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DWPF RISK ANALYSIS SUMMARY (U)

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DWPF RISK ANALYSIS IN SUMMARY

by

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1.0 INTRODUCTION

Following are selected risk analysis data from Chapter 9 (Safety Analysis) of the draft DWPF SAR (DPSTSA-200-10 SUP-20, Rev 1, dtd February 1990) and draft Addendum 1 (Additional Analysis For DWPF Feed Preparation by In-Tank Processing, dtd November 1989) to the Waste Tank Farms SAR (DPSTA-200-10, SUP-18). Although these data may be revised prior to finalization of the draft SAR and the draft addendum, they are presently the best available information and were therefore used in preparing the risk analysis portion of the DWPF Environmental Analysis (DWPF EA). This information has been extracted from those draft documents and approved under separate cover so that it can be used as reference material for the DWPF EA when it is placed in the public reading rooms.

2.0 SELECTED RISK ANALYSIS DATA

2.1 TANK FAILURE

Missile Penetrates Both Tanks (Section 9.2.2.4.1 in DWPF SAR)

The frequency of a missile strike resulting from a Fujita intensity F1 tornado (73-112 mph) or greater is estimated in a simulation of the Pilgrim Nuclear Power Station (2) to be $3.45\text{E-}13$ strikes/missile-yr-ft². Adjusting this result to include the possibility of missile formation in high straight winds and taking into account the relative frequency of tornadoes and high straight winds at SRS gives a combined strike frequency of $9.3\text{E-}12$ strikes/missile-yr-ft². The term "missile" refers to the numerous objects present in the target area that, if they become airborne in a high wind field, can result in target penetration.

The frequency of missile strike resulting in penetration of both the inner and outer tanks is estimated based on the basic frequency developed above and on the following additional assumptions:

- 100 candidate missiles are present in the vicinity of the Organic Waste Storage Tank (OWST).
- The probability of penetrating both tanks given a strike on the outer tank is 0.1. This probability results from factors such as missile velocity at strike being less than the maximum possible and less than that required for penetration of both walls, and oblique angles of incidence resulting in deflection rather than penetration.

These data lead to an estimated release frequency of:

$$9.3\text{E-}12 \text{ strikes/missile-yr ft}^2 \times 3040 \text{ ft}^2 \times 100 \text{ missiles} \times 1 \text{ double penetration/10 strikes} = 2.8\text{E-}07 \text{ releases/yr}$$

Because of the low frequency, the scenario is not considered credible and consequences are not analyzed.

Tornado Wind Forces Result in Double Tank Failure (Section 9.2.2.4.2 in DWPF SAR)

Assuming that design calculations contain a factor of safety (on applied force) of about 2.0, the approximate wind speed at failure is estimated to be $(2)^{1/2} \times 110 = 155$ mph. The frequency of occurrence of tornado wind exceeding 155 mph is $2.1\text{E-}05/\text{yr}$.

On a mass basis, the contents of the OWST are approximately 20% water and 80% benzene. Other organics such as phenol, biphenyl, formic acid, and methanol are also present from about 0.04% to 0.0001%. Since the specific gravity of benzene is 0.88, the volume fractions of water and benzene are 18% and 82%, respectively.

If, at the time of failure, the OWST is filled to 80% of capacity (a typical maximum operating level for tanks), the maximum release will be 120,000 gal. It is assumed that 1/3 of this spilled volume flows to Upper Three Runs creek via the surface drainage system, 1/3 evaporates, and 1/3 is absorbed in the top soils.

Before significant leakage from the failed OWST can occur, the tornado must have moved from the immediate vicinity; it is assumed that the average annual wind speed is 7 mph (1) during evaporation.

The rate of benzene evaporation from the spill is estimated using a spread factor of $0.15 \text{ m}^2/\text{kg}$ ($0.50 \text{ m}^2/\text{gal}$ for benzene) and is applied based on a predominantly gravel and soil surface (3). Air temperature is assumed to be the summer average of 80°F (27°C) (1), and the pool temperature is assumed to be the same as the air. The portion of the spill assumed to evaporate is 40,000 gal, of which 82% is benzene. The resulting source strength is $5.6\text{E}+07 \text{ mg/sec}$. At this rate, the entire 32,800 gallons of benzene would vaporize in about 30 min.

2.2 RISK FROM TORNADO-INDUCED FAILURE

The risk from tornado-induced failure of the OWST result from benzene vapor inhalation, contamination of surface streams, and uptake of radioactivity via atmospheric and liquid pathways.

Benzene Vapor Inhalation (Section 9.2.2.5.1 in DWPF SAR)

The Immediately Dangerous to Life and Health (IDLH) concentration for benzene is 2000 ppm (or 6000 mg/m^3). Exposure to a concentration of $60,000 \text{ mg/m}^3$ for 5 minutes has been reported to result in a fatality. With a source strength of $5.6\text{E}+07 \text{ mg/sec}$, benzene concentration exceeds the IDLH within approximately 410 ft. Potentially fatal concentrations can exist at the plume centerline within 110 ft. Calculated benzene

concentrations at the Service Building and Administration Building air intakes are approximately 700 mg/m³ (or about 200 ppm). Median dispersion values calculated by VENTSAR are used to estimate distances and concentrations resulting from the efficient atmospheric mixing that follows the passage of a tornado (the initiating event leading to OWST failure).

Benzene Contamination of Surface Water Streams (Section 9.2.2.5.2 in DWPF SAR)

The portion of the total benzene volume (32,800 gal) that flows to Upper Three Runs Creek is assumed to reach the creek over a period of 4 hr, for an average discharge rate of 8200 gal/hr. The average flow rate in Upper Three Runs Creek is 265 ft³/sec at a point about 7 km downstream from S-Area drainage (4). The assumed discharge rate results in a diluted benzene concentration of 1140 ppm in Upper Three Runs Creek. Assuming no holdup or depletion as the material moves down the creek, the discharge of Upper Three Runs into the Savannah River results in a diluted concentration of 30 ppm at the average river flow of 10,300 ft³/sec (1). Aquatic toxicity is measured by the median tolerance limit (TIM) which is the median concentration for mortality of particular aquatic species after a stated exposure time. For benzene, the TIM ranges from 10 to 100 ppm for 96 hr of exposure (5).

2.3 CHEMICAL RELEASES

Cause (Section 9.4.26.1 in DWPF SAR)

Based on operating experience in other cold feed areas the principle initiators for chemical releases are leaks, transfer errors, spills, overflows, and uncontrolled reactions. Released materials are contained in diked areas surrounding the tanks.

Detection (Section 9.4.26.2 in DWPF SAR)

Releases are detected through routine operator surveillance and by liquid level instrumentation.

Frequency (Section 9.4.26.3 in DWPF SAR)

The combined frequency of all initiators that result in a chemical release is estimated to be 1.23/vessel-yr, based on experience in F-Area and H-Area outside Facilities (7, 8). In F-Area the frequency is 1.52/vessel-yr, and in H-Area the frequency is 0.94/vessel-yr.

Consequence (Section 9.4.26.4 in DWPF SAR)

Leaks are the most common forms of release and their consequences are normally negligible. Overflows involve greater quantities and their consequences bound those of leaks. Analysis of overflow data from F-Area and H-Area Outside Facilities shows the mean release is 16,400 lb (7, 8). Some volatilization of the material contained in the diked area occurs.

The only chemicals judged to generate a sufficient quantity of hazardous fumes to create a potential exposure hazard are nitric acid and formic acid. The other substances present in cold feed storage have very low vapor pressures and therefore will not generate significant fumes.

Nitric Acid Overflow - an overflow in the outside storage area of 50% nitric acid would be totally contained in the 550-ft² diked area surrounding the tank. The resulting vapor concentration reduces to the IDLH level (250 mg/m³) within 10 m of the dike (source strength = 0.3 g/sec).

The nitric acid emission rate will increase if the spill is left uncontained within the diked area because of the preferential evaporation of water causing the nitric acid concentration in the solution to rise. The nitric acid emission rate increases as the nitric acid concentration in solution increases until the solution reaches the nitric acid azeotrope of 67 wt%. At the azeotrope the emission rate is at a maximum and remains unchanged even if further evaporation should occur. The nitric acid emission rate at the azeotrope is 2.75 g/sec which will exceed the IDLH concentration for a distance of 30 m.

Formic Acid Overflow - an overflow in the outside storage area of 90% formic acid would be totally contained in the 262-ft² diked area surrounding the tank. The resulting vapor concentration is above the IDLH level (180 mg/m³) for a distance of 650 ft (source strength = 77 g/sec).

The emission rate for formic acid, unlike nitric acid, decreases as the pool evaporates because the concentration of the formic acid-water azeotrope is lower than the stock solution concentration of 90 wt%. Formic acid evaporates preferentially causing a gradual decrease in the solution of formic acid concentration until formic acid concentration is reduced to the azeotropic composition of 77.5 wt%. The formic acid emission rate is the highest immediately after the spill which results in the maximum distance to IDLH.

The above distances are based on meteorological conditions that are less favorable only 0.5% of the time.

2.4 HAZARDOUS CHEMICAL RELEASE INSIDE VITRIFICATION BUILDING

There are no identifiable hazards associated with storage of hazardous chemicals inside the Vitrification Building (Building 221-S) as long as they remain within the confines of the intended vessels and piping. The mechanisms, frequencies, and consequences of accidental chemical releases from confinement are analyzed in this section.

Cause (Section 9.4.27.1 in DWPF SAR)

Based on experience with other operations involving hazardous chemicals, the principle chemical release initiators are overflows, leaks, transfer errors, and uncontrolled reactions.

Detection (Section 9.4.27.2 in DWPF SAR)

Releases are detected through routine operator surveillance and liquid level instrumentation.

Frequency (Section 9.4.27.3 in DWPF SAR)

The expected frequency for the release of hazardous vapors in an occupied area is $7.1\text{E-}02/\text{yr}$, based on experience during F Canyon operations (6). The frequency of hazardous vapors in occupied areas of F canyon is $3.2\text{E-}01/\text{yr}$. Since there are at least 73 tanks in F Canyon and only 16 vessels in DWPF, the canyon frequency is reduced by the ratio $16/73$ to arrive at $7.1\text{E-}02/\text{yr}$.

Consequence (Section 9.4.27.4 in DWPF SAR)

Tanks containing hazardous chemicals inside Building 221-S are diked. Tanks containing volatile chemicals (except for the 50% nitric acid feed tank) have drains inside the diked areas that lead to waste holding tanks in the tunnel level of the building. Therefore, only a spill of nitric acid is likely to result in significant vapor generation. Consequences are quantified based on overflow, since these events involve more material than leaks. The mean release from an overflow involving chemicals inside F Canyon is 3570 lb.

The estimated vapor generation rate is $5.3\text{E-}03\text{g/sec}$, and the estimated airborne concentration of nitric acid is 3.9 ppm.

If the spill is allowed to evaporate, then the acid concentration in the pool increases to the azeotrope, and the vapor emission rate increases to a maximum of $4\text{E-}02\text{ g/sec}$. The airborne concentrations of nitric acid reach a maximum of 25.5 ppm.

The above concentrations exceed the TLV of 2 ppm, but are used below the IDLH level of 100 ppm.

2.5 BENZENE LEAK DURING TRANSFER FROM THE SALT PROCESSING CELL

Benzene produced from the acid hydrolysis of cesium tetraphenyl borate is purified in the organic evaporator, collected in the organic evaporator condensate tank (OECT), and transferred in 350-gal batches to the organic waste storage tank (OWST). A leak in the above-ground benzene transfer line would spill benzene onto the ground.

Cause (Section 9.4.28.1 in DWPF SAR)

Failure of the overhead benzene transfer line can occur from corrosion or from damage in the course of maintenance activities. A moving crane boom striking the line could also cause failure.

Small leaks are difficult to prevent and are a common occurrence. A large leak should be noticed by the operator because of unexpectedly low flow readings.

Detection (Section 9.4.28.2 in DWPF SAR)

Benzene transfers are monitored by a flow totalizer, FIT 9177, that indicates the total volume of benzene received.

Frequency (Section 9.4.28.3 in DWPF SAR)

The estimated leak frequency is $8\text{E-}06/\text{hr}$, based on the recorded occurrence of solvent leaks during operation of the F- and H-Area Outside Facilities (7, 8). In F-Area, leaks occur at a rate of $2.0\text{E-}03/\text{hr}$; in H-Area the rate is $1.0\text{E-}03/\text{hr}$. These frequencies are for all leaks, aqueous and organic. Two percent of the F-Area Outside Facility leaks and 15% of the H-Area Outside Facility leaks involve solvent.

Consequence (Section 9.4.28.4 in DWPF SAR)

The consequences of a benzene transfer leak are dominated by the toxicity of benzene rather than radionuclides which are present in very low concentrations. Tritium, the only radionuclide contributing more than 0.1% of the total body dose, is present at a concentration of $2.2\text{E-}07\text{ Ci/gal}$, and the total quantity released in a 350 gal spill is $7.7\text{E-}05\text{ Ci}$. This is negligible compared to the normal daily releases of tritium from SRS.

A spill of 350 gal (the maximum batch volume) is assumed to occur on an average summer day with a temperature of 80 F. Solar energy heats the pool temperature to 10 C higher than the air temperature (9). The wind speed at the time of the accident is assumed to be 7 mph and inversion conditions are assumed to exist. The spill occurs on a coarse, unpaved surface, and the spread factor for gravel cited by Clewell (9) of $0.153\text{ m}^2/\text{kg}$ is applied. Neglecting to correct for the density of benzene, the spill area is 200 m^2 .

The source strength is 1.08 kg/sec , and the downwind distance at which the IDLH level (6000 mg/m^3) is reached is approximately 400 ft for meteorological conditions that are less favorable only 0.5% of the time.

3.0 TABLES OF DATA

Table 1.	Frequency of Exceedence of Earthquake Accelerations (Table 9.2-1 in DWPF SAR)
Table 2.	Component Seismic Failure Frequencies (Table 9.2-4 in DWPF SAR)
Table 3.	Radiological Risks to Offsite Maximum Individual (Adult) [Table 9.4-5 in DWPF SAR]
Table 4.	Accident Summary (Table 1.1. in DPSTSA-200-10, SUP-18)

4.0 BIBLIOGRAPHY

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Table 1.
Frequency of Exceedence of Earthquake Accelerations
(Table 9.2-1 in DWPF SAR)

Peak Ground acceleration (g)	Frequency of exceedance (/year)
0.03	5.0E-02
0.05	1.2E-02
0.07	5.4E-03
0.09	2.7E-03
0.11	1.5E-03
0.13	8.0E-04
0.15	5.2E-04
0.17	3.5E-04
0.19	2.4E-04
0.20 ¹	2.0E-04
0.21	1.8E-04
0.23	1.3E-04
0.25	9.0E-05
0.27	7.0E-05
0.29	5.2E-05

¹ Design Basis Earthquake

Table 2.

**Component Seismic Failure Rate
(Table 9.2-4 in DWPF SAR)**

Component	Fragility Parameters				Failure Frequency, /yr	Failure Probability Given Earthquake
	A-hat, g	Beta-R	Beta-U			
Hydroxylamine nitrate (HAN) tank	1.6	0.24	0.24		2.2E-12	4.3E-11
Formic acid tank	2.2	0.24	0.23		<1.0E-12	<1.0E-12
Pump pit tank	0.85	0.17	0.29		1.9E-08	3.7E-07
Precipitate reactor tank	0.75	0.17	0.29		7.1E-08	1.4E-06
Slurry mix evaporator (SME) tank	0.73	0.17	0.29		9.4E-08	1.9E-06
Organic waste storage tank (OWST)	1.0	0.1	0.42		9.0E-08	1.8E-06
Interarea transfer line	0.8	0.2	0.4		6.9E-07	1.4E-05
Emergency diesel day tank	1.8	0.26	0.42		4.4E-09	8.73E-08
Melter turntable						
Onset of motion	0.28	0.2	0.5		2.6E-04	5.3E-03
10-in. displacement	0.6	0.2	0.5		1.3E-05	2.5E-04
Emergency diesel control cabinet (overturning)	0.4	0.4	0.5		1.5E-04 ¹	2.9E-03
Zone 1 ventilation exhaust fan	0.22	0.33	0.5		7.8E-04	1.6E-02

¹ These failure data were developed for unanchored cabinets. Anchors have been installed, and failure is no longer considered credible.

Table 3.

Radiological Risks to Offsite Maximum Individual (Adult)
(Table 9.4-5 in DWPF SAR)

Risk, rem/yr

Event	Location ^a	Stream	Number of Vessels	Frequency, /yr	Dose Equivalent	GI Tract		Bone		Red Marrow		Liver		Surfaces		Thyroid		Lung	
						GI Tract	Bone	Bone	Total Bone	Bone	Red Marrow	Liver	Surfaces	Thyroid	Lung	Thyroid	Lung	Thyroid	Lung
Explosion	LPPP Tank	Stream 201	1	1.80E-03	7.22E-05	9.41E-06	1.15E-03	9.50E-05	2.47E-04	1.06E-03	9.90E-04	7.52E-06	4.30E-05	4.30E-05	4.30E-05	4.30E-05	4.30E-05	4.30E-05	4.30E-05
	APP Tank	Stream 201	1	1.80E-03	6.77E-05	8.84E-06	1.08E-03	8.89E-05	2.30E-04	9.90E-04	7.52E-06	4.01E-05	4.01E-05	4.01E-05	4.01E-05	4.01E-05	4.01E-05	4.01E-05	4.01E-05
	LPPP Cell	Stream 201	1	1.80E-06	7.22E-08	9.41E-09	1.15E-06	9.50E-08	2.47E-07	1.06E-06	9.90E-06	4.30E-08	4.30E-08	4.30E-08	4.30E-08	4.30E-08	4.30E-08	4.30E-08	4.30E-08
	APP Cell	Stream 201	1	1.80E-06	6.77E-08	8.84E-09	1.08E-06	8.89E-08	2.30E-07	9.90E-07	7.52E-09	4.01E-08	4.01E-08	4.01E-08	4.01E-08	4.01E-08	4.01E-08	4.01E-08	4.01E-08
	PR	Stream 201	1	2.20E-05	2.33E-09	3.04E-10	3.71E-08	3.08E-09	7.99E-09	3.41E-08	2.59E-10	1.39E-09	1.39E-09	1.39E-09	1.39E-09	1.39E-09	1.39E-09	1.39E-09	1.39E-09
	SPC Vent	Stream 201	1	4.40E-06	4.53E-11	5.94E-12	7.22E-10	5.90E-11	1.55E-10	6.64E-10	5.06E-12	2.70E-11	2.70E-11	2.70E-11	2.70E-11	2.70E-11	2.70E-11	2.70E-11	2.70E-11
	SRAI	Stream 7	1	6.30E-04	2.46E-05	4.93E-08	4.30E-04	3.28E-05	9.58E-05	3.97E-04	4.20E-08	1.68E-05	1.68E-05	1.68E-05	1.68E-05	1.68E-05	1.68E-05	1.68E-05	1.68E-05
	QMSI	Stream 222	1	8.10E-04	8.83E-12	5.43E-12	7.10E-11	5.52E-12	1.82E-11	6.55E-11	5.34E-12	5.40E-12	5.40E-12	5.40E-12	5.40E-12	5.40E-12	5.40E-12	5.40E-12	5.40E-12
	SPC	Stream 201	1	1.10E-02	1.96E-08	6.29E-09	2.37E-07	2.29E-08	4.91E-08	2.13E-07	5.36E-09	2.20E-08	2.20E-08	2.20E-08	2.20E-08	2.20E-08	2.20E-08	2.20E-08	2.20E-08
	SPC	Stream 212	1	4.00E-03	9.68E-16	9.44E-16	1.41E-15	4.72E-17	1.02E-15	1.36E-15	9.40E-16	9.76E-16	9.76E-16	9.76E-16	9.76E-16	9.76E-16	9.76E-16	9.76E-16	9.76E-16
Fire	APP	Stream 201	1	1.83E-01	2.27E-05	7.28E-06	2.73E-04	2.65E-05	5.65E-05	2.47E-04	6.19E-06	2.54E-05	2.54E-05	2.54E-05	2.54E-05	2.54E-05	2.54E-05	2.54E-05	2.54E-05
	LPPP	Stream 201	1	1.83E-01	2.42E-05	7.74E-06	2.93E-04	2.82E-05	6.06E-05	2.64E-04	6.62E-06	2.71E-05	2.71E-05	2.71E-05	2.71E-05	2.71E-05	2.71E-05	2.71E-05	2.71E-05
	SRAI	Stream 7	1	1.48E-02	4.85E-06	9.75E-09	8.51E-05	6.50E-06	1.89E-05	7.86E-05	8.32E-09	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06
	SNE	Stream 7	1	1.48E-02	4.85E-06	9.75E-09	8.51E-05	6.50E-06	1.89E-05	7.86E-05	8.32E-09	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06	3.33E-06
	DUTI	Stream 91	1	1.48E-02	1.13E-08	2.41E-10	1.94E-07	1.49E-08	4.32E-08	1.79E-07	2.06E-10	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09
	RCT	Stream 91	1	1.48E-02	1.13E-08	2.41E-10	1.94E-07	1.49E-08	4.32E-08	1.79E-07	2.06E-10	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09	7.78E-09
	PR	Stream 201	1	1.48E-02	4.68E-08	6.08E-09	7.43E-07	6.14E-08	1.60E-07	6.82E-07	5.19E-09	2.77E-08	2.77E-08	2.77E-08	2.77E-08	2.77E-08	2.77E-08	2.77E-08	2.77E-08
	OE	Stream 212	1	1.48E-02	1.72E-13	1.72E-13	1.76E-13	3.60E-16	5.73E-13	1.76E-13	1.72E-13	1.72E-13	1.72E-13	1.72E-13	1.72E-13	1.72E-13	1.72E-13	1.72E-13	1.72E-13
	Melter	Stream 24	1	2.00E-02	2.36E-09	1.56E-10	2.74E-10	1.42E-10	4.46E-13	1.33E-10	1.33E-10	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08
	Melter	Stream 23	1	8.80E-02	3.39E-07	7.25E-09	5.83E-06	4.51E-07	1.30E-06	5.38E-06	6.18E-09	2.34E-07	2.34E-07	2.34E-07	2.34E-07	2.34E-07	2.34E-07	2.34E-07	2.34E-07
Uncontrolled Reaction	CPC Tank	Stream 3	1	5.00E-02	2.43E-08	3.31E-09	3.84E-07	3.17E-08	8.25E-08	3.52E-07	2.84E-09	1.45E-08	1.45E-08	1.45E-08	1.45E-08	1.45E-08	1.45E-08	1.45E-08	1.45E-08
	CPC Tank	Stream 7	3	5.00E-02	4.47E-06	8.96E-09	7.82E-05	5.97E-06	1.74E-05	7.22E-05	7.64E-09	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06
	CPC Tank	Stream 91	16	5.00E-02	5.58E-08	1.79E-09	9.52E-07	7.34E-08	2.12E-07	8.80E-07	1.62E-09	3.87E-08	3.87E-08	3.87E-08	3.87E-08	3.87E-08	3.87E-08	3.87E-08	3.87E-08
	CPC Tank	Stream 201	2	5.00E-02	4.55E-08	6.18E-09	7.19E-07	5.94E-08	1.54E-07	6.60E-07	5.31E-09	2.71E-08	2.71E-08	2.71E-08	2.71E-08	2.71E-08	2.71E-08	2.71E-08	2.71E-08
	CPC Tank	Stream 212	5	5.00E-02	2.09E-12	2.09E-12	2.10E-12	8.70E-16	2.09E-12	2.10E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12
	LPPP Tank	Stream 91	1	2.30E-01	2.97E-08	9.52E-10	5.06E-07	3.91E-08	1.13E-07	4.67E-07	8.63E-10	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
Melter Release	Melter	Stream 24	1	2.00E-02	2.36E-09	1.56E-10	2.74E-10	1.42E-10	4.46E-13	1.33E-10	1.33E-10	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08
	Melter	Stream 23	1	8.80E-02	3.39E-07	7.25E-09	5.83E-06	4.51E-07	1.30E-06	5.38E-06	6.18E-09	2.34E-07	2.34E-07	2.34E-07	2.34E-07	2.34E-07	2.34E-07	2.34E-07	2.34E-07
	CPC Tank	Stream 3	1	5.00E-02	2.43E-08	3.31E-09	3.84E-07	3.17E-08	8.25E-08	3.52E-07	2.84E-09	1.45E-08	1.45E-08	1.45E-08	1.45E-08	1.45E-08	1.45E-08	1.45E-08	1.45E-08
	CPC Tank	Stream 7	3	5.00E-02	4.47E-06	8.96E-09	7.82E-05	5.97E-06	1.74E-05	7.22E-05	7.64E-09	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06	3.06E-06
	CPC Tank	Stream 91	16	5.00E-02	5.58E-08	1.79E-09	9.52E-07	7.34E-08	2.12E-07	8.80E-07	1.62E-09	3.87E-08	3.87E-08	3.87E-08	3.87E-08	3.87E-08	3.87E-08	3.87E-08	3.87E-08
	CPC Tank	Stream 201	2	5.00E-02	4.55E-08	6.18E-09	7.19E-07	5.94E-08	1.54E-07	6.60E-07	5.31E-09	2.71E-08	2.71E-08	2.71E-08	2.71E-08	2.71E-08	2.71E-08	2.71E-08	2.71E-08
	CPC Tank	Stream 212	5	5.00E-02	2.09E-12	2.09E-12	2.10E-12	8.70E-16	2.09E-12	2.10E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12	2.09E-12
	LPPP Tank	Stream 91	1	2.30E-01	2.97E-08	9.52E-10	5.06E-07	3.91E-08	1.13E-07	4.67E-07	8.63E-10	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08
Overflows	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08
	LPPP Tank	Stream 201	1	1.70E-01	1.43E-07	1.94E-08	2.26E-06	1.87E-07	4.46E-07	2.07E-06	1.68E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08	8.55E-08

Table 3. (Con't)

Radiological Risks to Offsite Maximum Individual (Adult)
(Table 9.4-5 in DWPF SAR)

Event	Location ^a	Stream	Number of Vessels	Frequency, /yr	Dose Equivalent	Risk, rem/yr					
						Total Bone	Bone, Red Marrow	Liver	Surfaces	Thyroid	Lung
	LPP Tank	Stream 1	1	8.10E-02	5.11E-06	8.99E-05	6.84E-06	2.01E-05	8.34E-05	4.12E-13	3.50E-06
	APP Tank	Stream 91	1	2.30E-01	2.78E-08	4.74E-07	3.66E-08	1.06E-07	4.37E-07	8.05E-10	1.93E-08
	APP Tank	Stream 201	1	1.70E-01	1.34E-07	2.13E-06	1.75E-07	4.56E-07	1.94E-06	1.57E-08	7.99E-08
	APP Tank	Stream 1	1	8.10E-02	4.80E-06	8.42E-05	6.41E-06	1.88E-05	7.78E-05	3.90E-13	3.27E-06
Leaks	CPC Tank	Stream 3	1	5.90E-01	2.86E-08	4.53E-07	3.73E-08	9.74E-08	4.15E-07	3.35E-09	1.71E-08
	CPC Tank	Stream 7	3	5.90E-01	5.27E-06	9.22E-05	7.04E-06	2.05E-05	8.51E-05	9.01E-09	3.61E-06
	CPC Tank	Stream 91	16	5.90E-01	6.58E-08	1.12E-06	8.66E-08	2.50E-07	1.04E-06	1.91E-09	4.57E-08
	CPC Tank	Stream 201	2	5.90E-01	5.37E-08	8.48E-07	7.01E-08	1.82E-07	7.79E-07	6.27E-09	3.20E-08
	CPC Tank	Stream 212	5	5.90E-01	2.47E-12	2.48E-12	1.03E-15	2.47E-12	2.43E-12	2.47E-12	2.47E-12
	SPC Tank	Stream 201	1	5.90E-01	7.43E-09	1.18E-07	9.74E-09	2.53E-08	1.08E-07	8.73E-10	4.44E-09
	SPC Tank	Stream 212	1	5.90E-01	1.37E-13	1.37E-13	5.71E-17	1.37E-13	1.37E-13	1.37E-13	1.37E-13
	LPPP Tank	Stream 91	1	2.30E+00	3.29E-07	1.06E-08	5.64E-06	4.35E-07	1.26E-06	9.57E-09	2.30E-07
	LPPP Tank	Stream 201	1	1.70E+00	1.59E-06	2.16E-07	2.52E-05	5.41E-06	2.31E-05	1.87E-07	9.50E-07
	LPPP Tank	Stream 1	1	8.10E-01	5.48E-05	4.58E-12	7.61E-04	2.23E-04	9.23E-04	4.58E-12	3.89E-05
	APP Tank	Stream 91	1	2.30E+00	3.08E-07	9.9E-09	5.27E-06	4.05E-07	1.17E-06	8.95E-09	2.15E-07
	APP Tank	Stream 201	1	1.70E+00	1.49E-06	2.02E-07	2.36E-05	1.94E-06	5.05E-06	1.73E-07	8.87E-07
	APP Tank	Stream 1	1	8.10E-01	5.33E-05	4.33E-12	9.40E-04	7.12E-05	2.08E-04	4.33E-12	3.63E-05
	Canister Rupture	Cell	1	2.00E-04	1.32E-09	2.40E-12	2.32E-08	1.77E-09	5.18E-09	2.14E-08	9.10E-10
	Total				3.56E-04	3.39E-05	5.76E-03	4.64E-04	1.25E-03	2.89E-05	2.5E-04

^aAPP = Auxiliary Pump Pit
 LPPP = Low Point Pump Pit
 CPC = Chemical Process Cell
 SPC = Salt Process Cell
 PR = Precipitate Reactor
 OE = Organic Evaporator
 SBAL = Slurry Receipt Adjustment Tank
 SWE = Slurry Mix Evaporator
 DWIT = Decontamination Waste Treatment Tank
 RCI = Recycle Collection Tank
 OWSI = Organic Waste Storage Tank

Table 4.
Accident Summary

<u>Analysis</u>	<u>Annual Risk, man-rem/year^a</u>			
	<u>Offsite Individual</u>	<u>Offsite Population</u>	<u>H-Area^b Personnel</u>	<u>Onsite^c Population</u>
1988 Tank Farm SAR	5.6E-5	3.8E-1	2.7E+0	2.9E+0
ITP Operations (Addendum)	2.2E-4	1.3E+0	1.5E+1	1.6E+1
Total	3E-4	2E+0	2E+1	2E+1

^a Based on lifetime total body dose commitments from short-term exposures and ICRP 2 dose-conversion factors.

^b About 300 workers.

^c Includes H-Area personnel.

END

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12 / 26 / 90