UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR REACTOR REGULATION
HAROLD R. DENTON, DIRECTOR

In the Matter of COMMONWEALTH EDISON COMPANY (Dresden Nuclear Power Station Unit No. 1)	))))))	Docket No. 50-10 (10 CFR 2.206)

DIRECTOR'S DECISION UNDER 10 CFR 2.206

By petition dated March 19, 1979, Ms. Kay Drey requested that the Nuclear Regulatory Commission (NRC) (the Commission) prepare an environmental impact statement on the Commonwealth Edison Company's (the licensee) proposed chemical decontamination of the Dresden Nuclear Power Station Unit No. 1. This request has been considered under the provisions of 10 CFR 2.206 of the Commission's regulations. Notice of receipt of the petition was published in the Federal Register April 16, 1979 (44 FR 22529).

By petition dated September 20, 1979, Ms. Marilyn Shineflug, on behalf of the Illinois Safe Energy Alliance, requested public hearings on the decontamination based on the the lack of assurance that the NRC would issue an environmental impact statement. Notice of receipt of the petition was published in the Federal Register November 7, 1979 (44 FR 64577). By petition dated March 13, 1980, Mr. Robert Goldsmith, on behalf of Citizens for Better Environment and Prairie Alliance supported Ms. Drey's petition requesting the preparation of an environmental impact statement.

Ms. Drey's petition raised seven questions related to the decontamination and asserts that these questions establish a basis for the preparation of an environmental impact statement. Ms. Shineflug's petition raised an additional eight questions. These questions and the NRC staff's response to each question are contained in Appendix A attached to this decision.

The NRC staff has completed its environmental evaluation of the Dresden decontamination. We have evaluated the occupational exposures estimated by the licensee, reviewed the construction of the support facilities at Dresden Station, and have evaluated the system to be used to solidify the waste. Based on this review we conclude, as we concluded in 1975, that the decontamination will not cause any adverse environmental impacts.

Although the results of the staff's review indicate that this action will not significantly affect the quality of the human environment, I have concluded that an environmental impact statement should be prepared because of significant interest and concern expressed by members of the public relating to decontamination of Dresden Unit No. 1. The Commission's staff has, therefore, issued a Draft Environmental Statement.

The questions raised by Ms. Drey and Ms. Shineflug and the NRC staff answers are incorporated as Appendix A to this statement.

CONCLUSION

Based on the public's expressed concern over this action and the provisions of 10 CFR 2.206, I have determined that an environmental impact statement should be prepared for Dresden Unit 1 decontamination. The requests of Ms. Drey and Mr. Goldsmith are, therefore, granted. The public hearings requested by Ms. Shineflug were predicated on the lack of assurance that the NRC would issue an environmental impact statement. Since the NRC has issued the statement, such hearings will not be necessary.

A copy of this decision and Appendix A will be placed in the Commission's Public Document Room at 1717 H Street, N. W., Washington, D. C. 20555 and the Local Public Document Room for the Dresden Nuclear Power Station located at the Morris Public Library, 604 Liberty Street, Morris, Illinois 60451. The Draft Environmental Statement will also be placed at these locations. A copy of this decision and Appendix A will also be filed with the Secretary of the Commission for its review in accordance with 10 CFR 2.206(c) of the Commission's regulations.

In accordance with 10 CFR 2.206(c) of the Commission's Rules of Practice, this decision will constitute the final action of the Commission 20 days after the date of issuance, unless the Commission on its own motion institutes the review of this decision within that time.

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Dated at Bethesda, Maryland
this 26th day of June, 1980

Attachments:
1. Appendix A -
   Staff Response to Questions
   Contained in Petitions from
   the Public

APPENDIX A

STAFF RESPONSE TO QUESTIONS CONTAINED

IN

PETITIONS FROM THE PUBLIC

STAFF'S RESPONSE TO QUESTIONS CONTAINED IN MS. DREY'S MARCH 19, 1979 PETITION

(DOCKET NO. 50-10)

QUESTION

1. First, is it possible that an environmental impact assessment and a negative declaration have already been written regarding the proposal to decontaminate Dresden Unit One?

RESPONSE

The Nuclear Regulatory Commission evaluated the environmental impact of the Dresden decontamination in 1975. As stated in our December 9, 1975 Safety Evaluation, the decontamination will take place within the closed cooling system located inside of the containment sphere. No decontamination effluents will be released to the environment as either liquids or gases. All of the radio-active waste will be solidified for shipment to a burial site authorized to accept the waste. The packaging and shipping of the waste will be in accordance with applicable Department of Transportation and NRC regulations.

Our 1975 review did not identify any adverse environmental impact associated with this project and the facility changes did not involve a change to the Technical Specifications or an unreviewed safety question. Therefore, no Environmental Impact Statement or Negative Declaration and Environmental Impact Appraisal was issued to support our conditional approval to begin the work necessary to prepare for the decontamination of the reactor. However,because of expressed public interest in this action we have prepared a Draft Environmental Statement in support of our final approval to decontaminate.

QUESTION

2. What do field or laboratory tests demonstrate to be the migration potential of radioactive wastes entrapped in the Dow Chemical solvent, assuming some were to escape from buried containers into the environment?

RESPONSE

The migration of radionuclides at a burial site is determined by the physical form of the waste, the rainfall at the site, and the geological and hydrologic features of the burial site. The risk associated with potential migration is further defined by the land uses in the vicinity of the buried waste.

The migration of radioactive waste which you have referred to was reported by Means, Crerar and Duguid (Science, Vol. 200, 30 June 1978). The referenced paper discusses the disposal of 35 million gallons of liquid waste in burial pits at

Oak Ridge National Laboratory between 1951 and 1965. Commonwealth Edison, the licensee for Dresden Unit No. 1, has agreed to dispose of the Dresden 1 solidified waste at either Beatty, Nevada or Hanford, Washington commercial low level waste burial sites. These sites differ significantly in their geologic and hydrologic characteristics from the Oak Ridge site where chelant-aided migration of radionuclides was observed by Means, Crerar and Duguid.

Specifically, the Oak Ridge site, where migration occurred, experiences very high precipitation and has a water table so shallow that it probably intersects the disposal pits and trenches during periods of heavy rainfall. In addition, the Oak Ridge topography is hilly with steep slopes underlain by fractured shale material which allows underground water and radioactive waste to flow down hill for approximately 50 meters through the fractures until it seeps to the surface within 75 meters of a perennial stream.

Conversely, the commercial waste burial sites at Beatty and Hanford, where no migration of radionuclides has been observed, are flat desert areas with very low precipitation, a water table approximately 90 meters below ground level and a distance of 13 to 16 kilometers to the nearest perennial stream.

In addition to these site characteristics, which prevent the migration of radioactive material from the desert waste burial sites, another significant difference between the proposed waste disposal technique and the now discontinued Oak Ridge methods is that Dresden waste will be disposed of as a solid. At Oak Ridge over 35 million gallons of liquid radioactive waste was pumped into the disposal trenches. We estimate that approximately 7 million gallons of liquid waste was disposed of in Trench No. 7, which was identified as a source of chelated radionuclides. Because of the differences we have concluded that solidified Dresden wastes, in a dry burial site will not migrate in the manner that liquid waste migrated at Oak Ridge.

We do not have field or laboratory tests results which quantify the migration potential of radionuclides associated with Dow solvent, assuming that some escapes from solidified waste and into the soils of a disposal site. The rate of water movement at a particular disposal site is the limiting factor for migration. Migration potential of chelated radionuclides is decreased when placed in a solid waste matrix and disposed at an arid disposal site.

The upper bound of the migration potential of non-volatile contaminants is determined by the availability of water and its rate of movement through soils. The lower bound is achieved when contaminants become fixed on solids or are held long enough to undergo decomposition or decay. In the absence of interactions with soils, such as adsorption, the migration potential of soluble contaminants is governed by the potential for water to carry contaminants from a source.

Migration potential of dissolved contaminants is generally assessed in laboratory tests using disposal site soils and water spiked with traces of contaminants. In the tests, the distribution coefficient (K_d) is typically measured and it is assumed that with a few adjustments the ratio of the velocity of dissolved contaminants to the velocity of water passing through the soil can be estimated. Referring to the example of migration at Oak Ridge site it has been observed that water flow rates are extremely rapid, and have been on the order of 100 feet in less than one month, at a trench similar to the one in which chelating agents have been found[1]. Since the migrating radionuclides were Strontium-90 and Cesium-137 (which do not form strong complexes with chelating agents), it appears that water flowing at high velocity through fractures caused these radionuclides to migrate. Fractures probably augmented the migration of chelated radionuclides at Oak Ridge as well.

We assume that the tests of migration potential which are addressed in your question refer to the adsorption of radionuclides by soil or K_d measurements. There are several caveats which must be considered in using K_d values from laboratory and site tests to predict conditions at other sites. In the case of laboratory tests, there is considerable uncertainty as to the chemical conditions which should be used to represent the disposal site environment in laboratory tests. Eh, pH, microbial activity and other dissolved substances are among the variables known to influence the distribution coefficient. Also, there may be differences in the results obtained under the same chemical conditions but with different testing techniques. Field tests may avoid some of these problems, but they have drawbacks in that many years of sampling may be required and the results may only apply to a limited range of conditions such as at the site being tested.

QUESTION

3. For how many years have radioactive corrosion products, bonded with the proposed Dow Chemical solvents, remained free of water after being solidified by the Dow Chemical polymer process?

RESPONSE

Radioactive corrosion products, bonded with the Dow Chemical solvent, have been tested to remain free of water after being solidified by the Dow Chemical polymer process since 1974.

(1) Loemenick, Jacobs, and Struxness, Health Physics, Pergamon Press 1967, Vol. 13, Behavior of Sr^{90} and Cs^{137} in Seepage Pits at Oak Ridge National Laboratory.

QUESTION

3a. Has the Dow solidification process been tested on reactor corrosion products comparable to those which will result from the Dresden experiment? What assurance is there that the encapsulated waste is going to be low-level?

RESPONSE

The Dresden decontamination is not an experiment, it represents the application of a proven method of decontamination that has been specifically developed and tested before being used on the Dresden Unit 1 primary cooling system.

The Dow Chemical polymer solidification process has been tested on reactor corrosion products comparable to those that will result from the Dresden Unit 1 decontamination operation. In June 1976, a Dresden Unit 1 corrosion test loop was decontaminated with the Dow Chemical Solvent, NS-1, to provide data on future decontamination operations. The test loop was originally installed to obtain stress corrosion data. Isotopic surveys indicated that the crud in the loop was representative of the rest of Dresden Unit 1 primary system. The spent decontamination solvent was solidified by employing the Dow Chemical polymer process.

Isotopic analyses of crud samples have been used to identify the type and amount of radioactivity. The total amount of radioactivity from the decontamination of the Dresden reactor system is estimated to be approximately 3,000 Ci and each 55-gallon drum of solidified radwaste will contain up to approximately 3 Curies of predominately Co-58 and Co-60. These radioactivity concentrations are not unlike those normally produced by typical operating reactor radwaste systems. These types of waste are considered to be low level for waste disposal purposes because they do not contain high concentrations of fission product nor transuranic isotopes.

QUESTION

3b. When did Dow Chemical first develop its solidification process for low-level radioactive wastes? What is the longest duration period for one of its "monoliths" or matrixes -- that is, how has such a solidified Dow substance remained free of liquid? What would be the long-term stability of the solid polymer over a period of thousands of years?

RESPONSE

The basic formulation of the Dow Chemical solidification process was developed in the late 1960s under the trade name of NAJVAR. The first solidified sample

of prototype test has remained free of liquid since 1974 when the test was made. Analysis has shown that the longest lived significant isotope that will be solidified after the decontamination is Co-60 with half-life of 5.2 years. Tests have been performed to demonstrate that the stability of the solid polymer will not substantially alter for over 50 years, corresponding to 10 half-lives of Co-60. These tests include accelerated aging, biological degradation, radiation degradation and temperature cycling (freeze and thaw resistance tests). After 10 half-lives the original 3,000 curies will have decayed to approximately 3 curies.

QUESTION

3c. What is the leach rate of the polymer under burial conditions, or the potential for diffusion and release of encapsulated radionuclides, solvents, etc.?

RESPONSE

We do not know the leach rate of Dow polymer under burial conditions. In arid disposal areas the potential for water to contact waste is very small, limiting the potential for leaching. The potential for diffusion and release of encapsulated radionuclides has been compared to other commonly used solidification agents under standardized laboratory conditions. Dow polymer was found to leach more slowly than cement, urea formaldehyde, and bitumen for strontium and cesium isotopes. Cement showed a lower leach rate for Cobalt-60.

There is not as yet any test which can simulate leaching under burial conditions. The potential for release of radionuclides has been compared on a relative basis, in the NRC funded study "Properties of Radioactive Wastes and Waste Containers", conducted at Brookhaven National Laboratories in Upton, New York. Dow polymer was compared to other common solidification agents (urea formaldehyde, cement, and bitumen) and found to have generally superior radioisotope leach rates. Cement was found to have a lower cobalt leach rate, however, the tests were performed with Cobalt-60 in an unchelated state. In the tests, small samples of solidified reactor wastes (excluding decontamination wastes) were immersed in salt, distilled, and ground waters for one to four months.

Dow has performed leach tests using wastes similar to those in the Brookhaven work and the results showed close agreement. Dow also performed leach tests with NS-1 decontamination waste solidified in Dow polymer, and found that the leach rates were slightly better for Cobalt-60 when the NS-1 waste was compared

to the other reactor wastes tested. It is possible that the reason for lower Cobalt-60 leach rates in the presence of NS-1 may be due to association with a larger molecule, resulting in slower diffusion through Dow polymer. The tests showed that after one week of immersion 0.7 percent of the cobalt leached from the solid waste and an additional 0.2 percent of the cobalt leached during the following two months. These results indicate a rapid reduction in leach rate after the first week.

It has been proposed by the International Atomic Energy Agency that the results of small sample leach testing be scaled by the ratio of the volumes to the surface areas of the sample and the actual waste (55 gallon drum dimensions in this case) using a formula specially derived for use with the leach test procedure. This scaling would result in a reduction by a factor of approximately 0.1 for comparing the cumulative fractions released in the drum sized wastes to the laboratory samples. The leach rates measured in the laboratory are mostly of use for estimating leaching under saturated conditions, or as a basis for comparing various solidification agents. In actual burial conditions at the low-level waste disposal sites considered for the disposal of Dresden 1 decontamination wastes, the waste is disposed in a dry unsaturated environment with very little moisture available. This is explained in more detail in the response to Question 4c.

QUESTION

3d. During the evaporation step, is the solvent volatile, and if so, will an ion exchange resin completely scrub chelated radionuclides from the evaporate? (I am told by one person that his experience indicates it will not).

RESPONSE

At the evaporation temperature, the chelating agent portion of the solvent is not volatile except for ammonia and organic compound components. Carryover of chelated radionuclides entrained in the vapor mist is an insignificantly small fraction. This carryover will be further reduced as the spent solvent is further processed by a mixed-bed demineralizer which has been tested to be effective in removing chelated radionuclides. The conductivity of the liquid is a strong function of the solvent concentration. In order to purify the water for reactor grade and suitable for plant reuse, the processing required has to reduce the residual solvent concentration to an insignificant amount.

QUESTION

4. For how many years have the barrels designed for burying the solidified wastes been found to remain resistant to corrosion from both the proposed contents and from surrounding environmental impacts?

RESPONSE

The barrels were designed to meet the packaging requirements for transport of the solidified waste and are not designed to serve the purpose of remaining corrosion resistant after burial. However, although there is no experience with buried barrels of the same Dow Chemical polymer content, actual experience with barrels of similar design and chemically comparable content at the burial sites has shown that most barrels remain resistant to corrosion and maintain their integrity for up to 5 years.

QUESTION

4a. According to a letter I received from Mr. Paul Pettit (Light Water Reactor Section, Division of Nuclear Power Development, DOE) dated February 6, 1979, the solidified wastes from the Dresden experiment are to be shipped in drums to a commercial low-level waste disposal site. Since additional wastes are no longer being accepted at the nearby Sheffield, Illinois burial site (in fact, the licensee has just walked away, with the NRC in hot pursuit), will the wastes be shipped to Nevada, South Carolina, or Washington? Were the drums designed to comply with the Department of Transportation's (DOT) packaging and shipping regulations for low-level or high-level wastes (49 CFR Parts 170-178), or to comply with the NRC transit regulations for fissile materials (10 CFR 71 and 73)? And/or were the drums designed for indefinite burial?

RESPONSE

The solidified radwaste will be shipped to a licensed commercial low level waste burial site located at either Beatty, Nevada or Hanford, Washington. Prior to shipment, estimates of radioactivity content and direct radiation measurements of the drums will be made. The licensee has committed to meet the applicable packaging, labeling and transportation regulations under 10 CFR Part 71 of the Nuclear Regulatory Commission and under 49 CFP Part 170-178 of the Department of Transportation. Regulations pertaining to fissile materials will not be applicable since the reactor fuel is removed prior to decontamination and no fissile material is expected in the decontamination waste.

QUESTION

4b. What is the estimated lifespan of the barrels? What precautions are going to be taken at the life-end of the barrels to ensure continued containment of the residual radioactivity? Have any metals been found that will resist the corrosive action of the proposed contents for even a decade? Is there apt to be any chemical reaction between the compounds going into the barrels and the materials of which the barrels are composed?

RESPONSE

It is not our present policy to rely upon barrels to contain wastes after disposal. The hydrogeological conditions of the disposal site and the waste solid are relied on to provide containment after containers are no longer intact. The specifications of the container are based on transportation requirements, not disposal requirements. The lifespan of the barrels has not been relied upon to contain the wastes after disposal. This has been the usual practice in the past for evaluating the performance of disposal sites.

The waste container (DOT approved 55 gallon drums) metal has been tested by our contractor, BNL, and based on the test results we find the container is adequate for waste in this solidified form. In the first series of tests we requested BNL to measure corrosion under the condition that the waste does not solidify. Under this assumption corrosion breakthrough could occur to a 55 gallon drum in about one month. In view of the assurance provided by the quality control and system design features of the solidification system, if the conditions that would result in the present of liquid NS-1 were to occur, they would be detected and appropriate corrections would be made. The corrosion rate was also determined for a more realistic hypothetical bounding case where a layer of liquid waste was tested in contact with the drum steel to simulate the worst case for condensate in the drum. Such a layer of liquid waste has not been observed in wastes solidified by BNL or the manufacturer (Dow Chemical Corporation) when the wastes were solidified in accordance with the procedure specified by the manufacturer. The results from this test show that the barrel could be expected to last one or two years, based on corrosion observed after 4 weeks of contact. This indicates that assuming the above as a trial worst case, corrosion would not penetrate the wall during handling and storage, if buried within a few months of solidification. A container corroding through in the disposal site would not present a problem since the waste is a solid and the quantity of condensate which could leak from the drum would be easily absorbed in the undersaturated soils at a semi-arid disposal site. Further corrosion tests conducted under expected conditions show that after 4 weeks of exposure no significant corrosion occurs

to the barrel steel in contact with solidified waste or vapor from liquid waste. The corrosion rate in contact with solidified waste indicate that the barrel could last tens of years and the vapor was found to be non-corrosive.

QUESTION

4c. In the June 30, 1978 Science article, Dr. Crerar and colleagues describe the accelerated dispersal through the groundwater and the increased uptake by vegetation of the radionuclides when bonded to nonbiodegradable chelates. If the buried drums with the solidified Dresden effluent were to corrode and the matrix were to come into contact with water, would the radionuclide-chelate complex not become soluble again? Could this solution then migrate through the environment in the same manner found at the Oak Ridge burial site?

RESPONSE

No. The migration of radionuclides at Oak Ridge was associated with the disposal of 35,000,000 gallons of liquid waste. The significance of the migration at Oak Ridge was addressed by Means, Crerar, and Duguid in 1976 as follows:

> "A seep approximately 50 meters east of trench 7 within the ORNL restricted area contains ^{60}Co in concentrations of 10^4 to 10^6 dpm/g in the soil and 10^3 dpm/ml in the water. Traces of ^{125}Sb and various transuranics have also been detected in the soil. However, because the volume of water discharge from the seep is small, the total radionuclide contribution from the trench 7 area to White Oak Creek and the Clinch River is insignificant."

Migration as observed at the Oak Ridge site would not occur at the Beatty, Nevada or Hanford, Washington commercial disposal sites. A solid waste is to be disposed at the commercial sites. The climate, geology, and hydrologic conditions eliminate the possibility for flow to saturate soils and transport radionuclides as observed at Oak Ridge.

(2) MEANS, J. L., D. A. CRERAR, and J. O. Duguid. 1976. Chemical Mechanisms of ^{60}Co transport in ground water from intermediate-level liquid waste trench 7: Progress report for period ending June 30, 1975. ORNL/TM 5348. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

The migration as observed at the Oak Ridge site would not occur at the disposal sites which may receive the solidified Dresden 1 decontamination wastes, assuming that container corrosion and leaching of soluble radionuclides occur. Commonwealth Edison has notified NRC staff that the disposal sites which are being considered for the Dresden 1 wastes are the Beatty, Nevada and Hanford, Washington commercial low-level waste disposal sites. Table 1 gives a brief summary of the disposal and environmental conditions at these sites, with a comparison to the region of disposal pits 2, 3 and 4 and trenches 5, 6 and 7 at Oak Ridge. These pits and trenches are clustered in the vicinity of Whiteoak Creek. There are many similarities between these disposal units, which include trench 7. This trench was found to be a source of chelated radionuclides. The major difference between the Oak Ridge site, where migration has been observed, and the commercial sites, where no migration has been detected, is the general lack of water at the commercial sites and the abundance of water at the Oak Ridge site. Oak Ridge experiences very high precipitation, has a water table which probably intersects pits and trenches, and the waste disposed was entirely liquid. For trench 7, which was identified by Duguid, Means and Crerar as a source of chelated radionuclides, we estimate that approximately 7 million gallons of liquid waste was disposed during a three year period from 1962 to 1965. Considering the liquid to be evenly distributed over the area of trench 7, the equivalent water flow in terms of precipitation would be on the order of 100 feet per year. This is far in excess of the few inches of precipitation incident at the desert sites, where the majority of the precipitation is rapidly returned to the atmosphere by evaporation. The estimates of water flows at Oak Ridge are based on figures reported by Lomenick, Struxness, and Jacobs and trench dimensions from a report by Duguid.

Migration of radionuclides from the Oak Ridge disposal trenches to the surface was also promoted by the type of geologic material in which the trenches were excavated. The trenches were founded in fractured shale which may have small solution cavities as well as fractures available to conduct water at rapid rates. Trench 6, which received liquid wastes for approximately one month, had to be taken out of service due to the breakthrough of radionuclides at a seep 100-feet downslope. Cesium-137 and Strontium-90 were present in the seep water, having migrated 100 feet in less than one month, due to fracture flow. In comparison the commercial disposal trenches at Beatty and Hanford are excavated in a weakly cemented alluvial fill and unconsolidated sand and gravel, neither supporting fracture flow. The topography and location of the

Oak Ridge disposal sites promoted migration to surface seeps. The trenche were excavated in hills, such that trench bottoms are saturated, a hydraulic gradient exists to drive flow to surface seeps. The slopes leading from the wet low areas up to the disposal trenches are often in the range of 1:5 to 1:10. The commercial disposal sites at Beatty and Hanford on the other hand are characterized as flat desert areas with slopes on the order of 1:100 to 1:300, providing a much longer path between the trench bottoms and points where the surface are at equal elevation. Also, the intervening material is under-saturated, and volumes of water which are much greater than available in the desert would be required to saturate the soil before any significant flow to the surface could occur (for example as would cause the swampy regions associated with the Oak Ridge seeps).

Also, the solid wastes disposed at Beatty and Hanford are covered with three to five feet of dry sandy materials, which would absorb precipitation. This provides some protection against the occurrance of waste leaching. Should water be supposed to enter a desert disposal trench, it would tend to be absorbed by the trench walls and bottoms rather than collect in the trench bottom, thus, preventing saturation of the wastes and minimizing the time of the contact of wastes and water.

Table 1. Comparison of the conditions at the Hanford, Washington, and Beatty, Nevada, commercial low-level radioactive waste disposal sites to the conditions at the Oak Ridge, Tennessee, liquid waste disposal area (Pits 2, 3, and 4, and trenches 5, 6, and 7)

	Oak Ridge	Beatty	Hanford
Average precipitation	50"/year	4.5"/year	6.25"/year
Waste to aquifer distance	0+	300 feet	290 feet
Distance to nearest perennial stream	250 feet	10 miles	8 miles
Average evaporation from open water surfaces	34"/year	70"/year	42"/year
Waste form	35,000,000 gallons (liquid)	Solid*	Solid*
General description of site	Hilly, humid area	Flat, desert area	Flat, desert area

*Some liquid wastes were solidified on site or received sorbed on solids or packaged in sorbent material.

+The water table intersects some trench bottoms in the Oak Ridge disposal areas.

QUESTION

4d. If chelates are to be used, can they be deactivated thermally, chemically, or biologically before evaporation and solidification?

RESPONSE

The chelating agent can be "deactivated" (reduced to simple molecules) thermally or chemically. However, this process has not been chosen by the licensee because: (1) the leach rate with chelating agent is tested to be less than those of solidified radioactivity without the chelating agent and (2) the additional process of "deactivation" adds complication to radwaste handling and may also result in additional equipment maintenance and personnel radiation exposure.

QUESTION

5. Is it possible that any of the solvent with or without dissolved radionuclides may remain after the principal effluent and first rinse water have been removed for evaporation and solidification -- and then be flushed into the Illinois River? If so, might the radionuclides absorbed by the river's sediment near the plant's cooling water outfall in years past become resuspended and migrate into the food chain?

RESPONSE

Approximately 99.9% of the radioactivity and chelating agents will be contained in the drainage of the initial decontamination solution and first rinse. These waste volumes will be evaporated because of their relatively high radioactivity and chemical concentration. After the decontamination solution and the first rinse, the subsequent rinses are expected to contain only 0.1% (approximately 3 Ci) of the total radioactivity from the decontamination operation. These subsequent rinses will be stored (after processing to improve purity if necessary) for plant reuse. No liquid waste from the decontamination operation will be flushed into the Illinois River.

QUESTION

5a. How much radioactivity and residual chelating agent are expected in the first rinse? How many additional rinses will there be? Scientists have told me that they did not think that chelated, radioactive metal ions would be removed by a demineralizer; although demineralizers have a high affinity for naked metal ions, I have been informed that they generally do not remove chelated forms. Or will the chelating agent perhaps be charged, and thereby be removable by the demineralizing step? People with whom I have spoken seem surprised to learn that the purification of the first rinse -- the removal of the residual chelating agents and chelated metal ions -- was to be done with a demineralizer. What is the explanation for this apparent departure from traditional practice?

RESPONSE

It is expected that approximately 140 Ci of radioactivity will be present in the first rinse. There is no estimate on the amount of residual chelating agent in the first rinse. However, since the solvent will be drained prior to the first rinse, the amount of chelating agent in the first rinse should be proportional to the small amount of residual fluid after the drainage. One or more rinses will be performed after the first rinse depending on the analysis of the rinse water. After each rinse, the water will be drained. Considering the large amount of water for each rinse (100,000 gallons), the amount of chelating agent in the second and/or third rinse should be minimal. The first rinse will be processed through the evaporator. No significant amount of chelating agent should be present in the distillate. Additional treatment by demineralizer of the distillate and/or subsequent rinses may be performed if necessary. The licensee's tests indicate that the demineralizer is effective in removing radioactive metals bonded by the chelating agent.

QUESTION

5b. According to Mr. Pettit's letter of February 6, 1979, "the formulation of the Dow Chemical solvent is known to DOE staff, but is protected from release to the public by a proprietary agreement." Solvents used for decontamination purposes at nuclear facilities have been described elsewhere, however, by DOE, Dow and Commonwealth Edison representatives as being "chelating agents" (pronounced key-lay-ting) -- that is, a chemical compound (typically organic) capable of forming clawlike multiple bonds with a metal ion. Typically these agents are also non-irritating to skin or eyes, a characteristic of the solvent which Mr. Pettit happened to mention.

Assuming the components of the solvent fit the definition of a chelating agent, is there any likelihood that there will be enough residual after the primary effluent and first rinse water have been removed, that some might be flushed into the Illinois River along with future routine releases of the coolant water? (The coolant-water discharge canal empties into the Illinois River at the confluence of the Des Plaines and Kanakee Rivers at Illinois River Mile 272.4). How tightly does the solvent bond metals? That is, if some were to pass through the sediment near the canal's discharge point, might it leach out additional radionuclides which have accumulated in the sediment near the outfall? Or if it is a relatively weak agent, might the sediments attract radioactive metals out of the chelate solution, thereby increasing the amount of radionuclides in the sediment and the potential for further contamination of the benthos? (The EPA report entitled "Radiological Surveillance Studies at a Boiling Water Nuclear Power Reactor", BRH/DER 70-1, describes the contents of the Dresden Unit One liquid waste effluents during tests in 1967 and 1968. Two later companion studies at reactors in Massachusetts and Connecticut describe the significance of the concentration of radionuclides in the sediments).

RESPONSE

No liquid waste, including water from all the rinses, from the decontamination operation will be discharged into the river. The licensee has committed to process all liquid waste to meet reactor coolant (RC) purity requirements for recycle as plant makeup water. RC purity requirement precludes significant quantities of chelating agent. In addition, any trace amounts of chelating agent will be decomposed to simple molecules at plant heatup during startup (chelating agent decomposition temperature is around 300°F).

QUESTION

6. What will be the impact of the solvent on the future safe operation of the Dresden plant?

According to the book, Dangerous Properties of Industrial Materials, by N. Irving Sax, published in 1963:

"One fallacy in the initial concept of stainless steel or other 'impervious' surfaces is that they are truly impervious. This has been shown to be false. Stainless steel after one vigorous cleaning is found to deteriorate in that more and more material may be absorbed or adsorbed and retained on the surface. Successive cleanings have been found to become more difficult and to require more vigorous methods of decontamination." (p. 149)

a. I understand that the NRC is responsible for making certain that this project will not compromise the integrity of the reactor vessel and its parts. What assurances, however, does either the NRC or the DOE have that this massive cleaning effort will not increase the surface fouling of the reactor system in the future, causing an acceleration in the buildup of crud in its many nooks, crannies and blind holes? Will even stronger chelating agents be needed at Dresden Unit One for future decontamination efforts, assuming the stainless steel properties quoted above from the Sax book are correct?

b. Could an acceleration in the rate of buildup of crud after the decontamination project increase the potential for pipe cracking or rupture? And also increase the radiation hazards to workers?

RESPONSE

a. There is no evidence based upon decontaminations that have been performed at the Canadian reactors and at the British reactors to indicate that the rate of recontamination or the rate of crud deposition on the cleaned surfaces would be accelerated by the decontamination process. On the surfaces of cleaned carbon steel, subsequent rates of deposition of copper have been shown to increase, but in the Dresden 1 cleaning process this copper will be removed by a "copper rinse". In fact, rather than using stronger chelating agents at Dresden Unit 1 in the future, it is quite possible that, following the strong decontamination solution to be used in August of 1979, the utility may elect to use a weaker but more frequent decontamination process on line that is currently being developed under EPRI sponsorship by Battelle Northwest.

b. There is no evidence that the buildup of crud either during routine operation or following decontamination could increase the potential for pipe cracking or rupture. The initiation of pipe cracking appears to require relatively high stresses and perhaps a specific rate of straining of the stainless steel in conjunction with the oxygen in the coolant. There is no evidence that crud deposits influence this initiation. Various laboratory tests on specimens that have been decontaminated and then re-exposed to typical BWR primary coolant water have shown no increased sensitivity to integranular stress corrosion of the type that causes the pipe cracking incidents that have occurred in boiling water reactors. Since there is no anticipated acceleration in the buildup of crud, it would appear that there would be no concomitant increase in radiation hazards to workers. In fact, the primary reasons for doing the decontamination in the first place is to reduce these radiation hazards. In some units the rate of recontamination has been shown to decrease simply because a substantial

portion of the Cobalt 59 has been removed from the surfaces of the piping materials by corrosion processes earlier in operation of the unit, so that the buildup of Cobalt 60 following the decontamination is reduced substantially.

QUESTION

7. What assurances are there that the men who participate in the Dresden decontamination experiment will not suffer from exposure to the combination of the solvent and the radioactive materials suspended in the solvent in either the aqueous or gaseous forms?

One of the possible reasons for the increased incidence of leukemia and cancer at Portsmouth and other naval shipyards which Drs. Thomas Najarian and Theodore Colton mention in their communication published in The Lancet, May 13, 1978, is that: "Other factors (asbestos, smoking, industrial solvents) may have interacted synergistically with radiation to cause more deaths from cancer and leukemia than radiation alone would have caused." (emphasis added). I realize that one of the primary reasons for trying to develop an effective decontamination process is to reduce the accumulation of gamma-emitting corrosion products which in turn cause high radiation fields within operating nuclear power plants, and thereby necessitate the hiring of excessive numbers of repair and maintenance workers.

RESPONSE

The concerns about operating personnel receiving radiation exposure and being exposed to the decontamination solution are synonymous. Since the spent decontamination solution contains radioactivity, exposure to the solution will result in exposure to radiation. The design of the system is such that personnel should not have direct physical contact with the radioactive decontamination solution. Personnel working near such solutions generally wear protective clothing, e.g., face masks, to further minimize the possibility of contamination. The licensee is committed to comply with limiting radiation exposure to personnel to within the limits specified in 10 CFR Parts 20.101 and 20.103. The licensee is also committed to meet the objective of limiting the radiation exposures to as low as reasonably achievable (ALARA) level in accordance with 10 CFR Section 20.1(c).

QUESTION

7a. According to a letter dated March 13, 1979, from Mr. A. David Rossin (System Nuclear Research Engineer, Commonwealth Edison), thirty workers will be needed during the presently proposed 100-hour project. And although I was told by Mr. Paul Pettit of the DOE that his agency is not concerned about the toxicity of the Dow solvent itself during the decontamination operation, what hazards may it pose to workers when it is in combination with radioactive materials?

RESPONSE

Although there is no demonstrated synergistic interaction between the Dow Chemical NS-1 solvent and radiation exposure, the ALARA consideration for radiation exposure should be sufficient to limit the exposure to the Dow Chemical NS-1 solvent. The licensee has submitted the plans and has committed to maintain the radiation exposure to personnel to ALARA. The NRC staff has reviewed the ALARA plan and concluded that the ALARA objective can be met by the proposed plan of actions.

QUESTION

7b. What procedures are to be taken to make certain that the radionuclide-chelating agent is totally contained and will not in fact come in contact with the workers? What is the radiation dose expected per hour at one meter from the reactor containment vessel, the effluent piping, the evaporation and solidification equipment, and the drums preparatory to and during shipping? What shielding will be erected to protect the workers?

RESPONSE

The licensee is committed to comply with radiation exposure limits to operating personnel pursuant to 10 CFR Part 20. In addition, the licensee is committed to design features and operating procedures such that radiation exposure to plant personnel will be maintained ALARA. Since radioactivity is contained in the decontamination solution, contact exposure to the solution will also be kept at a minimum.

The radiation dose varies depending on local equipment geometry, plate-out distribution and self shielding factors. The radiation at one meter from a reactor system component during the decontamination process is generally less than that during normal operation and is expected to be in the several Rads per hour range. The radiation near evaporation and solidification equipment should not be more than an order of magnitude higher. These kinds of dose rates are not uncommon at radwaste equipment during routine operation. However, it should be noted that personnel access to those areas is not expected because of remote control features.

The objective of the decontamination process is to reduce the total radiation exposure to plant personnel. The decontamination will remove the major source of radioactivity encountered by workers during operation and maintenance of the plant and, thus, significantly reduce personnel exposure in performing these activities. It is estimated that the saving in radiation exposure to personnel over the next 10 years is 10 times the radiation exposure to personnel expected for performing the decontamination operation.

Date: June 26, 1980

STAFF'S RESPONSE TO QUESTIONS CONTAINED IN THE
ILLINOIS SAFE ENERGY ALLIANCE'S SEPTEMBER 20, 1979 PETITION

(DOCKET NO. 50-10)

QUESTION

1. What effect(s) will the admittedly corrosive solvent NS-1 have on the reactor's piping system? As stated under Category A Technical Activity No. A-15, "The primary NRC concern related to the decontamination is to assure that the decontamination method does not degrade the integrity of the primary coolant system boundary. This consideration involves both immediate degradation during decontamination and latent effects that could cause degradation during subsequent operation of the reactor." How can all the crucial welds, valves and joints, etc., many of which are inaccessible, be inspected to assure decontamination has not caused damage?

RESPONSE 1

All primary cooling system materials that will be in contact with NS-1 have been tested extensively to assure that the integrity of the primary cooling system will not be degraded by the cleaning. The corrosion research program covered several thousand individual corrosion tests of all the basic Dresden Unit No. 1 primary cooling system materials that will be exposed to the solvent under conditions of time and temperature exceeding those proposed for the actual decontamination.

Based upon the staff's review of the tests carried out by CECo, we have concluded that the plant materials will not be significantly damaged by the decontamination solution.

The successful laboratory testing program has provided a significant basis for authorizing this action. In addition, pilot scale projects utilizing NS-1 have been successfully carried out at the Peach Bottom Nuclear Power Station where a heat exchanger was decontaminated and at Dresden Station where the Dresden Unit No. 1 Corrosion Fatigue Test Loop was decontaminated. These decontaminations, carried out on full scale components of portions of the primary cooling systems at these facilities have provided assurance that full scale operations utilizing NS-1 will produce similar results to the laboratory scale experiments.

The inspection program that will be carried out by CECo after the cleaning will be used to determine whether the decontamination has caused the structural integrity of the primary cooling system to be degraded. Only a very small number of the "welds, valves and joints, etc." are physically inaccessible for inspection. These components are inaccessible only because it is impractical to inspect them while they are radioactive. The chemical cleaning will allow the inspection of these components and will increase the level of confidence that the primary cooling system does not contain incipient defects.

In the case of the few welds that are physically inaccessible, there is no reason to expect that their condition following decontamination will differ from the condition of the inspectible welds that have been cleaned by the same NS-1 solvent under identical conditions of time and temperature. Therefore, if the inspection of the accessible welds indicates that there has been no significant degradation caused by the cleaning, there will be reasonable basis to conclude that similar welds in inaccessible locations will exhibit similar results.

QUESTION

2. What standards or guidelines will be utilized for "'baseline' inspection and appropriate followup inspections to provide a high degree of confidence that no degradation has occurred?" Reliance on existing Technical Specifications and "special inspections" seems inadequate in light of the following NRC admission: "Since this is an area (decontamination) where the NRC staff has limited expertise and experience with commecial nuclear power plants, it will be difficult to establish the necessary meaningful guidance and criteria for the decontamination of operating reactors in advance of these anticipated licensee submittal." (Emphasis added) To my knowledge the NRC has not yet published a NUREG Document on Decontamination and/or a Regulatory Guide which identifies acceptable methods of decontamination and establishes materials testing criteria that must be satisfied to qualify each decontamination method for licensing approval. Whether or not enforceable. However, since the integrity of the primary coolant system is essential for protection of the public health, decontamination should not proceed until this important unresolved generic safety issue is resolved.

RESPONSE 2

The integrity of the primary cooling system is inspected on a continuing basis in accordance with the requirements of Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code and Addenda.

Section 50.55a(g) of Title 10 Part 50 of the code of Federal Regulations establishes the requirements for inspection of the primary cooling system integrity. The inspection program for Dresden Unit No. 1 is in accordance with the requirements contained therein.

Facility Operating License No. DPR-2 issued to Dresden Unit No. 1 requires that Commonwealth Edison operate the facility in accordance with Section XI of the Code and periodically update their inspection proram to agree with the Edition of the Code currently required by our Regulations.

We have concluded that inspection of the primary cooling system in accordance with Section XI of the ASME Boiler and Pressure Vessel Code provides adequate assurance that the system is free of incipient flaws larger than those allowed by the ASME code and therfore provides adequate assurance that the primary cooling system has not been significantly degraded.

QUESTION

3. Whether or not decontamination wastes can accurately be classified as "low-level" remains unanswered. What radionuclides and in what concentrations are expected besides cobalt 58 & 60, cerium, manganese, zirconium and cesium? According to NRC information, 3000 curies of radioactive material will be removed and eventually placed in 1200 55 gallon drums. If the radioactive material is uniformly distributed throughout the solidification agent, one can conclude each barrel will contain 2 1/2 curies of radioactivity or 12,500 nanocuries per gram. Can waste with this concentration of radionuclides be defined as low-level? What assurances does the public have that significant amounts of transuranics won't be present? According to Mr. Steve Lange of Commonwealth Edison, "transuranics are not expected," but apparently their presence cannot be ruled out. If the waste contains 10 or more "nanocuries of transuranic contaminants per gram of material," where will it be buried? Or will it remain at the Dresden site forever as stated by Mr. Lange?

RESPONSE 3

The radionuclides expected to be present in the Dresden decontamination waste are listed in Table 1 below along with the estimated total activity of each isotope expected.

Radioactive wastes are separated into two broad classifications: "high level wastes" and "other than high level wastes". High level wastes are radioactive wastes produced in the first solvent extraction cycle of fuel reprocessing operations. If fuel is not reprocessed, the unprocessed fuel will be classified as high level waste should it be discarded. High level wastes are highly radioactive, contain significant quantities of transuranic radionuclides, and require extensive shielding, sophisticated remote handling techniques, and often require cooling to remove the heat generated by the decay of the contained fission products.

The second waste classification "other than high level wastes" includes wastes that are not produced in the first step of the solvent extraction cycle of fuel reprocessing or the unprocessed fuel. The Dresden 1 waste that will be produced from the decontamination falls into this class and therefore may be buried in a commercial waste burial site.

The Dresden decontamination waste will not be high level wastes. These wastes will be packaged and shipped in full conformance with all applicable NRC and Department of Transportation requirements.

Commonwealth Edison has committed to measure the concentration of the transuranic nuclides in the waste generated by the decontamination of the Dresden 1 primary cooling system. The presence of transuranic elements in levels in excess of 10 nanocuries per gram is definitely not expected based upon measurements of the transuranic content of the corrosion product film observed on artifacts and samples removed from the Dresden Unit No. 1 primary system and other boiling

TABLE 1

NUCLIDE	CURIES	HALF LIFE	ESTIMATED* Ci/55 Gal. DRUM
^{60}Co	2160	5.3 years	1.80
^{58}Co	630	22 days	0.53
^{144}Ce-^{144}Pr	117	290 days	0.10
^{54}Mn	30	25 days	0.03
^{95}Zr-^{95}Nb	21	63 days	0.02
^{57}Co	15	270 days	0.01
^{141}Ce	15	32 days	0.01
^{103}Ru	9	41 days	.01
MFP	3	**	.01
	3000		2.50

* Assumes that the waste will be uniformly distributed in 1200 drums.

** The half life of mixed fission products may be approximated by assuming that $T_{\frac{1}{2}} = t$ where t is the time since fission.

water reactors. However, the actual waste will be analyzed for transuranic content and if greater than 10 nanocuries per gram (10^{-9} Ci/gm) is detected, the waste will not be disposed of at a commercial waste burial site that has a 10^{-9} Ci/gm limit for transuranics.

In the unlikely event that transuranic radionuclides are discovered present in concentrations above these applicable limits, the waste will not remain at Dresden "forever". The waste would be disposed of at a waste depository operated by the U. S. Government which is authorized to dispose of transuranic waste.

QUESTION

4. What is the long term environmental impact of combining radioactive waste with chelating agents? As you know, Drs. Means, Crerar and Duguid found chelating agents to be the very agents responsible for radionuclid mobilization at Oak Ridge, Tennessee (See Science, Vol. 200, June 30, 1978). The NRC response that decontamination wastes from Dresden 1 will be buried in "dry" areas is not adequate in light of man's inability to predict climatic conditions over the long time spans this waste remains dangerous to life. Furthermore, radionuclides can leach out (in a manner similar to the operation of a flea collar) even in dry areas and be carried from original burial sites by scant amounts of rain water. At least one recent study shows radionuclide-chelate complexes are persistent over time and can readily be taken up by plants, etc.

RESPONSE 4

Migration as observed at the Oak Ridge site would not occur at the Beatty, Nevada or Hanford, Washington commercial disposal sites. A solid waste is to be disposed of at the commercial sites. The climate, geology and hydrologic conditions eliminate the possibility for flow to saturate soils and transport radionuclides as observed at Oak Ridge.

The migration as observed at the Oak Ridge site would not occur at the disposal sites which may receive the solidified Dresden 1 decontamination wastes, assuming that container corrosion and leaching of soluble radionuclides occur. Commonwealth Edison has notified NRC staff that the disposal sites which are being considered for the Dresden 1 wastes are the Beatty, Nevada and Hanford, Washington commercial low-level waste disposal sites. Table 2 gives a brief summary of the disposal and environmental conditions at these sites, with a comparison to the region of disposal pits 2, 3 and 4, and trenches 5, 6 and 7 at Oak Ridge. These pits and trenches are clustered in the vicinity of Whiteoak Creek. There are many similarities between these disposal units, which include trench 7, which was found to be a source of chelated radionuclides. The major difference between Oak Ridge site, where migration has been observed, and the commecial sites, where no migration has been detected, is the general lack of water at the commercial sites and the abundance of water at the Oak Ridge site. Oak Ridge experiences very high

Table 2 Comparison of the conditions at the Hanford, Washington, and Beatty, Nevada, commercial low-level radioactive waste disposal sites to the conditions at the Oak Ridge, Tennessee, liquid waste disposal area (Pits 2, 3, and 4, and trenches 5, 6, and 7)

	Oak Ridge	Beatty	Hanford
Average precipitation	50"/year	4.5"/year	5.25"/year
Waste to aquifer distance	0+	300 feet	290 feet
Distance to nearest perennial stream	250 feet	10 miles	8 miles
Average evaporation from open water surfaces	34"/year	70"/year	42"/year
Waste form	35,000,000 gallons (liquid)	Solid*	Solid*
General description of site	Hilly, humid area	Flat, desert area	Flat, desert area

*Some liquid wastes were solidified on site or received sorbed on solids or packaged in sorbent material.

+The water table intersects some trench bottoms in the Oak Ridge disposal areas.

precipitation, has a water table which probably intersects pits and trenches, and the Oak Ridge waste was disposed of as a liquid. For trench 7, which was identified by Duguid, Means and Crerar as a source of chelated radionuclides, we estimate that approximately 7 million gallons of liquid waste was disposed during a three year period from 1962 to 1965. Considering the liquid to be evenly distributed over the area of trench 7, the equivalent water flow in terms of precipitation would be on the order of 100 feet per year. This is far in excess of the few inches of precipitation incident at the desert sites, where the majority of the precipitation is rapidly returned to the atmosphere by evaporation. The estimates of water flows at Oak Ridge are based on figures reported by Lomenick, Struxness, and Jacobs and trench dimensions from Duguid.

Migration of radionuclides from the Oak Ridge disposal trenches to the surface was also promoted by the type of geologic material in which the trenches were excavated. The trenches were founded in fractured shale which may have small solution cavities as well as fractures available to conduct water at rapid rates. Trench 6, which received liquid wastes for approximately one month, had to be taken out of service due to the breakthrough of radionuclides at a seep 100-feet downslope. Cesium-137 and strontium-90 were present in seep water, having migrated 100 feet in less than one month, due to fracture flow. In comparison, the commercial disposal trenches at Beatty and Hanford are excavated in a weakly cemented alluvial fill and unconsolidated sand and gravel, neither supporting fracture flow. The topography and location of the Oak Ridge disposal sites promoted migration to surface seeps. The trenches were excavated on hills, such that trench bottoms were higher than wet swampy areas downslope. Thus, when the trench bottoms are saturated, a hydraulic gradient exists to drive flow to surface seeps. The slopes leading from the wet low areas up to the disposal trenches are often in the range of 1:5 to 1:10. The commercial disposal sites at Beatty and Hanford on the other hand are characterized as flat desert areas with slopes on the order of 1:100 to 1:300, providing a much longer path between the trench bottoms and points where the surface are at equal elevation. Also, the intervening material is undersaturated, and volumes of water which are much greater than available in the desert would be required to saturate the soil before any significant flow to the surface could occur (for example as would cause the swampy regions associated with the Oak Ridge seeps).

Also, the solid wastes disposed at Beatty and Hanford are covered with three to five feet of dry sandy materials, which would absorb precipitation. This provides some protection against the occurrence of waste leaching. Should water be supposed to enter a desert disposal trench, it would tend to be

absorbed by the trench walls and bottoms rather than collect in the trench bottom, thus preventing saturation of the wastes and minimizing the time of contact of wastes and water.

QUESTION

5. How stable will vinyl ester plastic resin be which is supposed to encapsulate the decontamination wastes? According to NUREG-0471, "There are no current criteria for acceptability of solidification agents." Therefore, what it the basis established by the NRC (and not Dow Chemical or Commonwealth Edison) for concluding this solidification process will be acceptable? What consideration has been given to the fact that organic solvents present in much radioactive waste can disolve the Dow solidification agent?

RESPONSE 5

The basic formulation of the Dow Chemical solidification process was developed in the late 1960s under the trade name NAJVAR. The first solidified samples of prototype test has remained free of liquid (since 1974 when the test was made). Analysis has shown that the longest lived significant isotope that will be solidified after the decontamination is Co-60 with half-life of 5.2 years. Tests have been performed to demonstrate that the stability of the solid polymer will not substantially alter for over 50 years, corresponding to 10 half-lives of Co-60. These tests include accelerated aging, biological degradation, radiation degradation and temperature cycling (freeze and thaw resistance tests). After 10 half-lives, the original 2160 curies of Co-60 will have decayed to less than 2.16 Ci.

The use of the Dow solidification media is explicitly authorized in the state of Washington license issued to the Hanford, Washington commercial waste disposal operation. The NRC staff has reviewed the Dow solidification process and has concluded that the solid waste form resulting from the process is acceptable for burial.

QUESTION

6. What the the maximum levels of radiation exposure workers could receive while carrying out decontamination? What are the expected levels of radiation exposure workers may receive? If NS-1 is regarded as corrosive or a "strong chemical decontamination," (NUREG-0410), how can it be claimed that "it is essentially non-irritating when applied directly to the skin or eyes ...? (Letter from D.O.E.).

RESPONSE 6

Workers are normally limited to 1.25 rem to the whole body per calendar quarter. However, in accordance with the provisions of 10 CFR 20 Section 20.101, a licensee may permit an individual in a restricted area to exceed 1.25 rem per quarter if 1) the dose does not exceed 3 rem, 2) the total cumulative occupational dose to the whole body shall not exceed 5(N-18) rems where "N" equals the individual and 3) the licensee has determined the individual's accumulated occupational dose on Form NRC-4. The exposures at Dresden are expected to be maintained below these limits.

During the decontamination regular industrial safety measures will be employed to prevent all hazardous chemicals from contacting the skin or eyes. Experience to date has not indicated any significant indistrial safety problems with NS-1.

QUESTION

7. How many truckloads of waste will have to be shipped and at what risk? This question has not been adequately answered because it is possible NS-1 will have to be flushed through the system more than once. According to Mr. Lange, the absorption capacity of the solvent may be taken up by iron instead of "crud" resulting in the production of twice as much waste.

RESPONSE 7

The exact quantity of solid waste that will be generated by the decontamination cannot be identified until the decontamination has been completed. The uncertainty exists because it is the concentration of radioactivity that will limit the concentration of waste placed in each barrel.

Based upon CECo's preliminary estimates, approximately 600 to 1200 55 gallon drums of solidified waste may be produced by the decontamination. The number of barrels that will be placed on a truck depends on the radiation levels at the drum surface and will not be known until the decontamination takes place. We estimate that between 10 and 100 truck loads of waste will be generated.

QUESTION

8. What is the status of the NRC's consideration of the need for an Environmental Impact Statement for the Dresden 1 decontamination?

RESPONSE 8

As stated in the Director's Decision on your petition, the NRC is preparing an environmental impact statement on the decontamination. You will receive a copy as soon as it is available. The statement is expected to be complete by the end of May.