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July 18, 1980

PUBLIC COMMENT ON DRAFT ENVIRONMENTAL STATEMENT ON DECONTAMINATION OF DRESDEN I

Director
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir,

Rather than a thorough investigative study, the "Draft Environmental Statement related to Primary Cooling System Chemical Decontamination at Dresden Nuclear Power Station Unit No. 1," is, in general, merely a publication of correspondence between concerned individuals, members of the Nuclear Regulatory Commission (NRC), and the Department of Energy (DOE). In the opinion of the ISEA, a project of the scope and size of the Dresden I clean-up warrants a complete, detailed, and fully documented environmental study. The draft environmental statement falls far short of this goal for many reasons, a few of which include:

1) Sec. 2.3, Need for Decontamination
"The decontamination effort will facilitate implementation of other actions ordered by the Commission such as the installation of a new high pressure coolant injection system, in service inspection, and modifications to the reactor protection system."

Comment: Nowhere in the draft environmental statement are the implications for reactor safety of an extended wet lay-up period raised. According to a Brookhaven National Laboratory Memorandum dated April 16, 1979 from John Weeks to Frank Almeter:

> What has not, however, been adequately demonstrated is the effect of leaving residual NS-1 solvent at ambient temperatures for a period of ten months between the planned August, 1979, cleaning and the June, 1980, return to service...However, in creviced areas such as those used around, for example, type 410 bolts, or in creviced pockets of the type shown where the NS-1 has by galvanic corrosion caused a substantial undercutting of the vessel clad in the vicinity of the defect, I suspect that significant amounts of the NS-1 solvent may indeed be trapped. There is a further possibility that potentially harmful impurities such as chlorides or sulfates that had been absorbed in the crud deposits on the piping and removed by NS-1 could also be trapped in these crevices; with air in the reactor vessel, local galvanic cells could be set up that could cause corrosion to continue during the period of wet layup...The NRC has seen enough problems with the residuals of corrosive solutions left in reactors during

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> long periods of wet layup, as in the Palisades steam generator incident several years back, that we should be somewhat cautious in this area.

The memo continues:

> Further, Table 1.C.1 of the Dow report states that the type 410 steel is used in a number of pins, screws and bolts in the core support structure where there would undoubtedly be crevices around this material from which NS-1 solvent may not be properly rinsed following the cleaning and in which possible copper deposits may remain following the copper rinse procedure. As stated in the Dow report, some areas continue to have small patches of undissolved copper typically within tight crevices; copper deposits are known to produce a potential at which intergranular stress corrosion of sensitized stainless steel is most likely to occur. (Complete memo attached)

While the above dates are obviously in need of revision, the concerns raised by Weeks still appear to be valid particularly in light of the extended time period which may be required for the stated installations, inspections and modifications to be completed.

2) Sec. 4.2.1 B Occupational Radiation Exposure Because of Decontamination Operation

"The NRC staff has reviewed the licensee's methods of estimating occupational exposure during this project. We conclude that these methods are conservative and that the estimates realistically bound the anticipated dose and are acceptable to the staff."

Comment: Since the NRC itself states in its news announcement dated June 3, 1980 that one of the "major" issues in the environmental review is "the occupational radiation exposures associated with the proposed decontamination...," it seems negligent to omit from the draft environmental statement the licensee's methods of estimating occupational exposures expected during this project. While the NRC concludes "that these methods are conservative and that the estimates realistically bound the anticipated dose and are acceptable to the staff," the methods are not presented in the environmental statement for public scrutiny. How can the public adequately judge the correctness of the NRC's conclusion when the basic data is not included? What projected exposure levels from what accidents have been taken into account? For example, "[t]he radwaste facility specifically constructed for the process has been designed for remote operation of all phases, including filling, capping, and storage of the waste drums." What exposure levels would result if this remote system breaks down and the work needs to be completed by manual labor? Could potential exposure levels be high enough to preclude completion of the project?

3) Sec. 4.2.1 C Conclusion from Occupational Exposure Review

"Based on the estimated occupational exposure savings of 7500 to 12,500 man-rem because of the decontamination operation, we conclude that the expenditure of the estimated total exposure of 300 man-rem for the decontamination operation would result in a significant net reduction of exposure over the remaining years of plant operation. The decontamination operation itself, therefore, can be an effective method of maintaining the long-term overall occupational exposure to ALARA."

Comment: The logic of this conclusion is devastated by the fact that electricity from the Dresden I reactor is not needed. The attached chart* demonstrates Edison has large reserve margins which would not be significantly reduced by continued removal of the relatively small Dresden I from the company's generating capacity.

*"Troubled Edison Faces Fight Over Growth," Chicago Sun-Times, June 8, 1980

4) Sec. 4.2.1 C (con't)
"For the decontamination operation, the estimated radiation exposure of 300 man-rem represents an increased risk of premature fatal cancer induction prediction of less than one-tenth of one event...The increased risk of this exposure on genetic effects to the ensuing 5 generations is also predicted to be less than one-tenth of one event."

Comment: The accuracy of the above prediction is questionable. New information contained in a Natural Resources Defense Council Bulletin states that Arthur Tamplin and Elizabeth Shafer conclude that the report of the National Academy known as the BEIR Report underestimated the effects in the low-dose exposure range possibly by a factor of 10. For example, new studies suggest that the estimated effects of 1 million person-rem are not 100 to 450 induced cancers, but 4500. Genetic disorders from the exposure, listed only as 30-750 in the BEIR Report, may be in the range of 240-6000. These findings seem to suggest that there is a super-linear effect operating, i.e. that low doses cause proportionately higher damage than would be predicted by the linear theory of dose-effect. While the NRC currently does not recognize the validity of this new information, the public should be aware of the great controversy surrounding the safety of exposure to low-level radiation and the adequacy of the NRC's standards.

5) Sec. 4.2.1 C (con't)
"The estimated dose of 300 man-rem will spread over about 350 workers over at least a one-year period. Therefore, the average dose to a worker for this operation will be roughly 1 man-rem or one-fourth of the variation in natural background radiation between Denver and Washington over an average lifetime of an individual. It is not evident that the variation in natural background would be a significant factor influencing any decision on an individual's activities (i.e. moving from Denver to other locations of lower background radiation levels). Therefore, the fractional increase in comparison to background radiation resulting from the decontamination operation represents an insignificant and acceptable impact."

Comment: The comparison of projected exposures from the Dresden decontamination to variations in background radiation is unwarranted and misleading. Some persons may interpret this comparison to mean exposure to background radiation is safe. However exposure to even small amounts of radiation from any source including background radiation increases one's risk of sustaining cell damage the effects of which are cumulative. Also, exposure to background radiation is unavoidable while exposure to radiation from the decontamination project is avoidable.

6) Sec. 4.2.3 Radioactive Waste Disposal
"The solidified radioactive waste from the Dresden Unit 1 Decontamination will be shipped to a commercial low-level burial site in either Beatty, Nevada or Hanford, Washington. These sites have been chosen as waste burial locations because of their dry, arid environment and their favorable geologic, hydrologic and meteorologic features. These two sites are located in dry desert locations where there is a very low annual rate of precipitation and a very deep water table. These two features combined with the remote location of these burial sites, provide assurance that the waste can remain isolated from the human environment for a period long enough to allow the principal radionuclides to decay to significant levels."

Comment: The solution of burial in dry commercial sites (or a federally-owned site as suggested in response to Question 3, ISEA, in the Appendix if transuranics appear in unexpectedly high concentrations) remains inadequate in light of man's inability to predict climatic conditions over the long time spans this waste remains dangerous to life. Recent volcanic activity and possible changing weather patterns already challenge the acceptability of both the federally-owned and commercial sites in Washington. Public pressure and/or state actions may force closure of the Nevada and Washington sites. With no other dry sites available in the country, the ISEA's concern that the chelated wastes may stay in Illinois remains valid.

Disagreement still exists regarding the "principal" radionuclides which may appear in the chelated waste and thus the length of time required for waste isolation. The table presented in Response 3 to Question 3, Drey, excludes nickel 63 which has a half-life of 92 years. However because Dresden I feedwater tubing was 70-30 copper-nickel and originally had admiralty condenser tubing, could not significant concentrations of nickel isotopes appear in the crud? (See p. 11, 24, 25 from "Primary System Shutdown Radiation Levels at Nuclear Power Generating Stations, PB 251 343--attached)

7) Sec. 4.2.3 (con't)

"Decontamination wastes containing chelating agents will be segregated from other wastes, stored separately, and be disposed of either in separate trenches or in specifically segregated areas within an existing trench, and isolated from other wastes with 10 feet of soil. However, this waste does not require segregation from wastes containing toluene, xylene or other organic material."

Comment: While segregation of chelated wastes is proposed, why isn't separation from toluene and xylene or other organic material required? Aren't these chemicals capable of dissolving polymers?

Additional Comments:/ a. The pros and cons of deactivating or breaking down the chelate complexes are treated only in a response to Question 4d, Drey. While a response to her question 3c seems to indicate "the leach rates were slightly better for Cobalt 60 when NS-1 waste was compared to the other reactor wastes tested," no numerical data is presented in the draft environmental statement to demonstrate how much better the Cobalt 60, NS-1 sample performed. Therefore the public cannot judge the validity of the conclusion that deactivation of chelates is not a superior choice when a total risk/benefit comparison of burying chelated vs. burying nonchelated or deactivated wastes is made.

b. What assurance does the public have that "full scale qualification tests using simulated waste " can be used as an accurate prediction of the behavior of actual wastes?

c. What measures can be taken in the event wastes in drums do not completely solidify? While a layer of liquid in the waste drums apparently is not expected if wastes are "solidified in accordance with the procedure specified by the manufacturer," the possibility of this occurrence should not be ruled out. According to certain tests cited, under "worst case" conditions, containers could corrode through during handling and storage if not buried within a few months of solidification. Another figure cited elsewhere is 1 month. (The data on leach rates is perhaps the most poorly organized of all subjects presented in the draft environmental statement.)

8) Sec. 4.3 Environmental Impact of Postulated Accidents

Comment: This section does not/fully describe possible accidents nor the exact procedures to cope with them. If specific postulated accident scenarios are not presented, how can their environmental impacts be adquately assessed by the public?

9) Impact of Alternatives

Sec. 5.2 Shut The Reactor Down Permanently

"The permanent shutdown of the reactor would , therefore, result in the need to purchase approximately 300 million dollars worth of replacement power over the remaining 15 years that the Dresden I license is in effect."

Comment: Justification for the choice of decontamination over reactor shutdown is based on the assumption that electricity from the plant is needed. What demand projections are being used as a basis of the claim that "300 million dollars worth of replacement power over the remaining 15 years..." will be needed? Edison's large present and future reserve generating capacities (see chart from Chicago Sun-Times, June 8, 1980, attached), the lower than expected growth rates in peak demand, and the untapped potential of conservation incentives combine to show that electricity from Dresden I simply is not needed.

The ISEA formally requests the public comment period be extended as the public meeting to be held in the vicinity of the plant has not yet even been scheduled. Persons learning of the decontamination can then be afforded an opportunity to submit their comments.

Sincerely,

Marilyn J. Shineflug
Chairperson, ISEA

BROOKHAVEN NATIONAL LABORATORY

MEMORANDUM

DATE: April 16, 1979

TO: Frank Almeter

FROM: John R. Weeks

SUBJECT: Chemical Decontamination of Dresden 1 Review of Documents Submitted in March, 1979 (2/15/79 CECo to NRC)

As a general rule, I think sufficient data have now been obtained to give some confidence that the chemical cleaning of this unit can be carried out without significant damage to the materials. There are sufficient stress corrosion data on most of the material and on the rates of crack penetration on specimens simulating defects in the vessel cladding. However, all of these data were taken under conditions that simulated return of the unit to service shortly following the chemical cleaning operation. Under these conditions the remaining NS-1 solvent will be decomposed by the higher temperatures into relatively harmless constituents and no additional corrosion will occur. This has been adequately demonstrated. What has not, however, been adequately demonstrated is the effect of leaving residual NS-1 solvent at ambient temperatures for a period of ten months between the planned August, 1979, cleaning and the June, 1980, return to service. I discussed this particular point with W.L. Walker during the course of the NACE meeting in March. He advised me at that time that there will be a number of rinses following the chemical cleaning. Walker also advised me that at room temperature the corrosion rates of most materials in the NS-1 solvent are significantly lower than they are at the higher temperatures at which the cleaning will take place. However, in creviced areas such as those used around, for example, type 410 bolts, or in creviced pockets of the type shown where the NS-1 has by galvanic corrosion caused a substantial undercutting of the vessel clad in the vicinity of the defect, I suspect that significant amounts of the NS-1 solvent may indeed be trapped. There is a further possibility that potentially harmful impurities such as chlorides or sulfates that had been absorbed in the crud deposits on the piping and removed by NS-1 could also be trapped in these crevices; with air in the reactor vessel, local galvanic cells could be set up that could cause corrosion to continue during the period of wet layup. I think the subject should be addressed by the applicant if indeed the information that Walker gave me can be demonstrated by existing results or can be demonstrated by rather a simple test. The NRC has seen enough problems with the residuals of corrosive solutions left in reactors during long periods of wet layup, as in the Palisades steam generator incident several years back, that we should be somewhat cautious in this area.

(27)

April 16, 1979

TO: Dr. Frank Almeter

The Dow report DNS-D1-029 said that highly stressed samples of type 410 stainless steel show relatively high rates upon exposure to the Dow solvent NS-1. However, they indicated that maximum expected stress levels in the Dresden system for this material are much less than the 85% of yield at which it was tested. In the absence of detailed information on thermal stresses, bolting stresses or other residuals from fabrication or from heating up to the operating temperature, I think we should assume that at least some of the type 410 material may be at the higher stress level and examine what actually has happened to this material during the cleaning. The Dresden letter BPS 78-1550 indicates that metal surveillance including this material will be performed during the cleaning. This is all well and good. I am, however, somewhat concerned at the relatively high corrosion rates of this material and that the fact that what are given are average corrosion rates as indicated by weight change measurements whereas figures 1.C.2 and 1.C.3 from the Dow report indicate that the corrosion is somewhat localized, and the maximum penetration rates must be at least a factor of 2 greater than the average penetration rates given in the report. Further, Table 1.C.1 of the Dow report states that the type 410 steel is used in a number of pins, screws and bolts in the core support structure where there would undoubtedly be crevices around this material from which the NS-1 solvent may not be properly rinsed following the cleaning and in which possible copper deposits may remain following the copper rinse procedure. As stated in the Dow report, some areas continue to have small patches of undissolved copper typically within tight crevices; copper deposits are known to produce a potential at which intergranular stress corrosion of sensitized stainless steel is most likely to occur. (This is, of course, the principal of the Strauss test for sensitization). I, therefore, would suggest that some of the type 410 surveillance specimens be stressed heavily and contain crevices so that following the chemical decontamination and copper rinse it will be possible to ascertain what is going on in the real system that is in the creviced (bolts etc.) areas within the core support structure.

The possible crack extension underneath the simulated cladding defects on the reactor vessel* should, of course, be carefully evaluated by the fracture mechanics people within the NRC. I am concerned in this area particularly that unremoved solvent during the rinsing process may cause these cracks to extend more than described in Walker's work, in which the system was rapidly heated to BWR operating tempratures and the solvent materials decomposed thermally.

Once these reservations are satisfactorily resolved, I believe that the Dresden 1 unit can be safely cleaned and safely returned to service for continued operation, subject possibly to increased in-service inspection, particularly of stress corrosion sensitive areas such as heat affected zones of welds in piping.

*Do we know whether such defects exist, or is this only a hypothetical possibility?

JRW:ob

Dist. W.Y. Kato
Corrosion Science Group Files (10)
V. Noonan
W. Hazelton
J. Knight
S. Pawlicki

Troubled Edison faces fight over growth

Claudia Ricci and Tom Furlong

Sun-Times
Sunday, June 8, 1980

Commonwealth Edison's nuclear construction program, stricken by poverty and encircled by critics, goes on trial later this month before the Illinois Commerce Commission.

In the short term, the commission will consider the economics of further delaying completion of the utility's Braidwood nuclear plant near Joliet.

Ultimately, however, the debate will shift to a more fundamental question: how quickly should Edison build new plants now that growth in the public's appetite for electricity is subsiding?

Moreover, the commission is trying to pinpoint what the utility's new plants will cost inflation-weary customers.

"There's no question that construction of these plants is forcing up rates," said Wanda Kamphuis, who's acting as the examiner in this week's hearings. "The question is whether it's more economical to force up the rates and build those plants now."

"The company has dug themselves in over their heads," said Deborah Senn, attorney for the Illinois Office of Consumer Services, who opposed Edison's last rate increase.

"Frankly," she said, "we wonder why Edison continues to build so many units when there is so much evidence that growth in electricial demand is down."

The hearings are in two phases. Phase I, which concerns the economics of the Braidwood plant, will recommence (it began last year) June 30 in Chicago and should last no more than a week. Phase II, which concerns the utility's entire building program, should commence by late summer, Kamphuis said.

The consumer advocates who requested the hearings say electricity bills have been skyrocketing because Edison planned for too much electrical demand during the mid-1970s.

While conceding the utility's "crystal ball" was way off, George Rifakes, utility vice president for fuel and budgets, says no one could have predicted the 1973 Arab oil embargo, the main cause of higher petroleum prices and lessened electrical demand.

"We had a helluva good record on forecasting until 1974," Rifakes said. In the near term, there's little argument that Edison's multibillion-dollar construction program has meant larger electricity bills. That and inflation are the prime reasons the financially wobbly utility recently received a 16 percent rate hike, the highest ever granted by the ICC.

Everyone agrees customers will be digging even deeper into their pockets again soon. More income from the rate payers is needed so the company can attract investors and continue the building program. The utility now plans to have three new nuclear plants on line by the mid-1980s.

Recently, however, Edison unexpectely announced delays in those nuclear plants, including a two-year delay at Braidwood, because of "additional engineering and construction requirements." Kamphuis said the hearings will proceed nonetheless, with a further delay of Braidwood [illegible] 1988 possible.

The hearings are coming at a time when utilities from Long Island to California are shelving or stalling power plants.

In California, energy regulators believe that through conservation efforts, 4 percent economic growth can be achieved in

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Critics hit Edison growth plans

Continued from Page 8

tandem with a 1.5 percent electricity growth. Detroit Edison announced two months ago it had scrapped plans to build two nuclear plants in part because it didn't need the power.

One of the core issues in the Commonwealth Edison hearing is the so-called reserve margin, which is the excess capacity the utility maintains over and above the summer peak load. In 1979, this figure was above 30 percent, more than twice the 14 percent that even Edison says it needs to prevent possible blackouts and brownouts.

EDISON EXECUTIVES explain this condition is temporary. They say it's the result of circumstances beyond their control, such as cool weather and the unexpected lower demand. They admit, though, that reserve margins will continue to be substantially in excess of 14 percent (see chart) until late in the decade. To Edison's critics, though, the excessive reserve margins are proof the utility has become dangerously overweight.

Historically, the demand for electricity increased about 7 percent per year. But beginning in 1973—about the time Edison was charting its present expansion—growth in demand began to plunge. It has averaged about 3 percent most of the decade.

As recently as 1978, Edison's forecast called for a growth rate of 6.5 percent. The company now anticipates a 4 percent annual increase through the 1980s.

A forecast reflects a number of criteria, particularly past trends in electricity usage and weather. Usage is measured in terms of "peak demand," the maximum electricity used during a year. Typically, electricity use peaks on the hottest day of the summer, when air conditioners run all day.

Consumer groups say utilities overestimate future demand in order to justify more construction and higher profits. These forecasts fail to account for the impact conservation and higher prices will have in further reducing electricity growth in the future, they say.

Robert Goldsmith, attorney for Citizens for a Better Environment and one of Edison's most active adversaries, says excess capacity cost customers $93 million in 1979. With 2.9 million customers, that comes to about $32 per customer.

THE UTILITY replies that plant delays are what cost the customer most dearly. A one-year delay at a single site can mean increased installation costs and operating costs of nearly $500 million, says chairman James J. O'[illegible].

O'Connor says Edison will request another rate increase this year, but he doesn't say when or how much it will be. Some industry analysts predict the amount will be in the range of the $452 million they requested ($359 million granted) last time.

The higher rates are needed, say the analysts, to improve Edison's financial picture, depicted in terms ranging from "very bad" to "pathetic."

1980s Commonwealth Edison Reserves (estimated)

Year	Peak Load (megawatts)	Summer Capability (megawatts)	Reserves
1980	14,750	17,717	+20.1%
1981	15,270	18,765	+22.9%
1982	15,910	19,510	+22.6%
1983	16,670	19,501	+17.0%
1984	17,470	20,621	+18.0%
1985	18,290	21,741	+18.9%
1986	19,150	22,803	+19.1%
1987	20,030	24,118	+20.4%
1988	20,930	23,806	+13.7%
1989	21,830	24,[illegible]	+14.1%

Sun-Times chart

BIBLIOGRAPHIC DATA SHEET	1. Report No. EPRI 404-2.	2.	PB 251 343

4. Title and Subtitle Primary System Shutdown Radiation Levels at Nuclear Power Generating Stations	5. Report Date December 1976
	6.
7. Author(s) W. Pearl, N. Jacob, S. Sawochka	8. Performing Organization Rept. No.
9. Performing Organization Name and Address Nuclear Water & Waste Technology P. O. Box 6406 San Jose, CA 95150	10. Project/Task/Work Unit No. RP 404-2
	11. Contract/Grant No.
12. Sponsoring Organization Name and Address Electric Power Research Institute 3412 Hillview Avenue Palo Alto, CA 94304	13. Type of Report & Period Covered FINAL REPORT
	14.

15. Supplementary Notes

16. Abstracts This report documents the results of a survey of operating nuclear stations to determine the extent and seriousness of radioactivity buildup in nuclear plants; to access the value of the available data base for extrapolating observations to longer operating times; to define corrective options and associated R&D programs; and to define additional information gathering programs where needed.

17. Key Words and Document Analysis. 17a. Descriptors

Light Water Reactors
Radiation Levels
Radioactivity Buildup
Survey

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
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	20. Security Class (This Page) UNCLASSIFIED	

Inconel-600 tubed systems. Assuming a fixed cobalt impurity level in the base metal nickel, Co-60 inventory would be similarly affected.

It should be noted that as of 1970, Westinghouse reported insignificant differences in steam generator radiation levels between all stainless and stainless-Inconel plants.[1] This observation is not necessarily incompatible with the differences in possible parent nuclide system inventories because of the complexity of the contamination process. For example, the difference in corrosion product composition could also affect the tendency to deposit on in-core surfaces (which is required for activation), release from in-core surfaces after activation, or removal by the purification system.

In a BWR system, the major source of corrosion products entering the primary system is via the feedwater as a result of incomplete removal by the condensate demineralizer system.[2] Differences in system materials can significantly affect the feedwater corrosion product composition and input rate to the core. For this reason, large differences in shutdown radiation levels can exist between early generation and current generation plants. Of major significance are the expected differences between plants with copper or nickel alloy feedwater heaters (Admiralty, copper-nickel, Monel) and those with stainless steel heater materials. The rate of nickel input to the core has been as great as 90 kg/y in the former type systems even in plants rated at $<$ 300 MWe.[3] In large stainless steel heater systems ($>$ 500 MWe), the nickel input is less than 5 kg/y.

In addition to this major effect, differences in corrosion product input and composition are also expected with differences in condenser alloys and modes of condensate treatment. It should be recognized that all BWRs have full flow condensate treatment. Either deep beds operated at 70 to 125 m/h or powdered resin precoat demineralizers operated at 8.6 to 10.5 m/h are employed. With Admiralty tubed condensers and deep bed demineralizers, very low levels of soluble copper and zinc are observed in the reactor water. This generally corresponds to low Cu-64 and Zn-65 levels in the reactor

copper

Shutdown Radiation Levels

Radiation level data were collected from 13 BWR units. Major system variables for each unit are given in Tables 12 and 13. Results obtained at each plant are summarized in the Appendices.

The following nine surveyed BWR plants were considered representative of current generation BWRs, in particular relative to major sources of corrosion products and therefore Co-60 and Co-58.

Dresden 2	Monticello
Dresden 3	Millstone 1
Quad Cities 1	Vermont Yankee
Quad Cities 2	Pilgrim 1
Nine Mile Point 1	

Each of these plants has stainless steel recirculation piping, a stainless steel clad pressure vessel, Zircaloy-2 fuel cladding, and an all ferrous feedwater system.

The remaining four plants, Big Rock Point, Dresden 1, Humboldt Bay, and LaCrosse, have operated for varying periods of time with Admiralty, copper-nickel, and/or Monel feedwater heaters.

Since large inputs of copper, nickel, and zinc during such periods will have an overriding effect on corrosion product inputs, fuel deposits, activated corrosion product levels and consequently out-of-core shutdown radiation levels, observations at these plants are not considered representative of current generation designs. Results for these four plants are discussed separately.

Current Generation Plant Data: To allow comparisons among the 9 surveyed plants representative of current generation designs, radiation levels on recirculation piping to and from the reactor were selected.

TABLE 12

MAJOR PARAMETERS FOR SURVEYED BWR PLANTS

BWR Name	Appendix Ref	Net MWe	Feedwater Heater Tubing	Condenser	Fuel Cladding	Recirculation Piping	Condensate Treatment
LaCrosse	1	52	2LP stainless[a] 1HP Monel	Admiralty	Stainless	Stainless	Deep-bed
Humboldt Bay	2	63	Stainless[b]	Aluminum brass	Zircaloy-2	none	Deep-bed
Monticello	4	545	Stainless	Admiralty	Zircaloy-2 Zircaloy-4	Stainless	Powdex
Nine Mile Point	5	620	Stainless	Admiralty	Zircaloy-2	Stainless	Deep-bed
Quad Cities 1	8	810	Stainless	Stainless	Zircaloy-2	Stainless	Powdex
Quad Cities 2	8	810	Stainless	Stainless	Zircaloy-2	Stainless	Powdex
Millstone 1	10	652	Stainless	Aluminum brass and 70-30 Cu-Ni	Zircaloy-2	Stainless	Deep-bed
Pilgrim	11	655	Stainless	Aluminum brass and 90-10 Cu-Ni	Zircaloy-2	Stainless	Deep-bed
Big Rock Point	15	70	Stainless[c]	Admiralty	Zircaloy-2[d]	Stainless	Deep-bed
Dresden 1	18	200	2LP 70-30 Cu-Ni 3HP Monel	Stainless[e]	Zircaloy-2	Stainless	Deep-bed
Dresden 2	19	810	Stainless	Stainless	Zircaloy-2	Stainless	Deep-bed
Dresden 3	19	810	Stainless	Stainless	Zircaloy-2	Stainless	Deep-bed
Vermont Yankee	20	517	Stainless	Admiralty and Stainless	Zircaloy-2	Stainless	Powdex

a) Originally 70-30 Cu-Ni; retubed in mid 1975

b) Originally Admiralty; retubed in 1967

c) Low and intermediate pressure heaters originally Admiralty, high pressure heaters originally 70-30 Cu-Ni; retubed in March 1968

d) Test bundles of stainless, Inconel-600, Incoloy-800, Zirconium-chrome, and Zircaloy-4 cladding intermittantly employed

e) Originally Admiralty; retubed in 1959