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ENGINEERING DESIGN FILE

EDF No.: EDF-5196 EDF Rev. No.: 0 Project File No.: 22091

1. Title: SUPPORTING CALCULATIONS FOR APAD 04-53 TAN V-TANKS REMEDIATION TSF-09 TSF-18

2. Index Codes:
Building/Type TAN V-tanks SSC ID V-tank Consolidated Waste Site Area WAG 1, OU 1-10

3. NPH Performance Category: _____ or ☒ N/A

4. EDF Safety Category: _____ or ☒ N/A SCC Safety Category: _____ or ☒ N/A

5. Summary:
This EDF documents the supporting calculations for performing an Air Permitting Applicability Determination for the consolidated V-Tanks waste treatment system. This EDF is based upon 90% UCL concentrations for the consolidated V-tanks waste from EDF-4928. This consolidated waste stream includes the waste from the tanks V-1, V-2, V-3, and V-9 as well returned samples from the V-tanks, ARA 16 waste, and OU 1-07 B waste. Constituents are divided into carcinogens, non-carcinorgens, radionuclides, and CAA significant pollutants. Total masses of pollutants and appropriate emission rates (either annual or per hour) are calculated.

6. Review (R) and Approval (A) and Acceptance (Ac) Signatures:
(See instructions for definitions of terms and significance of signatures.)

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7. Distribution: (Name and Mail Stop) John Gill

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Site Area	WAG 1, OU 1-10
13. Registered Professional Engineer's Stamp (if required)	

ENGINEERING DESIGN FILE

Design Basis for Preparation of Air Permitting Applicability Determination for the V-Tanks Treatment System

The following calculations provide the design basis for the determination of air pollution control needs. The 90% UCL concentrations were taken from the draft EDF-4928 "Feed Streams for Potential Inclusion into V-Tank Treatment Process." This same EDF also documents the mass of the consolidated waste stream to be 45,987 kg.

Projected Non-Carcinogenic Emission Rate

The projected non-carcinogenic emission rate is based on potentially emitting all non-carcinogenic contaminants within one 48-hour period. Therefore the 90% UCL concentration for each contaminant is multiplied by the mass of waste to be treated (45,987 kg), divided by 48 hours, and converted to pounds.

Example:

Aluminum

6.08 E2 mg/kg X 45987 kg X 1kg/1E6mg X 2.2046 lbs/kg / 48 hours = 1.28 lbs/hour per 48 hour operating period

Constituent (non-carcinogens)	90% UCL (mg/kg)	Total Constituent (lb)	Emissions (lbs/hr/48hrs)
Al	6.08E+02	6.17E+01	1.28E+00
Cr	3.84E+02	3.89E+01	8.11E-01
Fe	3.61E+03	3.66E+02	7.63E+00
Mg	2.03E+03	2.06E+02	4.29E+00
Mn	9.44E+02	9.57E+01	1.99E+00
Si	1.54E+04	1.56E+03	3.25E+01
Sb	1.56E+00	1.58E-01	3.29E-03
Ba	2.46E+01	2.50E+00	5.20E-02
Hg	9.67E+01	9.80E+00	2.04E-01
Se	4.93E-01	4.99E-02	1.04E-03
Ag	2.40E+01	2.43E+00	5.07E-02
Zn	2.55E+02	2.59E+01	5.39E-01
Co	5.63E-01	5.71E-02	1.19E-03
Cu	2.42E+01	2.45E+00	5.10E-02
Sn	2.29E+00	2.33E-01	4.85E-03
TCA	1.26E+02	1.28E+01	2.66E-01
acetone	9.27E+01	9.39E+00	1.96E-01
carbon disulfide	8.02E+00	8.13E-01	1.69E-02
trans-1,2-dichloroethylene	6.12E+00	6.20E-01	1.29E-02
2-butanone	4.93E+01	4.99E+00	1.04E-01
1,2-dichloropropane	1.65E+01	1.67E+00	3.49E-02
bromoform	3.29E+01	3.34E+00	6.95E-02
2-hexanone	3.29E+01	3.33E+00	6.95E-02
toluene	1.66E+01	1.68E+00	3.51E-02
chlorobenzene	8.00E+00	8.11E-01	1.69E-02
ethylbenzene	8.01E+00	8.12E-01	1.69E-02
styrene	1.65E+01	1.67E+00	3.48E-02
cis-1,2-dichloroethylene	7.49E+00	7.59E-01	1.58E-02
xylene	8.06E+00	8.17E-01	1.70E-02
naphthalene	1.30E+01	1.32E+00	2.76E-02

1,2,4-trichlorobenzene	1.37E+01	1.39E+00	2.89E-02
1,4-dichlorobenzene	1.42E+01	1.44E+00	3.01E-02
phenol	1.41E+01	1.43E+00	2.99E-02
2,4,5-trichlorophenol	7.39E+01	7.49E+00	1.56E-01
2-chlorophenol	1.53E+01	1.55E+00	3.24E-02
2-nitroaniline	7.39E+01	7.49E+00	1.56E-01
3-nitroaniline	7.39E+01	7.49E+00	1.56E-01
4-chlorophenyl-phenyl ether	1.53E+01	1.55E+00	3.24E-02
4-nitroaniline	7.39E+01	7.49E+00	1.56E-01
di-n-octylphthalate	1.54E+01	1.56E+00	3.24E-02
diethylphthalate	1.53E+01	1.55E+00	3.24E-02
dimethylphthalate	1.53E+01	1.55E+00	3.24E-02
hexachlorocyclopentadiene	1.53E+01	1.55E+00	3.24E-02
isophorone	1.53E+01	1.55E+00	3.24E-02
nitrobenzene	1.53E+01	1.55E+00	3.24E-02
pentachlorophenol	7.39E+01	7.49E+00	1.56E-01
pyridine	1.53E+01	1.55E+00	3.24E-02
Fluoride	9.87E+00	1.00E+00	2.08E-02
di-n-butylphthalate	1.37E+01	1.39E+00	2.90E-02

Projected Carcinogenic Emission Rate

The projected carcinogenic emission rate is based on potentially emitting all carcinogenic contaminants over a one-year time frame. Therefore the 90% UCL concentration for each contaminant is multiplied by the volume of waste to be treated (45987 kg), divided by 8760 hours (24 hrs x 365 days), and converted to pounds.

Example:

Arsenic

5.20 E-1 mg/kg X 45987 kg X 1kg/1E6mg X 2.2046 lbs/kg / 8760 hours = 6.02E-6 lbs / hour / annual

Constituent (carcinogens)	90% UCL (mg/kg)	Total Constituent (lb)	Emissions (lbs/hr/annual)
As	5.20E-01	5.27E-02	6.02E-06
Be	1.42E+00	1.44E-01	1.64E-05
Cd	2.85E+00	2.89E-01	3.30E-05
Ni	2.09E+01	2.11E+00	2.41E-04
vinyl chloride	8.02E+00	8.13E-01	9.29E-05
methylene chloride	1.73E+01	1.76E+00	2.01E-04
1,1-dichloroethane	3.43E+00	3.48E-01	3.97E-05
chloroform	8.00E+00	8.11E-01	9.26E-05
1,2-dichloroethane	1.66E+01	1.68E+00	1.92E-04
carbon tetrachoride	8.01E+00	8.12E-01	9.27E-05
1,1,2-trichloroethane	8.00E+00	8.12E-01	9.26E-05
benzene	1.65E+01	1.67E+00	1.91E-04
bis(2-ethylhexyl)phthalate	5.25E+02	5.32E+01	6.07E-03
benzo(a)pyrene	1.53E+01	1.55E+00	1.77E-04
hexachlorobenzene	1.53E+01	1.55E+00	1.77E-04
hexachlorobutadiene	1.53E+01	1.55E+00	1.77E-04
hexachloroethane	1.53E+01	1.55E+00	1.77E-04

bis(2-chloroethyl)ether	1.53E+01	1.55E+00	1.77E-04
Aroclor-1260	2.10E+01	2.12E+00	2.43E-04
Aroclor-1254	2.47E-02	2.50E-03	2.86E-07
1,1,-dichloroethylene	8.12E+00	8.23E-01	9.39E-05
2,4,6-trichlorophenol	1.53E+01	1.55E+00	1.77E-04
TCE	7.67E+02	7.78E+01	8.88E-03
PCE	1.76E+02	1.79E+01	2.04E-03
1,1,2,2-tetrachloroethane	8.01E+00	8.12E-01	9.27E-05

Projected Radionuclide Emission Rate

The projected radionuclide emission rate is based on potentially emitting 0.001 of each solid or liquid radionuclide within a one-year time frame. Tritium is the exception as tritium is a gas. The emission factor for gases is 1.000. These emission factors are documented by EPA in 40 CFR 61 Appendix D, "Methods for Estimating Radionuclide Emissions". Therefore the 90% UCL concentration for each radionuclide is multiplied by the volume of waste to be treated (45987 kg) and then multiplied by the appropriate emission factor.

Example:

Plutonium 239/240

1.14 E0 nCi/g X 45987 kg X 1000 g/kg X 1Ci/1E9nCi X .001 (emission factor) = 5.23E-5 Ci/yr/annual

Radionuclides	90% UCL nCi/g	Total Curies	Emission Factor	Emission Rate (Ci/yr)
Pu-239/240	1.14E+00	5.23E-02	0.001	5.23E-05
Am-241	1.42E+00	6.54E-02	0.001	6.54E-05
Cm-242	5.85E-03	2.69E-04	0.001	2.69E-07
Cm-243/244	3.66E-01	1.68E-02	0.001	1.68E-05
Np-237	4.86E-03	2.24E-04	0.001	2.24E-07
U-233/234	8.65E-01	3.98E-02	0.001	3.98E-05
U-235	2.79E-02	1.28E-03	0.001	1.28E-06
U-238	1.85E-02	8.51E-04	0.001	8.51E-07
Sr-90	2.35E+03	1.08E+02	0.001	1.08E-01
Ag-110m	2.60E-01	1.20E-02	0.001	1.20E-05
Ce-144	1.84E+00	8.45E-02	0.001	8.45E-05
Co-58	2.65E-01	1.22E-02	0.001	1.22E-05
Co-60	6.51E+01	2.99E+00	0.001	2.99E-03
Cs-134	7.79E-01	3.58E-02	0.001	3.58E-05
Cs-137	1.18E+03	5.42E+01	0.001	5.42E-02
Eu-152	3.04E+00	1.40E-01	0.001	1.40E-04
Eu-154	5.03E+00	2.31E-01	0.001	2.31E-04
Eu-155	5.39E-01	2.48E-02	0.001	2.48E-05
Mn-54	9.56E-02	4.40E-03	0.001	4.40E-06
Nb-95	5.68E-01	2.61E-02	0.001	2.61E-05
Ra-226	4.04E-01	1.86E-02	0.001	1.86E-05
Ru-103	2.31E+00	1.06E-01	0.001	1.06E-04
Ru-106	1.92E+00	8.83E-02	0.001	8.83E-05
Sb-125	7.74E-01	3.56E-02	0.001	3.56E-05

Zn-65	2.44E-01	1.12E-02	0.001	1.12E-05
Zr-95	5.50E-01	2.53E-02	0.001	2.53E-05
I-129	1.01E-02	4.66E-04	0.001	4.66E-07
Ni-63	1.53E+02	7.06E+00	0.001	7.06E-03
Tritium	2.76E+01	1.27E+00	1.000	1.27E+00
Ag-108m	1.80E-01	8.28E-03	0.001	8.28E-06
K-40	4.56E-05	2.10E-06	0.001	2.10E-09
Th-228	5.91E-06	2.72E-07	0.001	2.72E-10
Th-230	6.94E-06	3.19E-07	0.001	3.19E-10
Pu-238	2.61E+00	1.20E-01	0.001	1.20E-04

Projected Potentially Significant Emissions Rate

The projected emission rate for significant pollutants is based on potentially emitting all of each pollutant within a one year time frame. Therefore the 90% UCL concentration for each pollutant is multiplied by the volume of waste to be treated (45987 kg) and then converted to tons/year.

Example:

Lead

4.36E1 mg/kg X 45987 kg X 1kg/1E6mg X 2.2046 lbs/kg X 1 ton/2000lbs = 2.24E-3 tons/year

Pollutant	mg/kg	Total Constituent (lb)	Emission Rate (lbs/hr)	Emissions tons/year
Pb	4.36E+01	4.42E+00	5.04E-04	2.21E-03
Be	1.42E+00	1.44E-01	1.64E-05	7.19E-05
Hg	9.67E+01	9.80E+00	1.12E-03	4.90E-03

Reference

EDF-4928 "Feed Streams for Potential Inclusion into V-Tank Treatment Process," September 2004

40 CFR 61 Appendix D, "Methods for Estimating Radionuclide Emissions"