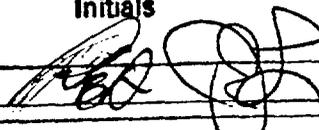
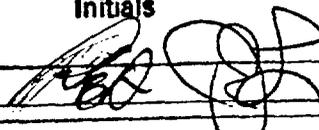


SUMMARY REPORT  
THE STATE OF KNOWLEDGE  
OF  
WASTE CONFIDENCE

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SUMMARY REPORT

THE STATE OF KNOWLEDGE OF WASTE CONFIDENCE

TABLE OF CONTENTS

<u>SECTION</u>	<u>DESCRIPTION</u>	<u>PAGE</u>
I.	THE PERTINENT HISTORY OF THE WASTE CONFIDENCE ISSUE . . . . .	1
II.	A SUMMARY, CONTEXT, AND ANALYSIS OF WASTE CONFIDENCE DECISION. . . . .	3
	A. <u>Summary of the Decision</u> . . . . .	3
	B. <u>Context of the Decision</u> . . . . .	4
	C. <u>Analysis of the Decision</u> . . . . .	5
	Finding 1. . . . .	5
	Finding 2. . . . .	8
	Finding 3. . . . .	9
	Finding 4. . . . .	9
	Finding 5. . . . .	10
	D. <u>Qualifications and Commitment by the Commission     Concerning the Waste Confidence Decision</u> . . . . .	10
III.	THE CURRENT CONTEXT OF THE WASTE CONFIDENCE ISSUE . . . . .	10
	A. <u>The NWPA Amendments</u> . . . . .	11
	B. <u>The DOE Mission Plan Amendments in Response to the     NWPA Amendments</u> . . . . .	11
	C. <u>Recycling</u> . . . . .	12
	D. <u>Present and Projected Waste Generation</u> . . . . .	12
	E. <u>Trends in Expression of Congressional Policy and the     Statutory Framework for Groundwater Protection and     Land Disposal</u> . . . . .	12
	F. <u>Future Demand for Electricity and the Role of Nuclear     Power</u> . . . . .	13
IV.	THE "STATE OF KNOWLEDGE" WITH RESPECT TO THE WASTE CONFIDENCE ISSUE. . . . .	14
V.	OBSERVATIONS FOR THE SHORT AND LONG TERM. . . . .	15

## Summary Report: The State of Knowledge of Waste Confidence

The Center for Nuclear Waste Regulatory Analyses has endeavored in this Summary Report to describe the "State of Knowledge" with respect to the waste confidence issue within the context of the history of the issue, the parameters of the original waste confidence decision, and developments which have occurred subsequent to that decision. This approach is reflected in the organization of the report. The report concludes with summary observations for short and long term.

### I. THE PERTINENT HISTORY OF THE WASTE CONFIDENCE ISSUE

The Waste Confidence Issue, as it has come to be known, grew out of litigation concerning license applications for expanded storage capacity in the spent fuel pools of Northern States Power Company's Prairie Island nuclear facility in Goodhue County, Minnesota and Vermont Yankee Nuclear Power Corporation's generating facility at Vernon, Vermont.

Prior to litigation, the Licensing Board had granted modifications in separate proceedings for both facilities based on NRC Staff findings of reasonable assurance that the modifications would not endanger public health and safety (thus satisfying Atomic Energy Act and NRC requirements), and that the modifications themselves would not "significantly affect the quality of the human environment" and therefore not require an environmental impact statement pursuant to the National Environmental Policy Act (NEPA). As the District of Columbia Circuit Court of Appeals in Minnesota v. Nuclear Regulatory Commission, 620 F2d 412 (1979) later noted:

"The evaluations extended only to the safety and environmental effects of the proposed modifications themselves; the Staff did not consider any implications arising from the possibility that the unavailability of a permanent nuclear waste disposal solution might cause the plant sites to become permanent storage facilities, or even to continue on as storage beyond the expiration dates of the licensees' operating authority (for Vermont Yankee and Prairie Island, during the years 2007-2009).

. . . .

Each Board excluded from its determination any consideration of the safety and environmental effects of long-term storage of nuclear wastes on the site." 620 F2d at 413

In a consolidated proceeding, the NRC Appeal Board addressed the intervenors' contention that:

"... the uncertainty as to the feasibility of ultimate solutions for the disposal of commercial nuclear wastes raises the possibility that the reactor sites might become

Summary Report: The State of Knowledge of Waste Confidence

long-term and possibly indefinite storage sites, persisting subsequent to the expiration of the plants' operating licenses. Before any expansion of on-site storage capacity should be approved, the Commission must consider the safety and environmental implications of indefinite storage on-site after decommissioning of the reactor." 620 F2d at 413

The Appeal Board rejected these contentions on the grounds: 1) That NEPA's "Rule of Reason" doctrine did not require their consideration, and 2) That a prior NRC decision refusing to initiate a rulemaking to determine "whether radioactive wastes can be generated in nuclear power reactors and subsequently disposed without undue risk to the public health and safety" precluded them from considering the larger issue. In that decision, the Commission found an "implicit" finding of reasonable assurance in "a coordinated Federal program to develop an actual disposal facility."

The Commission declined, without comment, to review the Appeal Board's decision with respect to the Prairie Island and Vermont Yankee storage expansion.

The intervenors (petitioners) renewed these same contentions in the D. C. Circuit Court of Appeals. The holding in that court may be summarized as follows:

1. The Court clearly rejected the petitioners' contention that the waste confidence issue should be addressed in an adjudicatory proceeding:

"... We agree with the Commission's position that it could properly consider the complex issue of nuclear waste disposal in a "generic" proceeding such as rulemaking, and then apply its determinations in subsequent adjudicatory proceedings. Where factual issues do not involve particularized situations, an agency may proceed by a comprehensive resolution of the questions rather than relitigating the question in each proceeding in which it is raised. Ecology Action v. AEC, 492 F.2d 998, 1002 (2d Cir.1974) (Friendly, J.); see American Airlines, Inc. v. CAB, 123 U.S.App. D.C.310, 359 F.2d 624 (en banc), cert. denied, 385 U.S. 843 (1966)."

2. The waste confidence issue was remanded for further consideration by the Commission.

3. The Commission was given the latitude to consider the issue by "such procedure as it may deem appropriate."

4. The court perhaps gave birth to the phrase "state of knowledge" within the context of waste confidence with the statement:

"The complex and vexing question of the disposal of nuclear wastes is a matter that is currently before the Commission in a related proceeding, and is characterized by continuing evolution of the state of pertinent knowledge."

## II. SUMMARY, CONTEXT, AND ANALYSIS OF THE WASTE CONFIDENCE DECISION

### A. Summary of the Decision

Partially in response to remand in the above litigation, NRC initiated a rulemaking proceeding on October 25, 1979 to:

"... assess generically the degree of assurance now available that radioactive waste can be safely disposed of, to determine when such disposal of (sic) off-site storage will be available, and to determine whether radioactive wastes can be safely stored on-site past the expiration of existing facility licenses until off-site disposal or storage is available." (49 FR at 34658)

The Commission summarized its final waste confidence decision (49 FR 34658) [August 31, 1984] in the following five findings of "reasonable assurance:"

1. "...safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository is technically feasible."
2. "...that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by the years 2007-09, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of existing commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time."
3. "...high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level radioactive waste and spent fuel."
4. "...that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating licenses at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations."

## Summary Report: The State of Knowledge of Waste Confidence

5. "...that safe independent onsite or offsite spent fuel storage will be made available if such storage capacity is needed." (49 FR at 34658)

### B. Context of the Decision

Distinguishing the context of the original waste confidence decision from the context in which any current assessment of "state of knowledge" must proceed is useful. While the expressed primary purpose of the Waste Confidence Decision proceedings was to respond to the D. C. Circuit's remand in Minnesota v. Nuclear Regulatory Commission, the Commission invited and considered comments concerning a number of related concurrent issues.

Specifically, the Commission, in the course of the proceedings, invited comment upon a Presidential Nuclear Policy Statement (October 9, 1981) favoring commercial reprocessing and the announcement by the DOE of its decision to "discontinue [its] efforts to provide federal government-owned or controlled away-from-reactor (AFR) [spent fuel] storage facilities." (March 27, 1981).

In addition, the Nuclear Waste Policy Act (NWPA) of 1982 was passed. The Commission found that the NWPA:

"...had a significant bearing on the Commission's decision, and the Commission has considered the NWPA in reaching its conclusions. [T]... the NWPA had its most significant impact in narrowing the uncertainties surrounding institutional issues and, ...although the NWPA is intrinsically incapable of resolving technical issues, it will establish the necessary programs, milestones, and funding mechanisms to enable their resolution in the years ahead." (49 FR at 34659)

Contemporaneously, and therefore included as an additional aspect of the context in which the original waste confidence decision was promulgated, the Commission had before it the so-called "S-3" proceeding. The proceeding commenced in 1972 when the Commission's predecessor (the Atomic Energy Commission) proposed a rulemaking to reconsider whether the environmental effects of the uranium fuel cycle should be included in the cost/benefit analysis prepared in licensing each plant. Although concluding that the environmental effects of the fuel cycle were "relatively insignificant," the Commission found it preferable to take them into account. It promulgated its rule as "Table S-3," which specified a series of numerical values intended to represent the incremental contribution of one nuclear reactor to the total environmental impact of the uranium fuel cycle.

The "S-3" proceeding was itself the subject of litigation and, in fact, was on remand from the Supreme Court to the D. C. Circuit Court of Appeals when the D. C. Circuit issued its opinion concerning waste confidence. See NRDC v. NRC 178 U.S.App.D.C. 336, 345, 547 F.2d 633,642 (1976), reversed sub nom. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S.519 (1978).

## Summary Report: The State of Knowledge of Waste Confidence

Last, but not least, the Commission viewed the Waste Confidence proceedings as "[i]n keeping with its commitment to issue a rule providing for procedures for considering environmental effects of extended onsite storage of spent fuel in licensing proceedings, the Commission issued final amendments to 10 CFR Parts 50 and 51 simultaneously with the Waste Confidence Decision. (See 49 FR 34688-34696)

Two relevant developments which occurred subsequent to closing of the record in the Waste Confidence Proceedings were publication of the DOE's Draft Mission Plan for the Civilian Radioactive Waste Management Program (April 1984) and the Commission's concurrence in DOE's general guidelines for Recommendation of Sites for Nuclear Waste Repositories (July 3, 1984). With respect to these developments, the Commission stated:

"These developments are a matter of public record, and in the case of the Commission's concurrence was the conclusion of a separate public proceeding. The Commission has considered the effects of these developments on its previously announced decision in this proceeding and determined that these developments do not substantially modify the Commission's previous conclusions". (49 FR at 34659)

This subsection has attempted to briefly describe the complex and dynamic nature of the context in which the original waste confidence decision was reached. As later subsections document, this aspect of the decision was recognized and requisite flexibility sought. The Commission wisely recognized from the outset that the context would require continual monitoring and, as a result, that waste confidence was, by nature, not static but dynamic.

### C. Analysis of the Decision

The Commission summarized its decision of waste confidence in a five partite finding of reasonable assurance (see A. Summary of the Decision above). The rationale for these five findings of reasonable assurance is contained in an Appendix to the Waste Confidence Decision (49 FR 34666-34688). Summary and analysis of the five findings, and their respective rationales, follows:

**Finding 1. "...safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository is technically feasible."**

Part I of the Commission's summary of its findings is both expanded and qualified in the accompanying rationale:

"...[s]afe disposal of high-level radioactive waste and spent fuel is technically possible and that it is achievable using existing technology. Although a repository has not

yet been constructed and its safety and environmental acceptability demonstrated, no fundamental breakthrough in science or technology is needed to implement a successful waste disposal program" (emphasis added) (49 FR 34667)

Reliance upon a multibarrier approach (waste package, engineered, and geologic) pervades the rationale as well as does the recognition by the Commission that "the period during which the wastes must be isolated from the biosphere is at least several millennia... (and that) [t]he geologic setting is the 'final' barrier." (49 FR 34667)

The Commission's discussion of the first finding involves consideration of the identification of acceptable sites (49 FR 34667-69), development of effective waste packages (49 FR 34669-71) and the development of effective engineered barriers (49 FR 34671-72).

With respect to identification of an acceptable site, the Commission noted DOE's on-going "site exploration efforts" with respect to various geologic media:

"Although the record of this proceeding does not show that DOE has progressed far enough in site characterization to confirm the existence of an acceptable site, the record does indicate that DOE's site characterization and selection program is technically sound.

. . .

In summary, the Commission believes that technically acceptable sites for disposal of radioactive waste and spent fuel exist and can be found. There are a number of suitable host rock types to select from; many areas are underlain with massive, stable formations containing these host rocks; the areas being investigated by DOE contain such rock formations; and the uncertainties in knowledge of the earth and material sciences relevant to the identification of an acceptable repository site are not fundamental uncertainties that would prevent the identification of technically acceptable sites. Further, in situ testing required to characterize a candidate site would not necessarily compromise its integrity." (49 FR 34668)

With respect to development of a waste package for deep geologic emplacement, the Commission realized the interplay between the waste package, the waste form, and the geologic medium and the determination of waste form any decision on reprocessing would have:

"...the possibility of future reprocessing, and the potential need to dispose of high-level radioactive waste resulting from reprocessing, does not significantly alter the technical feasibility or the schedule for developing a mined geologic repository and the design of its multiple barriers.

Summary Report: The State of Knowledge of Waste Confidence

With regard to technical feasibility, the effect of spent fuel reprocessing on the commercial radioactive waste disposal problem is not a new consideration. The disposal of waste from reprocessing spent fuel has been studied for a longer time than the disposal of spent fuel. Until 1977, the commercial waste management program was directed primarily toward disposal of waste from spent fuel reprocessing and those efforts have continued. A variety of waste forms has been studied (DOE PS pp.II-153 to II-160). Thus, considerable information is already available on the technical feasibility of developing a suitable waste form for reprocessed high-level radioactive waste. In fact, there is evidence that the disposal of reprocessed high-level waste may pose fewer technical challenges than the disposal of spent fuel (Tr.p.29). Moreover, commercial reprocessing of spent fuel cannot be undertaken in this country in the absence of a full NRC licensing review. That review will consider, among other things, the waste form to be produced by the reprocessing method and its implications for waste disposal. (49 FR 34670)

Unless the Commission determines that commercial reprocessing and management of its products assure adequate protection to the public health and safety and the common defense and security, spent fuel will continue to be the predominant commercial waste form available for disposal in a repository." (49 FR 34669)

The Commission concluded, however, that regardless of future decisions on reprocessing:

"...that the chemical and physical properties of spent nuclear fuel and high-level radioactive waste can be sufficiently understood to permit the design of a suitable waste package.

the DOE program is capable of developing a suitable waste package which can be disposed of in a mined geologic repository. This conclusion is based upon the large number of candidate materials being considered by DOE, the detailed evaluation of these materials to be conducted as part of the DOE program and the results of DOE's preliminary analysis of candidate materials." (49 FR 34670)

It is important to note that the Commission apparently considered waste package development both within and separate from deep geologic emplacement.

"...the context of the chemical and physical properties of spent nuclear fuel and high-level radioactive waste can be sufficiently understood to permit the design of a suitable waste package.

The Commission also concludes that the DOE program is capable of developing a suitable waste package which can be disposed of in a mined geologic repository." (emphasis added) (49 FR 34669)

With respect to the development of engineered barriers, the Commission found that "DOE's on-going developmental studies... are technically sound and provide a basis for reasonable assurance that engineered barriers can be developed to isolate or retard radioactive material released by the waste package.

In summary, the Commission's consideration of waste disposal in a mined geological repository, while it acknowledged the necessity of multiple barriers, "found no known fundamental technical problems which would make safe waste disposal impossible." Implicit in the Commission's first finding, however, is the conscious realization of the assumption of the Nuclear Waste Policy Act of 1982 that utilization of natural barriers is a pre-requisite of deep geologic disposal due to the length of time for which isolation is required and the interaction, within that time frame, between the waste form, waste package and potential geologic and geohydrologic events. There also may be, in the Commission's discussion of the finding of waste package both within and separate from the context of deep geologic disposal, the realization that the implicit policy decision (in this case legislative) to utilize natural barriers might at some point be reconsidered.

Both the original NWPA of 1982 and the Act as amended press the Congressional finding that "long term storage of high level radioactive waste or spent nuclear fuel in monitored retrievable storage facilities is an option for providing safe and reliable management of such waste or spent fuel." (Section 141 (a.) (1)). There is, in the legislative history of the NWPA, a long standing discussion of MRS facilities and repositories as alternative options. The question whether to "dispose" or "manage" may not be finally settled and the Commission's first finding appears flexible in that regard.

Finding 2. "...that one or more mined geologic repositories for commercial high-level radioactive waste and spent fuel will be available by the years 2007-09, and that sufficient repository capacity will be available within 30 years beyond expiration of any reactor operating license to dispose of existing commercial high-level radioactive waste and spent fuel originating in such reactor and generated up to that time."

In reaching this conclusion, the Commission noted the existence of both technical and institutional uncertainties:

"The technical issues concern DOE's ability to find technically acceptable sites in a timely fashion and the timely development of waste forms, packages, and engineered barriers. The institutional issues concern primarily Federal-state relations and the management and funding of the Federal program."

In fact, the Commission went so far as to note:

"While the record of the proceeding supports a finding that disposal is technically achievable, the Federal government has, in the past, made inadequate progress in developing sound waste management policies and programs."

In spite of these reservations, the Commission reached its finding of reasonable assurance primarily based upon passage of the Nuclear Waste Policy Act of 1982 and its view that the Act reduced both uncertainties in scheduling related to technical activities and institutional uncertainty. There is, perhaps, implicit in the Commission's expression of a rationale for this finding, both a reflective consideration of the Commission's proper role within the statutory framework of the Atomic Energy Act and the Nuclear Waste Policy Act, and a healthy skepticism of the certainty of implementation of legislative and regulatory pronouncement based upon past operating history.

**Finding 3. ...high-level radioactive waste and spent fuel will be managed in a safe manner until sufficient repository capacity is available to assure the safe disposal of all high-level radioactive waste and spent fuel."**

The basis for this finding was that the spent fuel and any HLW would be subject in any case to NRC regulation "during the entire period between initial... operation and availability of a waste repository" regardless of whether the spent fuel or HLW remained in the custody of the operating utility or was transferred to DOE. Again, there is implicit in this finding a realization by the Commission that some flexibility is necessitated by the inability to absolutely determine future events. There may also be, although not expressed, a realization that development of a geologic repository (especially given past history) is not an absolute certainty and that the Commission views its duty to public welfare, health and safety as extending beyond current legislative pronouncement. This is not to say that the Commission, in its finding, was not impeccable in its homage to the Nuclear Waste Policy Act, which was passed at the very conclusion of the Waste Confidence Proceedings.

**Finding 4. "...that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the expiration of that reactor's operating licenses at that reactor's spent fuel storage basin, or at either onsite or offsite independent spent fuel storage installations."**

The Commission based this finding upon considerations of the long term integrity of spent fuel under water pool storage conditions, structure and component safety for extended facility operating the safety of dry storage, and potential risks of accidents and acts of sabotage. The finding was based both upon probabilistic and deterministic risk analysis. The significance of this finding is discussed in the next subsection. The effect of the finding is that development of a repository is not a sine qua non for waste confidence.

**Finding 5. "...that safe independent onsite or offsite spent fuel storage will be made available if such storage capacity is needed."  
(49 FR at 34658)**

The basis for the Commission's fifth finding was simply the availability and demonstrated ability of the technology for independent fuel storage installations. The fifth finding has essentially the same significance and effect as the fourth finding with the exception that it requires transportation of HLW.

D. Qualifications and Commitment by the Commission concerning the Waste Confidence decision:

The Waste Confidence decision was accompanied by the following statement:

"The Commission's Waste Confidence decision is unavoidably in the nature of a prediction. While the Commission believes for the reasons set out in the assurance, that it can, with reasonable assurance, reach favorable conclusions of confidence, the Commission recognizes that the possibility of significant unexpected events remains open. Consequently, the Commission will review its conclusions on waste confidence should significant and pertinent unexpected events occur, or at least every 5 years until a repository for high-level radioactive waste and spent fuel is available. (Emphasis added) (49 FR at 34660)

There is in the qualification the recognition of the possibility, if not likelihood, of major technical developments, developments in technology, institutional interplay and/or legislative or regulatory developments during the period for which waste confidence was being assessed. In fact, latter sections of the report suggest that some of these developments are occurring or have already occurred.

It is important to note that the Commission's Waste Confidence Decision was not dependent upon either a finding that a mined geologic repository is necessary for reasonable assurance of public health and safety and environmental quality, or that a mined geologic repository is necessary for reasonable assurance of public health and safety or environmental quality prior to 30 years after a

reactor's decommissioning nor was such a basis made necessary by the courts decision which was the impetus for the decision. Further, it should be noted that the original waste confidence decision resulted from a proceeding the focus of which was broader than the D. C. Circuit's instruction on remand. The court's remand simply required the Commission to address the question whether off-site storage for spent fuel would be available by the expiration of reactor operating licenses and, if not, whether spent fuel could continue to be safely stored on-site.

### III. THE CURRENT CONTEXT OF THE WASTE CONFIDENCE ISSUE

There have been a number of developments since the final Waste Confidence Decision of August 31, 1984. It is not the purpose of this section to exhaustively analyze or list all developments or to attempt to assess the developments in terms of whether they are "significant pertinent unexpected events" within the meaning of the statement (above) which accompanied the original waste confidence decision. The purpose of this section is simply to provide some overview of several parameters which may have either changed or appeared since the original decision. It is also the purpose of this section to suggest that context is an all important consideration. The section concludes by suggesting that context may be a more important consideration than "state of knowledge." In fact, context may suggest the knowledge it might be pertinent for a policymaker to acquire.

#### A. NWPA Amendments

The Nuclear Waste Policy Act Amendments of 1987, among other things, limited current site characterization activities to Yucca Mountain, Nevada and terminated site characterization at the other two previously nominated sites and all site specific activity for a second repository. In addition, NWPA altered the Act's provisions with respect to both the establishment and general nature of an MRS facility. The amendments also require DOE to conduct a study to evaluate the use of dry cask storage technology at the sites of civilian reactors. The overall effect of the amendments is to reduce and focus site specific activities associated with a repository while expanding activities associated with various other options (MRS, dry cask storage) which may be viewed as aspects of an integrated waste management system or as alternatives to a repository.

In addition, the Amendments at least create the framework for and (therefore the possibility) that a negotiated agreement might solve Federal-state institutional uncertainties associated with the Nevada site or with respect to an, as yet, undetermined site.

#### B. The DOE Mission Plan Amendments in Response to NWPA

As detailed in a previous report by the Center, (see Staff Comments accompanying letter of July 11, 1988 from John Latz, President, CNWRA to Mark Delligatti, NRC), the currently proposed draft Mission Plan Amendments introduced system

engineering and systems integration in both organizational and programmatic senses to the Civilian Radioactive Waste Management Program. There is clear indication of intent to "make more extensive use of systems engineering ... (to) achieve the best overall solution for the long term disposal of radioactive wastes."

### C. Recycling

Presidential Policy with respect to recycling has vacillated. Recycling was at one point expressly deferred, ostensibly because the thought that reprocessing might create undue risk for diversion of plutonium and nuclear weapons proliferation. Whether to reprocess or not is obviously a question which includes ramifications beyond weapons proliferation. Several of these ramifications would determine systems engineering options for waste management and in turn bear upon consideration of waste confidence.

### D. Present and Projected Waste Generation

It is quite clear that waste generation is not and will not be, for the short term, what was originally projected. For the long term, a host of factors will determine the waste generation for which management confidence must be assessed. Some of these factors are identified elsewhere in this section. Some factors may at least be finitely bounded while others are extremely complex and subject only to broad comparative assessment. Some factors are internal to nuclear generation and some factors are external in that they determine to what extent the nuclear option will be relied upon. All of the factors, however, are germane to the larger context within which waste confidence must periodically be reassessed.

### E. Trends in Congressional Policy and the Statutory Framework for Groundwater Protection and Land Disposal

Within the time frame of the original proceedings, and since issuance of the last waste confidence decision, there have been a host of developments concerning protection of groundwater resources. Some thought and explanation will eventually have to be given to the extent that Congressional policy, and those laws which implement the policy with respect to land disposal hazardous waste (RCRA, CERCLA, CWA, SDWA, etc.), are consistent with or conflict with the NWPA as presently written.

The express purpose of RCRA is to minimize, if not eventually eliminate, land disposal of hazardous waste. It may not be sufficient for the long run to distinguish land disposal of HLW or spent fuel on the basis of distinctions which can be made between risk residing in chemical activity and risk residing in radioactivity or simply the increased depth and more involved engineering of a repository. The fact that a literal reading of CERCLA would require notification of the National Hazardous Response Center concerning emplacement of waste packages in a repository indicates that all these statutes are not

integrated in either a legal or a policy sense. Similarly a combination of the CWA and SDWA amendments (the sole source aquifer and wellhead protection provisions) could conceivably have allowed Texas to prevent characterization of the Deaf Smith County site which was originally named for characterization. The elimination of that site and the Hanford site may indicate, in part, a convergence of Congressional policy with respect to hazardous and nuclear waste.

#### F. Future Demand for Electricity and the Role of Nuclear Power

Although the waste confidence issue was narrowly defined initially, it both affects and is affected by the role of nuclear power in electric power demand and electric power generation in the future. It can be anticipated that thermal electric power generation will play a significant role in meeting electrical demand for the foreseeable future, although perhaps not the dominant role played today.

At present, about 85% of U. S. electric power is supplied thermally, about 50% by burning coal, 20% by burning oil, and 15% by nuclear generation. The remainder is supplied by hydropower. For the past decade in the U. S., annual growth in demand for electricity has been approximately 3% and the trend is toward a slightly lower growth rate. Hydropower resources are static, and the use of geothermal, solar and wind energy either to generate electricity or to supply heat directly cannot be expected to supply more than 10-15% of the near-term future electrical demand. The most abundant resources which the United States has to produce electricity are uranium and coal. (U. S. Department of Energy, Annual Energy Outlook for 1984 with projections to 1985, EIA Office of Markets and End Use, (DOE/EIA-0383) USDOE, Washington, D.C 1985):

Both in the scientific literature and in the popular press, long term climatic change and possible anthropomorphic forcing functions are enjoying unprecedented attention. Within the scientific literature, there is continuing steady progress in compiling and synthesizing evidence of past climatic change and the modeling of the parameters of future climatic change. Careful science would acknowledge that causal connections are still quite speculative in spite of some "official" pronouncements to the contrary. It can be concretely offered that major climatic change has occurred throughout the quaternary and will likely continue.

Within the popular press, there is a remarkable increase in apparent public interest in climatic and ecologic change and its economic and strategic implications. This interest extends to a concern of the ecologic effect of CO<sub>2</sub>, SO<sub>2</sub>, and NO<sub>x</sub> emissions from coal-fired electricity production and, thus, for the first time, a realization of several benign aspects of nuclear normal operations. The double effect of all this is renewed discussion of the nuclear option and increased focus on the waste or back end of the cycle as the ecologically crucial aspect of that option.

The risk a society incurs with any method of power production is a function of production level. To date the waste confidence issue has been narrowly defined (this was the aspect - no consideration of long term effect - which gave rise to the original litigation). Over the long term, the central question may be what level of electricity production is appropriate. This entails a whole gamut of considerations which include energy mix (as petroleum supplies become scarce or expensive), life style change, climatic change, and technological breakthrough (whether in conservation - perhaps via superconductivity), production in the form of advanced reactor design, or waste management or reduction. This perspective entails all of the complexity which was alluded to in the opening paragraph of this section, and which makes bounding of risk a very imprecise matter.

The only certainty is that to the extent waste can be minimized (or safely utilized), risk will be minimized (or sharply utilized), cost of waste management will be minimized, waste confidence will be increased and the technology choice will become more obvious.

#### IV. THE "STATE OF KNOWLEDGE" WITH RESPECT TO THE WASTE CONFIDENCE ISSUE

The choice of the term "state of knowledge" by the D. C. Circuit in the original waste confidence litigation may be in retrospect a curious one. "Knowledge" may refer to technical knowledge in a systems engineering context, to knowledge of risk in an epidemiological or other sense, or, finally, it may refer to a given policy choice concerning waste management as being more obviously correct. The phrase may also refer to greater consensus either by reason of technical knowledge, epidemiological knowledge or some other knowledge (perhaps ecologic, economic or political) which is beyond the engineering of a specific system and its immediate (proximate) effects.

The original waste confidence decision was finalized in a context which is briefly summarized in Section II of this report. The two overriding parameters of that context were the passage of the original Nuclear Waste Policy Act and the assumption that commercial spent fuel would<sup>not</sup> be reprocessed.

In the interim, the reprocessing assumption has been politically and economically deferred. In addition, the amendments to the Nuclear Waste Policy Act reflect some implicit and explicit Congressional policy judgments. Perhaps it can be said that sufficient data had been gathered since the NWA of 1982 to indicate to Congress the full cost of characterization of three sites simultaneously and sufficient data had also been gathered to indicate which site was the best candidate to characterize initially.

Legislative developments since the original waste confidence decision are two pronged. There has been increasingly stringent regulation aimed at elimination of land disposal of hazardous waste and protection of groundwater resources (in the form of amendments to RCRA, CERCLA, CWA, and the SDWA). Simultaneously,

## Summary Report: The State of Knowledge of Waste Confidence

there has been a legislative (the basis of which was at least partially technical consideration) narrowing of potential sites, a spent fuel and HLW repository from three to one. What this says about waste confidence depends on the extent to which a deep geologic repository for HLW may be distinguished from land disposal of hazardous waste and how the narrowing of three sites to one bears upon waste confidence.

There are in the neighborhood of ten (e.g., Groundwater Travel Time, Definition of Substantially Complete Containment, Implementation of the EPA Standard, etc.) items which either are presently, or are being considered potentially as subjects for NRC rulemaking and which at least tangentially bear upon waste confidence. It would greatly exceed the scope of this Summary Report to describe these various endeavors, let alone indicate an interrelationship or hierarchy vis a vis waste confidence. However, it would be proper to suggest that all of these matters are part and parcel of the "state of knowledge" in which waste confidence must be addressed.

### V. OBSERVATIONS FOR THE SHORT AND LONG TERM

The Commission's original waste confidence decision found, significantly, that safe disposal of high-level radioactive waste and spent fuel in a mined geologic repository was "technically feasible." The Commission's explanation or rationale for this finding elaborated that disposal was "technically possible" and "achievable using existing technology" requiring "no fundamental breakthrough in science or technology." While the Commission did express cognizance of both technical and institutional uncertainties as well as cognizance that "the Federal government has, in the past, made inadequate progress in developing sound waste management policies and programs."

The Commission's Waste Confidence Decision was not dependent upon either a finding that a mined geologic repository is necessary for reasonable assurance of public health and safety and environmental quality, or that a mined geologic repository is necessary for reasonable assurance of public health and safety or environmental quality prior to 30 years after a reactor's decommissioning nor was such a basis made necessary by the courts decision which was the impetus for the decision. Further, it should be noted that the original waste confidence decision resulted from a proceeding the focus of which was broader than the D.C. Circuit's instruction on remand. The court's remand simply required the Commission to address the question whether off-site storage for spent fuel would be available by the expiration of reactor operating licenses and, if not, whether spent fuel could continue to be safely stored on-site.

The Commission, therefore, has wisely left itself the latitude to deal with any future legislative developments concerning the back half of the nuclear fuel cycle without prejudging, by exclusion, any of those options which presently may be in the background. Presumably the Commission would wish to retain this latitude in the current context of the waste confidence issue (see Section III above).

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Future consideration of the waste confidence issue may be focused either in its temporal or policy aspects. Certainly, the Commission would wish to strive for understanding of the issue in its broadest definition (economic, ecologic and temporal). However, the extent to which the Commission publicly acknowledges the larger context is a delicate matter in terms of both the Commission's statutorily defined role and its need to remain uncompromised in dealing with future developments, be they technical, policy, or institutional in nature. Similarly, the forum in which the Commission deals with the focused aspects of the waste confidence issue will, in large part, determine the time frame in which some decision must be made, the parties who may participate in it, and therefore, the extent to which those parties contribute to or hinder the process.

Crucial to establishing the Commission's focus in a future waste confidence proceeding is a consideration of the interplay of the various statutes which bear upon the Commission's role (both independently and vis a vis other agencies) in the area of nuclear waste management. The interplay of the two major statutes (the AEA, as amended, and the NWPA, as amended) is presently under study by the Center for Nuclear Waste Regulatory Analyses in connection with developments of the Program Architecture.