

ATTACHMENT 1

CALCULATIONS FOR PRODUCTION-BASED
BPT, BCT, AND BAT EFFLUENT LIMITATIONS
FOR
CHEVRON RICHMOND REFINERY

References:

- 1) 40 CFR § 419 Subpart E Effluent Limitations Guidelines and New Source Performance Standards for the Petroleum Refining Point Source Category (Integrated Subcategory)
- 2) Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Petroleum Refining Point Source Category
- 3) Guide for the Application of Effluent Limitations Guidelines for the Petroleum Refining Industry
- 4) NPDES Application for Permit Reissuance (November 2005)
- 5) Refinery Production Data 2002 – 2005, provided by the facility. The highest 12-month average from this period was used in calculations (June 2004 through May 2005).

Production-Based Effluent Limitations

STEP 1: Determine the size factor based on the refinery feedstock rate. Based on 40 CFR § 419 Subpart E, a total refinery throughput of 224.2 kbb/d results in a

SIZE FACTOR = 0.99

STEP 2: Determine the process configuration based on the process rates:

Process	Process Feedstock Rate (kbb/d)	Fraction of Total Throughput	Weight Factor	Process Configuration
Total Refinery Throughput = 224.2 kbb/d				
CRUDE:				
Atmospheric Distillation	224.2	1.0		
Vacuum Crude Distillation	102.6	0.458		
Desalting	241.5	1.077		
TOTAL	568.3	2.535	1	2.535
CRACKING & COKING:				
Fluid Catalytic Cracking	67.4	0.301		
Hydrocracking	114.2	0.509		
Hydrotreating	156.2	0.697		
TOTAL	337.8	1.507	6	9.042
LUBE				
Lube Hydrofining	20.3	0.0905		
Propane Deasphalting	40.3	0.1798		
TOTAL	60.6	0.2703	13	3.514
TOTAL PROCESS CONFIGURATION =				15.09

(kbb/d = Thousand Barrels per day)

STEP 3: Determine the process factor. Based on 40 CFR § 419 Subpart E, a total process configuration of 15.09 results in a

PROCESS FACTOR = 2.26

STEP 4: Based on 40 CFR § 419.22(a), 419.23(a), and 419.24(a), the BPT/BAT/BCT effluent limit is equal to
(THROUGHPUT) X (SIZE FACTOR) X (PROCESS FACTOR) X (EFFLUENT LIMIT FACTOR)

$$\text{EFFLUENT LIMIT} = (224.2)(0.99)(2.26)(\text{Effluent Limit Factor})$$

$$= (501.6)(\text{Effluent Limit Factor})$$

Pollutant	Effluent Limit in 40 CFR 419E						Multiplier	Final Limit Calculated						Final Limit	
	BPT		BAT		BCT			BPT		BAT		BCT			
	Daily Max	30-d Avg	Daily Max	30-d Avg	Daily Max	30-d Avg		Daily Max	30-d Avg	Daily Max	30-d Avg	Daily Max	30-d Avg	Daily Max	30-d Avg
	lb/kbbl	lb/kbbl	lb/kbbl	lb/kbbl	lb/kbbl	lb/kbbl		lb/d	lb/d	lb/d	lb/d	lb/d	lb/d	lb/d	
BOD ₅	19.2	10.2			19.2	10.2	501.6	9630	5116			9630	5116	9630	5116
TSS	13.2	8.4			13.2	8.4	501.6	6621	4213			6621	4213	6621	4213
TOC	42.2	22.4					501.6	21167	11235					21167	11235
O&G	6	3.2			6	3.2	501.6	3010	1605			3010	1605	3010	1605
Phenols (4AAP)*	0.14	0.068					501.6	70.22	34.11					70.22	34.11
NH ₃ -N	8.3	3.8	8.3	3.8			501.6	4163	1906	4163	1906			4163	1906
Sulfide	0.124	0.056	0.124	0.056			501.6	62.2	28.1	62.2	28.1			62.2	28.1
Total Cr	0.29	0.17					501.6	145.5	85.3					145.5	85.3
Hex Cr	0.025	0.011					501.6	12.5	5.5					12.5	5.5

*The BPT limits for these constituents are applicable only if they are more stringent than BAT limits (see STEP 5) below).

STEP 5: Calculate Amended BAT limits pursuant to 40 CFR § 419.53, for phenolic compounds (4AAP), total and hexavalent chromium. The effluent limit is equal to the sum of the products of each effluent limitation factor times the applicable process feedstock rate.

Pollutant	Process Category	BAT Effluent Limit Factors (lb/kbbl)		Feedstock (kbbl/d)	Effluent Limitation (lb/d)	
		Daily Max.	30-d Average		Daily Max.	30-d Average
Phenolic Compounds (4AAP)	Crude	0.013	0.003	568.3	7.39	1.70
	Cracking & Coking	0.147	0.036	337.8	49.66	12.16
	Lube	0.369	0.090	60.6	22.36	5.45
	Reforming & Alkylation	0.132	0.032	68.1	8.99	2.18
	TOTAL				88.40	21.50
Total Chromium	Crude	0.011	0.004	568.3	6.25	2.27
	Cracking & Coking	0.119	0.041	337.8	40.20	13.85
	Lube	0.299	0.104	60.6	18.12	6.30
	Reforming & Alkylation	0.107	0.037	68.1	7.29	2.52
	TOTAL				71.86	24.95
Hexavalent Chromium	Crude	0.0007	0.0003	568.3	0.40	0.17
	Cracking & Coking	0.0076	0.0034	337.8	2.57	1.15
	Lube	0.0192	0.0087	60.6	1.16	0.53
	Reforming & Alkylation	0.0069	0.0031	68.1	0.47	0.21
	TOTAL				4.60	2.06

STEP 6: Compare Amended BAT limitations for phenolic compounds (4AAP), total chromium, and hexavalent chromium with BPT limitations.

Except for daily maximum limitation for phenolic compounds, the above BAT limits are more stringent than the BPT limits calculated in STEP 4. Therefore, for these constituents, the above BAT limits, and the daily maximum BPT limit for phenolic compounds are considered for inclusion in the permit.