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MEMORANDUM FOR: Dennis Ziemann, Chief, Operating Reactors Branch #2, DOR

FROM: George W. Knighton, Chief, Environmental Evaluation Branch, DOR

SUBJECT: DRESDEN UNIT 1, DECONTAMINATION; ENVIRONMENTAL IMPACT APPRAISAL

Per our meeting with the Council of Environmental Quality on the subject issues, we have indicated that we would prepare an Environmental Impact Appraisal (EIA) in support of a Negative Declaration. Enclosed are two sections of the appraisal, on Occupational Radiation Protection and Radioactive Waste, for you to include in the EIA. If you have further needs of EEB on the preparation of the EIA, please let us know.

Sincerely,

Original signed by
George W. Knighton

George W. Knighton, Chief
Environmental Evaluation Branch
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X.1 Occupational Radiation Exposure

A. Reduction of Future Occupational Radiation Exposure

The purpose of the proposed decontamination operation is to reduce overall occupational radiation exposure to meet regulatory limits and to meet the objective of maintaining doses "as low as reasonably achievable" (ALARA). Due to the buildup of radioactive corrosion products on plant piping and component internal surfaces, the radiation levels of the Dresden Unit-1 primary systems have been increasing. The increased radiation levels causes a corresponding increase in occupational radiation exposure. Besides the need to reduce this exposure to achieve ALARA for normal plant operation and maintenance, exposure reduction is necessary to permit inservice inspections which are presently unfeasible because of the existing high radiation levels. It is expected that 40 to 50 welds considered to be inaccessible because of radiation levels should be capable of inspection after the decontamination operation and thereby significantly increasing the safety margin of future plant operating.

The effectiveness of radiation level reduction by the proposed chemical decontamination operation has been successfully demonstrated by the licensee when a contaminated primary system test loop in Unit 1 was chemically cleaned by the same proposed method in 1976. The licensee has estimated a total of 5,000 man-rem will be saved by chemically decontaminating the primary stystem. This is based on an average saving of 500 man-rem/yr for the next 10-years operating life. The decontamination procedure will, however, itself result in occupational radiation exposure and the handling and disposal of the spent decontamination solutions.

B. Occupational Radiation Exposure Because of Decontamination Operation

The proposed decontamination has resulted in extensive testing, planning, and engineering. Operation of the radwaste treatment equipment to concentrate and dispose of the spent decontamination solutions will result in some occupational exposure. In addition, several modifications must be made to the existing facility to permit the decontamination. Some of these modifications must be made in radiation fields near existing contaminated components. Consequently, consideration must be made to keep occupational exposures "as low as reasonably achievable" (ALARA) while making these modifications, performing the decontamination, and disposing of the contaminated solutions. The major contribution to occupational exposures will be from installation of decontamination and radwaste treatment system interface piping to the reactor primary system and the installation of instrumentation and electrical equipment in the containment. This work has to be performed in existing radiation areas inside the containment.

The licensee has an extensive program in keeping occupational exposures ALARA. This program consists of engineering,pre-operational testing, monitoring, and training. Temporary shielding were used where a significant reduction in exposure could be expected. The primary system was drained and flushed prior to the installation of interface piping and instrumentation. Portions of the primary system was backfilled with water to provide additional self-shielding. Primarily because of these precautions, with over 90% of the pre-decontamination installations completed, the occupational exposure expended is kept to about 200 man-rem. This compares with an original estimate prior to the installations of about 400 man-rem. The reduction is mainly due to the extensive planning, training, and strict adherence to the ALARA objective and demonstrates the success of the licensee's program in keeping occupational exposures ALARA.

Following the installation phase, the licensee plans an operational test with clean water before the actual decontamination. The actual cleaning step will follow. Most of the cleaning operations will be done remotely, at the control panel area where the design radiation level is less than 1 mrem/hr. However, some valve lineups must be done manually prior to the start of the decontamination and will result in some exposure. The licensee has estimated a dose of 8 man-rem will be accumulated during the test and 15 man-rem during the actual cleaning.

The decontamination solution and rinses are to be stored in tanks and processed through the special radwaste system. The processing includes evaporation of the spent decontamination solution with solidification of the evaporator concentrate. The 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. These processes will be operated from the control panels in the Chemical Cleaning building with radiation levels designed to be less than 1 mrem/hr. Commonwealth Edison has estimated that 6 man-rem will be accumulated during the evaporation (including the solidification of concentrate) of the radioactive waste solutions. They also estimate another 4 man-rem will be expended for transportation of the solidified waste to a licensed burial facility. Distillate from the evaporator will be further cleaned (polished) by a demineralizer system. The polished water will be stored and recycled as reactor makeup water in the later operation of Dresden 1. The spent demineralizer resins will be solidified similar to the evaporator concentrate. The licensee has estimated an occupational dose of 10 man-rem for operating the demineralizer system.

Preparation of the reactor for return to service will again entail modifying piping, instrumentation, and electrical equipment. These activities will follow the decontamination and will, therefore, be performed in lower radiation fields. The licensee estimates an expenditure of 20 man-rem for preparing the reactor for a return to service. Finally, dismantlement of equipment used in the decontamination and cleanup of the unit will result in 25 man-rem.

With 90% of the pre-decontamination installation work completed, the estimated total occupational dose for the entire decontamination procedure is about 300 man-rem. The estimates quoted include only those operations associated with the decontamination operation.

Normal work items such as removal of control rod drives and other normal reactor outage maintenance not associated with the decontamination are not included.

C. <u>Conclusion From Occupational Exposure Review</u>

We have reviewed the licensee's submittals regarding occupational exposures and conclude that the licensee has taken adequate actions to maintain occupational radiation exposure ALARA during the decontamination operation. By extensive pre-operation planning and training and the effective methods of reducing radiation levels, occupational exposure for pre-decontamination operations has been reduced to about one-half of earlier estimates. Based on our review of the work to be performed, the estimate of additional exposure of about 100 man-rem is reasonable. The licensee has stated the actual decontamination operations will be continually monitored by his Health Physics staff such that experiences gained during the operation will be considered in his ALARA program. Based on the information available and the licensee's commitment to an ongoing radiation exposure ALARA plan, we conclude that the licensee can maintain occupational exposures ALARA.

Based on the estimated occupational exposure saving of about 5,000 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.

For the decontamination operation, the estimated radiation exposure of 300 man-rem represents a predicted increased risk of permature fatal cancer induction of less than one-tenth of one event (e.g., 0.03) events risk estimation from data for the population as a whole as given in the November 1972 report of the National Academy of Sciences, "The effects on Populations of Exposure to Low Levels of Ionizing Radiation"). The increased risk of this exposure on genetic effects to the ensuing five generations is also predicted to be less than one-tenth of one event (e.g., 0.075 events risk estimation from data for the popuation as a whole as given in the same National Academy of Sciences report). For a selected population such as is likely for the exposed workers involved in the decontamination program, consisting principally of adult males, these risks would tend to be even less. These risks are incremental risks, risks in addition to the normal risks of cancer deaths and genetic effects which all persons face continously. To put these risks into perspective, for a population of 350, the approximate number of workers that will be involved in the various phases of operation, normal risks from all factors (genetic or environmental) would result in roughly 40-60 cancer deaths and 15-20 genetic effects

Another view of assessing the occupational exposure impact is a comparison with variation of natural background radiation. The average annual dose to an individual due to natural background radiation is about 0.1 rem. However, there are variations in average background radiation levels due to a number of factors characterizing the locations (e.g., altitude above sea level, local geological formations). For example, because of the higher altitude, the average background dose in Denver, Colorado, is roughly 0.08 rem per year higher than that in Washington, D.C. Over the average lifespan of an individual, an individual would receive about 4 rem more dose by residing in Denver than he would by living in Washington. 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 noted that practically no one would even consider the variation in natural background to be a significant factor influencing his decision on 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.

For the foregoing reasons, the staff concludes that the environmental effect due to occupational radiation exposure is not a significant environmental impact. The staff has determined that relative to the requirement set forth in 10 CFR Part 51 and the Council of Environmental Quality's Guidelines, 40 CFR 1500.6, the proposed decontamination operation will not significantly affect the human environment on account of occupational exposure. Therefore, the staff has found that an environmental impact statement, because of occupational exposure concerns, need not be prepared.

X.2 Radioactive Waste

The decontamination operation is not expected to result in the liquid or gaseous radioactivity releases to the environment in any significant quantities. The expected generation and treatment of the radioactive wastes is discussed below.

A. Radioactive Liquid Waste

A total of approximately 3,000 Ci of radioactivity is expected to be in the decontamination solvent and subsequent rinses. About 95% of the radioactivity is expected to be in the form of cobalt isotopes. Over 99% of the radioactivity will be in the decontamination solvent and the first rinse, containing about 200,000 gallons of liquid. This liquid will be processed through an evaporator. The concentrated waste, about 20,000 gallons of evaporator bottoms, will be solidified for offsite burial. The remaining 180,000 gallons of waste (distillate from evaporator) will be sampled and sent to the existing plant holdup system or will be polished through the demineralizer before being stored for plant re-use. Water from the subsequent rinse(s) will be sampled and processed through the demineralizer and/or the evaporator. The processed water will also be recycled into plant holdup systems for re-use. It is expected that no liquid radioactive effluents will result from the decontamination operation.

B. Gaseous Radioactive Waste

No significant source of gaseous radioactive effluent is anticipated. The NS-1 solvent for the decontamination is non-volatile. All radioactive iodine isotopes have been decayed to insignificant levels. The only expected source of gaseous radioactivity effluents during the decontamination operation is the venting of the noncondensable gases from the evaporator distillate. A number of partition and decontamination factors during the evaporation, condensation, and filtration processes, however, reduce this source to a small quantity (estimated to be less than 1 uCi).

Unplanned releases due to leaks or spills will be continuously sampled and monitored. Technical Specification limiting release rates during normal plant operation will also be in effect during the decontamination operation. Consequently, the environmental impact from airborne radioactive effluents should not be greater than those described in the Final Environmental Statement (FES), November 1973 (FES for Dresden Units 2 and 3 also addresses radiological impact of releases from the site which includes Dresden Unit 1).

C. Solidified Radioactive Waste

About 1,200 55-gallon drums of solidified radioactive waste containing approximately 3,000 Ci of radioactivity will be shipped for offsite burial. The radioactivity consists mainly of activated corrosion products (over 95% consists of CO-58 and CO-60). Compared with the operation of the Dresden Units at the site, shipment of this solidified waste is a fraction of the solidified waste routinely shipped from the site since the commercial operation of all three units in 1972 (estimated to be approximately 10% of the 28,554 curies shipped and 1.3% of 692,000 ft^3 of solid waste shipped from Dresden Station from 1973 to 1977). Solidification of the evaporator bottoms and spent resins will utilize the Dow Chemical Company's proprietary vinyl ester-styrene polymer system. Solidification tests with spent radioactive decontamination solvent obtained from the actual decontamination of a Dresden Unit 1 test loop has been performed. The decontamination solvent was then solidified using the Dow system. Samples of the solidified waste indicated no free-standing liquid. Leach tests on samples indicated that the Dow solidification process is equivalent or better than other solidification methods being routinely employed by nuclear power plants.

For the solidification fo the spent decontamination waste, controls will be implemented to ensure a completely solidified waste with no free-standing liquid. Prior to the solidification of the radioactive waste, a nonradioactive batch simulating the chemical properties of the waste will be solidified to establish an acceptable process.

The simulated solidified waste drum will be sectioned to demonstrate that there is no free-standing liquids for the acceptable process control program which will be followed. For each drum of solidifying waste, thermal couples will be inserted to show the temperature increase as an indication of the occurrence of polymization and solidification process. Television camera will also allow the observation of solidification at the top of the waste drums. Since the liquid waste for solidification is added to the top of the drum above the solidification agent prior to mixing, any incomplete solidification would likely be observable from the top.

The amount of radioactivity of the solidified radwaste amounts to less than 0.1% of the 4.3×10^6 Ci of total radioactivity shipped to commerical burial sites as of 1977. The volume of solidified radwaste expected to be generated by the Dresden Unit-1 decontamination operation amounts to less than 0.06% of the 1.8×10^7 cubic feet of total radwaste shiped to commerical burial sites as of 1977.

The licensee has committed to meet all the applicable NRC and Department of Transportation regulations regarding packaging of the radwaste for shipment. Therefore, the environmental impact enroute to the burial site (e.g., direct radiation, accident considerations) is not significantly different from those already analyzed in the FES, November 1973. The solidified waste will be shipped for burial at the commerical radwaste disposal site in Hanford, Washington. This site is chosen for its relative dry and arid environment to further decrease the probability of leaching and migration of the waste. The decontamination wastes will be buried in their own trenches separated from other radioactive waste burials at the site. This precaution provides additional assurance that the chelating agents in the solidified decontamination waste will not complex with other radioactive wastes at the site.

Based on the above discussion, we have determined that there is no significant environmental consequences resulting from the liquid, gaseous, and solid radioactive wastes generated from the decontamination operation. In reference to the requirements set forth in 10 CFR Part 51 and the Council of Environmental Quality's Guidelines, 40 CFR 1500.6, we have determined that the radioactive wastes will not significantly affect the quality of human environment. Therefore, the staff has found that an environmental impact statement need not be prepared with regard to radioactive waste concerns.