POLICY ISSUE
(Information)

March 18, 1982 SECY-82-121

FOR: The Commissioners

FROM: Executive Director for Operations

SUBJECT: STATUS OF STUDIES ON POSSIBLE ALTERNATIVES FOR TMI-2 ACCIDENT WATER DISPOSITION

PURPOSE: To inform the Commission of three separate studies currently underway, which will assess potential technical, regulatory and socio-economic impacts for possible alternatives for TMI-2 accident water disposition.

DISCUSSION: In its April 28, 1981 Policy Statement on the Cleanup of the TMI-2 Plant, the Commission reserved for itself final approval of any future proposal for disposition of the processed accident-generated water. Earlier, pursuant to the February 27, 1980 City of Lancaster Agreement, the Commission had agreed that:

"...prior to holding any meeting to approve any discharge of accident-generated wastewater into the Susquehanna River, except emergency discharges, the NRC will

(a) Give notice of such meeting...to the Mayor of the City of Lancaster...

(b) Afford such interested persons as the Commission may determine an opportunity to make a technical presentation to the Commissioners of the NRC under procedures approved by the NRC."

In this regard, several possible disposition alternatives were identified in the March 9, 1981 Final Programmatic Environmental Impact Statement (PEIS) of TMI-2 cleanup activities. Three

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separate studies, under the purview of NRR-Three Mile Island Program Office (TMIPO), are now underway to evaluate the potential technical, regulatory and socio-economic impacts of those alternatives already identified as well as additional disposal alternatives which have since been developed. Ultimately, these assessments are intended to serve as important input to the Commission's decision-making process on this matter.

It should be noted that the TMI-2 licensee, GPU Nuclear, is not expected to submit any proposal for disposition of the processed accident water before January 1983. Adequate on-site storage capacity currently exists and some of the water is being re-used in the cleanup process. Current projections of the amount of processed accident water from all sources (including in-leakage) which will have to be disposed of is approximately 1.9 million gallons. The projected characteristics of the processed water as well as the status of accident water processing activities to date are given in Enclosure I.

The contractor for the first study, Waste Management Group, Inc. (WMG) of White Plains, N.Y., will:

(1) identify a range of feasible alternatives for disposal of processed water;

(2) evaluate the technical considerations and indicate specific advantages and disadvantages of the various water disposition alternatives;

(3) identify radiation releases to the environs associated with appropriate alternatives;

(4) estimate the economic cost of each alternative and

(5) identify regulatory constraints which apply to each alternative.

WMG has identified several feasible processed water disposal alternatives in addition to the ten considered in the PEIS--for a total of twenty-seven alternatives--which will be included in the above review. The twenty-seven alternatives, accompanied by a brief description of each, are indicated in Enclosure II.

As a logical extension of the WMG study, the second on-going research effort will identify probable socio-economic impacts of the twenty-seven disposal alternatives and evaluate means for minimizing and/or mitigating any such impacts. The contractor, Battelle Pacific Northwest Laboratories (PNL) in Richland, Washington will examine possible impacts from the actual physical activities associated with disposal as well as those likely to result from perceived threat of physical harm. Finally, PNL will develop impact cost estimates for all cases where quantification of impacts is possible. Specifically, these estimates will indicate the range of minimum and maximum magnitudes of likely impacts.

As originally conceived, the PNL scope of work did not include the potential socio-economic impacts on the Chesapeake Bay from disposal of processed accident water into the Susquehanna River. As noted in Section 7.2.5 of the PEIS, the State of Maryland had informed the NRC of its intentions to undertake a comprehensive study of its own to determine potential economic impacts to Chesapeake Bay activities. With requested assistance from the TMIPO staff, the State of Maryland selected R. J. Harmon and Associates of Washington, D.C. as its contractor for this work.

However, as a result of recent discussions with the State of Maryland, it appears that their study will only go so far as to identify the probable, major areas of socio-economic impact on the Chesapeake Bay--without attempting to assess the severity of potential economic losses or mitigation. In order to achieve a consistent depth of study for all of the disposition alternatives, we (with the State of Maryland's endorsement) have already requested PNL to expand their current scope of work to include, where feasible, the development of impact cost estimates for the Chesapeake Bay.

Close coordination among these three studies will be accomplished by the TMIPO. The anticipated schedule for each of the studies is as follows:

Waste Management Group

Start: January 12, 1982

Final Report Due: July 1982

Pacific Northwest Laboratories

Start: October 1981

Phase I Report Due: January 31, 1983

Phase II Report (Chesapeake Bay) Expected: Summer 1983

State of Maryland

Start: February 1, 1982

Final Report Due: December 1982

Upon receipt of a proposal from the licensee, the staff will utilize the results of the studies in forwarding a recommendation to the Commission regarding disposal of the processed accident water. Until appropriate action is taken by the NRC, the TMI-2 license has a specific prohibition for any final disposition of this water.

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Executive Director for Operations

Enclosure(s):
1. Current Status and Projected Characteristics of TMI-2 Processed Accident Water
2. TMI-2 Processed Water Disposition Alternatives Currently Under Study

ENCLOSURE I

CURRENT STATUS AND PROJECTED CHARACTERISTICS

OF TMI-2 PROCESSED ACCIDENT WATER

The status of accident-generated water processing activities is:

Auxiliary Fuel Handling Building - Essentially all of the approximately 750,000 gallons of water have been processed by the EPICOR-II System as of this past fall.

Containment Building - Approximately 600,000 gallons of sump water have been processed by the Submerged Demineralizer System and EPICOR-II. As of February 28, 1981, the sump has about 30,000 gallons of water left, at a depth of 5 inches. (Originally, water in the sump was 8 1/2 feet deep.) Sump water processing is complete for now and will be resumed once initial decontamination of the containment building is finished.

Reactor Coolant System - None of the 90,000 gallons of water in the reactor coolant system have been processed to date. Plans are under review for processing; however, any schedule is uncertain due to current financial constraints.

The projected characteristics of the TMI-2 processed accident water are:

Radionuclide	Curie Inventory
H-3	2,600
Co-60	0.043
Sr-90	0.1
Ru-106	0.038
Sb-125	0.032
Cs-134	0.2
Cs-137	0.5
Ce-144	0.033

These estimated radionuclide inventories in the processed water, except for tritium, are based on accident water constituents, submerged demineralizer system performance and the recommendations made by the Advisory Panel for the

Decontamination of TMI-2. As you will recall in a February 20, 1981 letter to the Commission, the Advisory Panel recommended: "That the design and operation of decontamination systems for processing radioactively contaminated water should minimize, as far as practicable, the amounts of residual radioactivity in the resulting processed water.

The Panel believes the following curie inventories for all processed water resulting from clean-up activities are achievable:

Isotope	Curies
Sr-89*, 90	0.1
Cs-134	0.2
Cs-137	0.5 "

Upon advice from the staff, these levels were considered achievable by the Commission in its April 9, 1981 letter to John Minnich, Chairman of the Advisory Panel. Based on water processing activities to date, that information still holds true.

*Although Sr-89 was included by the Advisory Panel, decay has reduced its level to undetectable amounts.

ENCLOSURE II

TMI-2 PROCESSED WATER

DISPOSITION ALTERNATIVES CURRENTLY UNDER STUDY

A. Reuse/Recycle

Alternatives 1 and 2: Reuse at TMI-1 or TMI-2

These alternatives would involve retaining the processed accident water in storage tanks, and using it, in lieu of fresh water as make-up for water removed from either unit's primary cooling system. When added to the cooling system, the accident water would become mixed with, and indistinguishable from, the non-accident water in the cooling system. Eventually this mixed water might be lost to the environment via normal leakage, processing and discharge pathways.

These alternatives could not be implemented until one of the TMI units has been restarted, and necessary regulatory requirements have been met. In addition, disposing of the processed accident water in this manner would be a slow and indirect process, amounting to a deferred discharge option.

Alternative 3: Reuse at Other PWRs

Assuming other utilities with PWRs willing to accept the processed water could be identified, bulk liquid would be transported to other sites for use as make-up for reactor operation. This would amount to defacto disposal to the environment from normal plant releases.

Alternative 4: Reuse at DOE Facilities

Reuse at production reactor or defense reactor facilities would be contemplated.

B. Long Term On-Site Storage

Alternative 5: Bulk Liquid Storage

Processed water would continue to be stored in currently available holding tanks on TMI. The presence of this water is not an issue receiving much public attention at this time. However, this may change if a decision is made to use this as a means for long term storage of the water (20-25 years). Ultimately, and perhaps well before 20-25 years have passed, the water would have to be disposed of in some manner. Prior to that time, there is the possibility of accidental releases to the river, i.e., leaks or tank rupture.

Alternative 6: Cement Block Storage

This alternative would require the construction of cement mixing facilities on TMI. Large cement blocks would be made (6' X 6' X 10'), coated with a weather resistant material, and placed above ground, in a storage area occupying about four acres. Eventually these would have to be permanently disposed of, most likely by offsite burial.

This alternative would involve release of tritium vapor to the atmosphere during the mixing phase. Additionally, about half of the remaining tritium would be given off as the cement blocks cured. Even after coating, tritium would continue to escape, although the other radionuclides would be immobilized.

C. Treatment

Alternative 7: Combined Catalytic Exchange Process (CECE)

The Combined Catalytic Exchange Process (CECE) removes tritium from the processed accident water via an equilibrium exchange reaction between molecular tritium and tritium oxide which favors formation of the latter. Detritiated water would then be released to the atmosphere as gaseous hydrogen and oxygen. The tritium and other radionuclides are concentrated in about 1,000 gallons of water which would remain after the CECE process is completed. This water would be solidified for offsite burial, resulting in the same kind of tritium releases as described for Alternative 6.

Implementing this alternative would take approximately ten years, four years for construction of the facility, and six years to process the water. The CECE process has not previously been used on the scale that would be required for treatment of the processed accident water.

Alternative 8: Direct Electrolysis

Similar to the CECE process, electrolysis would require the construction of a facility on TMI to separate the processed accident water into gaseous tritiated hydrogen and oxygen which would be released to the atmosphere. Gaseous tritiated hydrogen has 1/1,000 of the health effect rate of tritiated water vapor. However, the gaseous tritiated hydrogen would readily recombine with water to form tritiated water vapor so that only the adjacent populace would benefit from the temporary conversion of the processed accident water into gaseous tritiated hydrogen.

Alternative 9: Distillation Process

Distillation is based on deuterium production processes involving columns used in conjunction with processes for catalytic exchange between deuterium and heavy water vapor. Most of the tritium in the processed accident water would be concentrated in about 95,000 gallons of the water. This water would then be solidified for offsite burial, resulting in the same kind of tritium releases as described in Alternative 6.

The detritiated water would remain in liquid form after processing, and be released to the river. It would take about two years of processing to concentrate the tritium. In addition, facilities for the distillation process would have to be constructed on TMI.

D. Controlled Discharge to the Susquehanna River

Alternative 10: Controlled High Volume Release

In this option, the processed accident water would be diluted by a factor of at least 120 and released to the river at the highest permissable flow rate. The dilution factor would reduce concentration levels enough to allow release to the river within existing regulatory requirements. All the processed accident water could be released in less than a week with this option.

Alternative 11: Controlled Annual Releases

This is similar to Alternative 10 except that the amount of processed water to be released each year would be equivalent to the amount which would have been released if TMI-2 had not been damaged and had continued to operate in a normal fashion. This would extend the period necessary to release all the processed accident water to about five years.

E. Ocean Disposal

Alternative 12: Bulk Liquid Release

Processed water would be shipped as bulk liquid to a remote location in the Atlantic Ocean for permanent disposal. High dilution and dispersion would likely occur.

Alternative 13: Packaged Solid Disposal

Processed water would be solidified and shipped to port handling facility. Acceptable packaging would have to meet various current U.S. and/or international regulations. Packaged processed water would be transferred to a barge and subsequently transported to an EPA-designated ocean disposal site.

F. Forced Evaporation

Alternative 14: Open Cycle Evaporation at TMI-2

Processed water would be released to the atmosphere via a direct distillation process. Offsite doses would likely exceed those of other on-site alternatives.

Alternative 15: Open Cycle Evaporation at Off-Site Facility

Assuming facility willing to accept accident water could be identified, processed water would be transported in bulk and same process as that described for Alternative 14 would occur. Entire tritiated water inventory would be removed from TMI-area.

Alternative 16: TMI Cooling Tower Evaporation

The TMI mechanical draft cooling towers would be used to evaporate the processed accident water. About 95% of the water and the tritium would be released to the atmosphere as water vapor. The remaining 5% of the water, termed "blowdown", would fall to the bottom of the cooling tower, be diluted and discharged to the river. The blowdown would contain about 95% of the radionuclides other than tritium (and 5% of the tritium) that are in the processed accident water. The entire process would be a controlled method of disposal which would take about one year or less to complete.

G. Pond Evaporation

Alternative 17: On-Site Ponds

Large man-made ponds already exist on TMI. With minor modifications, they could be used to store the processed accident water. The tritium would be released to the atmosphere as water vapor. However, the volume of water in the pond would remain constant because precipitation is approximately equal to evaporation in the TMI area. Radionuclides other than tritium would remain in pond residues, eventually requiring drainage into the river. The pond lining would be disposed of by offsite disposal. The initial rate of release of tritium would depend upon the time of the year the water is put into the pond--initial release rates would be higher in the summer than the winter. After three to five years the tritium concentration of the pond water would be equal to that of the river. Prior to that time accidental releases of the water to the river are unlikely but possible.

Alternative 18: Off-Site Ponds

Bulk liquid would be transported to remote DOE site, e.g., Nevada Test Site where high evaporation rates are typical.

H. Near Surface Land Disposal

Alternative 19: Land Burial at Commercial Sites

Solidified accident water would be transported in numerous shipments to commerical sites in Nevada or Washington State. Land disposal operations would provide a high degree of waste isolation and environmental control. Site specific surface water, groundwater and erosion based radionuclide migration pathways must be considered.

Alternative 20: Land Burial at DOE Site

Same as Alternative 19 except burial would occur at a DOE site such as Hanford.

Alternative 21: Liquid Dispersal in Cribs (Hanford)

This is a controlled disposal practice, similar to leaching ponds, for intermediate activity radioactive liquid. Local groundwater is principal migration pathway.

Alternative 22: Land Spraying (Nevada Test Site)

This is a process which results in fast evaporation and dispersion of tritium at a remote site already contaminated. This has been done in the past (pre-1974) with contaminated water for dust control.

I. Deep Land Disposal

Alternative 23: Deep Well Injection at TMI Site

This option would require construction of a deep well injection facility on TMI, and acquisition of a permit to dispose of low-level wastes at that location. Satisfying these two criteria may require a long lead time; however, once these steps were accomplished the processed accident water could be disposed of relatively quickly. The water would be injected, under high pressure, to a depth well below aquifers which are a source of drinking water.

Alternative 24: Commercial Deep Well Injection

Same process as Alternative 23, assuming commercially operated deep well system willing to accept accident water can be identified. Federal and State Underground Injection Control regulations apply.

Alternative 25: DOE Facility Deep Well Injection

Same process as Alternative 23, using deep well systems at either Nevada Test Site or INEL in Idaho.

Alternative 26: Hydrofracturing at ORNL

Processed water would be mixed with cement and pumped deep into the ground, thereby hydraulically fracturing the strata.

J. Alternative 27: High Altitude Release to Atmosphere

This option would be performed over remote low population areas whereby processed water would be evaporated and discharged into the upper atmosphere.