CONTROLLING LAND USE AND POPULATION GROWTH NEAR NUCLEAR POWER PLANTS

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I. INTRODUCTION

The United States Nuclear Regulatory Commission (NRC) has given very little attention to the regulation of land use and population growth near nuclear plants to avoid the consequences of a potentially dangerous release of radioactivity near nuclear plants. The reasons for this are uncertain, but it is clear that the NRC has concentrated on technological issues related to controlling the dangers from nuclear plants and, more recently, evacuation techniques. This certainly is understandable, given the complicated technology involved. Increasing opposition to nuclear plants and continuing public concern, however, favor increased consideration of other techniques.[1] It is the purpose of this Article to examine the relation-

1. The nuclear power industry has suffered a number of woes recently. According to an article in Time Magazine, DeMott, *An Industry Still in Disarray*, TIME, Apr. 11, 1983, at 72, "[t]he industry is plagued by soaring cost overruns, unfinished plants, waste disposal problems and environmental suits, shoddy workmanship, tricky technology, constantly changing safety regulations, disillusioned shareholders, weak political support and public mistrust. . . ." *Id.* at 72.

A recent article focusing on the shocking excess costs of nuclear power and their resulting effects on power rates stated that some delayed projects were over budget by more than 1000%. N.Y. Times, Feb. 26, 1984, at A1, col. 3 (late ed.). The article also noted that some studies have cast doubt on whether the most expensive of these plants ever will justify their costs. *Id.* at A42, col. 1. The causes of these cost overruns are many and varied. The underlying problem has been misjudgment of the growth in demand for electricity. For example, the Wolf Creek plant in Burlington, Kansas, when finished, will have a generating capacity 50% above demand, and a rate increase of 65% is expected. *Id.* The article also cited other reasons for runaway costs: the use of full cost-reimbursable construction contracts, added regulatory burdens, increasing

ship of land use control techniques to nuclear power plants. The Article considers the extent to which the NRC and the courts have considered this relationship. The Article next examines the types of land use techniques available for use by communities and how these techniques can be applied to the specific problems of nuclear power plants. Finally, the Article offers some suggestions on how to establish a process that will consider land use control techniques in the nuclear plant planning process.

This Article emphasizes the utilization of land use control techniques to deal with problems of population density. Thus, the Article does not treat specifically the site aspects of plant location in terms of physical land features. For example, the Article does not deal with the question of how the NRC evaluates a potential site location to determine its susceptibility to earthquakes or other natural and geological hazards. Similarly, the Article does not examine specific problems related to the implementation of the National Environmental Policy Act[2] in the plant siting process. While these issues are important, this Article emphasizes that the NRC can structure a process that reduces the risk of population exposure from an accident by dealing with population growth and density. As discussed below, the NRC currently focuses on evacuation techniques in the event of an accident. It is the authors' belief that putting improved land use control techniques in place before a plant is built, or even after the fact, can be of great benefit by itself, as well as in conjunction with evacuation considerations.

Land use controls promulgated for the purpose of protecting the public health and safety must be designed to create some reasonable likelihood of providing that protection. Developing legally supportable land use controls for the purpose of protecting the public from the

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inflation and interest rates, falling or constant costs of alternate types of fuel, and costly safety questions. *Id.*

The Three Mile Island incident brought the safety issue to the attention of the American public in 1979. Concern for emergency planning and the lingering psychological impact on survivors of a nuclear accident has increased since the Three Mile Island incident, while construction of some new plants has been delayed or called off altogether. The industry also is attempting currently to deal with such issues as the transportation and disposal of radioactive waste produced by nuclear power plants, problems of plant and personnel security, and the possibility of intentional sabotage of nuclear facilities.

2. 42 U.S.C. §§ 4321-4370 (1982). On the topic of the National Environmental Policy Act and nuclear power, see Baltimore Gas & Elec. Co. v. NRDC, 462 U.S. 87 (1983).

consequences of an accident at a nuclear power plant is difficult because of the uncertainty surrounding the dangers from these plants. The uncertainty is of two types. First, there is the uncertainty of the probability of an accident actually occurring. Contradictory evidence regarding the likelihood of an accident resulting in a release of radioactivity into the atmosphere, and the attendant risk to the public, demonstrates the difficulty of assessing the costs and benefits of regulatory proposals.[3] The second type of uncertainty involved is determining the size of the geographic area affected by an accident.

3. The question of risks associated with the operation of nuclear power plants is by no means settled. Many experts disagree on the degree of risk involved and how to measure it meaningfully. The estimation of risk does not utilize highly certain methods and new estimates may not be any more accurate than old ones.

In 1975, the United States Nuclear Regulatory Commission Reactor Safety Study (WASH-1400) predicted that melting of the reactor core is expected once per 20,000 years of reactor operation. Yet, two public interest scientists have estimated that the study may be wrong by a factor of 100 or more, and that a major release of radioactivity can render an area of 5,300 square miles uninhabitable for decades. N.Y. Times, July 9, 1982, at B3, col. 2 (late ed.).

The NRC has revised the Reactor Safety Study, N.Y. Times, July 6, 1982, at A10, col. 1 (late ed.). The revised study, entitled *Potential Precursors for Severe Core Damage*, is based on the experiences of more than 70 commercial reactors in the 1970s and sets the chance of such an accident happening at one in 1,000 years of operation, 20 times the original estimate. The NRC cautions, however, that the study did not take into account data since 1979, including improvements made since then.

Other aspects of the radiation problem have difficulties as well. The National Academy of Sciences' Committee on Biological Effects of Ionizing Radiation published a report in 1972 (BEIR Committee I), entitled *The Effects of Population of Exposure to Low Levels of Ionizing Radiation*, which developed an absolute and a relative risk model for estimating effects of low-level radiation exposure. BEIR Committee II and III Reports also have been published and criticized. *See Re* South Carolina Elec. & Gas Co. (Virgil C. Summer Nuclear Station, Unit I), 16 N.R.C. 477, 501 (1982). Controversy has increased in recent years concerning such risk estimates of low-level radiation. These estimates generally are speculative because they are created by extrapolating downward from more harmful, known effects of high-level radiation exposure.

Problems also exist with the public's perception of risk. For example, a pair of scientists have argued that the public does not understand risk because it generally is not expressed in understandable terms. *See generally* Cohen & Lee, *A Catalog of Risks*, 1979 HEALTH PHYSICS 702. These scientists state that risk figures usually are given in terms of annual mortality rates and believe that a better expression would be in terms of days of life expectancy lost. Utilizing this method, they calculated a loss of life expectancy due to reactor accidents of two days (assuming that all power used in the United States was nuclear). This two-day loss ranked 47th in a list of 54 various causes of loss of life expectancy. *Id.* at 720. Similarly, a report by the Office of Technology Assessment cites to research showing that the difficulty of changing public attitudes concerning nuclear energy stems from the tendency of people to overestimate the risk of low frequency events and to associate nuclear technology with

Wind direction and other meteorological conditions that may accompany an accidental release of radioactivity generally are not predictable and danger, although highly unlikely, possibly can exist for hundreds of miles; predetermining the size of the affected areas is impossible. Moreover, evidence that a high foreseeability of danger exists at a particular location with a resulting severe impact on life and property may be difficult to establish, and legal support for land use regulation more difficult to find.[4] This is especially true when controls exist far away from the plant and severely affect land use.

Another difficulty in implementing regulations is the system of land use control in the United States. Control of land is entrenched firmly at the local level of government. Although there have been repeated calls for regional regulation, the federal government and even the states strongly resist the imposition of land use controls. Thus, a nuclear plant may be located in one jurisdiction, but the effects of an accident will be felt in many others that may have their own ideas about where or how to control population growth. Planning in the face of multi-jurisdictional interests is a difficult task. A recent survey of land use conditions around forty-nine of this nation's

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catastrophe because of its perceived connection with nuclear war. N.Y. Times, Feb. 7, 1984, at D23, col. 5 (late ed.).

Meanwhile, the NRC continues to support its recent approach. Two recent Licensing Board decisions have discussed the use of models and risk estimators. In *Re* South Carolina Elec. & Gas Co. (Virgil C. Summer Nuclear Station, Unit 1), 16 N.R.C. 477 (1982), the Board found that health effects had not been under-estimated and that the risk estimators used were in substantial agreement with those published by other highly regarded organizations, such as the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the National Council of Radiation Protection Measurements (NCRP), and the International Commission on Radiological Protection (ICRP). *Id.* at 507. In *Re* Wisconsin Elec. Power Co. (Point Beach Nuclear Plant, Units 1 and 2), 17 N.R.C. 109, 128 (1983), the Licensing Board ruled that the regulations do not require the use of a formal, probabilistic risk analysis.

4. *See* Freilich & Ragsdale, *Timing and Sequential Controls—The Essential Basis for Effective Regional Planning: An Analysis of the New Directions for Land Use Control in the Minneapolis-St. Paul Metropolitan Region*, 58 MINN. L. REV. 1009, 1079-80 (1964) (discussing the "high foreseeability of danger" and "the high degree of impact" criteria as necessary prerequisites to the validation of flood plain zoning). Courts have applied these criteria in cases dealing with flood plain ordinances. *See, e.g.*, Turner v. Del Norte, 24 Cal. App. 3d 311, 314-15, 101 Cal. Rptr. 93, 96 (1972); Vartelas v. Water Resources Comm'n, 146 Conn. 650, 657, 153 A.2d 822, 825 (1959); Sturdy Homes, Inc. v. Township of Redford, 30 Mich. App. 53, 58-59, 186 N.W.2d 43, 46 (1971); Kraiser v. Zoning Hearing Bd., 45 Pa. Commw. 277, 279-89, 406 A.2d 577, 578 (1979).

operating nuclear power plants, conducted by the authors and others,[5] confirms this conclusion.[6] More than sixty percent of the approximately 185 localities responding to the survey administer their own local land use plans.[7] Only thirty-two percent reported county-wide master plans and even fewer responded that regional planning authority exists.

The results of this questionnaire, which are discussed throughout this Article, suggest that the implementation of meaningful land use controls will not be an easy task. Nonetheless, the United States has had substantial experience with the use of these techniques to control growth in other contexts, so there is a place to begin.

II. THE FEDERAL ROLE

Before proceeding to a discussion of land use techniques, it is important to examine the federal government's involvement in the process. Federal activity in this area has not been extensive. The NRC concentrates on the technical aspects of the nuclear plant process or

5. The authors examined various aspects of land use and nuclear plants for a project funded by the Brookhaven National Laboratory. A report, prepared in part by the authors, was given to the Brookhaven National Laboratory in 1983 under the title, *Land Use Control Techniques for Low Population Density.* Although funding was cut before the entire project was completed, a draft of what has been finished is available under the title, BROOKHAVEN NATIONAL LABORATORY, POPULATION AND LAND USE CHANGE IN THE VICINITY OF OPERATING NUCLEAR POWER STATIONS—AN ANTHOLOGY (W. Metz ed. 1983).

6. The Brookhaven National Laboratory (BNL) study included a survey of 204 political entities within 10 miles of the 49 operating nuclear power plants in this country. One hundred eighty-five respondents to the questionnaire provided the first detailed information ever gathered concerning land use and population changes as well as land use control mechanisms employed within these jurisdictions. Some of the principal findings revealed in the survey results are: 1) Respondents attributed little or no importance to the nuclear power plant as a growth catalyst, although some respondents mentioned that the lower taxes often accompanying the operation of a nuclear generating station have stimulated some growth; 2) commercial, industrial, and recreational land uses increased significantly in all regions with an accompanying decrease in agricultural land use; 3) in areas where the population declined, only 6% of the respondents attributed this decline to the existence of the nuclear power station; 4) the lack of land use policies designed to control development near nuclear power plants is evidenced by reports from one-half of the respondents that they were unsure if any land uses are expressly prohibited or regulated within 10 miles of the station, and by reports from one-half of the respondents that no prohibitions or regulations exist that are related specifically to the presence of the plant.

7. The respondents typically were planning officials in communities where nuclear plants were located, as well as planners in adjacent communities.

emergency planning in the event of an accident and pays relatively little attention to the land use issues that may arise.

Despite the importance of protecting the population from potential nuclear plant accidents, there is little in the federal statutes that addresses the question. The Atomic Energy Act emphasizes two principal purposes for the control of nuclear material: to provide for the common defense and security, and to protect the "health and safety of the public."[8] Beyond such noble sentiments, little statutory guidance exists. The statute, however, establishes a licensing procedure that, *inter alia*, provides that the NRC must issue licenses to individuals that have the capability to observe safety standards, and agree to observe them for public health and the protection of life and property.[9] In addition, licensees also must agree to provide data concerning activities under their licenses that may affect public health and safety.[10]

The requirements of the Act vest substantial discretion in the NRC to determine issues related to health and safety. Standards must be determined by rules established by the Commission.[11] The Commission's substantial rule-making authority suggests that Commission regulations and interpretations are the principal source of law on the subject.

The Commission has responded to the statutory mandate by issuing a number of orders, guidelines, and technical documents. The most important of these relates to population safety.[12] The purpose of these regulations is "to describe criteria which guide the Commission in its evaluation of the suitability of proposed sites. . . ."[13] Factors that the NRC considers include: The design and reactor type, population density and land use in the area, and the physical characteristics of the area such as seismology, meteorology, geology, and

8. 42 U.S.C. §§ 2012(d)-(e), 2013(d) (1982).

9. *Id.* § 2133(b)(2).

10. *Id.*

11. *Id. See* Power Reactor Dev. Co. v. International Union of Elec. Workers, 367 U.S. 396, 407-09 (1961); Siegel v. AEC, 400 F.2d 778, 783 (D.C. Cir. 1968).

12. 10 C.F.R. § 100.10 (1984). Factors other than population include: Intended uses of the reactor, including proposed maximum power level and the nature and extent of radioactive materials; satisfaction of engineering design standard criteria; unusual features of the reactor that may have a bearing on the probability of an accident; safety features employed; and physical characteristics of the site, including seismology, meteorology, geology, and hydrology. *Id.*

13. 10 C.F.R. § 100.1(a) (1984).

hydrology.[14]

The NRC has designed these regulations to deal with several types of severe accidents. One is the design basis loss-of-coolant accident (DBA-LOCA), which would not result in exposure of twenty-five rem (thyroid) and five rem (whole body) doses beyond a ten-mile range from a site. A more serious type is a "Class 9" accident, which the NRC considers to be so low in probability as not to require specific additional provisions in the design of a reactor. Class 9 accidents include a total core meltdown and consequent breach of the containment. A "minor" Class 9 accident would involve a melt-through from the core containment and would not likely result in doses above the figures just given. A major accident occurs when the containment vessel is seriously breached and large quantities of radioactive materials are released directly into the atmosphere. This condition typically would result either from overpressurization or a steam explosion. The NRC estimates that for severe Class 9 accidents serious contamination could occur up to about fifty miles from the plant.[15]

A rem is defined as "the quantity of absorbed ionizing radiation that has the same biological effect as one roentgen of high voltage x-ray radiation."[16] The figures given above are known as "Protection Action Guides," which the NRC uses to determine the point at which protective action is warranted following a contaminating event.[17]

For purposes of dealing with population and reactor safety, the NRC requires the applicant for a license to determine three zones: an exclusion zone, a low population zone, and a population center distance.[18] The exclusion zone and the low population zone are determined by reference to radioactivity doses incurred in the event of a major accident involving a substantial meltdown of the core and the "subsequent release of appreciable quantities of fission products."[19]

14. *Id.* § 100.10.

15. *See* U.S. NUCLEAR REGULATORY COMMISSION & U.S. ENVIRONMENTAL PROTECTION AGENCY, PLANNING BASIS FOR THE DEVELOPMENT OF STATE AND LOCAL GOVERNMENT RADIOLOGICAL EMERGENCY RESPONSE PLANS IN SUPPORT OF LIGHT WATER NUCLEAR POWER PLANTS, NUREG-0396, EPA 520/1-78-016 (1978) [hereinafter cited as PLANNING BASIS/EMERGENCY].

16. WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 1919 (1971).

17. *See* PLANNING BASIS/EMERGENCY, *supra* note 15, at 28.

18. 10 C.F.R. § 100.11(a) n.1 (1984).

19. *Id.* § 100.11(a)(1).

In the event of an accident, the calculation of such levels and the subsequent determination of the zone, affect the requirements placed upon the utility as well as planning considerations.

The exclusion zone is the area around the plant that in the event of an accident would produce a whole body dose in excess of twenty-five rem squared—or three hundred rem squared to the thyroid from iodine exposure—for any individual located on the outer boundary for a two-hour period.[20] The purposes of the exclusion zone are to control land use close to the plant, to protect the public in the event of an accident, and to protect the plant from off-site man-made events.[21] Activities unrelated to the operation of the plant may be permitted as long as "no significant hazard to the public health and safety will result."[22] In practice, control of the exclusion zone is shown by outright ownership of mineral and surface rights.[23] Many activities not related to the plant are permitted on a case-by-case basis.[24]

The low population zone involves a limit of twenty-five rem for whole body exposure—or three hundred rem to the thyroid from iodine exposure—during the entire period of passage of the radioactive cloud.[25] The zone typically has an outer boundary of two to three miles and surrounds the exclusion zone.[26] The low population zone does not have to be under the control of the applicant and can contain residents when there is a "reasonable probability that appropriate protective measures could be taken in their behalf in the event of a serious accident."[27] Appropriate protective actions are decided on a case-by-case basis.[28] The NRC staff views the low population zone as an area where evacuation is feasible and as a zone that creates a buffer between the exclusion zone and large population concentra-

20. *Id.* § 100.11(a)(2).

21. *See* U.S. NUCLEAR REGULATORY COMMISSION, OFFICE OF NUCLEAR REACTOR REGULATION, REPORT OF THE SITING POLICY TASK FORCE, NUREG-0625, Aug. 1979, at 16 [hereinafter cited as SPTF].

22. 10 C.F.R. § 100.3 (1984).

23. *See* SPTF, *supra* note 21, at 16. Lack of control judged to be "de minimis," however, is not a problem.

24. *See* SPTF, *supra* note 21, at 16.

25. 10 C.F.R. § 100.11(a)(2) (1984).

26. *Id.* §§ 100.3, 100.11.

27. *Id.* § 100.3(b).

28. *Id.*

tions.[29] Although the regulations and staff practice do not deal with land use controls, this quite obviously is an area where land use controls can have a major impact on plant siting and suitability.

Finally, the population center distance is defined as the "distance from the reactor to the nearest boundary of a densely populated center containing more than about [twenty-five thousand] residents."[30] The applicant is required to determine a population center distance of "at least one and one-third times the distance from the reactor to the outer boundary of the low population zone."[31] The regulations recognize, however, that political boundaries cannot be the sole factor in determining a population center distance. Thus, the regulations require the applicant to consider population distribution and emphasize that, in locations near large metropolitan areas, the population center distance may need to be greater than normal.[32]

These regulations are based on the doctrine of "maximum credible accident." The term maximum credible accident means "a major accident, hypothesized for purposes of site analysis or postulated from considerations of possible accidental events, that would result in potential hazards not exceeded by those from any accident considered credible."[33] The Commission's initial focus was on the philosophy of containment, with reference to the notion of maximum credible accident. While the Commission recognized that more severe accidents were conceivable—for example, Class 9 accidents—such accidents were not typically examined in the site suitability process. Over time, the containment capabilities of reactors increased. By using designs with improved safety factors, the area of the low population zone and exclusion zones have been reduced substantially in some cases. This means that the population center distance requirements also have diminished. One of the major purposes for the population center distance was to provide some protection in the event of a Class 9 accident. As a result of improved safety designs, however, the protection afforded by distance in the event of these accidents has de-

29. *See* SPTF, *supra* note 21, at 17.

30. 10 C.F.R. § 100.3(c) (1984).

31. *Id.* The regulations also contain a brief discussion of multiple reactor facilities. The regulations require that where the possibility of an accident in one reactor can affect the safety of other reactors, it must be assumed that all reactors have simultaneous accidents. *Id.* § 100.11(b).

32. *Id.* § 100.11.

33. *Id.* § 100.11(a) n.1.

creased. Given the uncertainty of the consequences of a Class 9 accident, the protection afforded by these regulations has become even less clear. Moreover, as reliance on technological progress increases, safe operation of the devices becomes even more imperative. When system failures occur, more down time and increased expenses result.[34]

In addition to the definitions of exclusion zone, low population zone, and population center in the NRC's regulations, broad population density guidelines appear in NRC Regulatory Guide 4.7.[35] When considering the appropriateness of a site, Regulatory Guide 4.7 requires that alternative sites be considered if the projected population density exceeds "[five hundred] persons per square mile averaged over any radial distance out to thirty miles" or "the projected population density over the lifetime of the facility exceeds [one thousand] persons per square mile averaged over any radial distance out to thirty miles."[36] Moreover, the Regulatory Guide suggests an exclusion zone of four-tenths of a mile and finds that three miles to the outer boundary of the low population zone usually is adequate.[37]

The Regulatory Guide also indicates that consideration should be given to a transient population when a significant number of nonpermanent residents work in the area of a proposed nuclear plant. This is done by weighting the transient population on the basis of the percentage of time the transients are in the area.[38] These criteria trigger an added depth of review if their limits are exceeded. Several problems, however, exist. First, exceeding the limits merely stimulates additional review. A site that exceeds the population density guidelines still can be approved if no other appropriate sites exist.[39] More importantly, once a nuclear power plant site meets the NRC

34. *See* SPTF, *supra* note 21, at 10-11 (discussion of the development of 10 C.F.R. § 100).

35. *See* N.R.C., REGULATORY GUIDE 4.7, GENERAL SITE SUITABILITY CRITERIA FOR NUCLEAR POWER STATIONS (Revision 1, Nov. 1975) [hereinafter cited as REGULATORY GUIDE 4.7]. This is one of a series of guides designed to enable applicants to meet the requirements of The Energy Reorganization Act of 1974, 42 U.S.C. § 8580 (1976), *enunciated in* 10 C.F.R. § 100 (1984), as well as The National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321-4370 (1982). These documents are of a more technical nature and include further specification.

36. REGULATORY GUIDE 4.7, *supra* note 35, at 4.7-2.

37. *See id.* at 4.7-9.

38. *Id.*

39. *See* SPTF, *supra* note 21, at 19.

population guidelines and is accepted, the regulation assigns no responsibility nor establishes any controls to assure that these densities are not later exceeded.

Finally, the weighting of transients by the percentage of time spent in the area of a proposed nuclear plant means that, while there may well be a considerable population at risk for a significant period of time, the protection extended to them will be reduced because they are not present all the time. As noted in the discussion of the Seabrook litigation,[40] this playing of the odds means that an unreasonable risk of harm to a great many people may exist because the NRC policy favors judging the risk through the notion of the likelihood of being at risk. Instead of favoring this policy, the NRC more properly should make a judgment based on the existence of a significant likelihood of some substantial population being at risk for more than a minimal time and set that as a baseline.

In view of the voluminous regulations issued by other agencies, the brevity of the NRC regulations regarding population density or land use may seem refreshing. One wonders, however, why there is so little regulation of such an important topic. The answer appears to be related to the NRC's desire[41] to retain maximum flexibility in the administration of its current regulations. For example, there have been repeated attempts to determine formulas for weighting populations nearest the plant, but the only guidelines that have been agreed upon are those that establish the maximum densities outlined in Regulatory Guide 4.7.[42]

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40. *See infra* text accompanying notes 93-101.

41. The Atomic Energy Commission (AEC), predecessor to the NRC, apparently shared this perspective. The NRC replaced the AEC as the agency responsible for regulating the safety aspects of nuclear energy, pursuant to the Energy Reorganization Act of 1974, Pub. L. No. 93-438, 88 Stat. 1233 (codified as amended at 42 U.S.C. §§ 5801-5879 (1982)).

42. The debate over issuing density guidelines reveals that the NRC considered various formulas. N. OKRENT, NUCLEAR REACTOR SAFETY, ON THE HISTORY OF THE REGULATORY PROCESS 140, 153, 154, 182, 206-08 (1981). The most completely developed and discussed proposal was a reactor site index developed by the regulatory staff that suggests weighting the population by a distance factor. The NRC rejected this proposal on the ground that the formula had the "curious result" of giving a poor rating to some plants with wide exclusion zone and low population zone radii, while giving a high rating to plants close to densely populated areas. *Id.* at 207. The NRC also issued this proposal as an interim guide in WASH-1308, *Population Distribution Around Nuclear Power Plant Sites* (1973) and discussed in Buchanan, *A.E.C. Working Paper on Population Density Around Nuclear Power Plant Sites*, 16 NUCLEAR SAFETY 1 (1975).

The early history of nuclear power reinforces the conclusion that flexibility in administering regulations is an important factor for the NRC. In 1956, the Acting Chairman of the Atomic Energy Commission (AEC), W.F. Libby, wrote to Senator Bourke Hickenlooper of the Joint Committee on Atomic Energy and explained that, from the viewpoint of safety alone, large reactors should be located in areas of low population density. Nonetheless, he added that the atomic energy industry cannot grow and develop under "conditions of isolation."[43] Indeed, the policy of the Commission has long been to allow applicants to prove that other considerations are more relevant in a given situation.[44] The reason for conducting business in this manner is the result of a compromise between population safety considerations and the "needs of the utility industry."[45] It is difficult for nuclear reactors located far from load centers to be practical sources of power. The result has been an agency decision to permit placement of reactors at a reasonable distance from densely populated areas,[46] and to allow for close-in plants, provided that the plants have special compensatory engineering safeguards.

Another possible explanation of the regulatory silence concerning population density control is that the NRC has not yet viewed excessive population growth around nuclear plants as a serious problem. According to a 1979 study, fewer than ten percent of the approved or proposed sites exceeded federal population density guidelines[47] and all of these locations were approved prior to the issuance of the NRC guidelines. In a separate analysis of population change at forty-three sites, the Brookhaven questionnaire found that within a ten-mile radius low population densities continue to prevail. Twenty-two sites showed densities of from zero to one hundred persons per square

43. *See* Letter from W.F. Libby to Bourke Hickenlooper (Mar. 14, 1956), *reprinted in* OFFICE OF NUCLEAR REGULATION, U.S. NUCLEAR REGULATORY COMMISSION, PB 294946, NUREG-0478; BUNCH, METROPOLITAN SITING—A HISTORICAL PERSPECTIVE 26 (1978) (available from the National Technical Information Service) [hereinafter cited as BUNCH].

44. *See* Letter from H.L. Price, Director of Regulation (AEC) to Arthur C. Perry, Assistant to the Vice-President (Apr. 24, 1963), *reprinted in* BUNCH, *supra* note 43, at 28.

45. *See* BUNCH, *supra* note 43, at 1.

46. *See id.* at 2.

47. *See* OFFICE OF NUCLEAR REGULATOR REGULATION, N.R.C., NUREG-0348, DEMOGRAPHIC STATISTICS PERTAINING TO NUCLEAR POWER REACTOR SITES (1979) [hereinafter cited as NUREG-0348].

mile, eleven had one hundred one to two hundred, seven had two hundred one to four hundred, and three had more than four hundred one.[48] Only five sites had, or may have by the year 1990, populations exceeding five hundred persons per square mile.[49] The changes in population and land use that have occurred so far generally are in line with the goals and plans set forth by local planning units in these areas.[50]

With low densities continuing to be maintained without land use controls, and only a handful of jurisdictions experiencing problems with growth in excess of current NRC guidelines, it appears that there is no need to change current regulations and practices. Density calculations based on a distribution of population averaged over 360 degrees, however, give a false view of the population at risk. Pockets of dense population are neutralized, and it appears that at any point within the radius only a small population is at risk. In fact, however, given an accident on the day when the wind blows in the direction of this dense population, a significant population may be at risk.[51]

Moreover, at least some evidence exists to support a conclusion that population growth is occurring at a rapid rate near nuclear plants. As part of the Brookhaven Study, Donald Krueckeberg and Michael Greenberg analyzed growth near nuclear plants and concluded that during the 1970s, when most nuclear facilities began operation, "a very strong, local growth component was found, unexplained by national, regional, county growth trends, or urbanizations."[52] Of the forty-three power stations for which they had data, they found that 1.75 million people lived within ten miles of a plant in 1970. By 1980, that figure had grown to 2.1 million and they projected that in 1990 the figure would reach more than 2.6 million.[53] This rate of increase is considerably more than the national rate of population increase.[54] Whatever the reasons for this growth, it also is

48. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 39.

49. *See id.* at 29, 39. These five sites are Beaver Valley, Pa. (1980 density was 480/sq. mile); Indian Point, N.Y. (1980 density was 784/sq. mile); Surry, Va. (1980 density was 364/sq. mile); Three Mile Island, Pa. (1980 density was 517/sq. mile); and Turkey Point, Fla. (1980 density was 321/sq. mile).

50. *See id.* at 216.

51. See *infra* note 153 for a list of plants that already have populated communities within the potential control zones.

52. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 25.

53. *See id.* at 28.

54. *See id.*

clear that population increases around nuclear plants are expected to continue.[55]

Although the nuclear industry presently is in the throes of a depression with many plants being discontinued or experiencing significant difficulties,[56] it is not necessarily true that this state of affairs will continue. Changes in the cost of competing fuels, improved technology, or changing public opinion may result in increased numbers of new plant proposals. Many of these plants will need to be located in densely populated areas.[57]

Finally, there is some dispute concerning the NRC distance criteria. Should these criteria change,[58] it is quite possible that plants that are now in compliance with current NRC regulations may be placed in a questionable position. These changes also can affect plants that are under consideration.

In spite of these considerations, the NRC has not revised extensively its regulations on population control for some time. The NRC made some revisions dealing with emergency planning after the accident at Three Mile Island.[59] These changes, however, did not deal with population and growth control. In 1980, the NRC issued a notice of proposed rule-making to consider revision of its regulations. This led to a number of studies, including the Brookhaven study, but to date, the NRC has made no regulatory changes and the issuance of new regulations does not appear on the horizon.[60]

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55. The Brookhaven study contains a substantial discussion as to whether the plants, and the revenues generated from them, cause growth. *See id.* at 90-136. The results presented in the study are inconclusive, with some evidence indicating that the plants play a role in growth and other evidence suggesting that different factors, such as roads and infrastructure, are more significant. Whatever the reason, however, the continuing population increases are a basis for concern.

56. *See supra* note 1.

57. The nuclear industry in other countries is not in the same state of poor health. France, for instance, has an active and efficiently-run industry, which is the major source of electric power in that country. Forty-eight percent of electric energy generated in France comes from nuclear power. *See Pulling the Nuclear Plug*, TIME, Feb. 13, 1984, at 37.

58. For a discussion of one such proposal, see *infra* text accompanying note 231.

59. *See infra* note 104.

60. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 2. There was a major "research fund cut experienced in the Office of Regulatory Research." *Id.*

III. JUDICIAL REVIEW

The courts have shed little light on the limits of the NRC's licensing powers in the area of land use and growth control. Given the amount of discretionary authority possessed by the AEC and NRC,[61] this lack of litigation is not surprising. *Porter County Chapter of the Izaak Walton League of America v. Atomic Energy Commission*,[62] the only case in this area to reach the Supreme Court, arose out of the issuance of an AEC construction permit for a reactor at the Bailly site near Portage, Indiana. The history of the case is especially instructive on the issue of discretionary authority. In 1970, the Northern Indiana Public Service Company (NIPSCO) filed a petition for an operating license for the Bailly facility with the AEC. Numerous groups opposed operating the facility but the AEC's Atomic Safety and Licensing Board (ASLB) held hearings and issued the license.[63] The AEC's Atomic Safety and Licensing Appeal Board (ASLAB) confirmed the decision on appeal.[64] The Court of Appeals for the Seventh Circuit set aside the license on the grounds that the AEC had violated its own regulation requiring a minimum distance between a reactor and the nearest boundary of a densely populated area over twenty-five thousand residents.

The court examined NRC regulations that require "a population center distance of at least one and one-third times the distance from the reactor to the outer boundary of the low population zone," and define population center distance as the distance from the reactor "to the nearest boundary of a densely populated center containing more than about [twenty-five thousand] residents."[65] The appropriate calculations yielded a population center distance of two miles in the Bailly situation, as well as an exclusion area of .1168 mile and a low population zone of one and one-half miles.[66] The evidence was uncontroverted that the population in the area of the plant would grow to more than twenty-five thousand inhabitants during the early years of the life of the reactor. Although the corporate boundary of Portage was only about a mile from the reactor, the ASLB and ASLAB

61. The NRC is authorized to delegate its licensing authority for nuclear reactors to its Office of Nuclear Reaction Regulation. 42 U.S.C. § 5843 (1982).

62. 515 F.2d 513 (7th Cir. 1975), *rev'd*, 423 U.S. 12 (1975).

63. Northern Ind. Pub. Servs. Co., 7 A.E.C. 557 (1974).

64. Northern Ind. Pub. Servs. Co., 8 A.E.C. 244 (1974).

65. 10 C.F.R. §§ 100.11(a)(3), 100.11(c) (1984).

66. 515 F.2d at 519-20.

chose to ignore that boundary and based their judgment on maps showing that the heavily populated section of Portage was further than the required two miles away from the reactor.[67] Moreover, the court noted that eight nuclear power plants already existed within seventy-five miles of downtown Chicago, with six more in the planning stage.[68]

Finally, the court noted the AEC's failure to consider testimony of the harm that the plant would cause to the nearby Indiana Dunes National Lakeshore.[69] The AEC's guidelines required it to consult with other agencies having expertise concerning scenic or recreational lands devoted to public use.[70] Their consultation with the National Park Service of the Department of the Interior resulted in a recommendation that the plant not be built.[71]

After examining the area within the third buffer zone and beyond, the court then considered the exclusion zone and the low population zone. The court found that the AEC's Draft Working Paper[72] and the Draft Regulatory Guide 4.7 both led to the conclusion that the exclusion zone should be four-tenths of a mile, although the AEC required only one-tenth of a mile in this case.[73] Additionally, the court found that the AEC customarily required two miles for the low population zone, and preferred three, but in this case the AEC required only one and one-half miles.[74] The court also noted that to

67. *Id.* at 520-21. The reactor also was less than two miles from the boundaries of Dune Acres, Porter, and Burns Harbor, which have a combined population greater than 25,000. Furthermore, the master plan for the Indiana Dunes National Lakeshore provided for 87,000 visitors per day, a large number of whom could come within the two-mile zone. *Id.* at 522.

68. *Id.* at 523.

69. Most of the potential damage was of a nonradioactive nature and included: Lowering the groundwater table during construction; creating an acrid mist from the water vapor plume; polluting Lake Michigan with undesirable waste materials, including radioactive waste; polluting the National Lakeshore from ash ponds, killing fish in the lake; and a visual intrusion from the cooling tower. *Id.* at 527.

70. *See* N.R.C., DRAFT REGULATORY GUIDE 4.7, GENERAL SITE SUITABILITY CRITERIA FOR NUCLEAR POWER STATIONS (Sept. 1974).

71. The response was written after preparing a draft environmental impact statement. 515 F.2d at 526.

72. *Id.* at 528 (citing A.E.C. REGULATORY STAFF WORKING PAPER, POPULATION DISTRIBUTION AROUND NUCLEAR POWER PLANT SITES (Apr. 17, 1973) (released for publication Apr. 9, 1974)).

73. 515 F.2d at 528-29.

74. *Id.* at 529.

apply the four-tenths mile exclusion zone would place the exclusion zone into the National Lakeshore and create a potential source of interference with the jurisdiction of the Secretary of the Interior.[75]

The court, however, based its decision solely on the population center distance issue, namely that the plant should have been located at least two miles from the political boundary of Portage.[76] The court used other evidence to support the conclusion that the AEC was not justified in deviating from its regulations. The court felt that although there may be circumstances in which the AEC can deviate, they were not present in this case.[77] In conducting this analysis, the court indicated its willingness to examine closely the exercise of the AEC's discretionary authority.[78]

Judge Tone, dissenting, noted that the court usurped the agency's power to make administrative decisions within its area of expertise.[79] He argued that the case rested on the meaning of the word "boundary" in the language, "the nearest boundary of densely populated center containing more than about [twenty-five thousand] residents."[80] Judge Tone argued that the discretion to interpret AEC regulations rested with the agency and the decision to look at the boundary of dense population was reasonable. Indeed, he noted, that the majority cited with approval a previous AEC decision in which the AEC recognized under certain circumstances that the boundary of the high population area would extend beyond the political boundary.[81] The majority distinguished that situation as one provid-

75. *Id.*

76. *Id.* at 521-22.

77. *Id.*

78. *Id.* at 522. The court found compelling evidence that the plant would be a boon to employment and the economy of the area. This led the court to the exaggerated conclusion that:

> perhaps the AEC in a completely well-intentioned and good faith effort to accomplish ends which everyone seeks to accomplish has tended to become somewhat lax in assuring that the means employed thereby function in as safe a manner as possible so that one day we do not come to regret the proliferation of nuclear power.

Id. This statement tends to show that the court had gone beyond the traditional scope of review of agency decisions. It is one thing to argue that an agency failed to follow its own regulation. It is another to argue that it has become derelict in its duty.

79. *Id.* at 530-31 (Tone, J., dissenting).

80. *Id.* at 531 (Tone, J., dissenting) (construing 10 C.F.R. § 100.11(3) (1984)).

81. *Id.* at 531 (Tone, J., dissenting). *See also Re* Southern Cal. Edison Co. (San Onofre Station), 8 A.E.C. 957, 960 n.7 (1974).

ing additional protection, but stated that "there is neither reason nor sound safety policy to cut down the boundaries . . . and make some hopeless attempt to construct imaginary boundaries."[82] For Judge Tone, however, no difference existed between the two situations. In both instances the agency interpreted "boundary" as the line of dense population, not as a political boundary. He noted that it was within the agency's prerogative to make that determination.[83] Judge Tone concluded that the regulation refers to population terms but fails to mention political boundaries.[84]

The AEC appealed and the United States Supreme Court, in a unanimous per curiam opinion, reversed and remanded the case.[85] The Supreme Court held that the court of appeals erred in rejecting the agency's interpretation of its own regulations. The Court found that the agency had applied its population regulation with consistency[86] because the regulation, as it existed at that time, required consideration of population distribution, but did not indicate any preference for following political boundaries. Therefore, the acceptable distance of the proposed plant to the dense population area was four and one-half miles. Indeed, the Court noted that political boundaries could be drawn for reasons not relevant to population safety.[87]

During the course of the *Porter County* litigation, the AEC revised its regulation. When the case arose, the regulation required that the AEC give "due consideration . . . to the population distribution within the population center."[88] Subsequently, the NRC amended the regulation to read that the agency shall determine "the boundary of the population center . . . upon consideration of population distribution. Political boundaries are not controlling in the application of this guide. . . ."[89] This constituted an ex post facto attempt by the AEC to make explicit its interpretation of its own regulations.

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82. 515 F.2d at 521.

83. *Id.* at 531 (Tone, J., dissenting) (construing 10 C.F.R. § 100.3(c) (1984)).

84. *Id.* (Tone, J., dissenting).

85. Northern Pub. Serv. Co. v. Izaak Walton League, 423 U.S. 12 (1975).

86. *Id.* at 14 n.3. The Court cited *Re* Southern Cal. Edison Co. (San Onofre Station), 8 A.E.C. 957, 960 n.7 (1974); *Re* Consumers Power Co., 5 A.E.C. 214, 218 (1972); *Re* Consolidated Edison Co., 5 A.E.C. 43, 45 (1972).

87. 423 U.S. at 14-15.

88. *See* 27 Fed. Reg. 3,509 (1962) *as amended* at 31 Fed. Reg. 4,670 (1966).

89. 40 Fed. Reg. 26,527 (1975) (codified at 10 C.F.R. § 100.11(a)(3) (1984)).

Justice Douglas' concurrence raised the issue that the AEC was in danger of overstepping its bounds by making ex post facto changes to its regulations.[90] While Justice Douglas' argument is not necessarily germane to this case because the Court did not rely on the new wording, his opinion raised vital questions in the context of the AEC's continued unwillingness to provide more detailed regulations for what is clearly a critical area of social concern. Frequently, the NRC relies on regulations promulgated many years ago, and to anyone not familiar with nuclear power, it is difficult to determine what methodologies the NRC uses and why. Because courts are rightfully reluctant to overturn administrative decisions involving methodological decisions, Justice Douglas justifiably was concerned about the difficulty of pinning down the agency.

When the court of appeals decided the case on remand, it deferred to the AEC's judgment.[91] The court agreed with the AEC that the boundaries of the low population zone are merely one factor that the AEC must consider and that the AEC staff had done an adequate job of determining the risks of an accident. The court concluded that the AEC must decide whether "the possibility of such an accident is sufficiently real that reactors should be located only in unpopulated areas."[92]

Another case also raised important related issues, although it did not go to the Supreme Court. In *New England Coalition on Nuclear Pollution v. United States Nuclear Regulatory Commission*,[93] the Court of Appeals for the First Circuit also upheld the NRC in a land use case that involved the question of population center distance. In this case, the NRC determined that the low population zone was one and one-half miles in connection with the facility at Seabrook, New Hampshire. Based on the regulation that the population center distance be at least one and one-third times the low population zone, the NRC required a population center distance of 1.95 miles.

Several towns and the Hampton Seabrook beach were located nearby. ASLB determined, however, that because Portsmouth, the largest population center, was twelve miles away, the population

90. 423 U.S. at 15-18 (Douglas, J., concurring).

91. 533 F.2d 1011, 1015 (7th Cir. 1976) ("In view of the Supreme Court's decision, little is left of petitioner's argument that the order is not in compliance with AEC's siting regulations. . . .").

92. *Id.* at 1018.

93. 582 F.2d 87 (1st Cir. 1978).

center distance requirement was satisfied. Before ASLAB, the plaintiffs argued that several towns located near the plant contained a population greater than twenty-five thousand—the required amount for determining the population center distance. Moreover, they argued that the beach had a large summer population that the NRC also should consider as a single population center.[94]

ASLAB rejected the argument as it pertained to the towns. It held that because the population was spread out in a semicircle, it was not at risk to the required extent. Whatever the conditions, the wind could not blow radioactive particles over the whole population at one time. Even if the wind shifted, each area would receive a lower dose of radiation than the low population zone was established to protect against. This reasoning is similar to that of the weighting of transients by time spent process.[95]

As to Hampton Seabrook beach, however, ASLAB drew a contrary conclusion. Because the concentrated beach population could exceed twenty-five thousand persons during the summer—the estimates were as high as thirty-seven thousand by 1980—ASLAB concluded that the beach was the nearest population center. The beach was 1.67 miles from the reactor. Consequently, the low population zone had to be 1.25 miles from the reactor, rather than 1.5 miles—the reactor had to meet the radiation tolerance level within 1.25 miles. The Seabrook plant was designed to meet the more stringent requirement.

Based on a standard of reasonableness and consistency of application, the court upheld ASLAB's conclusion. The court concluded that the NRC was entrusted with seeing that safety considerations were met. The court's only role was to determine if the NRC performed this task in accordance with the law.[96]

The Seabrook case, the only NRC case on population control and growth besides *Porter County* to reach the federal courts,[97] indicates that the NRC is willing to interpret its regulations in a flexible fashion to assure that safety considerations are taken into account, pro-

94. *Id.* at 91. The towns of Seabrook, Hampton Falls, and Hampton were expected to have a combined population of more than 25,000 by 1985. The case does not give the distances of the towns from the plant, although presumably they were closer than 12 miles.

95. *See supra* text accompanying notes 38-39.

96. 582 F.2d at 92.

97. For another case arising from the *Seabrook* proposal, but dealing with evacuation, see Seacoast Anti-Pollution League v. NRC, 690 F.2d 1025 (D.C. Cir. 1982).

vided that there is a fairly compact group of people at risk. At the same time, the NRC appears reluctant to extend protection afforded by distance to a compact group of fewer than twenty-five thousand people. One can argue that where a considerable population is at risk, the NRC should consider the likelihood that some part of that population will be exposed to radiation resulting from an accident. A strong argument for this proposition is that, in determining the emergency population zone, the NRC examines the issue from the viewpoint of average density over an area. Yet, when land use and population are at issue, the NRC switches to a concentration factor.[98] If the wind changes direction after an accident, no residents in the towns are likely to receive a harmful dose of radiation. If the wind does not change direction, however, a considerable number of people may be exposed to unnecessary radiation.

Another land use issue is the extent of a nuclear plant's impact on the socio-economic character of an area, a cognate matter that has not always been considered as sharply as it should. In the Seabrook case, however, both ASLB and ASLAB raised and considered the issue. ASLB considered the possibility of alternate sites and rejected a number of sites in northern New Hampshire that were disadvantageous because of the socio-economic impacts of locating piants in areas of low population.[99]

ASLAB rejected ASLB's conclusion on the ground that ASLB did not establish whether there would be harmful socio-economic consequences. ASLB cannot reject a site on the basis of an *a priori* idea of socio-economic impacts. As ASLAB noted, the presence of a plant can give a boost to the local economy. ASLAB reiterated that it would consider any site that met Commission regulations on its merits, and that the NRC staff and ASLB could not use additional considerations without substantiation in each instance.[100]

The question of socio-economic impact is one of great importance. Nonetheless, it is a question that receives less attention than more typical land use considerations for population safety. The results from the Brookhaven study suggest that significant changes in economic conditions may exist in communities near nuclear plants. While the study did not pinpoint the causes of change in a definitive manner, it demonstrated that areas near nuclear plants have grown

98. 10 C.F.R. § 100.11 (1984).

99. *Re* Public Serv. Co. of N.H., 6 N.R.C. 134, 138-39 (1977).

100. *Re* Public Serv. Co. of N.H., 7 N.R.C. 477, 508-09 (1978).

faster than national, regional, or county population trends.[101] This is an additional reason to consider this question further.

IV. THE NRC RESPONSE

Recently, the NRC has focused on evacuation procedures. This is a result of the Three Mile Island accident in 1979. The accident led to a number of investigations and reports, which found that the evacuation procedures around Three Mile Island were deficient.[102] In particular, although there was a low population zone of two miles, studies expressed concern about the need for evacuation of an area of up to ten miles. The studies recommended that the NRC adopt emergency evacuation procedures.[103]

The NRC responded by promulgating new regulations to require emergency planning. The regulations adopted an emergency planning zone and required applicants to submit evacuation time estimates. The NRC required "reasonable assurance" of a range of adequate protective measures, both on site and off, to be taken during an emergency.[104]

The NRC left the boundaries of the emergency planning zone variable. Pursuant to regulation, the exact size and configuration of the emergency planning zone surrounding a particular nuclear reactor must be determined in relation to local emergency response needs and capabilities as they are affected by conditions such as demography, land characteristics, topography, access routes, and jurisdictional boundaries.[105] Furthermore, state and local governments have the responsibility to set Emergency Planning Zones around nuclear power plants.[106] The zones may be geographically larger than those specified in the Commission's rules, but in these cases, the state must enforce its own standards when they exceed those required by federal

101. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 17. The report speculates that some of the changes could have been caused by local infrastructural development and other industrial growth, but that "it is reasonable to consider that the plants may have induced this growth." *Id.*

102. *See* 1 NUCLEAR REGULATORY COMMISSION SPECIAL INQUIRY GROUP, THREE MILE ISLAND: A REPORT TO THE COMMISSIONERS AND TO THE PUBLIC (Rogovin Report) P.A. at 197-210; REPORT OF THE PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND P.A. at 211-15 (Oct. 1979).

103. *Id.*

104. 10 C.F.R. §§ 50.34(b)(6)(v), 50.47(a)(1), 50.47(b)(10) (1984).

105. *Id.* § 50.47(c)(2).

106. *Id.* § 50.47(a)(2).

regulations.[107] It should be noted that this does not mandate evacuation plans, although such plans have been required in many cases as part of emergency preparedness.[108] In addition, the Commission made the requirements for emergency preparedness retroactive. The regulations require plants under construction to prepare new emergency plans before being given an operating license and plants with construction licenses had to prepare emergency plans by April 1981.[109]

Finally, the NRC retains the discretion to postpone decisions on

107. *See Re* Pacific Gas & Elec. Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), 16 N.R.C. 756 (1982).

108. Issues related to the emergency response plan have been developed in a number of recent NRC decisions. *See generally Re* Pennsylvania Power and Light Co. and *Re* Allegheny Elec. Cooperative, Inc. (Susquehanna Steam Electric Station, Units 1 and 2), 15 N.R.C. 771 (1982) (school plans; public notification systems; evacuation; training programs); *Re* Consumers Power Co. (Big Rock Point Plant), 15 N.R.C. 874 (1982) (early evacuation of children and pregnant women); *Re* Cincinnati Gas & Elec. Co. (Wm. H. Zimmer Nuclear Power Station, Unit 1), 15 N.R.C. 1549 (1982) (plan is not inadequate solely because preferable locations of relocation centers exist; any deficiencies in public notification system must be corrected prior to operation); *Re* South Carolina Elec. & Gas Co. (Virgil C. Summer Nuclear Station, Unit 1), 16 N.R.C. 477 (1982) (shape of emergency planning zone; public education; crop and livestock contamination); *Re* Consumer's Power Co. (Big Rock Point Plant), 16 N.R.C. 540 (1982) (transients; emergency planning pamphlet); *Re* Louisiana Power & Light Co. (Waterford Steam Electric Station, Unit 3), 16 N.R.C. 730 (1982) (preemergency public information program); *Re* Pacific Gas & Elec. Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), 16 N.R.C. 756 (1982) (initial siren system, plus other methods to warn all people within the emergency planning zone who may not have received the initial notification by siren); *Re* Metropolitan Edison Co. (Three Mile Island Nuclear Station, Unit 1), 16 N.R.C. 1265 (1982) (notification of state and local government response agencies; yearly dissemination of information to the public); *Re* Metropolitan Edison Co. (Three Mile Island Nuclear Station, Unit 1), 16 N.R.C. 1290 (1982) (protection of emergency workers; both on-site and off-site facilities for the management of accidents); *Re* The Detroit Edison Co. (Enrico Fermi Atomic Power Plant, Unit 2), 16 N.R.C. 1408 (1982) (using a road, which is the sole evacuation route, creates a negligible increase in total risk to residents and does not justify building a new road); *Re* South Cal. Edison Co. (San Onofre Nuclear Generating Station, Units 2 and 3), 17 N.R.C. 346 (1983) (protective action for the public in the plume exposure pathway of emergency planning zone should include means for protecting those whose mobility may be impaired, such as the elderly, handicapped, and school children; training program for those assisting in radiological emergency); *Re* Louisiana Power & Light Co. (Waterford Steam Electric Station, Unit 3), 17 N.R.C. 1076 (1983) (training program for off-site emergency workers; emergency preparedness exercises); *Re* Public Serv. Co. of N.H. (Seabrook Station, Units 1 and 2), 17 N.R.C. 1170 (1983) (evacuation time estimates).

109. 10 C.F.R. §§ 50.54(5)(1) & (2) (1984). For an example of a plant that was under construction, see NRDC v. NRC, 695 F.2d 623 (D.C. Cir. 1982).

the safety of evacuation plans until the operating permit stage, even though evidence of inadequacy is available during construction.[110] The NRC retains this discretion, even though it is more difficult to make a reasoned decision after a plant has been constructed. Nonetheless, while the inertia caused by the construction of a plant may be great, "a court may not transform a projected tendency to inertia into a presumption of infidelity to duty."[111] While the NRC acts within the law here, this flexibility adds to the uncertainty surrounding the potential adequacy of evacuation plans.

There are required procedures, however, in this process that provide data that can be used to establish NRC's land use regulations. The analysis must identify the "degree of seriousness and potential scope of radiological consequences of emergency situations within and outside the site boundary. . . ."[112] The NRC has refined this analysis to apply to two exposure pathways. First is the plume exposure pathway, which involves whole body external exposure from the plume and the deposited material, as well as inhalation exposure.[113] Additionally, there is the ingestion exposure pathway, involving ingestion of contaminated water or foods.[114] The NRC has chosen as the emergency planning zone a ten-mile radius for the plume exposure pathway and a fifty-mile radius for the ingestion pathway, based upon Protective Action Guides that warrant protective actions for the public.[115] These guides do not necessarily represent, in the NRC's words, acceptable exposure, nor are they necessarily the minimum exposure levels required to trigger emergency procedures. Moreover, they are approximations only and may change to reflect the particular topographical and land characteristics surrounding a plant. The emergency planning zone is not related directly to the purpose for the

110. Seacoast Anti-Pollution League v. NRC, 690 F.2d 1025, 1031 (D.C. Cir. 1982) (citing Power Reactor Dev. Co. v. International Union of Elec., Radio and Mach. Workers, 367 U.S. 396, 406 (1961)).

111. Porter County Chapter of the Izaak Walton League v. NRC, 606 F.2d 1363, 1370 (D.C. Cir. 1979).

112. 10 C.F.R. § 50, app. E (1984).

113. *Id.* § 54(s)(1).

114. The 50-mile ingestion exposure pathway is the "zone in which the majority of the exposure would result from ingestion of contaminated water or foods." SCENARIO DEVELOPMENT FOR EMERGENCY PREPAREDNESS EXERCISES, § 6, at 6.0-8 (1984).

115. *See* PLANNING BASIS/EMERGENCY, *supra* note 15, at 3. *Cf.* 10 C.F.R. §§ 50.33, 50.54(s)(1) (1984).

low population zone requirements[116] because the emergency protection zone is designed to deal with evacuation rather than land use restrictions.[117]

It has become apparent that the NRC emergency planning requirements are troublesome. Recently, a number of plants have had difficulties over evacuation planning and, in several instances, the planning requirements have threatened the future of the proposed plant. The complexities of the situation are difficult to evaluate. For example, at the Limerick nuclear plant near Pottstown, Pennsylvania, reports suggest that serious difficulties with evacuation measures may prevent the opening of the plant. A recent article[118] notes that the emergency planning zone includes forty-three municipalities and thirteen school districts in parts of four counties. Included in that zone are three hospitals, nine nursing homes, a center for the mentally retarded, and a prison. The evacuation measures will require the deployment of hundreds of volunteers and substantial amounts of communications equipment, along with buses and ambulances. According to the article, planners are skeptical as to whether the resources can be gathered quickly enough for outlying areas. In addition, the siren system lacks emergency power.

It is, of course, not possible to evaluate the emergency planning issues inherent in the location of plants in this Article. Nevertheless, the problems that have arisen because of the complexity of emergency plans, not to mention the fact that we do not know if the plans will work until an emergency occurs, mean that at best, there is a potential problem in relying on such plans. This leaves states and communities with the question of the permissible boundaries of state and local action in these circumstances. To consider this question, it is necessary to examine the changing law of preemption in this area.

V. THE PREEMPTION ISSUE

Federal court decisions reviewing NRC actions in effect leave court review of agency nuclear licensing decisions no more stringent than decisions involving matters that sometimes are considered to be

116. *See supra* text accompanying notes 25-29.

117. Further guidance was provided by the NRC in U.S. NUCLEAR REGULATORY COMMISSION & FEDERAL EMERGENCY MANAGEMENT AGENCY, CRITERIA FOR PREPARATION AND EVALUATION OF RADIOLOGICAL EMERGENCY RESPONSE PLANS AND NUCLEAR POWER PLANTS, NUREG-0654 (1980).

118. The Philadelphia Inquirer, Apr. 22, 1984, at A1, A16.

of less concern to the public health and safety. As a result, state and local governments have attempted to influence the development and siting of nuclear power plants.

State and local involvement in nuclear power matters raises preemption problems. The Atomic Energy Act of 1954 (AEA),[119] which launched the commercial nuclear power industry, vested control of nuclear power development in the federal government. In 1959, Congress added section 274[120] to the AEA in order to clarify the roles of federal and state governments. While it provides that the Atomic Energy Commission maintains control over hazardous materials and the construction and operation of nuclear power plants, section 274(k) also protects "the authority of any state or local agency to regulate activities for purposes other than protection against radiation hazards."[121]

The leading case on federal preemption of the radiation safety field is *Northern States Power Co. v. Minnesota.*[122] Minnesota's standards for limiting the discharge of radioactive materials from power plants were more stringent than those promulgated by the AEC. The Court of Appeals for the Eighth Circuit found the standards unconstitutional, holding that the AEA established federal preemption of the authority to regulate nuclear power plant construction and operation, "which necessarily includes regulation of the levels of radioactive effluents discharged from the plant."[123] The Supreme Court affirmed the Eighth Circuit's holding in a memorandum opinion, but did not address directly the preemption issue until over a decade had passed.[124]

The Supreme Court clarified the respective roles of federal and state government regarding regulations affecting nuclear power plant development and operation in *Pacific Gas and Electric Co. v. State*

119. 42 U.S.C. §§ 2011-2296 (1982).

120. *Id.* § 2021(k).

121. *Id.*

122. 447 F.2d 1143, 1150 (8th Cir. 1971), *aff'd mem.*, 405 U.S. 1035 (1972).

123. *Id.* at 1154.

124. 405 U.S. 1035 (1972). *But see* Train v. Colorado Pub. Interest Research Group, 426 U.S. 1, 15-16 (1975) (Federal Water Pollution Control Act did not lessen federal control of nuclear materials; discussing with approval the *Northern States* analysis); Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 542-49 (1978) (states determine power requirements; the NRC is responsible for safety concerns).

Energy Resources Conservation and Development Commission.[125] The *Pacific Gas* Court held that the AEA does not preempt the states' traditional utility regulatory role in matters concerning "need, reliability, cost and related concerns."[126] The Court, consistent with *Northern States*, held that the AEA preempts state regulation of nuclear hazards.[127] *Pacific Gas* involved a challenge to the constitutionality of a California statute that imposes a moratorium on constructing new nuclear power plants until the federal government implements a means for permanent nuclear waste disposal.[128]

Although the California statute had safety-motivated predecessors, California successfully argued that the statute developed out of concern about the financial losses and power disruptions that may result from plant shutdowns when temporary waste storage space is filled. Having determined that Congress left to the states the power to determine the economic wisdom of building a nuclear plant, the Court found that California's regulation was properly motivated by non-safety concerns.[129] It is clear from the majority's opinion that states may neither prohibit construction of nuclear plants for safety-related reasons, nor regulate the construction and operation of nuclear plants.

Justice Blackmun, in a concurring opinion joined by Justice Stevens, characterized the preempted field as regulation of the method of plant construction and operation.[130] According to Justice Blackmun, a state may prohibit the construction of nuclear plants for safety reasons; if, however, a state decides to permit nuclear plant construction, only the federal government may regulate the details of plant construction and operation.[131]

One year after determining that the AEA does not preempt the

125. 461 U.S. 190 (1983). For a discussion of *Pacific Gas*, see Comment, *State Power and Preemption in the Nuclear Energy Field:* Pacific Gas and Electric Co. v. State Energy Resources Conservation & Development Commission, 26 WASH. U.J. URB. & CONTEMP. L. 139 (1984).

126. 461 U.S. at 212-13.

127. 461 U.S. at 216.

128. The Warren-Alquist State Energy Resources Conservation and Development Act, CAL. PUB. RES. CODE §§ 25000-25986 (Deering 1974 & Supp. 1980). The moratorium provision was added in 1976. *Id.* § 25524.2.

129. Pacific Legal Found. v. State Energy Resources Conservation & Dev. Comm'n, 659 F.2d 903, 925 (9th Cir. 1981), *aff'd*, 461 U.S. 190, 216 (1983).

130. 461 U.S. at 226-29 (Blackmun, J., concurring).

131. 461 U.S. at 226 (Blackmun, J., concurring).

states' traditional role as utility regulators, the Court held that the Act also does not preempt the availability of state common law tort remedies, even when applied in cases involving injury from radiation exposure.[132] In *Silkwood v. Kerr-McGee Corp.*,[133] a five-member majority of the Court upheld an award of both compensatory and punitive damages to the administrator of the estate of Karen Silkwood in a suit arising out of Ms. Silkwood's radiation contamination at the Kerr-McGee plant in Oklahoma.

Kerr-McGee argued that the award of punitive damages amounted to a form of regulation and, therefore, was preempted by the AEA.[134] The Court, however, concluded that Congress intended not to interfere with state tort law, even in the case of punitive damages.[135] Four members of the Court were unconvinced that punitive damages were available in cases involving radiation injury. The dissenting Justices, in opinions written by Justice Blackmun and by Justice Powell, argued respectively that punitive damages amounted to safety regulation[136] and that relevant legislative history failed to reveal congressional intent to permit all tort remedies.[137]

Silkwood and *Pacific Gas* do not speak specifically to the issue of preemption in a land use context. They do show, however, that a majority of the Justices are willing to uphold state laws affecting the nuclear industry when the state is acting in a traditional role. Land use regulation, traditionally a local function, arguably is entitled to the same type of treatment given by the Court to utility regulation and to the provision of tort remedies.[138]

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132. Silkwood v. Kerr-McGee Corp., 104 S. Ct. 615, 623-26 (1984). *See infra* notes 133-38 and accompanying text.

133. 104 S. Ct. 615, 626 (1984).

134. *Id.* at 619-20.

135. *Id.* at 623-25.

136. *Id.* at 627-34.

137. *Id.* at 634-40.

138. Another traditionally local function that appears to survive preemption by the AEA is regulation of public nuisances. The Court of Appeals for the Seventh Circuit has held that a city may order abatement of nonradiological hazards present at a plant that once processed radioactive materials. Illinois v. Kerr-McGee Chemical Corp., 677 F.2d 571, 582 (7th Cir. 1982), *cert. denied*, 103 S. Ct. 469 (1982). The court held that the AEA did not preempt local regulation of off-site dumping so long as there was no local regulation of radiological hazards over which the NRC had jurisdiction. *Id.* at 582-84.

In a case arising out of the Three Mile Island accident, the Court of Appeals for the Third Circuit ruled that, while the attorney general may bring abatement actions,

It is still unclear how important the *Pacific Gas* Court's discussion of state motive will be in future cases, especially those involving mixed-motive regulation.[139] Land use decisions, even given the presence of radiation safety concerns, involve intense consideration of economic and social concerns. Such decisions arguably could pass muster under *Pacific Gas* and *Silkwood.*

Pacific Gas probably permits local governments at least as much freedom to regulate in traditional areas as it permits the states. The state regulation involved in *Pacific Gas* directly confronted one aspect of the nuclear power cycle—adequacy and sufficiency of disposal facilities. Land use decisions, even when motivated by safety concerns, will not deal directly with the nuclear process, but rather with control of population growth, and, therefore, may satisfy the *Pacific Gas* standard. At this point the issue is inconclusive. Thus, in our analysis we assume that the states and local governments cannot consider safety questions in their regulations. This Article outlines a framework within which these decisions can be made with the blessings of the NRC, or at least in situations that cannot be interpreted as regulation of the process.

VI. THE NRC AND PLANNING

While it is clear that the federal government neither has accepted nor assigned the responsibility for population density control, it is equally clear that neither utility companies nor federal, state, or local jurisdictions have voluntarily accepted responsibility for maintaining low density populations around nuclear power plants. In fact, nowhere in its regulations has the federal government acknowledged that land use controls may be an effective tool to insure the safety of residents around a plant. Engineered safety features and emergency planning can be supplemented effectively with appropriate land use controls. Later in this Article, the advantages of some of the existing

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private litigants, including states and municipalities, may not obtain injunctive relief under the AEA. Pennsylvania v. General Utils. Corp., 710 F.2d 117, 119-20 (3d Cir. 1983). The court remanded the case to determine whether the plaintiffs suffered any damages that are compensable under state tort law. *Id.* at 121-24.

139. At least one commentator has noted that *Pacific Gas* created a loophole by which states can regulate matters touching on nuclear safety concerns, by using economic motives as a pretext for safety regulation. *See* Comment, *supra* note 125, at 154.

controls that planners can use to accomplish this task will be discussed.

Several huge obstacles lie in the path of local regulation of land around nuclear power plants. As mentioned previously, multiple jurisdictions often lie within the area surrounding a nuclear power plant site and planning, in the face of these interests, is a difficult task. This planning problem has been demonstrated convincingly in the area around the Indian Point reactors in New York State, where several jurisdictions refused to participate in the development and implementation of a federally-mandated emergency evacuation plan for these reactor sites.[140]

Another problem that can arise, one closely related to the above issue, is that local communities may refuse to implement land use controls designed to limit growth in an area without specific orders from the federal government. Population, industrial, and commercial growth have been actively encouraged in local areas around nuclear power plants, and attempts to restrict growth may face stiff opposition.[141] Given the federal government's position that land use control is a local and not a federal problem, and the repeated reinforcement of this stance by the federal courts,[142] it seems highly unlikely that federal intervention will be forthcoming.

A third obstacle to implementation of local land use controls is the lack of consistent standards and guidelines from the NRC addressing the issues of how large an area should be controlled and what population density guidelines should be followed within the area. Should the area be as small as the low population zone, as large as the thirty-mile radius, or some intermediate range such as the emergency planning zone? Should the density be averaged over the entire radius or should populations closest to the reactor site boundaries be maintained at a lower density?[143]

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140. N.Y. Times, May 8, 1983, at A24 (late ed.). The federal government representative responded that the states can require participation, but New York Governor Cuomo refused to cooperate. *Id.*

141. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 216. According to the Brookhaven survey, county governments were cited by 55% of the respondents and local governments were cited by 63% as actively encouraging growth.

142. *See generally* Construction Indus. Ass'n v. City of Petaluma, 522 F.2d 897 (9th Cir. 1975), *cert. denied*, 424 U.S. 934 (1976); Boraas v. Village of Belle Terre, 476 F.2d 806 (2d Cir. 1973), *rev'd*, 416 U.S. 1 (1974); Steel Hill Dev., Inc. v. Town of Sanbornton, 469 F.2d 956 (1st Cir. 1972).

143. *See supra* text accompanying notes 35-36 for discussion of planning radii.

A fourth obstacle involves the designation of an administrative agency. Even if local jurisdictions can be compelled, or at least encouraged, to promulgate low density land use regulations, how would compliance with the regulations be monitored? It is common practice for local authorities to alter adopted land use plans, especially plans formulated under previous administrations. With multiple jurisdictions to monitor, often crossing state boundaries, assigning responsibility for monitoring compliance will be difficult.

Solving these problems will require a concerted effort by all interested parties, but one issue in particular can be addressed and resolved by the NRC. This issue is the lack of a standard on which to base local land use controls. The NRC created the existing population guidelines to assure that in the event of an accidental release of radioactivity, the population at risk is relatively small and emergency measures within a given area can be taken to assure the safety of this population. For local planners, the preliminary question is: How large an area is sufficient to accomplish this goal?

The NRC has given mixed signals to planners regarding the appropriate safety distance. For example, the low population zone has been described as an area where members of the public can be evacuated or otherwise protected in a timely fashion.[144] Yet, this zone, which typically ranges from .66 to 6.75 miles at active reactor sites within ten miles of a metropolitan center,[145] has not been designated as one of the emergency planning zones for utility, local, and state emergency planners. Instead, the plume exposure pathway emergency planning zone, that area within which plans should be made to shelter or evacuate the general public, is defined as an area of about ten miles in radius.[146]

The designation of a ten-mile emergency planning zone is supported by scientific evidence suggesting that the worst consequences of an accident can be avoided if individuals in the path of the plume, out to ten to twenty miles, can be evacuated.[147] The issue of how

144. *See* BUNCH, *supra* note 43, at 36; N. OKRENT, *supra* note 42, at 199.

145. *See* NUREG-0348, *supra* note 47, at T319, table 19.

146. *See supra* note 106.

147. *See* N. OKRENT, *supra* note 42; PLANNING BASIS/EMERGENCY, *supra* note 15, at 132-34; Camarinopoulos & Yadigaroglu, *Large Population Center and Core Melt Account Considerations in Siting*, NUCLEAR SAFETY, Jan. 1983, at 60; Niehaus & Otway, *The Cost Effectiveness of Remote Nuclear Reactor Siting*, NUCLEAR TECHNOLOGY, Aug. 1977, at 394.

large the planning area should be appears to have been resolved by the designation of a ten-mile emergency planning zone. Under the emergency planning guidelines of NUREG-0654, however, the Federal Emergency Management Agency (FEMA) and the NRC introduce another distance factor: "[I]nitial evacuation of a 360 [degree] area around the facility is desirable out to a distance of two to five miles although initial efforts would of course be in the general downwind direction."[148] This distance appears to indicate that an area closer to the size of the original low population zone should warrant concentrated attention for evacuation purposes and that land use controls designed to limit population density within this critical zone, will help expedite evacuation. In fact, a two-mile radius was suggested recently by senior officials at the NRC as that portion of the emergency planning zone where evacuation should be stressed.[149] Two other planning distances discussed previously, the thirty-mile radius where population density must be calculated before siting, and the fifty-mile ingestion pathway for emergency planning,[150] are not considered to be maximum areas where emergency measures must be taken to protect the public immediately, but are areas where monitoring to avoid ingestion of contaminated foodstuffs following an accident should be concentrated.[151] Thus, for land use planning purposes, the regulatory and emergency planning guides imply that a low population zone of two to five miles and an emergency planning zone from two to ten miles can constitute potential land use control areas. A third zone for distances beyond ten miles can be developed to encourage, rather than require, the use of controls. It is reasonable to assume that the zones agreed upon will not be the same for every reactor site, just as the existing low population zone is different for each site.

Establishing planning zones, however, is not the most difficult issue to be decided. Density guidelines, as currently applied to each site, pose an even greater problem for local planners. Only one reference in the NRC guidelines alludes to the possibility that growth may oc-

148. OFFICE OF NUCLEAR REACTOR REGULATION, N.R.C., CRITERIA FOR PREPARATION AND EVALUATION OF RADIOLOGICAL EMERGENCY RESPONSE PLANS AND PREPAREDNESS IN SUPPORT OF NUCLEAR POWER PLANTS NUREG-0654 (Oct. 1980).

149. N.Y. Times, Nov. 4, 1983, at B2 (late ed.).

150. For a discussion of the 30 and 50 mile radii, respectively, see REGULATORY GUIDE 4.7, *supra* note 35 and accompanying text, and PLANNING BASIS/EMERGENCY, *supra* note 15.

151. *See supra* note 114 and accompanying text.

cur around a reactor site. As mentioned previously, the density of the population within the various radii, out to thirty miles, is allowed to double during the lifetime of the plant.[152] Unfortunately, this "growth guideline" gives minimal consideration to the manner in which the population is distributed within the specified radii. Thus, this guideline may allow a highly dense population within a few miles of the power plant, yet when averaged over the entire radial distance, the density guideline is met.[153]

This problem has not gone unnoticed by the NRC and the Advisory Committee on Reactor Safeguards. There have been recurrent attempts to formulate a methodology for calculating population densities and distances to population centers. Unfortunately, the precedent set by the approval of the first Indian Point reactor only thirty-five miles from New York City, and pressure by utilities to allow metropolitan sitings equipped with the most advanced engineering safety features, thus far have prevented any change in the regulation.[154] The most recent effort was set in motion in July 1980 when the NRC published a rule-making notice for the revision of regulations controlling the siting of nuclear power reactors. In support of the Environmental Impact Statement (EIS) for the rule-making, the Oak Ridge National Laboratories conducted numerous studies. The purpose of one of these research efforts was to quantify the regulatory requirements[155] for avoiding population centers in terms of density values rather than the dose calculations presently in use.[156] The NRC's goal was to establish generic criteria that may eliminate or reduce the need for custom designs required to fit each plant to its site demography.

The result was an alternative methodology for evaluating the population distribution for siting purposes based on both circular and

152. *See supra* text accompanying note 36.

153. In fact, the decision to issue these density guidelines was not strongly supported by the Advisory Committee on Reactor Safeguards (ACRS). In their deliberations, the ACRS used methodology that weighted persons closer to the site more heavily and considered both the persons in the potential plume pathways and an integrated population. *See* N. OKRENT, *supra* note 42, at 153.

154. *Id.* at 58, 135, 140.

155. 10 C.F.R. 100.11(a)(3) (1984).

156. *See* Durfee & Coleman, *Population Distribution Analyses for Nuclear Power Plant Siting*, N.R.C., OFFICE OF NUCLEAR REGULATORY RESEARCH, DIVISION OF HEALTH, SITING AND WASTE MANAGEMENT, NUREG/CR-3056, at 3 (Dec. 1983) [hereinafter cited as N.R.C., POPULATION ANALYSES].

sector density criteria independent of design differences among plants. The existing methodology measures the population as if distributed homogenously around the site, while the proposed alternative considers the angular distributions of population centers. For example, one case under this alternative establishes radial thresholds based on population density criteria which allow two hundred fifty inhabitants per square mile from zero to two miles, and seven hundred fifty inhabitants per square mile from two to thirty miles. Sector criteria is based on one-fourth the maximum radial criteria population allowable within two adjacent sectors.[157]

The Oak Ridge study, the Brookhaven study, and many other NRC-sponsored research efforts verify that some attention has been paid to streamlining siting regulations for nuclear power plant licensing. Unfortunately, funding cuts and the postponement of rule-making for the revision of existing regulations have placed these efforts on hold. If, in the future, these streamlining measures are adopted, it is clear that a basis for local land use planning also will be established.

Another issue that the NRC and local communities must address is whether the risk of a major accident justifies the cost of implementing land use controls.[158] In a report to the State of California Energy Resources Conservation and Development Commission, analysts at the Lawrence Berkeley Laboratory concluded that a land use control zone of only a one-mile radius is probably the largest that can be justified using a traditional cost-benefit analysis.[159] Nevertheless, unquantifiable benefits, such as "peace of mind" or more effective evacuation procedures, can justify a land use control zone as large as the

157. *Id.* at 70. Under this alternative, four currently operating plants exceed both the radial density and sector threshold limits (Indian Point, N.Y.; Millstone, Conn.; Oyster Creek, N.J.; Zion, Ill.) while 11 clearly exceed the sector or population center threshold limits (Beaver Valley, Pa.; Dresden, Ill.; Fort Calhoun, Neb.; Ginna, N.Y.; Haddam Neck, Conn.; McGuire, N.C.; Pilgrim, Mass.; Rancho Seco, Cal.; St. Lucie, Fla.; Three Mile Island, Pa.; Turkey Point, Fla.; Zion, Ill.). *Id.* at 185-86. These plants, however, do meet existing NRC regulations and are acceptable from a safety standpoint.

158. The probability of a major accident at a nuclear power station with a subsequent release of radioactivity into the atmosphere has been hotly debated. *See supra* note 3.

159. *See* Nero, Schroeder, & Yen, *Control of Population Densities Surrounding Nuclear Power Plants*, 5 HEALTH AND SAFETY IMPACTS OF NUCLEAR, GOETHERMAL, AND FOSSIL-FUEL ELECTRIC GENERATION IN CALIFORNIA 13 (Berkeley: Lawrence Berkeley Report LBL-5921, 1977).

low population zone.[160]

Because the NRC now is focusing more attention and resources on emergency preparedness, this is perhaps the opportune time to reevaluate the existing population guidelines and standards. Because coordination of local, county, and state actions is required to develop and implement an emergency management program, a forum exists through which discussion of coordinated land use controls in the emergency planning zone can be realized. Certainly, control of population densities within this zone can serve to reduce implementation headaches in the event that emergency evacuation becomes necessary.

VII. Local Land Use Techniques

While local levels of government have not given sufficient consideration to the land use problems involving nuclear plants, unlike the federal government, they have been involved intimately in the day-to-day problems of land use planning for many years. Thus, a developed body of law exists and numerous techniques are available for local government to utilize in dealing with the problem of land use control around nuclear plants. Given the federal government's position on this subject and the stance by the federal courts that land use is a local problem,[161] progress in this area will require the adoption of local land use techniques. These techniques should be adopted by local initiative or through state encouragement to perform local land use planning near nuclear plants.

This section examines different land use control techniques that have been used in other contexts and attempts to establish their relevance to the subject of nuclear plants. To examine the question in this fashion is to reason by analogy to a large extent. This involves some speculation. Nevertheless, it is an approach that must be considered to arrive at reasonable policies on the subject.

The available techniques fall into three categories. First, zoning

160. *Id.* Risk analysis actually has been applied to zoning decision-making by the province of Alberta, Canada, to promulgate zoning regulations establishing buffer zones between residents and over 100 sour gas fields. Researchers assigned numerical values to the risk as a function of distance and calculated the acceptable distance for safe occupancy of residential housing. *Risk Based Zoning for Toxic-Gas Pipelines*, 2 Risk Analysis 163, 167-68 (1982).

161. *See, e.g.*, Construction Indus. Ass'n v. City of Petaluma, 522 F.2d 897 (9th Cir. 1975), *cert. denied*, 424 U.S. 934 (1976).

techniques are available for dealing directly with the control of population density. These techniques present the possibility of withholding government-supplied services, thereby discouraging development. These options involve direct government intervention. The second category involves options that affect the tenure of property by requiring the utility company to purchase either the fee or easements, sufficient to keep the population low. A major advantage of this approach is that, while government is free to change zoning ordinances, contractual agreements to keep land in open space are binding and enforceable in court. The third category deals with incentives, including transferable development rights and possible tax proposals designed to compensate industry and property owners for restrictions on development.

The three sets of possibilities are not mutually exclusive. They can be used individually or in some combination, and depending on the specific circumstances, the useful combinations can be many and varied.

A. *Zoning and Public Facilities Control for Low Population Density*

1. Zoning

Several types of zoning are particularly well suited to the low-density development desired around nuclear power plants: agricultural, large-lot, recreational, and industrial. These types of zoning create low-population areas because they either prohibit residential development or control the density of development through property size and use requirements. A favorable response to implementing low-density zoning controls around nuclear power plants is suggested by the results of the Brookhaven questionnaire. Over fifty percent of the jurisdictions report the existence of large-lot zoning regulations and twenty-five percent have agricultural preservation programs.

a. *Agricultural Zoning*

Agricultural zoning prohibits uses other than those that are compatible with an agricultural economy. In addition to normal farming activities, agricultural zoning districts generally include single-family homes on large lots, and sometimes allow industrialized agriculture, such as stock feeding and canneries. Conventional subdivisions and other urban uses are prohibited.

The purpose of most agricultural zoning is to preserve prime agricultural land. In rapidly developing areas, however, local govern-

ments have used agricultural zoning to create holding zones for a timed-development plan so that development can be delayed until services can be extended, or until it is desirable to extend the urban area into the previously restricted zone.[162] Another frequent use of agricultural zoning is to restrict development on floodplains and around airports to protect the public from hazards associated with these areas.[163]

A recent demographic study of reactor sites reveals that of the ninety currently active sites,[164] seventy-nine are located ten miles or more from a metropolitan center of more than twenty-five thousand inhabitants, and fifty-eight are located outside a Standard Metropolitan Statistical Area (SMSA).[165] A concentrated analysis of twenty-four of the forty-nine power plant sites studied for the Brookhaven Laboratory project revealed that eighty-three percent can be classified as "moderately isolated" to "semi-rural."[166] These findings demonstrate that most sites probably are well suited to agricultural zoning, especially where agriculture is the current land use. Most agricultural uses are compatible with nuclear power plant operation. As a result, this type of zoning will meet little opposition. In fact, retention of the rural-agricultural nature of land surrounding plant sites is unquestionably the best strategy for maintenance of a low-population density. Yet, forty-five percent of area jurisdictions reported a decline in land devoted to agriculture in the ten-mile study

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162. *See* Freilich & Ragsdale, *supra* note 4, at 1064.

163. In 1981, it was reported that 271 county and municipal governments had passed agricultural zoning ordinances; a great majority of these were adopted in California, Illinois, Iowa, Maryland, Minnesota, Oregon, Pennsylvania, South Dakota, and Wisconsin. *See* Coughlin & Keene, *The Protection of Farmland: An Analysis of Various State and Local Approaches*, 33 LAND USE LAW AND ZONING DIGEST, June 1981, at 5, 8.

164. The number of active sites is taken from a 1982 report, ATOMIC INDUSTRIAL FORUM, ELECTRICITY FROM NUCLEAR POWER: A 1982 MAP OF NUCLEAR POWER PLANTS (July 1982), and differs from those figures reported in NUREG-0348, *supra* note 47.

165. *See* NUREG-0348, *supra* note 47, at T77-T149, M1-M49. In NUREG-0348, the reactor site to population center distance is defined as the distance from the site to the *center* of the population center. The NRC and utility figures for population center distance (PCD) are based on the distance from plant center line to the *boundary* of the population center. Furthermore, since 1974 they also have included *potential* centers based on population projections. These potential centers were not included in the figures cited in NUREG-0348.

166. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 97.

radius.[167] Host areas jurisdictions have noticed this discouraging trend. Twenty-five percent have agricultural preservation plans in place and another fifteen percent are considering them.[168]

Legally, the designation of an area within the control zone as an agricultural district probably will pose few problems as long as farming is a reasonable use of the property. One California court has upheld an agricultural zoning ordinance when the land was not well suited for farming, citing uses to which the land could be put that are compatible with agriculture.[169] Particular care must be taken, however, when zoning unsuitable land. Unless the compatible uses clearly are suitable and provide the landowner enough return on his land to do more than pay his taxes, the courts may declare the ordinance invalid.[170]

In addition to upholding agricultural zoning ordinances designed to pursue the goal of agricultural land preservation, the courts have upheld those that local governments intended as temporary holding zones to "prevent haphazard commercial development which would obstruct orderly planning"[171] and as a method designed to "prevent urban sprawl and to forestall the development of residential zones in areas . . . susceptible to . . . above average hazards."[172]

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167. *Id.* at 203.

168. *Id.* at 200.

169. Paramount Rock Co. v. County of San Diego, 180 Cal. App. 2d 217, 234-35, 4 Cal. Rptr. 317, 328 (1960). The court listed alternative uses such as golf courses, dairies, riding stables, cattle grazing, et cetera, in turning aside the plaintiff's argument that there could be no use of his land under such a zoning designation. *Id.* at 228-29, 4 Cal. Rptr. at 324-25. In Pennsylvania, however, courts uphold large lot agricultural zoning only as long as it has a rational relationship to the purposes of agriculture. *See In re* Appeal of Buckingham Developers, Inc., 61 Pa. Commw. 408, 414-15, 433 A.2d 931, 934 (1981); Hopewell Township v. Golla, 58 Pa. Commw. 572, 583, 428 A.2d 701, 705 (1980).

170. *See* Comment, *One Tier Beyond* Ramapo: *Open Space and the Urban Reserve*, 15 SAN DIEGO L. REV. 1211 (1978).

171. State *ex rel.* Randall v. Snohomish, 79 Wash. 2d 619, 624, 488 P.2d 511, 514 (1971). *Cf.* Golden v. Planning Bd., 30 N.Y.2d 359, 389, 285 N.E.2d 291, 308, 334 N.Y.S.2d 138, 161 (1972), *appeal dismissed* 409 U.S. 1003 (1972) (holding zones validly and effectively can implement land planning, and cited *Randall* for the rule that the right to impose holding zones must be reasonably limited in its duration).

172. Morse v. County of San Luis Obispo, 247 Cal. App. 2d 600, 603, 55 Cal. Rptr. 710, 712 (1967). *See also* Eck v. City of Bismarck, 302 N.W.2d 739, 745 (N.D. 1981) (upholding airport zoning to protect the public from excessive noise).

b. *Large-Lot Zoning*

When agricultural zoning may be impractical, such as where the reactor site is less than ten miles from a major metropolitan center of more than twenty-five thousand persons or in a jurisdiction where agricultural zoning is not used for purposes other than agriculture, a combination of controls that provide low-density development may be possible. An additional control technique is large-lot zoning, which generally requires that lots where residences are to be constructed must be equal to or greater than one acre. Because this requirement disperses homesites, low residential density results. Large-lot zoning, however, has received mixed reviews by the courts. Some courts carefully examine these ordinances to determine if they artificially thwart development, and as a consequence, discriminate against and exclude racial minorities because they cannot afford single-family homes on large lots.[173] The intended purpose is an important factor in determining the constitutionality of large-lot zoning. If the minimum lot size is kept small enough so that the lots are marketable and no exclusionary effect is identified, the courts generally uphold the validity of the zoning.[174]

As a practical matter, demographic data on active reactor sites and the existence of large-lot zoning in more than one-half of the affected jurisdictions lend support to the use of this technique. According to the Brookhaven Study, in 1980 the average population density within ten miles of forty-three operating power plants was 155 persons per square mile, less than one inhabitant per acre.[175] Projected figures to

173. *See, e.g.*, Board of County Supervisors v. Carper, 200 Va. 653, 660-62, 107 S.E.2d 390, 398 (1959).

174. *See* Comment, *supra* note 170, at 1224. The author suggests a five-acre maximum lot size for nonagricultural land to insure marketability. *See also* Eldridge v. City of Palo Alto, 57 Cal. App. 3d 613, 628-29, 129 Cal. Rptr. 575, 584 (1976) (the court invalidated a 10-acre minimum lot size principally because of its concern about the marketability of the lots); Application of Wetherill, 45 Pa. Commw. 303, 305, 406 A.2d 827, 828-29 (1979) (the court determined an exclusionary effect and invalidated a 10-acre minimum). For a discussion of situations when large-lot zoning is useful in preserving environmentally sensitive areas, see Comment, *Environmental Considerations: New Arguments for Large Lot Zoning*, 8 URBAN L. ANN. 370, 377 (1974). New York State uses the balancing test of Berenson v. Town of New Castle, 38 N.Y.2d 102, 110, 341 N.E.2d 236, 242, 378 N.Y.S.2d 672, 680-81 (1975), to determine if an ordinance is exclusionary. The *Berenson* Court developed a two-tiered doctrine to prevent exclusion. The ordinance must: 1) Provide a properly balanced and well-ordered plan for the community to meet present and future housing needs; and 2) consider regional needs.

175. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 29.

the year 1990 indicate that this ratio is expected to increase to about 197 persons per square mile, although the ratio of inhabitants per acre will remain below one.[176] Despite the presence of metropolitan centers in a few areas, these figures strongly suggest the existence of some areas near nuclear power plants of very low-density development. If local authorities can establish guidelines setting the maximum density levels allowable in specified zones around the reactor site, minimum lot standards may be acceptable and compatible with these regions. For example, lot sizes nearest the reactor may be as large as eight to ten acres, with those at the perimeter of the ten-mile radius set at one acre or less.

Alternatively, lot sizes can be based on an average maximum density over the entire ten-mile radius. This gives developers an opportunity to cluster residences on small lots while maintaining the density standards inherent in a large-lot zoning district. While this cluster technique will produce a greater population density at the development site, it will maintain overall low-density requirements through the use of open space around the development site. By concentrating the population in one compact area, the technique can facilitate evacuation in case of an emergency. Support for this concept is found in land use regulations promulgated by almost sixty percent of the jurisdictions around existing nuclear power plants. Although challenged in the courts on many grounds, the cluster technique has been widely upheld.[177]

c. *Industrial and Recreational Zoning*

In addition to residential zoning possibilities, some areas of the low population zone may be suitable for industrial development. When the nuclear power plant is located in an area zoned for industrial use, the inclusion of compatible industries in this district should not be objectionable. Some restrictions on the numbers of employees that work in the industrial zone may be necessary to assure safe and

176. *Id.*

177. *See generally* Orinda Homeowners Comm. v. Board of Supervisors, 11 Cal. App. 3d 768, 90 Cal. Rptr. 88 (1970); Bruni v. Farmington Hills, 96 Mich. App. 664, 292 N.W.2d 609 (1980); Chrinko v. South Brunswick Township Planning Bd., 77 N.J. Super. 594, 187 A.2d 221 (N.J. Super. Ct. Law. Div. 1963); Kamhi v. Planning Bd., 89 A.D.2d 111, 454 N.Y.S.2d 875 (1982). For cases sustaining planned unit development, see Cheney v. Village 2 at New Hope, Inc., 429 Pa. 626, 635-36, 241 A.2d 81, 86 (1968); Dupont Circle Citizen Ass'n v. District of Columbia Zoning Comm'n, 355 A.2d 550, 560 (D.C. 1976), *cert. denied*, 429 U.S. 966 (1976).

prompt evacuation, if required.[178]

Recreational zoning can allow for parks, golf courses, playing fields, riding trails, tennis clubs, and camping. These uses frequently are permitted in floodplains to allow use of the land while protecting the public from health and safety problems associated with other types of land development. Normally, recreational land yields very low density populations; nevertheless, recreational amenities near nuclear power plants have complicated calculation of population density because of the seasonal migration of vacationers to beaches and lake resorts. In addition, recreational amenities such as freshwater lakes, reservoirs, and coastal zones have been cited as possible catalysts for growth in host areas that previously had been considered low growth areas.[179] Thus, the existence of recreational facilities in areas around nuclear power plants may tend to increase, rather than maintain, the low population density.

From the time construction of nuclear power plants began, the amount of land area actually zoned for commercial, industrial, and recreational uses has increased in all regions. In the Brookhaven questionnaire, fifty-three percent of the jurisdictions reported an increase in commercial zoning, forty-eight percent reported an increase in industrial zoning, and thirty-nine percent reported an increase in recreation zoning. Actual land use increases in these categories were significantly higher. There has been a seventy percent increase in commercial land use, a sixty percent increase in industrial land use, and a sixty-three percent increase in recreational land use in all regions.[180]

2. Beyond Direct Zoning

Most of the types of low density land use discussed thus far often are included under the broad heading of "open space." Agricultural land, houses located on large lots, public parks, and private recrea-

178. *See* Marcus Assocs., Inc. v. Town of Huntington, 45 N.Y.2d 501, 382 N.E.2d 1323, 410 N.Y.S.2d 546 (1978), when the court upheld a population density restriction concluding that a municipality has the right to restrict population density in order to "conserve the desirable nature and economic value" of an industrial zone, as well as a residential zone. *Id.* at 507, 382 N.E.2d at 1325, 410 N.Y.S.2d at 548.

179. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 38. Of the nine regions surrounding nuclear power plants where population growth was underestimated by the utility by at least 17%, many were near freshwater lakes, reservoirs, and impoundments. *Id.*

180. *Id.* at 203.

tional facilities such as golf courses or riding trails are examples of open space. Except in the case of public parks, this open space has been created by private landowners, often under the requirements of zoning regulations that the courts have upheld despite charges of severe reductions in property values. There is a point, however, beyond which local governments cannot use the police power to accomplish development goals. If property is "taken" through regulation so that no permitted use or value remains,[181] the governing body must pursue other avenues. Thus, if the goal of low-density development around nuclear power plants cannot be accomplished by utilizing zoning techniques alone, a combination of regulations, public facilities control, and incentives may be required to keep the land substantially undeveloped for the extended periods of time demanded by the operating life time of the nuclear power plant.

One growth management device, which effectively could complement and enforce zoning regulations around nuclear power plants is controlling the location of public facilities, particularly sewers and highways. By providing public facilities and services to areas outside the designated low-population zone around the reactor site, state and local governments can direct development to areas where higher density development is desirable. By withholding public facilities and services from the control zone, state and local governments can restrict development in this area to non-intensive uses, such as low density residential or agricultural use. Several regional growth management systems, and one statewide system, utilize this technique as a critical part of their programs. These programs have sought to neutralize the legal problems[182] inherent in any attempt to withhold public services by carefully defining urban growth boundaries.[183] The existence of forceful state statutes, and the consistent policies of commissions that administer the programs have strength-

181. While the police power may be used to restrict severely the use and value of private property, the taking clause of the fifth amendment—applicable to the states through the fourteenth amendment—does provide some protection against confiscation. *See, e.g.*, Pennsylvania Coal Co. v. Mahon, 260 U.S. 393, 412-16 (1922). *Cf.* Penn Cent. Transp. Co. v. New York City, 438 U.S. 104, 133-35 (1978) (holding that application of New York's Landmarks Preservation Law did not affect a taking of private property by the government without just compensation).

182. *See infra* text accompanying notes 186-90.

183. Urban growth boundaries establish a line beyond which the cities will provide few, if any, public services. This boundary may be termed "temporary," although prohibitions against expansion may extend up to 25 years or more.

ened their legal position.[184]

Two utility extension control strategies have been proposed to manage and direct growth. First, local authorities responsible for providing public facilities can refuse to extend services to areas within the service area where development is not desired. Second, connection fees to users of these facilities can be based on a graduated scale of "desirability of the development from a land use planning viewpoint."[185] "Desirability" can be defined in terms of location, density, and need.

The first strategy is likely to be successfully challenged in the courts by opponents that argue that public service providers "must as a matter of equal protection and common law duty extend facilities."[186] The common law duty of public service providers—whether public utility corporations, service districts, or municipalities—to provide service to everyone in the service area has been well established.[187] The only exceptions to this rule apply in cases where there is a lack of capacity, financial crisis, or when the expense of providing the service will far exceed the revenues to be gained.[188]

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184. *See* Coughlin & Keene, *supra* note 163, at 11.

185. *See* Deutsch, *Capital Improvement Controls as Land Use Control Devices*, 9 ENVTL. L. 61, 70 (1978).

186. *See* Freilich & Ragsdale, *supra* note 4, at 1077.

187. 64 AM. JUR. 2D *Public Utilities* § 32 (1972). *See generally* Barbaccia v. County of Santa Clara, 451 F. Supp. 260 (N.D. Cal. 1978); Robinson v. City of Boulder, 190 Colo. 357, 547 P.2d 228 (1976); Delmarva Enters., Inc. v. Mayor of Dover, 282 A.2d 601 (Del. Super. Ct. 1971); Reid Dev. Corp. v. Township of Parsippany-Troy Hills, 10 N.J. 229, 89 A.2d 667 (1952).

188. *See, e.g.*, Swanson v. Marin Mun. Water Dist., 56 Cal. App. 3d 512, 524, 128 Cal. Rptr. 485, 492 (1976) (actions declaring water shortage emergency and moratorium on new water service connections were within district's power to control expansion during spells); Mayor of Cumberland v. Powles, 255 Md. 574, 578, 258 A.2d 410, 413 (1969) (no water shortage or financial crisis to justify refusal); Drake v. Town of Boonton, 106 N.J. Super. 79, 84, 254 A.2d 151, 153 (N.J. Super. Ct. Law. Div. 1969) (extension would not be feasible economically); Charles v. Diamond, 41 N.Y.2d 318, 331-32, 360 N.E.2d 1295, 1305, 392 N.Y.S.2d 594, 604-05 (1977) (temporary restrictions were justified because of deficiencies in system, but permanent restrictions were not); Haines v. City of New York, 41 N.Y.2d 769, 773, 364 N.E.2d 820, 823, 396 N.Y.S.2d 155, 158 (1977) (extension would overload system); Kennilworth Management Co. v. Ithaca, 63 Misc.2d 617, 621-22, 313 N.Y.S.2d 35, 40-41 (N.Y. Sup. Ct. 1970) (possible water shortage in city if service extended to outlying areas). *See also* Barbaccia v. County of Santa Clara, 451 F. Supp. 260, 265 (N.D. Cal. 1978) (noted that several state courts have held that a city acting as the sole provider of sewer service can deny sewer hookups within its "service area" only for such utility-related reasons as lack of capacity); 64 AM. JUR. 2D *Public Utilities* § 44 (1972) (duty to ex-

Municipalities that provide public services have argued unsuccessfully that the rules that apply to municipal corporations should prevail in considering service extensions,[189] and that cities should have the right to predicate service extensions on sound land use planning considerations. Courts, however, continue to uphold the view that in their capacity as public service providers, cities can withhold services only for utility-related reasons.[190]

The second strategy, differential connection fees calculated on the basis of the "desirability" of the project rather than by the presently employed cost-based system, has not received wide attention in the literature. In fact, attempts to impose "desirability-based" fees are not well documented. Differential connection fees based on service-related factors have received wide acceptance throughout the United States and have been sustained in the courts.[191] When these fees are unrelated to service costs, however, the courts have denied authority

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tend service depends generally upon need, cost of extension, and revenues which may be expected).

189. *See, e.g.*, Robinson v. City of Boulder, 190 Colo. 357, 361-62, 547 P.2d 228, 230-32 (1976). *See also* Ramsay, *Control of the Timing and Location of Government Utility Extensions*, 26 STAN. L. REV. 945 (1974) (discretion and limits of a municipality's obligation to extend utility service).

It is generally accepted that a city has no obligation to extend water services beyond city limits, except when it has a contractual agreement to do so. *See* Exchange Nat'l Bank v. Behrel, 9 Ill. App. 3d 338, 341-43, 292 N.E.2d 164, 167-68 (1972); Montgomery v. Olley, 42 Misc. 2d 906, 908, 249 N.Y.S.2d 205, 207 (N.Y. Sup. Ct. 1964); Big Spring v. Board of Control, 389 S.W.2d 523, 528 (Tex. Civ. App. 1965). *See also* City of El Paso v. State Line, Inc., 570 S.W.2d 409, 414 (Tex. Civ. App. 1978) (city had no obligation outside corporate limits, but when it chose to serve some customers in outlying areas, it could not deny service to others).

190. See Golden v. Planning Bd., 30 N.Y.2d 359, 383, 285 N.E.2d 291, 304-05, 334 N.Y.S.2d 138, 156 (1972) (upheld a timed-development plan linked to provision of public services; the court implied that service-related, not land-use-related problems, validated the "access to public facilities" provision of the development plan), *appeal dismissed*, 409 U.S. 1003 (1972). *But see* Dateline Builders, Inc. v. City of Santa Rosa, 146 Cal. App. 3d 520, 531, 194 Cal. Rptr. 258, 266 (1983) (court ruled city's adoption of a general land use plan within its policy of orderly and compact growth to avoid urban sprawl was proper exercise of its police power; thus, city's refusal, as a planning device, to extend utility services was consistent with the land use plan and was within city's police power).

191. *See generally* Contractors' and Builders' Ass'n v. City of Dunedin, 329 So.2d 314 (Fla. 1976); Hartman v. Aurora Sanitary Dist., 23 Ill. 2d 109, 177 N.E.2d 214 (1961); Spalding v. Granite City, 415 Ill. 274, 113 N.E.2d 567 (1953); Airwick Indus., Inc. v. Carlstadt Sewerage Auth., 57 N.J. 107, 270 A.2d 18 (1970), *cert. denied*, 402 U.S. 967 (1971); Hayes v. City of Albany, 7 Or. App. 277, 490 P.2d 1018 (1971); Lafferty v. Payson City, 642 P.2d 376 (Utah 1982).

to impose them.[192] How the courts will view "desirability-based" connection fees may turn on whether they are "just and equitable."[193] Court acceptance, however, will be difficult to obtain.

While the body of case law relating to these two strategies reveals judicial disfavor for the manipulation of utility extensions to accomplish land use planning objectives, courts, in considering the validity of this technique as a growth management device around power reactor sites, nevertheless, may conclude that the potential danger is sufficiently high to justify an exception to the prevailing rules. Combined with growth control zoning, this approach will be a powerful growth management tool in the critical evacuation zone around power plant sites.

B. *Land Tenure: Easements, Full Fee Acquisition, and Eminent Domain*

For property near nuclear power plants where zoning alone is inadequate to control development, other control methods are available. Two land tenure devices, which will provide varying degrees of control over land development around reactor sites, are the purchase of easements and full-fee interests in property. Although these techniques offer more permanent control than zoning, their effectiveness may be realized only if these property interests can be obtained through exercise of the power of eminent domain. Thus, analysis of the eminent domain issue is included for each technique.

1. Easements

A utility company's purchase of a less-than-fee interest in property around the reactor site can take the form of development rights easements. These easements will restrict development on the property beyond that deemed appropriate for maintenance of low-population density.

California is the only state that has adopted land use controls around nuclear power plants. One provision of California's Warren-Alquist Act requires the utility to purchase development rights when the State Energy Commission determines that existing land use con-

192. *See, e.g.*, Strahan v. Aurora, 38 Ohio Misc. 37, 43, 311 N.E.2d 876, 889 (1973).

193. Contractors' and Builders' Ass'n v. City of Dunedin, 329 So.2d 314 (Fla. 1976).

trols are insufficient to guarantee maintenance of population levels and land use during the lifetime of the plant.[194] The State Energy Commission also is granted authority to approve any change in governmental land use restrictions to ensure that the change is not in conflict with health and safety requirements.[195] The Supreme Court recently declined to rule on the legality of the development rights purchase requirement, concluding instead that the case was not "ripe" for discussion.[196]

There is ample precedent for restricting development on private property through easement agreements. This technique has been used by state and federal governments, and upheld in the courts,[197] to preserve scenic vistas, to provide protected buffers near national monuments and parks, to conserve natural conditions around seashore and lakeshore areas, and to protect scenic and wild rivers and other natural resources.[198] Taking a cue from the success of these programs, states recently have instituted easement programs to preserve farmland and open space.[199]

To the utility company, an easement agreement may be attractive for several reasons: 1) it may ease the financial burden of acquiring the fee interest; 2) title and possession, as well as the expense of maintaining the land, remain with the owner; and 3) land so restricted remains usable within the constraints of the low-density development requirements. For the landowner, an easement may be preferable to outright purchase because he retains title and possession of his property and at the same time may realize some reduction in either in-

194. CAL. PUB. RES. CODE § 25528(a) (Deering 1977).

195. *Id.* § 25528(d).

196. Pacific Gas & Elec. Co. v. State Energy Resources Conservation & Dev. Comm'n, 103 S. Ct. 1713, 1719-20 (1983).

197. *See generally* United States v. Albrecht, 364 F. Supp. 1349 (D.N.D. 1973), *aff'd*, 496 F.2d 906 (8th Cir. 1974); Richley v. Crow, 43 Ohio Misc. 94, 334 N.E.2d 542 (1975); Kamrowski v. State, 31 Wis. 2d 256, 142 N.W.2d 793 (1966). Note, however, that the Maryland court has not ruled favorably on the use of scenic easements. *See* Hardesty v. State Road Comm'n, 276 Md. 25, 33-35, 343 A.2d 884, 889 (1975) (taking in a scenic easement of less than perpetual duration, and taking may occur without actual physical appropriation).

198. Roe, *Innovative Techniques To Preserve Rural Land Resources*, 5 ENVTL. AFF. 419, 431 (1976). *See also* Kiernat v. County of Chisago, 564 F. Supp. 1089, 1090-91 (D. Minn. 1983) (easement to protect wild and scenic river was valid).

199. *See* Coughlin & Keene, *supra* note 163, at 8; Netherton, *Environmental Conservation and Historic Preservation Through Recorded Land-Use Agreements*, 14 REAL PROP., PROB. & TRUST J. 540, 558-59 (1979).

come or property taxes due to the decreased development value of his land. This plan, however, is not without costs. Purchasing a development rights easement in areas subject to strong development pressure may be as expensive as purchasing the full fee.[200]

Legally, the type of development rights easement that the utility will purchase differs by common law definition from the conservation easements mentioned previously; thus, the potential legal problems envisioned by the proponents of conservation easements should not be encountered. Conservation easements are easements "in gross" under the common law because they do not benefit another parcel of land. Problems of enforceability and assignability of these types of easements have led to the passage of statutory authority for conservation easements in more than forty states. The development rights easements that the utility will purchase, however, will be defined as "appurtenant" in that they benefit another parcel of land. Under common law these easements run with the land and are assigned with relative ease.[201]

Another potential problem with the easement technique is that some owners invariably will be reluctant to surrender development rights even though the value of their rights is low. This may be a significant problem in the host areas attributable to the reported population growth occurring around many of the nation's operating plants. For example, in the analysis of population change in the ten-mile study area, the Brookhaven study found that population growth in the vicinity of these plants has been faster than in the nation as a whole, and that this change is increasingly independent of national, regional, and county influence.[202] If the utility company must rely on the discretionary surrender of easements, gaining control of development in designated sectors may be haphazard. Therefore, the power to acquire easements by eminent domain may be essential. In most states, statutes have granted the power of eminent domain to gas and electric power companies.[203] Although these statutes generally include the right to condemn an easement or right-of-way over private

200. One source indicates that purchasing the fee, followed by resale with a retained easement, may be less expensive than purchasing the easement alone. *See* W. SHANDS, FEDERAL RESOURCE LANDS AND THEIR NEIGHBORS 78 (1979).

201. *See* RESTATEMENT OF PROPERTY § 453 (1944); Netherton, *supra* note 199, at 558.

202. *See supra* text accompanying note 96.

203. *See* 29A C.J.S. *Eminent domain* §§ 23-24 (1965). *See also supra* note 199.

land for erection of transmission lines, only California specifically has addressed the right to condemn development rights.[204] A survey of eminent domain legislation granting utilities this power reveals, however, that many of the state statutes can be construed to permit the acquisition of development rights if this can be proven necessary to the operation of the plant.[205] In those states with more specific language, amendments to the existing statute may be required to extend the power of eminent domain to the acquisition of development rights easements.[206]

The courts apply a narrow scope of review in eminent domain cases. In the absence of a determination of fraud, bad faith, or gross abuse of discretion, courts have held the determination of the necessity of a taking by the legislature or its delegate is inherently a matter for the legislature,[207] and will uphold the taking if a reasonable ground exists to support it.[208] When the legislature has not clearly delineated the extent of the property interest that may be taken, the courts prefer the taking of an easement to the taking of a fee simple interest as long as the easement will satisfy the needs of the condemnor.[209] All indications, therefore, point to legal authorization for the condemnation of development rights easements, provided that

204. CAL. PUB. RES. CODE § 25528(a) (Deering Supp. 1984).

205. Selected state authorizations reveal that in Colorado, condemnation authority is granted "[f]or transacting its business or for any lawful purpose connected with the operations of the company." COLO. REV. STAT. § 38-2-101 (1982). Similar language appears in Michigan, where eminent domain is granted to acquire lands "necessary to generate, transmit, and transform electric energy for public use." MICH. COMP. LAWS ANN. § 486.252 (West Supp. 1984). In Minnesota, eminent domain is granted to acquire "[s]uch private property as may be necessary or convenient for the transaction of the public business. . . ." MINN. STAT. ANN. § 300.04 (West Supp. 1984). Other state statutes containing very general language include: IND. CODE ANN. §§ 32-11-3-1, -2 (Burns 1980); N.J. STAT. ANN. § 48:7-8 (West 1969); N.Y. TRANSP. CORP. LAW § 11 (McKinney 1943); OHIO REV. CODE ANN. § 4933.15 (Page 1977).

206. Statutes with more specific language include: ARK. STAT. ANN. § 35-301 (1962); KAN. STAT. ANN. § 17-618 (1981); ME. REV. STAT. § 2306 (1978); OR. REV. STAT. § 772.210 (1983).

207. This is true except in Arizona, Colorado, Mississippi, and Washington where the judiciary determines the necessity. *See, e.g., In re* Petition of City of Seattle, 96 Wash. 2d 616, 624-65, 638 P.2d 549, 554-55 (1981).

208. *See* Falkner v. Northern States Power Co., 75 Wis. 2d 116, 132, 248 N.W.2d 885, 894 (1977).

209. *Id.* at 140-42, 248 N.W.2d at 897; Krauter v. Lower Big Blue Natural Resources Dist., 199 Neb. 431, 436-37, 259 N.W.2d 472, 475 (1977); I. LEVEY, CONDEMNATION IN THE UNITED STATES 262 (1969).

statutory delegation exists and the public purpose for which the taking is necessary has been well established.

An alternative approach is the acquisition of these easements by a governmental entity. Maryland has given the Secretary of the Department of Natural Resources the power to condemn and purchase potential power plant sites, which then are made available for purchase or lease to public utilities.[210] Funds for this acquisition are collected by a surcharge on kilowatt hours generated. The adoption of this type of scheme for the acquisition of development rights easements can be investigated. Although the legal issues raised by private-public cooperation recently have been aired in the courts with mixed results,[211] previously, courts have upheld this power in other contexts.[212]

Whichever path is taken, utility acquisition or government acquisition, the purchase of development rights easements offers an equitable means of controlling population density near nuclear power plants, particularly in areas with high development pressure. Easements offer a more reliable and permanent control than zoning and provide tighter controls for areas nearest the reactor site. The permanency of easements plus the power to obtain them by eminent domain will assure complete control of designated sectors during the lifetime of the plant.

The principal disadvantage of this method is that eminent domain condemnations are expensive, unpopular, and time consuming. The costs of these condemnations may be passed on to the populace through substantial increases of utility rates. In addition, it will be necessary to acquire easements far in advance of plant construction and operation to assure maintenance of the site's low density characteristics.

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210. MD. NAT. RES. CODE ANN. § 3-305 (1983).

211. *See, e.g.*, Mayor of Baltimore v. Chertkolf, 293 Md. 32, 42, 441 A.2d 1044, 1051 (1982); Poletown Neighborhood Council v. City of Detroit, 410 Mich. 616, 632, 304 N.W.2d 455, 458 (1981). *Cf. In re* Petition of City of Seattle, 96 Wash. 2d 616, 633-36, 638 P.2d 549, 559-60 (1981) (Although motives of the city council were not questioned in planning municipal improvement project, the project, which was designed to enhance and forestall "flight to the suburbs" by city, was not a public use within the meaning of the eminent domain power.).

212. *See In re* Petition of City of Seattle, 96 Wash. 2d at 633-34, 638 P.2d at 559. *See also* Berman v. Parker, 348 U.S. 26 (1954); Lerch v. Maryland Port Auth., 240 Md. 438, 214 A.2d 761 (1965); Frostburg v. Jenkins, 215 Md. 9, 136 A.2d 852 (1957); Courtesy Sandwich Shop, Inc. v. Port of New York Auth., 12 N.Y.2d 379, 190 N.E.2d 402, 240 N.Y.S.2d 1 (1963).

Utilization of this method of controlling population density around nuclear power plants is not contingent on the passage of local legislation. It is interesting to note, however, that in jurisdictions near these plants, conservation easement programs, which have been supported by the passage of local legislation, are growing in all regions. According to respondents to the Brookhaven questionnaire, twenty-two percent officially have adopted easement programs. Nearly forty percent of the entities in the Northeast report these programs.[213] These figures suggest that the idea of instituting a development rights easement program for control areas around the power plant may receive support in some regions.

2. Full Fee Acquisition

Traditionally, utility companies have acquired the full fee to property within the required exclusion zone around their reactor sites. Extending acquisition beyond this perimeter can be one of a combination of land use control devices employed around the site. One of the advantages of this technique is readily apparent: the utility company will acquire complete control over activities on the surrounding property. Two principal advantages will accrue to property owners. First, the owners of land in the affected zones are not reluctant or captive property owners in a potentially hazardous area. They can choose to remain on the land by leasing it from the power company with an option to buy it back when the site is abandoned, or they can choose to leave. Second, landowners that fear that their property will be reduced in value because of its proximity to the plant site may be able to prevent a loss by selling directly to the utility company.

The arguments against this technique, however, are numerous. First, control over development can be achieved through less costly means. Second, unlike other techniques, title will transfer to the utility company and, along with it, the necessity of upkeep, the responsibility for paying real estate taxes, and the potential for becoming landlord over thousands of acres. Third, the exercise of eminent domain almost certainly will be required and acquisition of the full fee through condemnation procedures may present legal obstacles not present with less-than-fee techniques.[214] Fourth, as with easement acquisition, costs may have a substantial impact on utility rates.

213. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 200, 201.

214. *See supra* text accompanying notes 203-05.

If the NRC and the utility company support this technique, successful implementation undoubtedly will hinge on the acquisition of the fee through condemnation. If an easement satisfies the needs of the condemnor, a court will prefer the taking of an easement to the taking of a fee simple interest.[215] Because it already has been shown that other techniques exist that can accomplish the goal of low-density development without full fee acquisition, proving that a full fee interest is essential may be a difficult legal obstacle.

An examination of *Falkner v. Northern States Power Co.*,[216] a 1977 Wisconsin Supreme Court eminent domain case involving land purchase requirements for a nuclear power plant, illustrates the court's preference for the taking of an easement. In this case, the court considered condemnation of the fee versus condemnation of an easement for two zones around a reactor site: 1) the exclusion zone, and 2) property outside this zone. The court found that acquisition of the fee for property within the exclusion zone is a valid exercise of the eminent domain power because the NRC requires that the power company determine all activities in this zone and, under these conditions, owners will retain few ownership rights anyway.[217] Beyond the exclusion zone, however, the court upheld condemnation only because a high probability "of serious adverse effects upon the owners' property" existed from the operation of two cooling towers.[218] The court's analysis implies that, absent serious and certain adverse effects, the exercise of eminent domain cannot be sustained to acquire the full fee. This finding is consistent with court decisions validating protective zoning regulations that severely reduce property values based on the existence of highly foreseeable danger combined with a potentially severe impact.[219]

This case suggests that, in order to sustain the use of the power of eminent domain to purchase the fee to property outside the exclusion zone, the NRC will have to promulgate regulations requiring the extension of exclusion zone controls to a wider area. Because of the substantial amount of land that may fall under the affected zone, however, full fee acquisition probably is neither feasible nor war-

215. *See supra* note 205.

216. 75 Wis. 2d 116, 248 N.W.2d 885 (1977).

217. *Id.* at 141-42, 248 N.W.2d at 899.

218. *Id.* at 144, 248 N.W.2d at 900.

219. *See supra* note 4 and accompanying text.

ranted beyond the exclusion zone, unless an unusually high risk of danger exists.

C. *Financial Incentives: Transferable Development Rights and Preferential Tax Assessment*

Two types of financial incentives used in land conservation and preservation schemes are potentially applicable as land controls near nuclear power plant sites. In exchange for restricting development on their property, landowners can receive transferable development rights or preferential tax assessments. Transferable development rights allow owners to realize some of the development potential of their property by transferring the development rights to another piece of property that they own or by selling these rights to another property owner outside of the impact zone. Preferential tax assessments permit the property to be assessed at its current value rather than its development value, which results in either lower real estate taxes or favorable income tax adjustments.

1. Transferable Development Rights

Landmark, agricultural, and open space preservation laws occasionally utilize transferable development rights as a means of compensating property owners for leaving their property undeveloped.[220] By severing the development rights from the property and allowing landowners to sell or transfer the rights to developers in other designated land use areas, the property owner is compensated for the restrictions placed on his property.

Several cities and counties in the United States have enacted preservation ordinances with a provision for transferable development rights. Between 1972 and 1980, ten municipalities and two counties incorporated the scheme of transferable development rights in programs to preserve farmland and other open space.[221] Nevertheless, as of June 1981 only four transferable development rights transactions had occurred.[222] New York City was a leader in implementing the scheme in the early 1970s, authorizing transferable development

220. *See* Costonis, *"Fair" Compensation and the Accommodation Power: Antidotes for the Taking Impasse in Land Use Controversies*, 75 COLUM. L. REV. 1021, 1044-45 (1975); Schnidman, *Transferable Development Rights: An Idea in Search of Implementation*, 11 LAND & WATER L. REV. 339 (1976).

221. Coughlin & Keene, *supra* note 163, at 10.

222. *Id.*

rights in a provision of its Landmarks Preservation Law and Special Park District ordinance. Both of these ordinances subsequently were challenged in the courts, however, and the resulting opinions left the constitutionality of the transferable development rights scheme in doubt.[223]

A recent case has given new hope to the supporters of transferable development rights. In Florida, a state court of appeals upheld the City of Hollywood's attempt to protect a one and one-fourth mile long beachfront from overdevelopment by offering transferable development rights to property owners.[224] Applying the standards that the United States Supreme Court developed in *Penn Central Transportation Co. v. New York City*,[225] the court found the government

223. In Fred F. French Investing Co. v. City of New York, 39 N.Y.2d 587, 350 N.E.2d 381, 385 N.Y.S.2d 5 (1973), *appeal dismissed*, 429 U.S. 990 (1976), the court agreed that the development rights to the properties were an essential component of the value of the underlying property and, as such, were a potentially valuable transferable commodity that should be considered in determining whether the ordinance destroyed the economic value of the property. The court, however, held that the New York City TDR scheme "constituted a deprivation of property without due process of law" because it failed "to assure the preservation of the very real economic value of the development rights as they existed when still attached to the underlying property." *Id.* at 598, 350 N.E.2d at 388, 385 N.Y.S.2d at 12.

Several years later in Penn Cent. Transp. Co. v. City of New York, 42 N.Y.2d 324, 366 N.E.2d 1271, 397 N.Y.S.2d 914 (1975), the New York Court of Appeals considered a New York City ordinance involving the preservation of the Grand Central Station. The terminal had been designated as an historical landmark and the development rights above the terminal had been made transferable to numerous sites in the vicinity, some of which Penn Central owned. When the city denied the owners of the station permits to construct a multi-story office building over the terminal, the owners brought suit claiming that the city had "taken" their property without just compensation. The court found that the TDRs provided "significant, perhaps 'fair' compensation for the loss of rights about the terminal" and concluded that there was no taking. *Id.* at 336, 366 N.E.2d at 1278, 397 N.Y.S.2d at 922.

When the decision was appealed to the United States Supreme Court, Penn Cent. Transp. Co. v. New York City, 438 U.S. 104 (1978), the Court gave no consideration to the TDR program because it did not find that a "taking" had occurred. The Court did, however, note that "while these rights may well not have constituted 'just' compensation if a 'taking' had occurred, the rights nevertheless undoubtedly mitigate whatever financial burdens the law had imposed on appellants and for that reason, are to be taken into account in considering the impact of regulations." *Id.* at 137. *See supra* note 181.

224. City of Hollywood v. Hollywood, Inc., 432 So. 2d 1332 (Fla. Dist. Ct. App. 1983).

225. 438 U.S. at 137. The court examined the questions of whether the program serves a valid public purpose and whether the program mitigates the economic advantage of the developer. For a discussion of the *Penn Central* case, see *supra* note 223.

action to be "proper and reasonably related to a valid public purpose"[226] and concluded that the developer had little to complain about. In exchange for deeding the beachfront to the city, the developer could build 368 more multifamily units on adjoining land with an uninterrupted oceanfront view. It appears that the marketability of the additional units was a critical factor in the court's decision to uphold the program.

This technique has potential application for controlling land use around nuclear power plants. Property owners within the low population zone can be allowed to transfer their development rights to land outside the zone. If the prevailing winds are such that a particular sector within the control zone required stricter density controls than other sectors, the development rights of that sector may be transferred to another sector within the control zone as well as to land outside the zone.

Although the concept of transferable development rights has been gaining proponents nationally, in the regions around nuclear power plants only fifteen percent of the 163 jurisdictions responding to the Brookhaven questionnaire reported the existence or development of transferable development rights programs. This finding does not preclude implementation of such a program for the purpose of maintaining low-density development near the plants, but the lack of actual implementation elsewhere indicates that various difficulties may exist with the transferable development rights scheme.[227] It is premature to recommend this scheme for controlling land use around these plants before these difficulties are identified and resolved.

2. Preferential Tax Assessment

Whether development rights are surrendered temporarily through easement agreements and zoning regulations, or permanently through transfer, most conservation and preservation programs offer tax reductions both as incentives and compensation for relinquishing

226. 432 So. 2d at 1338.

227. Denver's original transferable development rights scheme, which allowed development rights to be transferred to contiguous properties only, recently was amended to allow transfers to nonadjacent property in return for renovating the existing historical structure. It is hoped that development rights in over-built areas now will have a market elsewhere in the City. One promising note is that the acceptance of these rights as collateral for renovation loans supports the contention that development rights are marketable. *See Development Rights Ordinance Breaks New Ground,* COLO. BUS., Dec. 1982, § II, at 24.

these rights. To property owners whose lands are subject to severe developmental pressure, the reduction in property taxes can be a compelling incentive to participate in a development rights control program. As the market values of surrounding properties escalate, the value of all property rises with a corresponding escalation in real estate taxes. This substantial property tax burden often forces farmers to sell their land to developers. When development rights are severed from the property, real estate tax assessments reflect the decrease in market value as well as the elimination of potential market appreciation.[228]

This technique, however, probably has little applicability to areas surrounding nuclear power plants. For the most part, plants are located in rural, unincorporated areas where taxes generally are much lower than in urban areas.[229] Furthermore, the nuclear power plant itself may generate forty to seventy-five percent of local revenues and thus will keep local taxes low.[230]

VIII. Strategy for a National Land Use Policy on Nuclear Plants

This section discusses a possible strategy illustrating how land use control techniques might be utilized in maintaining low population zones. As discussed earlier, the NRC already has identified—through regulation, guidelines, and handbooks—several critical zones around nuclear power plants. In addition, empirical studies have shown that the worst consequences of an accident can be avoided if evacuation occurs in the plume pathway out to a distance of approximately ten miles. The authors believe, on the basis of these currently recognized zones of concern, that the NRC is justified in designating three of these zones as the spatial boundaries for land use controls designed to complement and strengthen emergency planning measures and to heighten safety for the population at risk. The precise boundaries and configuration of these zones should remain relatively site-specific.

With the nuclear power plant as the center, these three zones can be defined as concentric circles radiating out from the plant sites and

228. *See* Roe, *Innovative Techniques to Preserve Rural Land Resources*, 5 ENVTL. AFF. 419, 430 (1976).

229. *See* BROOKHAVEN NATIONAL LABORATORY, *supra* note 5, at 104.

230. *Id.* at 114.

having radii equal to: 1) The present exclusion zone; 2) a very low population zone, in the range of zero to five miles; and 3) a low population zone, in the range of two to ten miles. The exclusion zone will retain its present definition as a calculable distance based on radiation dose. The very low population zone distance should no longer be based on calculated radiation doses, but instead should conform to the emergency planning "initial evacuation zone" defined earlier in this article.[231] This zone should constitute a circle with a radius of from two to five miles from the plant site. The third and final land use planning zone should lie in a circle with a radius of two to ten miles from the plant. This zone will be defined as the area within which protective measures, such as sheltering or evacuation, may occur in the event of an accident.

Density guidelines for each of these zones should not be based solely on the average density in the designated radial areas. Instead, a combination of the radial and sector density guidelines, described earlier in this article,[232] should be applied to reflect accurately the actual population distribution. In addition, densities in the very low population zone should differ from densities in the remaining zones. It remains for the NRC to determine what these density values should be, but as indicated earlier, the groundwork has been laid through studies that have evaluated differing criteria.[233]

Once the zones and densities are established, the land use controls previously discussed can be applied based on the densities that must be maintained. Table 1 illustrates the combination of controls that may be appropriate in the suggested planning zones. Another potential control area is the population center outside these planning zones. Because distance criteria undoubtedly will be retained in the NRC regulations, any shrinkage of the prescribed distances or any increases beyond the sector density thresholds should be avoided. Land use control techniques that can help to accomplish the desired level of control should include transferable development rights to adjacent sectors, large-lot zoning, and withholding public utilities and municipal services.

Evident from the conclusions of the population and density analyses undertaken by the Brookhaven project, the majority of nuclear

231. *See supra* text accompanying note 111.

232. *See supra* text accompanying note 157.

233. *See supra* text accompanying note 157.

Table 1

Suggested Controls for Designated Planning Zones

Zone	Suggested Controls
Exclusion Zone	Full fee acquisition by utility
Very Low Population Zone	Development rights easement—purchased by utility
	Transferable development rights—transferable to low population zone
	Agricultural zoning
	Industrial zoning
	Withholding public utilities and municipal services
Low Population Zone	Cluster development
	Large-Lot zoning
	Transferable development rights—transferable from low population zone and also out of controlled areas

power plant host regions are rural, sparsely populated areas that are experiencing slow to moderate growth. The pressure for growth control measures, therefore, is not acute. In the more urbanized areas of the Northeast and Midwest, however, problem areas are developing. Assistance and guidance in implementing appropriate land use controls should be directed in these host areas. Although the number of these sites is small, and one may ask why so much fuss over such a small number of problem areas, the populations at risk in these densely populated areas is high.

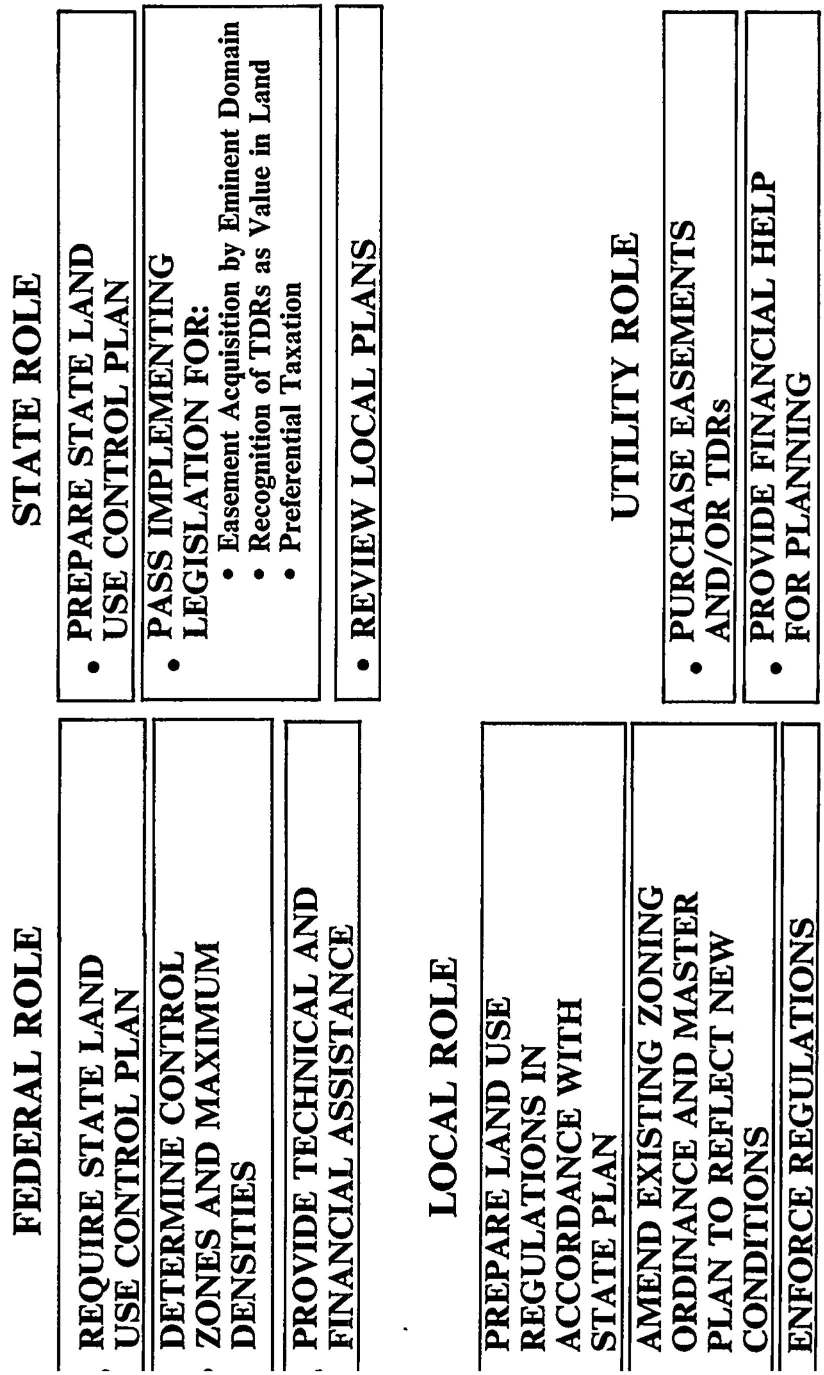
By providing guidelines to communities through the regulation of land use prior to the possible occurrence of any accident, the NRC can offer the land use approach as an additional method of protecting local populations. The NRC's programs also can be examined as they are put into operation. Certainly, if experience is gained with improving controls near power plants, the NRC will have an ever-growing body of data with which to refine its scope of operations. The problem with emergency regulations is that the variability of plant and atmospheric conditions, coupled with the fortunate lack of serious accidents in the past, means that emergency systems cannot

adequately be tested until an actual emergency occurs. It makes sense, therefore, to have land use regulations in effect that increase the likelihood of a successful emergency response.

A thornier question is the type of response that the NRC should take. The question of how to organize an effort raises issues of federal versus state versus local control. Figure 1 outlines a possible strategy to address this question. As figure 1 demonstrates, there is substantial reluctance on the part of federal officials to involve themselves in the local land use process. Moreover, local governments oppose state control. Our modest suggestion is that the NRC issue regulations requiring states to prepare land use planning documents for the control of land use around nuclear plants. At a minimum, the states' planning documents should require that localities where plants are located, or are proposed to be located, should demonstrate that they have considered the full range of available land use control techniques. Moreover, they should be required to indicate what combination of techniques they have chosen to use, and the reasons for their choices. Given the wide range of voluntary as well as mandatory techniques available, this approach should give local communities the opportunity to examine the problem in a noncoercive atmosphere.

Figure 1

Proposed Strategy for Implementing Land Use Controls



States also should be responsible for preparing guidelines for interjurisdictional coordination. Again, localities should be required to examine the issues involved, and should have their plans reviewed by the state. The NRC should require that states demonstrate that they are providing technical assistance to localities, sufficient to enable the localities to make well-considered choices. The NRC should adopt the role of reviewer and provider of technical documents to assist the states. The NRC should provide states with planning documents.

The NRC's reluctance to devote resources to this issue at a time of budgetary uncertainties is understandable. Given the continuing opposition to nuclear plants, however, and the reluctance of many communities to prepare emergency evacuation plans, it may be necessary for the NRC to consider other means of fulfilling its responsibilities to assure safe nuclear power.

The NRC has recognized that the perceived risk is as important in this area as the qualified risk: "Reactors are unique in this regard: radiation tends to be perceived as more dangerous than other hazards because the nature of radiation effects are [sic] less commonly understood and the public generally associates radiation effects with the fear of nuclear weapons effects."[234] Recent events suggest that the perceived risk still is very high in many instances. Control of land use offers another way to deal not only with the perceived risks, but also to diminish the consequence of an unwanted accident.

234. *See* PLANNING BASIS/EMERGENCY, *supra* note 15, at app. I, 1-2.