8903984

003777

Department of Energy

Richland Operations Office
P.O. Box 550
Richland, Washington 99352

SEP 11 1989

SEP 16 1989

Mr. Roger F. Stanley, Project Manager
State of Washington
Department of Ecology
Mail Stop PV-11
Olympia, Washington 98504

Dear Mr. Stanley:

PUREX PROCESS DISTILLATE DISCHARGE CHARACTERIZATION DATA

At the August 18, 1989, briefing on the PUREX process distillate discharge (PDD) and the 216-A-45 crib, you requested additional information on (1) PDD laboratory analyses, (2) evaluation of the stream as a characteristic dangerous waste per the Washington Administration Code Chapter 173-303, and (3) further evaluation of the expected PDD characteristics during PUREX stabilization operation.

Be advised that the PDD laboratory data is included in Volume 2, Section A.5, of WHC-EP-0287, "Waste Stream Characterization Report," which is being transmitted separately. Additional information is provided in Attachments 1, 2, and 3 of this letter.

If you have any questions regarding this information, please contact Mr. A. J. Knepp, U.S. Department of Energy, Richland Operations Office, at (509) 376-1471.

Sincerely,

Margo Anthony for
R. D. Izatt, Director
Environmental Restoration Division
Richland Operations Office

ERD:AJK

for
R. E. Lerch, Manager
Environmental Division
Westinghouse Hanford Company

Attachments:
1. PDD laboratory analyses
2. Evaluation of the PUREX process
3. PUREX process distillate discharge during PUREX stabilization campaign

cc w/atts:
[redacted]

SEP 1989
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Attachment 1
Consisting of
Nine Pages

PUREX PROCESS CONDENSATE

DETECTED ANALYTES

DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
R. E. Lerch, 6-5556	R. F. Stanley, Ecology	Incoming: 8903984

Subject

PUREX PROCESS DISTILLATE DISCHARGE CHARACTERIZATION DATA

Internal Distribution

Approval	Date	Name	Location	w/att
		Correspondence Control		X
		N. C. Boyter	R2-52	X
		J. C. Fulton	R2-42	X
		K. L. Hoewing	B3-06	X
		R. H. Koga	B3-07	X
		R. J. Landon	H4-50	X
		R. E. Lerch (Assignee)	H4-51	X
		H. E. McGuire	H4-51	X
		R. C. Nichols	B3-02	X
		J. E. Nolan	B3-01	X
		M. A. Payne	S5-66	X
		D. H. Shuford	S6-02	X
		D. E. Simpson	B3-51	X
		S. A. Wiegman	H4-50	X
		EDMC	H4-51	X

SEP 19 1989

Maximum Analyte Concentration
Detected in the PUREX Process Condensate Streams*

Analyte	Maximum Result (ppb)
Alpha Activity (pCi/L)	1.33E+03
Beta Activity (pCi/L)	6.82E+04
Acetone	9.50E+02
Ammonium	1.35E+02
Barium	2.20E+01
Butraldehyde	1.80E+01
Butyl Alcohol	5.00E+01
Butyl Nitrate	2.40E+02
Cadmium	9.00E+00
Calcium	2.14E+04
Chloride	7.83E+03 (1 dilution)
Chromium	1.40E+01
Conductivity - Field (us)	1.55E+03
Copper	1.30E+01
Cyanide	1.40E+02
Decane	2.30E+02 (1 Dilution)
Dodecane	7.40E+04 (1 Dilution)
Fluoride	3.96E+03
Iron	2.31E+02
Isophorone	1.30E+01
Magnesium	4.62E+03
Manganese	1.20E+01
Mercury	9.00E+00 (1 Dilution)
N-Methoxymethanamine	1.25E+02
Methylene Chloride	1.30E+02
Methyl ethyl ketone	9.00E+01
Methyl vinyl ketone	2.20E+01
Methyl Nitrate	2.40E+02
Nickel	1.00E+01
Nitrate	1.69E+06
Nitromethane	8.00E+00
pH-Field	2.12 to 10.8
Pentadecane	3.10E+03 (1 dilution)
Potassium	2.59E+05 (1 dilution)
Sodium	2.19E+03
Sulfate	1.25E+04
Temperature (^{o} C)	19.7 to 48.5
Tetradecane	2.05E+05 (1 dilution)
Tetrahydrofuran	2.40E+01
TOC	1.45E+05 (1 dilution)
TOX	2.74E+02
Tributyl phosphate	1.83E+05 (1 dilution)
Tridecane	2.30E+05 (1 dilution)
Undecane	9.50E+02 (1 dilution)
Uranium	5.87E+01
Zinc	3.20E+01

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* Based on 8 process samples shown in following pages.

PUREX Process Condensate

ID: PP00, S=50005, 08/23/85 09:59

Detected Analytes

Note: Units are PPB unless otherwise indicated.

Key	Analyte	Result
S	Alpha Activity (LDL,pCi/L)	1.04E+02
S	Beta Activity (pCi/L)	1.55E+04
S	Butraldehyde	1.20E+01
S	Butyl alcohol	5.00E+01
S	Cadmium	9.00E+00
S	Calcium	7.60E+01
S	Conductivity-Field (uS)	7.01E+02
S	Copper	1.30E+01
S	Isophorone	1.30E+01
S	Magnesium	1.90E+01
S	Mercury	2.10E-01
S	Methyl vinyl ketone	2.20E+01
S	Nickel	1.00E+01
S	Nitrate	1.75E+05
S	Nitromethane	8.00E+00
S	pH-Field	3.45E+00
S	Sodium	4.41E+02
S	Temperature-Field (celsius)	3.96E+01
S	TOC	1.86E+04 (1 Dilution)
S	TOC	2.74E+04 (1 Dilution)
S	Tributyl phosphate	3.55E+04
S	Unknown	1.90E+03
S	Unknown	5.50E+02
S	Unknown	8.60E+03
S	Unknown	9.70E+03
S	Uranium	3.21E+01
S	Zinc	3.20E+01

Key: S = Sample, E = Extract, B = Blank, T = Trip Blank

PUREX Process Condensate

ID: PP00, S=50049, 05/20/86 10:41
(B=50050)

Detected Analytes

Note: Units are PPB unless otherwise indicated.

Key	Analyte	Result
S	Alpha Activity (LDL,pCi/L)	8.96E+02
S	Beta Activity (pCi/L)	6.82E+04
S	Acetone (VOA)	3.20E+02
S	Ammonium	1.35E+02
S	Butyl alcohol	3.00E+01
S	Butylnitrate	2.40E+02
S	Conductivity-Field (uS)	9.16E+02
S	Cyanide	1.40E+02
S	Dodecane	1.00E+03 (1 Dilution)
S	Mercury	6.50E+00
S	N-Methoxymethanamine	1.25E+02
S	Methylene chloride	6.00E+01
S	Methyl nitrate	2.40E+02
S	Nitrate	1.69E+06
S	Pentadecane	3.00E+02 (1 Dilution)
S	pH-Field	2.12E+00
S	Sodium	1.20E+02
S	Temperature-Field (celsius)	4.35E+01
S	Tetradecane	4.60E+03 (1 Dilution)
S	TOC	4.40E+04 (1 Dilution)
S	TOC	4.59E+04 (1 Dilution)
S	TOX	2.74E+02
S	Tributyl phosphate	7.20E+04 (2 Dilutions)
S	Tridecane	4.70E+03 (1 Dilution)
S	Uranium	3.35E+01

Key: S = Sample, E = Extract, B = Blank, T = Trip Blank

PUREX Process Condensate

ID: PPCO, S=50095, 07/24/86 09:37
(B=50096)

Detected Analytes

Note: Units are PPB unless otherwise indicated.

Key	Analyte	Result
S	Alpha Activity (LDL,pCi/L)	1.33E+03
S	Beta Activity (pCi/L)	2.06E+04
S	Acetone (VOA)	9.50E+02
S	Butraldehyde	1.80E+01
S	Butyl alcohol	2.90E+01
S	Chloride	1.22E+03
S	Conductivity-Field (uS)	1.55E+03
S	Cyanide	5.40E+01
S	Dodecane	7.10E+02 (1 Dilution)
S	Mercury	9.00E+00 (1 Dilution)
B	Methylene chloride	1.30E+02
S	Nitrate	5.16E+05 (1 Dilution)
S	pH-Field	3.32E+00
S	Potassium	2.59E+05 (1 Dilution)
S	Sodium	1.78E+03
S	Sulfate	1.53E+03
S	Temperature-Field (celsius)	4.85E+01
S	Tetradecane	5.80E+03 (1 Dilution)
S	TOC	3.12E+04 (1 Dilution)
S	Tributyl phosphate	7.23E+04 (2 Dilutions)
S	Tridecane	5.20E+03
S	Uranium	5.87E+01

Key: S = Sample, E = Extract, B = Blank, T = Trip Blank

PUREX Process Condensate

ID: PP00, S=50289, 04/22/87 10:13
(B=50290)

Detected Analytes

Note: Units are PPB unless otherwise indicated.

Key	Analyte	Result
S	Alpha Activity (LDL,pCi/L)	2.76E+01
S	Beta Activity (pCi/L)	2.98E+02
S	Acetone (VOA)	2.80E+02
S	Butylnitrate	2.90E+01
S	Calcium	5.84E+03
S	Conductivity-Field (uS)	7.38E+02
S	Cyanide	2.22E+01
S	Dodecane	4.25E+02 (1 Dilution)
S	Fluoride (IC)	7.50E+02
S	Magnesium	7.75E+02
S	Mercury	3.10E-01 (1 Dilution)
B	Methylene chloride	3.80E+01
S	Methyl ethyl ketone	2.20E+01
S	Nitrate	1.22E+04
S	pH-Field	1.08E+01
S	Potassium	1.23E+05 (1 Dilution)
S	Sodium	1.42E+03
S	Sulfate	3.37E+03
S	Temperature-Field (celsius)	3.49E+01
S	Tetradecane	1.67E+03 (1 Dilution)
S	TOC	5.21E+04
S	Tributyl phosphate	7.96E+04 (2 Dilutions)
S	Tridecane	2.07E+03 (1 Dilution)
S	Uranium	9.88E-01
S	Zinc	7.00E+00

Key: S = Sample, E = Extract, B = Blank, T = Trip Blank

PUREX Process Condensate

ID: PP00, S=50295, 05/06/87 10:03
(B=50296)

Detected Analytes

Note: Units are PPB unless otherwise indicated.

Key	Analyte	Result
S	Alpha Activity (LDL,pCi/L)	1.59E+01
S	Beta Activity (pCi/L)	3.11E+01
S	Barium	2.20E+01
S	Calcium	2.14E+04
S	Chloride	1.10E+03
S	Conductivity-Field (uS)	1.36E+02
S	Dodecane	8.50E+01
S	Iron	2.31E+02
S	Magnesium	4.62E+03
S	Mercury	1.50E-01
B	Methylene chloride	3.90E+01
S	Nitrate	1.99E+03
S	pH-Field	5.62E+00
S	Potassium	2.27E+03
S	Sodium	2.19E+03
S	Sulfate	1.25E+04
S	Temperature-Field (celsius)	1.97E+01
S	Tetradecane	4.43E+02 (1 Dilution)
S	TOC	1.93E+04
S	Tributyl phosphate	9.49E+03 (2 Dilutions)
S	Tridecane	4.34E+02 (1 Dilution)
S	Uranium	7.49E+00
S	Zinc	7.00E+00

Key: S = Sample, E = Extract, B = Blank, T = Trip Blank

PUREX Process Condensate

ID: PP00, S=50319, 06/24/87 10:29
(B=50320)

Detected Analytes

Note: Units are PPB unless otherwise indicated.

Key	Analyte	Result
S	Alpha Activity (LDL,pCi/L)	8.74E+01
S	Beta Activity (pCi/L)	7.89E+01
S	Acetone (VOA)	9.00E+02
S	Ammonium	9.40E+01
S	Barium	1.20E+01
S	Butyl alcohol	1.40E+01
S	Butylnitrate	7.50E+01
S	Calcium	3.24E+03
S	Conductivity-Field (uS)	1.16E+02
S	Dodecane	7.40E+04 (1 Dilution)
S	Iron	2.12E+02
S	Magnesium	8.42E+02
S	Manganese	1.20E+01
S	Mercury	4.40E-01
B	Methylene chloride	3.00E+01
S	Methyl ethyl ketone	9.00E+01
S	Nitrate	3.35E+03
S	pH-Field	8.32E+00
S	Potassium	1.41E+04
S	Sodium	5.78E+02
S	Sulfate	1.72E+03
S	Temperature-Field (celsius)	4.03E+01
S	Tetradecane	2.05E+05 (1 Dilution)
S	Tetrahydrofuran	1.40E+01
S	TOC	1.11E+05
S	TOX (LDL)	2.06E+02
S	Tributyl phosphate	1.80E+05 (1 Dilution)
S	Tridecane	2.30E+05 (1 Dilution)
S	Uranium	3.07E+01

Key: S = Sample, E = Extract, B = Blank, T = Trip Blank

PUREX Process Condensate

ID: PP00, S=50322, 06/26/87 10:02
(B=50323)

Detected Analytes

Note: Units are PPB unless otherwise indicated.

Key	Analyte	Result
S	Alpha Activity (LDL,pCi/L)	4.27E+01
S	Beta Activity (pCi/L)	8.38E+01
S	Acetone (VOA)	1.45E+02
S	Barium	6.00E+00
S	Butyl alcohol	2.60E+01
S	Butylnitrate	3.20E+01
S	Calcium	1.40E+03
S	Chloride	7.83E+03 (1 Dilution)
S	Chromium	1.40E+01
S	Conductivity-Field (uS)	2.07E+02
S	Cyanide	1.95E+01
S	Decane	2.30E+02 (1 Dilution)
S	Dodecane	3.61E+04 (2 Dilutions)
S	Magnesium	3.00E+02
S	Mercury	1.70E-01
B	Methylene chloride	1.60E+01
S	Methyl ethyl ketone	5.00E+01
S	Nitrate	4.37E+03
S	Pentadecane	3.10E+03 (1 Dilution)
S	pH-Field	8.94E+00
S	Potassium	2.94E+04
S	Sodium	4.33E+02
S	Sulfate	6.28E+02
S	Temperature-Field (celsius)	4.72E+01
S	Tetradecane	1.03E+05 (3 Dilutions)
S	TCC	1.01E+05
S	TOX (LDL)	4.84E+01
S	Tributyl phosphate	1.65E+05 (3 Dilutions)
S	Tridecane	1.26E+05 (3 Dilutions)
S	Undecane	9.50E+02 (1 Dilution)
S	Uranium	2.37E+01

Key: S = Sample, E = Extract, B = Blank, T = Trip Blank

PUREX Process Condensate

ID: PP00, S=50334, 08/20/87 09:52
(B=50335)

Detected Analytes

Note: Units are PPB unless otherwise indicated.

Key	Analyte	Result
S	Alpha Activity (LDL,pCi/L)	6.28E+00
S	Beta Activity (pCi/L)	7.62E+01
S	Acetone (VOA)	1.10E+02
S	Butyl alcohol	1.90E+01
S	Butylnitrate	2.60E+01
S	Chloride	6.27E+03
S	Conductivity-Field (uS)	4.41E+02
S	Cyanide	5.79E+01
S	Dodecane	2.60E+04 (2 Dilutions)
S	Fluoride (IC)	3.96E+03
S	Mercury	2.00E-01
S	Methylene chloride	1.30E+01
S	Methyl ethyl ketone	1.40E+01
S	Nitrate	1.02E+04
S	Pentadecane	2.28E+03 (1 Dilution)
S	pH-Field	1.03E+01
S	Potassium	7.27E+04 (1 Dilution)
S	Sodium	5.22E+02
S	Temperature-Field (celsius)	4.65E+01
S	Tetradecane	6.24E+04 (2 Dilutions)
S	Tetrahydrofuran	2.40E+01
S	TOC	1.45E+05 (1 Dilution)
S	TOX (LDL)	5.42E+01
S	Tributyl phosphate	1.83E+05 (3 Dilutions)
S	Tridecane	6.60E+04 (2 Dilutions)
S	Undecane	5.20E+02 (1 Dilution)
S	Uranium	1.51E+00

Key: S = Sample, E = Extract, B = Blank, T = Trip Blank

EVALUATION OF THE PUREX PROCESS CONDENSATE STREAM BY THE PROCEDURES OF THE WASHINGTON STATE DANGEROUS WASTE REGULATIONS, WAC 173-303

A waste designation was performed on the sample from the PUREX Process Condensate to determine if the stream could be considered to be a regulated hazardous waste due to the chemical species present.

In order to determine the toxicity of the sample, an equivalent concentration was calculated. The equivalent concentration of the organic constituents was calculated directly from concentrations and toxicity categories of organic compounds present in the sample. For the inorganic components, neutral compounds were formed for each cation using sulfate, phosphate, chloride, nitrate, sulfide, and fluoride as possible anions. The compound with the worst hazardous waste characteristics was then used for designation purposes. The concentration of the compound was calculated from the concentration listed for the cation. A sample calculation is provided below. The equivalent concentration of the sample was calculated to be 4.53E-05%, well below the limit of 0.001 to be designated as Dangerous Waste according to the Washington State Dangerous Waste Regulations, (WAC) 173-303. Table A provides the chemical component and its concentration, the designated compound and its calculated concentration, toxicity category, and equivalent concentration. The stream is not regulated due to toxicity according to the Dangerous Waste Regulations.

SAMPLE CALCULATION

Concentration of Barium 22 ppb (0.022 mg/liter)

Designated compound: $BaCl_2$, Toxicity Category C

(0.022 mg/l Ba) / (137.3 mg/mmol Ba) = 1.6E-04 mmol/liter Ba

(1.6E-04 mmol/l Ba) * (1 $BaCl_2$ /1 Ba) = 1.6E-04 mmol/l $BaCl_2$

1.6E-04 mmol/l $BaCl_2$ * 2.1E+02 mg/mmol $BaCl_2$ = 3.36E-02 mg/l $BaCl_2$

0.0001% / 1 ppm -- parts per million to weight percent conversion

E.C. = (3.36E-02 ppm) * (0.0001% / 1 ppm) * (1 / 1000)--toxic C

= 3.36E-09%

Toxicity Determination

Analyte	Maximum Concentration (ppb)	Designated Compound	WT%	Toxic Category	E.C.(%)
Ammonia**	1.32E+02	NH_3	1.34E-05	B	1.34E-07
Ammonium*	6.54E-01	NH_4OH	1.27E-07	C	1.27E-10
Barium	2.20E+01	$BaCl_2$	3.36E-06	C	3.36E-09
Cadmium	9.00E+00	$CdCl_2$	1.47E-06	B	1.47E-08
Calcium	2.14E+04	$CaCl_2$	5.93E-03	D	5.93E-07
Chronium	1.40E+01	$CrCl_2$	3.31E-06	C	3.31E-09
Copper	1.30E+01	$CuSO_4$	3.27E-06	A	3.27E-07
Cyanide	1.40E+02	NaCN	2.64E-05	A	2.64E-06
Iron	2.31E+02	FeF_2	3.88E-05	B	3.88E-07
Magnesium	4.62E+03	$MgCl_2$	1.81E-03	D	1.81E-07
Magnanese	1.20E+01	$MnCl_2$* $4H_2O$	4.32E-06	D	4.32E-10
Mercury	9.00E+00	$HgSO_4$	1.33E-06	A	1.33E-07
Nickel	1.00E+01	$NiCl_2$	2.21E-06	C	2.21E-09
Potassium	2.59E+05	KF	3.85E-02	C	3.85E-05
Sodium	2.19E+03	NaF	4.00E-04	C	4.00E-07
Uranium	5.87E+01	$UO_2(NO_3)_2$	9.72E-06	B	9.72E-08
Zinc	3.20E+01	$ZnCl_2$	6.67E-06	C	6.67E-09
Acetone	9.50E+02	Same	9.50E-05	D	9.50E-09
Butraldehyde	1.80E+01	Same	1.80E-06	No Listing	------
Butyl Alcohol	5.00E+01	Same	5.00E-06	D	5.00E-10
Butyl Nitrate	2.40E+02	Same	2.40E-05	Nontoxic	------
Decane	2.30E+02	Same	2.30E-05	Nontoxic	------
Dodecane	7.40E+04	Same	7.40E-03	Nontoxic	------
Isophorone	1.30E+01	Same	1.30E-06	D	1.30E-10
N-Methoxymethanamine	1.25E+02	Same	1.25E-05	No Listing	------
Methylene Chloride	1.30E+02	Same	1.30E-05	C	1.30E-08
Methyl ethyl ketone	9.00E+01	Same	9.00E-06	D	9.00E-10
Methyl vinyl ketone	2.20E+01	Same	2.20E-06	B	2.20E-08
Methyl nitrate	2.40E+02	Same	2.40E-05	C	2.40E-08
Nitromethane	8.00E+00	Same	8.00E-07	D	8.00E-11
Pentadecane	3.10E+03	Same	3.10E-04	Nontoxic	------
Tetradecane	2.05E+05	Same	2.05E-02	Nontoxic	------
Tetrahydrofuran	2.40E+01	Same	2.40E-06	C	2.40E-09
Tributyl phosphate	1.83E+05	Same	1.83E-02	D	1.83E-06
Tridecane	2.30E+05	Same	2.30E-02	Nontoxic	------
Undecane	9.50E+02	Same	9.50E-05	Nontoxic	------

Summation of E.C. 4.53E-05%

* Toxic categories were derived from the January 1989 edition of the NIOSH Registry (RTECS) and the July 1, 1988 edition of 40 CFR 302.4 (EPA Spill Table).

** The maximum concentration of the ammonium ion were calculated using the following equation provided by the Washington State Department of Ecology.

$f + 1/[10^{(pka-pH)}+1]$

where
f = Decimal fraction NH_3
pka = 0.09018+2729.92/T
T = Water

PUREX PROCESS DISTILLATE DISCHARGE DURING PUREX STABILIZATION CAMPAIGN

The PUREX Process Distillate (PDD) stream consists of condensate from the first uranium cycle concentrator (E-J8) and the final uranium cycle concentrator (E-K4). Neutralization is accomplished by adding a dilute solution of potassium hydroxide (KOH) to the PDD through the E-K4 sample pot, then running the neutralized stream through a bed of calcium carbonate located in a tank south of the 295-AB building. The stream is then routed to the 216-A-45 crib for disposal.

An alternate route for handling PDD during the stabilization campaign is to send it to Tank Farms. This involves routing the condensate from the K4 sample pot to TK-G7. The stream is then routed to Tank Farms. Rerouting of PDD to Tank Farms requires additional pH adjustment and the addition of sodium nitrite to meet double-shell tank storage requirements. This is a standard requirement whenever dilute waste is sent to double-shell tanks and is not a departure from the way the waste is normally handled.

The PDD quality during the stabilization campaign is not expected to differ from what has been observed in the past for normal operations. This is based on several factors:

- As part of the normal shutdown of the process, the two concentrators (E-J8 and E-K4) were thoroughly flushed. When they are brought back on line, the operating procedures require that boilup begins with water, and the feed solutions are gradually added. Thus, there is no possibility of concentrated material entering the PDD from the concentrators during the stabilization startup phase.

- The concentrators and the PDD piping are fabricated from stainless steel. Buildup of corrosion products in the concentrators or the piping will not occur. The E-J8 concentrator was replaced in May 1989 and has seen no active service.

- The PDD contains only small amounts of solids, either dissolved or suspended. It is highly unlikely that there has been any solids buildup in the piping either through settling or crystallization that would be "flushed" out during the stabilization campaign.

- Finally, during the stabilization campaign, the plant will be operated essentially the same as during normal operations. There will be some modifications to head-end operation, but these will not affect the PDD. There will be no differences in the process which could impact PDD quality.

During the stabilization campaign, PDD stream sampling (if routed to Tank Farms) will consist of shiftwise samples to confirm pH and NO_2; daily samples to confirm plutonium; and weekly samples (unneutralized) for stream characterization.