ORIGINAL

BEFORE THE POLLUTION CONTROL BOARD
OF THE STATE OF ILLINOIS

IN THE MATTER OF:	)	
	)	R97-28
SITE SPECIFIC PETITION OF	)	(Water - Regulatory)
MOBIL OIL CORPORATION FOR	)	
RELIEF FROM 35 ILL. ADM. CODE 304.122,	)	
AMMONIA NITROGEN EFFLUENT STANDARDS	)	

NOTICE OF FILING

To: Ms. Dorothy Gunn
Clerk
Pollution Control Board
100 West Randolph, Suite 11-500

Margaret P. Howard, Esq.
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62794

PLEASE TAKE NOTICE that this day I have filed with the Illinois Pollution Control Board the **TESTIMONY OF LILLIANA GACHICH, JAMES E. HUFF AND JOHN H. KOON** on behalf of Mobil Oil Corporation. Copies are attached and served upon you.

Respectfully submitted,

By: _____

Dated: June 23, 1997

ROSS & HARDIES
James T. Harrington, Esq.
David L. Rieser, Esq.
David A. Piech, Esq.
150 North Michigan Avenue
Suite 2500
Chicago, Illinois 60601
(312) 558-1000

STATE OF ILLINOIS)
COUNTY OF WILL)

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
PETITION OF MOBIL OIL	)	
TO AMEND	)	R 97-28
REGULATIONS	)	
PERTAINING TO	)	
WATER POLLUTION	)	

TESTIMONY OF LILLIANA GACHICH

My name is Lilliana Gachich. I am an Environmental Advisor for Mobil Oil Corporation, Joliet Refinery. Specifically, I am responsible for the NPDES Permit administration and all other water related issues. My education background consists of a Bachelor's Degree in Chemistry and a Master's Degree in Organic Chemistry. I have been employed by Mobil Oil for nineteen years, thirteen years at the Joliet Refinery and six years at the Beaumont Refinery in Texas. Prior to assuming my current duties as an Environmental Advisor, I held the position of Supervisor of the Laboratories at both Joliet and Beaumont. During my employment with Mobil Oil, I have participated in a number of environmental projects and, most recently, I was the team leader for the Joliet Refinery Waste Water Treatment Plant Nitrification Optimization Study and Upgrade project. I also helped prepare the PETITION FOR SITE-SPECIFIC RELIEF FROM 35 ILL. ADM. CODE 304.122 and am hereby stating that the facts contained in the petition and its attachments are all true and correct.

On March 3, 1994 the Illinois Pollution Control Board (PCB) granted Mobil a four year variance from Section 304.122(b) (PCB 93 -151) with a monthly average effluent ammonia concentration of 13 mg/l and a daily maximum of 26 mg/l. Subsequently, the variance was extended by one year. During the term of the this variance, Mobil was to perform an extensive investigation to identify means by which Mobil can come into compliance with Section 304.122(b), submit six month progress reports detailing the investigation findings, and ultimately submit a compliance plan with Section 304.122(b) or seek a Site Specific relief.

The purpose of my testimony today is to describe the WWTP historical performance, its current configuration and Mobil's efforts during last three years to minimize ammonia concentration in its effluent. The testimony will describe the findings of the Nitrification Optimization Study, the actual mechanical upgrades of the WWTP and the current WWTP Performance.

WASTE WATER TREATMENT PLANT CONFIGURATION

An average of about 1900 gallons per minute (gpm) of process wastewater and contaminated surface run-off is processed through the Refinery WWTP, shown in Figure I. This is mainly accomplished by a program to increase cooling tower recycling and in-plant water reuse, thereby lessening water discharge to the sewer. The modern design features, such as separation of the storm water and the process water systems and extensive water reuse enable Mobil to achieve an effluent discharge rate of only 14 gallons per barrel of crude oil refined.

In comparison, under the BAT guidelines, the discharge rate for a refinery of Joliet's size and configuration would be about 5200 gpm, which translates to about 38 gallons of effluent per barrel of crude oil refined. However, the conservation efforts inevitably result in more concentrated effluent. In the case of Mobil, the multiple between BAT guideline discharge rate and the actual *rate is 2.7 (38 gal/bbl : 14 gal/bbl).* If a similar concentration effect were applied to the existing NH_3 - N effluent standard, it would result in an "equivalent" increase from 3.0 mg/l to 8.1 mg/l. Or conversely, because of the additional water available for dilution, Mobil's 1996 annual average NH_3 - N effluent concentration would have been 1.4 mg/l instead of 3.9 mg/l.

The Waste Water Treatment process consists of:

o Sour Water Stripper	o Primary removal of ammonia and sulfides
o Desalter	o Partial removal of phenolics and in- plant water reuse
o TK 103	o Primary equalization
o Benzene Air Stripper	o Removal of benzene, sulfides, and volatile organics
o Diversion Basin	o Basin used for hydraulic overflow during wet weather
o Dual Channel Preseparation Flume	o Primary solids removal
o API Oil Separator	o Primary Oil separator
o Dissolved Air Flotation	o Residual oil and solids removal
o Equalization Biological Treatment Unit	o Secondary equalization, aggressive phenolic removal and partial COD removal
o Two Aeration Basins (with diffused air)	o Conventional activated sludge system for for ammonia, organics, cyanide, and other pollutant removal
o Two Clarifiers	o Bio solids settling/removal
o Guard Basin	o Final retention basin
o Aeration Cone	o Saturation with oxygen

WASTE WATER TREATMENT PLANT HISTORICAL PERFORMANCE

As shown in Table I and further detailed in Exhibit I, the performance of the WWTP has progressively improved from start up in 19973 to the present. From March, 1994 to May, 1997, the monthly limitation of 13 mg/l was exceeded only in January, 1995 and March and April, 1996. During the same period, the maximum daily limitation of 26 mg/l was exceeded in April, 1996 and May, 1997. The 1995 exceedance was directly attributable to an incursion of spent caustic from the Merox Gasoline Treating Unit into Process Water system. Since this incident, to prevent recurrences of a similar incident, Mobil has installed a caustic free Merox Gasoline Treating Unit. The 1996 exceedances occurred when 100 gallons of diethanol amine (DEA) was drained to a process sewer instead of a holding tank. Maintenance procedures were reviewed and revised to ensure that this event would not recur. The 1997 exceedance was caused by an undetermined amount of oily water influx into the activated sludge system prior to API Oil separation. This bypass around the API separator occurred due to the plugging of the line leading to the primary treatment portion of the WWTP. The plugged line has been cleaned and will be subject to a routine inspection in order to prevent a recurrence of a similar event.

TABLE I

REFINERY AMMONIA DISCHARGE HISTORY (mg/L)

YEAR	ANNUAL AVERAGE	RANGE
1973	77	27 - 236
1974	55	4 - 191
1975	42	12 - 100
1976	36	9 - 120
1977	17	1 - 69
1978	9	1 - 30
1979	13	1 - 38
1980	17	0 - 53
1981	13	0 - 40
1982	15	0 - 66
1983	4	0 - 27
1984	3	0 - 19
1985	3	0 - 25
1986	4	0 - 32
1987	2	0 - 13
1988	1	0 - 12
1989	0.2	0 - 3
1990	0.3	0 - 5
1991	0.4	0 - 7
1992	3.2	0 - 22
1993	4.0	0 - 22
1994	4.9	0 - 19
1995	6.3	2 - 13
1996	3.9	0 - 27
1997(5mos)	2.6	0 - 33

RESULTS OF NITRIFICATION OPTIMIZATION STUDY

Broadly speaking, Mobil's investigative efforts pursuant to 1994 Variance were divided into the following categories:

- o Pollution Source Survey/Nitrification Inhibition Study
- o Removal of Inhibitors of Biological Nitrification
- o WWTP Respiration Studies

As shown in Exhibit II, Mobil has submitted six progress reports detailing the outcome of the above activities. In order to avoid restating the information which already has been submitted the Agency, I will summarize the most significant findings:

- o Pollution Source Survey/Nitrification Inhibition Study confirmed Mobil's contention that the installation of the Benzene Reduction Unit (BRU) **increased toxicity** of the WWTP influent resulting in the less efficient ammonia removal . The BRU was installed in September of 1990 as required by RCRA and NESHAPS regulation.

- o Spent caustic solution containing phenolic and sulfidic compounds generated in the Refinery Gasoline Caustic Treaters was also found to be highly inhibitory to the WWTP ammonia removal process.

- o A strong correlation between the residual Chemical Oxygen Demand (COD) concentration and the degree of nitrification inhibition indicated that some biodegradation products are toxic to the nitrifying bacteria. By comparison, the correlation between the degree of nitrification inhibition and the influent COD concentration is much weaker, thus further indicating that the biodegradation process itself generates major contributors to the nitrification inhibition. Subsequently, it can be concluded that the activated sludge process is **self limiting or autoinhibitive**. Exhibits III and IV are graphic representation of these findings.

- o An upstream removal of inhibitory substances may not result in commensurate decrease in the degree of nitrification inhibition at the WWTP due to the autoinhibitive nature of the process.

- o WWTP respiration study indicated that the activated sludge system was air deficient under peak loadings. Furthermore, the existing mechanical aerators were not delivering the air to the system in an uniform fashion. The combination of these factors seriously affected the WWTP ammonia removal capability.

WASTE WATER TREATMENT PLANT MECHANICAL UPGRADES

The intent of the mechanical upgrades was to improve the efficiency of the WWTP by optimizing both the upstream, as well as, the downstream processes.

- o The replacement of the caustic Merox Gasoline Treaters with caustic free treaters was an upgrade designed to eliminate an entire stream from the refinery byproduct inventory. This project was implemented, in spite of the inhibition study finding indicating that due to the autoinhibition in the activated sludge system, an upstream control may not be very effective. Fortunately, this upstream process change not only precluded direct upsets of the WWTP by spent phenolic caustic, it also partially offset the increase in toxicity resulting from RCRA mandated installation of the BRU unit. Exhibit V shows the toxicity increase across the BRU unit and an **overall decrease in toxicity** subsequent to the installation of the Caustic Free Merox Gasoline Treaters.

o The installation of the fine bubble diffusers, the replacement of the clarifier internals and the changes made to the Dissolved Air Flotation (DAF) unit were changes directly intended to enhance the performance of the WWTP itself. Of these changes, only the installation of the air diffusers was found to be required as per the finding indicating shortage and maldistribution of air in the activated sludge system. All other changes were implemented in order to more closely align the WWTP with current technology.

CURRENT WWTP PERFORMANCE

As shown in Exhibit VI, the performance of the upgraded WWTP has been very good. Between November, 1996 and May, 1997, the average ammonia effluent concentration was about 2.2 mg/l. However, on several occasions and as explained in the WWTP historical performance review, the daily maximum ammonia effluent concentration has reached levels as high as 33 mg/l. Some upsets were associated with a known cause and for some no obvious cause could be found. However, all have been of short duration. Such quick recovery of the WWTP indicates that the recent upgrades are effective and that the a good prospective performance can be expected.

Nevertheless, even when the explainable high concentrations are removed from the upgraded WWTP performance chart, as shown in Exhibit VII, an 8.5% of the effluent samples are still not in compliance with the Sate daily maximum effluent standard of 6 mg/l. Since the WWTP was upgraded less than one year ago, at the existing rate of non compliance, the annual non compliance rate with the same standard could easily be as high as 15%.

Not all upsets can be associated with a preventable cause and probably most are directly associated with the Refinery crude oil mix variability. Exhibit VIII shows various crudes processed in 1996 and the substantial changes in both the crude mix and its nitrogen content. The changes represented here are based on monthly averages. In reality, the crude mix changes every several days. In addition to the crude mix change, the refinery product mix may be changing due to the market demands. As more sulfur and nitrogen are removed from the crude oil , the composition of the waste water also changes. This constant flux in the waste water composition, in spite of Mobil's large equalization capacity, can easily cause an upset of the WWTP .

In summary, the improved and the robust operation of the WWTP shows a strong commitment by Mobil to comply with Section 304.122(b). Since completing the WWTP upgrades in November, 1996 Mobil has achieved a 40% reduction in ammonia discharge. However, in spite of having spent a large amount of money to upgrade its WWTP, a technically feasible and cost effective solution resulting in **consistent compliance** with the State effluent standards has not been found. Further, Mobil's ammonia discharge has an insignificant effect on the ammonia concentration of the Des Plaines River. Requiring compliance now would not result in any measurable lowering of ammonia concentration in the receiving waters. For that reason, Mobil is seeking this Site Specific relief from Section 304.122(b) or it would otherwise suffer an arbitrary and unreasonable hardship.

TABLE II
Mobil Oil Joliet Refinery Ammonia Compliance vs Section 304.122(b)
Annualized Average in mg/l

1994	1995	1996	1997
4.9	6.3	3.9	2.6

Average in mg/l Nov 1, 96 to May 31, 97
2.2

This completes my prepared remarks and I thank you for your attention. I will be pleased to answer any questions you may have.

FIGURE 1

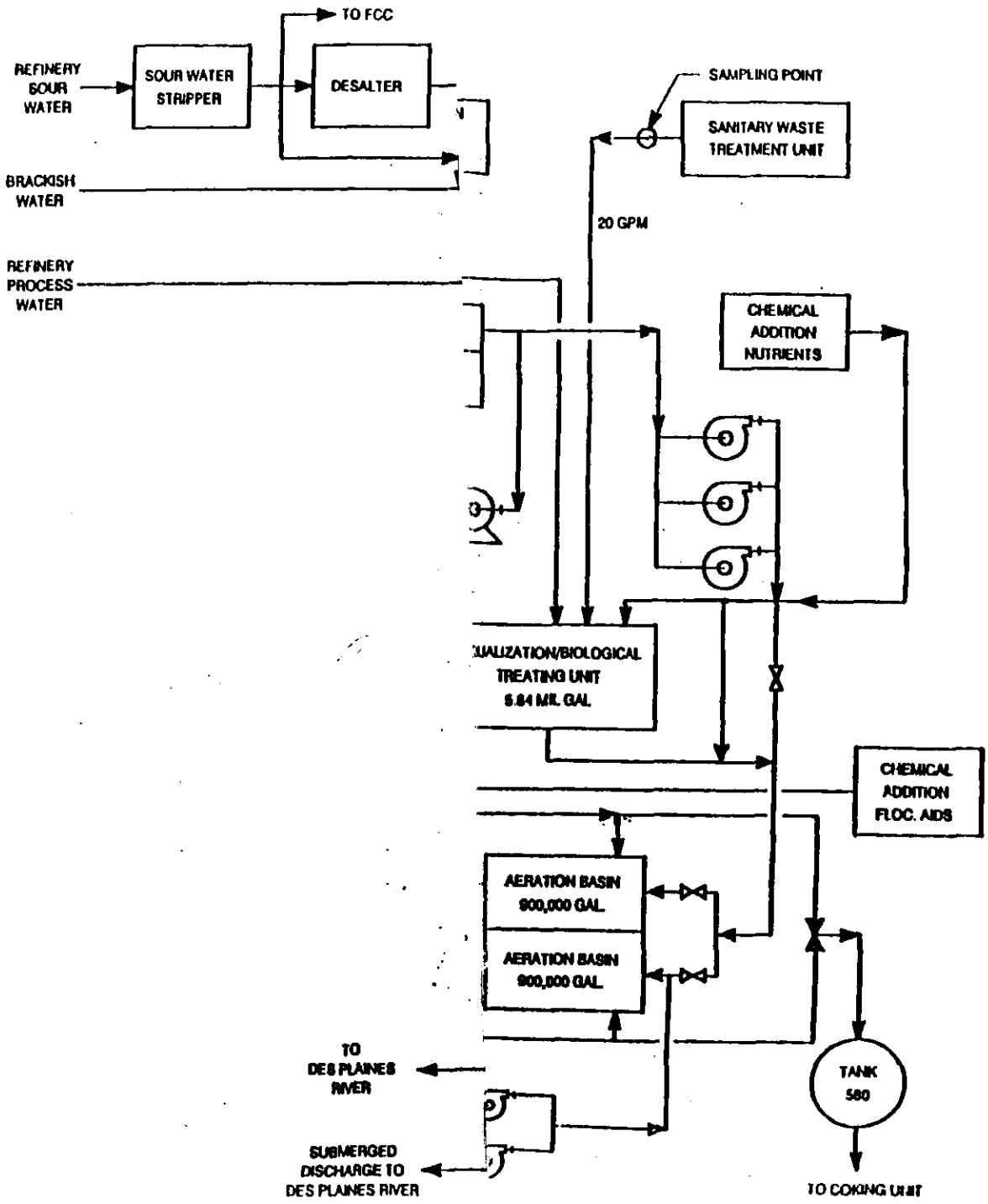

TO FCC
REFINERY SOUR WATER
SOUR WATER STRIPPER
DESALTER
BRACKISH WATER
SAMPLING POINT
SANITARY WASTE TREATMENT UNIT
20 GPM
REFINERY PROCESS WATER
CHEMICAL ADDITION NUTRIENTS
UALIZATION/BIOLOGICAL TREATING UNIT
5.84 MIL GAL
CHEMICAL ADDITION FLOC. AIDS
AERATION BASIN 900,000 GAL
AERATION BASIN 900,000 GAL
TO DES PLAINES RIVER
SUBMERGED DISCHARGE TO DES PLAINES RIVER
TANK 580
TO COKING UNIT

EXHIBIT I
MOBIL OIL CORPORATION
JOLIET REFINERY
AMMONIA DISCHARGE HISTORY
MARCH 1994 - MAY 1997
mg/l

Month	Influent- Average	Influent-Range	Effluent-Average	Effluent-Range	% Average Conversion
Mar-94	34	26 - 30	4.9	1.4 -14.9	86
Apr-94	37	31 - 43	1.6	0.7 - 3.5	96
May-94	32	26 - 40	3.7	0.4 - 12.9	88
Jun-94	37	35 - 39	8.1	1.7 - 16.6	78
Jul-94	43	34 - 58	3.7	0.8 - 14.3	91
Aug-94	37	30 - 43	6.0	2.4 - 10.8	84
Sep-94	23	7 - 35	9.9	5.0 - 16.	57
Oct-94	30	3 - 43	1.2	0.0 - 3.0	96
Nov-94	31	27 - 38	3.5	0.4 - 8.0	89
Dec-94	22	12 - 30	12.2	5.5 - 19.2	45
Jan-95	22	17 - 26	13.7	8.7 - 19.1	38
Feb-95	17	14 - 21	7.2	0.6 - 20.4	58
Mar-95	33	30 - 38	1.8	0.4 - 3.7	95
Apr-95	34	31 - 38	6.6	2.4 - 13.9	81
May-95	30	8 - 39	7.5	4.1 - 10.8	75
Jun-95	30	6 - 40	12.2	0.3 - 22.9	59
Jul-95	43	35 - 49	0.4	0.1 - 0.8	99
Aug-95	41	24 - 73	2.0	0.2 - 5.8	95
Sep-95	59	37 - 73	2.2	0.5 - 5.7	96
Oct-95	31	13 - 52	2.7	0.2 - 7.2	91
Nov-95	40	30 - 44	8.1	0.2 - 19.0	80
Dec-95	40	31 - 49	11.0	6.0 - 25.5	73
Jan-96	28	22 - 35	8.5	2.6 - 16.9	70
Feb-96	25	14 - 38	5.3	0 - 21.4	79
Mar-96	24	11 - 30	9.2	0 - 27.4	62
Apr-96	33	21 - 49	14.9	0.6 - 21.1	55
May-96	37	28 - 55	1.3	0 - 4.2	96
Jun-96	37	32 - 42	3.6	0 - 13.7	90
Jul-96	43	37 - 56	1.3	0 - 4.2	97
Aug-96	40	25 - 45	0.3	0 - 0.7	99
Sep-96	29	16 - 40	0.3	0 - 1.7	99
Oct-96	32	25 - 44	0.1	0 - 0.2	100
Nov-96	38	34 - 45	0.3	0 - 0.8	99
Dec-96	40	36 - 42	1.6	0 - 14	96
Jan-97	35	33 - 36	3.8	0 - 14	89
Feb-97	27	11 - 35	0.3	0 - 0.8	99
Mar-97	36	22 -48	1.3	0.1 - 6.5	96
Apr-97	34	28 -39	1.3	0.1 - 3.1	96
May-97	31	24 -28	6.2	0.3 - 33.3	80
Period Average	34		4.9		83
Period Minimum			0.1		38
Period Maximum			14.9		100

9497var.pfc

EXHIBIT II

AMMONIA REMOVAL OPTIMIZATION ACTIVITIES

ACTIVITY		NATURE	COST i	COST e	COST m	COST tot
1st report 3/3/94-9/3/94						
Refinery Sour Water Pollutant Survey		i	$ 10M			$ 10M
Activated Sludge System Aeration Capability Engineering Analysis		i	$ 5M			$ 5M
WWTP API and DAF System Assessment		i	$ 6M			$ 6M
SWSTU Laboratory Investigation - Phase 1		i	$ 25M			$ 25M
2nd report 9/3/94-3/3/95						
Envirex, Inc. Activated Sludge System Field Analysis		i	$ 4M			$ 4M
SWSTU Laboratory Investigation - Phase 2		i	$ 25M			$ 25M
Upgrade Crude Unit Desalter Controls		e		$ 100M		$ 100M
Constructed Caustic Free Merox Treaters		e		$ 3MM		$ 3MM
3rd report 3/3/95-9/3/95						
SWSTU Laboratory Investigation - Phase 3		i	$ 25M			$ 25M
SWSTU Pilot Plant Study		i	$ 30M			$ 30M
MICROTOX/Nitrification Inhibition Study		i	$ 120M			$ 120M
Upgraded West Side of Activated Sludge System		e		$ 1.75MM		$ 1.75MM
Replaced West Clarifier Internals		e		$ 225M		$ 225M
$Mg(OH)_2$ Addition Facilities		e		$ 25M		$ 25M
Bioaugmentation		m			$ 65M	$ 65M
$Mg(OH)_2$ Addition		e		$ 40M		$ 40M
4th report 9/3/95-3/3/96 - Pending						
Upgrade East Side of Activated Sludge System		e				
Upgrade East Clarifier Internals		e				
Complete WWTP Laboratory		e				
Complete DAF Controls Upgrades		e				
Perform WWTP Post Mechanical Upgrade Optimization		m				
5th report 3/3/96 - 9/3/96 - Completed & Pending						
	completion dates					
Upgraded East Side of Activated Sludge System	Jun-96	e		$ 1.75MM		$ 1.75MM
Completed WWTP Laboratory	Sep-96	e		$ 100M		$ 100M
Completed DAF Controls & Recycle Upgrades	Sep-96	e		$ 143M		$ 143M
Install Liquid Nutrient (Phosphate) Addition System	Pending	e				
Perform WWTP Post Mechanical Upgrade Optimization	Pending	m				
6th report 9/3/96 - 3/3/97 - Completed & Pending						
	completion dates					
Upgrade East Clarifier Internals	Nov-96	e		$ 225M		$ 225M
Perform In-Stream Water Quality Data Collection	Oct-96	i				$ 33M
Install Liquid Nutrient (Phosphate) Addition System	Pending	m		$ 25M		$ 25M
Perform WWTP Post Mechanical Upgrade Optimization	Pending	i	$ 33M		$ 45M	$ 45M
TOTAL			**$ 283 M**	**$ 7.383 M**	**$110 M**	**$ 7.776 MM**

LEGEND

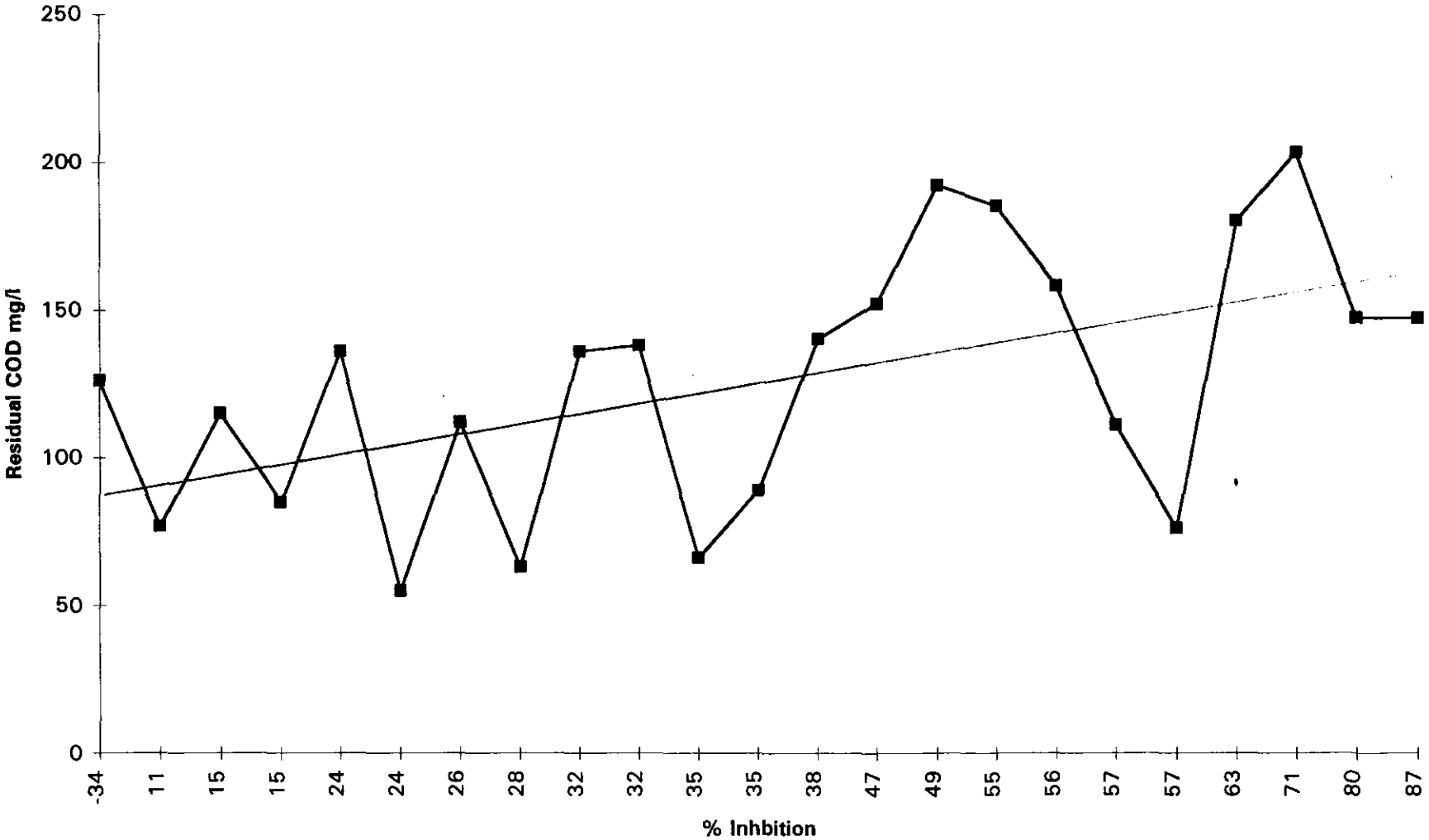
i = investigative activity
e = equipment change or upgrade

m = miscellaneous upgrade

varrpt.6th

EXHIBIT III

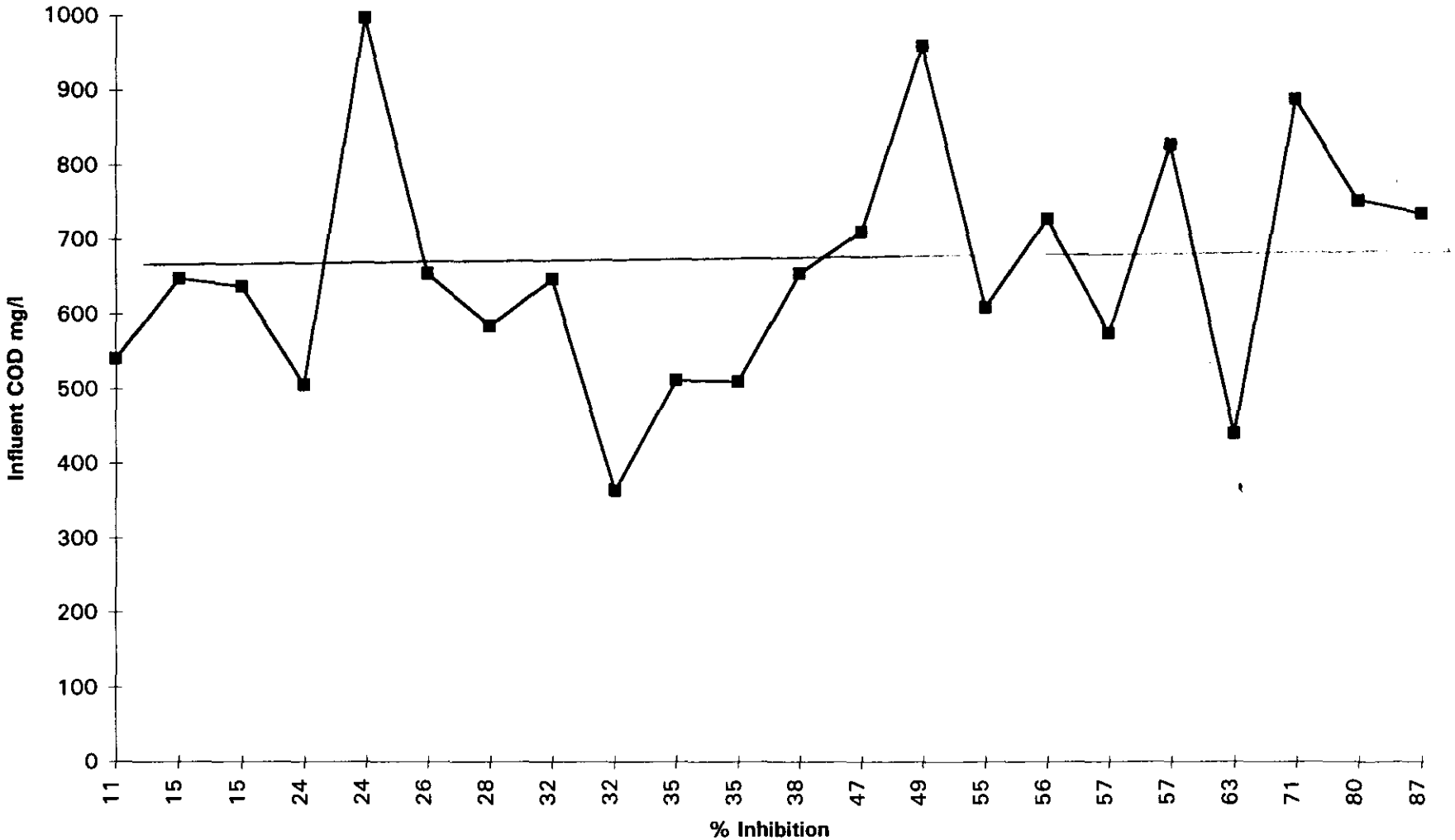
ECL Inhibition vs Residual COD r = 0.5



eclinbr.cod

EXHIBIT IV

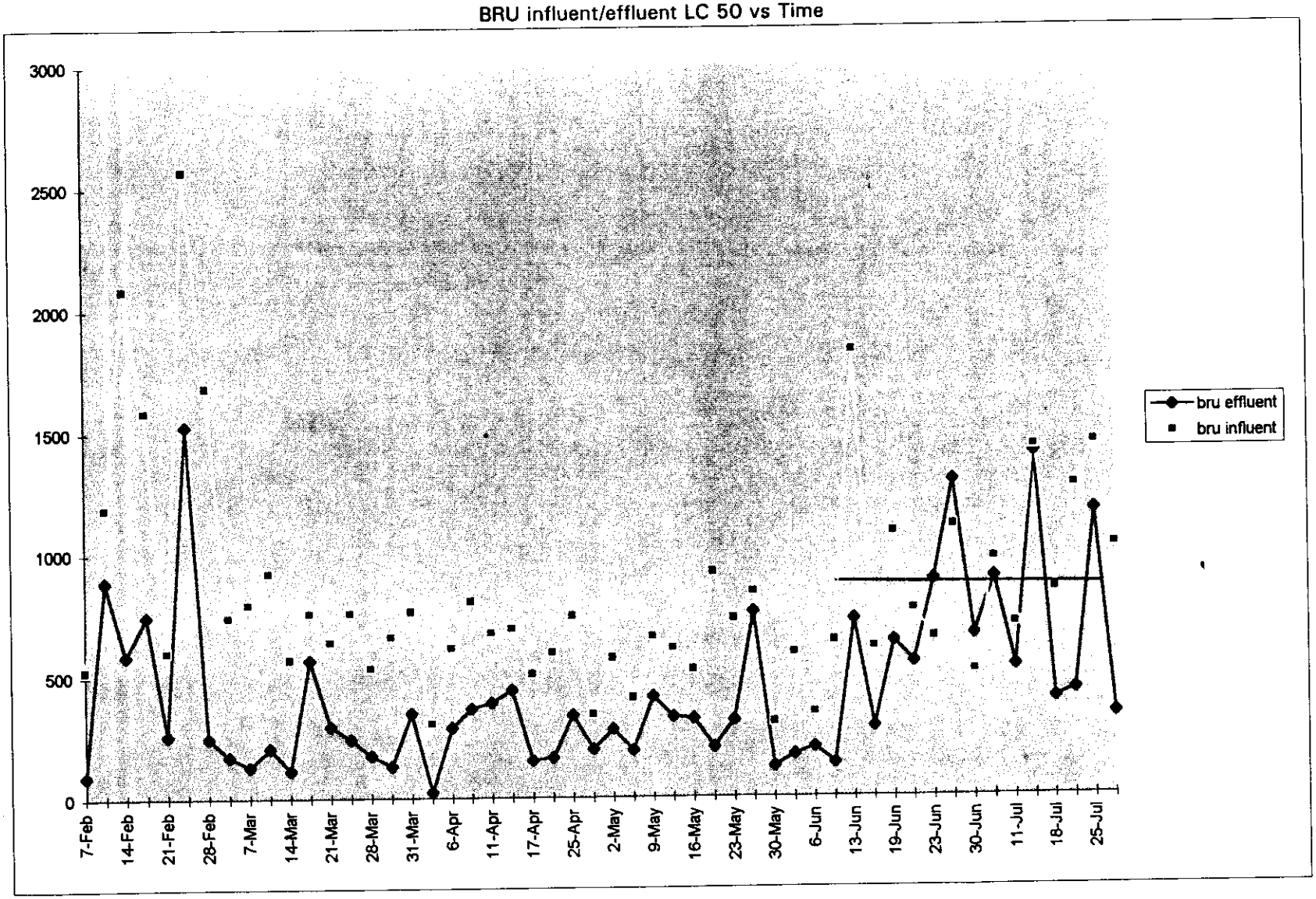
ECL Inhibition vs Influent COD r = 0.2



eclinhi.cod

EXHIBIT V

BRU influent/effluent LC 50 vs Time



1996 TEST DATA

Toxicity is inversely proportional to LC 50 value. Lower the value of LC 50, more toxic the material.

bruedt.tox

EXHIBIT VI

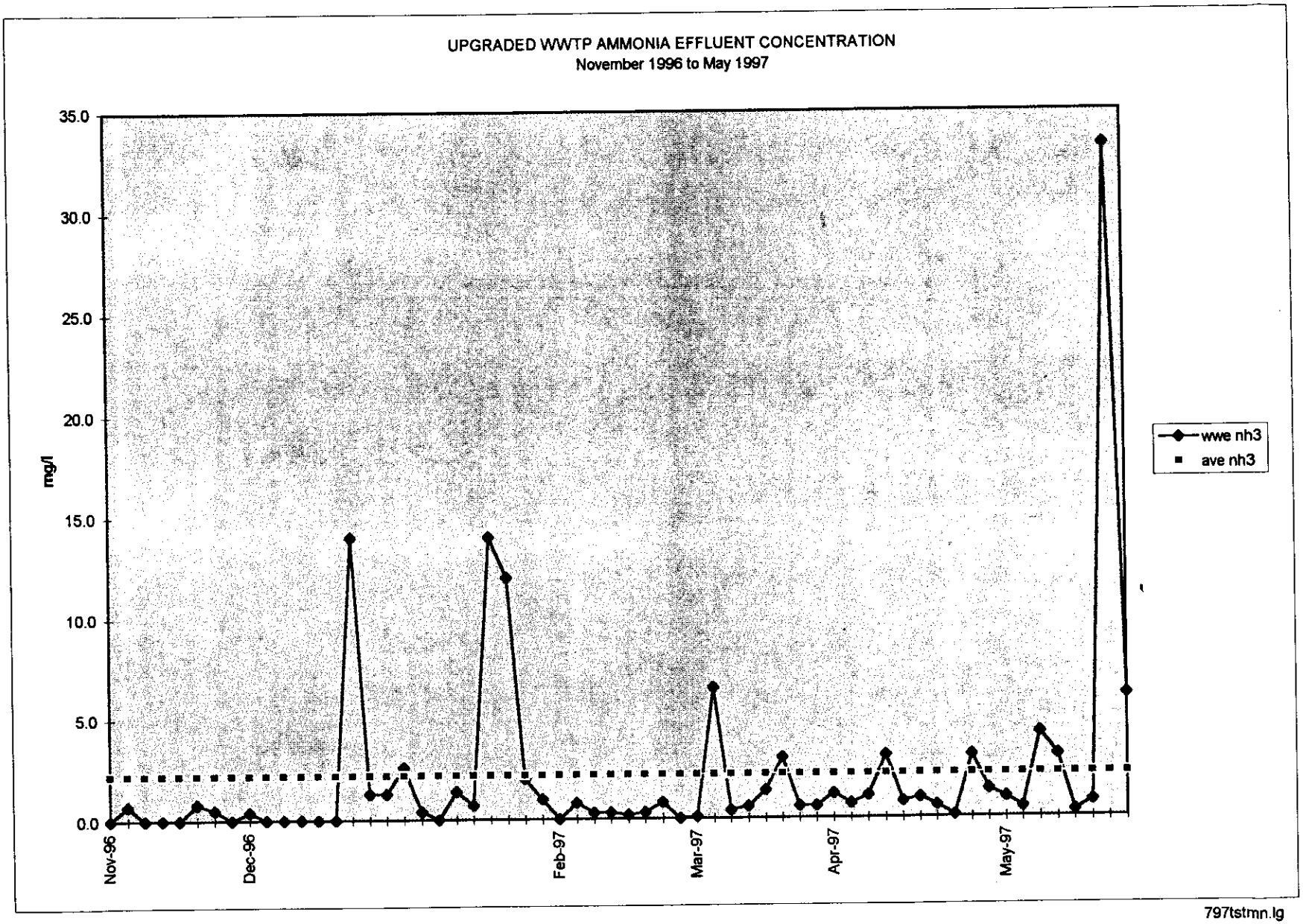

UPGRADED WWTP AMMONIA EFFLUENT CONCENTRATION
November 1996 to May 1997
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
mg/l
Nov-96
Dec-96
Feb-97
Mar-97
Apr-97
May-97
wwe nh3
ave nh3
797tstmn.lg

EXHIBIT VII

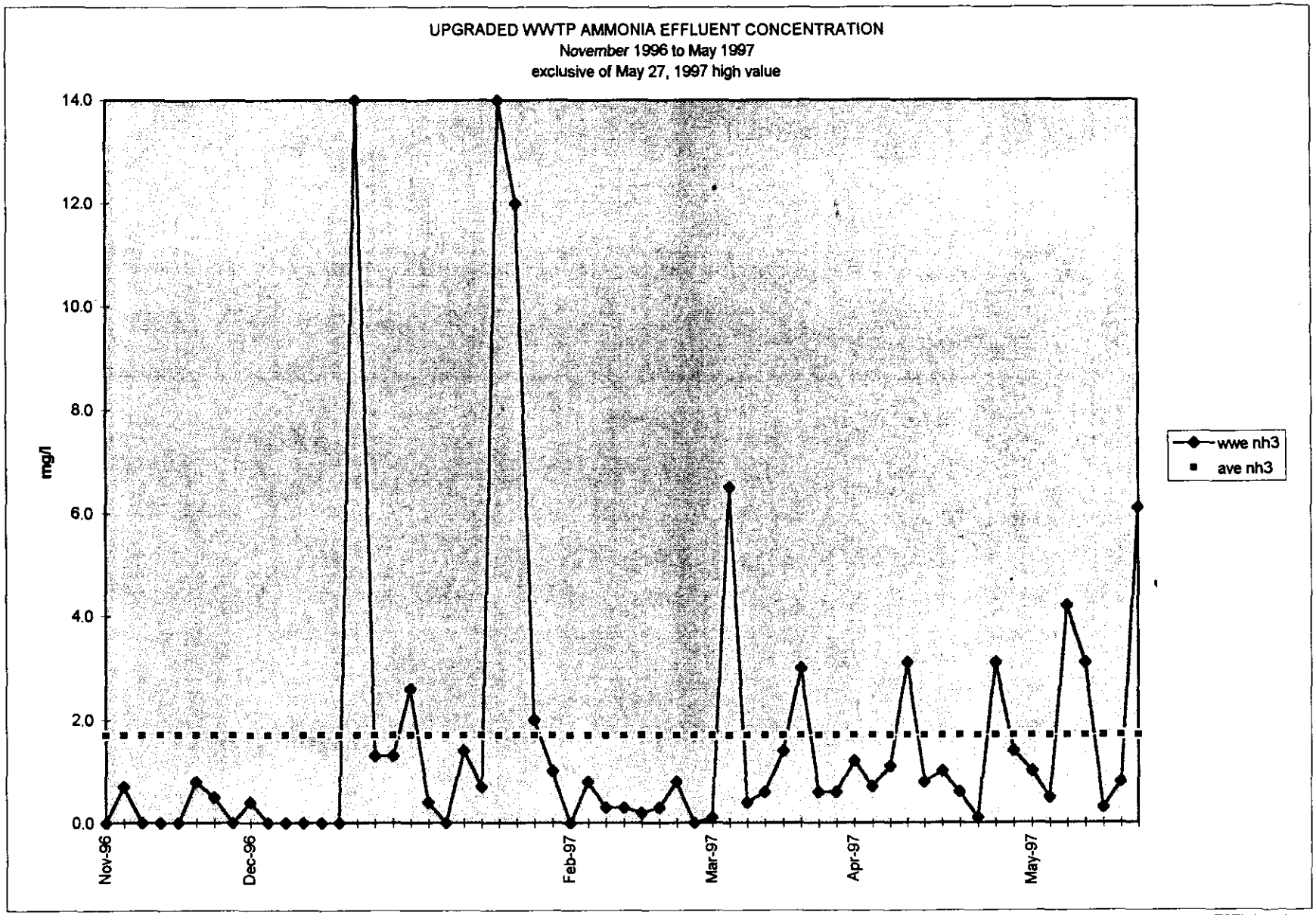

UPGRADED WWTP AMMONIA EFFLUENT CONCENTRATION
November 1996 to May 1997
exclusive of May 27, 1997 high value
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
mg/l
Nov-96
Dec-96
Feb-97
Mar-97
Apr-97
May-97
wwe nh3
ave nh3
797tstmn.lg

EXHIBIT VIII

Mobil Oil Corporation

MIDWEST REGION OFFICE
P.O. BOX 874
JOLIET, ILLINOIS 60434-0874

Certified Mail

January 24, 1997

Illinois Environmental Protection Agency
Division of Water Pollution Control
Compliance Assurance Section
2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276

File: 1006.15
Joliet Refinery
Facility I.D. 197800AAA

MOBIL OIL CORPORATION
OIL FEEDSTOCK NITROGEN
CONCENTRATION REPORT
NPDES PERMIT NO. IL0002861

Gentlemen:

As required by Special Condition No. 16 of the above captioned NPDES Permit, the average crude feedstock nitrogen concentration was 1571 mg/l for the period from January 1, 1996, to December 31, 1996.

Very truly yours,

James M. Kenna
Refinery Production Manager

LG/mmm
96ntg.rpt

cc: Mr. Adolfo Gonzalez, Jr. - IEPA, Maywood

1996 | 1996

Crude Source	JAN N2 WPPM	JAN BBLS	JAN API	JAN CRUDE MLBS	JAN N2 MLBS	FEB BBLS	FEB API	FEB CRUDE MLBS	FEB N2 MLBS	BBLS	API
1	879	920,511	31.0	280,825	247	925,250	31.6	281,232	247	780,540	32.2
2	600	10,083	35.0	3,002	2			0	0		
3	600			0	0	54,263	36.9	15,974	10	3,339	36.9
4	570	56,739	31.0	17,310	10			0	0		
5	5,000			0	0			0	0		
6	2,300	455,339	23.0	146,105	336	298,294	23.2	95,590	220	309,110	23.6
7	1,364	229,499	25.3	72,560	99	350,156	25.1	110,848	151	338,507	25.3
8	1,900	82,077	28.7	25,399	48	297,143	28.7	91,952	175	283,489	28.8
9	2,100	729,187	23.0	233,975	491	883,951	23.2	283,268	595	585,339	23.2
10	1,840	456,482	23.5	146,000	269	256,559	23.6	82,004	151	532,314	23.3
11	1,162	269,346	23.1	86,370	100	262,238	23.7	83,765	97	260,099	23.2
12	1,429	114,078	22.6	36,699	52	136,199	26.3	42,788	61	139,640	22.8
13	300			0	0			0	0		
14	1,313	410,628	23.3	131,503	173	251,391	23.3	80,508	106	234,159	23.3
15	4,200	457,388	23.2	146,573	616	291,811	23.5	93,332	392	394,010	23.6
16	996	1,433,611	29.4	441,708	440	1,435,828	29.5	442,116	440	1,403,739	29.9
17	393	57,952	26.8	18,149	7	7,670	27.0	2,399	1	146,128	27.1
18	2,000			0	0			0	0		
19	0	224,759	33.2	67,652	0	215,754	26.6	67,653	0	111,050	32.3
20	600			0	0			0	0		
21	1,000	265,041	34.5	79,153	79	116,968	34.8	34,869	35	111,787	34.7
22	700	50,146	39.5	14,538	10			0	0		
23	893			0	0			0	0		
24	170			0	0			0	0		
25	2,100			0	0			0	0		
26	1,452	106,385	30.0	32,656	47			0	0		
27	3,300			0	0			0	0		
				0	0			0	0		
TOTAL		6,329,251		1,980,177	3,027	5,783,475		1,808,299	2,681	5,633,250	
N2, WPPM					1,528				1,482		

1996

Crude Source	MAR			APR				MAY				JUN			
	N2 WPPM	CRUDE MLBS	N2 MLBS	BBLS	API	CRUDE MLBS	N2 MLBS	BBLS	API	CRUDE MLBS	N2 MLBS	BBLS	API	CRUDE MLBS	N2 MLBS
1	879	236,378	208	980,430	27.6	305,496	269	710,069	31.1	216,491	190	1,275,793	31.4	388,257	341
2	600	0	0			0	0	95,791	35.0	28,521	17	22,339	35.0	6,651	4
3	600	983	1			0	0			0	0			0	0
4	570	0	0			0	0	96,843	31.0	29,544	17	22,339	31.0	6,815	4
5	5,000	0	0			0	0			0	0			0	0
6	2,300	98,801	227	599,403	23.4	191,835	441	512,335	23.2	164,181	378	566,215	22.7	182,036	419
7	1,364	107,024	146	342,963	25.0	108,641	148	175,739	25.0	55,669	76	108,119	23.9	34,491	47
8	1,900	87,672	167	112,843	28.8	34,898	66	69,034	28.8	21,350	41	180,140	28.4	55,850	106
9	2,100	187,576	394	490,316	23.1	157,227	330	395,653	22.6	127,283	267	806,867	22.5	259,741	545
10	1,840	170,473	314	388,234	23.2	124,412	229	544,867	23.0	174,832	322	619,707	22.5	199,492	367
11	1,162	83,350	97	266,130	22.8	85,504	99	144,737	22.5	46,593	54	189,862	22.0	61,318	71
12	1,429	44,865	64	117,181	22.5	37,722	54	113,982	22.2	36,764	53	113,746	21.8	36,784	53
13	300	0	0			0	0			0	0			0	0
14	1,313	74,989	98	197,365	22.9	63,370	83	55,186	22.4	17,777	23	354,717	22.4	114,262	150
15	4,200	125,938	529	365,582	24.5	116,177	488	240,252	23.3	76,941	323	443,289	22.8	142,442	598
16	996	431,164	429	1,344,191	30.5	411,344	410	1,095,087	27.8	340,794	339	1,189,159	29.3	366,618	365
17	393	45,676	18	139,959	26.9	43,803	17	54,544	26.4	17,125	7	9,225	27.0	2,885	1
18	2,000	0	0			0	0			0	0			0	0
19	0	33,610	0	137,344	33.7	41,215	0	144,161	37.1	42,389	0	164,255	36.5	48,470	0
20	600	0	0			0	0			0	0			0	0
21	1,000	33,344	33	181,800	34.8	54,195	54	241,222	34.6	71,996	72	142,858	34.2	42,741	43
22	700	0	0			0	0			0	0			0	0
23	893	0	0			0	0			0	0			0	0
24	170	0	0			0	0			0	0			0	0
25	2,100	0	0			0	0			0	0			0	0
26	1,452	0	0	52,329	30.5	16,014	23	46,109	30.1	14,145	21	81,636	30.0	25,059	36
27	3,300	0	0			0	0			0	0	12,536	21.8	4,054	13
		0	0			0	0			0	0			0	0
TOTAL		1,761,843	2,725	5,716,070		1,791,854	2,712	4,735,611		1,482,395	2,199	6,302,802		1,977,965	3,184
N2, WPPM			1,547				1,514				1,484				1,600

1996

Crude Source	N2 WPPM	JUL BBLS	JUL API	JUL CRUDE MLBS	JUL N2 MLBS	AUG BBLS	AUG API	AUG CRUDE MLBS	AUG N2 MLBS	SEP BBLS	SEP API	SEP CRUDE MLBS	SEP N2 MLBS	BBLS	API
1	879	445,207	31.0	135,821	119	643,539	30.7	196,691	173	348,074	30.4	106,582	94	579,461	33.6
2	600			0	0			0	0			0	0		
3	600	54,512	36.9	16,048	10	10,552	36.9	3,106	2			0	0		
4	570	548,723	31.0	167,402	95	785,773	31.0	239,720	137	667,764	31.0	203,718	116	189,339	31.0
5	5,000			0	0			0	0			0	0		
6	2,300	697,993	22.3	224,985	517	585,008	21.8	189,182	435	423,753	22.2	136,678	314	632,602	22.3
7	1,364	15,988	25.0	5,065	7			0	0			0	0	169,438	25.0
8	1,900	36,752	28.0	11,423	22	28,520	33.0	8,595	16	68,717	29.9	21,107	40	218,312	27.2
9	2,100	727,724	21.9	235,180	494	406,519	23.2	130,272	274	431,786	22.1	139,360	293	567,428	21.8
10	1,840	747,623	22.0	241,454	444	529,698	22.0	171,072	315	517,753	22.1	167,106	307	597,141	21.7
11	1,162	315,475	22.0	101,886	118	212,460	21.6	68,796	80	235,597	21.7	76,238	89	191,459	21.6
12	1,429	236,366	22.1	76,288	109	194,009	21.9	62,698	90	59,433	22.1	19,182	27	150,828	22.1
13	300	58,170	32.1	17,627	5	9,290	32.1	2,815	1			0	0		
14	1,313	193,254	21.8	62,495	82	202,650	21.5	65,662	86	166,813	22.1	53,839	71	410,330	21.8
15	4,200	472,463	22.3	152,290	640	411,494	22.6	132,379	556	144,299	21.9	46,633	196	512,820	22.2
16	996	1,540,975	28.8	476,565	475	1,484,268	28.5	459,888	458	1,417,194	30.2	434,489	433	1,652,250	28.5
17	393			0	0	50,211	29.1	15,499	6	6,340	29.1	1,957	1		
18	2,000			0	0			0	0			0	0		
19	0	74,883	31.8	22,733	0	163,313	48.3	45,029	0	84,053	49.1	23,073	0	72,635	49.2
20	600			0	0			0	0			0	0		
21	1,000	102,578	34.2	30,690	31	61,018	34.6	18,212	18	282,016	33.8	84,579	85	208,367	34.5
22	700			0	0			0	0			0	0		
23	893			0	0			0	0			0	0		
24	170	30,023	46.8	8,348	1	50,029	46.8	13,910	2	440,822	46.8	122,566	21	375,458	46.8
25	2,100			0	0	636,652	28.5	197,261	414	108,817	28.5	33,716	71		
26	1,452	307,017	30.0	94,243	137	(46,851)	30.0	(14,382)	(21)			0	0		
27	3,300			0	0	113,918	21.8	36,839	122	842,960	21.8	272,599	900	89,725	21.8
				0	0			0	0			0	0		
	TOTAL	6,605,726		2,080,541	3,307	6,532,070		2,043,245	3,163	6,246,191		1,943,422	3,056	6,617,593	
	N2, WPPM				1,589				1,548				1,573		

1996

Crude Source	OCT			NOV				DEC				TOTAL		
	N2 WPPM	CRUDE MLBS	N2 MLBS	BBLS	API	CRUDE MLBS	N2 MLBS	BBLS	API	CRUDE MLBS	N2 MLBS	BBLS	CRUDE MLBS	N2 MLBS
1	879	173,995	153	192,310	28.8	59,474	52	101,240	32.6	30,585	27	7,902,424	2,411,826	2,120
2	600	0	0			0	0			0	0	128,213	38,175	23
3	600	0	0			0	0			0	0	122,666	36,111	22
4	570	57,763	33	497,842	31.0	151,879	87	583,789	31.0	178,099	102	3,449,151	1,052,249	600
5	5,000	0	0	61,078	22.4	19,675	98			0	0	61,078	19,675	98
6	2,300	203,908	469	577,662	22.9	185,475	427	621,450	23.0	199,406	459	6,279,164	2,018,182	4,642
7	1,364	53,673	73	602,088	24.8	190,968	260	499,128	24.8	158,312	216	2,831,625	897,250	1,224
8	1,900	68,196	130	213,807	28.4	66,288	126	221,831	29.1	68,476	130	1,812,665	561,205	1,066
9	2,100	183,497	385	776,064	22.1	250,476	526	784,761	22.6	252,461	530	7,585,595	2,440,316	5,125
10	1,840	193,231	356	642,133	22.5	206,711	380	755,646	23.0	242,465	446	6,588,157	2,119,253	3,899
11	1,162	61,996	72	387,494	22.1	125,064	145	320,864	22.6	103,223	120	3,055,761	984,104	1,144
12	1,429	48,680	70	218,159	22.5	70,210	100	201,333	22.8	64,686	92	1,794,954	577,366	825
13	300	0	0			0	0			0	0	67,460	20,442	6
14	1,313	132,694	174	256,284	22.3	82,609	108	151,273	22.7	48,634	64	2,884,050	928,342	1,219
15	4,200	165,406	695	457,842	22.7	147,194	618	605,151	23.1	194,050	815	4,796,401	1,539,355	6,465
16	996	511,936	510	1,517,331	29.5	467,212	465	1,370,779	29.6	421,824	420	16,884,412	5,205,658	5,185
17	393	0	0			0	0			0	0	472,029	147,494	58
18	2,000	0	0			0	0			0	0	0	0	0
19	0	19,927	0	7,204	49.0	1,979	0	41,495	49.1	11,390	0	1,440,906	425,119	0
20	600	0	0			0	0			0	0	0	0	0
21	1,000	62,227	62	72,706	34.8	21,674	22	9,159	34.8	2,730	3	1,795,520	536,408	536
22	700	0	0			0	0			0	0	50,146	14,538	10
23	893	0	0			0	0	410,939	36.4	121,335	108	410,939	121,335	108
24	170	104,393	18			0	0			0	0	896,332	249,217	42
25	2,100	0	0			0	0			0	0	745,469	230,977	485
26	1,452	0	0			0	0			0	0	546,625	167,736	244
27	3,300	29,016	96			0	0			0	0	1,059,139	342,508	1,130
		0	0			0	0			0	0	0	0	0
TOTAL	2,070,536	3,295	6,480,004		2,046,888	3,416	6,678,838		2,097,676	3,532	73,660,881	23,084,841	36,277	
N2, WPPM		1,591				1,669				1,684				1,571

BEFORE THE POLLUTION CONTROL BOARD
OF THE STATE OF ILLINOIS

IN THE MATTER OF:	)	
	)	
SITE SPECIFIC PETITION OF	)	R97-28
MOBIL OIL CORPORATION FOR	)	(Water - Regulatory)
RELIEF FROM 35 ILL ADM. CODE 304.122	)	
AMMONIA NITROGEN EFFLUENT STANDARDS	)	
	)	

TESTIMONY OF JAMES E. HUFF

My name is James E. Huff, and I am Vice President and part owner of Huff & Huff, Inc., an environmental consulting firm founded in 1979. I received a Bachelor of Science in Chemical Engineering in 1970 from Purdue University and was awarded a Masters of Science in Engineering from the Environmental Engineering Department at Purdue University in 1971. I am a registered Professional Engineer in Illinois as well as in New Jersey. My work experience includes two years with Mobil Oil as an Advanced Environmental Engineer during the construction and start-up of the Joliet Refinery. My responsibilities at the Joliet Refinery included the following:

- Construction oversite of some of the wastewater treatment facilities
- Preparation of Operation & Maintenance Manual for the wastewater treatment facilities
- Training the wastewater treatment operators
- Technical support for the wastewater treatment facilities, including sampling coordination, trouble shooting, and discharge monitoring reports
- Operations of the wastewater treatment facilities for a 6 week period
- Oil spill response program development

From the above responsibilities, I am familiar with the refinery, its wastewater treatment system, as well as the receiving waterway, the Des Plaines River.

After leaving Mobil in the fall of 1973, I was employed for three years at IIT Research Institute in the Chemical Engineering Department, working on advanced wastewater treatment projects including catalytic oxidation of cyanide in petroleum wastewaters. I then spent four years with the Armak Company, now called Akzo Nobel Chemicals. I was the Corporate Manager of Environmental Affairs responsible for regulatory compliance and engineering design of environmental systems at nine manufacturing facilities in the United States and Canada. Three of these chemical plants were fatty amines manufacturers, where ammonia was utilized as a raw material and was a major component in the wastewater. For the last 17 years at Huff & Huff, Inc., I have been involved in over 20 environmental impact studies associated with the impact of wastewater discharges on receiving streams throughout the United States. Many of these studies have involved ammonia nitrogen impacts, including those for the City of Lockport, the Uno-Ven Refinery and its predecessor Union Oil, the Galesburg Sanitary District, and Modine Manufacturing. I was Project Manager on a year long Fox River Ammonia Study on behalf of most of the municipal discharges on the Fox River below the Chain-of-Lakes. I was an active participant in the recent ammonia water quality proceedings (R94-1b), on behalf of six communities and also Indian Refining Corporation.

In addition, I have designed nitrification facilities for both industrial and municipal wastewater treatment plants. Most recently, after a nine month pilot study on nitrification of anaerobic digester supernatant, I designed a batch biological system that will take influent ammonia levels from above 300 mg/ℓ to less than 1 mg/ℓ. This system is currently under construction.

I was retained by Mobil to evaluate the environmental impact of Mobil's discharge on the Des Plaines River and ensure that the effluent standards recommended are protective of stream uses and consistent with water quality goals and standards. The report included as Exhibit VIII was prepared under my supervision and direction. The purpose of my testimony is to summarize this report.

Background

The Mobil refinery is located in Will County approximately 10 miles southwest of Joliet, Illinois, on the south side of the Des Plaines River, just upstream of the Interstate 55 bridge. The Des Plaines River is approximately 600 ft wide at the location of the outfall. The Des Plaines River above the I-55 Bridge is designated as a Secondary Contact Water under 35 Ill Adm. Code 303.441. The ammonia water quality standard for Secondary Contact Waters is 0.1 mg/ℓ un-ionized ammonia.

Mixing Zone Determination

The available dilution within the mixing zone and Zone of Initial Dilution are important in establishing the potential impacts of a discharge on water quality. Based upon field measurements and both U.S. EPA and IEPA policies, the Zone of Initial Dilution or ZID, and the full mixing zone were determined. Factoring in the mixing of once through cooling water, which is discharged through the same effluent channel, as well as the stream mixing, the available dilution within the ZID is 4.2 to 1. The overall available dilution within the mixing zone was determined to be 63 to 1.

At the I-55 Bridge, the Des Plaines River is designated as a "General Use" waterway. The winter un-ionized ammonia standard becomes 0.025 mg/ℓ below the I-55 Bridge, or four fold more restrictive than the 0.1 mg/ℓ Secondary Contact Water Quality Standard. The extent of mixing achieved by the I-55 Bridge was also determined as part of the field work, as one of our tasks was to ensure that the recommended effluent standards would be protective of the "General Use" waterway below the I-55 Bridge. Further dilution from the edge of the mixing zone to the I-55 Bridge was found to be 4 fold. Thus, if the edge of the mixing zone achieves 0.1 mg/ℓ un-ionized, the Des Plaines at the I-55 Bridge will achieve 0.025 mg/ℓ, ignoring any ammonia removal processes such as plant uptake, volatilization, and nitrification. Thus, effluent limits protective of the Secondary Contact Water Quality Standard (0.1 mg/ℓ un-ionized ammonia) will also assure compliance with the General Use Water Quality winter un-ionized standard (0.025 mg/ℓ). As the General Use Water Quality Summer un-ionized standard is 0.057 mg/ℓ, the summer standards will also be achieved.

Derivation of Effluent Limits

Appropriate effluent limits can be derived based on water quality considerations, existing effluent quality, as well as existing permit limits under IEPA and U.S. EPA policies. The most restrictive of the three approaches is the appropriate methodology. Using the 0.1 mg/ℓ un-ionized ammonia water quality standard, with the 75th percentile stream temperature and pH, the equivalent total ammonia water quality level can be derived. Then factoring in the available dilution within the mixing zone, the water quality based ammonia effluent limits for Mobil are back calculated as follows:

Summer	70 mg/ℓ monthly average
Winter	243 mg/ℓ monthly average

U.S. EPA's methodology for statistically deriving effluent limits based upon existing effluent quality was also utilized, as typically determined by IEPA at permit renewals. With the recent wastewater treatment upgrades, the representative monthly average database was limited from November, 1996 to March, 1997. However; short term upsets can still occur, independent of the upgrade. Therefore, for deriving a daily maximum effluent limit, a larger database is appropriate. The daily values from 1992 through 1996 were utilized for deriving a daily maximum limit. The results of this statistical analysis are as follows:

Monthly Limit	9 mg/ℓ
Daily Maximum	23 mg/ℓ

The present variance from Section 304.122 limits Mobil's ammonia effluent to 13 mg/ℓ monthly average and 26 mg/ℓ daily maximum. Unless a discharger can not meet existing effluent limits derived using best professional judgement, Section 404 of the 1987 Clean Water Act amendments prohibits less stringent effluent limits in renewal permits.

The appropriate effluent limits then become the most restrictive of the above three described effluent limits, which are as follows:

Monthly Effluent	Ammonia Limit	9 mg/ℓ
Daily Maximum	Effluent Limit	23 mg/ℓ

These limits reflect a 31 percent reduction from the current monthly average limit and a 12 percent reduction from the current daily maximum limit. The larger reduction in the monthly limit reflects the greater improvement the expanded treatment will have on the average ammonia achieved; however, shorter term upsets still have the potential to occur.

In summary, the proposed effluent limits are more restrictive than the existing effluent limits, reflecting the improvements from $7.8 million in expenditures. The proposed limits will readily result in maintaining ammonia water quality in the Des Plaines River, both upstream of the I-55 bridge (Secondary Contact) and downstream of the I-55 Bridge (General Use).

ATTACHMENT I

JAMES E. HUFF, P.E.

Education:

1966-1970	Purdue University, West Lafayette, Indiana B.S. in Chemical Engineering
1970-1971	Purdue University, West Lafayette, Indiana M.S.E. in Environmental Engineering
1974-1976	University of Chicago Graduate School of Business. Part time
Honors:	Omega Chi Epsilon (Chem. Engr. Honorary) President's Academic Award Graduated with Distinction Fellowship from the Federal Water Quality Admin.
Thesis:	"Destabilizing Soluble Oil Emulsions Using Polymers with Activated Carbon," Major Professor, Dr. J. E. Etzel

Experience:

Since 1980, Mr. Huff has been vice president of Huff & Huff, Inc. responsible for projects pertaining to wastewater treatment, hazardous waste management, ground water and soil remediation, and compliance assessments. A significant portion of his time has been devoted to assisting clients on day-to-day environmental issues; from permitting and reports to setting up programs for compliance.

Mr. Huff has designed industrial wastewater treatment plants ranging in size from less than one thousand gallons per day to five million gallons per day. These designs have ranged from foundries, plating, metal working, and printed circuit boards to the organic chemical industry. Mr. Huff has also directed ten municipal wastewater treatment design projects and four country club on-site wastewater systems over the past fifteen years. Two novel in-stream aeration systems, using high-purity oxygen on a shallow Illinois stream, were designed and installed. Mr. Huff was retained by a community to direct (contract O&M) the operations of a new 1.5 mgd tertiary treatment plant until the system was lined out and a superintendent hired.

In the area of Water Quality Analysis, Mr. Huff has completed a variety of projects, including both biological and chemical assessments. Mr. Huff has directed studies for two of the Quad Cities to assess the environmental impact of water treatment plant discharges on the Mississippi River. These studies have included evaluating various locations along the Mississippi for the presence of mussel beds, the *potential* presence of endangered species, primarily the *Lampsilis higginsi*, and whether the areas were important for fish spawning. The scope-of-work for the mussel surveys developed by Mr. Huff were reviewed and approved by U.S. Fish & Wildlife, IDOC, IEPA, and the Illinois Natural History Survey. Approval for both of the outfalls was secured.

On the Fox River, Mr. Huff was project manager for a group of municipal dischargers on a project to collect and analyze weekly water quality samples along the river, its tributaries, and outfalls at over 30 locations to establish a better database than currently exists. Mr. Huff has directed fish and benthic surveys for industrial, storm water, and municipal wastewater discharges located on the following waterways: Cedar Creek, Deep Run, Thorn Creek, North Kent Creek, Chicago Sanitary & Ship Canal, and Casey Fork Creek.

In the hazardous waste field, over sixty industrial plants have relied on Mr. Huff's expertise for complying with the regulations. Mr. Huff has provided the required RCRA and DOT training, prepared inspection plans, contingency plans, training plans, and waste minimization plans. Mr. Huff directs H&H's underground storage tank (UST) closure and remediation projects for a variety of clients. Both petroleum and solvent tank releases have required regulatory reporting and remediation. Tank systems have varied in size from single units to 50 USTs.

Remediation designs, many associated with underground storage tank releases, are a major portion of Mr. Huff's activities. He has designed and implemented landfarming, soil vapor extraction, air sparging, ground water pump and treat systems utilizing batch biological reactors, activated carbon, air strippers, and in situ enhanced bioremediation. Mr. Huff has completed treatability studies at a Federal Superfund site for cyanide and thiocyanate destruction in ground water, including operation of a 4,000 gpd pilot reactor at the site and was the lead engineer for a feasibility study for a major chlorinated solvent release at a state superfund site. Mr. Huff has directed over fifteen hazardous waste closures of TSD facilities, ranging from drum storage areas to the complete clean-up of a 27-acre abandoned manufacturing facility. This abandoned manufacturing site included plating solutions, cyanide bearing sludges, oils, and over 20,000 gallons of virgin chemicals requiring placement.

Compliance assessment is a significant part of Mr. Huff's work. Over 100 environmental audits of manufacturing firms have been conducted by Mr. Huff over the last fifteen years. These audits have included potential acquisitions as well as on-going industrial operations. Mr. Huff has also been involved in siting and permitting of new industrial facilities, including a mining operation.

From 1987 through 1990, Mr. Huff was a part-time faculty member, teaching the senior level environmental courses in the Civil Engineering Department at IIT-West in Wheaton, Illinois.

From 1976 to 1980, Mr. Huff was Manager of Environmental Affairs for the Armak Company (now Akzo Nobel Chemicals), a diversified industrial chemical manufacturer. At Armak, Mr. Huff was responsible for all environmental activities at eight plants located throughout the United States and Canada. Technical work included extensive biological and chemical treatability studies as well as designing new facilities, including two wastewater pretreatment facilities, a land application system, and an incinerator system.

Previously, Mr. Huff was an Associate Environmental Engineer in the Chemical Engineering Section at IIT Research Institute (IITRI). The work included extensive testing of wet scrubbers for odor control in the rendering industry as well as carbon adsorption evaluations. Also Ozone/UV was tested as a treatment method for cyanide, PCB's, RDX, HMX, and TNT. At Mobil Oil's Joliet refinery Mr. Huff was employed as an Advanced Environmental Engineer during the construction and start-up of the grassroots refinery. Mr. Huff was responsible for wastewater, water supply, solid waste, and noise abatement issues at the refinery from 1971 to 1973.

J. E. Huff, P.E. - Resume

Membership

Water Environment Federation Member
Illinois Water Environment Federation
National Water Well Association
Certified Class 2 and Class K Sewage Treatment Works Operator in Illinois

Licenses: Registered Professional Engineer, Illinois and New Jersey

Papers:

"Ozone-U.V. Treatment of TNT Wastewater," E.G. Fochtman and J.E. Huff, International Ozone Institute Conference, Montreal, May 1975.

"Characterization of Sensory Properties" Qualitative, Threshold, and Supra-Threshold," J.E. Huff and A. Dravnieks, American Water Works Assoc. Seminar, Minneapolis, MN, June 1975.

"Optimizing Wet Scrubber Systems for Odor Control in the Rendering Industry," R.H. Snow, J.E. Huff, and W. Boehme, Purdue Air Quality Conference, Lafayette, IN, November 1975.

"Control of Rendering Plant Odors by Wet Scrubbers: Results of Plant Tests," R.H. Snow, J.E. Huff, and W. Boehme, APCA Conference Boston, MA, June 1975.

"Asbestos Manufacturing Waste Disposal and Utilization," P. Ase, J.E. Huff, L.L. Huff, C.F. Harwood, and D. Oestreich, Mineral Waste Utilization Symposium, Chicago, IL, April, 1976.

"Alternative Cyanide Standards in Illinois, a Cost-Benefit Analysis," L.L. Huff and J.E. Huff, 31st Annual Purdue Industrial Waste Conference, Lafayette, IN, May 1976.

"Cyanide Removal from Refinery Wastewaters Using Powdered Activated Carbon," J.E. Huff, J.M. Bigger, and E.G. Fochtman, American Chemical Society Annual Conference, New Orleans, LA, March 1977. Published in Carbon Adsorption Handbook, P.N. Cheremisinoff and F. Ellerbusch, Eds., Ann Arbor Science Publishers, Inc., 1978.

"Industrial Discharge and/or Pretreatment of Fats, Oils and Grease," J.E. Huff and E.F. Harp, Eighth Engineering Foundation Conference on Environmental Engineering, Pacific Grove, CA, February, 1978.

"A Review of Cyanide of Refinery Wastewaters," R.G. Kunz, J.E. Huff, and J.P. Casey, Third Annual Conference of Treatment and Disposal of Industrial Wastewater and Residues, Houston, TX, April 1978. Published as: "Refinery Cyanides: A Regulatory Dilemma," Hydrocarbon Processing, pp 98-102, January, 1978.

"Treatment of High Strength Fatty Amines Wastewater - A Case History," J.E. Huff and C.M. Muchmore, 52nd Conference - Water Pollution Control Federation, Houston, TX, October 1979. Published JWPCF, Vol. 54, No. 1, pp 94-102, January, 1982.

"An Overview of Environmental Regulations," E.F. Harp and J.E. Huff, Soap & Detergent Association Annual Meeting, Boca Raton, FL, January 1980.

"A Proposal to Repeal the Illinois Pollution Control Board's Construction Permit Water Regulations," J.H. Russell and J.E. Huff, Chicago Bar Record, Vol. 62, No. 3, pp 122-136, Nov.-Dec., 1980.

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"Technical and Economic Feasibility of a Central Recovery Facility for Electroplating Wastes in Cook County, IL," J.E. Huff and L.L. Huff, 1986 Governor's Conference on Science and Technology in Illinois, Rosemont, IL, Sept. 3, 1986.

"Hazardous Waste Closure Procedure," J.E. Huff, Federation of Environmental Technologists Seminar, Rockford, IL, Dec. 17, 1986.

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"Storm Water Discharges," J.E. Huff, Federation of Environmental Technologists Environment '90 Seminar, Milwaukee, WI, March 7, 1990.

"Cleanup Standards-Past, Present and Future," J.E. Huff and D.O'Neill, Chicago Bar Association's Environmental Law Seminar "Underground Tanks: Down and Dirty," Chicago, IL, June 8, 1993.

"Engineering Aspects of Individual Wastewater System Design," J.E. Huff, 22nd Annual Northern Illinois Onsite Wastewater Contractors Workshop, St. Charles, IL, February 27, 1995.

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
SITE SPECIFIC PETITION OF	)	R97-28
MOBIL OIL CORPORATION FOR	)	
RELIEF FROM 35 ILL. ADM. CODE 304.122,	)	
AMMONIA NITROGEN EFFLUENT STANDARDS	)	

TESTIMONY OF JOHN H. KOON, Ph.D., P.E.

INTRODUCTION

My name is John H. Koon and I am affiliated with Parsons Engineering Science, Inc. (Parsons ES). I have been working with Mobil Oil Corporation (Mobil) in evaluating Mobil's Joliet refinery's wastewater treatment plant (WWTP) with regard to achieving the State of Illinois ammonia discharge limitation. A copy of our full report is included as Exhibit VII to Mobil's petition. This exhibit accurately reflects our analysis and conclusions.

Parsons ES was retained by Mobil to provide a technical evaluation of the refinery's WWTP and treatment process modifications that have been made or investigated with specific regard to the removal of ammonia. Our specific tasks were to:

> Evaluate the design, operation, and performance of the existing wastewater treatment system, paying special attention to any circumstances that would interfere with biological nitrification.
>
> Determine if changes in the treatment system operation would improve ammonia removal.
>
> Determine if the present wastewater treatment system meets the United States Environmental Protection Agency (USEPA) Best Available Technology (BAT) economically achievable criteria.

Determine how recent changes in the Resource Conservation and Recovery Act (RCRA) regulations have adversely impacted the ammonia removal performance of the system.

Review the evaluation of alternative ammonia removal technologies performed by Mobil, evaluate any additional technologies, as appropriate, and develop current cost estimates for the construction of applicable technologies.

We began our study in October of 1996. We conducted a two-day site visit to inspect the treatment plant and review operating procedures and data. Mobil also provided us with extensive treatment plant operating data and information on capital improvement projects and previous investigations. We used this information to form our opinions and conclusions.

I was the lead technical resource for this investigation and the report was prepared under my supervision and direction. Christopher Donohoe, a junior engineer, gathered most of the information and conducted the initial analysis. Gregory M. Gibbons, P.E. worked with Mr. Donohoe in the information analysis and was a primary author of the report.

I have over 27 years experience in the environmental field. My educational background includes a B.E. in Civil Engineering, a M.S. in Environmental Engineering from Vanderbilt University, and a Ph.D. in Environmental Engineering from the University of California, Berkeley.

I have specialized in the area of industrial water pollution control and have worked with numerous industries with regard to biological nitrification and nitrogen control. A detailed list of projects is included in the attached biographical information.

WASTEWATER TREATMENT PLANT DESCRIPTION

Mobil owns and operates a 200,000 barrels per day (bbl/day) refinery on the Des Plaines River in Joliet, Illinois. Process wastewater and contact storm-water runoff are

treated in the facility's WWTP. The facility is a conventional activated sludge treatment plant with solids and oil removal as primary treatment. Major unit process include:

Sour Water Stripper - Primary removal of ammonia and sulfide. This treatment unit is located in the refinery process area.

Desalter - Partial removal of phenolics and in-plant water reuse. This unit is located in the refinery process area.

TK 103 - Wastewater flow equalization. This unit is located in the refinery process area.

Benzene Removal Unit - An air-stripping process for removal of benzene, sulfide, and volatile organic compounds. This unit is located in the refinery process area.

Diversion Basin -Basin used for hydraulic overflow during wet weather..

API Oil/Water Separator - Parallel basin process for the oil removal of gravity separable oil.

Dissolved Air Flotation - Parallel basin process for the removal of suspended oil. The DAF system was modified/upgraded in 1996 with enhanced air injection features.

Equalization Biological Treatment Unit (EBTU) - Secondary equalization with surface aerators for phenolic and other chemical oxygen demand (COD) oxidation. The EBTU normally receives treated sanitary wastewater and effluent from the dissolved air flotation units (DAF).

Aeration Basins - Parallel activated sludge basins for ammonia, organic, cyanide and other pollutant removal. The aeration basins were upgraded in 1996 with the installation of a fine bubble air diffuser system and new aeration blowers.

Clarifiers - Parallel clarifiers for solids removal/sludge settling. The settled sludge and surface skimming mechanisms in the clarifiers were replaced to improve separated solids removal from the units.

Guard Basin - Effluent retention prior to discharge.

The facility also has a biological-sludge thickening tank, where waste activated sludge is gravity settled and stabilized. Waste bio-sludge is then hauled to the on-site coker for recycling. The nominal design capacity of the treatment plant is 2,500 gallons per minute (gpm). Current throughput is 1,900 gpm.

Mobil has implemented a number of capital improvement projects to optimize the WWTP processes, including enhancement of ammonia removal. Mobil has conducted laboratory studies to pinpoint inhibition to the nitrification/denitrification process. Mobil has also evaluated further improvements to the WWTP to improve ammonia removal. These actions were considered in our evaluation.

WASTEWATER TREATMENT PLANT MODIFICATIONS

Since 1990, Mobil has made the following modifications:

Installed a benzene removal unit (BRU).

Converted an equalization basin to an aerated biological pretreatment unit, the equalization biological treatment unit (EBTU).

Switched to a caustic-free Merox gasoline treating unit.

Upgraded to diffused aerators in the activated sludge basins.

Upgraded the WWTP clarifiers.

Made extensive modifications to the DAF system.

The BRU was installed in September of 1990 to meet the requirements of RCRA (40 CFR 261) and the National Emission Standards for Hazardous Air Pollutants (NESHAPS-40 CFR 61) regulations at a cost of $2.1 million. Mobil constructed and operates the unit to remove benzene, other volatile hydrocarbons, and a substantial amount of sulfide from a major

portion of their process wastewater. Similarly, in 1991, upon the listing of F037 and F038 sludges, Mobil converted an equalization basin to the EBTU through the addition of surface aerators. The EBTU is an aggressive biological treatment unit.

The nitrification performance of the treatment system has deteriorated since 1991. This is most likely attributable to increases in some chemical inhibitory substance in the BRU or the EBTU. A nearly identical conclusion was made at the UNO-VEN refinery in Lemont, Illinois, in a 1993 petition to the IL PCB (R 93-8).

In June of 1995, Mobil began operating a newly constructed caustic-free Merox gasoline treating unit (Merox unit). The nature of the new Merox unit is such that its operation precludes a recurrence of WWTP upsets caused by incursion of the phenolic spent caustic into the wastewater system thus, at least removing one source of known inhibitory substances.

Mobil also upgraded the WWTP's activated sludge basins and clarifiers to enhance nitrification. To promote more efficient oxygen transfer and to increase the dissolved oxygen (DO) levels in the aeration basins—creating a more suitable environment for nitrifiers—Mobil replaced the mechanical aerators of the west and east basins with fine bubble diffusers (November 1995 and June 1996, respectively). Mobil spent $3.5 million in modifying the activated sludge basins. Moreover, Mobil replaced the east and west clarifier internals by removing the suction-riser-pipe and installing bottom-suction-header equipment in each clarifier costing. These changes cost $450,000.

Mobil made upgrades to the DAF recycle system to increase the efficiency of the air saturation system. This also improved operability and reliability over the original system. This upgrade to the recycle system cost $143,000.

LABORATORY STUDIES

Mobil performed the following studies per IPCB order in PCB 93-151.

SOUR-WATER STRIPPER TAIL UNIT PROCESS

Mobil suspected that the stripped sour water stream was the most likely source of substances inhibitory to nitrification. As a result, Mobil conducted investigations to pinpoint and possibly remove inhibitors, including the installation of a sour water stripper tail unit (SWSTU). Mobil's SWSTU evaluation activities consisted of a refinery sour water pollutant survey, three phases of laboratory investigations, and a pilot-scale study.

The objective of the investigations was to determine the most probable cause of inhibition and to identify a promising treatment technology. Mobil researchers suspected phenol to be a major cause of inhibition and developed a nickel-tungsten catalyst bonded to activated carbon (Ni/W-AC) to remove phenol by catalytic oxidation. Laboratory investigations with the catalyst yielded positive results. However, pilot-scale testing with the Ni/W-AC process between March and September 1995 was less successful. Mobil researchers observed that phenol was removed by adsorption to the activated carbon, not by catalytic oxidation, and concluded that adsorption was not a commercially viable option for phenol removal from sour water. Mobil spent in excess of $100,000 for the multiple phases of the SWSTU investigation.

MICROTOX STUDY

Using MICROTOX technology, Mobil performed a toxicity identification study elucidating toxic inputs to the WWTP. This study concluded:

> Toxicity increases across the BRU—supporting Mobil's contention that the operation and performance of the WWTP has become less reliable after the BRU installation.

Commissioning of the new Merox unit led to an overall decrease in toxicity.

AMMONIA INHIBITION STUDY SUMMARY

Mobil conducted a nitrification inhibition study from October 1981 through January 1983. This study was summarized in Mobil's May 1, 1984, proposal to the Board (adopted rule PCB R84-16). Results from this study indicated that factors inhibitory to biological nitrification in Mobil's wastewaters were recurring and unpredictable.

In 1995 Mobil contracted with Nalco Chemical Company (Nalco) to conduct a second ammonia inhibition study on input streams to the WWTP. The work involved laboratory testing and a general review of the wastewater generation and treatment processes. Nalco conducted their study to assess the degree of nitrification inhibition of 15 wastewater influent component streams and the overall contribution of these influent streams to the quality of the final effluent. Nalco also attempted to correlate measured nitrification inhibition to such parameters as pH, ammonia, residual COD following biological treatment, cyanide, sulfide, phenols, conductivity (dissolved salts), nitrates, and process unit variability. The principal finding of the study was that inhibition to the nitrification process was caused by biological degradation products produced in the activated sludge process. Thus, by accomplishing its primary objective, i.e., the oxidation of degradable organics, the biological treatment process appeared to be creating conditions that prevented it from achieving high levels of nitrification.

Mobil spent a total of $120,000 for the MICROTOX and the Nalco nitrification inhibition studies.

All together, Mobil has spent nearly $10,000,000 on upgrades to the WWTP and studies investigating further enhancements to the facility's performance. A summary of these costs is presented in Table 1.

The Mobil Joliet refinery WWTP has a history of varying ammonia removal due to inhibition of nitrification in the treatment plant. Nitrification is a sensitive process that can be affected by many factors. Mobil has been able to identify some causes for reduced nitrification, e.g., increased WWTP influent toxicity resulting from the installation of the BRU and EBTU; incursion of the phenolic spent caustic into the wastewater system; and varying ammonia levels in the raw crude oil. However, even after installing the caustic free Merox unit and totally upgrading the WWTP, Mobil is unable to consistently meet the state effluent standard.

WASTEWATER TREATMENT PLANT OPERATION EVALUATION

Parsons ES evaluated the operation of the WWTP to assess if (1) the facility was well run, (2) operating conditions were favorable to nitrification, and (3) the facility meets or exceeds BAT requirements.

EVALUATION OF CURRENT OPERATION

Following a thorough inspection of the Mobil WWTP and operating data, Parsons ES concludes that Mobil properly operates their treatment facility. Removal efficiency data for major parameters of concern are shown in Table 2. This performance data are indicative of an exemplary treatment plant, evidenced by BOD_5, TSS, and phenolics data. Although the facility design promotes conditions well within the range for nitrification, the WWTP does not consistently achieve levels of nitrification necessary to meet Illinois regulations. Studies have

indicated that this inconsistency can be attributed to inhibitory agents resulting from RCRA and NESHAP mandated upgrades to the WWTP. Therefore, it is the opinion of Parsons ES that ammonia levels above the Illinois ammonia effluent standard do not result from poor facility operation. Furthermore, it is unlikely that significant additional removal of organics and ammonia could be achieved through operating or equipment modifications.

COMPARISON TO INDUSTRY PRACTICES AND GUIDELINES

A comparison of Mobil's treatment plant practices with BAT requirements are presented in Table 3. Mobil meets or exceeds all BAT treatment plant process requirements.

Parsons ES compared the Mobil Joliet refinery's WWTP effluent with the BAT effluent guidelines. This comparison is presented in Table 4. The Joliet refinery WWTP effluent is significantly below the USEPA BPT and BAT ammonia effluent limitations (daily maximum of 2,215 lb/day and daily average of 1,007 lb/day). The facility also has operated at flow rates significantly lower than the BPT average flow rate, due to water conservation and stream segregation. These water conservation and segregation practices may, in a sense, hinder Mobil's efforts to meet the Illinois concentration-based effluent limit. The net result of discharging less water is that wastewater constituents are concentrated in the reduced flow.

ALTERNATIVE TREATMENT TECHNOLOGY EVALUATION

Mobil has evaluated a number of alternative treatment technologies to further enhance ammonia removal. These have included:

Pre-ICPB 93-151 Variance Petition

From 1979 through 1982 Mobil operated a two-stage pilot treatment system.

Addition of rotating biological contactors (RBCs) for second-stage secondary treatment.

Addition of a trickling filter as second-stage treatment.

Addition of a third aeration basin and clarifier in parallel to the existing activated sludge system.

Technology Assessment Associated with ICPB Variance Petition

Breakpoint chlorination.

Addition of powdered activated carbon (PACT) to the aeration basins.

Selective ion exchange.

Mobil has experimented with and performed engineering evaluations on a number of processes that might provide the means to comply with the state ammonia standard. None have proved suitable due to a variety of problems including performance shortfalls, unsuitability for the Joliet site, and the generation of unacceptable toxic byproducts.

Furthermore, the process costs associated with removing the incremental amount of ammonia necessary to meet the state effluent guideline are prohibitive. Assuming that 3 mg/L effluent ammonia concentration could be consistently reached, in order to remove an additional 0.9 mg/L to meet the 3 mg/L effluent limitation, PACT, ion exchange, and breakpoint chlorination will cost \$490/lb NH_3, \$609/lb NH_3, \$163/lb NH_3, respectively.

To put these costs for ammonia removal in perspective, we compared them to existing Joliet Refinery treatment costs, both before the 1990 to 1996 upgrade efforts and current treatment costs. A baseline ammonia removal cost was calculated that reflects the costs prior to the WWTP upgrades made between 1990 and 1996. Parsons ES calculated that ammonia removal cost approximately \$8/lb of ammonia removed by the pre-1990 treatment system.

Considering the cost of the upgrades to promote ammonia removal, ammonia removal following these upgrades costs $24/lb. We then compared the pre-upgrade, i.e., prior to 1990, ammonia removal cost of $8/lb and the current cost of $24/lb to the removal cost estimates noted above for the three alternative technologies. The estimated cost increase would be:

Pre-upgrade cost comparison - 20 to 76 times the pre-1990 ammonia removal cost on a per pound of ammonia removed basis.

Current cost comparison - 7 to 20 times the current ammonia removal cost on a per pound of ammonia removed basis.

FINDINGS SUMMARY

Our findings from this investigation were:

The treatment system is properly designed and operated. It consistently meets its discharge permit and performs well above the USEPA Best Available Technology (BAT) guidelines for the refining industry.

Many improvements have been made to the system since it was initially placed into operation in 1973. Approximately $10 million has been spent on these improvements. These improvements (presented in detail in Table 1) have had the objectives of accomplishing the following:

Decrease and control ammonia loadings to the treatment plant.

Increase equalization capacity and degree of pretreatment.

Improve the design and performance of the treatment system, and create conditions favorable to achieving biological nitrification.

Mobil has investigated a number of technologies in order to identify one which could achieve consistent compliance with the state ammonia standard. No applicable process has been

identified. Problems with the technologies evaluated include high cost, site suitability problems, and generation of chlorinated organics. These technologies are not proven for the Mobil Joliet Refinery application and their cost is prohibitively high to recommend them for implementation.

Mobil has conducted studies and implemented changes in operations to reduce sources of inhibition that might prevent effective and consistent nitrification. The efforts to identify and remedy the sources of inhibition have not been completely successful. The most consistent conclusions from these tests are that some toxicity is added to the wastewater with passage through a benzene removal unit (required for compliance with Resource Conservation and Recovery Act [RCRA] and the Clean Air Act) and that byproducts of the degradation of organics in the EBTU and activated sludge system are inhibitory to the nitrification process.

This evaluation of the Mobil treatment system revealed no further operational changes nor feasible modifications that would likely lead to consistent nitrification. Recent data indicates that the system is operated within the envelope of conditions required to achieve nitrification. In fact, nitrification is achieved in the system on occasion for several months at a time. However, there are other operating periods during which nitrification ceases or is significantly reduced due to reasons that can best be explained as chemical inhibition of nitrifying organisms.

Because of these problems, the treatment system does not consistently meet the Illinois ammonia standard. While effluent ammonia concentrations have progressively decreased from an annual average of 17 mg/L in 1977 to values ranging from less than 1 mg/L to 6 mg/L in recent years, Mobil has not, even with the improvements and studies summarized above, been able to meet the state average standard of 3 mg/L with sufficient consistency.

CONCLUSION

Based on our findings, Parsons ES concludes modification of the WWTP to achieve consistent ammonia removal to meet the current permit standard is technically infeasible and economically unreasonable.

Biographical Data

JOHN H. KOON, Ph.D.

Technical Manager, Industrial and Hazardous Wastes

EXPERIENCE SUMMARY

Twenty-seven years of extensive technical experience combined with administrative and management responsibilities. Key contributor to significant advances in the technologies used worldwide in the treatment of industrial wastes; widely recognized as an authority in the evaluation and design of water and wastewater treatment systems. Has extensive experience in the evaluation and design of biological wastewater treatment systems. Assists clients in resolving complex environmental problems with state and federal regulatory agencies. Has worked with industries, defense agencies, and municipalities at over 200 locations. Has also directed projects dealing with the management of hazardous wastes including the development of remedial action plans for the correction of chemical contamination problems at numerous industrial and defense locations.

EXPERIENCE RECORD

1991-Date Parsons Engineering Science, Inc. **Vice President/Technical Manager, Industrial and Hazardous Wastes**. Directs industrial waste program and works with industrial clients to resolve difficult and complex issues. Responsible for providing technical direction on industrial and hazardous waste projects. Scope includes overseeing the development of project approaches to achieve desired results, participating in engineering investigations, and reviewing projects to ensure conformance to client needs.

Representative assignments include the following:

Development of treatment system upgrades at a petrochemical complex for ARCO Chemical Co. Considerations were given to meeting RCRA land ban and wastewater treatment system exclusion regulations, anticipated Clean Air Act requirements, and NPDES requirements. Work included treatment testing and design assistance.

Development of projected NPDES permit requirements and treatment upgrading alternatives to meet these requirements for five treatment systems at the Y-12 Plant in Oak Ridge, TN.

Conduct of testing to evaluate air sparging, soil washing, and solidification to treat contaminated soil at an Arkansas Superfund site.

Development of wastewater characterization and treatment system design requirements for a pharmaceutical plant operated by Pfizer, Inc.

Stormwater and NPDES permitting assistance for BASF synthetic fibers plant.

Technical support for a wastewater treatment system operating permit hearing in Texas for a new organic chemicals plant.

1983-1991 Post, Buckley, Scuh & Jernigan, Inc., **Vice President - Director of Industrial Services**. Directed the firm's work with industrial clients to insure completion of quality projects within time and budget constraints. Also responsible for the technical direction and quality control of major environmental projects.

Vice President - Manager of Industrial and Hazardous Waste Division (1988-1990). Directed technical, administrative, and business development operations for all industrial waste and hazardous waste projects.

Regional Manager - Nashville office (1983-1988). Responsible for technical direction, business development, administrative management, and financial performance of office. Directed project efforts to assure completion of projects within time and budget constraints. Developed and supervised projects in industrial and municipal wastewater treatment system design including sludge handling, contaminated site remediation, and NPDES permitting. Representative assignments include the following:

Conducted treatment investigations, process design development, detailed design development, construction assistance, and start-up assistance for a 1-mgd treatment facility for M&T Chemicals in Bucks, Alabama.

Planned and designed new sludge handling facilities for the 100-mgd Central Wastewater Treatment Plant in Nashville, Tennessee.

Developed a two-stage anaerobic-aerobic system to treat wastewater from a commercial baker's yeast plant.

Directed the conduct of treatment investigations, process design development, detailed design development, construction engineering services, and start-up of an industrial pretreatment system for Reichhold Chemicals in Pensacola, Florida.

Conducted RI/FS investigations at an air force base to remediate VOC-contaminated soil and groundwater.

1982-1983 John H. Koon Company, **President**. Responsible for all engineering work provided by the company; provided environmental engineering services for the treatment of industrial and municipal wastewaters, hazardous waste management, and expert testimony before regulatory agencies and courts of law.

1972-1982 AWARE, Inc., Nashville, Tennessee **Vice President/Technical Director; Manager of Operations Division** (1980-1982); **Director of Wastewater Management** (1974-1980); **Senior Engineer** (1972-1974). Played key role in the firm's emergence as one of the nation's leading industrial environmental management firms in the 1970s. Responsible for:

Development of plans for remediating organic chemicals and mercury contamination at a plant producing chlorofluorocarbons, chlorine, and caustic.

Development of treatment options for a specialty organic chemicals plant including waste characterization, waste minimization, treatment testing, permitting, and preliminary system design.

Addressing a wide variety of wastewater management and permitting problems at 20 pulp and paper mills.

Development of wastewater treatment strategies for a specialty organic chemicals plant operated by CIBA-GEIGY Corporation. Tasks included design and operational evaluation of an existing six-state trickling filter system and activated carbon adsorption; experimental testing of one- and two-stage combined systems using plant

chemical and municipal wastewater to evaluate the treatment alternatives; planning and conduct of in-plant waste minimization measures to reduce waste loads; evaluation of sludge dewatering alternatives; system design.

Development of treatment methods to handle highly saline wastes in various organic chemicals and textile plants.

Participation in the development of a new anaerobic treatment system.

Conduct of environmental investigations at an elemental phosphorus plant including development of wastewater treatment and reuse system, development of storm water management system, and evaluation of potential pollutant migration from on-site activated carbon system for removal of elemental phosphorus.

Development of a wastewater treatment system for Nissan Manufacturing Corporation's Smyrna, Tennessee plant. The design included facilities for batch pH adjustment and coagulation of the wastewater, solids separation in a tube settler, and sludge dewatering using a belt filter press.

Education

B.E., Civil Engineering, 1967, Vanderbilt University, Nashville, Tennessee

M.S., Civil and Environmental Engineering, 1969, Vanderbilt University, Nashville, Tennessee

Ph.D., Environmental Engineering, 1971, University of California, Berkeley, California

Professional Affiliations

Registered Professional Engineer, (Alabama 1984, No. 14766; Florida 1987, No. 36964; Georgia 1991 No. 19285; Kentucky 1988, No. 15408; Tennessee 1973 No. 9590)

American Academy of Environmental Engineers (Diplomate)

American Society of Civil Engineers

American Water Works Association

International Association on Water Pollution Research and Control

Water Environment Federation (Program Committee; Hazardous Waste Committee; Industrial Waste Committee)

Honorary Affiliations

Tau Beta Pi

Chi Epsilon

Publications

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"Ammonia Removal from Municipal Wastewaters by Ion Exchange," *Journal of the Water Pollution Control Federation*, Vol. 47, No. 3, March, 1975, coauthor Warren J. Kaufman.

"Biological and Physical-Chemical Treatment of Waste from a Diversified Organic Chemical Plant," *Proceedings of the 30th Annual Purdue Industrial Waste Conference*, 1975, coauthored by Carl E. Adams, Jr.

"Planning for Industrial Wastewater Reuse in the Cleveland-Akron Area," *Proceedings of the National Conference on Complete WateReuse*, sponsored by AIChE, 1973, coauthored by Carl E. Adams, Jr., and W. Wesley Eckenfelder, Jr.

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"TSD for Water Quality-Based Toxics Control," presented at the Kentucky/Tennessee WPCA annual conference, Chattanooga, Tennessee, 1990.

"The Study of a Wastewater Management System for a Chlorinated Pesticide Manufacturing Facility," presented at the 73rd Annual Meeting of AIChE, Chicago, Illinois, 1980.

"Adsorption of Chlorinated and Nonchlorinated Organics from a Pesticide Manufacturing Plant Waste Stream," presented at the 53rd Annual Conference of the Water Pollution Control Federation, 1980, coauthored by Sam E. Shelby, Jr., Dan R. Marks, and H. Allen Scott.

"Treatment and Reuse of Water in an Elemental Phosphorus Plant," presented at the 53rd Annual Conference of the Water Pollution Control Federation, 1980, coauthored by Gary M. Davis, Ted T. Garret, and Sam Barco.

"Chemical Waste Disposal in the 80s," presented at the National Association for Purchasing Management, Chemical Group, Mid-winter Conference, Savannah, Georgia, 1980.

"Lagooning of Biological Sludges," presented at the Vanderbilt University Conference, 1980, coauthored by C. E. Adams, Jr.

"Anaerobic Treatment of Wastewater," presented at Vanderbilt University Workshop; "Design for 80s." March 1981, coauthored by Yerachmiel Argaman.

"The Use of Coagulation-Clarification Process in the Treatment of Textile Wastewaters," presented at the EPA Symposium on Textile Industry Technology, 1978.

"Trends and Directions in Achieving BAT Standards," presented to the Pulp Chemicals Association Environmental Meeting, Savannah, Georgia, 1978.

"The Implications of EPA's National Pretreatment Program Regulations," presented to Mobil Chemical Corporation Environmental Group, 1978.

"Cost-Effective Evaluation of Treatment Alternatives for a Heavy Metals Wastewater," presented at the 5th Annual Industrial Pollution Conference and Exposition, 1977.

"Oxygen Activated Sludge Considerations for Industrial Applications," presented at the 70th annual AIChE Meeting, 1977, New York, coauthored by W. Wesley Eckenfelder, Jr., Carl E. Adams, Jr., and Sam E. Shelby.

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"Treatment Investigations and Process Design for the H-Coal Liquification Wastewater," 1976.

"Economic Aspects of Compliance with Proposed Toxant Pollutant Standards," presented at the 48th Annual Water Pollution Control Federation conference, 1975.

"Advanced Technology for Metals Removal," presented at the Matcon 1974 conference, Detroit, Michigan.

"Pretreatment Considerations for Industrial Wastewaters," presented to the State of New York WPCA, 1973.

"Economic Considerations for the Combined Treatment for Industrial Wastes in the Cleveland-Akron Area," presented at the 46th Annual Water Pollution Control Federation Conference, 1973, Cleveland, Ohio, coauthor by Carl E. Adams, Jr.

"Advanced Wastewater Treatment Technology," presented to the U.S. Army COE, 1972.

"Alternative Methods for Nitrogen Removal from Wastewater," presented at the Theory and Design of Advanced Waste Treatment Processes Seminar, Continuing Education in Engineering, University Extension and the College of Engineering, University of Berkeley, California, San Francisco, 1971.

SEMINARS AND WORKSHOPS

"Designing and Operating Groundwater Treatment System : Still Trying to Get It Right," presented at Executive Enterprises, 1993, Atlanta, Georgia.

"Industrial Requirements for Storm Water Permitting," presented to the Chemical Industry Council of North Carolina, 1991.

"Strategies for Complying with Storm Water Regulations," presented to the Coastal Carolina Section, AIChE, 1991.

"Strategies for Permitting Industrial Storm Water Discharges," seminars presented by Clemson University Continuing Engineering Education, 1991.

"Management of Leachate and Groundwater at Waste Disposal Sites," seminar presented by Vanderbilt University, 1986.

"Upgrading Aerated Lagoons to Achieve High Levels of BOD and Suspended Solids Removal," workshop sponsored by Municipal Environmental Research Laboratory, Clemson University, 1983.

"Wastewater Treatment," seminar presented by Southern Methodist University, 1983.

"Operation, Control, and Management of Activated Sludge Plants," seminar sponsored by Vanderbilt University, Continuing Engineering Education, Nashville, 1982 and 1986.

"Wastewater Engineering," seminar sponsored by Vanderbilt University, Continuing Engineering Education, Nashville, 1981 and 1986.

"Process Design and Water Quality Engineering," seminar sponsored by Vanderbilt University, School of Engineering, Department of EWRE, Arlington, 1981.

"A Conference for Industry on Complying with RCRA and Effluent/Pretreatment Guidelines," seminar sponsored by Industrial Waste Committee, California Water Pollution Control Association, Sacramento, 1981.

"Design for the Eighties," seminar sponsored by Vanderbilt University, Continuing Engineering Education, Nashville, 1981.

Series of four pretreatment seminars presented at major locations in Tennessee, sponsored by the state of Tennessee, 1980.

"Control, Operation and Management of Biological Wastewater Treatment Plants," seminar sponsored by Vanderbilt University, School of Engineering, Department of EWRE, Nashville, 1977, 1979, and 1980.

"The Use of the Coagulation-Clarification Process in the Treatment of Textile Wastewaters," presented at the Textile Industry Technology Seminar sponsored by Vanderbilt University, School of Engineering, Department of EWRE, Nashville, 1979.

"Management of Refining and Petrochemical Wastewaters," seminar sponsored by the University of Tulsa Continuing Education Division, College of Engineering and Physical Sciences, Tulsa, 1979.

"Upgrading of Wastewater Treatment Plants," seminar sponsored by Vanderbilt University, School of Engineering, Department of EWRE, Nashville, 1978 and 1979.

"Hazardous Waste Management," seminar sponsored by Vanderbilt University, School of Engineering, Department of EWRE, Nashville, 1978.

"Water Quality Engineering for Industry," AIChE Continuing Education Series, Chicago, 1977.

"Advanced Wastewater Treatment," AIChE Continuing Education Series, Chicago, 1977.

"Technical Preparation for Negotiating and Amending NPDES Permits," Legal and Regulatory Implications of Compliance and Noncompliance with NPDES Permits. Short Course sponsored by Auburn University, Birmingham, 1975.

"Advanced Wastewater Treatment," continuing education, sponsored by the Engineering Extension Service, Auburn University, Auburn, 1975.

"Optimization of Ammonia Removal by Ion Exchange Using Clinoptilolite," presented at Vanderbilt University, Department of Environmental and Water Resources Engineering, 1972.

TABLE 1
AMMONIA REMOVAL OPTIMIZATION ACTIVITIES

WASTEWATER TREATMENT PLANT
MOBIL REFINERY
JOLIET, ILLINOIS

1973 through 1990					$2,100,000
3/3/94-9/3/94					
Refinery Sour Water Pollutant Survey	i	$10,000			$10,000
Activated Sludge System Aeration Capability Engineering Analysis	i	$5,000			$5,000
WWTP API and DAF System Assessment	i	$6,000			$6,000
SWSTU Laboratory Investigation - Phase 1[1]	i	$25,000			$25,000
9/3/94-3/3/95					
Enviex, Inc. Activated Sludge System Field Analysis	i	$4,000			$4,000
SWSTU Laboratory Investigation - Phase 2[1]	i	$25,000			$25,000
Upgrade Crude Unit Desalter Controls	e		$100,000		$100,000
Constructed Caustic Free Merox Treaters	e		$3,000,000		$3,000,000
3/3/95-9/3/95					
SWSTU Laboratory Investigation - Phase 3[1]	i	$25,000			$25,000
SWSTU Pilot Plant Study[1]	i	$30,000			$30,000
MICROTOX/Nitrification Inhibition Study	i	$120,000			$120,000
Upgraded West Side of Activated Sludge System	e		$1,750,000		$1,750,000
Replaced West Clarifier Internals	e		$225,000		$225,000
Mg(OH)2 Addition Facilities	e		$25,000		$25,000
Bioaugmentation	m			$65,000	$65,000
Mg(OH)2 Addition	e			$40,000	$40,000
3/3/96-9/3/96 - Completed and Pending					
Upgraded East Side of Activated Sludge System	e		$1,750,000		$1,750,000
Completed WWTP Laboratory	e		$100,000		$100,000
Completed DAF Controls and Recycle Upgrades	e		$143,000		$143,000
Upgrade East Clarifier Internals (11/96)			$225,000		$225,000
Perform In-Stream Water Quality Data Collection	i	$33,000			$33,000
Install Liquid Nutrient (Phosphate) Addition System[2]	e				$25,000
Perform WWTP Post *Mechanical Upgrade Optimization*[2]	m				$45,000
Total		$283,000	$7,343,000	$150,000	$9,876,000

Legend:
Nature of Task:
- i - indicates investigation
- e - indicates equipment upgrade
- m - indicates miscellaneous upgrade

[1] SWSTU = Sour Water Stripping Tail Unit
[2] indicates an activity not completed, and therefore a cost not yet incurred.

TABLE 2
REMOVAL EFFICIENCIES FOR RELEVANT WATER QUALITY PARAMETERS
(1996)

WASTEWATER TREATMENT PLANT
MOBIL REFINERY
JOLIET, ILLINOIS

Parameter	Units	Influent Concentration	Effluent Concentration	Removal Efficiency (%)
BOD_5	mg/L	193	9	95
COD	mg/L	662	131	80
TSS	mg/L	288	20	93
NH_3-N	mg/L	34	3.9	89
Phenolics	mg/L	27	0.006	99.9

TABLE 3
COMPARISON OF BAT REQUIREMENTS WITH MOBIL'S PRACTICES

MOBIL REFINERY
JOLIET, ILLINOIS

BAT REQUIREMENT	MOBIL'S PRACTICE
Sour Water Stripper (SWS) sulfur and ammonia minimum removal efficiency equal to 85%	15 MBBL/day at 99.5% efficiency
In-Plant Water Reuse	SWS effluent directed to Desalter SWS effluent directed to Fluid Catalytic Cracker
Flow Equalization	Primary Equalization - 4.2 million gallons (TK 103) Secondary Equalization - 5.8 million gallons (EBTU) Wet Weather Diversion Basin - 1.6 million gallons
Oil and Solids Separation	Dual Channel Preseparator Flume Dual Channel API Separator
Additional Oil and Solids Separation	Dual Channel Dissolved Air Flotation
Biological Treatment	Two 900,000 gallon Aeration Basins Two 500,000 gallon Clarifiers
Final Polishing	One 4.9 million gallon Guard Basin for Treated Process Water One 5.8 million gallon Uncontaminated Storm Water Impoundment Basin

TABLE 4
COMPARISON OF EFFLUENT (1996) WITH BAT EFFLUENT GUIDELINES

WASTEWATER TREATMENT PLANT
MOBIL REFINERY
JOLIET, ILLINOIS

Parameter	Units	BAT Limit (30-day Average)[1]	Mobil WWTP Discharge[2]
BOD_5	lb/day	1,846	205
COD	lb/day	12,886	3,098
NH_3-N	lb/day	1,007	89
Phenolics	lb/day	12.1	0.16
Oil & Grease	lb/day	537	52
TSS	lb/day	1,477	456
Sulfide	lb/day	9.7	0.4
Flow	gpm	5,200[3]	1,900

Notes:

[1] Calculations made according to 40 CFR 419—using 200,000 bbl/day, size factor = 1.41, and process factor = 1.19.

[2] Calculations made using average Outfall 001 effluent concentrations for 1996 and 1,900 gpm.

[3] Represents BAT flow for refinery of similar size.

CERTIFICATE OF SERVICE

I, DAVID L. RIESER, an attorney, hereby certify that on June 23, 1997, I caused copies of the foregoing **TESTIMONY OF LILLIANA GACHICH, JAMES E. HUFF AND JOHN H. KOON** to be served upon:

Ms. Dorothy Gunn
Clerk
Pollution Control Board
100 West Randolph, Suite 11-500

Margaret P. Howard, Esq.
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62794