MUNICIPAL AND INDUSTRIAL DISCHARGE SURVEY FOR SELENIUM

California Regional Water Quality Control Board
Central Valley Region
3443 Routier Road
Sacramento, California 95827-3090

October 1988

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

Board Members

Karen Vercruse, Chair
Clifford C. Wisdom, Vice Chair
John S. Corkins
Hugh V. Johns
Wendy Johnston
Robert N. Klein, Sr.
Paul E. Simpson
W. Steve Tompkins
W. M. "Walt" Winn

William H. Crooks, Executive Officer

The staff involved in the
preparation of this report are:

Dennis Westcot, Senior Land and Water Use Analyst
Jeanne Gonzalez, Geologist Assistant

MUNICIPAL AND INDUSTRIAL DISCHARGE SURVEY FOR SELENIUM

Background

The impact of agricultural return flows on the beneficial uses of surface water has been documented. One major concern has been the discovery of the element selenium in tile drainage discharges. The agricultural discharges, however, make up only a part of the total discharges to surface water. Selenium may also be discharged from municipal and industrial facilities. The State Water Resources Control Board and the Central Valley Regional Water Quality Control Board have initiated efforts to formulate water quality standards for selenium and implement regulatory programs where needed to control these discharges. An important part of formulating programs to control the selenium in municipal, industrial, and agricultural discharges is information about the source including the geographic distribution of selenium and its concentration.

The California Legislature, through the Governor's 1985-86 budget, provided funding for an intensive look at municipal and industrial discharges for selenium. Due to the importance of selenium in the Central Valley, the Regional Board sampled a large number of dischargers within the Valley. Prior to this survey, no check of municipal and industrial discharges for selenium had been made regionwide or statewide. To ensure proper quality control and sampling uniformity, all samples were collected by Regional Board staff in cooperation with the dischargers and data analysis was done in cooperation with the dischargers.

Purpose

The purpose is to provide the Regional Board and dischargers with sound water quality monitoring data on individual discharges, including, where needed, changes in selenium concentrations that are occurring within the treatment system. The data developed will be used by the Regional Board and the Dischargers to:

a. develop follow-up water quality monitoring programs in areas where further data is needed;

b. evaluate existing water quality data programs and the need for increased quality control and quality assurance programs, and;

c. evaluate the need for developing additional regulatory programs for municipal and industrial dischargers.

Scope

Selenium samples were taken from 109 discharge points within the Central Valley. Seventy-five samples were from municipal discharges thirty-four were taken from industrial type discharges. The majority of the samples were taken from discharges that

eventually find their way into the Sacramento-San Joaquin Rivers and Delta, or from municipal and industrial discharges that are located in or in close proximity to the agricultural drainage problem area. Most samples were collected once during the period of April - June 1986.

Quality Assurance

Regional Board staff were responsible for sampling and transport of the samples to the laboratory. Analyses were done by Department of Water Resources Laboratory at Bryte using the hydride generation technique. In addition to a laboratory internal QA/QC program, a quality assurance program was also operated by the Regional Board. The program included site-anonymous sample IDs, duplicates and spikes.

Sample collection and preservation were conducted in accordance with U.S. Environmental Protection Agency and U.S. Geological Survey guidelines as outlined in National Handbook of Recommended Methods for Water Data Acquisition. Selenium samples were collected in 1 pint nitric acid-washed polyethylene bottles. All samples were collected for total selenium, therefore, no filtration was done prior to acidification. Acidification was done within two hours of sample collection using one milliliter of ultra pure nitric acid per pint sample. The sample was then stored in a cool dark room until transferred for laboratory analysis.

Results and Discussion

Of the 75 municipal discharge samples taken in this survey, only 5 showed detectable concentrations of selenium (Table 1). The detection level was 1 ug/l (parts per billion) selenium in most instances. Of the 5 samples, 2 were at the level of analytical detection. The remaining 3 samples (2 from the City of Davis discharge and 1 from a treatment pond at Lemoore Naval Air Station) showed elevated levels of selenium. The concentrations found, however, were only slightly elevated and in only one instance, City of Davis, did the concentration exceed an existing water quality standard. The standard applies to the receiving water, however, and no receiving water samples were taken. It is not likely that selenium levels this high would be found downstream of the discharge.

Of the 34 industrial wastewater samples taken in this survey, only 4 showed detectable concentrations of selenium (Table 2). Of these, 2 were at the level of analytical detection. The remaining 2 samples were from one discharger, J.R. Simplot Company's Helm Fertilizer Plant. Both samples were taken from inflow to their wastewater treatment ponds. These levels in the wastewater did not exceed an existing water quality.

The sites with elevated levels of selenium (Table 3) are primarily located in known selenium problem areas and the findings of selenium were not unexpected. The existing levels in the City of

Davis discharge are probably associated with the elevated levels often found in their drinking water supply. The City of Davis has conducted follow-up sampling at their facility which confirms the presence of selenium in similar concentrations to those found during this study. The concentrations found have ranged from 3-13 ug/L.

The Lemoore Naval Air Station and the J.R. Simplot sites are located within the drainage problem area or immediately adjacent to it. An agricultural evaporation pond is located immediately adjacent to the Lemoore Naval Air Station ponds and this evaporation pond shows concentrations similar to those in the Naval Air Station ponds. The selenium in the wastewater could be from high ground water in the area from agricultural operations. The source of selenium at the J.R. Simplot Plant at Helm is unknown.

The relative level of selenium in both industrial and municipal discharges is low with only a few isolated instances of elevated levels. The elevated levels, however, are far less than concentrations being found in agricultural tile drainage systems. It is recommended that:

1. Regional Board continue their emphasis on selenium problems related to agricultural tile drainage discharges because of the magnitude of the discharges and the selenium levels being found;

2. Periodic monitoring for selenium be conducted at those municipal and industrial sites found to have elevated levels. The frequency of monitoring should be site specific;

3. A further investigation should be initiated at the J.R. Simplot Company at Helm to determine the source or sources of selenium entering the wastewater ponds and whether the selenium level in the ponds is building up to concentrations of concern. This assessment must be placed in priority with other investigations being made at the plant;

4. A further evaluation of this data needs to be made as soon as additional water quality criteria are available from the State Water Resources Control Board; and

5. A further water quality monitoring program needs to be initiated for oil field and refinery discharges which have been shown to be a major source of selenium discharges in the San Francisco Bay Region.

TABLE 1. Selenium Levels in Wastewater from Municipal Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se(ug/L)
ANDERSON,CITY OF	14 MAY 86	TREATED EFFLUENT	SHASTA	T30N R4W SEC 11		<1
ATWATER, CITY OF*	10 FEB 86	TREATED EFFLUENT	MERCED	T7S R12E SE1/4 NW1/4 SEC 12	37 20' 30" N / 120 36' 30" W	<3
ATWATER, CITY OF*	11 MARCH 86	PLANT EFFLUENT	MERCED	T7S R12E SE1/4 NW1/4 SEC 12	37 20' 30" N / 120 36' 30" W	<5
ATWATER, CITY OF*	15 APRIL 86	PLANT EFFLUENT	MERCED	T7S R12E SE1/4 NW1/4 SEC 12	37 20' 30" N / 120 36' 30" W	<5
ATWATER, CITY OF	8 MAY 86	EFFLUENT FROM CHLORINE CONTACT CHAMBER	MERCED	T7S R12E SE1/4 NW1/4 SEC 12	37 20' 30" N / 120 36' 30" W	<1
ATWATER, CITY OF	8 MAY 86	CHANNEL TO SAN JOAQUIN RIVER	MERCED	T7S R12E SE1/4 NW1/4 SEC 12	37 20' 30" N / 120 36' 30" W	<1
ATWATER, CITY OF*	13 MAY 86	PLANT EFFLUENT	MERCED	T7S R12E SE1/4 NW1/4 SEC 12	37 20' 30" N / 120 36' 30" W	<5
ATWATER, CITY OF*	10 JUNE 86	PLANT EFFLUENT	MERCED	T7S R12E SE1/4 NW1/4 SEC 12	37 20' 30" N / 120 36' 30" W	<5
BAKERSFIELD, CITY OF	15 MAY 86	WWTP NO. 2 EAST CELL NO. 2	KERN	T30S R28E SEC 9,10	35 20' 00" N / 118 59' 00" W	<1
BAKERSFIELD, CITY OF	15 MAY 86	WWTP NO. 2 EAST CELL NO. 4	KERN	T30S R28E SEC 9,10	35 20' 00" N / 118 59' 00" W	<1
BAKERSFIELD, CITY OF	15 MAY 86	WWTP NO. 3 POND 4	KERN	T30S R27E SEC 33	35 22' 30" N / 119 07' 03" W	<1
BAKERSFIELD, CITY OF	15 MAY 86	WWTP NO. 3 POND 8	KERN	T30S R27E SEC 33	35 22' 30" N / 119 07' 03" W	<1
BEALE AFB WWTP	15 MAY 86	S. BEALE RD ADJ HUTCHINSON CREEK	YUBA	T14N R5E SEC4	39 05' N / 121 25' 30" W	<1
CHOWCHILLA, CITY OF	8 MAY 86	SECONDARY CLARIFIER	MADERA	T9S R16E SEC 31	37 6' N / 120 15' W	<1
CHOWCHILLA, CITY OF	8 MAY 86	SECONDARY CLARIFIER	MADERA	T9S R16E SEC 31	37 6' N / 120 15' W	<1
COALINGA, CITY OF	9 MAY 86	FIRST POND AFTER AERATED POND	FRESNO	T20S R15E SEC 33	36 08' 00" N / 120 20' 00" W	<1
COALINGA, CITY OF	9 MAY 86	HOLDING POND	FRESNO	T20S R15E SEC 33	36 08' 00" N / 120 20' 00 ' W	<1

TABLE 1. Selenium Levels in Wastewater from Municipal Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se(ug/L)
CORNING, CITY OF	11 JUNE 86	STP TREATED EFFLUENT	TEHAMA	T24N R2W SEC 20		<1
DAVIS, CITY OF*	2 FEB 87	INFLUENT	YOLO	T9N R3E SEC 29	30 36' N / 121 40' W	10
DAVIS, CITY OF*	2 FEB 87	EFFLUENT	YOLO	T9N R3E SEC 29	30 36' N / 121 40' W	2
DAVIS, CITY OF*	2 FEB 87	R-1: IMMEDIATELY UPSTREAM FROM POINT OF DISCHARGE	YOLO	T9N R3E SEC 29	30 36' N / 121 40' W	2
DAVIS, CITY OF*	2 FEB 87	S-7: POND EFFLUENT BEFORE LAND APPLICATION	YOLO	T9N R3E SEC 29	30 36' N / 121 40' W	4
DAVIS, CITY OF	13 JUNE 86	WWTP OXIDATION POND WATER	YOLO	T9N R3E SEC 29	30 36' N / 121 40' W	4/4
DAVIS, CITY OF	13 JUNE 86	WWTP OVERLAND FLOW EFFLUENT	YOLO	T9N R3E SEC 29	30 36' N / 121 40' W	11/6
DELANO, CITY OF	26 JUNE 86	WWTP OUT OF POND	KERN	T25S R25E SEC 9	35 46' 24" N / 119 17' 10" W	<1
DINUBA, CITY OF	16 MAY 86	WWTP POND EFFLUENT	TULARE	T16S R23E SEC 13	36 32' 30" N / 119 25' 30" W	<1
DEUEL VOCATIONAL INSTITUTE	27 MAY 86	DISCHARGE SUMP TO DVI DRAIN TO PARADISE CUT	SAN JOAQUIN	T2S R6E NE1/4 SEC 20		<1
DOS PALOS, CITY OF*	27 MARCH 86	N SIDE SWIFT AVE	MERCED	T11S R12E SW1/4 SEC 8	36 59' 30" N / 120 41' W	<5
DOS PALOS, CITY OF*	19 JUNE 86	OUTFALL	MERCED	T11S R12E SW1/4 SEC 8	36 59' 30" N / 120 41' W	<5
DOS PALOS, CITY OF*	7 AUG 86	EFFLUENT	MEERCED	T11S R12E SW1/4 SEC 8	36 59' 30" N / 120 41' W	<5
DUNSMUIR, CITY OF	15 MAY 86	STP TREATED EFFLUENT	SHASTA	T38N R3W SEC 1		<1
EAST YOLO COMMUNITY SERVICES DISTRICT	13 JUNE 86	WWTP EFFLUENT PRIOR TO CHLORINATION	YOLO	STP: T8N R4E SEC 4 DISCHARGE: T7N R4E SEC 22	STP: 38 33' N / 121 31' W DIS: 38 26' N / 121 31' W	<1
FIREBAUGH, CITY OF	1 MAY 86	OUTFALL FROM POLISHING POND	FRESNO	T12S R14E S1/2 SEC 33&34	36 50' N / 120 26' W	<1

TABLE 1. Selenium Levels in Wastewater from Municipal Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se(ug/L)
FIREBAUGH, CITY OF	1 MAY 86	OUTFALL FROM POLISHING POND	FRESNO	T12S R14E S1/2 SEC 33&34	36 50' N / 120 26' W	<1
FRESNO, CITY OF	29 MAY 86	EFFLUENT FROM CLARIFIERS #1 & #2	FRESNO	T14S R19E SEC 20,21,22,27,28	36 42' N / 119 54' W	<1
FRESNO, CITY OF	29 MAY 86	EFFLUENT FROM ALL 4 CLARIFIERS	FRESNO	T14S R19E SEC 20,21,22,27,28	36 42' N / 119 54' W	<1
GUSTINE, CITY OF*	6 FEB 86	WWTP EFFLUENT	MERCED	T8S R9E SEC 10	37 15' N / 120 57' 30" W	<3
GUSTINE, CITY OF*	13 MARCH 86	WWTP EFFLUENT	MERCED	T8S R9E SEC 10	37 15' N / 120 57' 30" W	<5
GUSTINE, CITY OF*	3 APRIL 86	WWTP EFFLUENT	MERCED	T8S R9E SEC 10	37 15' N / 120 57' 30" W	<5
GUSTINE, CITY OF*	1 MAY 86	WWTP EFFLUENT	MERCED	T8S R9E SEC 10	37 15' N / 120 57' 30" W	<5
GUSTINE, CITY OF	3 JUNE 86	OUTFALL OF LAST POND	MERCED	T8S R9E SEC 10	37 15' N / 120 57' 30" W	<1
GUSTINE, CITY OF	3 JUNE 86	EFFLUENT BEFORE CHLORINATOR	MERCED	T8S R9E SEC 10	37 15' N / 120 57' 30" W	<1
HANFORD, CITY OF	9 MAY 86	WWTP POND 5	KINGS	T19S R21E SEC 12	36 17' 30" N / 119 38' 00" W	<1
HANFORD, CITY OF	9 MAY 86	WWTP POND 6	KINGS	T19S R21E SEC 12	36 17' 30" N / 119 38' 00" W	<1
HURON, CITY OF	9 MAY 86	WWTP WEST PERC POND	FRESNO	T20S R17E SEC 1	36 12' 30" N / 120 05' 00" W	<1
HURON, CITY OF	9 MAY 86	WWTP EAST PERC POND	FRESNO	T20S R17E SEC 1	36 12' 30" N / 120 05' 00" W	<1
KELSEYVILLE COUNTY WATER WORKS DISTRICT 3	25 APRIL 86	SEWAGE EFFLUENT FROM CHLORINATION POND (NOT CHLORINATING)	LAKE	T13N R9W SEC 11	38 59' 35" N / 122 49' 50" W	<1
KERMAN, CITY OF	1 MAY 86	EFFLUENT FROM FACULTATIVE LAGOONS	FRESNO	T14S R17E SEC 13	36 42' 30" N / 120 4' W	<1
KERMAN, CITY OF	1 MAY 86	EFFLUENT FROM FACULTATIVE LAGOONS	FRESNO	T14S R17E SEC 13	36 42' 30" N / 120 4' W	<1

TABLE 1. Selenium Levels in Wastewater from Municipal Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se(ug/L)
LAKE COUNTY SANITATION DISTRICT NW PLANT	25 APRIL 86	TREATED EFFLUENT	LAKE	T15N R10W SEC 25	39 07' 00" N / 122 55' 00" W	<1
LAKE COUNTY SANITATION DISTRICT SE PLANT	25 APRIL 86	CHLORINATED SEWAGE EFFLUENT	LAKE	T13N R7W SEC 15	38 58' 45" N / 122 37' 05" W	<1
LEMOORE, CITY OF	9 MAY 86	EASTERN MOST POND (NOT AERATED) S. OF IONA AVE ON AVE 18 1/2	KINGS	T19S R20W SEC 15	36 17' 00" N / 119 47' 30" W	<1
LEMOORE NAVAL AIR STATION	8 APRIL 87	POND 1	KINGS	T19S R19S SEC 29	36 15' 00" N / 119 55' 30" W	2/1
NAVAL AIR STATION	8 APRIL 87	POND 2	KINGS	T19S R19S SEC 29	36 15' 00" N / 119 55' 30" W	1/1
NAVAL AIR STATION	8 APRIL 87	POND 4	KINGS	T19S R19S SEC 29	36 15' 00" N / 119 55' 30" W	1/1
NAVAL AIR STATION	8 APRIL 87	POND 5	KINGS	T19S R19S SEC 29	36 15' 00" N / 119 55' 30" W	1/1
LIVINGSTON, CITY OF (FOSTER FARMS)	9 MAY 86	OUTFALL OF POND 11	MERCED	T6S R11E N1/2 SEC 23	37 24' N / 120 44' W	<1
LIVINGSTON, CITY OF (FOSTER FARMS)	9 MAY 86	OUTFALL OF POND 10	MERCED	T6S R11E N1/2 SEC 23	37 24' N / 120 44' W	<1
LODI, CITY OF	26 JUNE 84	OUTFALL	SAN JOAQUIN	T3N R5E SE1/4 SEC 23		<2
LODI, CITY OF	27 MAY 86	STP LINE TO OUTFALL	SAN JOAQUIN	T3N R5E SE1/4 SEC 23		<1
LOS BANOS, CITY OF	27 MARCH 86	NE SIDE OLD SANTA FE GRADE	MERCED	T10S R11E SEC 7,8	37 5' N / 120 48' W	<5
MADERA, CITY OF	8 MAY 86	EFFLUENT FROM SECONDARY CLARIFIER	MADERA	T11S R17E SEC 30	36 56' N / 120 9' 30" W	<1
MADERA, CITY OF	8 MAY 86	EFFLUENT FROM SECONDARY CLARIFIER	MADERA	T11S R17E SEC 30	36 56' N / 120 9' 30" W	<1
MANTECA, CITY OF	26 JUNE 84	OUTFALL	SAN JOAQUIN	T2S R6E SEC 4		<2

TABLE 1. Selenium Levels in Wastewater from Municipal Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se(ug/L)
MENDOTA, CITY OF	1 MAY 86	EFFLUENT FROM AERATION PONDS	FRESNO	T13S R15E NW1/4 SEC 29	36 46' 30" N / 120 22' 30" W	<1
MENDOTA, CITY OF	1 MAY 86	EFFLUENT FROM AERATION PONDS	FRESNO	T13S R15E NW1/4 SEC 29	36 46' 30" N / 120 22' 30" W	<1
MERCED, CITY OF*	10 FEB 86	WWTP EFFLUENT	MERCED	T8S R13E SW1/4 SEC 10	37 15' N / 120 31' 30" W	<3
MERCED, CITY OF*	3 MARCH 86	WWTP EFFLUENT	MERCED	T8S R13E SW1/4 SEC 10	37 15' N / 120 31' 30" W	<5
MERCED, CITY OF*	7 APRIL 86	WWTP EFFLUENT	MERCED	T8S R13E SW1/4 SEC 10	37 15' N / 120 31' 30" W	<3
MERCED, CITY OF*	5 MAY 86	WWTP EFFLUENT	MERCED	T8S R13E SW1/4 SEC 10	37 15' N / 120 31' 30" W	<1
MERCED, CITY OF	8 MAY 86	EFFLUENT FROM CHLORINE CONTACT CHAMBER	MERCED	T8S R13E SW1/4 SEC 10	37 15' N / 120 31' 30" W	<1
MERCED, CITY OF	8 MAY 86	CHANNEL TO SAN JOAQUIN RIVER	MERCED	T8S R13E SW1/4 SEC 10	37 15' N / 120 31' 30" W	<1
MERCED, CITY OF*	2 JUNE 86	WWTP EFFLUENT	MERCED	T8S R13E SW1/4 SEC 10	37 15' N / 120 31' 30" W	<3
MERCED, CITY OF	26 JUNE 84	OUTFALL	MERCED	T8S R13E SW1/4 SEC 10	37 15' N / 120 31' 30" W	<2
MODESTO, CITY OF*	6 JAN 86	WWTP EFFLUENT	STANISLAUS	T5S R8E SEC 3		<5
MODESTO, CITY OF*	5 FEB 86	WWTP EFFLUENT	STANISLAUS	T5S R8E SEC 3		<3
MODESTO, CITY OF*	5 MARCH 86	WWTP EFFLUENT	STANISLAUS	T5S R8E SEC 3		<5
MODESTO, CITY OF*	2 APRIL 86	WWTP EFFLUENT	STANISLAUS	T5S R8E SEC 3		<5
MODESTO, CITY OF	26 JUNE 84	OUTFALL	STANISLAUS	T5S R8E SEC 3		<2
NEWMAN, CITY OF	10 APRIL 86	OXIDATION POND	STANISLAUS	T7S R9E NE1/4 SEC 9		<1
NEWMAN, CITY OF	10 APRIL 86	OXIDATION POND	STANISLAUS	T7S R9E NE 1/4 SEC 9		<1

TABLE 1. Selenium Levels in Wastewater from Municipal Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se(ug/L)
PORTERVILLE, CITY OF	26 JUNE 86	FIRST POND	TULARE	T21S R27E NW1/4 SEC 27		<1
PORTERVILLE, CITY OF	26 JUNE 86	LAST POND	TULARE	T21S R27E NW1/4 SEC 27		<1
RED BLUFF, CITY OF	11 JUNE 86	STP DOMESTIC TREATED EFFLUENT	TEHAMA	T27N R3W SEC 29		<1
REDDING, CITY OF	6 MAY 86	CLEAR CREEK STP TREATED EFFLUENT	SHASTA	T31N R4W SEC 31		<1
REEDLEY, CITY OF	16 MAY 86	WWTF EFFLUENT STORAGE TANK (FROM CLARIFIERS)	FRESNO	T15S R23E SEC 34	36 35' N / 119 27' 30" W	<1
REEDLEY, CITY OF	16 MAY 86	WWTP EFFLUENT FROM CLARIFIERS	FRESNO	T15S R23E SEC 34	36 35' N / 119 27' 30" W	<1
RIO VISTA, CITY OF	17 APRIL 86	INFLUENT TO STP	SOLANO	T4N R3E SEC 31	38 8' 30" N / 121 41' 30 " W	<1
RIO VISTA, CITY OF	17 APRIL 86	EFFLUENT FROM STP	SOLANO	T4N R3E SEC 31	38 8' 30" N / 121 41' 30" W	<1
ROSEVILLE, CITY OF	21 MAY 86	WWTP EFFLUENT	PLACER	T10N R6E SEC 10		<1
ROSEVILLE, CITY OF	21 MAY 86	WWTP EFFLUENT	PLACER	T10N R6E SEC 10		<1
SAN JOAQUIN, CITY OF	1 MAY 86	SOUTH EVAP/PERC POND	FRESNO	T15S R16E N1/2 SEC 27	36 36' N / 120 12' 30" W	<1
SAN JOAQUIN, CITY OF	1 MAY 86	NORTH EVAP/PERC POND	FRESNO	T15S R16E N1/2 SEC 27	36 36' N / 120 12' 30" W	<1
SHASTA DAM PUD	6 MAY 86	STP TREATED EFFLUENT	SHASTA	T32N R4W SEC 1		<1
STOCKTON, CITY OF	26 JUNE 84	OUTFALL	SAN JOAQUIN	T1N R6E NW1/4 SEC 17		<2
STOCKTON, CITY OF	5 JUNE 86	STP EFFLUENT TO SAN JOAQUIN RIVER	SAN JOAQUIN	T1N R6E NW1/4 SEC 17		<1
TAFT, CITY OF	3 JUNE 86	WWTF FIRST POND IN SERIES	KERN	T32S R24E SEC 17	35 08' 00" N / 119 25' 30" W	1/<1
TAFT, CITY OF	3 JUNE 86	WWTF LAST POND IN SERIES	KERN	T32S R24E SEC 17	35 08' 00" N / 119 25' 30" W	1

TABLE 1. Selenium Levels in Wastewater from Municipal Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se(ug/L)
TRACY, CITY OF	26 JUNE 84	OUTFALL	SAN JOAQUIN	T1S R5E SEC 34		<2
TRANQUILITY, CITY OF	1 MAY 86	PUD OXIDATION POND	FRESNO	T15S R16E W1/2 SEC 4	36 39' N / 120 14' 30" W	<1
TRANQUILITY, CITY OF	1 MAY 86	PUD OXIDATION POND	FRESNO	T15S R16E W1/2 SEC 4	36 39' N / 120 14' 30" W	<1
TULARE, CITY OF	26 JUNE 86	END OF DOMESTIC TREATMENT	TULARE	T20S R24E SEC 16		<1
TULARE, CITY OF	26 JUNE 86	COMBINED OUTFALL TO IRRIGATION	TULARE	T20S R24E SEC 16		<1
TURLOCK, CITY OF	26 JUNE 84	OUTFALL	STANISLUAS	T5S R9E NE1/4 SEC 36		<2
TURLOCK, CITY OF*	19 JULY 84	FINAL EFFLUENT	STANISLAUS	T5S R9E NE1/4 SEC 36		<1
TURLOCK, CITY OF*	20 JAN 86	FINAL EFFLUENT	STANISLAUS	T5S R9E NE1/4 SEC 36		<5
TURLOCK, CITY OF*	18 FEB 86	FINAL EFFLUENT	STANISLAUS	T5S R9E NE1/4 SEC 36		<5
TURLOCK, CITY OF*	19 MARCH 86	FINAL EFFLUENT	STANISLAUS	T5S R9E NE1/4 SEC 36		<1
TURLOCK, CITY OF*	21 APRIL 86	FINAL EFFLUENT	STANISLAUS	T5S R9E NE1/4 SEC 36		<3
TURLOCK, CITY OF	10 JUNE 86	DISCHARGE	STANISLAUS	T5S R9E NE1/4 SEC 36		<1
VISALIA, CITY OF	26 JUNE 86	OUTFALL TO MILL CREEK	TULARE	T19S R24E SEC 6		<1
VISALIA, CITY OF	26 JUNE 86	POND PRIOR TO OUTFALL	TULARE	T19S R24E SEC 6		<1
WOODLAND, CITY OF	13 JUNE 86	STP RAW SEWAGE POND ADJACENT PLANT OFFICE	YOLO	T10N R3E SEC 29	38 41' N / 120 44' W	1/<1

*Data collected by discharger

TABLE 2. Selenium Concentrations in Wastewater from Industrial and Other Types of Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se (ug/L)
ALLIED ENERGY CORP	8 MAY 86	EFFLUENT	CONTRA COSTA	T1N R2E NE 1/4 SEC 10		<1
ANDERSON MINE	24 APRIL 86	DRAINAGE BELOW ADIT	LAKE	T11N R8W SEC 25	38 46' 22" N / 122 41' 18" W	<1
ANDERSON CREEK	24 APRIL 86	PG&E GAGE STATION	LAKE	T11N R8W SEC 25	38 46' 30" N / 122 41' 18" W	<1
BALSAM MEADOWS HYDROELECTRIC PLANT	11 JUNE 86	EFFLUENT PRIOR TO DISCHARGE TO NORTH FORK STEVENSON CREEK	FRESNO	T9S R25E SEC 9,21		<1
BALSAM MEADOWS HYDROELECTRIC PLANT	19 JUNE 86	EFFLUENT PRIOR TO DISCHARGE TO WEST FORK BALSAM CREEK	FRESNO	T9S R25E SEC 9,21		<1
BEAR CREEK	25 APRIL 86	HWY 20 UPSTREAM OF BRIDGE 20 YDS LEFT BANK	COLUSA	T14N R5W SEC 36	39 1' N / 122 21' W	<1
CROWN ZELLERBACH CORP (GAYLORD CONTAINER CORP)	4 FEB 86	PLANT EFFLUENT BEFORE COOLING WATER	CONTRA COSTA	T2N R2E SE 1/4 SEC 17		<1
EAST LAKE LANDFILL	25 APRIL 86	LEACHATE COLLECTION SUMP	LAKE	T13N R7W SEC 26		<1
FEATHER RIVER - MIDDLE FORK	30 APRIL 86	ROAD A-23, 60 YDS BELOW BRIDGE	PLUMAS	T23N R14E SEC 27	39 49' 08" N / 120 23' 27" W	<1
FIBREBOARD CORP, SAN JOAQUIN DIV PULP MILL (LOUISIANA-PACIFIC CORP)	5 JUNE 86	PLANT EFFLUENT	CONTRA COSTA	T2N R2E NE 1/4 SEC 17		<1
FIBREBOARD CORP, SAN JOAQUIN DIV PULP MILL (LOUISIANA-PACIFIC CORP)	4 FEB 86	PLANT EFFLUENT	CONTRA COSTA	T2N R2E NE 1/4 SEC 17		1
GEOTHERMAL RECLAMATION INC	24 APRIL 86	NW CORNER POND P-1	LAKE	T10N R6W	38 44' 20" N / 122 33' 25" W	<1
GEOTHERMAL RECLAMATION INC	24 APRIL 86	NW CORNER POND P-4	LAKE	T10N R6W	38 44' 18" N / 122 33' 20" W	<1

TABLE 2. Selenium Concentrations in Wastewater from Industrial and Other Types of Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se (ug/L)
HAYDEN HILL MINE JOE MUNKHOFF	6 MAY 86	RECYCLE PROCESS EFFLUENT	LASSEN	T37N R9W SEC 1		<1
IMPERIAL WEST CHEMICAL CO	24 JUNE 86	PLANT EFFLUENT	CONTRA COSTA	T2N R2E S1/2 SEC 17		<1
INTERNATIONAL OIL AND GAS	8 MAY 86	EFFLUENT	CONTRA COSTA	T1N R2E S1/2 SEC 10		<1
JOHN PESTANA FAMILY TRUST	8 MAY 86	PLANT EFFLUENT	CONTRA COSTA	T1N R2E S1/2 SEC 10		<1
JR SIMPLOT CO - HELM PLANT	9 MAY 86	INFLUENT TO LINED POND	FRESNO	T16S R17E SW 1/4 SEC 10	36 33' N / 120 6' W	10
JR SIMPLOT CO - HELM PLANT	9 MAY 86	INFLUENT TO LINED POND	FRESNO	T16S R17E SW 1/4 SEC 10	36 33' N / 120 6' W	8
JR SIMPLOT CO - HELM PLANT	8 APRIL 87	LINED POND (SOUTH)	FRESNO	T16S R17E SW 1/4 SEC 10	36 33' N / 120 6' W	20
JR SIMPLOT CO - HELM PLANT	8 APRIL 87	LINED POND (NORTH)	FRESNO	T16S R17E SW 1/4 SEC 10	36 33' N / 120 6' W	20
MARBLE HOT SPRINGS	30 APRIL 86	15 YDS WEST FROM SPRING	PLUMAS	T22N R14E SEC 13	39 45' 19" N / 120 19' 50" W	<1
McCORMICK & BAXTER	30 JUNE 87	EFFLUENT TO MORMON SLOUGH	SAN JOAQUIN	T1N R6E		<1
PACKAGING CO OF CALIFORNIA	11 JUNE 86	TREATED PULPMILL PROCESS EFFLUENT	TEHAMA	T27N R3W SEC 23		<1
POPE CREEK	24 APRIL 86	2.5 MI NW BERRYESSA - KNOXVILLE RD ON POPE CANYON RD	NAPA	T9N R4W SEC 17	38 37' 40" N / 122 19' 50" W	<1
PUTAH CREEK	15 MAY 86	100 YDS UPSTREAM OF LAKE BERRYESSA	NAPA	T10N R5W SEC 14	38 42' 35" N / 122 23' 15" W	<1
SHARRON STEEL CORP - MAMMOTH MINE	22 MAY 86	MINE DRAINAGE	SHASTA	T34N R5W SEC 32		<1
SHELL AG CHEM CO (FORMERLY SHELL DEV CO)	1 MAY 86	WELL THAT SUPPLIES WATER FOR AC SYSTEM	STANISLAUS	T2S R8E NE 1/4 SEC 34		<1

TABLE 2. Selenium Concentrations in Wastewater from Industrial and Other Types of Discharges

DISCHARGER	SAMPLE DATE	SAMPLE POINT	COUNTY	LOCATION (T/R/S)	LATITUDE / LONGITUDE	Se (ug/L)
SHELL AG CHEM CO (FORMERLY SHELL DEV CO)	1 MAY 86	RECIRC PUMP FOR AC SYSTEM	STANISLAUS	T2S R8E NE 1/4 SEC 34		1
SHELL CALIFORNIA PRODUCTION	8 MAY 86	EFFLUENT	CONTRA COSTA	T1N R2E SE1/4 SEC 9		<1
SILVER KING MINE INC BALAKALA MINE	22 MAY 86	MINE DRAINAGE	SHASTA	T33N R6W SEC 12		<1
SIMPSON PAPER CO	9 MAY 86	PROCESS WATER FROM PULP AND PAPER MILL IN ANDERSON	SHASTA	T30N R3W SEC 4		<1
SPRECKLES SUGAR COMPANY -MENDOTA	19 JUNE 86	OUTFALL OF LAST POND	FRESNO	T13S R15E SEC 33 T14S R15E SEC 3,4		<1
SPRECKLES SUGAR COMPANY -MENDOTA	19 JUNE 86	OUTFALL OF LAST POND	FRESNO	T13S R15E SEC 33 T14S R15E SEC 3,4		<1
TERMO COMPANY	8 MAY 86	PLANT EFFLUENT	CONTRA COSTA	T1S R2E NW 1/4 SEC 15		<1
ULTRAPOWER INC	5 JUNE 86	COOLING AND FLOORDRAIN DISCHARGE	SHASTA	T35N R3E SEC 9		<1

TABLE 3

Municipal and Industrial Dischargers with Selenium Levels Elevated Above the Minimum Detection Level of <1 ug/l

Discharger	County	Selenium Concentration (ug/l)*
City of Davis (oxidation pond)	Yolo	4
City of Davis (overland flow)	Yolo	6-11
Lemoore Naval Air Station	Kings	1-2
City of Taft	Kern	1
City of Woodland	Yolo	1
Fibreboard Corporation	Contra Costa	1
Shell Ag Chem	Stanislaus	1
J.R. Simplot	Fresno	8-10
J.R. Simplot	Fresno	20

*The existing drinking water standard is 10 ug/l.