CHAPTER 2. EFFLUENT QUALITY

Leslie A. Sidio

I. INTRODUCTION

The goal of the Hyperion Treatment Plant (HTP) effluent monitoring program is to characterize the physical and chemical properties of treated wastewater discharged into Santa Monica Bay. The effluent monitoring data, in conjunction with receiving water monitoring data are used to assess the effects of effluent disposal on the physical, chemical, and biological aspects of the receiving waters. HTP's National Pollutant Discharge Elimination System (NPDES) permit provides guidelines referred to as Ocean Discharge Criteria to prevent the discharges of chemicals that could cause degradation of the local marine environment and marine recreational areas.

HTP has a design capacity of 450 million gallons per day (MGD), and receives wastewater from the Los Angeles area and excess flow from the San Fernando Valley. The plant also receives solids from primary and secondary treatment processes from the Donald C. Tillman and Los Angeles-Glendale Water Reclamation Plants. The solids from these upstream plants are discharged to the sewer lines transporting wastewater to HTP. Most of the sewage treated at Hyperion is domestic in nature. Approximately, 21% of the wastewater flow is from industrial/commercial discharge.

During the period from January 2001 through December 2002, HTP discharged an average of 317 MGD of treated wastewater into Santa Monica Bay through the 5-Mile Outfall. The effluent released had received complete secondary treatment. In November 1998, Hyperion Treatment Plant began discharging effluent that underwent full secondary treatment, whereas previously it had been discharging a mixture of advanced primary treated effluent and secondary treated effluent. Upon release from the 5-Mile Outfall into the Bay, the effluent, by design, is diluted a minimum of 84:1 in the zone of initial dilution (ZID).

This chapter reports the concentrations of the HTP effluent constituents from January 2001 through December 2002 and summarizes trends in effluent quality from 1986 to 2002. Table 2-1 lists constituents measured in the 5-Mile effluent under HTP's NPDES effluent monitoring program. Data for this reporting period is divided into separate tables for each year when necessary. Compounds listed in Tables 2-2a & 2-2b are grouped into three categories: 1) conventional constituents and nutrients, 2) inorganic priority pollutants, and 3) organic priority pollutants. Data pertaining to residual chlorine, radioactivity, effluent toxicity, and others are discussed individually. All of these categories are discussed below in terms of contaminants found and their concentrations in effluent relative to current NPDES permit limits and Ocean Plan objectives (SWRCB 1990). Assessment of bacterial data associated with effluent monitoring is discussed in Chapter 3 of this report.

II. MATERIALS AND METHODS

A. SAMPLE COLLECTION

Representative 5-Mile effluent samples were collected from the effluent-pumping plant wet-well. During the period from January 2001 through December 2002, the Hyperion Treatment Plant received influents from the five outfall sewers: North, North Central, Central, Coastal Water, and North Outfall Replacement (NOS, NCOS, COS, CWIS and NORS, respectively). Representative influent samples from these sewer outfalls were collected at sampling points located upstream of any in-plant return flows. Influent samples were collected with a programmed automatic sampler and the effluent was collected manually.

Monitoring of the HTP's individual five influent sewers resumed during this reporting period after a four year cessation. In 1998, it was decided to combine four of the influents (NOS, NCOS, NORS, and CWIS) together into one flow proportionate composite, and the fifth, COS, remained an individual composite. Although this sampling scheme resulted in a major workload reduction and savings in the cost of analysis, it was cancelled in October of 2002 in order to individually monitor plant influent loadings.

With the exception of oil and grease (O&G), cyanide, phenols (total), and volatile organic compounds (VOC's), analyses of all constituents listed in Tables 2-1a & b and 2-2a & b were performed on 24-hr composite samples. The 5-Mile effluent samples were collected hourly whereas influent samples were collected every two hours. These hourly or bi-hourly samples were composited in proportion to established diurnal flow data of the daily 24-hour collection period.

Cyanide and phenol (total) analyses were performed on grab samples collected at respective analyte peak loading hours. Analyte peak loading hours were based on previous diurnal studies.

Three grab samples were collected for O&G analyses, one at peak flow, and the other two, eight hours before and after. Solvent extracts from individual grabs were combined in proportion to flow and analysis continued on the extract composite.

Three grab samples for VOC analyses were also collected at eight-hour intervals, the middle grab at effluent peak flow. However, in accordance with the NPDES permit requirement, these grabs were first composited into a single sample in proportion to flow and then analyzed.

Samples for O&G and organics analyses were collected in glass bottles. All other samples were collected in plastic bottles. Samples for VOC's were collected in amber glass bottles with Teflon® lined screw caps, and with no headspace remaining after collection. Samples were preserved and stored as detailed in Standard Methods (APHA, 1992).

B. LABORATORY ANALYSIS

All samples were analyzed according to Environmental Laboratory Accreditation Program (ELAP) approved procedures while under ELAP accreditation. Specific methods used for individual analyte measurements are listed in Table 2-1.

Table 2-1. Constituents measured in the 5-Mile Effluent Monitoring Program.

Constituent	Units of Analysis	Frequency of Analysis	Sample Type	Method*
BOD	mg/L	daily	24-hour composite	5210B
Oil & Grease	mg/L	weekly	3 grab samples	EPA 1664
Total Organic Carbon	mg/L	weekly	24-hour composite	5310B
Suspended Solids	mg/L	daily	24-hour composite	2540D
Fecal Coliforms	#/100mL	5 times/month	grab	9222D
Total Coliforms	#/100mL	daily	grab	9222D
Enterococcus	CFU	daily	grab	9230C
Settleable Solids	mL/L	daily	grab & composite	2540F
Turbidity	NTU	weekly	24-hour composite	2130B
Dissolved Oxygen	mg/L	weekly	grab	4500-O C
Total Chlorine Residual	ug/L	daily	grab	4500-Cl C
Toxicity Concentration (Acute)	TU_a	monthly	24-hour composite	**
Toxicity Concentration (Chronic)	TU_c	monthly	24-hour composite	**
Radioactivity	pCi/mL	twice/month	24-hour composite	EPA9310
Nitrate-Nitrogen	µg/L	monthly	24-hour composite	4500-NO3-E
Ammonia-Nitrogen	µg/L	monthly	24-hour composite	4500-NH3-B&E
Floating particulates	mg/L	monthly	24-hour composite	2530 B
Flow	MGD	continuous	recorder/totalizer	
Temperature	°C	twice daily	grab	
pH	pH units	daily	24-hour composite	4600-H+
Arsenic	µg/L	monthly	24-hour composite	3030G, 3114B
Cadmium	µg/L	monthly	24-hour composite	3030H, 3120B
Chromium (hexavalent)	µg/L	monthly	24-hour composite	3500-Cr D, 3030G
Chromium (total)	µg/L	quarterly	24-hour composite	3030H, 3120B
Copper	µg/L	monthly	24-hour composite	3030H, 3120B
Lead	µg/L	monthly	24-hour composite	3030H, 3113B
Mercury	µg/L	monthly	24-hour composite	3030G, 3112B
Nickel	µg/L	monthly	24-hour composite	3030H, 3120B
Selenium	µg/L	monthly	24-hour composite	3030G, 3114B
Silver	µg/L	monthly	24-hour composite	3030H, 3113B
Zinc	µg/L	monthly	24-hour composite	3030H, 3120B
Tributyltin	ng/L	quarterly	24-hour composite	
Cyanide	µg/L	monthly	grab	EPA 335.2
Organic Nitrogen	µg/L	monthly	24-hour composite	4500-N-ORG
Total Phosphorus (as P)	µg/L	monthly	24-hour composite	4500-P E
Phenolic Compounds (non-chlorinated)	µg/L	monthly	grab	EPA 625
Chlorinated Phenolics	µg/L	monthly	24-hour composite	EPA 625
Aldrin and Dieldrin	µg/L	monthly	24-hour composite	EPA 608
Chlordane and Related compounds	µg/L	monthly	24-hour composite	EPA 608
DDT and Derivatives	µg/L	monthly	24-hour composite	EPA 608
Endrin	µg/L	monthly	24-hour composite	EPA 608
HCH	µg/L	monthly	24-hour composite	EPA 608
PCB's	µg/L	monthly	24-hour composite	EPA 608
Toxaphene	µg/L	monthly	24-hour composite	EPA 608
Detected Priority Pollutants				
Volatiles	µg/L	monthly	3 grab samples	EPA 624
Others	µg/L	monthly	24-hour composite	***
Remaining Priority Pollutants				
Volatiles	µg/L	monthly	3 grab samples	EPA 624
Others	µg/L	quarterly	24-hour composite	***

* All methods are from Standard Methods, 18th Edition (APHA 1992) unless otherwise specified.
** Acute toxicity is measured as described under EPA/600/4-85/013. Chronic toxicity is measured using EPA methods 600/4-87/028 and Anderson (90-10WQ) Marine Bioassay Project.
*** Chlorinated pesticides and base/neutral/acid extractable compounds are analyzed by EPA Method 608 and 625, respectively.

III. RESULTS AND DISCUSSION

A. CONVENTIONAL CONSTITUENTS AND NUTRIENTS

1. TSS, BOD, O&G and Settleable Solids

The main objective in the treatment of wastewater is the removal of suspended and floatable materials and the treatment of biodegradable organics (Metcalf & Eddy 1979). The discharge of materials with high total suspended solids (TSS), biochemical oxygen demand (BOD), and O&G can cause degradation of the receiving environment through eutrophication and the introduction of toxic materials (Morel and Schiff 1983; p. 103).

HTP discharge limits for TSS, BOD, and O&G are 30, 30, and 25 mg/L, respectively. Since November 23, 1998, when Hyperion went to full secondary treatment, all the NPDES limits for TSS, BOD, and O&G have been met.

The quality of HTP's effluent has been well within the interim NPDES limits for TSS and O&G since 1986 and for BOD since 1987 (Figure 2-1). Additionally, Hyperion's effluent has been well within the current NPDES limits for TSS, O&G, and BOD since the completion of the secondary treatment expansion. The trend of improved effluent quality resulted from implementation of a series of projects under the Hyperion Interim Improvement Program (HIIP). HIIP was conceived in early 1986 in an effort to produce the highest quality effluent possible until full secondary treatment came on-line in 1998. Under the program, the plant achieved an average of approximately 91% removal of TSS and 75% removal of BOD. These improvements (since fiscal year 1988-89) have consistently resulted in the best effluent quality ever achieved at HTP (Figure 2-1). Immediate reductions in BOD, TSS and O&G were seen in December 1998 due to the switch to full secondary treatment in November (Figure 2-1).

Table 2-3 illustrates maximum, minimum, and average concentrations of TSS, BOD, O&G, and settleable solids in the plant's influent and effluent during January 2001 to December 2002. During this period, removal efficiencies for these constituents were consistently high. On average, 96% of TSS, 95% of BOD, 96% of O&G, and 99% of settleable solids were removed from the wastewater treated at HTP.

During the period from January 2001 to December 2002, TSS, BOD, O&G, and settleable solids averaged approximately 16,15,1 mg/L, and <0.1 mL/L, respectively, in the 5-Mile effluent (Table 2-3). This is still an improvement over the last reporting period's performance, where the averages were 18, 23, 4 mg/L, and 0.1 mL/L, respectively. Concentrations of these four constituents were well below the new NPDES permit limits (Table 2-2a and b) for full secondary treatment, and were in full compliance.

Table 2-2a. Average, maximum, and minimum concentrations of conventional constituents and other pollutants in the 5-Mile effluent (*January 2001 to December 2001*). All concentrations are reported in µg/L unless otherwise noted.

Constituents	Current NPDES Limits[a]	Concentrations in 5-Mile Effluent Avg.	Max.	Min.	Concentrations After Initial Dilution[b] Avg.	Max.	Min.	CA Ocean Plan (ug/L) Objectives[c]
CONVENTIONAL CONSTITUENTS AND NUTRIENTS								
Total Suspended Solids (mg/L)	30 (60)*	16	27	10	0.19	0.32	0.12	
Biochemical Oxygen Demand (mg/L)	30 (175)*	15e	25	7	0.18	0.29	0.08	
Oil & Grease (mg/L)	25 (25)*	2e	8	ND	0.02	0.09	ND	25
Settleable Solids (mL/L)	1.0 (1.5)*	ND	3.0	ND	ND	0.035	ND	1.0
Total Organic Carbon (mg/L)	NL	24	68	15	0.28	0.80	0.18	
Phosphorus (Total) (mg/L)	NL	2.8	3.2	2.3	0.033	0.038	0.027	
Ammonia-Nitrogen (mg/L)	51	31.2	34.4	27.8	0.37	0.40	0.33	0.6
Organic-Nitrogen (mg/L)	NL	2.74	3.20	2.00	0.032	0.038	0.024	
Nitrate-Nitrogen (mg/L)	NL	0.28	0.50	0.11	0.003	0.006	0.001	
Turbidity (NTU)	75	7	11	4	0.082	0.129	0.047	75
pH	6.0-9.0	6.8	7.2	6.6	d	d	d	
PRIORITY POLLUTANT INORGANICS:								
Antimony	NL	ND	10	ND	ND	0.12	ND	1200
Arsenic	12	2.3	4.6	ND	0.027	0.054	ND	8
Beryllium	2.8	ND	ND	ND	ND	ND	ND	0.033
Cadmium	21	ND	ND	ND	ND	ND	ND	1
Chromium (hexavalent)[e]	113	ND	ND	ND	ND	ND	ND	2
Chromium (total)	NL	ND	12.6	ND	ND	0.15	ND	190000[f]
Copper	87	15	35	ND	0.18	0.41	ND	3
Lead	101	ND	5	ND	ND	0.059	ND	2
Mercury	1.1	ND	0.3	ND	ND	0.004	ND	0.04
Nickel	113	ND	23	ND	ND	0.271	ND	5
Selenium	1275	1.3	3.7	ND	0.015	0.044	ND	15
Silver	26	ND	2.4	ND	ND	0.028	ND	0.7
Thallium	1190	ND	5	ND	ND	0.059	ND	2
Zinc	346	26	43	ND	0.306	0.506	ND	20
Tributyltin(ng/L)	119	9	28	ND	0.106	0.329	ND	1.4
Cyanide	85	5	16	ND	0.059	0.188	ND	1
PRIORITY POLLUTANT ORGANICS:								
PESTICIDES:								
Aldrin	0.002	ND	ND	ND	ND	ND	ND	0.022 ng/L
Dieldrin	0.004	ND	ND	ND	ND	ND	ND	0.040 ng/L
Endrin	0.17	ND	ND	ND	ND	ND	ND	0.002
Toxaphene	0.018	ND	ND	ND	ND	ND	ND	0.210 ng/L
DDT & Derivates (ng/L)	14	ND	ND	ND	ND	ND	ND	0.17
HCH's	0.34	8	31	ND	0.094	0.365	ND	0.004
Endosulfan	0.765	ND	ND	ND	ND	ND	ND	0.009
PCB's	0.002	ND	ND	ND	ND	ND	ND	0.019 ng/L
Chlordane & Related Compounds	0.0019	ND	ND	ND	ND	ND	ND	0.023 ng/L
Heptachlor	0.061[g]	ND	ND	ND	ND	ND	ND	0.05ng/L
Heptachor Epoxide	NL	ND	ND	ND	ND	ND	ND	0.02ng/L
VOLATILE ORGANIC COMPOUNDS:								
Acrolein	18700	ND	ND	ND	ND	ND	ND	220
Acrylonitrile	9	ND	ND	ND	ND	ND	ND	0.10
Benzene	NL	ND	ND	ND	ND	ND	ND	5.9
Halomethanes	NL	3.43	4.65	2.38	0.040	0.055	0.028	130
Carbon tetrachloride	76	ND	ND	ND	ND	ND	ND	0.9
Chlorobenzene	NL	ND	ND	ND	ND	ND	ND	570
Chloroform	NL	5.52	6.19	5.02	0.065	0.073	0.059	130

Table 2-2a(cont.)

Constituents	Current NPDES Limits[a]	Concentrations in 5-Mile Effluent Avg.	Max.	Min.	Concentrations After Initial Dilution[b] Avg.	Max.	Min.	CA Ocean Plan (ug/L) Objectives[c]
Vinyl Chloride	NL	ND	ND	ND	ND	ND	ND	36
1,3-Dichloropropene	NL	ND	ND	ND	ND	ND	ND	8.9
Ethylbenzene	NL	ND	ND	ND	ND	ND	ND	4100
Methylene chloride	NL	8.68	18.1	2.85	0.102	0.213	0.034	450
1,1,2,2-Tetrachloroethane	NL	ND	ND	ND	ND	ND	ND	2.3
Tetrachloroethene	NL	2.40	3.65	1.44	0.028	0.043	0.017	2.0
Toluene	NL	0.14	0.23	ND	0.002	0.003	ND	85000
1,1,1-Trichloroethane	NL	ND	ND	ND	ND	ND	ND	540000
1,1,2-Trichloroethane	NL	ND	ND	ND	ND	ND	ND	9.4
Trichloroethene	NL	ND	ND	ND	ND	ND	ND	27
1,1-Dichloroethylene	NL	ND	ND	ND	ND	ND	ND	0.9
1,2-Dichloroethane	NL	ND	ND	ND	ND	ND	ND	28
Dichlorobromomethane	NL	1.350	1.672	0.921	0.016	0.020	0.011	6.2
Chlorodibromomethane	NL	1.547	2.263	0.995	0.018	0.027	0.012	8.6
ACID EXTRACTABLE COMPOUNDS:								
Non-Chlorinated Phenolic Compounds	NL	ND	ND	ND	ND	ND	ND	30
2,4-Dinitrophenol	340	ND	ND	ND	ND	ND	ND	4.0
4,6-Dinitro-2-Methyl Phenol	NL	ND	ND	ND	ND	ND	ND	220
Chlorinated Phenolic Compounds	85	0.047	0.187	ND	0.001	0.002	ND	1
2,4,6-Trichlorophenol	25	ND	ND	ND	ND	ND	ND	0.29
BASE AND NEUTRAL EXTRACTABLE COMPOUNDS:								
PAHs	0.748	ND	ND	ND	ND	ND	ND	8.8 ng/L
Fluoranthene	1270	ND	ND	ND	ND	ND	ND	15
Benzidine	0.006	ND	ND	ND	ND	ND	ND	0.069 ng/L
Bis (2-chloroethyl) ether	4	ND	ND	ND	ND	ND	ND	0.045
Bis (2-chloroethoxy) methane	374	ND	ND	ND	ND	ND	ND	4.4
Bis (2-chloroisopropyl) ether	NL	ND	ND	ND	ND	ND	ND	1200
Bis (2-ethylhexyl) phthalate	297	ND	3.9	ND	ND	0.046	ND	3.5
Di-n-butyl phthalate	NL	ND	ND	ND	ND	ND	ND	3500
1,4-Dichlorobenzene	NL	ND	1.67	ND	ND	0.020	ND	18
3,3-Dichlorobenzidine	0.688	ND	ND	ND	ND	ND	ND	0.0081
Diethyl phthalate	NL	ND	ND	ND	ND	ND	ND	33000
Dimethyl phthalate	NL	ND	ND	ND	ND	ND	ND	820000
2,4-Dinitrotoluene	221	ND	ND	ND	ND	ND	ND	2.6
Hexachlorobenzene	0.018	ND	ND	ND	ND	ND	ND	0.21 ng/L
Hexachlorobutadiene	NL	ND	ND	ND	ND	ND	ND	14
Hexachlorocyclopentadiene	4930	ND	ND	ND	ND	ND	ND	58
Isophorone	NL	ND	ND	ND	ND	ND	ND	730
Nitrobenzene	416	ND	ND	ND	ND	ND	ND	4.9
N-Nitrosodimethylamine	620	ND	ND	ND	ND	ND	ND	7.3
N-Nitrosodiphenylamine	212	ND	ND	ND	ND	ND	ND	2.5
N-Nitrosodi-N-propylamine	NL	ND	ND	ND	ND	ND	ND	0.38
Hexachloroethane	212	ND	ND	ND	ND	ND	ND	2.5
1,2-Diphenylhydrazine[h]	14	ND	ND	ND	ND	ND	ND	0.16
Dichlorobenzenes[i]	NL	ND	ND	ND	ND	ND	ND	5100
OTHERS:								
2,3,7,8-Dioxin**	0.4 pg/L	ND	ND	ND	ND	ND	ND	0.0039 pg/L
Residual Chlorine (mg/L)	0.17	ND	0.2	ND	ND	0.002	ND	0.002

a TSS, BOD, O&G and settleable solids limit based on 30-day average concentration. All others are based on monthly average concentration.
b Calculated values based on a minimum initial dilution of 84 parts seawater + effluent to 1 part effluent.
c For O&G and settleable solids based on 30-day avg. concentration. All others are based either on 30-day avg. or 6-month median.
d Not applicable: The concept of dilutions does not apply to pH measurements.
e Not listed as priority pollutants.
f as Chromium (III)
g "Heptachlor" means the sum of heptachlor and heptachlor epoxide.
h as Azobenzene
i "Dichlorobenzenes" mean the sum of 1,2- and 1,3-dichlorobenzene
* Values in parentheses represent prior discharge limits under the consent decree for Hyperion (1987-1999).
** Dioxin is analyzed by Severn Trent Laboratories, Carol Stream Ill.

MDL = Method Detection Limit; NL = Not Listed; NA = Not Available; ND = Not Detected; DNQ=Detected but Not Quantified
A lower case "e" after a numerical value denotes the numerical value as an estimate.

Table 2-2b. Average, maximum, and minimum concentrations of conventional constituents and other pollutants in the 5-Mile effluent (*January 2002 to December 2002*). All concentrations are reported in µg/L unless otherwise noted.

Constituents	Current NPDES Limits[a]	Concentrations in 5-Mile .Effluent Avg.	Max.	Min.	Concentrations After Initial Dilution[b] Avg.	Max.	Min.	CA Ocean Plan (ug/L) Objectives[c]
CONVENTIONAL CONSTITUENTS AND NUTRIENTS								
Total Suspended Solids (mg/L)	30 (60)*	17.5	32.0	6.0	0.206	0.376	0.071	
Biochemical Oxygen Demand (mg/L)	30 (175)*	16e	26	8	0.188	0.306	0.094	
Oil & Grease (mg/L)	25 (25)*	ND	4.0	ND	ND	0.047	ND	25
Settleable Solids (mL/L)	1.0 (1.5)*	ND	ND	ND	ND	ND	ND	1.0
Total Organic Carbon (mg/L)	NL	22	37	13	0.259	0.435	0.153	
Phosphorus (Total) (mg/L)	NL	2.60	3.48	1.92	0.031	0.041	0.023	
Ammonia-Nitrogen (mg/L)	51	32.5	36.1	29.8	0.382	0.425	0.351	0.6
Organic-Nitrogen (mg/L)	NL	3.21	4.20	1.95	0.038	0.049	0.023	
Nitrate-Nitrogen (mg/L)	NL	0.10	0.27	0.03	0.001	0.003	0.0004	
Turbidity (NTU)	75	8	15	3	0.094	0.176	0.035	75
pH	6.0-9.0	6.7	7.0	6.4	d	d	d	
PRIORITY POLLUTANT INORGANICS:								
Antimony	NL	ND	ND	ND	ND	ND	ND	1200
Arsenic	12	3	4	1	0.035	0.047	0.012	8
Beryllium	2.8	ND	ND	ND	ND	ND	ND	0.033
Cadmium	21	ND	ND	ND	ND	ND	ND	1
Chromium (hexavalent)[e]	113	ND	ND	ND	ND	ND	ND	2
Chromium (total)	NL	1	3	ND	0.012	0.035	ND	190000[f]
Copper	87	12	27	4	0.141	0.318	0.047	3
Lead	101	3	11	ND	0.035	0.129	ND	2
Mercury	1.1	0.02	0.08	ND	0.0002	0.001	ND	0.04
Nickel	113	9	33	ND	0.106	0.388	ND	5
Selenium	1275	1	2	ND	0.012	0.024	ND	15
Silver	26	0.5	3.7	ND	0.006	0.044	ND	0.7
Thallium	1190	ND	ND	ND	ND	ND	ND	2
Zinc	346	11	26	ND	0.129	0.306	ND	20
Tributyltin(ng/L)	119	ND	ND	ND	ND	ND	ND	1.4
Cyanide	85	3	8	ND	0.035	0.094	ND	1
PRIORITY POLLUTANT ORGANICS:								
PESTICIDES:								
Aldrin	0.002	ND	ND	ND	ND	ND	ND	0.022 ng/L
Dieldrin	0.004	ND	ND	ND	ND	ND	ND	0.040 ng/L
Endrin	0.17	ND	ND	ND	ND	ND	ND	0.002
Toxaphene	0.018	ND	ND	ND	ND	ND	ND	0.210 ng/L
DDT & Derivates (ng/L)	14	ND	ND	ND	ND	ND	ND	0.17
HCH's	0.34	1	5	ND	0.012	0.059	ND	0.004
Endosulfan	0.765	ND	ND	ND	ND	ND	ND.	0.009
PCB's	0.002	ND	ND	ND	ND	ND	ND	0.019 ng/L
Chlordane & Related Compounds	0.0019	ND	ND	ND	ND	ND	ND	0.023 ng/L
Heptachlor	0.061[g]	ND	ND	ND	ND	ND	ND	0.05ng/L
Heptachlor Epoxide	NL	ND	ND	ND	ND	ND	ND	0.02ng/L
VOLATILE ORGANIC COMPOUNDS:								
Acrolein	18700	ND	ND	ND	ND	ND	ND	220
Acrylonitrile	9	ND	ND	ND	ND	ND	ND	0.10
Benzene	NL	ND	ND	ND	ND	ND	ND	5.9
Halomethanes	NL	4.94	7.98	2.94	0.058	0.094	0.035	130
Carbon tetrachloride	76	ND	ND	ND	ND	ND	ND	0.9
Chlorobenzene	NL	ND	ND	ND	ND	ND	ND	570
Chloroform	NL	5.08	5.76	4.59	0.060	0.068	0.054	130

Table 2-2b (cont.)

Constituents	Current NPDES Limits[a]	Concentrations in 5-Mile Effluent Avg.	Max.	Min.	Concentrations After Initial Dilution[b] Avg.	Max.	Min.	CA Ocean Plan (ug/L) Objectives[c]
Vinyl Chloride	NL	ND	ND	ND	ND	ND	ND	36
1,3-Dichloropropene	NL	ND	ND	ND	ND	ND	ND	8.9
Ethylbenzene	NL	ND	ND	ND	ND	ND	ND	4100
Methylene chloride	NL	8.8	23.2	2.16	0.104	0.273	0.025	450
1,1,2,2-Tetrachloroethane	NL	ND	ND	ND	ND	ND	ND	2.3
Tetrachloroethene	NL	1.83	4.17	0.80	0.022	0.049	0.009	2.0
Toluene	NL	ND	0.176	ND	ND	0.002	ND	85000
1,1,1-Trichloroethane	NL	ND	ND	ND	ND	ND	ND	540000
1,1,2-Trichloroethane	NL	ND	ND	ND	ND	ND	ND	9.4
Trichloroethene	NL	ND	ND	ND	ND	ND	ND	27
1,1-Dichloroethylene	NL	ND	ND	ND	ND	ND	ND	0.9
1,2-Dichloroethane	NL	ND	ND	ND	ND	ND	ND	28
Dichlorobromomethane	NL	1.284	1.639	1.080	0.015	0.019	0.013	6.2
ChloroDibromomethane	NL	2.052	2.976	1.260	0.024	0.035	0.015	8.6
ACID EXTRACTABLE COMPOUNDS:								
Non-Chlorinated Phenolic Compounds	NL	ND	ND	ND	ND	ND	ND	30
2,4-Dinitrophenol	340	ND	ND	ND	ND	ND	ND	4.0
4,6-Dinitro-2-Methyl Phenol	NL	ND	ND	ND	ND	ND	ND	220
Chlorinated Phenolic Compounds	85	ND	ND	ND	ND	ND	ND	1
2,4,6-Trichlorophenol	25	ND	ND	ND	ND	ND	ND	0.29
BASE AND NEUTRAL EXTRACTABLE COMPOUNDS:								
PAHs	0.748	ND	ND	ND	ND	ND	ND	8.8 ng/L
Fluoranthene	1270	ND	ND	ND	ND	ND	ND	15
Benzidine	0.006	ND	ND	ND	ND	ND	ND	0.069 ng/L
Bis (2-chloroethyl) ether	4	ND	ND	ND	ND	ND	ND	0.045
Bis (2-chloroethoxy) methane	374	ND	ND	ND	ND	ND	ND	4.4
Bis (2-chloroisopropyl) ether	NL	ND	ND	ND	ND	ND	ND	1200
Bis (2-ethylhexyl) phthalate	297	ND	3.0	ND	ND	0.035	ND	3.5
Di-n-butyl phthalate	NL	ND	ND	ND	ND	ND	ND	3500
1,4-Dichlorobenzene	NL	1.0	2.3	ND	0.012	0.027	ND	18
3,3-Dichlorobenzidine	0.688	ND	ND	ND	ND	ND	ND	0.0081
Diethyl phthalate	NL	ND	ND	ND	ND	ND	ND	33000
Dimethyl phthalate	NL	ND	ND	ND	ND	ND	ND	820000
2,4-Dinitrotoluene	221	ND	ND	ND	ND	ND	ND	2.6
Hexachlorobenzene	0.018	ND	ND	ND	ND	ND	ND	0.21 ng/L
Hexachlorobutadiene	NL	ND	ND	ND	ND	ND	ND	14
Hexachlorocyclopentadiene	4930	ND	ND	ND	ND	ND	ND	58
Isophorone	NL	ND	ND	ND	ND	ND	ND	730
Nitrobenzene	416	ND	ND	ND	ND	ND	ND	4.9
N-Nitrosodimethylamine	620	ND	ND	ND	ND	ND	ND	7.3
N-Nitrosodiphenylamine	212	ND	ND	ND	ND	ND	ND	2.5
N-Nitrosodi-N-propylamine	NL	ND	ND	ND	ND	ND	ND	0.38
Hexachloroethane	212	ND	ND	ND	ND	ND	ND	2.5
1,2-Diphenylhydrazine[h]	14	ND	ND	ND	ND	ND	ND	0.16
Dichlorobenzenes[i]	NL	ND	ND	ND	ND	ND	ND	5100
OTHERS:								
2,3,7,8-Dioxin**	0.4 pg/L	ND	ND	ND	ND	ND	ND	0.0039 pg/L
Residual Chlorine (mg/L)	0.17	ND	ND	ND	ND	ND	ND	0.002

a TSS, BOD, O&G and settleable solids limit based on 30-day average concentration. All others are based on monthly average concentration.
b Calculated values based on a minimum initial dilution of 84 parts seawater + 1 part effluent.
c For O&G and settleable solids based on 30-day avg. concentration. All others are based either on 30-day avg. or 6-month median.
d Not applicable: The concept of dilutions does not apply to pH measurements.
e Not listed as priority pollutants.
f as Chromium (III)
g "Heptachlor" means the sum of heptachlor and heptachlor epoxide
h as Azobenzene
i "Dichlorobenzenes" mean the sum of 1,2- and 1,3-dichlorobenzene
* Values in parentheses represent prior discharge limits under the consent decree for Hyperion (1987-1999).
** Dioxin is analyzed by Severn Trent Laboratories, Carol Stream Ill.
MDL = Method Detection Limit; NL = Not Listed; NA = Not Available; ND = Not Detected; DNQ=Detected but Not Quantified
A lower case "e" after a numerical value denotes the numerical value as an estimate.

Figure 2-1. Average Concentrations of Total Suspended Solids, Biochemical Oxygen Demand, and Oil and Grease in 5-Mile effluent from fiscal years 1986-87 through 2001-2002.

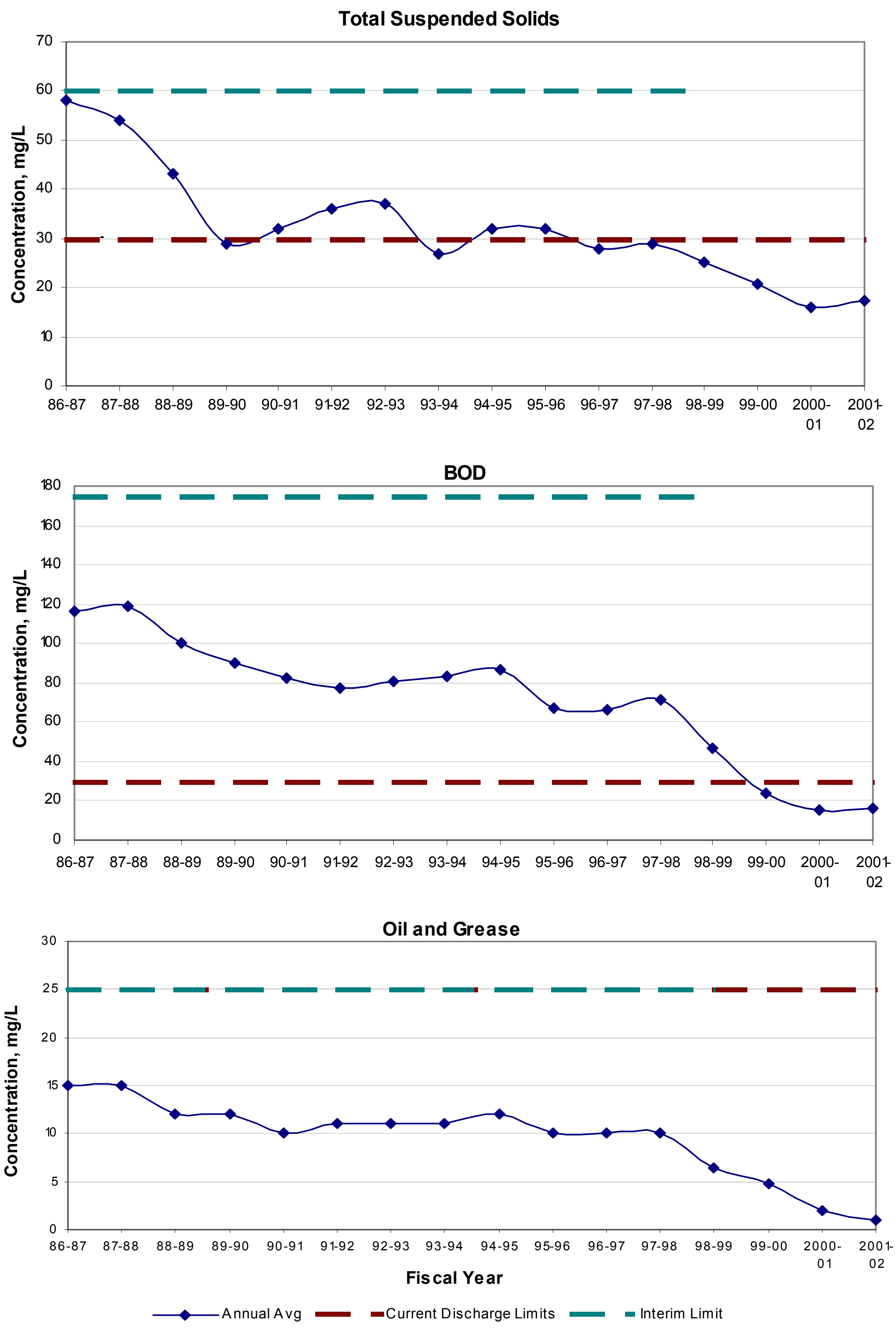


Table 2-3. Average, maximum, and minimum monthly averages of total suspended solids (TSS), Biochemical Oxygen Demand (BOD), oil & grease (O&G), and settleable solids in plant influent and 5-Mile effluent during January 2001 to December 2001 and January 2002 to December 2002.

Conc.		TSS			BOD		
		Influent mg/L	**5 Mile mg/L**	**% Removal**	**Influent mg/L**	**5 Mile mg/L**	**% Removal**
Avg.	2001	371	16	95.7	>279	15e	94.6
	2002	440e	17.5	95.9	361e	16e	95.6
Max.	2001	1595	27		>480	25	
	2002	1409e	32		836	26	
Min	2001	317	10		240	7.0	
	2002	376	6.0		310e	8.0	
Conc.		**O & G**			**Settleable Solids**		
		Influent mg/L	**5 Mile mg/L**	**% Removal**	**Influent mL/L**	**5 Mile mL/L**	**% Removal**
Avg.	2001	50	2e	96.0	20.3	<0.1	>99.5
	2002	63e	ND	>98.0	22.4	<0.1	>99.5
Max.	2001	87	8.0		22.0	3.0	
	2002	217	4.0		31.6	<0.1	
Min	2001	40	ND		18.1	<0.1	
	2002	52	ND		19.1	<0.1	

Effluent settleable solids concentrations during the years 2001 and 2002 had monthly averages of <0.1 mL/L, with resulting overall annual averages of <0.1mL/L, which is well below the permit limit (Table 2-2a ,b). For several months during the 2002 calendar year, influent to the plant had higher than normal solids that precipitated efforts in treatment remediation needed to maintain effluent quality. It is noteworthy that although the plant experienced an increased and lengthy treatment burden, there were no permit exceedances for any monitoring constituents or any measurable reduction in effluent quality.

Upon release from the 5-Mile Outfall, the effluent is diluted 84:1 within the Zone of Initial Dilution (ZID). For example, calculated concentrations of these contaminants in the receiving water after initial mixing varied between 0.071 to 0.37 mg/L for TSS, 0.08 to 0.031 mg/L for BOD, and 0.01 to 0.09 mg/L for O&G during the years 2001 and 2002 (Table 2-2a, b).

In calendar years 2001-2002, HTP effluent was in complete compliance with all the limitations for all effluent constituents.

2. Nutrients

Nutrients, mainly nitrogen, enter the Bay from a variety of natural and anthropogenic sources and are essential for survival of phytoplankton. However, if nutrient inputs are excessive, phytoplankton and algal blooms can produce excessive biomass, resulting in eutrophic conditions. For this reason, ocean discharges of nutrients are regulated. Regulation of ammonia-nitrogen is especially important because ammonia, particularly in its un-ionized form, is highly toxic to fish and other aquatic species.

Nutrient levels in the 5-Mile effluent averaged 2.7 mg/L for total phosphorus and 31.8 mg/L for ammonia-nitrogen in 2001-2002 (Table 2-2a, b). After an initial dilution of 84:1, concentrations of phosphorus and ammonia were calculated to be 0.03 mg/L and 0.38 mg/L respectively. Ammonia levels in 5-mile effluent have been slightly increasing in the last four years, believed to originate from the recently completed conversion of the anaerobic digesters from a mesophilic to a thermophilic process. Higher levels of ammonia-nitrogen occur in the digested sludge due to this process conversion. The water removed from the digested sludge, termed centrate, is returned for treatment at the primary stage of the process. It is anticipated that the ammonia increase will gradually level off further, since all digesters have converted over to thermophilic operation in late 2002, and a steady state should be obtained. Such an increase in ammonia should not impact the 5-Mile effluent's compliance with the discharge limit of 51 mg/L monthly average, though may encroach upon the plant's performance goal limit of 32mg/L. For ammonia, the 2001-2002 level was below the regulatory limits for ocean dischargers (Table 2-2a, b).

Concentrations of total phosphorus in Hyperion's influent were previously noted to have steadily declined, but appear now to have reached a steady-state range of 5-8 mg/L. Improved phosphorus removal was achieved through phosphorus precipitation by addition of iron salts (ferric and ferrous chloride) in the advanced primary treatment process and in the anaerobic digesters. On average, the plant achieved about 60% of phosphorus removal during 2001-2002. Total phosphorus in HTP's effluent has undergone a steady, gradual decline since the conversion to full secondary; this is notable in the annual averages though not readily apparent in the monthly averages.

B. PRIORITY POLLUTANT INORGANICS

1. Metals

During the 2001-2002 reporting period, four out of 13 priority pollutant metals as well as cyanide were *consistently* detected in both Hyperion's influent and effluent. The four metals were arsenic, copper, selenium, and zinc. Cadmium, total chromium, lead, silver, and mercury were consistently detected in the influent, but were mostly undetected or present in very low levels in the effluent (Table 2-4a, b). Antimony, beryllium, thallium, and hexavalent chromium were not detected in the influent or effluent (Table 2-2a, b). Concentrations of all detected metals were below NPDES limits and well below California Ocean Plan Standards (Table 2-2a,b).

The concentrations of most metals, except arsenic and selenium, in influent and effluent have declined significantly since 1986-87 (Table 2-5). Although the concentrations of arsenic were low, no significant changes were observed for arsenic during the period. The gradual decrease of arsenic in 5-mile effluent is concurrent with a decreasing concentration trend in the influent (Table 2-5), possibly the result of usage restrictions and/or source control. Arsenic is prevalent in ground water and present in the City of Los Angeles Department of Water and Power's water sources. This could explain the low but persistent presence of arsenic in the wastewater.

While the 2001 influent levels of priority pollutant metals were consistent with the historical downward trend, the 2002 influent levels reversed the trend and were higher than in previous years. Throughout 2002, elevated monthly averages were observed in the months having incidences of high influent loading. Most notably, arsenic, cadmium, lead, mercury, nickel, and selenium were undetected or not quantifiable (DNQ) throughout 2001 but in 2002, were elevated in the months of May through December.

Table 2-4a. Average, maximum, and minimum values of detected priority pollutant metals and cyanide (µg/L) in plant influent and 5-Mile effluent during January 2001 through December 2001.

Conc., µg/L	**As Influent**	**As 5-Mile**	**Cd Influent**	**Cd 5-Mile**	**Cr Influent**	**Cr 5-Mile**	**Cu Influent**	**Cu 5-Mile**
Avg.	3.8	2.3	2.6*	ND	ND	ND	179	15
Max.	7	4.6	16	ND	DNQ	13	554	35
Min.	ND	ND	ND	ND	ND	ND	113	ND
Conc., µg/L	**Pb Influent**	**Pb 5-Mile**	**Hg Influent**	**Hg 5-Mile**	**Ni Influent**	**Ni 5-Mile**	**Se Influent**	**Se 5-Mile**
Avg.	<9.7*	ND	ND	ND	24.6*	ND	<2.3*	1.3
Max.	DNQ	5	DNQ	0.3	DNQ	23	DNQ	3.7
Min.	ND	ND	ND	ND	ND	ND	ND	ND
Conc., µg/L			**Ag Influent**	**Ag 5-Mile**	**Zn Influent**	**Zn 5-Mile**	**CN^- Influent**	**CN^- 5-Mile**
Avg.			12	ND	218	26	DNQ	5
Max.			31	2.4	353	43	33	16
Min.			DNQ	ND	111	ND	ND	ND

* This average includes values reported as DNQ and/or <MDL. For the annual average, concentrations below detection limit were taken as zero.

Table 2-4b. Average, maximum, and minimum values of detected priority pollutant metals and cyanide (µg/L) in plant influent and 5-Mile effluent during January 2002 through December 2002.

Conc., µg/L	**As Influent**	**As 5-Mile**	**Cd Influent**	**Cd 5-Mile**	**Cr Influent**	**Cr 5-Mile**	**Cu Influent**	**Cu 5-Mile**
Avg.	5	3	1	ND	24	1	139	12
Max.	8	4	9	ND	104	3	163	27
Min.	3	1	ND	ND	ND	ND	112	4
Conc., µg/L	**Pb Influent**	**Pb 5-Mile**	**Hg Influent**	**Hg 5-Mile**	**Ni Influent**	**Ni 5-Mile**	**Se Influent**	**Se 5-Mile**
Avg.	13	3	0.1	0.02	28	9	2.8	1
Max.	41	11	0.3	0.08	102	33	8.2	2
Min.	7	ND	ND	ND	ND	ND	1.5	ND
Conc., µg/L			**Ag Influent**	**Ag 5-Mile**	**Zn Influent**	**Zn 5-Mile**	**CN^- Influent**	**CN^- 5-Mile**
Avg.			9.8	0.5	188	11	2	3
Max.			17.7	3.7	295	26	6	8
Min.			4.1	ND	129	13	ND	ND

Table 2-5. Concentrations (µg/L) of key metals in 5-Mile effluent and their removal efficiency for years 1986-87 through 2001-02.

Metal	Year	Influent Conc. (µg/L)	5-Mile Conc. (µg/L)	Percent Removal*
Arsenic	1986-87	11.2	7.6	32%
	1987-88	14.0	8.3	41%
	1988-89	10.6	6.8	36%
	1989-90	8.3	5.4	35%
	1990-91	6.2	4.0	36%
	1991-92	7.6	4.8	37%
	1992-93	7.3	5.1	30%
	1993-94	7.7	5.0	35%
	1994-95	7.9	5.2	34%
	1995-96	6.8	4.3	37%
	1996-97	4.9	3.2	35%
	1997-98	4.7	3.1	34%
	1998-99	3.6	2.4	33%
	1999-00	3.3	2.0	39%
	2001-02	4.4	2.6	40%
Chromium				
	1986-87	55.7	49.2	12%
	1987-88	56.9	21.0	63%
	1988-89	44.4	11.0	75%
	1989-90	38.1	6.3	84%
	1990-91	33.9	6.3	81%
	1991-92	23.5	4.0	83%
	1992-93	16.8	4.8	71%
	1993-94	16.9	3.0	82%
	1994-95	15.5	2.9	81%
	1995-96	17.8	4.2	76%
	1996-97	12.7	2.0	84%
	1997-98	16.2	3.0	82%
	1998-99	13.7	2.0	85%
	1999-00	13.5	0.5	96%
	2001-02	12‡	0.5‡	96%
Copper	1986-87	202.9	74.4	63%
	1987-88	157.2	50.9	68%
	1988-89	152.4	45.4	70%
	1989-90	139.9	36.7	74%
	1990-91	142.3	35.2	75%
	1991-92	150.8	36.3	76%
	1992-93	183.3	29.9	84%
	1993-94	145.4	34.1	76%
	1994-95	140.9	37.2	74%
	1995-96	152.2	37.8	75%
	1996-97	143.6	34.2	76%
	1997-98	140.3	31.6	78%
	1998-99	140.9	25.9	82%
	1999-00	127.7	10.9	91%
	2001-02	159.0	13.5	92%

* Based on calculation. ND = Not Detected
‡ Average calculated from values <MDL. Concentrations below detection Limit were taken as zero.

Table 2-5 (cont.)

Metal	Year	Influent Conc. (µg/L)	5-Mile Conc. (µg/L)	Percent Removal*
Lead	1986-87	74.3	37.5	50%
	1987-88	64.9	43.5	33%
	1988-89	63.3	39.3	38%
	1989-90	28.4	2.2	92%
	1990-91	19.8	2.7	86%
	1991-92	17.1	2.0	88%
	1992-93	10.9	1.3	88%
	1993-94	8.3	1.0	88%
	1994-95	8.8	1.8	80%
	1995-96	12.6	2.3	82%
	1996-97	15.4	1.5	90%
	1997-98	10.2	2.0	80%
	1998-99	11.3	ND	-
	1999-00	7	ND	-
	2001-02	11.4	1.5‡	-
Nickel	1986-87	68.2	65.0	5%
	1987-88	63.3	48.6	23%
	1988-89	60.3	43.7	28%
	1989-90	28.2	14.9	47%
	1990-91	35.1	19.8	44%
	1991-92	20.6	13.8	33%
	1992-93	26.7	14.4	46%
	1993-94	23.6	11.1	53%
	1994-95	37.4	17.2	54%
	1995-96	26.2	12.2	53%
	1996-97	15.8	9.1	42%
	1997-98	14.3	8.5	41%
	1998-99	17.9	10.7	40%
	1999-00	22	8.8	60%
	2001-02	26.3‡	4.5 ‡	83%
Zinc	1986-87	259	227	12%
	1987-88	226	96	57%
	1988-89	220	71	68%
	1989-90	219	69	68%
	1990-91	252	111	56%
	1991-92	324	78	76%
	1992-93	254	47	82%
	1993-94	255	44	83%
	1994-95	224	50	78%
	1995-96	230	56	76%
	1996-97	199	41	80%
	1997-98	183	42	77%
	1998-99	185	39	79%
	1999-00	167	32	81%
	2001-02	203	18	91%

* Based on calculation. ND = Not Detected.
‡ Average calculated from values <MDL. Concentrations below detection Limit were taken as zero.

The removal efficiency of metals through the treatment processes is related to the chemical and physical characteristics of the individual metal. In general, higher removal efficiencies are found in metals that are less soluble in wastewater and have greater tendencies to associate with particles in the wastewater (Chen et al. 1974). This group of less soluble metals includes cadmium, chromium, mercury, lead, copper, silver, and zinc. Arsenic and nickel are more soluble in wastewater and are not easily removed. Similarly, metals in the former group were found to be associated with the particulate phase of sewage treated at HTP, while arsenic and nickel were found mostly in dissolved form (EMD, unpublished data).

Removal efficiency of six detected priority pollutant metals are shown in Table 2-5. Figures 2-2, 2-3, and 2-4 show influent and effluent trends beyond the last decade. Consistent with the above findings, removal efficiencies of chromium, copper, silver, and zinc were much higher than the removal efficiencies of the more wastewater soluble metals, arsenic and nickel. Removal efficiencies for all metals, except arsenic, have dramatically improved since 1986-87. No significant change has been observed in arsenic removal efficiency.

2. Cyanide

Cyanide was not consistently detected in HTP's influent or 5-Mile effluent. The monthly average of cyanide in the effluent varied from below the minimum detection limit (MDL=2 µg/L) to 16 µg/L (Table 2-2a, b). The concentrations of cyanide in the 5-Mile effluent were always below the current NPDES permit limit (85ug/L). Cyanide for both years was well below the constituent’s limit in the Hyperion Effluent Quality Goals (NPDES pp27) of 50ug/L, and was within the California Ocean Plan objectives (Table 2-2a, b).

3. Tributyltin

HTP's NPDES permit, issued in 1994, requires quarterly monitoring of tributyltin. Low levels of tributyltin were detected in Hyperion's effluent in 2001 but not 2002 (Table 2-2a,b). The level detected was well below the permit limit of 119 ng/L.

C. ORGANIC CONSTITUENTS

After initial dilution, effluent concentrations of all organic compounds were low and less than NPDES limits and Ocean Plan levels (Table 2-2a,b). The priority pollutant limits are important because of their toxicity to the receiving environment. For example, lipid-soluble hydrophobic compounds such as polyaromatic hydrocarbons (PAH's), DDT's, and PCB's are known to bioaccumulate in tissues of organisms resulting in toxic effects. The effluent contained no detectable concentrations of PCB's, or PAH's. The levels of DDT were low during 2001-2002. The highest concentrations shown in Table 2-2a and b were for Bis(2-ethylhexyl) phthalate, followed by VOC's, methylene chloride, toluene, and other halogenated and aromatic hydrocarbons.

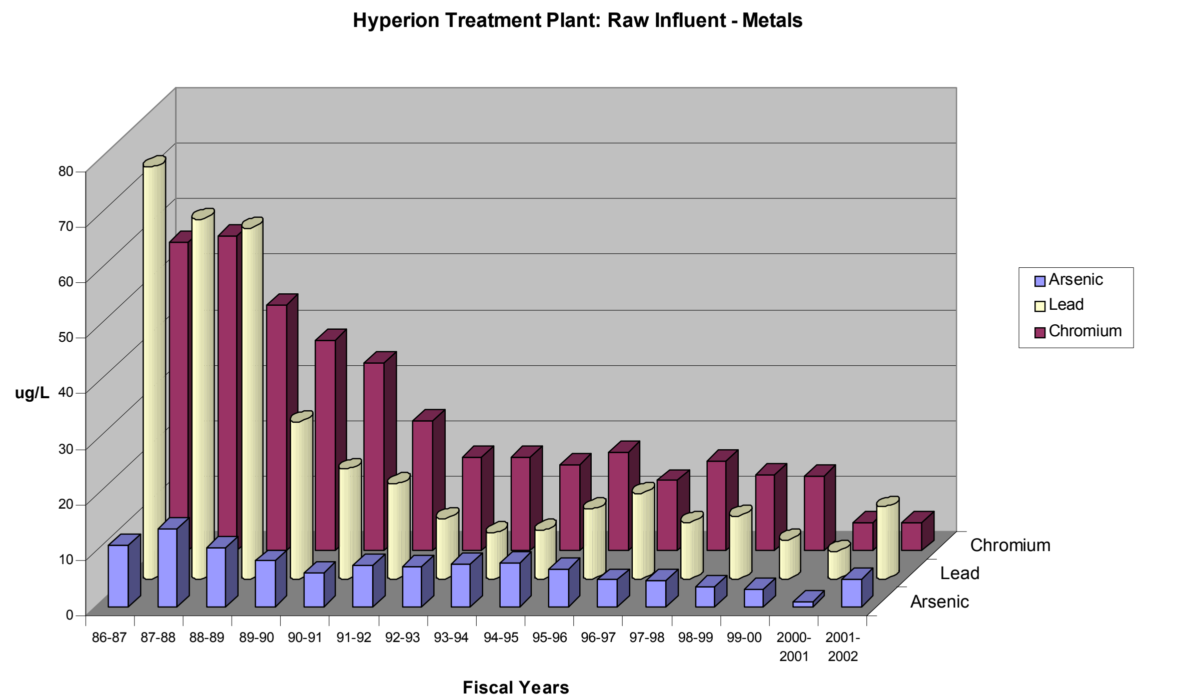
D. RESIDUAL CHLORINE

The current NPDES permit of HTP does not require chlorination of the final effluent. Only in the event of an emergency discharge through the 1-Mile outfall is chlorination of effluent required to prevent possible nearshore or beach contamination.

Even though the current NPDES permit does not require effluent chlorination, residual chlorine in the 5-Mile effluent is monitored daily because it is a permit requirement and for the following reason: a part of Hyperion's secondary effluent, which is chlorinated for in-plant use, is eventually released into the ocean through the 5-Mile Outfall. Daily residual chlorine of 5-Mile effluent is monitored to ensure that none is discharged into the receiving water. For this reporting period residual chlorine was detected once, in April 2001 (Table 2-2a & b). The level was 0.2 mg/L, far below the instantaneous maximum discharge limitation of 5.1 mg/L, and the monthly average remained <0.1 mg/L. No NPDES exceedances occurred for total residual chlorine during this reporting period.

.

Figure 2-2. Concentrations of Arsenic, Chromium, and Lead in plant influent and 5-Mile effluent for fiscal years 1986-87 through 2001-2002.



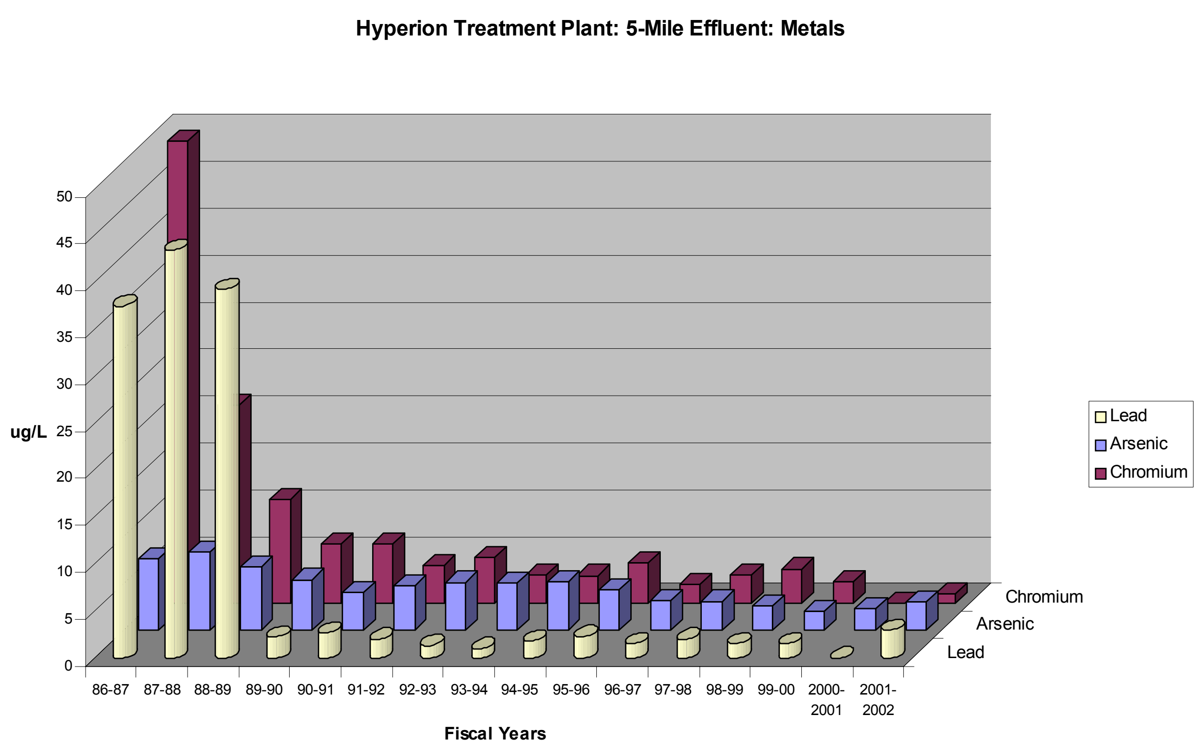
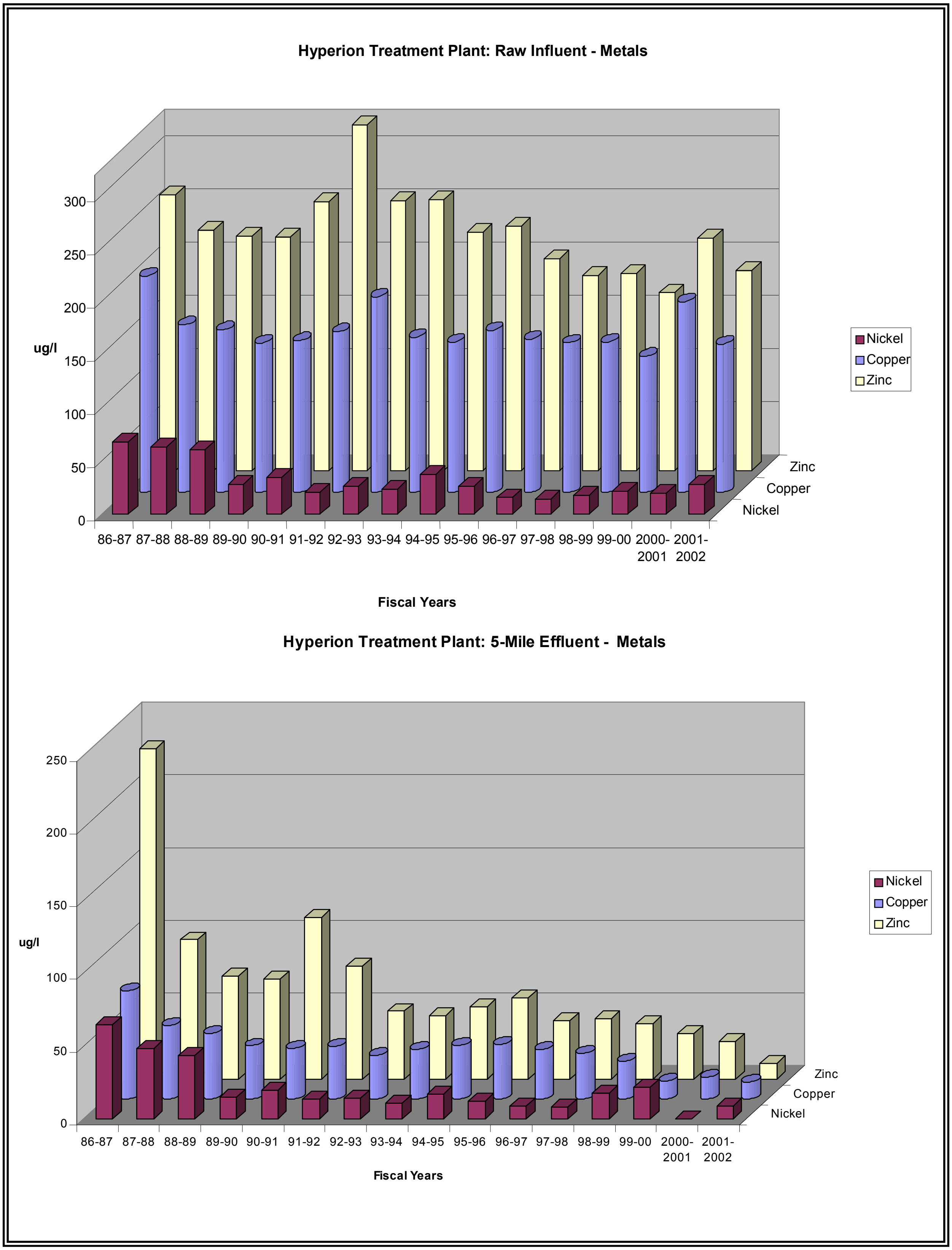


Figure 2-3. Concentrations of Zinc, Nickel and Copper in plant influent and 5-Mile effluent for fiscal years 1986-87 through 2001-2002.



E. RADIOACTIVITY

A low level of gross beta radioactivity was consistently detected in the 5-Mile effluent throughout 2001-2002. However, the amount detected was always below the NPDES limit (0.030 ρCi/ml).

F. TOXICITY

To control discharge of toxic chemicals to the environment, the Federal Clean Water Act mandates a national policy that "the discharge of toxic pollutants in toxic amounts be prohibited". The EPA, as authorized by the Clean Water Act, implements this policy through the use of "whole effluent toxicity" testing using the sensitive life stage of aquatic organisms exposed to wastewater effluents.

1. Effluent Acute Toxicity Tests

The Hyperion Treatment Plant is mandated by the Los Angeles Regional Water Quality Control Board under the NPDES permit to conduct acute toxicity testing of its 5-Mile effluent. This directive requires that the TUa (acute toxicity units) of the effluent be less than or equal to 1.5, which is to be determined by acute toxicity tests (EPA/600/4-85/013) using fathead minnow (*Pimephales promelas*).

For the periods January to December 2001 and January to December 2002, the 5-mile effluent of the Hyperion Treatment Plant met the acute limit of 1.5. The tests during these periods used pH adjustment (by CO_2 control) to counteract the drift that occurs in static-renewal acute toxicity tests. This modification was made as per an agreement with the RWQCB in order to accurately reflect the pH of the 5-Mile Effluent during the duration of the test.

2. Effluent Chronic Toxicity Tests

The Hyperion Treatment Plant is also required under its NPDES permit to conduct monthly chronic toxicity tests of its effluent. This directive requires that three species of marine organisms be tested each year for three consecutive months to select the most sensitive species. The three test organisms chosen for these screening tests are the veliger larvae of the red abalone (*Haliotis rufescens*), sporophytes of the giant kelp (*Macrocystis pyrifera*), and the larvae of the inland silverslide (*Menidia beryllina*). At the end of this screening period, the most sensitive species is to be used for the remainder of the year.

In August 2001, the three-most-sensitive-species screening tests determined the red abalone to be the most sensitive for this treatment plant, and it was used for the remainder of the year. In September 2002, the three-most-sensitive-species screening tests again determined the red abalone to be the most sensitive, and thus it remained the test organism for the year.

The chronic toxicity test limit is currently set at 84.0 TUc (chronic toxicity units) under the HTP NPDES permit. To comply with the TUc limit of 84.0, test organisms must not show any acute or chronic response in 1.19% plant effluent. From January 2001 to December 2002, the 5-Mile effluent met the TUc limit of 84.0.

IV. LITERATURE CITED

APHA. See American Public Health Association.

American Public Health Association. 1992. Standard Methods for the Examination of Water and Wastewater, 18th ed. American Public Health Association, Washington, D.C., unpaged.

Anderson(90-10WQ) Marine Bioassay Project.

California State Water Resources Control Board. 1990. Water Quality Control Plan: Ocean Waters of California. California State Water Resources Control Bd., California, 23 pp.

Chen, K.Y., C.S. Young, T.K. Jan, and N. Rohatgi. 1974. Trace metals in wastewater effluents. Journal of the Water Pollution Control Federation 46:2663-2675.

City of Los Angeles, Environmental Monitoring Division. 1993. Marine Monitoring in Santa Monica Bay: Annual Assessment Report for the Period July, 1991 through June, 1992. Report submitted to EPA and RWQCB (Los Angeles). Department of Public Works, Bureau of Sanitation, Hyperion Treatment Plant, Playa del Rey, California, pp. 1-1 to 9-16 + appendices.

CLA, EMD. See City of Los Angeles, Environmental Monitoring Division.

EPA. 1985. Methods for measuring the acute toxicity of effluent to freshwater and marine organisms. EPA/600/4-85/013

EPA. 1987. Short-term methods for estimating the chronic toxicity of effluents and receiving waters to marine and estuarine organisms. EPA/600/4-87/028

Metcalf and Eddy, Inc. 1979. Wastewater Engineering: Treatment, Disposal, Reuse McGraw-Hill, 920 pp.

Morel, F.M.M. and S.L. Schiff. 1983. Geochemistry of municipal waste in coastal waters. Pp. 251-421 in E.P. Myers and E.T. Harding, eds., Ocean disposal of municipal wastewater: Impacts on the coastal environment. Sea Grant College Program, Massachusetts Institute of Technology, Cambridge, Massachusetts, 517 pp.

SWRCB. See California State Water Resources Control Board.