Water Permitting for Petroleum Refineries

Melvin C. Mitchell, Sr.
Administrator

Louisiana Department of Environmental Quality
Office of Environmental Services
Water Permits Division

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LPDES PERMITS PROGRAM

The state water discharge permit program is called the **Louisiana Pollutant Discharge Elimination System** (**LPDES**)

LA has authority to implement the Federal (EPA) water permit program called the **National Pollutant Discharge Elimination System** (**NPDES**)

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Water Permits Role

- Issue water discharge permits
  - Shows all applicable limits and monitoring requirements
  - Basis for Surveillance Division's inspections
  - Basis for Enforcement Division's work

Water Permits Role

- Provide technical guidance for permit applications
  - Industry
  - Community
- Involvement with the public and community on permitting activities
  - Public comments
  - Public hearings

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The Application Form

In accordance with LAC 33:IX.2501.A.2 – All existing facilities must apply for a renewal permit using the state - or EPA - approved permit application form.

The state-approved permit application form (IND Application) may be obtained by contacting the Office of Environmental Services or by accessing the department's website at www.deq.louisiana.gov (go to Divisions > Water Permits > LPDES Permits > LPDES Application Forms).

The Application Form

An application with an **original signature** along with one copy shall be submitted to the following address:

Mailing Address:
Department of Environmental Quality
Office of Environmental Services
Post Office Box 4313
Baton Rouge, LA 70821-4313
Attention: Water Permits Division

Physical Address:
Department of Environmental Quality
Office of Environmental Services
602 N. Fifth Street
Baton Rouge, LA 70821-4313
Attention: Water Permits Division

Completion of the Application

•Before an application is forwarded to the Water Permits Division, it must be deemed as “administratively complete” by the Permit Application Administrative Review (PAAR) Group.

•Every item on the application must be addressed and the last page signed by an authorized company agent. If an item does not apply, the applicant may answer “Not Applicable” or “NA” to show that the question was considered.

•If an application is not administratively complete, a request for additional information will be sent to the applicant identifying the deficiencies.

•After the application is considered complete, a letter of “Administrative Completeness” will be sent to the applicant.

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Completion of the Application

Facility Specific Factors for Consideration - Refinery Applicants:

1. Section I.E.4 of the Application (Guideline/Production) - The applicant shall provide the guideline citation, the applicable subpart(s), and the production data for the processes utilized at their facility.
   - Applicants are required to report production in same units as in effluent guidelines.
   - Must provide a "Reasonable Estimate" of production
   - LAC 33:IX.2709 requires that TBELs be based on "not design capacity but reasonable measure of actual production"
   - Acceptable "reasonable measure"
     Long term average
     Highest month of the past year
     Highest year of the past five years

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Completion of the Application – Corresponding Application Page

SECTION I - FACILITY INFORMATION

3. Raw Materials.

4. Guideline/Production.
If an effluent guideline applies to the applicant and is expressed in terms of production (or other measure of operation), a reasonable measure of the applicant's actual production for each product reported in pounds per day, or other applicable units, is necessary.

Provide the highest monthly average production rate of the previous year. If this would not be representative of your normal production rate, provide total annual production rates from the previous 5 years.

If planning to increase the rate of production at this facility, please provide the current production rate, the anticipated rate and the planned date for increased production.

Current Production Rate: _____

Proposed Production Rate: _____

Date Proposed Production Rate Began/Will Begin: _____

Affected Outfall	Guideline Citation	Subpart and Fraction of Total Production	Production Rate in lbs/day
EXAMPLE 1 Outfall 001	*40 CFR 414*	*Subpart G = 72%, Subpart H = 28%*	
EXAMPLE 2 Outfall 001	*40 CFR 430*	*Subpart C = 30%, Subpart J = 70%*	*Subpart C = 3,000 lbs/day Subpart J = 7,000 lbs/day*

If your facility is classified as a Petroleum Refinery and falls within the Federal Guidelines cited under 40 CFR 419, refer to Attachment A.

Form_7018_r04
10/07/2009

Page 5 of 42
IND

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Completion of the Application

Facility Specific Factors for Consideration - Refinery Applicants Continued:

2. Section I.E.4 - Attachment A of the Application – The applicant shall provide specific details on their individual processes (crude, cracking and coking, lube, asphalt, and reforming and alkylation) and the corresponding unit process rate (in 1000 barrels per day).

Completion of the Application – Corresponding Application Page

ATTACHMENT A – PETROLEUM REFINERIES ONLY

OUTFALL NUMBER

Throughput Rate

Feedstock (Crude Oil & NGL) Rate to Topping Unit(s): _____

Flow Rates (if applicable)

Ballast Flow (1,000 gals/day): _____

Contaminated Water to Treatment System (1,000 gals/day): _____

Stormwater Process Area (square feet): _____

Processes	Unit Process Rate in 1,000 bbls/day
Crude Process:	
Atmospheric Crude Distillation	
Crude Desalting	
Vacuum Crude Distillation	
Cracking and Coking Processes:	
Visbreaking	
Thermal Cracking	
Fluid Catalytic Cracking	
Moving Bed Catalytic Cracking	
Hydrocracking	
Delayed Coking	
Fluid Coking	
Hydrotreating*	
Lube Processes:	
Hydrofining, Hydrofinishing, Lube Hydrofinishing	
White Oil Manufacture	
Propane: Dewaxing, Deasphalting, Fractioning, Derinsing	
Duo Sol, Solvent Treating, Solvent Extraction Duotreating, Solvent Dewaxing, Solvent Deasphalt	
Lube Vacuum Tower, Oil Fractionation, Batch Still (Naphtha Strip), Bright Stock Treating	
Centrifuge & Chilling	
Dewaxing: MEK, Ketone, MEK-Toluene	
Deoiling (Wax)	
Naphthenic Lube Production	
SO2 Extraction	
Wax Pressing	
Wax Plant (with Neutral Separation)	
Furfural Extracting	
Clay Contacting - Percolation	
Wax Sweating	

ATTACHMENT A – PETROLEUM REFINERIES ONLY

OUTFALL NUMBER

Processes	Unit Process Rate in 1,000 bbls/day
Acid Treating	
Phenol Extraction	
Asphalt Processes:	
Asphalt Production	
200 Deg. F Softening Point Unfluxed Asphalt*	
Asphalt Oxidizing	
Asphalt Emulsifying	
Reforming and Alkylation Processes:	
H2SO4 Alkylation*	
Catalytic Reforming*	

* These processes are not included in the refinery process configuration factor calculations.

Completion of the Application

Facility Specific Factors for Consideration - Refinery Applicants Continued:

3. Section III.C.4 of the Application - The applicant must provide sample data for every outfall as required by the Water Quality Regulations in accordance with the application. The applicant may request a waiver from the parameters listed in the section cited above in accordance with LAC 33:IX.2501.G.7.d if the applicant demonstrates that information adequate to support issuance of the permit can be obtained with less stringent requirements.

Completion of the Application – Corresponding Application Page

SECTION III – LABORATORY ANALYSIS

TABLE I:

CONVENTIONAL AND NONCONVENTIONAL POLLUTANTS

OUTFALL NUMBER

☐ Grab ☐ Composite

POLLUTANT	EFFLUENT ANALYSIS						UNITS	
	MAXIMUM DAILY VALUE		MAXIMUM 30 DAY VALUE		LONG TERM AVERAGE VALUE			
	CONCENTRATION	MASS	CONCENTRATION	MASS	CONCENTRATION	MASS	CONCENTRATION	MASS
BOD_5								
COD								
TOC								
Oil & Grease								
Ammonia (as N)								
Total Suspended Solids (TSS)								
Total Dissolved Solids (TDS)								
Hardness as $CaCO_3$								
Flow	Value		Value		Value			
Temperature (winter) °F	Value		Value		Value		DEGREES FAHRENHEIT	
Temperature (summer) °F	Value		Value		Value		DEGREES FAHRENHEIT	
pH (SU)	Minimum	Maximum	Minimum	Maximum			STANDARD UNITS	

Form_7018_r04
10/07/2009

Page 18 of 42
IND

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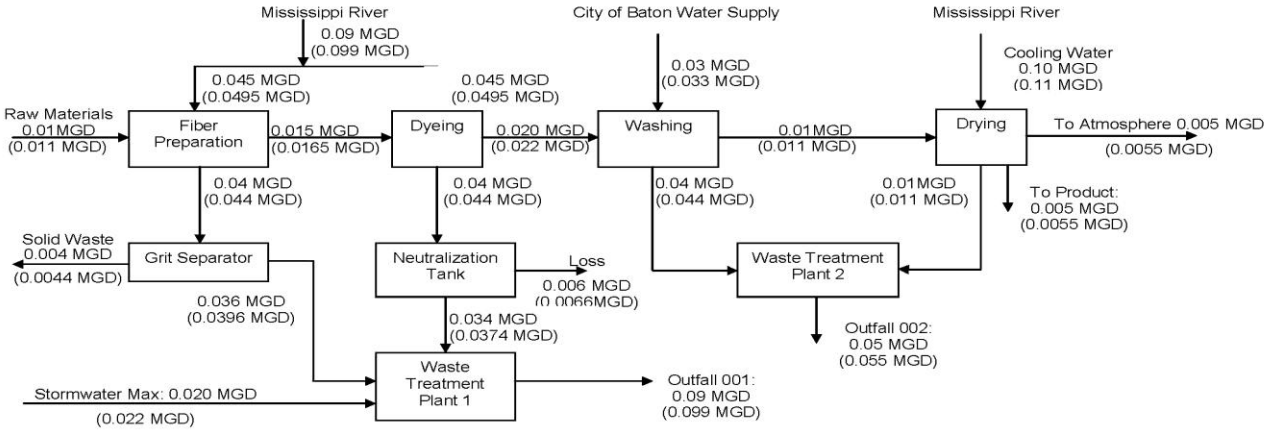
Completion of the Application

Facility Specific Factors for Consideration - Refinery Applicants Continued:

4. Section VII.A, B, and C of the Application – The applicant must provide a site diagram, a topographic map, and a block type water flow diagram (flow balance diagram).

Completion of the Application – Corresponding Application Page

ATTACHMENT B – BLOCK TYPE FLOW BALANCE EXAMPLE



Flow Legend:
Top number = Long Term Average (LTA)
Bottom Number (parentheses) = 30 Day Maximum

Form_7018_r04
10/07/2009

Page 42 of 42
IND

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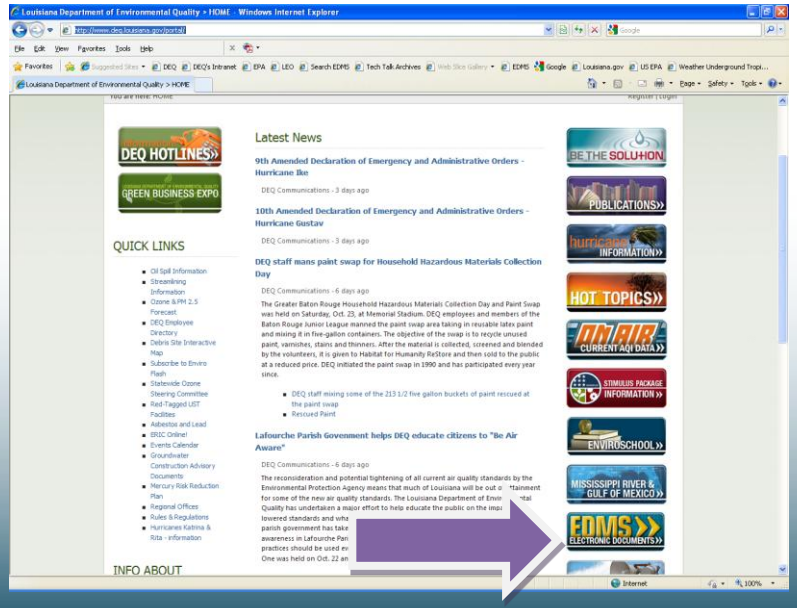
Completion of the Application

Upon Administrative Completeness, the application is concurrently forwarded to the Water Permits Division for assignment to a permit writer and for scanning where the application is made available for viewing through the Electronic Document Management System (EDMS).

EDMS can be accessed from LDEQ's home page at http://www.deq.louisiana.gov/portal/ by clicking on the EDMS button on the right-hand side.



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Questions About Application?

If an applicant or concerned citizen has questions regarding the application or application process, please contact the Water Permits Division at (225) 219-3181.

If an applicant needs help with completion of an application, the LDEQ Small Business/Small Community Assistance Program may be contacted at 1-800-259-2890.

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QUESTIONS ABOUT THE APPLICATION PROCESS?

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WATER PERMITTING

- Permit Supervisor receives permit application and assigns it to a permit writer (PW)
- PW reviews the application for technical completeness and requests additional information as necessary
- PW prepares preliminary draft permit (PDP) and fact sheet and rationale document
- PW routes PDP for internal review
- Upon completion of internal review, PW submits PDP to EPA for review
  - EPA has 30 days to comment
- Upon approval from EPA, the PW submits a draft permit for internal review
- Draft permit is signed by the Environmental Scientist Manager and routed for public notice

WATER PERMITTING

- Public notice for each permit – 30 day comment period
  - A public hearing may be held depending on comments or requests received
- PW responds to comments and prepares final permit decision
- Provisions of the permit may be appealed in writing pursuant to La. R.S. 2024(A) within 30 days from receipt of the permit.

PETROLEUM REFINING INDUSTRY PERMITTING

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Petroleum Refining Permitting

- Once crude oil is pumped out of a well, it is sent to a petroleum refinery and processed to be able to turn it into usable products. Refineries process raw material into a wide variety of petroleum products, including gasoline, fuel oil, jet fuel, heating oils and gases and petrochemicals.
- The Standard Industrial Classification (SIC) Code for a Petroleum Refinery is 2911.

Guidelines for Petroleum Refinery Point Source Category

Federal Guidelines

Regulated by the Guidelines cited at 40 Code of Federal Regulations (CFR), Part 419.

State Guidelines

None

REGULATORY BACKGROUND

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Regulatory Background

- **May 9, 1974** – Promulgation of best practicable control technology currently available (BPT), best available technology economically achievable (BAT), standards of performance for new sources (NSPS), and pretreatment standards for new sources (PSNS) in the Guidelines under 40 Code of Federal Regulations (CFR), Part 419.
- **May 20, 1975** – Amendment to BPT Guidelines
- **August 11, 1976** – BPT and NSPS Upheld (except storm water runoff remanded)
- **March 23, 1977** – Interim and Final pretreatment standards for existing sources (PSES) Promulgation

Regulatory Background

- **October 18, 1982** – Promulgation of BAT, PSES, and PSNS Guidelines
- **January 27, 1983** – 1983 Court Suit by NRDC on BAT Guidelines
- **April 17, 1984** – Settlement Agreement between EPA, NRDC, API, and 7 oil companies
  - More Stringent BAT Guidelines
  - BCT Guidelines
  - Stormwater Runoff
- **August 28, 1984** – Proposal of Settlement Agreement Terms

PETROLEUM REFINERY SUBCATEGORIES

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Petroleum Refinery Subcategories

Petroleum Refineries are Characterized by 5 Subcategories

- **Subcategory A – Topping**
  - Topping and catalytic reforming whether or not the facility includes any other process in addition to topping and catalytic reforming. This subcategory does not include facilities which include thermal processes (coking, visbreaking, etc.) or catalytic cracking.
- **Subcategory B - Cracking**
  - Topping and cracking whether or not the facility includes any other process in addition to topping and cracking, unless specified in one of the subcategories to follow.

Petroleum Refinery Subcategories

- **Subcategory C – Petrochemical**
  - Topping, cracking, and petrochemical operations (production of 2nd generation petrochemicals such as alcohols, ketones, cumen, styrene, etc. or 1st generation petrochemicals and isomerization products such as BTEX, olefins, cyclohexane, etc. when 15 % or more of refinery production is 1st generation or isomerization products) whether or not the facility includes any other process in addition to topping, cracking, and petrochemical operations, except lube oil manufacturing operations.
- **Subcategory D – Lube**
  - Topping, cracking, and lube oil manufacturing processes, whether or not the facility includes any other process in addition to topping, cracking, and lube oil manufacturing processes, except petrochemical operations

Petroleum Refinery Subcategories

- **Subcategory E – Integrated**
  - Topping, cracking, lube oil manufacturing processes, and petrochemical operations whether or not the facility includes any other process in addition to topping, cracking, lube oil manufacturing processes, and petrochemical operations.

TYPICAL UNITS AT A PETROLEUM REFINERY

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Types of Units at a Petroleum Refinery

- **Desalter unit**-before the crude oil enters the atmospheric distillation unit, the desalter unit will remove salt from it
- **Atmospheric distillation unit**-the crude oil is distilled into fractions.
- **Vacuum distillation unit**-after atmospheric distillation, the vacuum distillation unit will further distill residual bottoms
- **Naphtha hydrotreater unit**-desulfurize naphtha from atmospheric distillation by using hydrogen. This is done before sending to a Catalytic Reformer unit.
- **Catalytic reformer unit**-converts naphtha-boiling range molecules into higher octane reformate, which has a higher content of aromatics and cyclic hydrocarbons. The byproduct of a reformer is hydrogen, which is used either in the hydrotreaters or the hydrocracker.

Types of Units at a Petroleum Refinery

- **Distillate hydrotreater** unit desulfurizes distillates (such as diesel) after atmospheric distillation.
- **Fluid catalytic cracker (FCC) unit**-this upgrades the heavier fractions into lighter products that are more valuable.
- **Hydrocracker unit**-upgrades heavier fractions into lighter, more valuable products with the use of hydrogen.
- **Visbreaking unit**-thermally cracks heavy residual oils into lighter, reduced viscosity products that have a higher value.

Reference

http://www.maxtechoil.com/refinery-process-units/

TYPES OF WASTEWATERS

Guideline Wastewaters Found at Petroleum Refineries

- **Process wastewater** – wastewaters which, during manufacturing or processing, come into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.
- **Runoff** – storm water resulting from precipitation coming into contact with refinery property.
- **Ballast water** – flow of waters from a ship that is treated along with refinery wastewaters in the main treatment system.
- **Once-through cooling water** – waters discharged that are used for purposes of heat removal and do not come into direct contact with any raw materials, intermediate product, or finished product.
- **Contaminated runoff** – runoff which comes into contact with any raw materials, intermediate product, finished product, byproduct, or waste product located on the refinery property.

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TYPES OF LIMITATIONS

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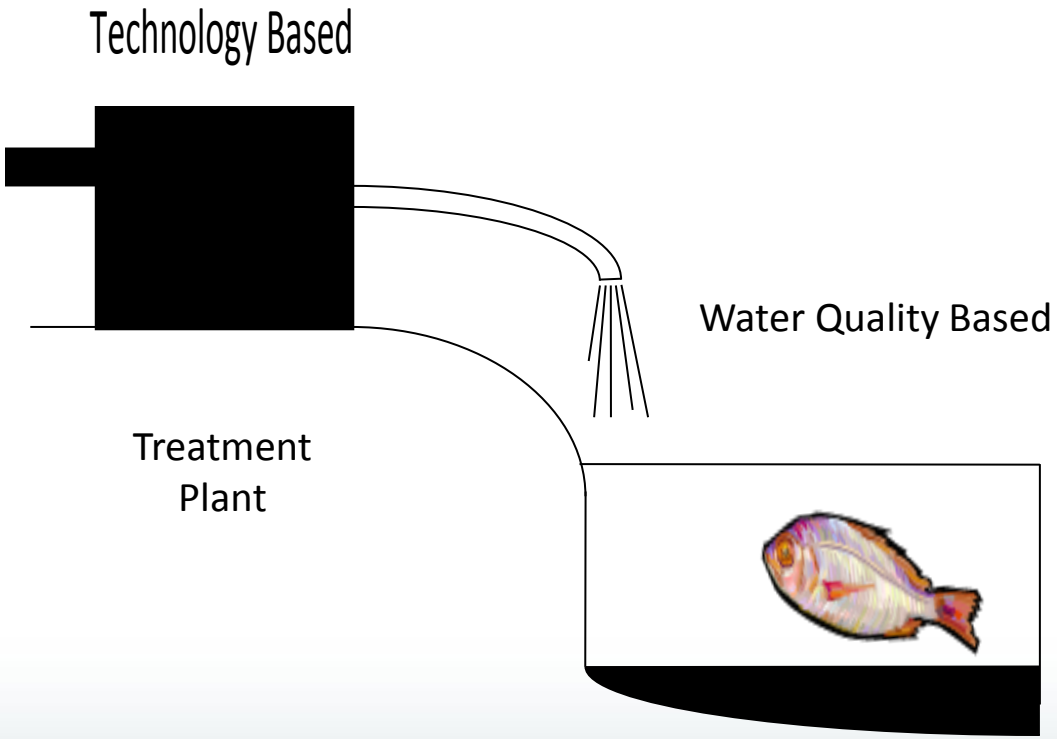
Types of Effluent Limitations

- Two Types of Effluent Limitations
  - Technology-Based Effluent Limitations (TBELs);
  - Water Quality-Based Effluent Limitations (WQBELs);

- Both TBELs and WQBELs are calculated and the more stringent limit is placed in the permit

Types of Effluent Limitations



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TECHNOLOGY-BASED EFFLUENT LIMITATIONS (TBELs)

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TBELs

Regulatory Basis for Technology-Based Limits

LAC 33:IX.2707 requires that LPDES permits include effluent limits and standards promulgated under the Clean Water Act (CWA), Sections 301 (effluent limits and standards) or 306 (new source performance standards), or 402(a)(1) (case-by-case basis) or a combination.

TBELs for Petroleum Refineries

Technology Limitation Parameters Mandated by Federal Guidelines – 40 CFR 419

BOD_5 - Biological Oxygen Demand
TSS – Total Suspended Solids
COD – Chemical Oxygen Demand
Oil & Grease
Phenolic Compounds
Ammonia (as N)
Sulfide
Total Chromium
Hexavalent Chromium
pH

TBELs for Petroleum Refineries

TBELs are production based limits = mass limitations (expressed in lbs/day)

Feedstock – the crude oil and natural gas liquids fed to the topping units.

Size Factor – based on the refinery feedstock rate (table in regulations at 40 CFR 419)

Process Factor – based on the process configuration, which looks at the process feedstock rate relative to the refinery feedstock rate and a weight factor (table in regulations at 40 CFR 419)

Example TBELs for a Petroleum Refinery

Example Calculations – Refinery Cracking Subcategory

- Guideline
  Refinery Guidelines

  Reference
  40 CFR 419, Subpart B, Cracking

- Feedstock rate to Topping Unit(s), 1000 bbl/day – 125

- Storm water flow, 210,000 gallons/day based on the maximum daily value flow from the application

Example TBELs for a Petroleum Refinery

Process Unit Rates, 1000 bbl/day:

Unit Process	Unit Process Rate (kbbl/day)
Crude Atmospheric Distillation	125
Crude Desalting	125
Crude Vacuum Distillation	50
Fluid Catalytic Cracking	35
Hydrotreating*	98
Distillate Hydrocracking	40
HF Alkylation*	9.5
Catalytic Reforming*	28
Residual Oil Supercritical Extraction	18

* Not applicable to refinery process configuration factor.

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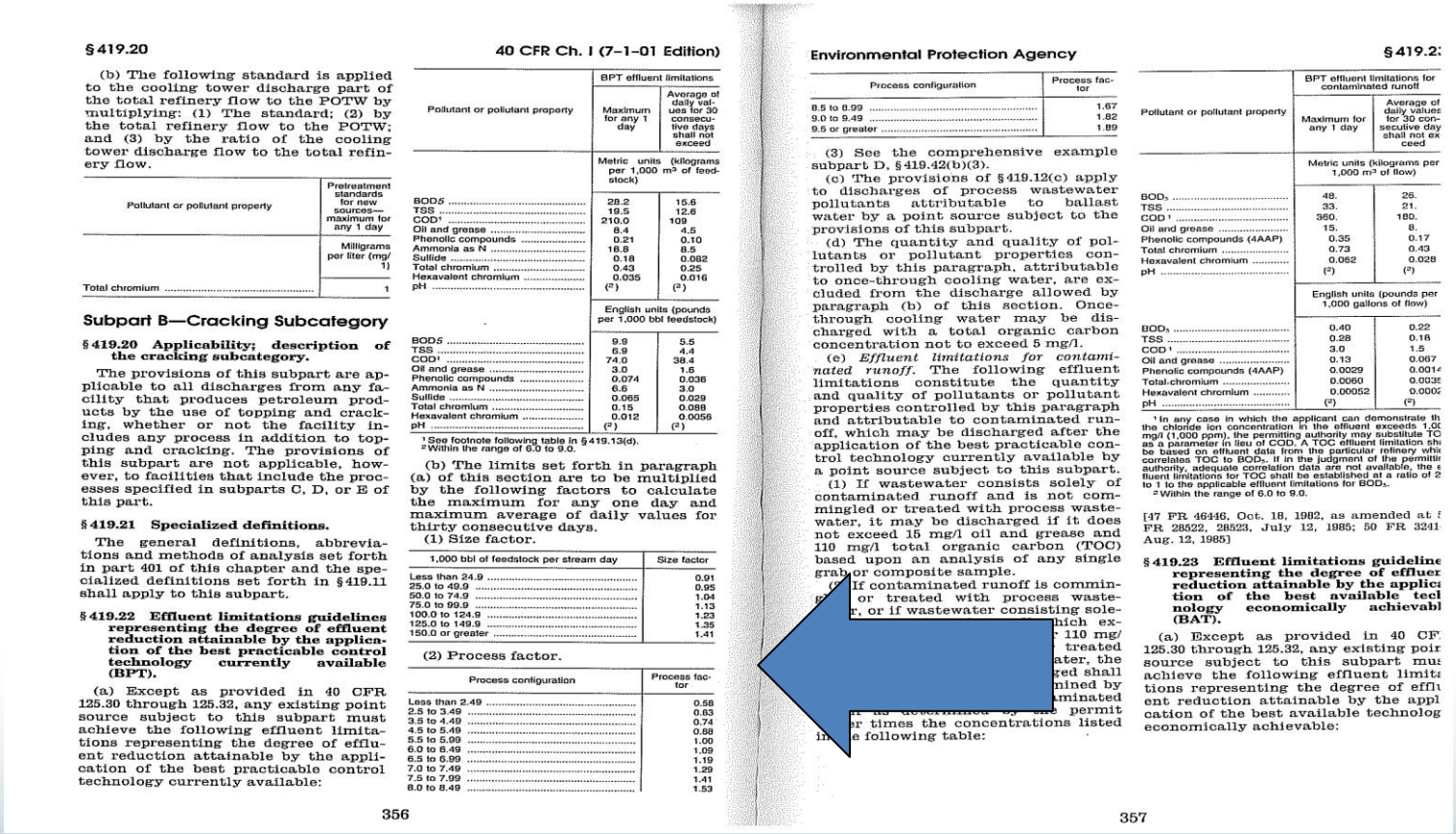
Example TBELs for a Petroleum Refinery

Feedstock Rate is 125 Kbbl/day

- Size Factor from 40 CFR 419.22 is 1.35
- Process Factor from 40 CFR 419.22 is 1.41

Process	Process Feedstock Rate	Process Feedstock Rate Relative to Refinery Feedstock Rate	Weight Factor	Process Configuration
Crude: Atm. Dist. Vac. Dist. Desalting Total	 125.00 50.00 125.00	 1.0 0.4 1.0 2.4	X1	2.4
Cracking: FCC Hydrocracking Total	 35 40	 0.28 0.32 0.60	X6	3.6
Lube: Res. Oil Ext. Total	 18	 0.144 0.144	X13	1.872
Asphalt:	0	0	X 12	0
Total Refinery				7.872

Example TBELs for a Petroleum Refinery – 40 CFR 419 Size and Process Factor Charts



§ 419.20

(b) The following standard is applied to the cooling tower discharge part of the total refinery flow to the POTW by multiplying: (1) The standard; (2) by the total refinery flow to the POTW; and (3) by the ratio of the cooling tower discharge flow to the total refinery flow.

Pollutant or pollutant property	Pretreatment standards for new sources—maximum for any 1 day
	Milligrams per liter (mg/l)
Total chromium	1

Subpart B—Cracking Subcategory

§ 419.20 Applicability; description of the cracking subcategory.

The provisions of this subpart are applicable to all discharges from any facility that produces petroleum products by the use of topping and cracking, whether or not the facility includes any process in addition to topping and cracking. The provisions of this subpart are not applicable, however, to facilities that include the processes specified in subparts C, D, or E of this part.

§ 419.21 Specialized definitions.

The general definitions, abbreviations and methods of analysis set forth in part 401 of this chapter and the specialized definitions set forth in § 419.11 shall apply to this subpart.

§ 419.22 Effluent limitations guidelines representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available (BPT).

(a) Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the degree of effluent reduction attainable by the application of the best practicable control technology currently available:

Pollutant or pollutant property	BPT effluent limitations: Maximum for any 1 day	BPT effluent limitations: Average of daily values for 30 consecutive days shall not exceed
	Metric units (kilograms per 1,000 m³ of feedstock)	
BOD5	28.2	15.6
TSS	19.5	12.6
COD[1]	210.0	109
Oil and grease	8.4	4.5
Phenolic compounds	0.21	0.10
Ammonia as N	16.8	8.5
Sulfide	0.18	0.082
Total chromium	0.43	0.25
Hexavalent chromium	0.035	0.016
pH	([2])	([2])
	English units (pounds per 1,000 bbl feedstock)	
BOD5	9.9	5.5
TSS	6.9	4.4
COD[1]	74.0	38.4
Oil and grease	3.0	1.6
Phenolic compounds	0.074	0.036
Ammonia as N	6.6	3.0
Sulfide	0.065	0.029
Total chromium	0.15	0.088
Hexavalent chromium	0.012	0.0056
pH	([2])	([2])

[1] See footnote following table in § 419.13(d).
[2] Within the range of 6.0 to 9.0.

(b) The limits set forth in paragraph (a) of this section are to be multiplied by the following factors to calculate the maximum for any one day and maximum average of daily values for thirty consecutive days.

(1) Size factor.

1,000 bbl of feedstock per stream day	Size factor
Less than 24.9	0.91
25.0 to 49.9	0.95
50.0 to 74.9	1.04
75.0 to 99.9	1.13
100.0 to 124.9	1.23
125.0 to 149.9	1.35
150.0 or greater	1.41

(2) Process factor.

Process configuration	Process factor
Less than 2.49	0.58
2.5 to 3.49	0.63
3.5 to 4.49	0.74
4.5 to 5.49	0.88
5.5 to 5.99	1.00
6.0 to 6.49	1.09
6.5 to 6.99	1.19
7.0 to 7.49	1.29
7.5 to 7.99	1.41
8.0 to 8.49	1.53

356

Process configuration	Process factor
8.5 to 8.99	1.67
9.0 to 9.49	1.82
9.5 or greater	1.89

(3) See the comprehensive example subpart D, § 419.42(b)(3).

(c) The provisions of § 419.12(c) apply to discharges of process wastewater pollutants attributable to ballast water by a point source subject to the provisions of this subpart.

(d) The quantity and quality of pollutants or pollutant properties controlled by this paragraph, attributable to once-through cooling water, are excluded from the discharge allowed by paragraph (b) of this section. Once-through cooling water may be discharged with a total organic carbon concentration not to exceed 5 mg/l.

(e) *Effluent limitations for contaminated runoff.* The following effluent limitations constitute the quantity and quality of pollutants or pollutant properties controlled by this paragraph and attributable to contaminated runoff, which may be discharged after the application of the best practicable control technology currently available by a point source subject to this subpart.

(1) If wastewater consists solely of contaminated runoff and is not commingled or treated with process wastewater, it may be discharged if it does not exceed 15 mg/l oil and grease and 110 mg/l total organic carbon (TOC) based upon an analysis of any single grab or composite sample.

(2) If contaminated runoff is commin- or treated with process waste- r, or if wastewater consisting sole- hich ex- 110 mg/ treated ater, the ed shall mined by minated permit r times the concentrations listed e following table:

Pollutant or pollutant property	BPT effluent limitations for contaminated runoff: Maximum for any 1 day	BPT effluent limitations for contaminated runoff: Average of daily values for 30 consecutive day shall not exceed
	Metric units (kilograms per 1,000 m³ of flow)	
BOD_5	48.	26.
TSS	33.	21.
COD[1]	360.	180.
Oil and grease	15.	8.
Phenolic compounds (4AAP)	0.35	0.17
Total chromium	0.73	0.43
Hexavalent chromium	0.052	0.028
pH	([2])	([2])
	English units (pounds per 1,000 gallons of flow)	
BOD_5	0.40	0.22
TSS	0.28	0.18
COD[1]	3.0	1.5
Oil and grease	0.13	0.067
Phenolic compounds (4AAP)	0.0029	0.001
Total chromium	0.0060	0.003
Hexavalent chromium	0.00052	0.000
pH	([2])	([2])

[1] In any case in which the applicant can demonstrate th the chloride ion concentration in the effluent exceeds 1,0 mg/l (1,000 ppm), the permitting authority may substitute TO as a parameter in lieu of COD. A TOC effluent limitation sh be based on effluent data from the particular refinery whi correlates TOC to BOD_5. If in the judgment of the permitti authority, adequate correlation data are not available, the e fluent limitations for TOC shall be established at a ratio of 2 to 1 to the applicable effluent limitations for BOD_5.
[2] Within the range of 6.0 to 9.0.

[47 FR 46446, Oct. 18, 1982, as amended at FR 28522, 28523, July 12, 1985; 50 FR 3241 Aug. 12, 1985]

§ 419.23 Effluent limitations guidelin representing the degree of effluer reduction attainable by the applic tion of the best available tec nology economically achievabl (BAT).

(a) Except as provided in 40 CF 125.30 through 125.32, any existing poir source subject to this subpart mu achieve the following effluent limit tions representing the degree of effl ent reduction attainable by the appl cation of the best available technolog economically achievable:

357

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Example TBELs for a Petroleum Refinery

- To calculate limitations for **ALL BCT** parameters
  Limit = Effluent Limitation
  X Size Factor
  X Process Factor
  X Refinery Feedstock Rate

- BCT limitations for **Ballast Water**: BOD_5, Oil & Grease, TSS, COD vs TOC
  None for this example

- BCT limitations for **Once-Through Cooling Water**:
  None for this example

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Example TBELs for a Petroleum Refinery

BCT for **Process Wastewater** (40 CFR 419.24(a))

Parameter	Monthly Average Limitation Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Pounds per 1000 barrels of feedstock	Size Factor	Process Factor	Refinery Feedstock Rate (KBBL/DAY)	Calculated Limitations	
						Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
BOD_5	5.5	9.9	1.35	1.41	125	1308.656	2355.581
TSS	4.4	6.9	1.35	1.41	125	1046.925	1641.749
Oil & Grease	1.6	3.0	1.35	1.41	125	380.7	713.8125

Example TBELs for a Petroleum Refinery

- To calculate BCT limitations for **Contaminated Storm Water**: BOD_5, Oil & Grease, TSS (40 CFR 419.24(e)(2))
  - Flow x Limitation

Parameter	Monthly Average Limitation Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Pounds per 1000 barrels of feedstock	Flow 1000 gallons per day	Calculated Limitations	
				Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
BOD_5	0.22	0.40	210	46.2	84.0
TSS	0.18	0.28	210	37.8	58.8
Oil & Grease	0.067	0.13	210	14.07	27.3

Example TBELs for a Petroleum Refinery

- BCT limitations for **Process Wastewater & Contaminated Storm Water** Combined: BOD_5, Oil & Grease, TSS
  - Process + Contaminated Storm Water = BCT Limitation

Parameter	Monthly Average Limitation PROCESS Pounds per 1000 barrels of feedstock	Daily Maximum Limitation PROCESS Pounds per 1000 barrels of feedstock	Monthly Average Limitation STORM WATER Pounds per 1000 barrels of feedstock	Daily Maximum Limitation STORM WATER Pounds per 1000 barrels of feedstock	Calculated Limitations	
					Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
BOD_5	1308.656	2355.581	46.2	84.0	1354.856	2439.581
TSS	1046.925	1641.749	37.8	58.8	1084.725	1700.56875
Oil & Grease	380.7	713.8125	14.07	27.3	394.77	741.1125

Cells highlighted are final limitations

Example TBELs for a Petroleum Refinery

- To calculate limitations for **ALL BPT** parameters
  Limit = Effluent Limitation
  X Size Factor
  X Process Factor
  X Refinery Feedstock Rate

- BPT limitations for **Ballast Water**: BOD_5, Oil & Grease, TSS
  None for this example

- BPT limitations for **Once-Through Cooling Water**:
  None for this example

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Example TBELs for a Petroleum Refinery

BPT for **Process Wastewater**

Parameter	Monthly Average Limitation Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Pounds per 1000 barrels of feedstock	Size Factor	Process Factor	Refinery Feedstock Rate (KBBL/DAY)	Calculated Limitations	
						Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
BOD_5	5.5	9.9	1.35	1.41	125	1308.656	2355.581
TSS	4.4	6.9	1.35	1.41	125	1046.925	1641.749
COD	38.4	74.0	1.35	1.41	125	9136.8	17607.375
Oil & Grease	1.6	3.0	1.35	1.41	125	380.7	713.8125
Total Phenolics	0.036	0.074	1.35	1.41	125	8.56575	17.607375

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Example TBELs for a Petroleum Refinery

BPT for **Process Wastewater**

Parameter	Monthly Average Limitation Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Pounds per 1000 barrels of feedstock	Size Factor	Process Factor	Refinery Feedstock Rate (KBBL/DAY)	Calculated Limitations	
						Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
Ammonia	3.0	6.6	1.35	1.41	125	713.8125	1570.3875
Sulfide	0.029	0.065	1.35	1.41	125	6.9001875	15.4659375
Total Chromium	0.088	0.15	1.35	1.41	125	20.9385	35.690625
Hexavalent Chromium	0.0056	0.012	1.35	1.41	125	1.33245	2.85525

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Example TBELs for a Petroleum Refinery

- To calculate BPT limitations for **Contaminated Storm Water**:
  - Flow x Limitation

Parameter	Monthly Average Limitation Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Pounds per 1000 barrels of feedstock	Flow 1000 gallons per day	Calculated Limitations	
				Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
BOD_5	0.22	0.40	210	46.2	84.0
TSS	0.18	0.28	210	37.8	58.8
Oil & Grease	0.067	0.13	210	14.07	27.3
COD	1.5	3.0	210	315	630
Total Phenolics	0.0014	0.0029	210	0.294	0.609

Example TBELs for a Petroleum Refinery

- To calculate BPT limitations for **Contaminated Storm Water**:
  - Flow x Limitation

Parameter	Monthly Average Limitation Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Pounds per 1000 barrels of feedstock	Flow 1000 gallons per day	Calculated Limitations	
				Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
Total Chromium	0.0035	0.0060	210	0.735	1.26
Hexavalent Chromium	0.00023	0.00052	210	0.0483	0.1092

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Example TBELs for a Petroleum Refinery

- BPT limitations for **Process Wastewater & Contaminated Storm Water** Combined:
  - Process + Contaminated Storm Water = BPT Limitation

Parameter	Monthly Average Limitation PROCESS Pounds per 1000 barrels of feedstock	Daily Maximum Limitation PROCESS Pounds per 1000 barrels of feedstock	Monthly Average Limitation STORM WATER Pounds per 1000 barrels of feedstock	Daily Maximum Limitation STORM WATER Pounds per 1000 barrels of feedstock	Calculated Limitations	
					Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
BOD_5	1308.656	2355.581	46.2	84.0	1354.856	2439.581
TSS	1046.925	1641.749	37.8	58.8	1084.725	1700.56875
Oil & Grease	380.7	713.8125	14.07	27.3	394.77	741.1125

Cells highlighted are final limitations

Example TBELs for a Petroleum Refinery

- BPT limitations for **Process Wastewater & Contaminated Storm Water** Combined:

Parameter	Monthly Average Limitation PROCESS Pounds per 1000 barrels of feedstock	Daily Maximum Limitation PROCESS Pounds per 1000 barrels of feedstock	Monthly Average Limitation STORM WATER Pounds per 1000 barrels of feedstock	Daily Maximum Limitation STORM WATER Pounds per 1000 barrels of feedstock	Calculated Limitations	
					Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
COD	9136.8	17607.375	315	630	9451.8	18237.375
Total Phenolics	8.56575	17.607375	0.294	0.609	8.85975	18.216375
Ammonia	713.8125	1570.3875	---	---	713.8125	1570.3875
Sulfide	6.9001875	15.4659375	---	---	6.9001875	15.4659375
Total Chromium	20.9385	35.690625	0.735	1.26	21.6735	36.950625
Hexavalent Chromium	1.33245	2.85525	0.0483	0.1092	1.38075	2.96445

Cells highlighted are final limitations

TBELs for Petroleum Refineries

- To calculate limitations for **BAT parameters**: Ammonia, Sulfide, and COD

  Limit = Effluent Limitation

  X Size Factor

  X Process Factor

  X Refinery Feedstock Rate

- BAT limitations for Ballast Water: COD

  None for this example

- BAT limitations for Once-Through Cooling Water: TOC

  None for this example

Example TBELs for a Petroleum Refinery

Calculating BAT **Process Wastewater** Limits

Parameter	Monthly Average Limitation Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Pounds per 1000 barrels of feedstock	Size Factor	Process Factor	Refinery Feedstock Rate (KBBL/DAY)	Calculated Limitations	
						Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
COD	38.4	74.0	1.35	1.41	125	9136.8	17607.375
Ammonia	3.0	6.6	1.35	1.41	125	713.8125	1570.3875
Sulfide	0.029	0.065	1.35	1.41	125	6.9001875	15.4659375

Example TBELs for a Petroleum Refinery

- To calculate limitations for **BAT parameters**: Phenolic Compounds, Total Chromium, and Hexavalent Chromium

  Individual Processes = Feedstock Rate of Processes x Limitation Factor from the Regulations

  Limit = Crude Process Allocation
  + Cracking and Coking Process Allocation
  + Asphalt Process Allocation
  + Lube Process Allocation
  + Reforming and Alkylation Process Allocation

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Example TBELs for a Petroleum Refinery

Calculating BAT **Process Wastewater** Limits

Parameter	Monthly Average Limitation Factor Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Factor Pounds per 1000 barrels of feedstock	Feedstock Rate from Processes	Calculated Limitations	
				Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
Total Phenolics Crude Crack Asphalt Lube Reform TOTAL	 0.003 0.036 0.019 0.090 0.032	 0.013 0.147 0.079 0.369 0.132	 300 173 --- 18 37.5	 0.9 6.228 --- 1.62 1.2 9.948	 3.9 25.431 --- 6.642 4.95 40.923
Total Chromium Crude Crack Asphalt Lube Reform TOTAL	 0.004 0.041 0.022 0.104 0.037	 0.011 0.199 0.064 0.299 0.107	 300 173 --- 18 37.5	 1.2 7.093 --- 1.872 1.3875 11.5525	 3.3 20.587 --- 5.382 4.0125 33.2815

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Example TBELs for a Petroleum Refinery

Calculating BAT **Process Wastewater** Limits

Parameter	Monthly Average Limitation Factor Pounds per 1000 barrels of feedstock	Daily Maximum Limitation Factor Pounds per 1000 barrels of feedstock	Feedstock Rate from Processes	Calculated Limitations	
				Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
Hexavalent Chromium					
Crude	0.0003	0.0007	300	0.09	0.21
Crack	0.0034	0.0076	173	0.5882	1.3148
Asphalt	0.0019	0.0041	---	---	---
Lube	0.0087	0.0192	18	0.1566	0.3456
Reform	0.0031	0.0069	37.5	0.11625	0.25875
TOTAL				0.95105	2.12915

Example TBELs for a Petroleum Refinery

- To calculate BAT limitations for **Contaminated Storm Water**: COD, Total Phenolics, Total Chromium, Hexavalent Chromium
  - Flow x Limitation

Parameter	Monthly Average Limitations Pounds per 1000 barrels of feedstock	Daily Maximum Limitations Pounds per 1000 barrels of feedstock	Flow 1000 gallons per day	Calculated Limitations	
				Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
COD	1.5	3.0	210	315	630
Total Phenolics	0.0014	0.0029	210	0.294	0.609
Total Chromium	0.0018	0.0050	210	0.378	1.05
Hexavalent Chromium	0.00052	0.00052	210	0.0483	0.1092

Example TBELs for a Petroleum Refinery

- BAT limitations for **Process Wastewater & Contaminated Storm Water Combined: COD, Ammonia, Sulfide**
  - Process + Contaminated Storm Water = BAT Limitation

Parameter	Monthly Average Limitation PROCESS Pounds per 1000 barrels of feedstock	Daily Maximum Limitation PROCESS Pounds per 1000 barrels of feedstock	Monthly Average Limitation STORM WATER Pounds per 1000 barrels of feedstock	Daily Maximum Limitation STORM WATER Pounds per 1000 barrels of feedstock	Calculated Limitations	
					Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
COD	9136.8	17607.375	315	630	9451.8	18237.375
Ammonia	713.8125	1570.3875	---	---	713.8125	1570.3875
Sulfide	6.9001875	15.4659375	---	---	6.900.875	15.4659375

Cells highlighted are final limitations

Example TBELs for a Petroleum Refinery

- BAT limitations for **Process Wastewater & Contaminated Storm Water** Combined:

Parameter	Monthly Average Limitation PROCESS Pounds per 1000 barrels of feedstock	Daily Maximum Limitation PROCESS Pounds per 1000 barrels of feedstock	Monthly Average Limitation STORM WATER Pounds per 1000 barrels of feedstock	Daily Maximum Limitation STORM WATER Pounds per 1000 barrels of feedstock	Calculated Limitations	
					Monthly Average (LBS/DAY)	Daily Maximum (LBS/DAY)
Total Phenolics	9.948	40.923	0.294	0.609	10.242	41.532
Total Chromium	11.5525	33.2815	0.378	1.05	11.9305	34.3315
Hexavalent Chromium	0.95105	2.12915	0.0483	0.1092	0.99935	2.23835

Cells highlighted are final limitations

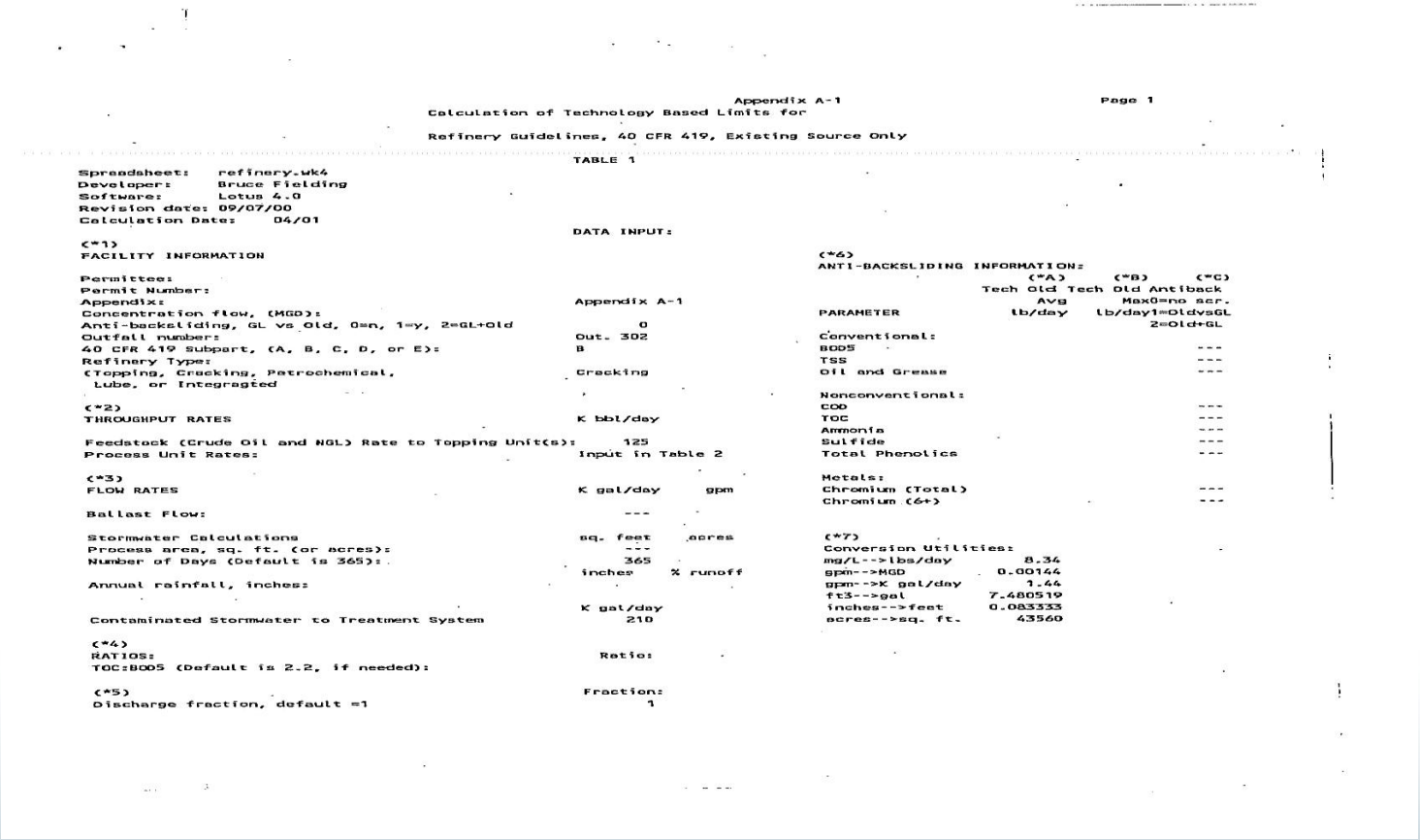
Example TBELs for a Petroleum Refinery

Pick the most stringent Limitation for each and this is what goes into the permit (HIGHLIGHTED IN PREVIOUS SLIDES).

TECHNOLOGY LIMITATIONS THAT WILL BE ESTABLISHED FOR THIS EXAMPLE

Parameter	Applicable Technology	Monthly Average LBS/DAY	Daily Maximum LBS/DAY
BOD_5	BCT	1354.85625	2439.58125
TSS	BCT	1084.725	1700.56875
Oil & Grease	BCT	394.77	741.1125
COD	BAT	9451.8	18237.375
Ammonia	BAT	713.8125	1570.3875
Sulfide	BAT	6.9001875	15.4659375
Total Phenolics	BPT	8.85975	18.216375
Total Chromium	BAT	11.9305	34.3315
Hexavalent Chromium	BAT	0.99935	2.23835

Example TBELs for a Petroleum Refinery - SPREADSHEETS



Appendix A-1 Page 1
Calculation of Technology Based Limits for

Refinery Guidelines, 40 CFR 419, Existing Source Only

TABLE 1

Spreadsheet:	refinery.wk4
Developer:	Bruce Fielding
Software:	Lotus 4.0
Revision date:	09/07/00
Calculation Date:	04/01

DATA INPUT:

(*1) FACILITY INFORMATION		
Permittee:		
Permit Number:		
Appendix:	Appendix A-1	
Concentration flow, (MGD):		
Anti-backsliding, GL vs Old, 0=n, 1=y, 2=GL+Old	0	
Outfall number:	Out. 302	
40 CFR 419 Subpart, (A, B, C, D, or E):	B	
Refinery Type: (Topping, Cracking, Petrochemical, Lube, or Integragted	Cracking	
(*2) THROUGHPUT RATES	K bbl/day	
Feedstock (Crude Oil and NGL) Rate to Topping Unit(s):	125	
Process Unit Rates:	Input in Table 2	
(*3) FLOW RATES	K gal/day	gpm
Ballast Flow:	---	
Stormwater Calculations	sq. feet	acres
Process area, sq. ft. (or acres):	---	
Number of Days (Default is 365):	365	
Annual rainfall, inches:	inches	% runoff
Contaminated Stormwater to Treatment System	K gal/day 210	
(*4) RATIOS:	Ratio:	
TOC:BOD5 (Default is 2.2, if needed):		
(*5) Discharge fraction, default =1	Fraction: 1	

(*6) ANTI-BACKSLIDING INFORMATION:

PARAMETER	(*A) Tech Avg lb/day	Old Tech Avg lb/day	(*B) Old Antiback Max0=no scr. 1=OldvsGL 2=Old+GL	(*C)
Conventional:				
BOD5				---
TSS				---
Oil and Grease				---
Nonconventional:				
COD				---
TOC				---
Ammonia				---
Sulfide				---
Total Phenolics				---
Metals:				
Chromium (Total)				---
Chromium (6+)				---

(*7) Conversion Utilities:

mg/L-->lbs/day	8.34
gpm-->MGD	0.00144
gpm-->K gal/day	1.44
ft3-->gal	7.480519
inches-->feet	0.083333
acres-->sq. ft.	43560

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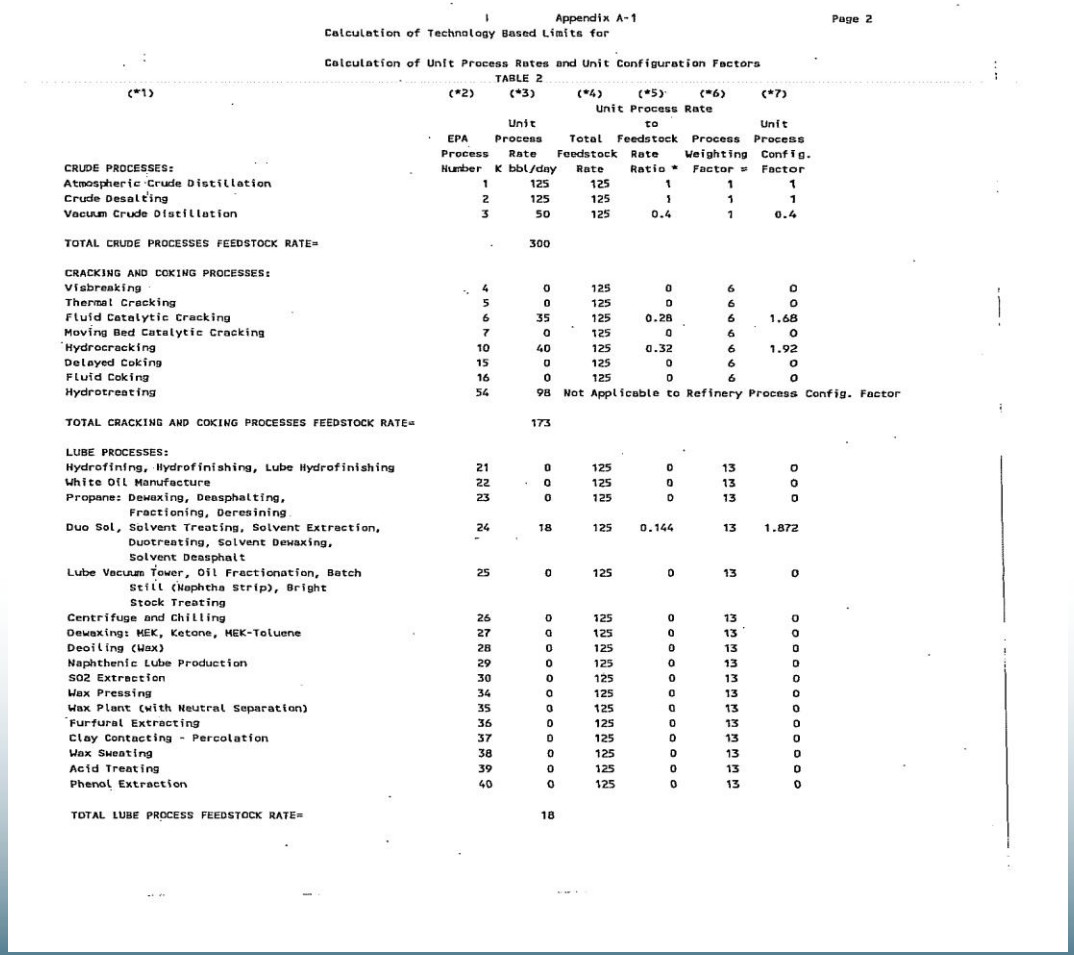
Example TBELs for a Petroleum Refinery - SPREADSHEETS



Appendix A-1 Page 2

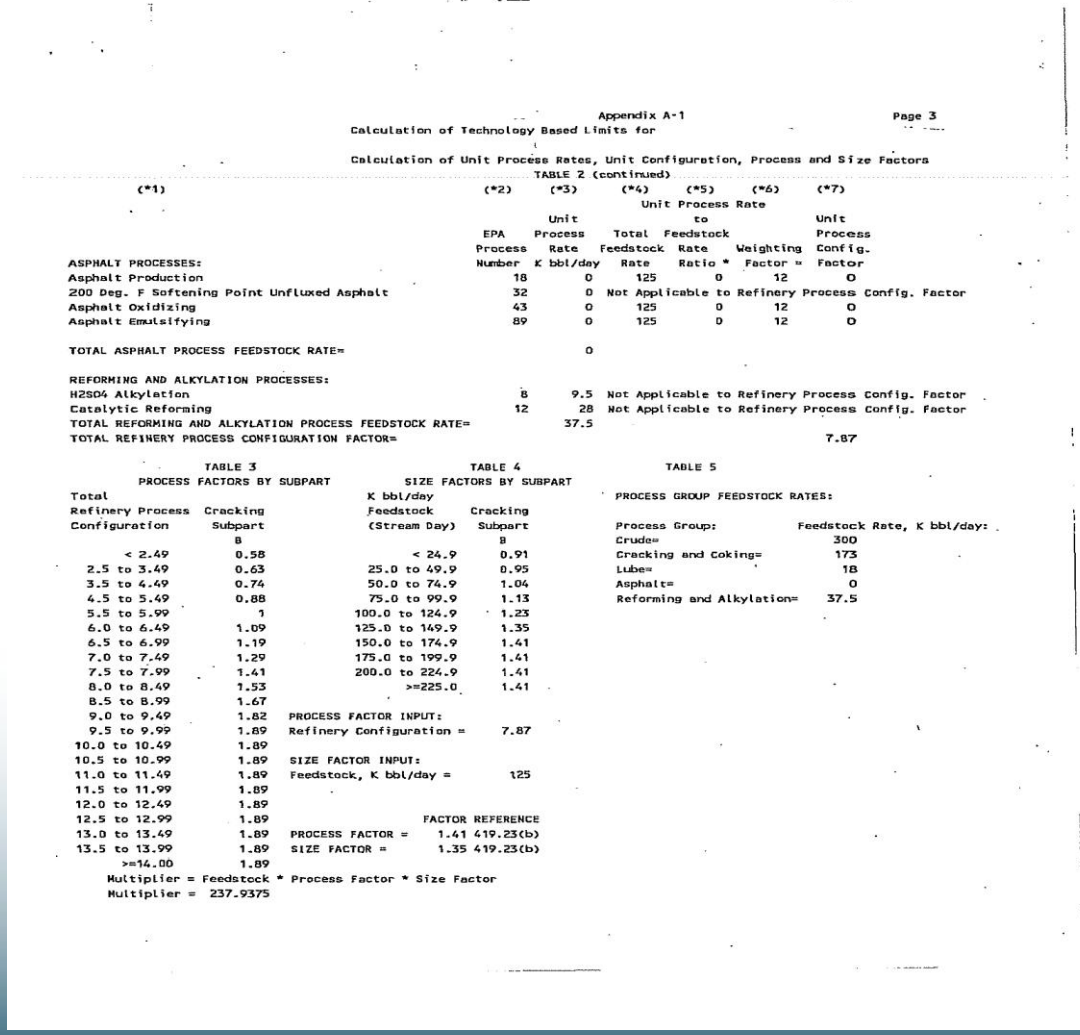
Calculation of Technology Based Limits for

Calculation of Unit Process Rates and Unit Configuration Factors

TABLE 2

(*1)	(*2)	(*3)	(*4)	(*5)	(*6)	(*7)
			Unit Process Rate			
	EPA Process Number	Unit Process Rate K bbl/day	Total Feedstock Rate	to Feedstock Rate Ratio *	Process Weighting Factor =	Unit Process Config. Factor
CRUDE PROCESSES:						
Atmospheric Crude Distillation	1	125	125	1	1	1
Crude Desalting	2	125	125	1	1	1
Vacuum Crude Distillation	3	50	125	0.4	1	0.4
TOTAL CRUDE PROCESSES FEEDSTOCK RATE=		300				
CRACKING AND COKING PROCESSES:						
Visbreaking	4	0	125	0	6	0
Thermal Cracking	5	0	125	0	6	0
Fluid Catalytic Cracking	6	35	125	0.28	6	1.68
Moving Bed Catalytic Cracking	7	0	125	0	6	0
Hydrocracking	10	40	125	0.32	6	1.92
Delayed Coking	15	0	125	0	6	0
Fluid Coking	16	0	125	0	6	0
Hydrotreating	54	98	Not Applicable to Refinery Process Config. Factor			
TOTAL CRACKING AND COKING PROCESSES FEEDSTOCK RATE=		173				
LUBE PROCESSES:						
Hydrofining, Hydrofinishing, Lube Hydrofinishing	21	0	125	0	13	0
White Oil Manufacture	22	0	125	0	13	0
Propane: Dewaxing, Deasphalting, Fractioning, Deresining	23	0	125	0	13	0
Duo Sol, Solvent Treating, Solvent Extraction, Duotreating, Solvent Dewaxing, Solvent Deasphalt	24	18	125	0.144	13	1.872
Lube Vacuum Tower, Oil Fractionation, Batch Still (Naphtha Strip), Bright Stock Treating	25	0	125	0	13	0
Centrifuge and Chilling	26	0	125	0	13	0
Dewaxing: MEK, Ketone, MEK-Toluene	27	0	125	0	13	0
Deoiling (Wax)	28	0	125	0	13	0
Naphthenic Lube Production	29	0	125	0	13	0
SO2 Extraction	30	0	125	0	13	0
Wax Pressing	34	0	125	0	13	0
Wax Plant (with Neutral Separation)	35	0	125	0	13	0
Furfural Extracting	36	0	125	0	13	0
Clay Contacting - Percolation	37	0	125	0	13	0
Wax Sweating	38	0	125	0	13	0
Acid Treating	39	0	125	0	13	0
Phenol Extraction	40	0	125	0	13	0
TOTAL LUBE PROCESS FEEDSTOCK RATE=		18				

Example TBELs for a Petroleum Refinery - SPREADSHEETS



Appendix A-1 Page 3

Calculation of Technology Based Limits for

Calculation of Unit Process Rates, Unit Configuration, Process and Size Factors

TABLE 2 (continued)

(*1)	(*2)	(*3)	(*4)	(*5)	(*6)	(*7)
			Unit Process Rate			
	EPA Process Number	Unit Process Rate K bbl/day	Total Feedstock Rate	to Feedstock Rate Ratio *	Weighting Factor =	Unit Process Config. Factor
ASPHALT PROCESSES:						
Asphalt Production	18	0	125	0	12	0
200 Deg. F Softening Point Unfluxed Asphalt	32	0	Not Applicable to Refinery Process Config. Factor			
Asphalt Oxidizing	43	0	125	0	12	0
Asphalt Emulsifying	89	0	125	0	12	0
TOTAL ASPHALT PROCESS FEEDSTOCK RATE=		0				
REFORMING AND ALKYLATION PROCESSES:						
H2SO4 Alkylation	8	9.5	Not Applicable to Refinery Process Config. Factor			
Catalytic Reforming	12	28	Not Applicable to Refinery Process Config. Factor			
TOTAL REFORMING AND ALKYLATION PROCESS FEEDSTOCK RATE=		37.5				
TOTAL REFINERY PROCESS CONFIGURATION FACTOR=						7.87

TABLE 3
PROCESS FACTORS BY SUBPART

Total Refinery Process Configuration	Cracking Subpart B
< 2.49	0.58
2.5 to 3.49	0.63
3.5 to 4.49	0.74
4.5 to 5.49	0.88
5.5 to 5.99	1
6.0 to 6.49	1.09
6.5 to 6.99	1.19
7.0 to 7.49	1.29
7.5 to 7.99	1.41
8.0 to 8.49	1.53
8.5 to 8.99	1.67
9.0 to 9.49	1.82
9.5 to 9.99	1.89
10.0 to 10.49	1.89
10.5 to 10.99	1.89
11.0 to 11.49	1.89
11.5 to 11.99	1.89
12.0 to 12.49	1.89
12.5 to 12.99	1.89
13.0 to 13.49	1.89
13.5 to 13.99	1.89
>=14.00	1.89

Multiplier = Feedstock * Process Factor * Size Factor
Multiplier = 237.9375

TABLE 4
SIZE FACTORS BY SUBPART

K bbl/day Feedstock (Stream Day)	Cracking Subpart B
< 24.9	0.91
25.0 to 49.9	0.95
50.0 to 74.9	1.04
75.0 to 99.9	1.13
100.0 to 124.9	1.23
125.0 to 149.9	1.35
150.0 to 174.9	1.41
175.0 to 199.9	1.41
200.0 to 224.9	1.41
>=225.0	1.41

PROCESS FACTOR INPUT:
Refinery Configuration = 7.87

SIZE FACTOR INPUT:
Feedstock, K bbl/day = 125

		FACTOR	REFERENCE
PROCESS FACTOR =		1.41	419.23(b)
SIZE FACTOR =		1.35	419.23(b)

TABLE 5
PROCESS GROUP FEEDSTOCK RATES:

Process Group:	Feedstock Rate, K bbl/day:
Crude=	300
Cracking and Coking=	173
Lube=	18
Asphalt=	0
Reforming and Alkylation=	37.5

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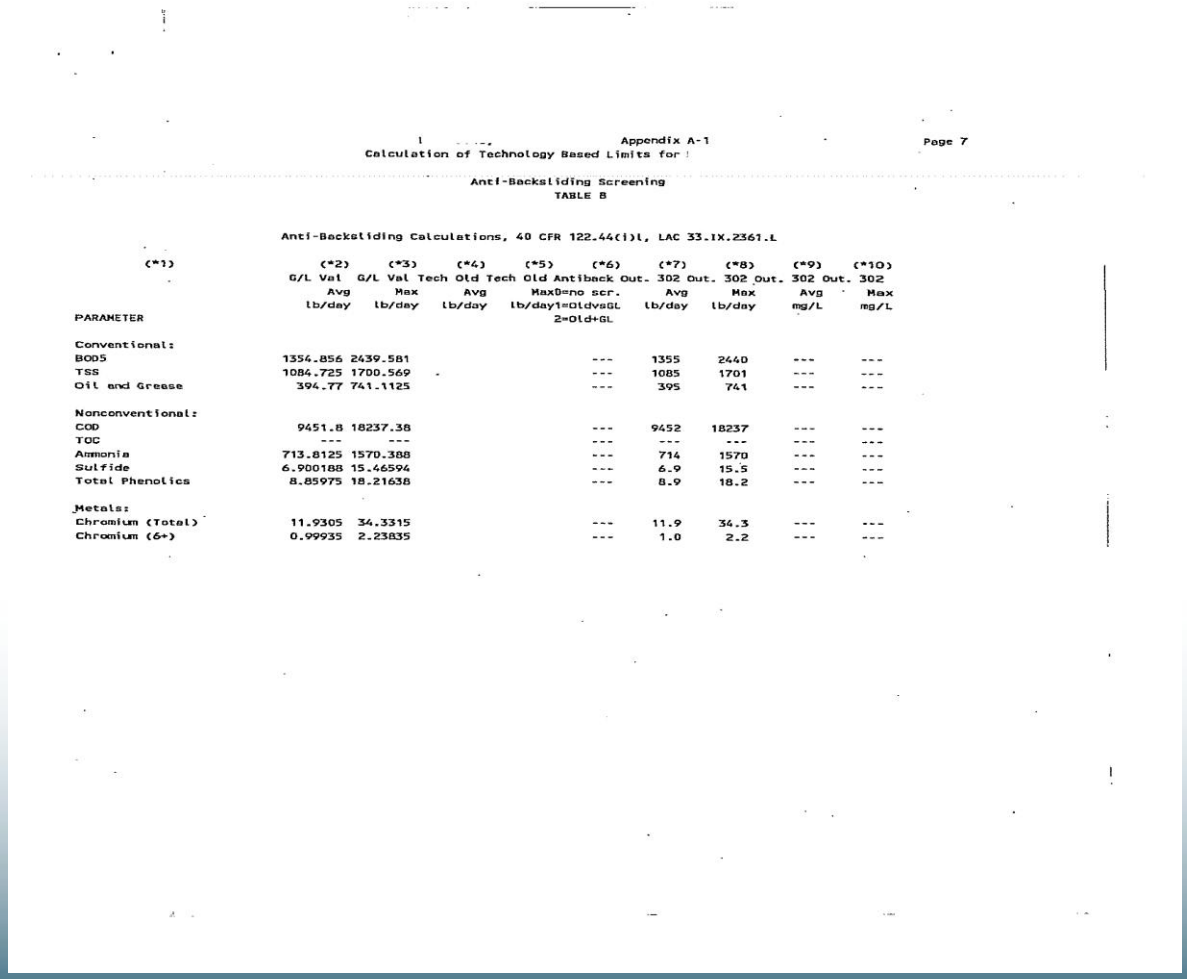
Example TBELs for a Petroleum Refinery - SPREADSHEETS



Appendix A-1 Page 7
Calculation of Technology Based Limits for !

Anti-Backsliding Screening
TABLE B

Anti-Backsliding Calculations, 40 CFR 122.44(i)l, LAC 33.IX.2361.L

(*1) PARAMETER	(*2) G/L Val Avg lb/day	(*3) G/L Val Max lb/day	(*4) Tech Old Avg lb/day	(*5) Tech Old MaxD=no scr. 1=OldvsGL 2=Old+GL	(*6) Antiback Out. lb/day	(*7) 302 Out. Avg lb/day	(*8) 302 Out. Max lb/day	(*9) 302 Out. Avg mg/L	(*10) 302 Out. Max mg/L
Conventional:									
BOD5	1354.856	2439.581			---	1355	2440	---	---
TSS	1084.725	1700.569			---	1085	1701	---	---
Oil and Grease	394.77	741.1125			---	395	741	---	---
Nonconventional:									
COD	9451.8	18237.38			---	9452	18237	---	---
TOC	---	---			---	---	---	---	---
Ammonia	713.8125	1570.388			---	714	1570	---	---
Sulfide	6.900188	15.46594			---	6.9	15.5	---	---
Total Phenolics	8.85975	18.21638			---	8.9	18.2	---	---
Metals:									
Chromium (Total)	11.9305	34.3315			---	11.9	34.3	---	---
Chromium (6+)	0.99935	2.23835			---	1.0	2.2	---	---

WATER QUALITY-BASED EFFLUENT LIMITATIONS (WQBELs)

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WQBELs

Regulatory Basis for Water Quality-Based Limits

Clean Water Act (CWA), Section 303(b)(1)(c) and LPDES regulations at LAC 33:IX.2707.D require limits more stringent than the technology-based limits when necessary to attain state water quality standards.

These limits are designed to ensure that the water quality standards are attained/maintained.

Water Quality Standards

- Standards are developed by states and approved by EPA
- Standards consist of
  - Designated Uses
  - Narrative and Numeric Criteria
  - Antidegradation policy

Types of Water Quality Criteria

- Narrative – “fishable, swimmable” or “no toxics in toxic amounts”
- Numeric Criteria - chemical specific concentration or whole effluent toxicity as toxic units
- Future criteria may include sediment, biological, or wildlife criteria

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Integrated Water Quality-based Toxics Control

- Chemical specific – implemented through numeric criteria and WQBELs
- Whole effluent toxicity – implemented through narrative and numeric criteria; whole effluent toxicity monitoring and/or limits in permits
- Bioassessments – implemented through narrative criteria; permit monitoring and/or limits, e.g., fish tissue analysis

Chemical-Specific Numeric Criteria

- Chemical-specific numeric criteria are established for:
  - Aquatic life protection (freshwater and marine)
    - Acute
    - Chronic
  - Human Health
    - Drinking water supply (also includes fish consumption, dermal exposure)
    - Non drinking water (fish consumption, dermal exposure)
- Numeric criteria provide a basis for numeric WQBEL

Water Quality-Based Effluent Limits (WQBELs)

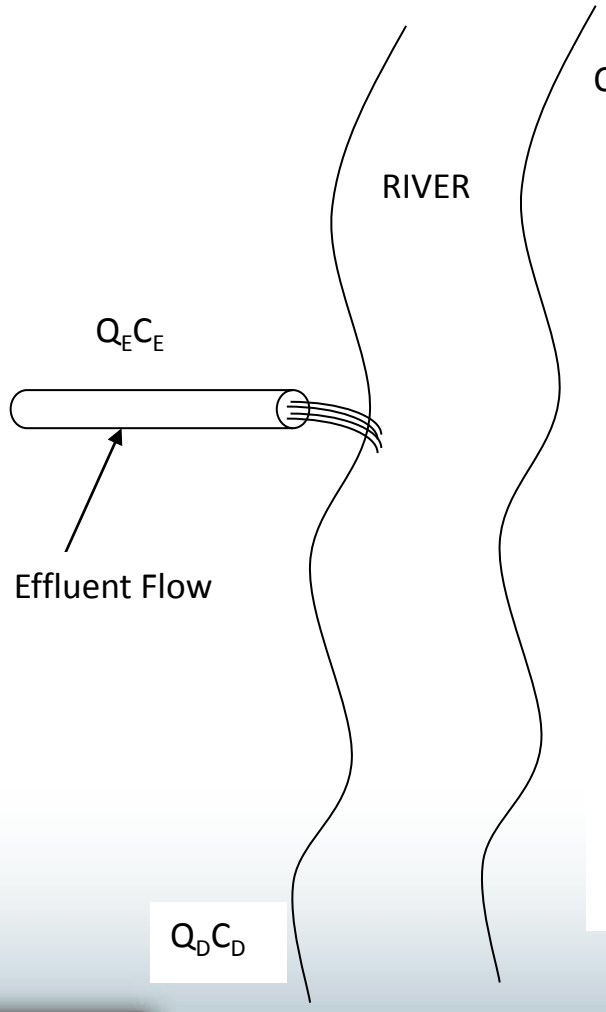
- Calculation procedure considers the potential impact of discharges on the receiving water quality;
- If WQBEL is < TBEL, then WQBEL is used in the permit;
- Even in absence of TBELs, WQBELs are imposed if there is "reasonable potential" to exceed water quality standards

Calculation of WQBELs

- May be calculated using simple, single discharge models (mass balance) or more complex water quality models that consider cumulative impacts of other discharges in the watershed (i.e. TMDL)

- WQBELs are fundamentally mass balance equations solved for the end-of pipe concentration that will not cause an in-stream exceedance of water quality standards

Mass Balance

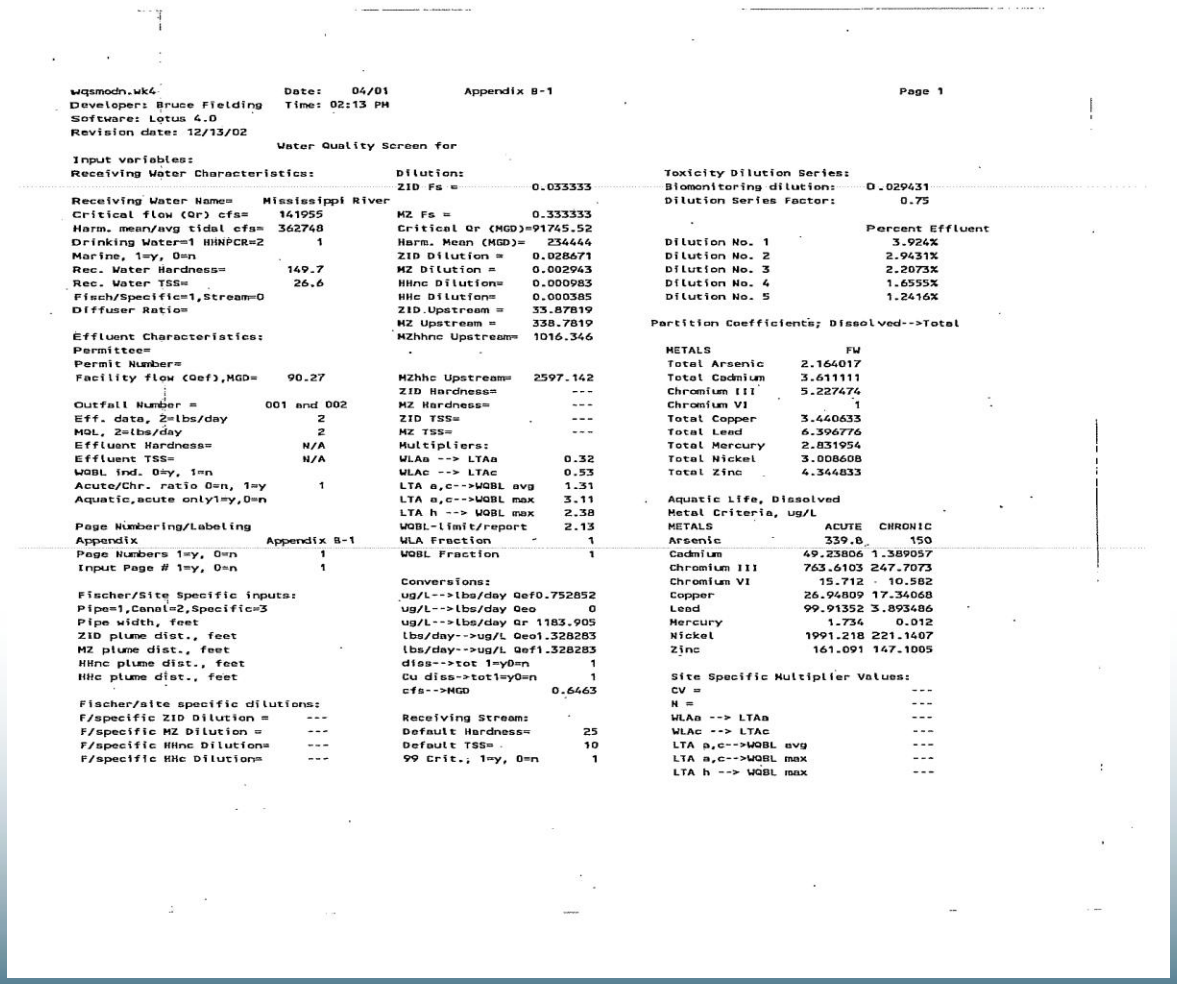


$$Q_EC_E + Q_UC_U = Q_DC_D$$

$$C_E = \frac{Q_DC_D - Q_UC_U}{Q_E}$$

C_D = Concentration Downstream (Criteria)
C_E = Effluent Concentration
C_U = Upstream Concentration
Q_D = Downstream Flow
Q_E = Effluent Flow
Q_U = Upstream Flow

WQBELs Example Spreadsheet Pages



wqsmodn.wk4 Date: 04/01 Appendix B-1 Page 1
Developer: Bruce Fielding Time: 02:13 PM
Software: Lotus 4.0
Revision date: 12/13/02

Water Quality Screen for

Input variables:
Receiving Water Characteristics:

Receiving Water Name=	Mississippi River
Critical flow (Qr) cfs=	141955
Harm. mean/avg tidal cfs=	362748
Drinking Water=1 HHNPCR=2	1
Marine, 1=y, 0=n	
Rec. Water Hardness=	149.7
Rec. Water TSS=	26.6
Fisch/Specific=1,Stream=0	
Diffuser Ratio=	

Effluent Characteristics:

Permittee=	
Permit Number=	
Facility flow (Qef),MGD=	90.27
Outfall Number =	001 and 002
Eff. data, 2=lbs/day	2
MDL, 2=lbs/day	2
Effluent Hardness=	N/A
Effluent TSS=	N/A
WQBL ind. 0=y, 1=n	
Acute/Chr. ratio 0=n, 1=y	1
Aquatic,acute only1=y,0=n	

Page Numbering/Labeling

Appendix	Appendix B-1
Page Numbers 1=y, 0=n	1
Input Page # 1=y, 0=n	1

Fischer/Site Specific inputs:

Pipe=1,Canal=2,Specific=3	
Pipe width, feet	
ZID plume dist., feet	
MZ plume dist., feet	
HHnc plume dist., feet	
HHc plume dist., feet	

Fischer/site specific dilutions:

F/specific ZID Dilution =	---
F/specific MZ Dilution =	---
F/specific HHnc Dilution=	---
F/specific HHc Dilution=	---

Dilution:

ZID Fs =	0.033333
MZ Fs =	0.333333
Critical Qr (MGD)=	91745.52
Harm. Mean (MGD)=	234444
ZID Dilution =	0.028671
MZ Dilution =	0.002943
HHnc Dilution=	0.000983
HHc Dilution=	0.000385
ZID Upstream =	33.87819
MZ Upstream =	338.7819
MZhhnc Upstream=	1016.346
MZhhc Upstream=	2597.142
ZID Hardness=	---
MZ Hardness=	---
ZID TSS=	---
MZ TSS=	---

Multipliers:

WLAa --> LTAa	0.32
WLAc --> LTAc	0.53
LTA a,c-->WQBL avg	1.31
LTA a,c-->WQBL max	3.11
LTA h --> WQBL max	2.38
WQBL-limit/report	2.13
WLA Fraction	1
WQBL Fraction	1

Conversions:

ug/L-->lbs/day Qef	0.752852
ug/L-->lbs/day Qeo	0
ug/L-->lbs/day Qr	1183.905
lbs/day-->ug/L Qeo	1.328283
lbs/day-->ug/L Qef	1.328283
diss-->tot 1=y0=n	1
Cu diss->tot1=y0=n	1
cfs-->MGD	0.6463

Receiving Stream:

Default Hardness=	25
Default TSS=	10
99 Crit., 1=y, 0=n	1

Toxicity Dilution Series:

Biomonitoring dilution:	0.029431
Dilution Series Factor:	0.75

	Percent Effluent
Dilution No. 1	3.924%
Dilution No. 2	2.9431%
Dilution No. 3	2.2073%
Dilution No. 4	1.6555%
Dilution No. 5	1.2416%

Partition Coefficients; Dissolved-->Total

METALS	FW
Total Arsenic	2.164017
Total Cadmium	3.611111
Chromium III	5.227474
Chromium VI	1
Total Copper	3.440633
Total Lead	6.396776
Total Mercury	2.831954
Total Nickel	3.008608
Total Zinc	4.344833

Aquatic Life, Dissolved
Metal Criteria, ug/L

METALS	ACUTE	CHRONIC
Arsenic	339.8	150
Cadmium	49.23806	1.389057
Chromium III	763.6103	247.7073
Chromium VI	15.712	10.582
Copper	26.94809	17.34068
Lead	99.91352	3.893486
Mercury	1.734	0.012
Nickel	1991.218	221.1407
Zinc	161.091	147.1005

Site Specific Multiplier Values:

CV =	---
N =	---
WLAa --> LTAa	---
WLAc --> LTAc	---
LTA a,c-->WQBL avg	---
LTA a,c-->WQBL max	---
LTA h --> WQBL max	---

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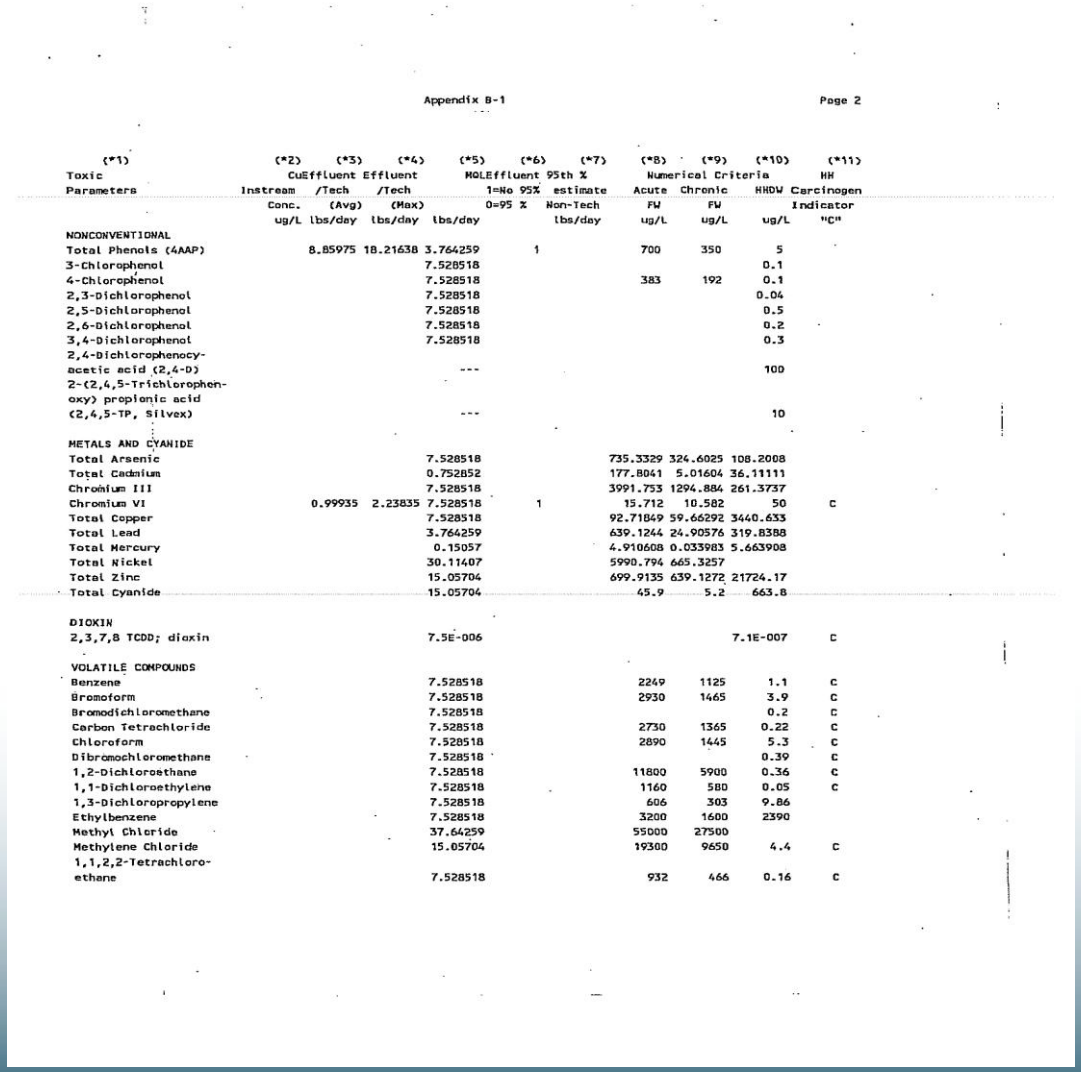
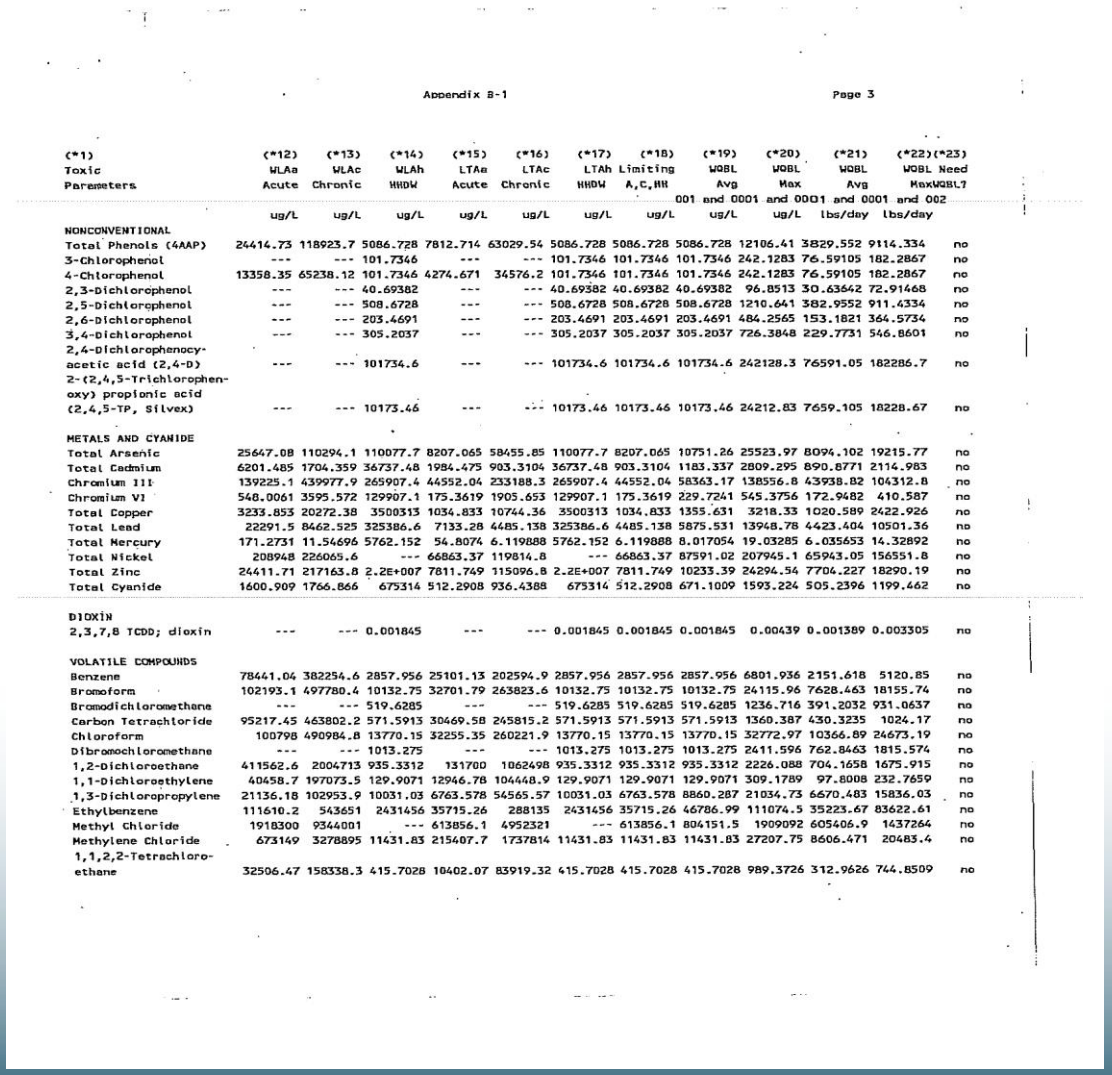
WQBELs Example Spreadsheets Pages



Appendix B-1 Page 2

(*1) Toxic Parameters	(*2) Instream Conc. ug/L	(*3) CuEffluent /Tech (Avg) lbs/day	(*4) Effluent /Tech (Max) lbs/day	(*5) WQLEffluent lbs/day	(*6) 1=No 95% 0=95 %	(*7) 95th % estimate Non-Tech lbs/day	(*8) Numerical Criteria Acute FW ug/L	(*9) Chronic FW ug/L	(*10) HHDW ug/L	(*11) HH Carcinogen Indicator "C"
NONCONVENTIONAL										
Total Phenols (4AAP)		8.85975	18.21638	3.764259	1		700	350	5	
3-Chlorophenol				7.528518					0.1	
4-Chlorophenol				7.528518			383	192	0.1	
2,3-Dichlorophenol				7.528518					0.04	
2,5-Dichlorophenol				7.528518					0.5	
2,6-Dichlorophenol				7.528518					0.2	
3,4-Dichlorophenol				7.528518					0.3	
2,4-Dichlorophenocy-acetic acid (2,4-D)				---					100	
2-(2,4,5-Trichlorophen-oxy) propionic acid (2,4,5-TP, Silvex)				---					10	
METALS AND CYANIDE										
Total Arsenic				7.528518			735.3329	324.6025	108.2008	
Total Cadmium				0.752852			177.8041	5.01604	36.11111	
Chromium III				7.528518			3991.753	1294.884	261.3737	
Chromium VI		0.99935	2.23835	7.528518	1		15.712	10.582	50	C
Total Copper				7.528518			92.71849	59.66292	3440.633	
Total Lead				3.764259			639.1244	24.90576	319.8388	
Total Mercury				0.15057			4.910608	0.033983	5.663908	
Total Nickel				30.11407			5990.794	665.3257		
Total Zinc				15.05704			699.9135	639.1272	21724.17	
Total Cyanide				15.05704			45.9	5.2	663.8	
DIOXIN										
2,3,7,8 TCDD; dioxin				7.5E-006					7.1E-007	C
VOLATILE COMPOUNDS										
Benzene				7.528518			2249	1125	1.1	C
Bromoform				7.528518			2930	1465	3.9	C
Bromodichloromethane				7.528518					0.2	C
Carbon Tetrachloride				7.528518			2730	1365	0.22	C
Chloroform				7.528518			2890	1445	5.3	C
Dibromochloromethane				7.528518					0.39	C
1,2-Dichloroethane				7.528518			11800	5900	0.36	C
1,1-Dichloroethylene				7.528518			1160	580	0.05	C
1,3-Dichloropropylene				7.528518			606	303	9.86	
Ethylbenzene				7.528518			3200	1600	2390	
Methyl Chloride				37.64259			55000	27500		
Methylene Chloride				15.05704			19300	9650	4.4	C
1,1,2,2-Tetrachloro-ethane				7.528518			932	466	0.16	C

WQBELs Example Spreadsheets Pages



Appendix B-1 Page 3

(*1) Toxic Parameters	(*12) WLAa Acute	(*13) WLAc Chronic	(*14) WLAh HHDW	(*15) LTAa Acute	(*16) LTAc Chronic	(*17) LTAh HHDW	(*18) Limiting A,C,HH	(*19) WQBL Avg 001 and 0001	(*20) WQBL Max 001 and 0001	(*21) WQBL Avg 001 and 0001	(*22)(*23) WQBL Need MaxWQBL? 001 and 002
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	lbs/day	lbs/day
NONCONVENTIONAL											
Total Phenols (4AAP)	24414.73	118923.7	5086.728	7812.714	63029.54	5086.728	5086.728	5086.728	12106.41	3829.552	9114.334 no
3-Chlorophenol	---	---	101.7346	---	---	101.7346	101.7346	101.7346	242.1283	76.59105	182.2867 no
4-Chlorophenol	13358.35	65238.12	101.7346	4274.671	34576.2	101.7346	101.7346	101.7346	242.1283	76.59105	182.2867 no
2,3-Dichlorophenol	---	---	40.69382	---	---	40.69382	40.69382	40.69382	96.8513	30.63642	72.91468 no
2,5-Dichlorophenol	---	---	508.6728	---	---	508.6728	508.6728	508.6728	1210.641	382.9552	911.4334 no
2,6-Dichlorophenol	---	---	203.4691	---	---	203.4691	203.4691	203.4691	484.2565	153.1821	364.5734 no
3,4-Dichlorophenol	---	---	305.2037	---	---	305.2037	305.2037	305.2037	726.3848	229.7731	546.8601 no
2,4-Dichlorophenocy-acetic acid (2,4-D)	---	---	101734.6	---	---	101734.6	101734.6	101734.6	242128.3	76591.05	182286.7 no
2-(2,4,5-Trichlorophen-oxy) propionic acid (2,4,5-TP, Silvex)	---	---	10173.46	---	---	10173.46	10173.46	10173.46	24212.83	7659.105	18228.67 no
METALS AND CYANIDE											
Total Arsenic	25647.08	110294.1	110077.7	8207.065	58455.85	110077.7	8207.065	10751.26	25523.97	8094.102	19215.77 no
Total Cadmium	6201.485	1704.359	36737.48	1984.475	903.3104	36737.48	903.3104	1183.337	2809.295	890.8771	2114.983 no
Chromium III	139225.1	439977.9	265907.4	44552.04	233188.3	265907.4	44552.04	58363.17	138556.8	43938.82	104312.8 no
Chromium VI	548.0061	3595.572	129907.1	175.3619	1905.653	129907.1	175.3619	229.7241	545.3756	172.9482	410.587 no
Total Copper	3233.853	20272.38	3500313	1034.833	10744.36	3500313	1034.833	1355.631	3218.33	1020.589	2422.926 no
Total Lead	22291.5	8462.525	325386.6	7133.28	4485.138	325386.6	4485.138	5875.531	13948.78	4423.404	10501.36 no
Total Mercury	171.2731	11.54696	5762.152	54.8074	6.119888	5762.152	6.119888	8.017054	19.03285	6.035653	14.32892 no
Total Nickel	208948	226065.6	---	66863.37	119814.8	---	66863.37	87591.02	207945.1	65943.05	156551.8 no
Total Zinc	24411.71	217163.8	2.2E+007	7811.749	115096.8	2.2E+007	7811.749	10233.39	24294.54	7704.227	18290.19 no
Total Cyanide	1600.909	1766.866	675314	512.2908	936.4388	675314	512.2908	671.1009	1593.224	505.2396	1199.462 no
DIOXIN											
2,3,7,8 TCDD; dioxin	---	---	0.001845	---	---	0.001845	0.001845	0.001845	0.00439	0.001389	0.003305 no
VOLATILE COMPOUNDS											
Benzene	78441.04	382254.6	2857.956	25101.13	202594.9	2857.956	2857.956	2857.956	6801.936	2151.618	5120.85 no
Bromoform	102193.1	497780.4	10132.75	32701.79	263823.6	10132.75	10132.75	10132.75	24115.96	7628.463	18155.74 no
Bromodichloromethane	---	---	519.6285	---	---	519.6285	519.6285	519.6285	1236.716	391.2032	931.0637 no
Carbon Tetrachloride	95217.45	463802.2	571.5913	30469.58	245815.2	571.5913	571.5913	571.5913	1360.387	430.3235	1024.17 no
Chloroform	100798	490984.8	13770.15	32255.35	260221.9	13770.15	13770.15	13770.15	32772.97	10366.89	24673.19 no
Dibromochloromethane	---	---	1013.275	---	---	1013.275	1013.275	1013.275	2411.596	762.8463	1815.574 no
1,2-Dichloroethane	411562.6	2004713	935.3312	131700	1062498	935.3312	935.3312	935.3312	2226.088	704.1658	1675.915 no
1,1-Dichloroethylene	40458.7	197073.5	129.9071	12946.78	104448.9	129.9071	129.9071	129.9071	309.1789	97.8008	232.7659 no
1,3-Dichloropropylene	21136.18	102953.9	10031.03	6763.578	54565.57	10031.03	6763.578	8860.287	21034.73	6670.483	15836.03 no
Ethylbenzene	111610.2	543651	2431456	35715.26	288135	2431456	35715.26	46786.99	111074.5	35223.67	83622.61 no
Methyl Chloride	1918300	9344001	---	613856.1	4952321	---	613856.1	804151.5	1909092	605406.9	1437264 no
Methylene Chloride	673149	3278895	11431.83	215407.7	1737814	11431.83	11431.83	11431.83	27207.75	8606.471	20483.4 no
1,1,2,2-Tetrachloro-ethane	32506.47	158338.3	415.7028	10402.07	83919.32	415.7028	415.7028	415.7028	989.3726	312.9626	744.8509 no

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DEQ LOUISIANA

Louisiana Implementation Policy

- Permitting Guidance Document for Implementing Louisiana Surface Water Quality Standards – October 26, 2010, Version 8
- Available on LDEQ website

  www.deq.louisiana.gov/permits/index.htm

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WQS Exclusions

- Waterbodies may be excluded from some numerical criteria if:
  - designated as intermittent streams; man-made watercourses, naturally dystrophic waters, wetlands, or
  - site-specific criteria have been adopted
- LAC 33:IX.1123 and/or 1113.C

WQS Variance

- Variance procedure -LAC 33:IX.1109.D
- Allows for temporary suspension of criteria or time to research site-specific criteria
- Considered on a case-by-case basis

Application of Metals Criteria

- Metals criteria are based on dissolved metal concentration in ambient water
- LPDES regulations (LAC 33:IX.2709) require effluent limitations to be expressed as total recoverable metal in most cases
- A conversion mechanism to translate dissolved metals to total metals has been developed for use in permitting and is outlined in Permitting Guidance Document for Implementing Louisiana Surface Water Quality Standards – October 26, 2010, Version 8

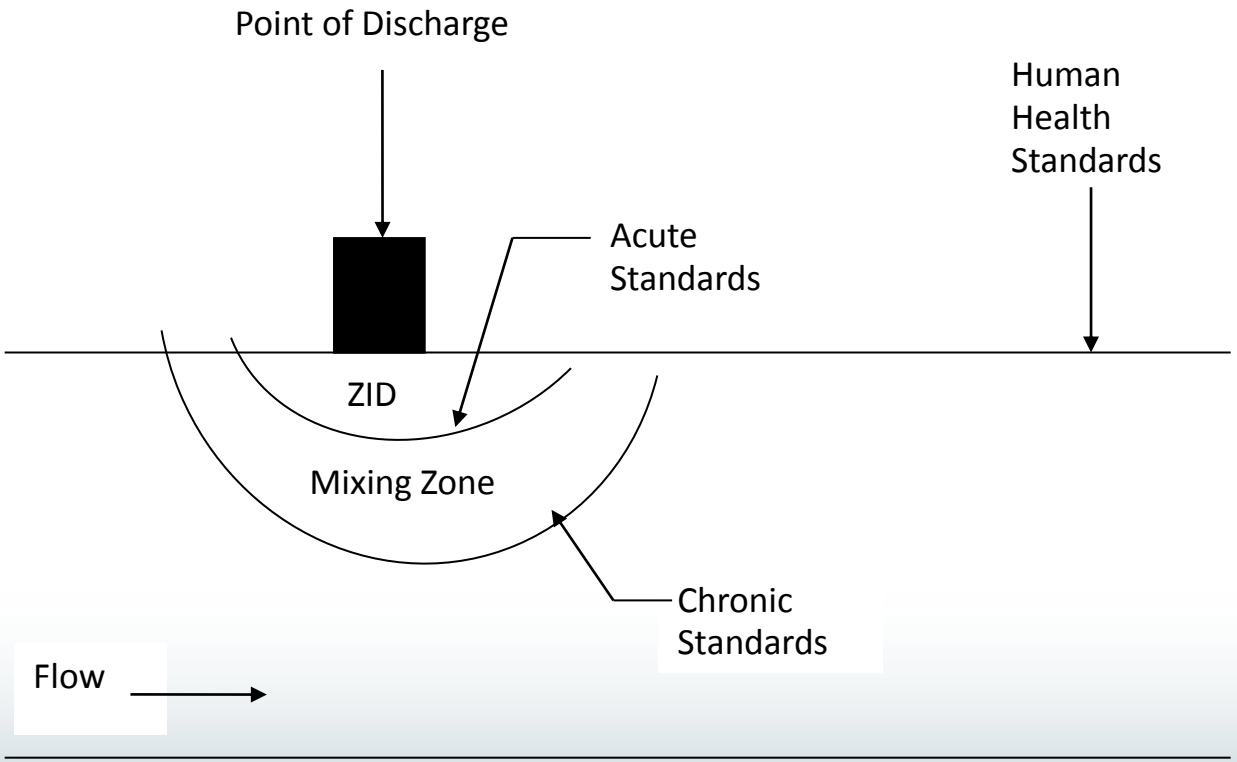
Application of Metals Criteria - Hardness

- Dissolved metals criteria are a function of hardness in the receiving water
- Other comparable data may be considered (i.e. permittee may provide)

Point of Water Quality Criteria Applicability

- Acute aquatic life criteria are applied at the edge of zone of initial dilution (ZID)
- Chronic aquatic life criteria are applied at the edge of the mixing zone
- Human Health criteria are applied assuming complete mixing below the point of discharge

Mixing Zone and ZID



Effluent Flow Considerations

- Max 30-day average for industrial
- Design flow for designated POTW
- For non-POTW domestic sewage – flow based on “Sewage Loading Guidelines” Appendix B Chapter XIII of the State of Louisiana Sanitary Code

Receiving Water Critical Flow – Aquatic life

- Flowing streams
  - MZ and ZID expressed as fraction of 7Q10 flow
- Tidal canals
  - MZ and ZID expressed as fraction of 1/3 of typical flow averaged over one tidal cycle
- For bays, lakes, gulf
  - MZ and ZID expressed as radial distances

Receiving Water Critical Flow – Human Health

- Flowing Streams
  - 7Q10 for carcinogens
  - Harmonic mean for non-carcinogens
- Tidally Influenced Waterbodies
  - Typical flow averaged over one tidal cycle for both carcinogens and non
- Bays, Lakes, Gulf
  - case-by-case basis

WQBEL Derivation

- Wasteload Allocations (WLA) are calculated based on each applicable criteria
- Flowing streams and tidal channels use Complete Mix Balance Model
- Lakes, bays, gulf use Fischer Model as a default
- WLA may come from TMDL

Calculation of LTA

- Individual WLAs (dilution model) are converted into long term average (LTA) concentrations using statistical procedures that are related to sampling frequency, number of samples, and data distributions

Calculation of WQBEL

- The most limiting LTA (acute, chronic or human health) is used to calculate the permit limits; again based on statistical assumptions
- The derivation of the statistics are given in implementation policy

When is a WQBEL needed in the Permit?

- To determine if a proposed discharge might cause or contribute to violation of water quality standards, the permit writer conducts an evaluation of the “reasonable potential” of the discharge to exceed standards.
- If reasonable potential exists, a WQBEL is required in the permit.

Reasonable Potential – TBEL Screening

- If TBELs exist for pollutant, then the limits are screened against the calculated WQBELs.
- If TBEL is greater than WQBEL, then placing the TBEL in the permit would present a reasonable potential for a violation and a WQBEL is required
- Reduced monitoring allowed if pollutant not present on-site

Reasonable Potential – Effluent Screening

- In absence of TBELs, the upper range of effluent concentration is estimated statistically as the 95th percentile of a lognormally distributed data set
- If the effluent 95th percentile exceeds the calculated daily average WQBEL, the WQBEL is placed in the permit

Reasonable Potential – Effluent Screening

- To determine 95th percentile
  - A single measurement or geometric mean is multiplied by 2.13 (assumes log normal data, CV= 0.6); or
  - If the data set contains greater than 10 values, the 95th percentile value may be directly calculated from the data set

Effluent Screening – MQL issues

- Analytical testing should achieve the required Minimum Analytical Quantification Level (MQL) (Appendix B of Implementation Policy)

- If nondetect is reported with detection limit greater than MQL, pollutant considered present at detection limit concentration.

Effluent Screening – MQL issues

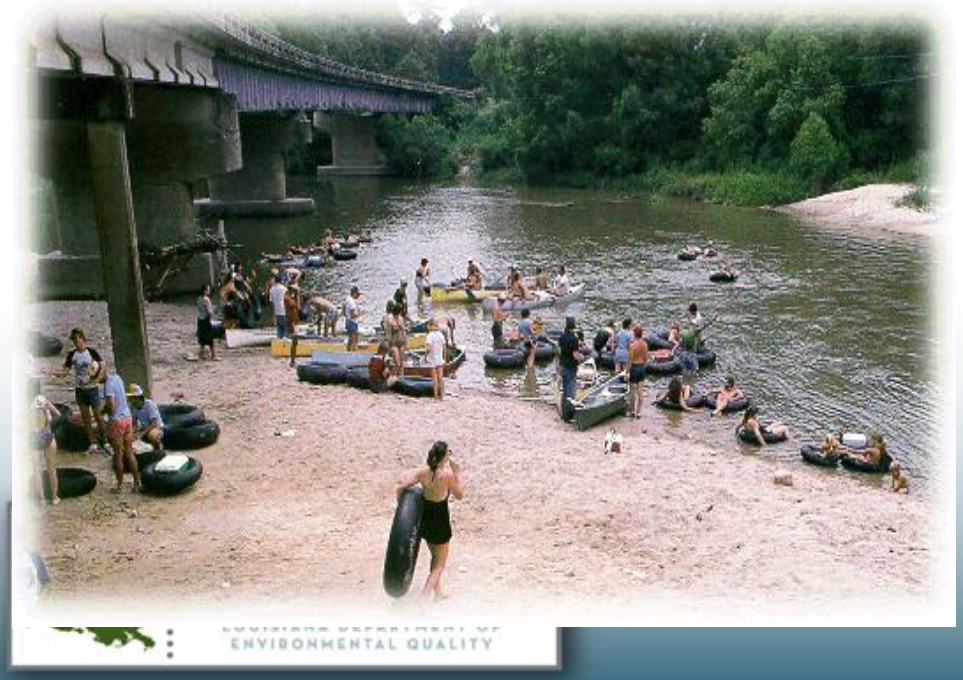
- Single measurements or groups of measurements reported as less than the required minimum quantification limit (MQL) will be assigned a value of zero
- If data contains values above and below MQL, values below MQL will be assumed present at 50% of MQL

IMPAIRED WATER BODIES

- Water bodies not in compliance with water quality standards
- Related terms
  - Total Maximum Daily Load (TMDL)
  - 303(d) List – Section 303(d) of the Clean Water Act
- May result in more stringent discharge limitations – water quality based effluent limits (WQBEL)
- Dischargers to non-impaired water bodies receive the more stringent of technology based effluent limits (TBEL) or WQBEL

LPDES Permitting in 303(d) Listed Water Bodies

Permit issuance prior to finalization of a TMDL



Permit issuance pursuant to a finalized TMDL

Permit Issuance Prior to Finalized TMDL

•Determine and list all suspected pollutants causing exceedances of Water Quality Standards.

•Evaluate permit application, process operation, prior permits, effluent data, DMRs, etc…, to determine facility's potential to discharge suspected pollutant(s) at levels which may cause or contribute to a violation of Water Quality Standards.

Facility has potential to discharge suspected pollutant(s)

Issue permit with WQBELs for end of pipe criteria or TBELs (whichever more stringent).

and

Place a reopener clause in permit to allow for finalized TMDL limitations.

Federal TMDL Regulations

Clean Water Act Section 303(d)

EPA Implementing Regulations at 40 CFR Part 130.7

Upon final EPA approval TMDLs become part of the State Water Quality Management Plan (WQMP) where they are implemented into LPDES permits.

BIOMONITORING

- Sublethal affects and/or Reasonable Potential Determination may result in WET limits when permit is reissued

- See the ***Permitting Guidance Document for Implementation of Louisiana's Water Quality Standards; October 26, 2010, Version***

- Contact Kimberly Corts at (225) 219-3074

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316(b)

- 316(b) of the CWA says to **minimize adverse environmental impacts from Cooling Water Intake Structures (CWIS)**
- Phase I applies to new facilities withdrawing 2 million gallons/day with 25% being used for cooling
- Phase II (existing power plants) suspended except for 4731.B
- Phase III applies to existing manufacturing facilities and new oil & gas facilities previously exempt from Phase I

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Questions?


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