fabrication facility. The desirability of keeping facility licensing to a minimum seems much encouraged by the Commission’s narrow definitions. But one somewhat peculiar problem exists for the activity not involving a licensed facility: unless the fabrication facility operates under a research and development arrangement with the Commission, which is highly unlikely, the act would not seem to authorize it to have a special nuclear material license without an underlying facility license. In spite of the apparently exclusive wording of the act concerning eligibility for a special nuclear material license, some leeway may be implied in the Joint Committee Report, which says that any facility which is not determined to be a production or utilization facility “is exempt from licensing as a facility, though the owner must still have a license for any special nuclear material involved.” At any rate, the Commission

148. Hearings, supra note 121, at 80, 83, 84.
151. Hearings, supra note 121, at 100.
requires a material license for the fabricator and health and safety measures will be contained therein.\textsuperscript{154}

Another quirk in the act is that facilities are defined according to potential use, not what they are in fact used for. Thus, any facilities capable of reprocessing nuclear material might require a license irrespective of their actual use. The regulations, however, embody the obvious intent of the law and apply only to facilities designed or used for production or utilization purposes.

Applicants for a license to construct or modify production or utilization facilities are first granted construction permits.\textsuperscript{155} Unless the modification or construction is completed within set time limits, the permit expires and all rights thereunder are forfeited—except where, for good cause shown, the Commission allows an extension. Some circumstances justifying extensions are set out in the regulations.\textsuperscript{156} Upon completion of construction, if the facility is not to operate in conformity with the application, the provisions of the act or the rules or regulations of the Commission (which are subject to change), or if good cause were shown the Commission why the granting of a license would not be in accordance with the provisions of the act, then the Commission still may deny the license, notwithstanding the expenditures of the applicant and without remuneration to him.

The act divides all licensed facilities into two classes—"research and development" and "commercial." All reactors thus far constructed or proposed fall in the former category. Research and development licenses are to be given preferentially to those projects which the Commission expects to lead to major advances in industrial or commercial utilization of atomic energy.\textsuperscript{157} However, the Commission will grant such licenses even to duplicate facilities so long as no special nuclear material shortage exists.\textsuperscript{158} Commercial facility licenses are available on a nonexclusive basis but only after the Commission has made a finding of "practical value" for the type of facility involved and has found that the specific proposed activity will serve a useful purpose proportionate to the quantity of source or special nuclear material to be utilized.\textsuperscript{159} Practical value means competitive in both the

\begin{footnotes}
\item[154] Hearings, supra note 121, at 100.
\item[156] 21 Fed. Reg. 359 (1956) (10 C.F.R. § 50.55(b)).
\item[158] Hearings, supra note 121, at 107.
\end{footnotes}
technical and economic sense; no facility has yet qualified for such a finding. Preferences for commercial licenses go to high cost power areas and to public or cooperative bodies. The preference is likely to have little effect, however, since it would seemingly apply only in case of material shortage (which is not the present situation) or in case of competition for serving the same area (which has probably already been settled).

Although no assurance is given that a facility licensed for research and development purposes may later obtain a commercial license if it demonstrates practical value, this is clearly the intent of the act since the regulation and terms of the research license are to be made compatible with regulation and terms which would apply to that class of facility under a commercial license. However, the conversion from a research to commercial license apparently will take place only at the time for renewal of the former, not before—and it would seem that such a conversion must take into account the preferences described in granting of commercial licenses.

In granting facility licenses, the Commission is authorized to group together classes of facilities, define the activities permitted by each class, and designate the amount of special nuclear material available to each facility. It is obvious that either a material or facility license may be valueless unless there is a concurrent license of the other type. The Commission has used that section of the act permitting it to combine several activities of one person within a single license. Under the regulations, the Commission may, upon request, incorporate provisions into the facility license designating the quantities of special nuclear material to be made available for the facility. Such an allocation necessarily depends upon material availability and later may be reduced by the Commission if it regards the amount as excessive.

Although commercial facility licenses have a statutory maximum duration of forty years, with the possibility of renewal at the expiration of such period,\textsuperscript{169} no other licenses have any statutory defined maximum or minimum period. The regulations provide, however, that subject to a forty-year maximum for any facility license, the period of the license may be made either that which is asked by the licensee or the useful life of the facility, whichever is shorter.\textsuperscript{170}

**Licensing in General**

Under such extensive licensing, it is not difficult to envisage situations of strain between industry and Government in the coming years. The requirement of a license could initially impose the opinion of the Commission upon that of industry as to the merits of the proposed venture, as well as constituting a perhaps unwelcome inquiry into the business activities of the applicant.\textsuperscript{171} For utilities, such regulation would be in addition to that already imposed by state regulatory bodies. It is doubtful that the Commission is currently using licensing to restrict entry into the field. Although there is evidence of past instances where the Commission itself has not desired to explore certain avenues of development and yet has withheld license from members of private industry who were willing and anxious to do so at their own expense, it is said that no facility license has yet been denied nor is licensing serving to delay proposed projects.\textsuperscript{172} When an industry proposal is rejected on the merits for the first time, criticism of the power will likely become more pronounced.

Even after obtaining a material or facility license, many problems remain. No license may be transferred without commission approval.\textsuperscript{173} This requires that the Commission be a party to arrangements for financing the reactor; specific provision is made for commission approval of a lienor in advance of reactor construction.\textsuperscript{174} Some private opinion is that the latter provision may be eliminated.\textsuperscript{175}

\textsuperscript{172} Hearings Before the Joint Committee on Atomic Energy, 84th Cong., 2d Sess. 105, 106, 122, 443 (1956).
Similarly, any reorganization altering control of a licensee would seem to require commission approval.

In the event of national emergency or war, the Commission may suspend any license; during the same period the Commission may recapture any special nuclear material or order the operation of the facility, although damages from these latter measures require just compensation.176 In fact, the Commission may condemn and acquire a production facility at any time in the interest of the common defense and security if just compensation is made.177

All licenses remain subject to amendment, revision or modification either by amendments to the act 178 or to rules and regulations issued thereunder.179 Conditions for revocation of licenses are a matter of concern, since they include the making of material false statements in the application, the existence of facts later revealed which would justify the Commission in not issuing an original license, violation of terms or provisions of the act or any regulation of the Commission or sometimes for violations of antitrust laws.180 Although the act requires that section 9(b) of the Administrative Procedure Act 181 be followed in case of license revocation,182 which entitles the licensee to notice and a chance to correct the violation, the Commission in certain instances may recapture all special nuclear material prior to any procedure thereunder.183 In some cases, the Commission may operate the facility before or after any such procedures,184 but paying just compensation for doing so.185 The Commission may also recall by-product material under conditions justifying revocation of the license.186 Under current

regulations, the Commission has provided that any action to suspend, modify or revoke any license or construction permit will be preceded by notice of the deficiency and a formal hearing—except that in some instances the action may be made effective without notice and prior to a hearing.187

Amendment, modification, suspension and revocation of licenses present a real source of concern.188 Most of these powers over the licensee provide no compensation to him for interrupting his business. Since the licensee is granted notice and a hearing, with a chance for subsequent judicial review of commission action,189 he seems adequately protected procedurally. However, the substantive bases for action seem rather harsh. Revocation could be limited, instead, to cases where the making of a false material representation led to granting of a license that would otherwise have been withheld. Suspension normally should be adequate sanction to assure compliance by the licensee with the act and the regulations. In extreme cases, a prescribed period of suspension could justify revocation. Aside from these sanctions, any requirement by the Commission that a licensee discontinue his activity should be accompanied by condemnation and just compensation. A change in opinion of the Commission as to the merits of an activity, which apparently could sustain revocation under the present law, should not be actionable at all.

Another concern lies in the fact that the construction permit is no guaranty of a subsequent license; one industry has already given this uncertainty as grounds for abandoning a proposed reactor project.190 The act gives no suggestion as to why the application need be scrutinized so carefully for a second time after investment by the applicant. Suggestion has been made that this is intended only to assure that the facility will operate safely before a license is given;191 the recent issuance of the first four construction permits was on such condition.192 If this is the reason, then the act expressly should limit denial to such grounds; even so, where the Commission has taken part in prescribing the original design and safety features of the facility, it would not seem unreasonable that the applicant be reimbursed for his expenditures if the Commission later decides that the

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188. See, e.g., Hearings, supra note 150, at 549, 596.
191. MARKS & TROWBRIDGE, FRAMEWORK FOR ATOMIC INDUSTRY 76 (1955).
facility cannot be licensed or that it requires extensive modification. The Joint Committee Report indicates that a license should follow the permit virtually as a matter of course and this concept should be incorporated into the act. 193

Under the indefinite duration of licenses provided by the act, some concern was expressed that long enough periods of operation to justify investment might not be permitted. However, the regulations providing for a period sufficient to cover the life of the facility ease this concern. Similarly, the Commission’s willingness to make special nuclear material licenses coincide with the facility license should remove remaining problems of duration.

One remaining requirement imposed on a licensee is the necessity to supply reports and records to the Commission and to submit to inspection. 194 In particular, commercial licensees must agree to disclose technical information concerning their operations when so asked by the Commission. 195 Since many licensees may have legitimate trade secrets which would be disclosed by these measures, adequate protection should be provided to assure that these confidential matters will not become disclosed to the public. This protection should be broader than the general proscription of unauthorized use of confidential information acquired by government personnel. 196 For the technical information disclosed by the commercial licensee, the act merely restricts its use to furthering the common defense and security and protecting the health and safety of the public. It is the feeling of many persons that continued need for licensing is in conflict with the principle of private enterprise, even though no one yet seems to have been hurt by such requirements. 197 However, it should be obvious that industry cannot be left wholly free in this field of endeavor. The country’s health, safety and security must be respected by industry. It may be essential to the country’s security that certain type facilities and certain grades of nuclear materials should not be sent to particular countries abroad. The inherent dangers of many atomic activities demand that precautions be taken during domestic operation to protect both workers and the surrounding populace. Ability to respond


financially to damage caused by accident should be a prerequisite to any undertaking. Disposal of unwanted radioactive wastes must be regulated with care.

Licensing is certainly one logical way to assure that these interests are protected. The only practical alternative would appear to be a system of regulation coupled with a requirement that all activities be reported to the regulatory agency. While this would impose no need for direct sanction by the Government of a proposed activity, the underlying practical requirement for such approval would be much the same. However, under either approach, some simplification of the present coverage of government control might be proposed.

The requirement of license for dealings in source material seems one that could readily be dispensed with. This material has little security importance since it is available in many countries and there is virtually an international market for it at present. In fact, the United States has quoted prices at which it will sell such material. Furthermore, until placed in a utilization facility, it poses no unusual health or safety problems. Removal of licensing might aid substantially in providing a competitive market for supply of refined source material, thus enabling a price determined independently of the Government. Eventually, the Government could satisfy its own needs from a totally private market. Meanwhile, so long as ore producers insist on a government-guaranteed minimum for their product and private industry shows little or no inclination to compete in the milling and refining of source material for sale to industry, there can be little meaningful criticism of the terms, availability or prices which the Government elects to put upon source material that it provides industry.

By-product materials require regulation primarily because of the health and safety problems which attend high concentrations of radioactivity emitted by them. There is no reason why possession of such materials should require a license for radioactivities below a certain intensity—in fact, the Commission has recognized this fact by granting a general license for their possession in limited quantity.\footnote{198. 21 Fed. Reg. 215 (1956) (10 C.F.R. § 30.21).} For more concentrated radioactivities, safety regulation becomes highly important and the requirement of a license is probably no more burdensome than a requirement of strict adherence to safety regulations.

For special nuclear material and for production and utilization facilities, the considerations of health, safety and security already mentioned are most critical. By requiring a license, the onus is put
on each person to show the Commission that his activity will not jeopardize public interests. In this manner it is probably simpler for the Commission to administer essentially the same standards which would be required anyhow under the guise of regulation.

**PATENTS**

One of the most controversial aspects of the atomic field is that concerning patents. The act deals with patents in two general ways: by putting limitations on the acquisition of patents and by dictating the usage of patents once acquired.

**Limitations on Patent Acquisition**

The act precludes patentability for inventions only to the extent that they involve the utilization of special nuclear material or atomic energy in atomic weapons. Just compensation is to be paid for the revocation of such patents if granted prior to the act, but no such compensation is provided for the denial of right to such future patents, other than an optional award.

Any invention or discovery made concerning the production or utilization of special nuclear material or atomic energy must be reported either to the Commission or by patent application within ninety days following completion of such invention or realization of its nature, whichever event occurs later. Furthermore,

"any invention or discovery, useful in the production or utilization of special nuclear material or atomic energy, made or conceived under any contract, subcontract, arrangement, or other relationship with the Commission, regardless of whether the contract or arrangement involved the expenditure of funds by the Commission, shall be deemed to have been made or conceived by the Commission, except that the Commission may waive its claim to any such invention or discovery if made or conceived by any person . . . under such . . . circumstances as the Commission may deem appropriate."

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Any dispute between the true inventor and the Commission as to proper ownership of the invention and patent is resolved by appeal first to the Board of Patent Interferences and thereafter to the Court of Customs and Patent Appeals.

Although such a provision is extremely broad, potentially encompassing virtually every invention in the atomic arena, the Commission has waived its ownership rights where the arrangement is only an access permit (including access to either secret or confidential restricted data), or a purchase of irradiation services or radioisotopes, or the use of materials made generally available by the Commission. It has also stated that it does not regard a mere license as an arrangement within the meaning of the statute. For those persons contracting with it, however, the Commission is continuing to use the relatively stringent patent clauses which it adopted under the 1946 Act.

Limitations on Patentees' Rights

The act also limits the customary rights associated with privately-owned patents. If an invention or discovery is of primary importance in the production or utilization of special nuclear material or atomic energy, and licensing of the invention is of primary importance in effectuating the policies of the act, the Commission may, after a hearing, declare it to be affected with the public interest. Thereafter, the Commission is licensed to use the invention and it may also grant licenses to private persons where use of the invention is of primary importance to such persons in activities authorized by the act. The Commission also has the power to compel licensing of such inventions under essentially identical standards, including a hearing, without a declaration of public interest, upon application initiated by certain prospective licensees. Under either approach, the license shall be nonexclusive and revocable. This compulsory licensing must provide a reasonable royalty to the patentee, as determined by the Commission in absence of agreement between the parties. But no court has


205. Hearings Before the Joint Committee on Atomic Energy, 84th Cong., 1st Sess. 193 (1955); see text at note 224 infra.


jurisdiction to enjoin authorized use of the invention by the licensee, even for failure to pay the royalty fee. As the act now reads, these compulsory licensing requirements last over the entire seventeen-year life of any patent which is issued on an application filed before September 1, 1959.

As a final intrusion on the patentee's rights, restricted data based on patent applications may be communicated to other nations by the Commission, but such action requires just compensation to the owner of the application. Traditionally, patent applications are held in confidence so as to prevent gratuitous disclosure of the inventor's work should a patent be denied.

**Background of the Patent Sections: Compulsory Licensing**

These extreme inroads on customary patent law represent two schools of thought as to the best method of preventing private patents from obstructing future development of atomic energy in the public's best interest. The Senate preferred to control patents by the compulsory licensing scheme; this measure was appreciably debated before passage. The House added the limitations giving the Commission proprietary rights to inventions; these measures did not appear in the bill as reported out by the Joint Committee and they were passed with little public comment. It was expected at the time of the act's passage that the patent provisions would be among the first to merit renewed consideration. Much of the expected criticism has failed to materialize publicly however, and one conclusion has been that the provisions are satisfactory for the time being.

Compulsory licensing has been often advocated, and as often rejected, in the traditional field of patents. A patent gives a temporary (seventeen-year) exclusive right to an invention, a privilege which obviously deprives the public of nothing which it previously possessed (except the academic right to invent and use the underlying invention). The prevailing opinion has been that if the inventor chooses not to license his patent during this period, then recognition of his property rights should preclude requiring him to do so. This intrusion into his rights was done for the first time by the 1946 Act and was carried

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over into the 1954 Act. The compulsory license section has had some doubt cast upon its constitutionality, the Constitution saying that: "The Congress shall have power . . . to promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." 213 The argument has been made that compulsory licensing is short of an "exclusive right." The Copyright Law, stemming from the same clause, also has some provisions for compulsory licensing which have never been declared unconstitutional. 214 Since the constitutional clause empowers, rather than requires, Congress to grant exclusive rights, the objections do not seem to propose a serious challenge to constitutionality.

The case for compulsory licensing is largely that no one should be able to substantially hamper the progress of others by patenting a crucial invention. In the present state of the art, it is most doubtful that any fundamental inventions would be patented which could not be circumvented by others in the field. 215

Compulsory licensing may somewhat weaken the patentee's bargaining position in attempting to voluntarily license his patent on terms most advantageous to him, since such licensing will be at a royalty determined or influenced by the Commission. Upon reflection, however, it will be remembered that a similar power in the 1946 Act was never used by the Commission. As preserved in the 1954 Act, the power is ringed with statutory standards which assure its use only in extreme situations—the power has not been used or solicited to date. 216 The Commission openly views it as a reserve power, at most. The power expires as to patents for which application is made after September 1, 1959; if no attempt is made to extend the life of this power, the whole controversy may prove to be a tempest in a teapot. In the meantime, many patent applications probably will be delayed until inventions are further perfected than is ordinarily the case. Some agitation exists for extension of the power, 217 however; if this persists, the teapot may again come to a boil.

The act requires reporting of inventions for which patents are not solicited, but the ninety-day time limit is determined with regard to completion, not conception, of the invention—completion denotes

a date sufficiently flexible to largely reduce the effect of the requirement, without much concurrent detriment to subsequent patentability. Willful failure to comply with this section, if established, could lead to a fine and perhaps might jeopardize continuance of a license held from the Commission.\textsuperscript{218} Since no mention is made in the act that failure to report an invention should forfeit patent rights, there seems no justification for such a result. Such reporting should be accompanied by an assurance that legitimate trade secrets will not be unfairly disclosed.

\textbf{The Direction of Future Patent Control}

Although compulsory licensing may raise the most smoke, it is the limitations on invention ownership and patent acquisition which create the most fire. The preclusion of patents in the atomic weapons field is understandable. The government monopoly of this area obviously would leave the patentee little chance to exploit his invention anyhow. It has been suggested that an optional award from the Commission may be more favorable than a royalty from government use of a patent—because the latter would have to be collected through the Court of Claims.\textsuperscript{219} Since a similar ban existed in the 1946 Act, the provision for just compensation for revoked patents is now of little or no concern. It might seem more fair if the award potentially available for cases of patent denial on future weapon inventions were assured rather than left optional.

The main objection to patent limitations may be expected, in fact has been manifested, from that section of the act which attributes conception of the invention to the Commission if it has been made under any arrangement with the Commission. The fact that the Commission may assert ownership under conditions which would give it no such right under general or contract law, plus the absence of compensation to the true inventor when it does so, has raised questions of constitutionality. Nothing in the Constitution seems to require that the patent go to the true inventor, although this has always been the patent statute requirement. Copyright, stemming from the same constitutional clause, may go either to the author or the proprietor of protectable works. However, confiscation of the invention by the Commission in cases of arrangements in existence on the date of the 1954 Act, with no provision for just compensation, suggests a taking of property without just compensation. No comparable argument


\textsuperscript{219} Boskey, \textit{supra} note 200, at 117.
would apply to arrangements entered into after passage of the act, since industry thereafter had warning of the consequences. In this vein, the question has arisen whether a pre-1954 contract with the Commission which reserved lesser rights for the Commission would be a waiver of rights under the 1954 act; in any event, the question is mooted by a Commission waiver in such cases of any extra rights it might have under the 1954 Act.

The act does not specify whether the terms "invention or discovery" as used in the sections concerning reporting and commission ownership refer to patentable invention or discovery or merely to significant improvements in the art. If only the former is intended, the atomic field may become ringed with trade secrets and "know-how" instead of patented inventions, thereby leading to secrecy and indefinite monopoly.

The practical consequences of this section, in light of the network of control exercised over the entire field by the Commission, could be that any invention or patent thereon in the atomic field belongs to the Commission unless it elects to waive its rights. It appears not unlikely that companies will report test case inventions to see the Commission's reactions before they decide whether their subsequent research should produce inventions or trade secrets. Some inference as to the Commission's interpretation of the potential scope of its rights may be drawn from its waiver of rights and its determination that licenses are not arrangements within the statutory intent. Even these exceptions do not apply where the least additional services or consultation may be rendered by the Commission. An especially vexing part of the section is the uncertainty involved for any given invention. Any clearly defined and unambiguous delineation of the Commission's rights would at least let industry know where it stands and provide a firm footing for a discussion as to the merits.

The Commission has stated that it lacks the experience to make any further general declaration of policy as to when waivers will or will not be made. In light of the absence of statutory standards for waiver, the Commission's reticence is understandable. Since the act creates the ambiguity, clarification must begin with it.

One further objection to this limitation of patenting by persons having a relationship with the Commission is that an area is thus restricted for American inventors without concurrent restriction of foreign inventors. A foreign inventor will have no relationship with

220. Hearings, supra note 205, at 193.
221. Hearings, supra note 772, at 284; 1 PANEL ON THE IMPACT OF THE PEACEFUL USES OF ATOMIC ENERGY, op. cit. supra note 197, at 16, 147.
222. Hearings, supra note 172, at 422, 433.
the Commission; thus, he may get a patent on the same invention for which a patent could be denied an American inventor, who would likely have some arrangement with the Commission.223

In addition to patent limitations set by the act, the patent rights of private industry operating under contract with the Commission are generally defined by contract.

“In contracts primarily for research or development or for the operation of a facility, the patent provision provides for a determination by the Commission of the right in and to any inventions. Such a clause is referred to as a type A patent provision.

“In instances where the work under a contract pertains indirectly to basic research and development and relates to a general field of activity of the contractor, the retention of a nonexclusive license by the contractor in fields other than the production of special nuclear materials or atomic energy is provided for under what is referred to as the type B patent provision.

“Where the work to be performed pertains only incidentally to research and development in which the Commission is interested and relates to a field in which the contractor has an established industrial and patent position, a type C clause is used. This provision allows the contractor to retain a sole license with the sole right to grant sublicenses for purposes other than use in the production or utilization of special nuclear material or atomic energy.

“In power study agreements the Commission has employed the so-called ‘C-plus’ patent clause. This provides, in effect, that inventions conceived in connection with the work under an agreement will be reported to the Commission and that the participant will retain an exclusive, irrevocable, royalty-free license against all but the government, with the right to grant sublicenses for purposes other than use in the production or use of special nuclear material or atomic energy. With respect to these uses, the participant will retain a nonexclusive, irrevocable, royalty-free license. The ‘C-plus’ type clause will be continued in study agreements and will be used also in access and commercial agreements.” 224

The Commission has proved itself highly capable of protecting its rights in inventions of contractors and it has continued in the same manner under the 1954 Act. Since persons operating under contract are given advance indication of the disposition of their atomic inventions and are presumably compensated accordingly, no practical objections can be raised to conditions to which the parties voluntarily agree.

223. Id. at 426.
In proposing more satisfactory regulation of the patent field, it may be advantageous to describe briefly conditions of patentability. The provisions of conventional patent law are designed to prevent a patentee from encroaching on the technical progress attributable to his predecessors. An understanding of this fact should enable realization of the fact that protection of past public expenditures, which ought to be the legitimate scope of the section giving ownership to the Commission, is adequately achieved by normal patent law. A patent gives the patentee the right to exclude anyone else from practicing the invention (that is, making or using it), without a license, for a period of seventeen years. In order to earn such a privilege to exclude, the patent applicant must not only produce something new, something not known in the prior art, but he must produce something whose creation required invention in view of the prior art, some development which would not be an innovation obvious to a person having ordinary skill in the particular art. And the 1954 Act states that even knowledge or use which was under secrecy within the atomic energy program of the United States shall be included in the prior art which a successful patent applicant must surpass, even though he had no possibility of access to it. Furthermore, principles or phenomena of nature, which underlie all invention, are not themselves patentable at all.

Thus, all information, knowledge, inventions and discoveries which the United States has uncovered or acquired during the course of its atomic energy program are safely secured from private monopoly and exploitation. Furthermore, any innovations which a person skilled in the art might be expected to make in light of such knowledge are likewise placed beyond the reach of private monopoly. In addition, the Government has an inherent right to practice any invention for its own purposes, irrespective of any private patent thereon, provided it pays just compensation for doing so. While it is just and fair that all industry benefit from progress made at public expense, it does not follow that all industry should benefit gratuitously from progress achieved at private expense. Such a view would mean that the more forward-looking segment of business contributes twice to atomic progress, once to public development as a taxpayer and again when bearing the cost of individual private research.

One potential situation exists which could justify government ownership even of privately-financed invention. That would be the


instance where participation in the field is artificially limited, where one party's presence precludes participation by another. This could be the case if special nuclear material were scarce and rationing of it led to a status of "ins" and "outs." However, recent announcements of the allocation of over forty tons of special nuclear material for peaceful purposes demonstrate that this situation does not exist at the present time. Hence, it would seem desirable that the section of the act attributing conception of private invention to the Commission be deleted.

The requirement of compulsory licensing is not subject to criticism as being grossly unfair—the patentee is assured a reasonable royalty. The major argument against such compulsion is that it has been discussed pro and con over a period of many years and the considered decision has been against it. The atomic energy field does not appear sufficiently different from other areas of science and invention to warrant separate treatment. If the private patentee in the atomic field has proved himself entitled to a patent at all, then his attendant rights should be no less than those of any other patentee. If compulsory licensing were indeed in the best public interest, then it should be a part of all patent law.

It appears not unlikely, however, that popular opinion, uncognizant of the nature of patent law or skeptical of it, may demand continued control of patents in the atomic domain. If so, then compulsory licensing at reasonable and fair royalties offers a means for assuring fair contribution by all those benefiting from privately sponsored progress, yet with the assurance that no patentee will block the progress of others unfairly. This is a palatable imposition, far preferable to outright confiscation of invention by the Commission on an ad hoc basis. Even so, the feeling of much of industry is that the United States patent system is being progressively emasculated and that hedging of the patentee's rights, such as occurs in the act, is already stifling invention.^^227^ The Congress might well pay heed to this goose which lays such golden eggs.

**HEALTH AND SAFETY**

**The Recognized Hazard**

Production or utilization of nuclear materials is inevitably accompanied by the presence of radioactivity. This form of radiant energy in sufficient intensity is lethal to living things; in any intensity it is harmful. Because of the highly penetrating nature of radioactivity

artificially induced in it, by-product material can be dangerous even where the material is confined. Special nuclear material, particularly plutonium, presents extreme health hazards when ingested or inhaled, because of its chemical nature and its natural radioactivity. The possibility is ever present that these materials may be widely scattered—the typical suggestion being the leakage or explosion of a nuclear reactor. A reactor of 100,000 kilowatt electrical capacity produces 200 pounds of fission product by-product material a year, the latter being from three million to two billion times more deadly than chlorine, the most potent common industrial poison.\textsuperscript{228} A reactor of 60,000 kilowatt electrical capacity creates enough fission products in one year to contaminate, to the limits of tolerance, an area twenty-five miles on a side to a height of one-half mile.\textsuperscript{229}

In its worst form, an explosion in a high pressure reactor, coupled with a moderate wind, might produce a local small scale radioactive fallout not unlike that popularized by weapons tests (aside from scattering radioactivity, the explosion itself would probably do little harm beyond a few hundred yards from the reactor). The American and Canadian commissions have had three “runaways” with experimental reactors—two of these being unplanned.\textsuperscript{230} None was of sufficient violence to scatter radioactivity beyond the vicinity of the reactor, but the reactor core, a mass of special nuclear material and fission products, was melted on each occasion. A somewhat larger explosion coupled with the rapid release of a high pressure coolant, such as would be expected from a large power reactor, might have produced a vastly different result in each instance. The Commission recognizes that such hazards are inescapable.\textsuperscript{231} A matter of equal practical importance with the reactor accident hazard is that of the welfare of workers in the field who are continually exposed to radioactivity in the course of their routine duties.

It is to be expected that private ventures into such an inherently dangerous field must be undertaken with consideration for the safety of the participants and of the public. The act requires every licensee, whether of materials or facilities, to adhere to safety standards pre-


\textsuperscript{229} McCULLOUGH, MILLS & TELLER, \textit{The Safety of Nuclear Reactors} 4 (1955).

\textsuperscript{230} The Canadian Commission had an unplanned runaway at the Chalk River site. The American Commission had an unplanned runaway at Arco, Idaho (AEC News Release, No. 808, April 5, 1956) and an experimental runaway at the Argonne National Laboratory. Only the last of these was of explosive violence.

\textsuperscript{231} \textit{Hearings Before the Joint Committee on Atomic Energy}, 84th Cong., 2d Sess. 69 (1956) (statement of Commissioner Willard L. Libby); \textit{Hearings, supra} note 205, at 59.
scribed by the Commission. Industry will feel the effects of such standards in the selection of project sites, the design of equipment, the establishment of methods of operation, the disposal of waste and the selection of employee operators. The precise standards necessary to assure safety often can be determined only after prolonged experiment and experience, i.e., limits for human exposure to radiation have been progressively decreased during the past fifteen years—they have been halved within the last two years. England’s maximum exposure limits are currently one tenth of ours. As a practical matter, only the Commission at present is qualified to determine what most official safety standards should be. In addition, there exists the National Committee on Radiation Protection, a group of scientists which recommends standards that may supplement commission regulations. This group and its recommendations are unofficial, although financially supported by the Bureau of Standards.

The expense of meeting the appropriate standards can appreciably affect the economics of atomic industry. Nevertheless, lack of adequate knowledge about the subject will probably preclude any serious criticism as to the reasonableness of many of the standards set, whatever they may be. No matter whether private industry continues under the present licensing system or whether it is given greater independence along the lines previously suggested, adherence to safety regulations established in the public interest must be accepted.

The Degree of Federal Preemption

Probably the most important question in safety regulation is the relationship between the federal and state governments. The major issue is, assuming Congress could have preempted the field, has it done so? Has it intended that its safety regulations stand alone or has it merely supplied the minimum standards? Or, assuming Congress gave the Commission power to preempt the field, has the Commission elected to do so? The Commission has never stated its views on these matters when the question has been raised, although the private view of certain of the commission staff is that federal law was intended

232. Atomic Energy Act of 1954, §§ 53(b), (e)(7), 63(b), 81, 103(b), 104, 161(b), (i), 68 Stat. 930, 931, 933, 935, 936, 937, 948, 42 U.S.C. §§ 2073(b), (e)(7), 2093(b), 2111, 2133(b), 2134, 2201(b), (i) (Supp. III, 1955); see 20 Fed. Reg. 5101 (1955) (10 C.F.R. proposed pt. 20). Those persons who have been exempted from by-product and special nuclear material licenses are not required to adhere to the safety regulations of part 20—this suggests that a general license should be given such persons, rather than an exemption.


234. See Hearings, supra note 231, at 100-03, 176-77.
The Commission has only expressed its attitude that it much prefers voluntary cooperation with the states to a dispute as to who has control of what.\footnote{235}{See, e.g., address by Robert Lowenstein, AEC Office of the General Counsel, Atoms for Peace Conference, Oklahoma City, April 16, 1956; Hearings, supra note 231, at 394; Price, The Civilian Application Program, Commercial and International Developments in Atomic Energy 202-03 (Atomic Industrial Report No. 7, 1956).}

The problem of the extent of federal preemption of a field is an old one, albeit of considerable recent interest, and one that admits of little generalization or accurate prediction. A recent Supreme Court case excerpt shows the three standards which courts are currently using in making their decisions:

"First, [is] ‘[t]he scheme of federal regulation . . . so pervasive as to make reasonable the inference that Congress left no room for the States to supplement it.’"

"Second, [do] the federal statutes ‘touch a field in which the federal interest is so dominant that the federal system [must] be assumed to preclude enforcement of state laws on the same subject.’"


In applying these tests to the health and safety regulation of the atomic field, it might be recognized that there are at least four general subdivisions of the regulation and that the extent of preemption may be different for each. These are considerations of reactor design, of reactor location, of radioactive waste disposal and of human tolerance to radiation exposure.

It is most likely that the federal aim of developing feasible types of atomic reactors would largely be thwarted if state regulation were recognized in this respect. Furthermore, both federal and state agencies would be weighing the same factors in approving reactor designs—there would seem to be no special considerations of interest to the state which would not be weighed fully by the Commission. Thus, federal preemption in this aspect might be expected.

The matter of project sites, on the other hand, is apt to be of extreme local interest. No matter what scientific assurance may be given as to the safety surrounding a given reactor, lay persons in the vicinity may well feel differently, \textit{i.e.}, anyone whose home lies down-wind from a reactor site, or lies within the range of even minute
amounts of stray radiation therefrom, may rest uneasy, notwithstanding any amount of technical assurance. Although the coverage from any accident-caused fallout would be much less than that from weapons tests, the effect on those concerned would be no different. Surely local interests must be allowed to decide whether they wish to assume the risk of locating a reactor in their midst—a reactor to serve New York City should not be thrust into the proximity of Peekskill if the latter objects. It might be advisable, as one condition of a license application, that local acquiescence be obtained in advance. Whether the Commission would regard an unwilling populace as unable to interfere with the progress of a federally-controlled development program remains to be seen.

The third health consideration is the disposal of radioactive waste. These wastes may be far too radioactive to be emptied into the customary sewage systems. Even "fixing" them so that they may be disposed of in a given site without subsequent dispersal is a matter of considerable complexity and expense. Choosing a site for their disposal should be done only with local approval, since it amounts to a virtual condemnation in perpetuity of the area selected. Yet, on the other hand, potential escape of such wastes to a neighboring state, as by leaching from ground water, gives the problem an interstate flavor also.

The final problem of limits for human radiation exposure would seem to involve no factors of peculiarly local interest. However, the experience necessary to set standards is known to be largely deficient. It is known that any degree of exposure entails some chance of permanent injury; any standard falls short of being safe, merely amounting to a calculated risk. If a state wishes to be more cautious of its citizens’ personal welfare, this seems well within its traditional police power.

The degree of preemption determines whether state regulation is totally precluded, whether state law may be made identical to federal law, or whether state law may be made more strict than federal law. Presumably, the constitutional supremacy clause would prevent more lenient state standards from excusing compliance with federal regulation. Also, since a nuclear reactor accident could easily have consequences extending across state lines, national regulation as to minimum standards seems most desirable. The tone of a recent meeting of state

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238. U.S. Const. art. VI.
representatives was a hope that the Commission would recognize the
validity of some state regulations. A bill was introduced in the last
Congress that would have required the Commission to relinquish health
and safety control to states so requesting. The possible interstate
effect of potential accident or radioactive waste disposal, coupled with
the relative inexperience of the states in this area, would not recom-

Perhaps the most practical and expedient act of the states, if
federal preemption does not preclude it, would be to embody the federal
standards in state law and enforce them accordingly. An adoption of
federal law for state law would enable any state to have a modern set
of safety standards with a minimum of effort. A uniform state law
certainly would ease the burden of industry, but there is no indication
that the Commission or anyone else is considering a general prototype
state act. One choice recently made available to the states in the
limited area of human radiation exposure is a model statute proposed
by the National Committee on Radiation Protection.

Intergovernmental Cooperation in Safety Regulation

Problems of enforcement still remain for either federal or state
safety standards. The Commission has indicated that its inspection
ability will be limited to spot checking. Continuous surveillance,
apparently, must then be of local origin. The recent formation of a
state commission to advise the Commission on its health and safety
standards should allow the states a voice in the formation of
federal regulations; cooperation in enforcement ought to be more
easily achieved in light of such action. If state assistance is expected for
enforcement of federal regulations, then financial aid presumably is
to be given the state agency by the Commission. State inspection
arrangements of this type have been entered into with at least twenty-
two states by the Commission.

239. Cavers, op. cit. supra note 237.
241. Hearings, supra note 231, at 100-03.
242. Bureau of Standards, Handbook No. 61, Regulation of Radiation
Exposure by Legislative Means (1955).
244. Nelson, The AEC Inspection Program, Commercial and International De-
245. AEC News Release, No. 735, Nov. 25, 1955; 1 Panel on the Impact of the
Peaceful Uses of Atomic Energy, Peaceful Uses of Atomic Energy 13, 133-35
(Report to the Joint Committee on Atomic Energy 1956).
Under the act, the Commission is required to notify states of commercial reactors to be located within their boundaries;\(^{247}\) in practice, it also notifies the state of any reactor application or license.\(^{248}\) The Commission has stated that it can issue a license without receipt of the state's view on the matter, but has said it would be greatly influenced by the latter. No mention is made of what happens if the state interfered with the licensee after the license grant. The license will not expressly require adherence to state law.\(^{249}\)

Another conflict in safety regulation may arise between the Commission and the foreign purchaser of a facility, such as a reactor. Any facilities for utilizing or producing nuclear materials in the United States must be constructed to conform to commission specifications. However, foreign governments may differ as to the wisdom of such specifications and may drop some and add others. If the domestic manufacturer is required to satisfy the demands of both, this may affect the willingness of a foreign customer to buy and will certainly add increased costs which will handicap the domestic manufacturer in meeting foreign competition. If it seems apparent that the foreign countries should set their own safety standards, it might be conjectured what adverse international feeling could arise from an accident resulting from supply of a facility which the Commission recognized as unsafe.

**LIABILITY**

Discussion of health and safety measures leads naturally to consideration of liability for harm resulting from various nuclear activities and to the availability of insurance protection. The kinds of liability which can result from atomic activities are vast in number. Mere prolonged exposure to everyday operation of a reactor will result in radiation harm to employees; for the person who has had several employers in the course of his radiation work, a difficult problem may arise in determining when he incurred a particularly damaging dosage. Apportionment of his damages may be the only feasible answer. As the average worker becomes more familiar with the severe personal injury hazards associated with even moderate radiation exposure, employers' problems and expenses are sure to multiply. The everpresent danger of a reactor runaway must be acknowledged; minor accidents could harm workmen, major accidents could lead to property damage and personal injury for those in the path of radioactive debris. Radio-


\(^{248}\) Hearings, supra note 231, at 104; Cavers, op. cit. supra note 237.

\(^{249}\) Id. at 4, 7.
active wastes may escape while in transit or after deposit and thereby endanger both persons and property. The mere proximity of nuclear activities which interfere with the enjoyment or value of land might be actionable as private nuisances. Other personal injuries could stem from overexposure in the course of handling materials in transit or during medical treatment. The potential liability of manufacturers and suppliers of nuclear products, such as reactors and fuel elements, not only to transferees of the products but also to persons injured by the latter's use of such products, poses the complex problems that go with third-party liability of suppliers of chattels.

Legal Bases of Liability

Probably no part of the atomic field is so unsettled as that surrounding the potential tort liability of the participants. Since the act makes no reference as to how such liability for injuries and damage is to be assessed, the resort must be to conventional tort law, either the common law or state statutes. The problem may be exemplified by envisaging a reactor accident, as described above, which leads to injuries to persons and property at some distance from the reactor site.

The reactor owner offers the immediate resort for liability. Being a public utility, it may present a very lush target for suit. Liability may seem self-evident to the layman; but the lawyer must consider several possible bases of legal liability. Tort liability, that liability of one private person to another, conventionally rests upon three concepts: liability for intentional harm inflicted on another, liability for harm resulting from a person's negligent conduct or lack of due care toward another, and strict liability which may be imposed on a party for harm which he causes to another even though through no fault of his own. The case of intentionally-inflicted harm is so straightforward as not to warrant further elaboration.

The doctrine of strict liability is generally heralded as stemming from an English case, Rylands v. Fletcher, wherein the judge of the Exchequer Chamber stated:

"[T]he person who for his own purposes brings on his land and collects and keeps there anything likely to do mischief if it escapes, must keep it in at his peril, and, if he does not do so, is prima facie answerable for all the damage which is the natural consequence of its escape."
On review, the House of Lords restricted such liability to instances where the defendant was making a non-natural use of his land. As so modified, the theory has been generally recognized in the United States.\textsuperscript{253} The Restatement view, which relaxes the theory by ignoring the non-natural use requirement but which restricts it by emphasizing a risk of serious harm which cannot be eliminated by the exercise of due care,\textsuperscript{254} has not been followed by most courts.

Barring statutory intervention, the general agreement of writers is to the effect that the reactor owner will find himself facing strict liability for damage caused by his reactor.

"The first case involving damage from the escape of radiation from the use of atomic energy has yet to reach the courts. When it does, it is not difficult to predict that there is no court which will refuse to apply to it the principle of strict liability found in the cases which follow Rylands v. Fletcher." \textsuperscript{255}

If the court were unwilling to impose strict liability, perhaps because of the social utility contributed by nuclear enterprise, the next avenue of resort would be that of negligence. Direct proof of negligence would be the most certain way to effect recovery. But the circumstances of a reactor accident may well obliterate or make inaccessible all traces of evidence which would indicate the cause of the accident. In such case, the injured party would have to depend on circumstantial evidence from which negligence could be inferred—in other words, this would seem a proper situation for application of the \textit{res ipsa loquitur} doctrine.\textsuperscript{256}

The impressive reactor record of the Commission over the past fourteen years, wherein there has been no serious personal injury, tends to prove that such accidents ordinarily would not occur in the absence of negligence;\textsuperscript{257} the exclusive control over the reactor by the owner should adequately show the defendant's responsibility for negligence associated with the instrumentality, as well as a lack of contributory negligence. The plaintiff need not eliminate all other possible causes of the accident—he need only show, on the whole, that the most likely fact is that the defendant was negligent, although it is

\textsuperscript{253} See PROSSER, Torts 329-38 (2d ed. 1955).
\textsuperscript{254} RESTATEMENT, TORTS §§ 519-24 (1938).
\textsuperscript{256} See PROSSER, Torts 199-217 (2d ed. 1955).
\textsuperscript{257} Graham, United States Reactor Operating History: 1943—1954, 13 NUCLEONICS 42 (1955); Hearings, supra note 231, at 35.
not known in exactly what way. This approach differs from strict liability in that it is open to the defendant to show that he did use due care and was not negligent. In this respect, the effect of his compliance with federal and state safety standards will have to be considered as a measure of due care.

Under either strict liability or negligence, the plaintiff must show that his injury was proximately caused by the defendant's activity. Normally, any substantial contribution of such activity to the plaintiff's injury will suffice. However, unforeseeable intentional acts of third parties (who thereby assume the liability) or acts of nature may relieve the defendant if they are regarded as intervening forces. The claim of freak weather, i.e., strong winds and rain which might carry released radioactivity long distances and deposit it in erratic manner, might be one of the more obvious of such causes. However, the government weapons tests have shown that freak weather is not unforeseeable but rather may be expected and may lead to deposits of radioactive fallout at long distances and diverse directions from the site of release. This experience of causes and results which are unforeseeable in particular but predictable in general may contribute heavily to a finding of proximate cause from the defendant's activity. In practice, a plaintiff's radiation injury, coupled with a showing of exposure to the defendant's radioactivity, should be enough to enable him to go to the jury; this ought to be essentially tantamount to recovery.

It is difficult to envisage defenses of contributory negligence or assumption of risk as applied against third persons not associated with the atomic venture. It is conceivable that these might be valid against some injuries sustained on the premises of an atomic venture, i.e., by employees or visitors. Whether advance waivers acquired from such persons would be effective is largely a matter of public policy.

Persons Potentially Liable

Persons other than the reactor owner may likewise be brought into focus for liability. It is virtually the universal view in this country that suppliers of chattels for consideration may be liable for harm to person or property of third parties who may be expected to be in the vicinity of probable use, at least if the supplier has failed to exercise reasonable care to make his chattel safe for its intended use. Under the current trend in the law, strict liability may even be imposed on suppliers for inherently dangerous chattels. The supplier of chattels

258. See Prosser, Torts 497-519 (2d ed. 1955); Restatement, Torts §§ 388-98 (1934).
may be the maker of a component part of a reactor, the assembler of the parts, the fabricator of fuel elements for the reactor, the maker of safety devices and so forth. The negligence of the user of the chattel in not discovering the defect may be no excuse for the supplier, especially for inherently dangerous chattels. Discovery of a defect in a fuel element for a reactor might not be made even by a reactor owner exercising due care, since the defect could lie within sealed units so as to defy detection; furthermore, these fuel elements made of poisonous materials and intended for dangerous usage probably fit nicely into that exception of dangerous chattels which precludes absolution of the supplier because of the user's negligence. The supplier also may be strictly liable to the user for defective chattels, under a legally-imposed implied warranty that the goods are safe for their intended use, at least so long as the user is ignorant of the defect.259 Even the building contractor for the reactor may be liable for subsequent injuries to third parties under the expanding scope of the law.260

Thus, fuel element fabricators and reactor builders become potential defendants; being large corporations, they present especially attractive defendants for suit. Suppliers of the special nuclear material, i.e., the Government or reprocessors, are less likely to be involved inasmuch as the fabricator subsequently performs so many operations on the material, including meltings and alloyings, as to break any thread of proximate causation running back to them. Even so, the Government requires that private owners and some foreign users under agreements for cooperation indemnify it against any liability arising out of use of the material,261 and it specifically disclaims any warranty as to the safe nature of the material for any purpose, including those which it has approved (the same disclaimer also applies to material supplied to foreign countries under agreements for cooperation).262 This indemnification and absence of warranty should not affect the right of a third party to sue the Government, if he were otherwise entitled to do so. However, the opinion of the Commission's general counsel has been that the Government will not recognize any liability arising from use of the material which it supplies.263

The inability to determine exactly what party's conduct was the cause of the accident will encourage suits against multiple defendants.

259. See Prosser, Torts 491-96 (2d ed. 1955).
260. Id. at 514-19.
263. Hearings, supra note 231, at 110, 113.
One theory of suit may be that the reactor owner, the reactor builder, the fuel element fabricator, the maker of safety devices and so forth are engaged in a joint enterprise. This theory should be most successful for the prototype reactors, wherein each of the foregoing participants is apt to be performing his services for less than cost as a sort of experiment and source of experience. Thus, all might be liable by imputation regardless of which one actually caused the accident.

On the other hand, if the various parties are viewed as alternatively liable, that is, if the plaintiff only can show that some one out of this group had to be the responsible party and that the others are not charged with that person’s conduct by imputation, then difficulties arise. Under the conventional view, circumstantial evidence of negligence cannot be used against parties in the alternative. However, several recent cases seemingly have allowed such procedure. This view becomes most tenuous when it is clearly apparent that one party’s negligence must necessarily preclude negligence of the other.

**Nuisance**

In view of the predictable hazards from reactor operation, a property owner may find that the enjoyment and value of his property are markedly decreased, and the insurance premiums appreciably increased, by the location of a reactor in his vicinity. In such a case, must he await an actual accident before having any legal remedy? If there is an interference with his use and enjoyment which would be substantial to an ordinary person in the community, without an overbalancing social utility in the continuance of the activity, the owner may have an action for private nuisance against the reactor owner. Even scientific assurance of the safety may be viewed with skepticism by lay persons of the community. “[T]he dread of contagion from a pesthouse, common to ordinary citizens, may make it a nuisance, although there is no foundation in scientific fact.”

A finding of private nuisance requires that the defendant’s conduct must be unreasonable, that is, its utility must be balanced against the risk of the harm which it creates. The legislature cannot give industry immunity to such suits because this would be tantamount to eminent

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266. See Prosser, Torts 389-426 (2d ed. 1955); Restatement, Torts §§ 822-31 (1939); University of Michigan Law School, Atomic Energy and the Law (1956).

267. Prosser, Torts 396-97 (2d ed. 1955). See also cases cited in id. at 407 n.82.
domain, requiring just compensation.\textsuperscript{268} In fact, utilities have been subjected to such suits in the past for various of their activities.\textsuperscript{269} Although the potential remedies for private nuisance include both an injunction and damages, the general interest of the public in atomic progress may make the former relief inappropriate. The latter, requiring a showing of actual injury, physical or mental, becomes much like strict liability.

\textbf{Immunity}

A still further complication arises where the responsible party is a body which is normally immune to private suit. These bodies include the federal government, state governments, municipal corporations and often hospitals and universities. Immunity of the federal government is partially waived under the Federal Tort Claims Act\textsuperscript{270} for acts of negligence but the waiver does not extend to "discretionary activities." Two federal district court cases have regarded the atomic weapons testing program of the Commission as such a discretionary activity,\textsuperscript{271} although one conceded that there might be actionable negligence in a ministerial function associated with such testing.\textsuperscript{272} A fortiori, the Government's own peacetime reactor program would seem discretionary although, again, negligence in ministerial functions surrounding reactor operation should be the immediate cause of accidents associated with government-owned reactors. Whether government liability could be attached to operations by private industry through the former's ownership of special nuclear material and possible negligence in the function of inspection remains in doubt. As already mentioned, the Commission's expressed opinion is in the negative.

One last resort in seeking governmental liability could be a claim of eminent domain, which requires compensation under the Federal Constitution and most state constitutions. Mere lowering of property values by reactor proximity is probably not a compensable "taking";\textsuperscript{273} however, extended deprivation of property through contamination by radioactivity from reactor accident, especially by government owned materials, might be sufficient to qualify.

\begin{footnotes}
\textsuperscript{268} The legislature cannot immunize persons against private nuisance suits since this is regarded as condemnation of property without just compensation. Richards v. Washington Terminal Co., 233 U.S. 546 (1914); Baltimore & Potomac R.R. v. Fifth Baptist Church, 108 U.S. 317 (1882).
\textsuperscript{269} Annot., 37 A.L.R. 800 (1925).
\textsuperscript{272} Ibid.
\textsuperscript{273} See U.S.C.A. Const. amend. 5, at 206 n.65 and 207 n.75 (Supp. 1955).
\end{footnotes}
It would seem only fair that the federal government accept liability for private injury and damage resulting from its own atomic ventures, at least for negligence of any kind, whether in the weapons field or in the reactor or other peaceful programs. This liability should have no such inadequate limit as the $5,000 currently available through settlement with the Commission of private claims resulting from weapons tests.\(^{274}\)

With regard to licensees normally immune to suit, it might be a matter of good policy to require that they waive their immunity in this respect before they are granted a license from the Commission. Municipal corporations may not be able to claim immunity if their atomic activities may be shown to be proprietary rather than governmental.

It might be expected that attempts by industry to minimize or limit their potential liability would include separate incorporation of that part of the industry engaged in nuclear work, maybe even separate incorporation of each power reactor plant. The legal effect of such measures may be as much in doubt as the ethics. The Commission has given indication that it will look to the financial responsibility of the licensee before approving his activity\(^{275}\)—but no suggestion has been made that this will include his ability to respond to damage claims. It has been indicated in hearings by the Joint Committee that the act did not contemplate such a condition for license.\(^{276}\)

Another consideration is that of the statute of limitations, which dictates the maximum time period which can elapse between injury and the initiation of suit for recovery. Radiation injuries are especially insidious in that they may manifest themselves only after passage of many years from the date of exposure; for example, radiation-caused cancer has never appeared in much less than five years from the date of exposure; genetic effects appear only after the birth of children. Almost all state tort statutes of limitation expire in one to three years, a time limit far too short for these unique type injuries. Even the 1954 Act imposes a one-year maximum for claims settled by the Commission for injuries resulting from radiation created and spread by atomic weapons tests\(^{277}\)—and the Federal Tort Claims Act has a two-year statute of limitations.\(^{278}\) If extension of these various


\(^{276}\) Id. at 107-09.


\(^{278}\) 28 U.S.C. § 2401(b) (1952).
If the determination of tort liability must be settled by state statutes or common law, there are obvious disadvantages. Any expectation of uniformity of liability would be fallacious. Some states might elect to attract reactor projects by limiting liability, thus possibly depriving injured parties in adjacent states of adequate recourse. Moreover, before thus limiting liability, states should be certain they are not depriving their own citizens of insurance settlements which would be available for more liberal liability. States may have different opinions as to the effect of a defendant's adherence to all federal and state safety regulation. Yet, state law imposing liability for violation of standards more strict than the federal regulations would again raise the question of conflict with possible federal preemption of the safety field. Uncertainties as to the extent of liability will render even more difficult the problem of providing insurance—thus retarding atomic progress. The possibility of a federal atomic tort law merits serious consideration.

One possible federal resolution of the problem was contained in a bill presented to the past Congress. This bill proposed limitation of liability of the licensee of a facility, his contractors and subcontractors to an amount double the capital value of his facility.

"The licensee of a production or utilization facility shall not be liable in damages for the malfunctioning of such facility in an aggregate amount more than twice the original capital cost of such facility. The aggregate of this limitation shall extend to, and include all contractors and subcontractors of the licensee in the design, construction, or operation of such facility. . . ." 279

This proposal harnesses the public with another subsidization of private nuclear programs and seems to have no justification in logic except to encourage private programs at the expense of the public. For projects such as that of Consolidated Edison, where the village of Peekskill is the site of a reactor whose power is destined for New York, little claim can be made that the populace are getting a proportionate benefit from the risk imposed on them. The constitutional basis of such a provision

is also hazy, since it essentially amounts to condemnation of one citizen's person and property to the benefit of another, without corresponding just compensation.\textsuperscript{280} Whether the bankruptcy clause\textsuperscript{281} would adequately support such a law is doubtful—the licensee may well not be bankrupt by any customary definition of the word. Reliance on the constitutional bases of general welfare and the common defense and security is also of dubious validity for a condemnation-type statute. Of far more merit is the suggestion of an Atomic Compensation Act, assessing maximum but just statutory damages so as to take the excess profit out of tort suits;\textsuperscript{282} even \textit{ad hoc} settlement might be left to an administrative agency rather than to a local jury.

**Insurance**

The potential magnitude of injury and damage, coupled with the uncertainty of liability, would be expected to make insurance risks hard to calculate and coverage difficult to obtain. This has proved to be the case.

**Private Insurance**

Workers in the field have found their insurance relatively simple to obtain. Workmen's compensation generally is regarded as covering any radiation injury—some states specifically so provide.\textsuperscript{283} Some need for modification of these laws may exist in the requirement of timely notice—the period may be too short for radiation injury, analogous to the discussion on statutes of limitation. Also, the causal relationship between injury and exposure may be difficult or impossible to prove by ordinary methods. Over 99.7 per cent of all commission employees have been able to obtain life, accident and health insurance exactly as though they were working in an ordinary industrial plant.\textsuperscript{284} However, it must be recognized that the safety which has been achieved for government employees has entailed an expense which may be beyond the ability of private industry to bear.

\textsuperscript{280} Hearings, supra note 231, at 244.
\textsuperscript{281} U.S. Const. art. I, § 8, cl. 4.
Otherwise, however, the insurance problem remains largely unsettled. The risk of reactor accident may be conceded as very small. Nevertheless, the damage from an accident could be huge (although it need not be) and it is most questionable whether either the utilities, their suppliers or their insurance companies could justify such gambling of assets that were accrued for more ordinary purposes and risks. The generally expressed attitude is summarized by one official of a leading utility: "At this time we do not see any sound basis on which we can risk our solvency on the possibility, remote as it may be, of a major nuclear catastrophe." 285

The private insurance companies, stock and mutual, have been conducting a study for some time and their latest report suggests that the stock companies may be able to offer coverage of about fifty million dollars for third-party liability and an equivalent amount for property damage insurance. The mutuals expect to offer about fifteen million dollars, which may be apportioned between third-party liability and the insured's property according to the insured's option. 286 These insurance limits are to represent all insurable interests associated with any single accident—an interesting problem will arise in apportioning this maximum among the reactor owner, the reactor builder, the fabricator and others. For the sake of comparison, the largest liability insurance now carried by a single person is in the region of fifteen million dollars.

This private coverage is being achieved by the formation of syndicates 287 which are exhausting the foreign market in their quest for reinsurance. Thus, the atomic industry has no further private insurance resources to investigate. The insurance which any company can offer on a single risk is limited by state law, generally being less than ten per cent of the company's capital. Even most of this is reinsured, however, so that the original insurer normally retains less than one per cent of its capital tied to a single risk. For atomic insurance, companies may be willing to raise this percentage to about 1¾ per cent. The rates reputedly will be set by a designated rating organization with no chance for negotiating between insured and insurer; the annual premium will run about one-tenth of one per cent of the coverage. The insurance apparently will not be offered on a "deduct-

287. Nuclear Energy Liability Insurance Association (stock casualty companies); Nuclear Energy Property Insurance Association (stock fire and property companies); Mutual Atomic Energy Pool (mutual fire and casualty companies).
ible" basis, since the insurance companies desire to handle all third-party claims \textit{ab initio}, thus improving their chances of establishing favorable legal precedent.

As reactor entrepreneurs insure, insurance companies may try to drop duplicate coverage from the individual policies of third parties, at least for personal injury and property damage—but probably not for life insurance. These proposals for eliminating minor pyramiding coverage may well run into opposition from state regulatory agencies and policy holders.

The effect of antitrust law upon such syndication is not of serious concern, apparently. Some companies do not regard the field as particularly profitable and state that their motivation is primarily to meet a demand by existing customers. The desire to limit government entry into the field is doubtless a further incentive.

\textit{Government Insurance}

Even the foregoing offer of private insurance is generally regarded as inadequate for the potential risks involved with a nuclear reactor. Reactor owners and their suppliers appear to regard this obstacle as one of the most difficult in the advance of atomic industry. Since industry will not or cannot proceed until more insurance is available, insurance by the Government is rapidly gaining in favor as the only recourse, short of imposing an involuntary risk and subsidy on the public.\textsuperscript{288} Government indemnification has always been required in the past to induce private industry to undertake projects for the Commission. A current question on federal insurance is whether the Government should insure from the ground up or merely offer topping insurance for that risk which the private companies cannot cover. The spirit of the act suggests the obvious answer—private insurance should be encouraged to the maximum, leaving only excess coverage for the Government.

There is little the Commission can do to provide insurance under the present act; the law specifically precludes any subsidization of industry and requires industry to hold the Government harmless for liability resulting from the use of special nuclear material.\textsuperscript{289} Several possibilities of amending legislation have been proposed, including.


bills introduced in the last session of Congress. The earliest proposal was the Price bill:

"Be it enacted . . . that (1) for a period of 10 years from the date of passage of this Act the Atomic Energy Commission shall, upon request, indemnify each owner, operator, manufacturer, designer and builder of a production or utilization facility, as defined in the Atomic Energy Act of 1954, and each supplier of equipment, material or services for such facility, as interests appear, against uninsured liability to members of the public for bodily injury or death and property damage arising from nuclear hazards, subject to the condition that primary non-governmental insurance against such liability has been procured in amounts deemed reasonably adequate by the Commission to provide against normal contingencies; and (2) each indemnification shall be evidenced by an agreement which shall become effective upon its execution and shall cover the liability for events occurring thereafter and during the useful life of the facility."

Two omissions on much-discussed issues were evident in the above bill. First, no compulsion was made that industry insure at all. Such a requirement should be made in fairness to the public. Second, no premium was exacted for government insurance. The desirability of such a giveaway was challenged by those who felt that nuclear power should operate on a competitive basis with conventional power.

A bill proposed in the closing days of the past session, by Chairman Anderson of the Joint Committee, would have required the Commission to insert in each license a condition specifying the amount and type of private "financial protection" the licensee must have to cover public liability claims. The Government then would provide up to 500 million dollars topping indemnification covering all insurable interests associated with any single reactor accident. Private liability would be limited by statute to the amount of total coverage available, private insurance plus government indemnification, excess losses being compensated for by private legislation, if at all. Annual premiums would be minimal, i.e., a maximum of thirty dollars per 1,000 kilowatt capacity. Waiver of a licensee's immunity to public liability could be required as a condition of license. The indemnification would be obtainable for licenses granted before August 1, 1966, but would cover all incidents during the life of the license, once obtained. The Commission would be given authority to settle claims, apparently without

regard to legal liability laws of any state and without judgment of liability by any court.

Any ultimately approved bill will probably be an amalgamation of the Anderson bill with a bill proposed by Representative Cole, which had the support of the Commission. The latter bill was rather poorly received. It would have required no financial responsibility as a condition of license; it would have provided unlimited government indemnification or reinsurance, but only for amounts in excess of the maximum insurance available from private sources. The premiums would be derived from private insurance rates and would be reserved to apply against future claims. The government obligation would not be effective in cases of certain conduct by the officials of the licensee.

It would seem that a change in the law should incorporate certain features of both bills. Financial responsibility should be a license condition in order that the public need not rely upon the sagacity of industry for its recovery of losses. The government obligation should begin only after private insurance has been exhausted and rates should be set according to probable loss insofar as is possible—unless the philosophy of no subsidy to private industry, as stated in the 1954 Act, is to be reversed. Similarly, premiums should be used to defray payments of claims for loss. No limit should be placed on government liability; private losses should be reimbursed totally, perhaps by administrative settlement. If the Government cannot afford to do so, then the merit of the atomic program requires re-evaluation. In reality, however, any change is more apt to limit government indemnity to a fixed amount, make it available before all private sources have been utilized, assess a token premium and limit private liability to the amount of insurance and indemnification.

**International Cooperation**

The new act, in contrast to the old, advocates a program of international cooperation. The interest of foreign countries in developing the utilization of atomic energy is growing just as it is in this country. In fact, the higher costs of power in most such countries give them an added incentive to develop nuclear energy. American industry will undoubtedly desire to bid for a fair share of this expanding foreign market and provisions of the act controlling such enterprise are important.

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Limitations on International Dealings

All three types of nuclear material may be shipped abroad subject to certain conditions. Foreign distribution of special nuclear material must be made pursuant to the terms of an agreement for cooperation between the United States and the country of the recipient.\(^{294}\) Source material can be distributed abroad either under terms of such an agreement for cooperation or upon a determination by the Commission that such activity will not be inimical to the interests of the United States.\(^{295}\) By-product material may be given foreign distribution either under an agreement for cooperation or where the Commission's opinion is that such distribution would not be inimical to the common defense and security; for this type material, the Commission is authorized to make the same charge as for domestic distribution and may require reports regarding the use of material so distributed.\(^{296}\) Foreign distribution of special nuclear material can be done only by the Commission;\(^{297}\) such distribution of source\(^{298}\) and by-product materials\(^{299}\) can be done either by the Commission or by private persons licensed to do so. Under the previously discussed allocation by the President, the United States is prepared to supply 20,000 kilograms of U-235 for sale or lease (or gift\(^{300}\)) to foreign users, in enrichment of up to twenty percent.\(^{301}\)

It has been mentioned that the export of either a production or utilization facility requires a commission license.\(^{302}\) Whether this be a research and development\(^{303}\) or a commercial facility,\(^{304}\) the statutory limitation is the same. The export license must be pursuant to an agreement for cooperation existing between the United States and the government of the country of the recipient, except that the Commission may give a license for the export of items that are component

\(^{300}\) Hearings, supra note 285, at 334-35.
\(^{301}\) Address by Clark L. Vogel, AEC Division of International Affairs, Atomic Industrial Forum Conference, Atlanta, April 18, 1956.
parts of such facilities if the Commission determines in writing that each export does not constitute an unreasonable risk to the common defense and security.

No restricted data may be exchanged with persons in other nations except as authorized by the President and even then the exchange must be undertaken pursuant to an agreement for cooperation or to an agreement existing as of the effective date of the act.\textsuperscript{305} Furthermore, no restricted data concerning design or fabrication of atomic weapons may be exchanged under any circumstances.

One final restriction on private international activity is that no one may directly or indirectly engage in the production of any special nuclear material outside the United States except under an agreement for cooperation or upon authorization by the Commission following a determination that such activity will not be inimical to the interest of the United States.\textsuperscript{306} A moment's reflection should give an appreciation of the potential magnitude of this superficially innocuous provision, a potential which has given industry many headaches. For example, industry representatives could not even discuss most unclassified matters abroad with foreign industry unless the provisions were met—virtually any subject matter could be indirectly linked to the production of special nuclear material. However, acting under the statutory authority, the Commission has given a general authorization for activities in foreign countries, except members of the Soviet bloc, provided no communication of restricted data or other classified defense information is involved.\textsuperscript{307} These latter activities still require specific sanction. Most commercial dealings involving modern design power reactors will, in fact, be of the latter kind so that the general authorization does not have too much effect in clearing the way for industrial negotiations.\textsuperscript{308}

"Agreements for Cooperation" and "International Arrangements"

Since so many foreign transactions hinge upon an "agreement for cooperation,"\textsuperscript{309} a knowledge of the nature of this type agreement is important. Such an agreement, as applied to peaceful uses of atomic energy, is an agreement initiated by the Commission between the United

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States and any nation or regional defense organization, which has the approval of the President and which has thereafter been submitted to the Joint Committee for a period of thirty days while Congress is in session. Because of the two-party nature, these agreements are popularly termed "bilaterals." The cooperating party must agree to maintain security safeguards and standards as set forth in the agreement, must guarantee that no material transferred shall be used for any military purpose, and must guarantee that material or restricted data supplied will not be transferred to unauthorized persons or beyond the jurisdiction of the cooperating party except as the agreement may specify.

In addition to negotiations made with industry or with the Commission under these agreements for cooperation, the act provides that a foreign nation may deal with the United States in matters of peaceful use of atomic energy by another means, the "international arrangement." This is defined as an international agreement approved by the Congress (requiring a majority of both the House and the Senate) or any treaty (requiring a two-thirds vote of the Senate), but does not include an agreement for cooperation. Under one section of the act, the President is specifically authorized to enter into such international arrangements but actual cooperation with any nation must still be pursuant to an agreement for cooperation. Under another section of the act, however, an international arrangement will automatically supersede the act or any action of the Commission in case of conflict and the Commission is directed to give maximum effect to the arrangement in its subsequent functions. If the latter section be accepted literally, international arrangements could override all those sections of the act which require a bilateral agreement for particular dealings with foreign countries.

The sections are obviously contradictory and a decision must be made as to which shall prevail. An international arrangement adopted by a majority of each branch of Congress would be tantamount to amendatory legislation; a treaty likewise is supreme over prior legislation. Thus, it seems apparent that an international arrangement can bypass agreements for cooperation if it is so devised. In practice, it is difficult to conceive of the United States entering into a multilateral

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international arrangement and then confining its actual participation
to those parties who enter an agreement for cooperation in addition.
In fact, some countries advocating multilateral cooperation may well
balk at entering bilaterals.

All United States international activities thus far have involved
bilateral agreements. The bilateral scheme of international cooperation
differs quite markedly from the international program originally
suggested to the United Nations General Assembly on December 8,
1953.313 At that time, President Eisenhower had proposed a sort of
international atoms-for-peace bank, which would receive contributions
of nuclear material from member countries and then redistribute them
for use by other member countries. Congressional reaction to this idea
at the time was that the United States should not relinquish direct
control over its special nuclear material. The original idea is not dead,
however; in fact, a draft statute proposed to effect such a bank under
an International Atomic Energy Agency has recently been revised and
adopted by an eighty-two nation conference, with the anticipation that
such a body ultimately will materialize after ratification by the requisite
number of nations.314

Such a multilateral arrangement will offer little or no technical
assistance from this country that is not now available via a bilateral.
The United States will be expected to contribute an appreciable amount
of nuclear material; apparently, some countries prefer to receive the
material from an intermediate international agency rather than from
donor nations. Such availability of material might deter other coun-
tries from constructing their own production facilities, thereby enabling
stronger supervision of their atomic progress. The existing allocations
of U-235 by this country for foreign use were originally destined for
bilateral purposes. However, the 5000 kilograms allotted to the initial
operations of the International Atomic Energy Agency plus the amounts
promised to match contributions of other nations also will be drawn
from such quantities made available by the President.315

The Bilateral Program

As of the close of Congress in July 1956, agreements for coopera-
tion were in effect with thirty-six countries. The research bilaterals
follow in general the prototype agreement made with Turkey; they

313. Id. at 100-03, 133 (minority); The Reporter, Jan. 12, 1956, p. 11; Wit, Some
International Aspects of Atomic Power Development, 21 LAW & CONTEMP. PROB. 148,
168-69 (1956).
are intended to provide the cooperating party with the means for acquiring a research reactor.\textsuperscript{316} The Commission is to lease enriched uranium (maximum U-235 content of twenty per cent) for a period of five years (ten for Turkey), which shall not at any time be in excess of six kilograms of contained U-235 (unless the Commission later specifies otherwise). Recent announcement has been to the effect that some research bilaterals may also be relaxed to allow provision to each country of 100 grams of U-235, ten grams of plutonium and U-233, all in highly enriched form.\textsuperscript{317} Originally, the form and content of this material were not to be altered between the time of delivery and the time of return to the Commission, meaning that all reprocessing of spent fuel, and plutonium recovery, would be done in the United States. Apparently recognizing the gross impracticality of such a provision, especially as applied to power reactors, the Commission now states that it may allow reprocessing either in commission facilities or in facilities designated by the Commission, the latter not necessarily being within the United States.\textsuperscript{318} The United States agrees to permit persons under its jurisdiction to provide information and services and to export materials, including equipment and devices, to the cooperating nation or authorized persons under its jurisdiction, but neither such information, service nor materials can involve the communication of restricted data. President Eisenhower promised that the United States would pay fifty per cent of the cost of all research reactors acquired under these bilaterals.\textsuperscript{319} As of June 23, 1955, 200 kilograms of U-235 had been allocated by the United States for distribution under these research bilaterals.\textsuperscript{320}

The initial reaction to the research bilateral approach was one of skepticism on the part of some. A major need of most foreign countries is power; research reactors used to train personnel and provide technical information may eventually enable a country to be largely self-reliant in its nuclear utilization. However, provision of power reactors in the first instance, along with technicians to operate them, offers the power-hungry country much more immediate benefit from investment of its limited funds. This choice was undoubtedly considered thoroughly

\textsuperscript{316} Argentina, Australia, Austria, Belgium, Brazil, Canada, Chile, Nationalist China, Columbia, Costa Rica, Cuba, Denmark, Dominican Republic, France, West Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Lebanon, Netherlands, New Zealand, Pakistan, Peru, Philippines, Portugal, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, Uruguay, Venezuela. An agreement with Guatemala has been signed. Negotiations are also being conducted with several other countries.

\textsuperscript{317} Address by Clark L. Vogel, AEC Division of International Affairs, Atomic Industrial Forum Conference, Atlanta, April 18, 1956.

\textsuperscript{318} Atomic Industrial Forum Memo, June 1956, p. 24.


\textsuperscript{320} AEC News Release, June 24, 1955.
before the research approach was adopted. Nevertheless, many countries have indicated a desire for nuclear power in the near future.\textsuperscript{321} If our industry is not allowed to supply the power reactor demand, it is certain that other countries will soon be willing and able to do so, although none is known to be doing so yet.\textsuperscript{322} But modern power reactors embody restricted data, thereby making it impossible for our industry to offer these for foreign sale under existing research bilaterals. This may deprive our industry of a much needed market for spreading the development costs now being incurred. Furthermore, United States industry may find it quite unprofitable to supply research reactors; little criticism can be levelled if industry proves unable to become a philanthropy or to devote its limited skilled personnel to an unremunerative aspect of the atomic field.

By the beginning of 1956 no research reactors had been contracted for, the only one to go abroad having been the demonstration swimming pool reactor sold to Switzerland at the conclusion of the Geneva conference. However, the early part of 1956 saw arrangements made for the supplying of research reactors to seven countries by several different American manufacturers. These reactors are going to Brazil, Denmark, Italy, Japan, the Netherlands, Spain and West Germany, and they range in heat capacity from fifty to 10,000 kilowatts. The United States has promised to contribute $350,000 to the cost of the reactor for Brazil,\textsuperscript{323} representing the first such contribution under the President's promise, and presumably will do likewise for other countries.\textsuperscript{324} In anticipation of further cooperation, the United States has allocated $2,800,000 to supply such aid to eight countries in 1956,\textsuperscript{325} and the Commission expects to make available additional amounts of $5,950,000 for seventeen countries in 1957 and $4,200,000 for twelve more countries in fiscal year 1958.\textsuperscript{326}

It still seems likely that many bilateral agreements will have to be upgraded to include power reactors without an intervening purchase of a research reactor. A group recently considering the problem has recommended that negotiations for upgrading be initiated with each bilateral country at the earliest opportunity.\textsuperscript{327} The 20,000 kilogram


\textsuperscript{322}Hearings, supra note 285, at 336; Life, June 4, 1956, p. 48.

\textsuperscript{323}AEC News Release, No. 814, April 20, 1956.


\textsuperscript{326}Atomic Energy Clearing House, July 9, 1956, p. 2.

\textsuperscript{327}1 PANEL ON THE IMPACT OF THE PEACEFUL USES OF ATOMIC ENERGY, \textit{op. cit.} supra note 308, at 8, 97.
allocation of U-235 by this country for foreign use probably anticipates such action. Some domestic companies reputedly have already arranged to construct power reactors in foreign countries if appropriate bilaterals can be achieved. Financial assistance for foreign atomic power plants can be obtained from the Export-Import Bank of Washington under its recent agreement with the Commission. As an extreme measure, some contemplation has been made of constructing power demonstration reactors in foreign countries at public expense as part of our development program.

Seven existing bilaterals, with Canada, Belgium, the United Kingdom, the Netherlands, France, Switzerland and Australia, deviate from the research pattern. They envisage the construction of power reactors and some restricted data may be communicated. The Commission may provide requisite nuclear materials. Private persons are to be permitted to provide information, services and materials, including equipment and devices, to the cooperating nation or authorized persons under its jurisdiction, within the limits set forth in the particular bilateral. Belgium has already contracted with a United States company to construct a 11,500 kilowatt reactor, this being the only power reactor yet exported under a bilateral. Authorization for some United States industrial companies to engage in classified work under the Canadian bilateral has been given recently. The agreement with the United Kingdom looks to fairly extensive exchange of information and materials; the agreements with the Netherlands, Switzerland and Australia permit export of up to 500 kilograms of U-235 in twenty per cent enrichment form; France will receive only forty kilograms of U-235 and no restricted data.

European Activities

The existing favorable foreign market for United States industry may very well become more competitive within a few years. A recent study by the Organisation for European Economic Co-operation demonstrates that many countries are now thinking in terms of atomic power with the intention of becoming self-sufficient as soon as possible. This seventeen-nation program of cooperation postulates not

only construction of reactors, but also construction of isotope separation plants, reprocessing and fabricating facilities and ore refining facilities. The high costs of such a program would be diffused by pooling the efforts and resources of member countries. A relatively open market for nuclear fuels is included as part of such a proposed program. According to the study, member countries already possess six power reactors and eight research reactors in operation or under construction, and all of European manufacture.

Another proposed program of foreign cooperation is Euratom, a proposal originated by M. Jean Monnet which would create a program of atomic development by the six nations now comprising the European Community for Coal and Steel. This proposal envisages a Euratom Commission acting as owner and distributor of all noncommitted nuclear fuels possessed in member countries. The Commission would have powers of project approval and inspection, designed to assure only peaceful application of these fuels. The Commission would be responsible for performing research and providing facilities for production of enriched uranium and other necessary common services.

**Obstacles to International Development**

A major problem that industry may encounter in the international field is that persons with whom it may desire to do business are located in countries which are not parties to any bilateral. In such a case, all discussion or negotiation involving restricted data is forbidden, the Commission being precluded from authorizing such activity. The export of by-product or source material may be done under commission authorization but no export of utilization or production facilities (aside from component parts) or special nuclear material can take place until a bilateral is effective. Thus, one of the parties must prod its government to undertake the arrangement of such a bilateral. The United States has indicated that it would respond to this outside impetus; however, the foreign country may not. In fact, some countries are probably abstaining from such bilaterals because of inability or lack of desire to meet the conditions imposed. At this point it is important to remember that the use of natural uranium is highly feasible for the utilization of atomic power and such material is available to most countries. Many countries had embarked upon programs of their own prior to 1954, and some of these are electing to continue their natural uranium programs so as to be independent of other countries. In fact, such programs will ultimately provide the countries with their own source of plutonium, for peaceful or military application as they
may see fit. This desire for independence is most understandable and it may be very unfortunate if American industry is deprived of a substantial market and a chance to assist foreign development.

Even where bilaterals of adequate scope do exist, problems may still be met. Strings tied to the supply of special nuclear material by the Commission, *e.g.*, inability or unwillingness to sell material outright or to provide for assurance of long term lease, may retard the marketing abroad of any but natural uranium reactors, at least until a foreign market develops for the supply of special nuclear material. Yet, most of American industry’s efforts so far have gone into developing reactors using enriched uranium fuel. The only way to be certain that foreign users do not divert some special nuclear material to military purposes would be to send them fabricated fuel elements and require their return intact when spent; until very recently, the Commission required such a procedure. Yet, it could not seriously be contemplated that highly radioactive fuel elements from power reactors in Turkey or Greece or Japan would be dispatched back to this country for reprocessing. The increase in cost of foreign electrical power attributed to such measures would be prohibitive in itself.\(^{333}\) As a necessary consequence, the Commission now states that foreign reprocessing of fuel elements may be permitted in commission-designated facilities. Many reactors use "blanket" material outside the reactor core, in which special nuclear material is created during operation. Since the blanket material will be owned by the foreign country, the Commission would seem to have no voice in the reprocessing and disposition of this material.

Supply of facilities may be complicated by a question already raised, that is, whether the Commission should exert any control over the character of the facility to be provided, especially as to its safety features. Specification by the Commission of safety features not required by the purchaser may place domestic industry at a marked price disadvantage with foreign industry which is free to supply whatever the buyer wants. Another danger to industry operating abroad is the infringement of foreign patents; *e.g.*, the Fermi patents cover an invention used in many reactors—in the United States this patent has been acquired by the Government for public use but in some foreign countries the patent is still outstanding in private hands.

Since foreign industry is not governed by the act, an interesting question concerns the effect on United States shareholders of such industry when it engages in activities that are barred to the persons

\(^{333}\) See 2 PANEL ON THE IMPACT OF THE PEACEFUL USES OF ATOMIC ENERGY, *op. cit.* supra note 308, at 326.
themselves. Are such activities imputed to the shareholders? If not, can our industry form foreign corporations and operate free of the act? In this connection, it must be decided whether the statutory proscription of unlicensed dealings in facilities applies to persons within the United States or to activities within the United States. Similarly, can American industry own special nuclear material in foreign countries? Can it own production facilities abroad, at least to the extent that they do not involve restricted data?

A reasonable suggestion for simplifying the international picture would be to allow unrestricted export of any nuclear material, facility or information which is otherwise available on the international market or which does not pose an unreasonable threat to the common defense and security when in foreign hands. At present, this should include all by-product material and source material and perhaps special nuclear material in small concentrations of isotopic enrichment. Restrictions might likewise be removed from the export of utilization or production facilities which do not embody restricted data. Finally, the exchange of restricted data, at least of the confidential category, should be made possible with any country which is willing and able to protect it from delivery into unfriendly hands. Since data of primary military importance is top secret, beyond the reach of private industry per se anyhow, this risk to security should not be appreciable even if some of the information does gradually leak away. In this connection, it might be remembered that the United States no longer is capable of controlling nuclear developments abroad. Much of our information has already been ferreted out by other countries through independent research; a great deal more will be achieved as scientists continue to explore the field. In all probability, foreign research will turn up important data that we do not have and which we will want. Other countries are going to have nuclear power and atomic weapons with or without our help; it may be to our long run advantage to have it be the former and to adjust our planning to an acceptance of these facts.

**OTHER CONSIDERATIONS**

In addition to the Atomic Energy Act, industry is also concerned with legal complications in at least two other fields of federal law.

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The novelty of atomic industry explains the relatively undeveloped law in these areas. It would seem certain, however, that as industry becomes more involved in atomic endeavors, the legal problems here will be substantial.

**Antitrust**

One of these peripheral concerns is with the field of antitrust law. The extreme financial losses which are currently involved in nuclear power development, coupled with a prospect of continued loss until at least 1965, have led many utilities to unite with each other and with various suppliers, often by the formation of jointly-owned subsidiaries, in building and operating prototype reactors. Private progress in power reactors seems almost dependent upon the ability of industry to thus share the expense. Such activities must be carefully designed to avoid involving a combination in unreasonable restraint of trade under the Sherman Act, an exclusive dealing or requirements contract arrangement under the Clayton Act, or an unfair method of competition under the Federal Trade Commission Act. The Atomic Energy Act specifically states that nothing in it shall be deemed to excuse any person from the effects of these antitrust laws.\(^3\)

**Holding Company Act of 1935**

The other field of appreciable concern to industry concerns the Holding Company Act of 1935.\(^3\) Under this act, all holding companies whose subsidiaries are engaged in the electric utility business are subject to regulation—and control is presumed where the holding company has at least ten per cent ownership of the subsidiary. Thus, an operating utility, a reactor construction company or a fuel fabricator, whenever it has an ownership interest in a corporation formed to construct a nuclear reactor, risks being subjected to regulation as a utility holding company. Several bills were introduced in Congress for the announced purpose of easing the application of this law to reactor building groups.\(^3\) The SEC now has modified rule U-7 under the Holding Company Act to provide that the definition of "electrical utility companies" shall not apply to companies organized on a non-profit basis to develop atomic power projectors where their

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only purpose is to produce heat or steam from special nuclear materials. The need for any immediate legislative change may therefore have been alleviated.

CONCLUSION

Control and utilization of nuclear power began in the United States under federal laws which effectively precluded industry from participation for private purposes. The Atomic Energy Act of 1954 represented a considerable relaxation and allowed private activities in many areas which theretofore had been the exclusive domain of the Government. In many respects, as might be expected, the act initially provided industry with more opportunity for participation than could be immediately utilized, with the consequence that there was little manifested chafing against the boundaries of permitted activity. However, as the scope of industry's endeavor in this new field has increased, government control has become a subject of more critical opinion.

Primarily for protection of health and safety of the general public and of persons engaged in this field, some continuing government regulation will probably remain necessary and desirable. Nevertheless, there is considerable private limitation in the act which does not pertain to health and safety, an appreciable part of which may have outlived its justification. Early modification or elimination of some sections in the act seems warranted.

A matter of even more concern to industry is the possibility of government re-entry into the nuclear power field. The calculated and somewhat conservative progress of industry to date, coupled with its current request for assistance from the Government in the form of insurance, has been criticized at length by advocates of federal nuclear power development. An entry by the Government into the large scale production, sale and distribution phases of nuclear power is possible, if not probable, and would certainly discourage further private expenditures. Few industries will feel justified in investing private funds in pioneer undertakings parallel to those of the Government. Any federal program conceived by the forthcoming session of Congress should be judiciously designed to protect the investment of those industries which have broken ground in the field with no expectation that the sovereign ultimately would be their competitor.