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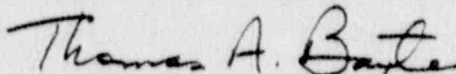 Commission
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Mr. Howard A. Wilber
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  Commission
Washington, D.C. 20555

In the Matter of
GPU Nuclear Corporation
(Three Mile Island Nuclear Station, Unit 2)
Docket No. 50-320-OLA
(Disposal of Accident-Generated Water)

Administrative Judges Moore, Kohl and Wilber:

Please find enclosed, for your information, a copy of the
Processed Water Disposal System Process Control Plan (Rev. 0),
dated December 15, 1989, which GPU Nuclear Corporation has pro-
vided to the NRC Staff.

Respectfully submitted,

Thomas A. Baxter
Counsel for Licensee

TAB:jah
Enclosure
cc: Service List attached

B:061TAB5413.89

D503

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD 29 A11 :55

In the Matter of	)	
	)	
GPU NUCLEAR CORPORATION	)	Docket No. 50-320-OLA
	)	(Disposal of Accident-
(Three Mile Island Nuclear	)	Generated Water)
Station, Unit 2)	)	

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PROCESSED WATER DISPOSAL SYSTEM
PROCESS CONTROL PLAN

Prepared By _____ 13 December 89
PWDS Cognizant Engineer

Concurred By _____ 12/14/89
RTR

Approved By _____ 12/13/89
Manager, TMI-2 Engineering

Approved By _____ FOR R.E. Sieglitz
Manager, Waste Management

Approved By _____ 15/15/89
Site Operations Director

Revision 0
Date: December 15, 1989

PROCESSED WATER DISPOSAL SYSTEM

PROCESS CONTROL PLAN

1.0 PURPOSE AND SCOPE

The purpose of this document is to describe the program which, when implemented by operating procedures, will ensure that the effluents from and the solid waste produced by the Processed Water Disposal System (PWDS) will be in compliance with all applicable regulatory requirements. Section 2 of this program describes the influent and effluent criteria to be imposed on PWDS operations with an explanation of how these criteria were derived. Section 3 presents the calculations used in setting the influent criteria that will assure meeting the effluent and solid waste specifications. Section 4 describes the sampling program that will be implemented by PWDS operating procedures to assure the collection of sufficient laboratory data to verify compliance with the applicable specifications.

2.0 DISCUSSION

This section describes the effluent criteria imposed on PWDS operations and explains how influent criteria have been developed to assure that effluents are within the required limits.

2.1 Effluent Limits

As discussed in the PWDS Technical Evaluation Report (TER), the evaporator system has two primary modes of operation. In the "coupled" mode, processed water is fed to the evaporator from a source tank (either a PWST or CC-T-1). As the evaporator distills the processed water, the distillate, or purified water, is fed directly to the vaporizer for discharge to the atmosphere. Simultaneously, the concentrated bottoms are discharged from the evaporator for drying and packaging as a solid waste. In this mode, the system produces an environmental effluent in the form of water vapor discharged to atmosphere. In addition, it produces an effluent in the form of a dry solid radioactive waste material.

If operating the evaporator in the "decoupled" mode, processed water is fed to the evaporator and distilled. The distillate is returned to a plant holding tank for later processing rather than being vaporized to the atmosphere. The evaporator bottoms are dried and packaged as in the coupled mode. In this mode, the system does not produce a planned direct release of vapor to the environment, but it does produce an effluent in the form of a dry solid radioactive waste material.

If operating the vaporizer in the "decoupled" mode, distillate is fed from a plant holding tank to the vaporizer for direct release to the atmosphere. No dry solid waste is produced in this mode. The only effluent is the release of the vapor to the environment.

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The disposal of the processed water was the subject of a full Programmatic Environmental Impact Statement (PEIS) performed by the U. S. Nuclear Regulatory Commission (NRC). The NRC staff evaluated the offsite dose consequences and environmental effects from the direct atmospheric discharge of the evaporator distillate. In the PEIS, the staff defined what they termed as "base case" water and listed the concentration of 30 radionuclides, including tritium, in the base case water. These contamination levels were considered to be the average contamination levels of all water that would be processed in the "coupled" mode through the evaporator. The staff assumed that all of the tritium in the base case water and 0.1 percent of each of the other radionuclides would be released into the atmosphere (i.e., the system operates with an overall decontamination factor, or DF, of 1000). The environmental impacts were calculated for the radioactive releases resulting from the processing of about 2.3 million gallons of this base case water. Even though the environmental release rates associated with this process are a small fraction of the regulatory limits, our average releases must be controlled to be less than or equal to the releases evaluated in the PEIS. Therefore, our environmental releases from the evaporator system must be limited to 0.1% (1/1000) of the concentrations listed in the table of "base case" water for all of the listed radionuclides except for tritium. The offsite doses from these releases were calculated based on total activity released, not the rate of release. Therefore, this limit will be imposed as a quarterly average release rate, assuring that the total activity released by processing the approximately 2.3 million gallons of processed water will not exceed the bounds of the PEIS.

As previously discussed, the other planned "effluent" from this process is the dried solid waste material. In the PWDS Technical Evaluation Report, and in the filings and testimony presented before the NRC Atomic Safety and Licensing Board, we evaluated the risks associated with commercial transport of this material as an LSA, Type A, Class A radioactive waste. Therefore, we must control the process so that the effluent produced as a dried solid waste meets the regulatory requirements for transport as a Type A quantity of an LSA waste and for commercial shallow land disposal as a Class A unstabilized waste form.

These effluent restrictions may be summarized as follows:

- When operating the PWDS in coupled mode, two planned effluents are produced. The process must be controlled so that the concentrations of radioactive contaminants, except tritium, in the vapor vented to atmosphere on a quarterly average are less than or equal to 0.1% of the concentrations listed as "base case" concentrations in Table 2.2 of NUREG-0683, Supplement No. 2, "Programmatic Environmental Impact Statement." In addition, the dry solid waste produced by the process must meet the regulatory requirements of LSA, Class A solid waste forms, and be suitable for transport in Type A quantities.

- When operating the PWDS evaporator in decoupled mode, the dry solid waste produced by the process must meet the regulatory requirements of LSA, Class A solid waste forms, and be suitable for transport in Type A quantities.

- When opearting the PWDS vaporizer in decoupled mode, the process must be controlled so that the concentrations of radioactive contaminants, except tritium, in the vapor vented to atmosphere on a quarterly average are less than or equal to 0.1% of the concentrations listed as "base case".

As stated in the TER, the primary method of control of effluents is to place stringent controls on the system influents and operate the system within its design parameters. Control of the influents is discussed in Section 2.2 below.

2.2 Influent Limits

As previously stated, effluents are controlled by placing restrictions on the PWDS influents. This method of control has been chosen because it allows verification of influent water contents on large batches of water prior to processing. Effluent limits can then be verified by periodic sampling rather than requiring continuous on-line monitoring.

2.2.1 Influent Limits to Assure Vapor Stack Effluents Are Within Limits

The PWDS is designed to operate with an overall system decontamination factor (DF) of at least 1000 for particulates. That is, the ratio of the concentration of a constituent in the influent stream to the concentration of the same constituent in the effluent vapor stream is equal to or greater than 1000. Therefore, if the PWDS operations are controlled on a batch basis so that the evaporator influent contaminant concentrations are no more than 1000 times higher than the effluent limits, then periodic sampling to verify that the system DF is at least 1000 will assure that the effluents are within the limits discussed in 2.1. The DF used in assessing system performance will be that determined by analysis for boron. Since boric acid is volatile in steam, the DF determined for boron is expected to be conservative in assessing the concentration of other constituents in the effluents. If, however, preoperational testing and/or actual processing experience demonstrates that the system reliably yields a DF greater than 1000 for any constituent, the influent concentration limit for that constituent may be increased proportionately.

If operating the vaporizer in decoupled mode, the vaporizer feed will be limited to concentrations of no more that 1/1000 of base case concentrations for all radionuclides except tritium. This limit may be increased by a factor equal to the vaporizer DF that can be reliably demonstrated.

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2.2.2 Influent Limits to Assure Solid Waste is Within Limits

The evaporator will concentrate the processed water feed solution to very near its saturation point. The concentrated liquid is then processed through the blender/dryer to produce a dry solid material. The majority of the solid waste produced by the process is boric acid, sodium hydroxide, and sodium borate salts resulting from the acid-base neutralization. The actual mass/weight of solids resulting from the radionuclides is relatively negligible. The projected amount of dry solids can be calculated knowing the boron and sodium concentrations in the feed solutions. From the weight of dry solids and the radionuclide concentrations in the feed solution, the projected radionuclide concentrations in the final dry waste form can be calculated. To assure that the PWDS operation produces only Type A, LSA, Class A waste, the influent water will be analyzed and, using the calculation techniques discussed in Section 3, the projected final solid waste will be verified to meet Type A, LSA, Class A limits prior to water processing.

3.0 INFLUENT VERIFICATION CALCULATION

This section describes the calculation techniques used to verify that the relationship between influent water chemistry and projected effluent chemistry is within the limits. These calculations will be formalized by an approved procedure that will be implemented for each batch of water to be processed.

3.1 Effluent Vapor Determination

Prior to processing a batch of water through the PWDS evaporator, the source tank will be sampled and analyzed. The concentration of each of the 30 radionuclides listed in the table of base case water must be determined. Those that cannot be determined by direct analysis using laboratory techniques available onsite will be determined by calculation using known ratios or scaling factors of nuclide concentrations in typical waste streams. If the evaporator system yields a DF of 1000, the source tank concentrations of each of these nuclides, except tritium, must be no more than the base case concentrations of those nuclides for the water to be acceptable for coupled mode processing. If the DF is greater than 1000, the influent concentration limit can be increased proportionately. The calculation to make this determination is as follows:

C_{oi} = The source tank concentration of constituent i

C_{bi} = The base case concentration of constituent i

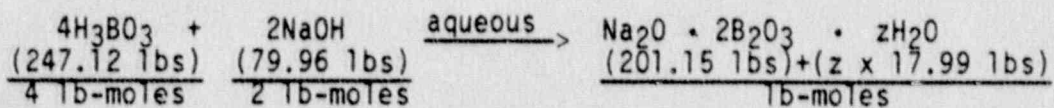DF_i = The system decontamination factor determined for constituent i

$C_{oi} \leq \dfrac{DF}{1000} \times C_{bi}$ for all constituents listed except tritium

If this relationship does not hold true for any of the radionuclides, the batch is not acceptable for processing in the coupled mode. It may be suitable for evaporator processing in decoupled mode if it meets the requirements of Section 3.2.

Prior to processing a batch of water through the vaporizer (in the decoupled mode), the concentration of contaminants in the source tank must be determined by analyses or by engineering evaluation and verified to be within the limits specified in 2.2.1. Since the concentrations may be lower than the analytical lower limit of detectability, engineering evaluation of the concentrations may include comparison of the analyzed concentrations in this water prior to evaporation and storage to its projected concentrations after initial evaporation using known evaporator DF's for comparison.

3.2 Solid Waste Form Verification

This section discusses the calculations used to project the radionuclide concentration in the solid waste produced by the PWDS and to determine whether the projected waste meets the regulatory requirements for Type A, LSA and Class A waste. In order to make this projection, the expected radionuclide concentrations in the dried solids must be calculated prior to processing the water. The projection will be based on laboratory analyses of the influent water. The dry solids result from dissolved boric acid (H_3BO_3) and sodium hydroxide (NaOH) in the processed water plus residual moisture in the final product. The boric acid and sodium hydroxide will yield a product, predominantly sodium tetraborate, from the following reaction:

$$\frac{4H_3BO_3}{4 \text{ lb-moles}} (247.12 \text{ lbs}) + \frac{2NaOH}{2 \text{ lb-moles}} (79.96 \text{ lbs}) \xrightarrow{\text{aqueous}} \frac{Na_2O \cdot 2B_2O_3 \cdot zH_2O}{\text{lb-moles}} (201.15 \text{ lbs}) + (z \times 17.99 \text{ lbs})$$

The portion of the borate salt formula depicted as "zH_2O" represents chemically bound waters of hydration resulting from the acid-base neutralization in aqueous solution. The number, z, is dependent upon many factors including the temperature, pH, and pressure at which the crystallization of the borate salt occurs; the presence of other chemical species in the solvent (water); and the temperatures and residence times in the blender/dryer. From the reaction equation, if the concentrations of boric acid and sodium hydroxide in a given volume of water are known, the weights of borate produced and remaining reactants can be calculated using stoichiometric balances. In the calculations, the waters of hydration will be neglected. This will yield a conservative weight when used to calculate the radionuclide concentrations in the final product, since the calculations will assume that all of the radionuclides except tritium are deposited in the dry solids (i.e., a lower weight of solid material yields a higher radionuclide concentration).

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The weights of boric acid and sodium hydroxide that were initially added to the water is calculated as follows:

W_{ba} = weight of boric acid in lbs dissolved in 1 gallon of processed water

W_{sh} = weight of sodium hydroxide in lbs dissolved in 1 gallon of processed water

[B] = boron concentration in ppm in the processed water as determined by onsite laboratory analysis

[Na] = sodium concentration in ppm in the processed water as determined by onsite laboratory analysis

$$W_{ba} = (1 \text{ gal}) \frac{(8.34 \text{ lbs})}{1 \text{ gal}} \frac{([B] \text{ lbs Boron})}{1E \; 6 \text{ lbs water}} \frac{(61.78 \text{ lbs } H_3BO_3)}{10.81 \text{ lbs Boron}}$$

or,

W_{ba} = 4.77 E-5 [B ppm] lbs of boric acid per gallon of processed water

Similarly;

$$W_{sh} = (1 \text{ gal}) \frac{(8.34 \text{ lbs})}{1 \text{ gal}} \frac{([Na] \text{ lbs Sodium})}{1E \; 6 \text{ lbs water}} \frac{(39.98 \text{ lbs NaOH})}{22.99 \text{ lbs Na}}$$

or,

W_{sh} = 1.45 E-5 [Na ppm] lbs of sodium hydroxide per gallon of processed water

These calculations determine the weight of boric acid and sodium hydroxide that was added to the known volume of water to yield the boron and sodium concentrations determined by chemical analysis. If the boron and sodium are present in stoichiometrically balanced proportion, then [B]:[Na] is 1:1.06. If the sodium concentration in ppm divided by the boron concentration in ppm is less than 1.06, then boric acid is present in excess. The weight of dried solids resulting from evaporation can be calculated by determining the weight of sodium borate produced assuming that all of the sodium hydroxide is consumed by the neutralization reaction, and by similarly calculating the weight of boric acid consumed. The presence of excess boric acid is typical of the water that will be processed through the PWDS. The calculations employ a simple stoichiometric ratio technique and are as follows:

Note: The calculations shown here assume that $\dfrac{[Na]}{[B]} \leq 1.06$.

The amount of borate salt, W_{bs}, produced by reacting a quantity of sodium hydroxide, W_{sh}, with excess boric acid is:

$$W_{bs} = \frac{W_{sh}}{79.96} \times 201.15$$

$$W_{bs} = \frac{1.45E-5 \text{ [Na ppm]}}{79.96} \times 201.15 = 3.65E-5 \text{ [Na ppm]}$$

The amount of boric acid consumed is:

$$W_{ba}' = \frac{W_{sh}}{79.96} \times 247.12$$

$$W_{ba}' = \frac{1.45E-5 \text{ [Na ppm]}}{79.96} \times 247.12 = 4.48E-5 \text{ [Na ppm]}$$

The weight of solids produced, then, is the weight of borate salt produced (product) plus the weight of unreacted boric acid remaining (excess reactant):

$$W_s = W_{ba} - W_{ba}' + W_{bs}$$

or,

$$W_s = 4.77E-5 \text{ [B ppm]} - 8.3E-6 \text{ [Na ppm]} \quad \text{in lbs of solids produced by evaporation of 1 gallon of water}$$

Note: This relationship is applicable only if $\frac{[Na]}{[B]} \leq 1.06$.

If $\frac{[Na]}{[B]} > 1.06$, then the relationship is:

$$W_s = 2.34E-5 \text{ [B ppm]} + 1.45E-5 \text{ [Na ppm]} \quad \text{in lbs of solids produced by evaporation of 1 gallon}$$

With this projection of the dry solids produced per gallon of AGW evaporated, the radionuclide concentrations in the solids and the quantity of radionuclides in the final package can be projected. The projection will be used to determine whether the predicted waste form meets Type A, LSA transportation and Class A burial limits. This is calculated as follows:

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C_{oi} = concentration of nuclide i in $\mu Ci/ml$ in the processed water source tank, as determined by laboratory analysis or scaling factor

W_s = weight of resulting dry solids in lbs solids/gal of water processed, from the preceding calculations

C_{wi} = concentration of nuclide i in curies per lb in the solid waste

D = the projected weight in lbs of solids to be packaged in each container

A_i = activity in curies of nuclide i in each container

Then: $C_{wi} = \dfrac{Coi \times 3.785E\text{-}3}{Ws}$ curies/lb

and: $A_i = C_{wi} \times D$ curies/package

With this information, the transportation and burial classifications of the projected waste form can be determined by direct input of the data into the existing waste management computer program A2QTY.

3.2.1   Verification of LSA Classification

In order to meet the regulatory limits for LSA material, the radioactivity must be uniformly dispersed throughout the waste and the radionuclide concentrations must be within the following limits:

(a) The total of all nuclides for which the A_2 value is not more than 0.05 curie cannot exceed a concentration of .0001 millicurie per gram.

The nuclides of interest in this category are Plutonium 238, Plutonium 239, Plutonium 240, and Americium 241.

(b) The total of all nuclides for which the A_2 value is more than 0.05 curie but not more than 1 curie cannot exceed a concentration of .005 millicurie per gram.

The nuclides of interest in this category are Strontium 90, Uranium 234, Uranium 235, Plutonium 241, and Curium 242.

(c) The total of all nuclides for which the A_2 value is more than 1 curie cannot exceed a concentration of 0.3 millicurie per gram.

The nuclides of interest in this category are Cesium 137, Cesium 134, Antimony 125/Tellurium 125m, Carbon 14, Technetium 99, Iron 55, Cobalt 60, Iodine 129, Cerium 144/Praseodymium 144, Manganese 54, Cobalt 58, Nickel 63, Zinc 65, Ruthenium 106/Rhodium 106, Silver 110m, Promethium 147, Samarium 151, Europium 152, Europium 154, Europium 155, and Tritium.

When the waste is a mixture of the nuclides from the three groups above, the fraction of the limit for each of the three groups must be determined and sum of the fractions must be no more than 1.0. If the totals of the concentrations of all nuclides in each of the categories above are expressed as ΣC_a, ΣC_b, and ΣC_c respectively, then the waste concentrations in millicuries per gram must meet the following relationship to qualify as LSA:

$$\frac{\Sigma Ca}{.0001} + \frac{\Sigma Cb}{.005} + \frac{\Sigma Cc}{0.3} \leq 1.0$$

3.2.2   Verification of Type A Transportation Limits

The regulatory requirements for transport of radioactive material suitable for Type A containers are contained in 10 CFR 71. The total quantity of material in a given package must not exceed a Type A quantity. As defined in 10 CFR 71.4, Type A quantity means "a quantity of radioactive material, the aggregate radioactivity of which does not exceed A_2 for normal form radioactive material." The A_2 values of each radionuclide are given in Appendix A of 10 CFR 71.

From the calculations of 3.2, A_i is determined as the number of curies of nucide i in each package of waste. From 10 CFR 71 Appendix A, A_{2i} is obtained. For the waste to qualify as a Type A quantity of radioactive material, the following relationship must hold:

$$\frac{\Sigma Ai}{A_{2i}} \leq 1$$

3.2.3   Verification of Class A Burial Limits

The regulatory requirements for waste form classification are given in 10 CFR 61.55, "Waste Classification." The regulations provide radionuclide concentration limits for long lived nuclides in 10 CFR 61.55, Table 1, and the limits for short lived nuclide concentrations in 10 CFR 61.55, Table 2. Since our projected waste form will contain a mixture of long lived and short lived radionuclides, it must meet the Class A limits specified in both Tables 1 and 2. Using the projected radionuclide concentrations in the dry solid waste as calculated in the previous sections, the calculations in this section provide verification that the projected waste form will meet Class A limits for shallow land burial.

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3.2.3.1 Classification based on long lived nuclides.

Table 1 of 10 CFR 61.55 specifies the concentration limits for long lived radionuclides. The nuclides of interest and their Class A limits are as follows:

(a) The concentration limit for carbon 14 is 0.8 curies per cubic meter.

(b) The concentration limit for technetium 99 is 0.3 curies per cubic meter.

(c) The concentration limit for iodine 129 is .008 curies per cubic meter.

(d) The concentration limit for the total of all alpha emitting transuranics with half lives greater than five years is 10 nanocuries per gram. The nuclides of interest in this category are Uranium 234, 235, and 238; ar Plutonium 238, 239, and 240; and Americium 241.

(e) The concentration limit for Plutonium 241 is 350 nanocuries per gram.

(f) The concentration limit for Curium 242 is 2000 nanocuries per gram.

When the waste is a mixture of the nuclides from the six categories above, the fraction of the limit for each of the six groups must be determined and the sum of the fractions must be less than 1.0. If the totals of the concentrations of all constituents in each category are expressed as ΣC_a, ΣC_b ... ΣC_f, then following relationship must be met to qualify as a Class A waste:

$$\frac{\Sigma Ca}{0.8} + \frac{\Sigma Cb}{0.3} + \frac{\Sigma Cc}{.008} + \frac{\Sigma Cd}{10} + \frac{\Sigma Ce}{350} + \frac{\Sigma Cf}{2000} < 1.0$$

It should be noted that the terminology C_a, C_b, and C_c used here is the same as that used in section 3.2.1. The meaning of the terms should be kept in the context within which they are used for derivation purposes. Unique terminology will be used where appropriate in the actual field calculations implemented by procedures.

3.2.3.2 Classification based on short lived nuclides.

Table 2, Column 1, of 10 CFR 61.55 specifies the concentration limits for short lived radionuclides. The nuclides of interest and their Class A limits are as follows:

(a) The concentration limit for Cobalt 60 is 700 curies per cubic meter.

(b) The concentration limit for Nickel 63 is 3.5 curies per cubic meter.

(c) The concentration limit for Strontium 90 is .04 curies per cubic meter.

(d) The concentration limit for Cesium 137 is 1.0 curies per cubic meter.

(e) The concentration limit for tritium is 40 curies per cubic meter.

(f) The concentration limit for the total of all nuclides with half lives of less than 5 years is 700 curies per cubic meter. The nuclides of interest in this category are Cesium 134, Antimony 125/Tellurium 125m, Iron 55, Cerium 144, Manganese 54, Cobalt 58, Zinc 65, Ruthenium 106/Rhodium 106, Silver 110m, Promethium 147, and Europium 155.

As discussed in Sections 3.2.1 and 3.2.2.1, the "sum of fractions" rule applies since our projected waste will consist of a mixture of these nuclides. Therefore, the relationship that must be satisfied to meet Class A limits is as follows:

$$\frac{\Sigma Ca}{700} + \frac{\Sigma Cb}{3.5} + \frac{\Sigma Cc}{.04} + \frac{\Sigma Cd}{1.0} + \frac{\Sigma Ce}{40} + \frac{\Sigma Cf}{700} < 1$$

3.2.4 Verification of Solid Waste Form Requirement

In addition to meeting the radionuclide concentration limits discussed above, the dry solid waste must meet certain physical property limits. These limits are specified in 10 CFR 61.56 and 49 CFR 173. Preoperational testing of the system using surrogate (i.e., non-radioactive) solutions simulating actual processed water will demonstrate that the system produces an acceptable waste form if operated within the procedurally specified parameters. During processing, this will be verified by visual observation of the solid waste.

3.3 Suitability of Water for Transfer to a Processed Water Storage Tank

The preceding discussions relate to the processing of water through the PWDS after that water has been staged for processing in one of the Processed Water Storage Tanks (PWSTs) or in the EPICOR off-spec receiving tank (CC-T-1). There are additional limits that must be verified prior to transferring a volume of water from a plant storage location to a PWST in preparation for processing. These limits are the result of environmental evaluations related to PWST storage of water presented in the NRC Staff's Programmatic Environmental Impact Statement (PEIS) of March 1981. The limit derived from the PEIS is based on assuring that the environmental release resulting from a rupture of a PWST is within the bounds of an analysis in the FSAR.

The limit imposed is as follows:

$$\Sigma \frac{Ai}{MPCi} \leq 6.4E6$$

where

Ai = the activity of radionuclide i in a PWST in curies

$MPCi$ = Maximum Permissible Concentration of radionuclide i as given in 10 CFR 20, Table II, Column 2, in $\mu Ci/ml$

The predominant radionuclides of interest in this case are Cobalt-60, Strontium-90, Ruthenium-106, Antimony-125, Cesium-134, Cesium-137, Cerium-144, and Tritium. Compliance with these limits must be evaluated prior to a transfer of water to a PWST.

3.4 Influent Verification Summary

The preceding calculations demonstrate the methods that will be used to project the effluent quality from the PWDS when the influent quality is known. Sampling to determine the influent characteristics and calculations to project the effluent characteristics are prerequisites for processing a given volume of water. The following limits from the results of these calculations apply to all water processing.

a) If the calculations of section 3.2.1 and 3.2.2 show that the projected waste form meets Type A, LSA limits and the calculations of section 3.2.3 show that the projected waste form meets Class A limits, then the volume of water is acceptable for processing through the PWDS. Whether it is suitable for processing in coupled or decoupled mode depends upon limit (b) which follows. If the projected waste form does not meet Type A, LSA and Class A limits, then it must be preprocessed by some other means to reduce its radionuclide content or to increase its total non-radioactive dissolved solids content prior to processing through the PWDS.

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b) If the calculations of Section 3.1 show that the projected vapor
    discharge concentrations meet the limits specified, and if the body
    of water is acceptable for processing through the PWDS per the
    specifications in (a) above, then coupled mode processing is
    permitted.

    If the calculations of Section 3.1 show that the projected vapor
    discharge concentrations exceed the limits specified, but the body
    of water is acceptable for processing through the PWDS per the
    specification in (a) above, then processing must be in the decoupled
    mode.

These influent limitations are shown in logic diagram format in
Attachment 1.

4.0 SAMPLING PROGRAM

This section describes the sampling program that will assure that PWDS
effluents are in conformance with the previously discussed requirements. The
program includes sampling and analysis of the water prior to processing
through the PWDS to verify that the projected effluents are acceptable plus
on-line sampling to periodically verify that the system is operating as
expected. The sampling program will include the following:

1) Prior to processing a source tank, the tank will be isolated from all
    sources of input, the tank will be recirculated for a minimum of three
    tank volumes, and a sample will be obtained. The sample will be
    analyzed for pH, conductivity, boron concentration, and sodium
    concentrations. It will also be subjected to the following analyses:

    -   gamma scan

    -   gross alpha

    -   strontium 90

    -   carbon 14

    -   tritium

    These sample results will be used to determine the water's acceptability
    for processing through the PWDS.

2) Once processing has begun on a tank of water, the tank will be resampled
    after each 20 percent of the tank's full volume has been processed, but
    not more frequently than daily. These samples will be analyzed for pH,
    conductivity, boron concentration, sodium concentration, gamma scan,
    gross alpha, and strontium 90. The purpose of these analyses is to
    confirm the original sample results obtained prior to processing and to
    detect any abnormalities that may occur during processing. In addition,
    these samples will be analyzed for C-14 and tritium during initial
    batches. Once experience demonstrates that the other analyses are

adequate to show that tank stratification has not occurred, the C-14 and tritium analyses will be deleted from these confirmatory samples. This will require the concurrence of the Pennsylvania Department of Environmental Resources.

3) During processing, the evaporator distillate and vaporizer discharge will be sampled every 12 + 2 hours and analyzed for boron concentration. The sample results will be used to calculate the evaporator DF and the overall system DF.

We have committed to the Pennsylvania Department of Environmental Resources to maintain a 96 hour "rolling average" decontamination factor of at least 1000 when operating in the "coupled" mode. These distillate samples will be used to compute a DF for boron about every 12 hours and will be averaged with previous sample results to calculate a volume weighted 96 hour average DF. These calculations will be documented and periodically reported to the Department of Environmental Resources.

4) During vaporizer operation, the vaporizer feed will be sampled every 48 + 4 hours. These samples will be analyzed for strontium 90, cesium 137, and carbon 14 and will be used for quantifying the system's effluents for reporting purposes. This sample will be obtained using an automatic composite liquid sampler that collects a total volume of about 6 gallons over a 48 hour period.

5.0 PROCESS CONTROL PROCEDURE

Evaporation of Accident Generated Water will be controlled by individual system and component operating procedures. In addition, an overall "Process Control Procedure" will be implemented to assure that appropriate portions of the individual system procedures are followed. This procedure will implement the requirements of this Plan. It will provide the overall governing document for specifying the appropriate modes of PWDS operations, for performing initial calculations necessary to provide the inputs into existing waste form verification computer software, and for documenting the results of laboratory analyses, calculations, and appropriate levels of review and approval of proposed PWDS operations.

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