A1756 PDR-1
LPDR- Wm-10 (2)
Wm-11 (2)
Wm-16 (2)

426.1 WK/87/06/16

JUN 16 1987

Dr. David Garvin
Chemistry B348
Chemical Thermodynamics Data Center
National Bureau of Standards
Gaithersburg, MD 20899

Dear Dr. Garvin:

Enclosed please find "Reaction Blocks" for 22 more reactions (19 measurements) involving plutonium. For the reactions involving solids, Free energies were calculated from solubility products.

Again, thank you for your assistance and guidance. I look forward to hearing from you soon.

Sincerely,

/S/

Walt Kelly
Geochemistry Section
Technical Review Branch
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

WM Record File Wm-Res A1756 SNL
WM Project 10, 11, 16
Docket No.
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LPDR ✓ (B,N,S)
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WM Project: WM-10,11,16
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WM Record File: A1756
LPDR w/encl

8709040273 870616
PDR WMRES EEC*****
A-1756 PDR

3931

Z: 76FUG/OET: Fuger, J., and Oetting, F.L.; The Chemical Thermodynamics of Actinide Elements and Compounds, Part 2. The Actinide Aqueous Ions; IAEA (1976)

R: $PuO_2^+ + H^+ = PuO_2^{2+} + \frac{1}{2}H_2$
DV: H, 92.47 $ 2.5 kJ
DV: G, 97.91 $ 5.0 kJ
S: WRK87

Z: 76FUG/OET: Fuger, J., and Oetting, F.L.; The Chemical Thermodynamics of Actinide Elements and Compounds, Part 2. The Actinide Aqueous Ions; IAEA (1976)

R: PuO_2^+
DV: S, -20.92 $ 8.4 $J\,mol^{-1}\,°C^{-1}$
S: WRK87

Z: 78VAS/BAG: Vasudeva Rao, P.R.; Bagawde, S.V.; Ramakrishna, V.V.; Patil, S.K.; J. Inorg. Nucl. Chem.; 40, 123 (1978)

R: $Pu^{3+} + HSO_4^- = PuSO_4^+ + H^+$
DV: G, -4.64 $ 0.1 kJ
S: WRK87

Z: 78VAS/BAG: Vasudeva Rao, P.R.; Bagawde, S.V.; Ramakrishna, V.V.; Patil, S.K.; J. Inorg. Nucl. Chem.; 40, 123 (1978)

R: $Pu^{3+} + 2HSO_4^- = Pu(SO_4)_2^- + 2H^+$
DV: G, -3.86 $ 0.12 kJ
S: WRK87

Z: 76BAG/RAM: Bagawde, S.V.; Ramakrishna, V.K.; Patil, S.K.; J. Inorg. Nucl. Chem.; 38, 1339 (1976)

R: $Pu^{4+} + HSO_4^- = PuSO_4^{2+} + H^+$
DV: G, -16.10 $ 0.12 kJ
S: WRK87

Z: 76BAG/RAM: Bagawde, S.V.; Ramakrishna, V.K.; Patil, S.K.; J. Inorg. Nucl. Chem.; 38, 1339 (1976)

R: $Pu^{4+} + 2HSO_4^- = Pu(SO_4)_2^\circ + 2H^+$
DV: G, -26.62 $ 0.5 kJ
S: WRK87

Z: 76PAT/RAM: Patil, S.K., and Ramakrishna, V.V.; J. Inorg. Nucl. Chem.; 38, 1075 (1976)

R: $PuO_2^{2+} + HSO_4^- = PuO_2SO_4^\circ + H^+$
DV: G, -6.61 $ 1.5 kJ
S: WRK87

Z: 59SHE/TIM: Shevchenko, V.B.; Timoshev, V.G.; Volkova, A.A.; Soviet J. At. Energy; 6, 293 (1959)

R: $Pu^{3+} + NO_3^- = PuNO_3^{2+}$
DV: G, -4.57 $ 1.2 kJ
S: WRK87

Z: 59SHE/TIM: Shevchenko, V.B.; Timoshev, V.G.; Volkova, A.A.; Soviet J. At. Energy; 6, 293 (1959)

R: $Pu^{3+} + 2NO_3^- = Pu(NO_3)_2^+$
DV: G, -6.85 $ 1.7 kJ
S: WRK87

Z: 59SHE/TIM: Shevchenko, V.B.; Timoshev, V.G.; Volkova, A.A.; Soviet J. At. Energy; 6, 293 (1959)

R: $Pu^{3+} + 3NO_3^- = Pu(NO_3)_3^o$
DV: G, -6.85 $ 2.9 kJ
S: WRK87

Z: 76BAG/RAM: Bagawde, S.V.; Ramakrishna, V.K.; Patil, S.K.; J. Inorg. Nucl. Chem.; 38, 1339 (1976)

R: $Pu^{4+} + NO_3^- = PuNO_3^{3+}$
DV: G, -3.42 $ 0.6 kJ
S: WRK87

Z: 76BAG/RAM: Bagawde, S.V.; Ramakrishna, V.K.; Patil, S.K.; J. Inorg. Nucl. Chem.; 38, 1339 (1976)

R: $Pu^{4+} + 2NO_3^- = Pu(NO_3)_2^{2+}$
DV: G, -6.28 $ 0.6 kJ
S: WRK87

Z: 65MAZ/SEV: Mazumdar, A.S.; Sivaramakrishnan, C.K.; J. Inorg. Nucl. Chem.; 27, 2423 (1965)

R: $PuO_2^{2+} + NO_3^- = PuO_2NO_3^+$
DV: G, 0.0 $ 2.9 kJ
S: WRK87

Z: 56WAR/WEL: Ward, M.; and Welch, G.A.; J. Inorg. Nucl. Chem.; 2, 395 (1956)

R: $Pu^{3+} + Cl^- = PuCl^{2+}$
DV: G, 0.0 $ 1.2 kJ
S: WRK87

Z: 76BAG/RAM: Bagawde, S.V.; Ramakrishna, V.K.; Patil, S.K.; J. Inorg. Nucl. Chem.; 38, 1339 (1976)

R: $Pu^{4+} + 2F^- = PuF_2^{2+}$
DV: G, -43.43 $ 0.2 kJ
S: WRK87

Z: 76PAT/RAM: Patil, S.K., and Ramakrishna, V.V.; J. Inorg. Nucl. Chem.; 38, 1075 (1976)

R: $PuO_2^{2+} + F^- = PuO_2F^+$
DV: G, -6.16 $ 0.6 kJ
S: WRK87

Z: 71MOS: Moskvin, A.I.; Soviet Radiochem.; 13, 688 (1971)

R: $Pu^{3+} + H_2PO_4^- = PuH_2PO_4^{2+}$
DV: G, -8.45 $ 0.6 kJ
S: WRK87

Z: 71MOS: Moskvin, A.I.; Soviet Radiochem.; 13, 688 (1971)

R: $Pu^{3+} + 2H_2PO_4^- = Pu(H_2PO_4)_2^+$
DV: G, -12.44 $ 0.9 kJ
S: WRK87

Z: 50BUS/COW: Busey, H.M.; and Cowan, H.D.; Los Alamos LAMS 1105 (1950).

R: $Pu(OH)_{2.5}Cl_{0.5} = Pu^{3+} + 2.5\ OH^- + 0.5\ Cl^-$
DV: G, 114.37 $ 6.0 kJ
S: WRK87

Z: 49KAS: Kasha, M.; Transuranium Elements, Part 1, Seaborg, G.T., et al., eds., Natl. Nucl. Energy Series IV; vol. 14B, 295 (1949).

R: $Pu(OH)_4(am) = Pu^{4+} + 4OH^-$
DV: G, 315.03 $ 6.0 kJ
S: WRK87

Z: 49KRA/DAM: Kraus, K.A.; and Dam, J.R.; Transuranium Elements, Part 1, Seaborg, G.T., et al., eds., Natl. Nucl. Energy Series IV; vol. 14B, 479 (1949).

R: $PuO_2(OH)(am) = PuO_2^+ + OH^-$
DV: G, 49.08 $ 6.0 kJ
S: WRK87

Z: 78COR/OHA: Cordfunke, E.H.P.: and O'Hare, P.A.G.; The Chemical Thermodynamics of Actinide Elements and Compounds, Part 3. Miscellaneous Actinide Compounds; IAEA (1978)

R: $Pu(SO_4)_2 = Pu^{4+} + 2SO_4^{=}$
DV: G, 42.46 $ 2.9 kJ
S: WRK87

Z: 49KIN: King, E.L.; Transuranium Elements, Part 1, Seaborg, G.T., et al., eds., Natl. Nucl. Energy Series IV; vol. 14B, 638 (1949).

R: $Pu(HPO_4)_2 \cdot nH_2O = Pu^{4+} + 2HPO_4^{=} + nH_2O$
DV: G, 154.09 $ 2.0 kJ
S: WRK87

426.1 WK/87/06/16

OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

LETTER TO: Dr. David Garvin
Chemistry B348
Chemical Thermodynamics Data Center
National Bureau of Standards
Gaithersburg, MD 20899

FROM: Walt Kelly
Geochemistry Section
Technical Review Branch
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

SUBJECT: "REACTION BLOCKS"

DATE: 87/06/ JUN 16 1987

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CONCURRENCES

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