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CBE 80-141

a CBE Comment

COMMENTS ON THE

DRAFT ENVIRONMENTAL STATEMENT

RELATED TO THE

CHEMICAL DECONTAMINATION AT DRESDEN UNIT 1

BEFORE THE

UNITED STATES NUCLEAR REGULATORY COMMISSION

SUBMITTED ON BEHALF OF

CITIZENS FOR A BETTER ENVIRONMENT

BY

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Citizens for a Better Environment

CBE comment

INTRODUCTION

The following are comments of Citizens for a Better Environment (CBE) concerning the Draft Environmental Statement (Draft EIS) related to "Primary Cooling System Chemical Decontamination at Dresden Nuclear Power Station Unit No. 1," Commonwealth Edison Company (CECo), May 1980, written by the U.S. Nuclear Regulatory Commission (NRC). CBE is a not-for-profit corporation specializing in environmental research and litigation. CBE has approximately 3500 members in Illinois and over 10,000 members nationwide. Many of CBE's members live near nuclear power plants and are seriously concerned about the environmental impact of these plants.

CBE applauds the NRC decision to do an EIS concerning the decontamination of Dresden 1. However, as these comments indicate, CBE believes the Draft EIS is technically deficient and superficial in its analysis. What is more, CBE has requested by petition a full public hearing on this EIS.

Because the decontamination of Dresden 1 will serve as a model for future decontaminations, CBE believes that this EIS should consider the environmental impact of future, similar decontaminations. It is CBE's position that a programmatic EIS must be done for the decontaminations which are sure to follow that of Dresden 1. Thus the Draft EIS under consideration is not only inadequate insofar as the Dresden 1 decontamination goes, but it is also deficient in that it fails to consider the disposal and transportation of all the waste generated in like decontaminations as well as other generic issues raised in these comments. Hence, to fulfill the ndate[1] of the National Environmental Policy Act (NEPA) the NRC must prepare and circulate an EIS related to the chemical decontaminations of light water, commercial power, nuclear plants.

GENERAL ORGANIZATION AND ANALYSIS

The overall organization and analysis of this Draft EIS are deplorable. Many pages are not even numbered. Several tables and charts are direct transfers from other documents. Much of the text is verbatim from previous memoranda or submittals. All of which evinces a failure to undertake a serious, independent, systematic analysis of the proposed decontamination. This certainly violates the spirit of NEPA and in many instances the letter.[2]

Beginning with Table 1, p. 2-2, the EIS directly lifts this table from CECo's submittal of April 14, 1975. These data are crucial because they are relied upon to determine how radioactive the resultant waste will be. Hence CECo's own data, not the NRC's, form the foundation upon which many steps and decisions are built. The EIS does not mention any confirmatory testing done by NRC or any other federal agency. This abdication of an essential piece of analysis negates the role of federal assessment of the environmental impact of the project.

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1. Section 102 of NEPA requires compliance "to the fullest extent possible."
2. See sections 102(2)(A) which requires a "systematic, interdisciplinary approach" and 102(2)(C) which requires a "detailed statement."

Tables 3, 4 and 5 and figure 2 in the Draft EIS are all identical to Table I, pages 5-9, and Figure II, p. 15, found in CECo's "Dresden 1 Chemical Cleaning Licensing Submittal," dated December 16, 1974. This direct transfer from CECo's submittal to the EIS again reflects the utter dearth of independent agency analysis. All the alternatives short of shutting the reactor down (see infra) are thus left up to the interested industry. In no sense of the term can the NRC in this Draft EIS be said to have taken a "hard look" at the environmental consequences. If anything, the uncritical adoption of an industry study submitted nearly six years ago demonstrates the NRC's desire to justify a decision already made and thus directly contravenes the Council on Environmental Quality (CEQ) regulations implementing NEPA, 40 CFR 1502.2(g) and 1502.14.

The analysis of Radioactive Waste, section 4.2.2, p. 4-6 et seq., is derived virtually word for word from Attachment 1 to a memorandum from G.W. Knighton to D. Ziemann, dated June 21, 1979. Even the conclusion on p. 2 of Attachment 1 is identical to the conclusion at the end of section 4.2.2 of the Draft EIS, except to the extent that the Draft EIS cites different regulations and statutes. On the face of it, this is not necessarily illegal since the NRC did perform some of its own analysis. However, it should be noted that Attachment 1 is based in part upon an earlier evaluation of December 9, 1975 along with information added since 1975. The EIS, on the other hand, adds nothing to the analysis of June 1979 and thus we wonder whether the NRC has overlooked any new developments and information since that time. Again this betrays NRC's cavalier attitude toward this EIS.

To a lesser extent the section on Occupational Radiation Exposure, 4.2.1, pp 4-1-4-6, is derived from a memorandum from G. Knighton to D. Ziemann, dated February 13, 1979. This section, in addition to the previous sections derived elsewhere, leaves only four to five pages of text which were done for the sake of this EIS. It is clear that this EIS is a "cut-and-paste" job and by no stretch of the imagination fulfills the requirements of NEPA.

ANALYSIS AND NATURE OF THE RADIOACTIVE "CRUD"

The initial step in analyzing the problem of radioactive deposits on reactor cooling pipes is to accurately identify the nature of the deposits. The NRC has apparently failed to accomplish this task. The value for the total amount of radiation, as reported by the NRC to Prof. Banaszak on 9/7/79, has a very large error (3000 ± 1000 curies). The total amount of radiation to be removed has an impact on several areas of the project, especially radiation exposure and waste disposal. Without an accurate assesment of the amount of radiation in the pipes there cannot be effective planning. The Draft EIS also does not indicate how the sampling was done, where the samples came from, how long they had been removed from exposure to radiation (in order to determine the presence of shorter lived isotopes), and the source of the large error.

The second critical question after the determination of the total amount of radiation to be removed is an analysis of the specific radionuclides present in the crud. There are two aspects to this question. First the possible presence of fission products and transuranics and second the presence of other radioisotopes generated from the materials in the cooling system. It is surprising to us that Table 1 does not contain any isotopes of materials found in the cooling system such as Fe, Cr, Ni or Cu isotopes. It is odd that the components of stainless steel (which was most likely used for at least part of the cooling system) would not contribute to the radionuclides in the crud. Furthermore a study by EPRI (see Appendix A) in December 1976 indicated that in 1968 large quantities of Cu-64 were found in the reactor water. Since Table 1 was constructed by CECo in a report prior to the shutdown of Dresden 1 in October 1978 it is surprising that Cu-64 is not included in the table.

The presence of fission products in the crud is of even greater concern given their longer half lives. The same EPRI report, mentioned above, indicated that Cs-134 and Cs-137 had been in some deposits in the stainless steel clean-up piping at Dresden 1 during a decontamination of the clean-up loop. Both Cesium isotopes are fission products with half-lives of 2.1 and 30.1 years respectively. Furthermore the Draft EIS mentions in section 4.2.2 that radioactive Iodine levels will have decayed to insignificant levels. If I-129 or I-131 are present, then other long lived fission products should also be present. If the NRC concludes they are not, a detailed explanation of that conclusion is necessary. As mentioned previously, paragraph 4.2.2 in the EIS was copied nearly verbatim from an earlier CECo report. Only the sentence on the radioactive iodine was added. Obviously the NRC thought it important enough to mention the possible problem from Iodine isotopes (and by implication the presence of other fission products) in the crud but not important enough to offer any reasons or explanations. The absence of any of these radioisotopes from Table 1 or any explanation of their absence raises serious questions about the adequacy of the analyses performed by CECo and Dow and their subsequent evaluation by the NRC.

CORROSION

One of the primary concerns of the NRC should be some assurance that the decontamination does not degrade the integrity of the primary coolant system boundary. Unfortunately the Draft EIS addresses this problem most perfunctorily. One of the bases of public concern over the decontamination has been the possibility of damaging the reactor and thus precipitating a major accident in the future. The NRC has ignored the concerns of the public as well as of government scientists. In particular, a memo from John Weeks (4/16/79) at Brookhaven National Laboratories (BNL) expressed concern that significant amounts of NS-1 solvent might be trapped in creviced areas around bolts or in creviced pockets formed by galvanic corrosion near defects of the vessel clad. The water rinse cycles could easily fail to remove such trapped solvents. The longer the solvent remains, the more corrosion becomes significant.

These concerns were initially raised by studies done by Dow and GE on various steel types found in the reastor. Those studies reported that type 410 steel which is used in a number of bolts and valves in the core support system is susceptible to corrosion under certain conditions. The BNL memo said that such conditions could readily exist in the reactor

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especially if there is an extended period between the decontamination and start up. It is likely there will be such an extended period since Dresden 1 will not be on line again until 1986.

At page 14, Appendix A of the Draft EIS, the NRC states that the chelating agent decomposes at 300 deg. F. Without knowledge of the formula for NS-1 it is impossible for commenters to confirm whether those decomposition products will indeed be innocuous. It is likely that the decomposition products will include other complexing agents or remain corrosive in some other fashion. Thus even the start up of the reactor would not alleviate the problem of trapped solvent.

REMOVAL AND CONTAINMENT OF USED SOLVENT

Since the decontamination solvent is not described in detail because of proprietary rights, several questions arise concerning the nature of the radionuclide-chelate complex. Since such complexes and the uncomplexed chelates are known to be highly mobile in the environment (see Crerar et.al. article referred to in Appendix A of the Draft EIS) and the food chain, there is great concern over any possible release of these materials.

After the decontamination, CECo plans to concentrate the decontamination solvent and the first rinse in an evaporator and further purify the distillate by passing it through a demineralizer. Other rinses, if necessary, will be purified similarly. If the complexes are non-ionic, significant quantities of radioactivity may distill over into the distillate along with some uncomplexed chelate. Moreover, any non-ionic species will be less efficiently removed from the distillate or later rinses than will ionic species. Such a situation could lead to increased time and costs in purifying the waste water and storage of the wastes. The Draft EIS also does not address the fate (i.e. eventual disposal) of these demineralizers and evaporators. They could be highly contaminated with radioactivity.

Also, if any chelate (whether complexed or not) were trapped in the pipes and only slowly leached out over time, it could eventually be flushed into the Illinois River. The release could cause radionuclides emitted in past years and now trapped in river sediments to be resuspended or redissolved and thus reenter the food chain. This would pose a long term problem even if only small quantities of chelate were involved. Even 0.01 of the original 200,000 gallons from the decontamination and first rinse could provoke serious environmental consequences. The Draft EIS does not adequately discuss these points, if address them at all.

PACKAGING AND DISPOSAL OF THE CONCENTRATED WASTE

The Draft EIS states that the concentrated waste will be solidified with a vinyl ester-styrene polymer in 55 gallon steel drums. In the process of describing the procedure (Draft EIS, section 4.2.3) the NRC shrugs off concerns about (1) the lifetime of the steel drums and whether they will remain intact long enough to be buried, (2) that the polymer matrix and steel drums will not prevent significant leaching, even at the "drier" disposal sites and (3) what will happen if the waste has radiation levels greater than 10 naocuries/gram and cannot be disposed of in a low level waste depository.

As to the durm's lifetime, experimental results from BNL (H. K. Manaktala memo, 10/31/79) indicate that pockets of liquid would be very corrosive to commercial grade mild steel used in the drums. Such pockets of liquid could form for several reasons, including mixing errors and variations in the composition of the solidified waste. The data showed that formation of pin holes was easily possible in 1 to 3 months. It is likely, given the extent of the project, that the barrels will not be delivered to the disposal site for several weeks after they are filled. In that time period it is reasonable to assume that some of the drums could develop small leaks. In the face of the BNL conclusions, the Draft EIS (section 4.2.3) concluded otherwise.

The Draft EIS almost completely ignores the problems of chelates leaching into the environment by saying that the chelate complexes will be trapped in the polymer matrix and surrounded by a "dry environment". However even in a dry environment a concentrated plume of chelate bound radionuclides could slowly leach out of the barrels and eventually the site. The solidification is only for ease of transportation and to slow down leaching - not eliminate it. In this case migration could be easily aided by the NRC's proposed burial policies. In particular, the NRC proposes to segregate the waste from everything but organic materials like toluene and xylene. In our experience such materials could probably dissolve the polymer

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matrix freeing the radionuclide-chelate complexes. In such a situation a highly dangerous form of radioactivity whose physical and chemical characterisitics are unknown would be released. It is frightening to see the NRC recommend a procedure which could have such consequences and runs counter to their own stated goals.

The problems raised in the first section of these technical comments concerning the amount of radioactivity and the nature of the radionuclides has further significance for the waste disposal problem. The presence of significant quantities of long-lived radionuclides and/or transuranics that increases the level of radioactivity over the limit for low level disposal would pose a very real disposal problem for the project. In that case the waste would have to be stored at Dresden until a "depository operated by the U.S government which is authorized to dispose of transuranic waste" is created (Draft EIS, Appendix A). That may take a long time. Alternatively if the waste is still "low level" but with longer lived isotopes than Co-60, leakage from the waste disposal site and contamination of water and the food chain could be very significant and hazardous. In either case, the assurances by the NRC in section 4.2.3 that the waste can be isolated from the human environment for a long enough period of time are not satisfying or even barely adequate given these uncertainties and the unanswered questions in the Draft EIS regarding the amount and type of radioactivity.

TRANSPORTATION AND EMERGENCY PROCEDURES

The Draft EIS does not mention or even appear to have thought about

about the problem of transporting the waste from Illinois to Washington State. We have already described the possibility of pin hole leaks developing in the drums. There is also a real possibility of a highway accident and resulting spills.The latter is even more serious since the NRC estimates from 10 to 100 trucks for transporting these wastes which must be multiplied for future decontaminations the NRC is planning. A spill from one of these trucks could cause severe long term harm. There is no mention in the Draft EIS of special precautions that will be necessary in the case of an accidental spill.

The Draft EIS downplays the possibility of anything going wrong with their plans. There are no contingency plans to inspect inaccessible welds, bolts etc. if accessible welds and bolts show signs of damage from the decontamination. There are few, if any, details on the post decontamination inspection procedures and criteria. There are no stated contingency plans to deal with any other potential problems at the reactor during or after the decontamination. Given the danger from the chelated forms of radiation in terms of human exposure as well as incorporation into the food chain the NRC should have paid more attention to precautions, plans and criteria in case of an accident.

SHUT THE REACTOR DOWN PERMANENTLY

The alternative of shutting the reactor down permanently is given short shrift. Three short paragraphs are directed to the topic and no detail or supporting data are given. The conclusion that \$300 million could be saved over 15 years is unsupported. A 60% "availability factor" is assumed and yet a capacity factor is required to determine the accuracy of the \$300 million. No cost per kilowatthour (kwh) for the replacement power nor for Dresden 1 to operate for the next 15 years are given, eliminating the possibility of auditing the \$300 million. The analysis is thus made up of conclusory statements and violates section 102(2)(C)(iii) of NEPA as well as CEQ regulation, 10 CFR 1502.14.

Even without the supporting data, a \$100,000 per day replacement cost is unduly high. Although \$100,000 per day may fairly represent the cost of purchasing the replacement power from other utilities, it is not a realistic figure. For example, during periods where there is little or no seasonal demand above the base load, such as spring or fall, CECo could very well replace Dresden 1 with its own base load generating plants.[3] Adding to the unreality of the \$100,000 per day figure is the fact that

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3. Excluding Dresden 1, CECo owns over 12,000 megawatts of coal or nuclear plants. (Annual Report of CECo for the year 1979 to the Illinois Commerce Commission (ICC)) CECo's estimated base load for 1978 was 8,727 megawatts (see Exhibit VI-3-b in the rebuttal testimony of G.F. Rifakes submitted by CECo in ICC Docket # 79-0214.) Even if the the base load grows at 4% a year, CECo will own an ample enough margin to use its own base load plants to replace Dresden 1 for much of the year, and in a few years new base load plants will be on line.

CECo does not plan to return Dresden 1 to service until June, 1986. (CECo's Load and Capacity Statement, May 28, 1980) At $100,000/day, this amounts to approximately $219 million. ($100,000/day X 365 X 6 years) It is therefore apparent that neither the $100,000 per day nor the $300 million for 15 years are meaningful figures.

The ultimate comparison of $300 million with the decontamination cost of $39.5 million is misleading and improper. To begin with $300 million is not properly comparable to the estimated $39.5 million cost of decontamination because the $39.5 million does not include the additional cost of generating electricity at Dresden 1 for the 15 year period. To properly compare the $300 million to the cost of decontamination, the cost of operating Dresden 1 for the 15 year period must be added to the $39.5 million. According to CECo's Annual Report to the ICC for 1979, the cost of running the Dresden station was 8.47 mills/kwh.[4] Assuming a 45% capacity factor, the daily operating cost of Dresden 1 would be approximately $18,300. (200 megawatts X .45 X .00847 X 24) Over the 15 year period (actually only 9 years of operation, considering the 60% availability factor) this would amount to about $60.1 million. Add this to the $39.5 million, and $99.6 million is the proper starting point of comparison.

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4. This figure does not actually include Dresden 1 because it did not operate in 1979. However, it is unlikely the oldest, smallest plant of the three would decrease this average cost.

As has been noted, the $300 million is unduly high since CECo could replace much of the electricity from Dresden 1 with its own base load, thus narrowing the gap between $99.0 million and $300 million even more. Moreover, it is probable the a 60% capacity factor was assumed in arriving at the $300 million calculation.[5] If this is the case, then the capacity factor assumption is significantly erroneous and hence biases the $100,000/day figure upward. For Dresden 1's actual capacity factor is around 45% cumulative.[6] The actual experience, a 45% capacity factor, would substantially reduce the $300 million replacement cost,[7] thus narrowing the differential even more.

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5. This is quite likely since a 200 megawatt plant with a 60% capacity factor would require 2,880,000 kilowatthours of replacement power each day. CECo currently purchases economy power at the suggested price of 3.5¢ per kwh. (CECo Exhibit 2.003, second revision, submitted with R. Heumann's testimony in ICC Docket #79-0214.) $100,000/day with a 60% capacity factor at a 200 megawatt plant means the purchased power costs between 3.4¢ and 3.5¢ per kwh.

6. See NUREG-0618, Nuclear Power Plant Operating Experience 1978, where the 1978 Dresden 1 capacity factor was 44% and operations were considered routine during the year. (p. B-80) See also, NUREG 0200, Operating Units Status Report, March 1980, where Dresden 1's cumulative lifetime capacity factor (DER Net) is 45.4%. (p. D-5)

7. The purchased power replacement cost would then be about $73,900 a day, or about $242.8 million for the 15 year period. This is still an inflated figure because it fails to account for CECo's own generating capabilities.

Hence the comparison of $300 million to $39.5 million is a meaningless exercise. The incorrect, implicit capacity factor, the assumption of only purchased power as he replacement power and the failure to account for Dresden 1's operating cost thus totally invalidate the analysis which eliminates the alternative of shutting the reactor down. From our analysis the cost differential between shutting the reactor down and decontamination plus resumed operation is not so significant as to outweigh the risk of environmental degradation from the entire project. Therefore, we believe NRC must perform a more thorough and supportable analysis before this alternative can be honestly discarded.

REQUEST FOR A PROGRAMMATIC EIS

CECo's proposed decontamination of Dresden 1 will be the first, large-scale commercial reactor system decontamination in the United States.[8] This decontamination experiment[9] is expected to provide experience and

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8. See letter of Harold Denton to Mrs. David Deutsch, dated September 14, 1979, in which Mr. Denton calls the Dresden 1 decontamination "...the first full-scale application of Dow Chemical's solvent NS-1 for the decontamination action of a complete primary coolant system." (at p. 2)

9. See letter from Ruth C. Clusen, Assistant Secretary for Environment, Department of Energy, to Mrs. Leo A. Drey, dated August 2, 1979, in which Ms. Clusen states: "Thus, no NRC license was issued specifically for the decontamination experiment."

background[10] for future decontaminations at other nuclear reactors under NRC regulation.

The NRC should not consider the Dresden 1 decontamination in a vacuum. Instead, it must assess the environmental impact of subsequent decontaminations. The waste generated during the Dresden decontamination may not present a significant transportation or disposal problem, assuming our other concerns are not realized. Nonetheless, the decontamination of 20 or more reactors may change the dimension of the problem. Hence the scope of this EIS is too narrow. Under CEQ regulations implementing NEPA, connected actions which are closely related must be discussed in the same impact statement. 40 CFR 1508.25(a)(1). Cumulative and similar actions, as well, merit a programmatic approach under the CEQ's regulations. 40 CFR 1508.25(2) and (3). The waste itself will obviously be accumulated after several decontaminations.

CBE, therefore, formally requests that a programmatic EIS be written relating to future chemical decontaminations of commercial nuclear reactors.

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10. The NRC in a response, dated May 21, 1979, to questions from the Illinois Attorney General's office, (at p. 6) stated: "However, it is very likely that the Dresden decontamination program will provide valuable confirmatory experience and background in large scale reactor system decontamination that will be useful in any Three Mile Island decontamination." See also, a letter to Mrs. Kay Drey, dated November 21, 1977, from Paul Pettit, Division of Nuclear Power Development, Department of Energy, in which he states: "The Commonwealth Edison Company is under contract to the Department of Energy to develop, demonstrate and document methods to chemically clean reactor equipment in nuclear power plants." (at p. 1) (emphasis added.)

PB 251 343

BIBLIOGRAPHIC DATA SHEET	1. Report No. EPRI 404-2	2.
4. Title and Subtitle: Primary System Shutdown Radiation Levels at Nuclear Power Generating Stations		5. Report Date: December 1976
		6.
7. Author(s): M. 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

...t Water Reactors
...ation Levels
...activity Buildup
Survey

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group

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Dresden I

Description

Dresden I (DI) is a dual cycle BWR rated at 700 MWt and 210 MWe (200 MWe net). The core contains 464 fuel elements, each composed of 36 Zircaloy-2 clad fuel rods in a 6x6 array. Steam generated in the stainless steel clad carbon steel pressure vessel is delivered as a steam-water mixture to the primary steam drum where separation occurs. Primary steam flow is approximately 1.5×10^6 lbs/h at 1000 psig. Secondary steam is produced in four stainless steel tubed steam generators at 500 psig. Reactor water cleanup at approximately 270 gpm is handled by a system consisting of 4 regenerative and 1 non-regenerative stainless steel tubed heat exchangers and 2 deep bed demineralizers. Full flow (~3000 gpm) condensate treatment is handled in the primary system by 2 deep bed demineralizers. Primary feedwater is returned to the steam drum. The 2 low pressure and 3 high pressure feedwater heaters in the primary system are tubed with 70-30 copper-nickel and Monel, respectively. Primary system piping is stainless steel. The condenser, originally tubed with Admiralty, was retubed with stainless steel in 1969.

Primary Containment Radiation Level Measurement Program

In mid-1974, a shutdown radiation level review was performed by Commonwealth Edison personnel. The following is an excerpt from that study.[A12]

"A. DI "A" and "C" Secondary Steam Generator Studies

Dose rate build-up surveys were performed in both "A" and "C" Secondary Steam Generator Rooms during major outages from 1960-1966. Approximately seven sets of dose rate measurements were obtained at each of 36 specified locations in these rooms. Surveys from Nov and Dec 1973 were reviewed for measurements at these same locations in order to extend this study to the present. Representative results were normalized to the Nov 1960 data and are presented in Figure 18.1.

A12. EBS Letter #467-74 to F. A. Palmer, A. P. Worden, W. I. Kiedasch/ R. A. Pavlick, July 12, 1974.

included in this program. Available dose rates at survey points in steam generator rooms B, C & D are given in Table 18.3.

Water Chemistry

General: During normal operation, reactor water pH and conductivity falls within 5.5 to 8.5 and ≤ 0.5 μmhos/cm, respectively.

The average soluble nickel concentrations from 1963-1968 (1.1-4.5 EFPY) in the condensate demineralizer effluent and feedwater were 6 ppb and 20 ppb, respectively.[A13] As a result of corrosion of the Monel and copper-nickel feedwater heaters, this nickel input to the reactor, ~ 200 lbs/y, is at least an order of magnitude greater than that at current generation BWRs with stainless steel feedwater heaters. As such, it is expected to strongly influence corrosion product deposit on the fuel and to lead to larger than average rates of Co-58 and Co-60 production.

Corrosion Product Radiochemistry: Available total (soluble and insoluble) reactor water isotopic data are given in Table 18.4.[A14,A15] High concentrations of Cu-64 and Co-58 are indicative of the copper and nickel input, respectively from the feedwater heaters.

Radiochemical analysis of a nickel-iron spinel deposit, found in the stainless clean-up piping during a decontamination of the clean-up loop, indicated that the major activity was Co-60 with about 10% due to Cs-134 and Cs-137.[A16]

A13. A. B. Sisson, "Water Chemistry at Dresden Nuclear Power Station", Paper published at the Houston National Association of Corrosion Engineers Meeting, April 1969.

A14. J. M. Skarpelos and R. S. Gilbert, "Technical Derivation of BWR 1971 Design Basis Radioactive Material Source Terms", NEDO-10871, General Electric Company, March 1973.

A15. B. Kahn, et al., "Radiological Surveillance Studies at a Boiling Water Nuclear Power Reactor", U. S. Department of Health, Education, and Welfare, Public Health Service, 1969.

A16. J. B. Scott, Private Communication, June 1975.

TABLE 18.1

DRESDEN I SECONDARY STEAM GENERATOR RADIATION

SU. FY IN OCTOBER-DECEMBER 1973

(~7.1 EFPY)

Description/Location of Measurement	Steam Generator (mR/h at 2") A	B	C	D
1. Handhole cover (right)	22	900	1600	300
2. Handhole cover (left)	110	800	900	100
3. Bottom drain (right)	3900	3500	2500-3000	3000
4. Bottom drain (left)	3000	3500	2500-3000	1500
5. Primary side vent (right)	1200	600	1300	3000
6. Primary side vent (left)	1600	550	1100	3000
7. To left of primary side vent, 1" pipe cupped off (secondary side drain)	NR*	NR*	NR*	600
8. Pump top of vent	20	250	500	600
9. Valve to right of pump top at vent	NR*	150	300	300
10. Decon flange	800	NR*	650	400
11. Suction side, decon flange	NR*	NR*	NR*	600
12. Primary lead drain line	NR*	1200	NR*	NR*
13. Secondary side drain	NR*	800	NR*	NR*

*NR - Not Reported

Table 18.2

EARLY RADIATION LEVEL MEASURMENTS ON RECIRCULATION LINE UPSTREAM OF PUMP IN LOOPS A AND C AT DRESDEN 1

	Radiation Level, mR/h	
EFPY	Loop A	Loop C
0.4	70	120-130
0.6	50	70
0.8	70	60
1.1	90	-
1.2	50	90
1.8	100	200
2.3	400	-
2.4	600	350
3.4	-	400

TABLE 18.3

DRESDEN I RADIATION LEVELS IN STEAM

GENERATOR ROOMS ON JUNE 22, 1974*

(~7.4 EFPY)

Point Number	Location	Approximate Elevation	Dose Rate (MR/HR)
1-3	D SSGR	529'	360
2-1	D SSGR	529'	150
3-3	D SSGR	529'	320
4-3	B SSGR	529'	220
5-1	B SSGR	529'	160
6-3	B SSGR	529'	330
7-3	C SSGR	529'	350
8-1	C SSGR	529'	250
9-3	C SSGR	529'	430

*Blue Diamond Survey

TABLE 18.4

DRESDEN 1 REACTOR WATER ISOTOPICS

(pCi/ml)

Nuclide	Date (EFPY) 1963[A12]	2/1/68 (4.1)[A13]	8/22/68 (4.3)[A13]
Cr-51	500	NM**	500
Mn-54	NR*	NM**	2
Fe-59	80	NR*	NR*
← Co-58	5000	14000	1700
Co-60	500	2200	260
← Cu-64	60000	10000	2200
Ni-65	300	NR*	NR*
Zn-65	2	NM**	4
Cs-134	NR*	13	23
Cs-137	NR*	30	44

*NR - Not Reported

**NM - Not Measured

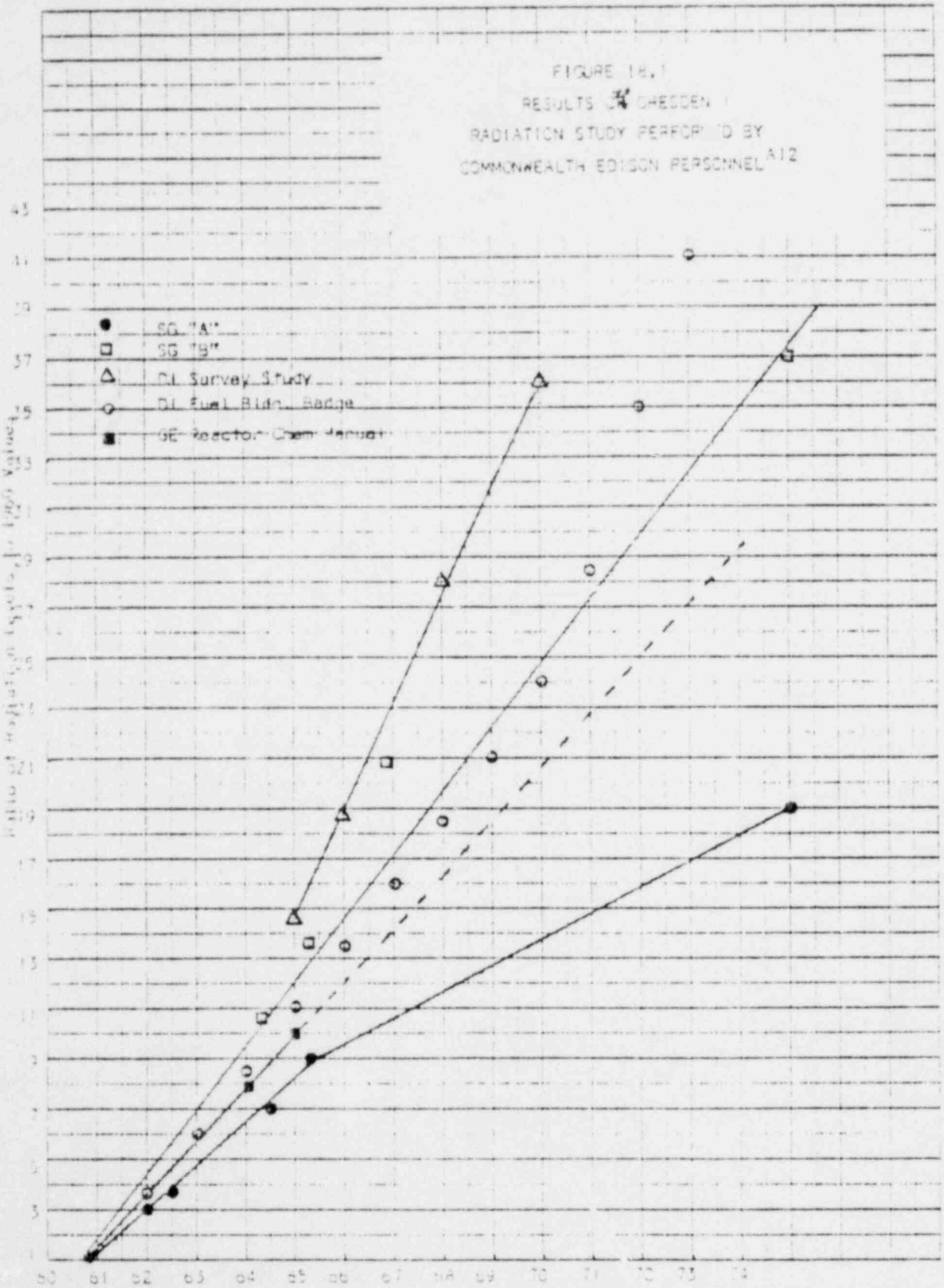
FIGURE 18.1
RESULTS OF DRESDEN 1
RADIATION STUDY PERFORMED BY
COMMONWEALTH EDISON PERSONNEL A12
SG "A"
SG "B"
DI Survey Study
DI Fuel Bldg. Badge
GE Reactor Chem Manual
Year