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TRANSMITTAL SHEET

TO:	FROM:
Carl Goldstein	X Steve Costa X Karen Glatzel
COMPANY:	DATE:
U.S. EPA	3/29/99
PHONE NUMBER:	TELEPHONE NUMBER:
415-	707-677-0123
RE:	FAX NUMBER:
Samoa Cannery Data	707-677-9210

☐ URGENT X FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

NOTES/COMMENTS:

Carl,

Enclosed are the documents you requested, as follows:

1) Effluent Testing Summary for Section D priority Pollutant and Bioassay Studies, for StarKist Samoa and VCS Samoa Packing, Tests Conducted Feb 1993 – Sept 1997.

2) Receiving Water Quality Monitoring Report Pago Pago Harbor, American Samoa, March 1996 Sampling. Conducted by StarKist Samoa and VCS Samoa Packing, for U.S. EPA and ASEPA. (Copy without appendices)

The March 1996 Water Quality Sampling Report is an example of the work conducted by the canneries for harbor water quality monitoring. This type of sampling was conducted in March 1995 (Supplemental Technical Memo for ASEPA), March 1996, November 1996, and September 1997.

We can supply you with complete copies of all the reports, but they should be in your files (from Pat Young). Please don't hesitate to call if you need more information.

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PAGO PAGO HARBOR DATA

DATE	SOURCE
NO DATE	FILE: SAMOAN AFFAIRS - "SUMMARY OF EXISTING METALS DATA OFF SWMARINE RAILWAY IN AMERICAN SAMOA" THIS HAS DATA FROM VARIOUS SOURCES AND IS ONLY ONE PAGE; HAS METALS IN WATER COLUMN & SEDIMENT
APRIL 29, 1993	"JOINT CANNERY OUTFALL SEDIMENT MONITORING STUDY" - INNER & OUTER HARBOR; COMPLIANCE W/ SECTION 6 OF PERMIT; ASSESS CONC. OF NUTRIENTS & ORGANICS - CH2M HILL
MARCH 15, 1991	"USE ATTAINABILITY AND SITE-SPECIFIC CRITERIA ANALYSES PAGO PAGO HARBOR, FINAL REPORT", CH2M HILL
JUNE 15, 1995	"METALS SOURCE IDENTIFICATION STUDY FOR SAMOA PACKING", CH2M HILL
AUGUST 1993	"JOINT CANNERY OUTFALL CORAL REEF SURVEY REPORT", CH2M HILL - NO SEDIMENT ANALYSES
AUGUST 8, 1991	"JOINT CANNERY OUTFALL MIXING ZONE APPLICATION", CH2M HILL, - HAS HISTORICAL WQ CONDITIONS
MARCH 1991	"ENGR & ENV FEASIBILITY EVAL. OF WASTE DISPOSAL ALT. CH2M HILL - HAS WQ & SEDIMENT DATA

APRIL 18, 1986 "PHASE II REPORT" - CH2M HILL - HAS WQ & SEDIMENT DATA.

7/84 - 9/85	Groundwater and rainfall data for Tutuila (USGS)
4/84	Oceonographic studies in support of AS wastewater facilities planning CH2MHill
1989	Wasteload Allocation for Pago Hydro Resources International
10/79	Baseline Water Quality Survey Corps of Engineers.
6/71	Tutuila Water Quality Survey. Charles Seeley.
3/91	Use Attainability and Site Specific Criteria Analysis CH2MHill
9/78	Wastewater Management Data Evaluation Study for American Samoa M&E Pacific
4/86	Conceptual Designs for Outfall and Barging Alternatives / Alternative Mixing Zone Analysis CH2MHill

? Estimating Streamflow Characteristics for Streams on Twitiler.

USGS.

Not Available Yet Watershed Plan.

Receiving Water Quality Monitoring Report

Pago Pago Harbor, American Samoa
March 1996 Sampling

Prepared for

StarKist Samoa
NPDES Permit AS0000019
and
VCS Samoa Packing
NPDES Permit AS0000027

APPENCIES NOT INCLUDED

Submitted to

U.S. Environmental Protection Agency
and
American Samoa Environmental Protection Agency

Prepared by

CH2M HILL
and
gdc

6 March 1997

TABLE OF CONTENTS

Page

1. Introduction 1-1
    1.1 Purpose 1-1
    1.2 Study Location 1-1
    1.3 Background 1-2
    1.4 Scope and Organization of Report 1-3

2. Field Data Collection 2-1
    2.1 General Description 2-1
    2.2 Description of Field Methods 2-2
    2.3 Deviations from the Study Plan 2-3

3. Data Summary 3-1
    3.1 Physical and Hydrographic Parameters 3-1
    3.2 Nutrient and Biological Parameters 3-4
    3.3 Zinc and Copper Concentrations 3-7

4. Conclusions and Recommendations 4-1

5. References 5-1

APPENDICES

Appendix I: USEPA Permit Modification for Receiving Water Quality Monitoring

Appendix II: Combined Sampling and Analysis Plan and Standard Operating Procedures

Appendix III: Vertical Profile Data for Each Station

Appendix IV: Corrections to Dissolved Oxygen and pH Measurements

Appendix V: Chain of Custody Records

Appendix VI: Laboratory Report for Nutrients and Biological Parameters

Appendix VII: Laboratory Results for Zinc and Copper

FIGURES

Page

Figure 1-1. Overview of Study Site 1-4
Figure 1-2. Pago Pago Harbor 1-5
Figure 1-3. Outfall and Mixing Zone Location 1-6

Figure 2-1. Station Locations 2-6

TABLES

Table 2-1. Station Occupation Summary: March 1996 2-4
Table 2-2. Sampling Analysis and Handing Procedures 2-5

Table 3-1.a. Summary of Temperature Measurements: 13 March 1996 3-8
Table 3-1.b. Summary of Salinity Measurements: 13 March 1996 3-9
Table 3-1.c. Summary of Sigma-t Measurements: 13 March 1996 3-10
Table 3-1.d. Summary of Dissolved Oxygen Measurements: 13 March 1996 3-11
Table 3-1.e. Summary of pH Measurements: 13 March 1996 3-12
Table 3-1.f. Summary of Tubidity Measurements: March 1996 3-13
Table 3-2. Results of Laboratory Analysis for Selected Stations: 13 March 1996 3-14
Table 3-3. Nutrients and Chlorophyll-a: March 1996 3-15
Table 3-4. Zinc and Copper Results: March 1996 3-16

1. INTRODUCTION

This report describes the first semi-annual Pago Pago Harbor water quality monitoring field measurements done under the revised NPDES permit condition (E) for VCS Samoa Packing and StarKist Samoa. The letter from the U.S. Environmental Protection Agency implementing the changes in the permits, and the revised permit condition are included as Appendix I. The revisions apply to both permits for discharge through the Joint Cannery Outfall (JCO): VCS Samoa Packing holds NPDES permit AS0000027and StarKist Samoa holds NPDES permit AS0000019. The overall purpose of this study and the purpose of this report, a description of the study site, a brief background of the water quality monitoring work done in the Harbor, and the scope and organization of this report are described below in this section of the report. Following sections of the report describe the field data collection, the laboratory results of samples collected, and conclusions and recommendations based on the results.

1.1 PURPOSE

The purpose of the Receiving Water Quality Monitoring Program is, as described in the permit, "to determine compliance with water quality standards". To achieve this the program must, as described in the permit, "document water quality at the outfall, at areas near the zone of initial dilution (ZID) and zone of mixing (ZOM) boundaries, at areas beyond these zones where discharge impacts might reasonably be expected, and at reference/control areas". The purpose of this report is to document the data collected during March 1996 and to evaluate these data in terms of compliance with water quality standards.

1.2 STUDY LOCATION

Water quality measurements and samples were obtained throughout Pago Pago Harbor, Tutuila Island, American Samoa. The island is located approximately 2300 miles southwest of Hawaii, 1600 miles northeast of New Zealand, and 1000 miles south of the equator at latitude 14° 17′ S and longitude 171° 40′ W (approximately). The general location is shown in Figure 1-1. The harbor is approximately 15,000 feet long with the entrance to the south. The outer harbor trends north-south with widths varying between 3000 and 6000 feet. The inner harbor trends east-west with the head of the harbor to the west and ranges from less than 1000 to about 3000 feet wide. Figure 1-2 shows the general harbor morphology. Maximum depths along a cross section range from less than 60 to over 200 feet, with fringing reefs periodically exposed at low tide throughout the middle and outer harbor areas.

The climate is tropical with about 200 inches of rainfall annually, air temperatures typically between 70 and 90°F, and high humidity. Orographic effects create higher rainfall in the vicinity of the harbor than at other locations on the Island. The watershed of the harbor is small relative to the harbor size with about 4.9 mi^2 of drainage area compared to about 2.4 mi^2

of water surface area. Therefore, the harbor is typically a marine dominated system with depressed salinities normally found only very close to stream mouths.

Tides are semi-diurnal with a range of about 2.5 feet and little diurnal inequality. The circulation in the Harbor is mainly wind driven with both tidal and freshwater influences generally very small except at extremely localized sites. Winds are usually from the east and southeast and are from this direction most of the time during the tradewind season, which is typically April/May through October/November. During November/December through March/April the east to southeast winds still predominate but a northwest to northeast component becomes more prevalent (the non-tradewind season).

The tuna canneries discharge through the JCO which terminates in a mulitport diffuser at a depth of approximately 176 feet in the outer harbor (see Figure 1-3). Typical flows through the outfall are approximately 2 mgd. The discharge is in the center of a mixing zone for total nitrogen (TN) and total phosphorous (TP) as shown in Figure 1-3. A small mixing zone for ammonia has also been established and is defined within 12 meters of the diffuser discharge ports.

1.3 BACKGROUND

Prior to the implementation of high strength waste segregation and outfall relocation, the canneries discharged treated wastewater into the inner harbor though two outfalls. These outfalls terminated in about 80 feet of water in open-ended pipes without diffusers. In August 1990 both canneries started high strength waste segregation and offshore ocean disposal of the high strength waste streams (those process streams highest in nitrogen, phosphorous, suspended solids, and BOD). In February 1992 both canneries began discharging treated wastewater (without the high strength waste component) through a single outfall, relocated approximately 8400 feet seaward from the previous discharge point, at about the 180-foot contour, in the outer harbor. The new outfall terminates in a diffuser consisting of four active and two inactive ports.

The current NPDES permits for both canneries, which became effective in October 1992, required monthly monitoring of water quality parameters, with emphasis on nutrients, at established monitoring stations throughout the harbor. This monitoring had been carried out by the American Samoa Environmental Protection Agency (ASEPA). In November 1995, USEPA revised the permit condition for reasons given in the notification of revision (Appendix I). The revised water quality monitoring (Appendix I) is similar to, and extends the usefulness of, the original monitoring condition. The major changes in the permit condition include:

- The frequency of sampling was reduced from monthly to semi-annually
- The number of sampling locations was increased from 17 to 20

- The number of sampling depths was changed from three to a maximum six at 30 foot

- Continuous vertical profiles of temperature, salinity, dissolved oxygen, pH, and turbidity, rather than grab samples, are now required

  increments plus near bottom (with a minimum of three samples in shallow water)
- Suspended solids was removed from the list of analytes
- Sampling for zinc and copper was added for seven locations at specified depths

The first of the monitoring episodes required by the revised permit was conducted in March 1996 and is described in this report.

1.4 SCOPE AND ORGANIZATION OF REPORT

The following sections of this report describe the field data collection (Section 2), summarize the data acquired (Section 3), and provide conclusions and recommendations (if any) based on the field data collection and results (Section 4). Section 2 includes specific information on sample station locations and times, field methods, and describes any deviations from the intended study plan. Section 3 presents summaries of field measurements and laboratory results with detailed information referenced to appendices when appropriate. Section 4 includes an evaluation of compliance with American Samoa Water Quality Standards (ASWQS) based on the data collected, and presents recommendations for changes in methodology, sampling strategies, or other requirements as appropriate. References are provided (Section 5) and appendices are included describing the specifics of the permit condition, the study and analysis plan and standard operating procedures (SAP/SOP), and detailed data supplements for field measurements and laboratory analyses.

2. FIELD DATA COLLECTION

A description of the field data collection during March 1996, including the methods used for field measurements and sample collection are described below. The types of data collected and the locations, dates, and times of measurements and sample collection are summarized. Deviations from the SAP/SOP are listed and discussed.

2.1 GENERAL DESCRIPTION

The field work was conducted between 11 March and 13 March 1996. The activities conducted during this time period included:

- 11 March - Sampling at stations 5, 5A, 6, 6A, 18, 7, 8, 13
- 12 March - Sampling at stations 8A, 9, 9A, 10, 10A, 11, 11A, 12, 14, 15, 16, 17
- 13 March - Continuous profile hydrographic casts made at all stations

During sampling at designated stations water samples were collected for laboratory analysis using standard water sampling bottles (Niskin type bottles). Secchi depth and total water depth were measured at each station. On March 12th dissolved oxygen (DO) was measured at each depth sampled using a YSI DO meter (temperature and salinity internally compensated). Profile casts were also made on March 11th and 12th, as well as on March 13th, but DO readings, when checked during the evening of March 11th, were found to be unacceptable. The DO probe on the profiling instrument was serviced and, as mentioned above, DO values were measured in each of the grab samples recovered on March 12th in addition to the profiles taken on that day.

The continuous profile hydrographic casts were done using a SeaBird conductivity, temperature, depth (CTD) instrument also equipped with pH, DO, and turbidity probes. The meter records every 0.5 seconds on both the downcast and upcast. It is equipped with a pump to provide for sufficient flushing past the sensors.

The meteorological conditions during sampling was as follows:

- 11 March (AM) - Light winds (<5 knots) from the north, generally sunny with scattered rain showers, calm seas
- 11 March (PM) - Light breeze from the north to calm, sunny, flat sea
- 12 March (AM) - Calm to light breeze from east, sunny, calm seas
- 12 March (PM) - Light wind (≈5 knots), sunny, calm seas
- 13 March (AM) - Stiff breeze to light wind (increasing) from north, cloudy, southern swells increasing to 3 feet near harbor entrance (rain squall at 11:45)

- 13 March (PM) - Same as AM with periodic rain squalls every 2 to 3 hours and moderate winds during squalls

Station locations are specified in the permit both by latitude and longitude and graphically. Problems have been encountered previously in correlating the latitude-longitude coordinates with known or charted positions in Pago Pago Harbor. There have been some simple human errors in some cases, but for the most part the explanation is more complex. We have reviewed National Ocean Service (NOS) Charts, British Admiralty Charts, and U.S. Geological Survey charts and bench mark descriptions. There are at least three datums in use in various references: Preliminary NAD (North American Datum) 1927, NAD 1927, and NAD 1983 which essentially corresponds to WGS 1984(World Geodetic System) which is typically used in satellite navigation systems and global positioning systems (GPS). Therefore, latitudes and longitudes derived from different sources can be significantly different for the same point or feature on the ground. Rather than try to reconcile all of the various sources, we have elected to use our best judgment in locating stations based on all of the available charts, maps, and the permit specifications which are mostly (but apparently not exclusively) based on the Preliminary NAD 1927. We have recorded, and permanently stored, the WGS coordinates of the stations actually occupied for this sampling and will use the same coordinates for all future sampling episodes. The WGS coordinates occupied, and the times of station occupation, are given in Table 2-1. Figure 2-1 shows the relative locations of the stations occupied for this study.

2.2 DESCRIPTION OF FIELD METHODS

Direct field measurements included water depth, Secchi depth, dissolved oxygen, in addition pH was measured for surface samples at the time of CTD casts on March 13th. These measurements were conducted as follows:

- Water depth was measured using a non-recording portable fathometer which was occasionally checked by observing the signal produced as the Secchi disk or the SeaBird were lowered and raised through the water column
- Secchi depth was determined by using a 6" diameter black and white (quartered) Secchi disk lowered through the water column on a measured line
- DO was measured using aliquots of each sample as collected in the field on 12 March using a YSI Model 50B meter following the manufactures instructions for use of the meter; the meter and probe were field calibrated before and after the sampling on 12 March
- pH was measured on aliquots of surface samples during the CTD casts on March 13th, as using an Orion Model 250A pH meter

As described above, conductivity, temperature, depth (pressure), DO, pH, and turbidity were measured using an internally recording profiling instrument (SeaBird 19) which had been

calibrated by the manufacturer prior to shipment to American Samoa. Salinity and sea water density were calculated from conductivity and temperature using the SeaBird supplied software.

Water samples were collected using a Niskin type sampling bottle from each depth specified in the permit (depths of collection at each station are shown in Table 2-1). The collection bottle was lowered to the appropriate depth using a measured line and allowed to hang for a minimum of 1 minute. A messenger was dropped down the line and the bottle was retrieved after being tripped by the messenger. Sample bottles as described in Table 2-2 were immediately filled and preserved as indicated in the table, stored on ice, and prepared for shipment to the laboratory as described in the SAP/SOP (Appendix II). In addition, a minimum of two liters was collected for chlorophyll-a analysis. The chlorophyll samples were later filtered through a Whatman grade GF/F glass membrane filter (0.7 microns) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

2.3 DEVIATIONS FROM THE STUDY PLAN

As in any field data collection, problems and required solutions in the field, interpretation of the guidelines being used, weather, equipment malfunctions, and a variety of other factors may lead to deviations from the study plan. There were only minor deviations during this episode of field data collection which either had no substantial effect on the data recovered and in some cases actually enhanced the objectives of the study. The identified deviations for this study included the following:

- Discrete grab samples for measuring turbidity were collected, in addition to the profile data required by the permit, at selected stations in and around the mixing zone including stations 5, 12, 15, 16, 17, and 18
- DO was measured for all discrete grab samples for all stations occupied on 12 March 1996
- pH was measured for surface samples at all stations, during CTD casts

Most of the actions listed above were used to verify, and adjust as necessary, data being taken by the vertical profiling (CTD) instrument.

Table 2-1
PAGO PAGO HARBOR WATER QUALITY MONITORING
STATION OCCUPATION SUMMARY
March 1996

Station Number	Sample Collection		CTD Casts [1]		Latitude 14° S [2]	Longitude 170° W [2]	Water Depth[3]	Secchi Depth[4]	Sampling Depths
	Date	Time	Date	Time	(minutes)	(minutes)	(feet)	(feet)	(feet)
TRANSITION ZONE									
5	3/11	11:30	3/13	10:24	17.713	39.733	142	77 (S)	S, 30, 60, 90, 120, B
5A	3/11	10:45	3/13	10:43	18.045	40.393	155	71 (S)	S, 30, 60, 90, 120, B
OUTER HARBOR									
6	3/11	13:03	3/13	11:03	17.211	40.298	204	43 (S)	S, 30, 60, 90, 120, B
6A	3/11	12:10	3/13	10:54	17.316	40.582	67	49 (S)	S, 30, B
7	3/11	15:20	3/13	11:53	17.226	39.878	182	53 (S)	S, 30, 60, 90, 120, B
8	3/11	16:23	3/13	11:20	16.843	40.098	180	62 (S)	S, 30, 60, 90, 120, B
18	3/11	13:45	3/13	11:48	17.092	40.041	194	50 (S)	S, 30, 60, 90, 120, B
MIDDLE HARBOR									
8A	3/12	10:30	3/13	12:09	16.826	40.150	181	52 (S)	S, 30, 60, 90, 120, B
9	3/12	14:55	3/13	13:05	16.562	40.194	125	40 (S)	S, 30, 60, 90, B
9A	3/12	15:30	3/13	13:15	16.293	40.559	125	31 (S)	S, 30, 60, 90, B
10	3/12	14:10	3/13	12:56	16.755	40.637	178	48 (S)	S, 30, 60, 90, 120, B
10A	3/12	13:40	3/13	12:45	16.997	40.451	121	45 (S)	S, 30, 60, 90, B
14	3/12	09:30	3/13	12:04	16.911	40.065	175	57 (S)	S, 30, 60, 90, 120, B
15	3/12	11:45	3/13	12:20	16.584	40.116	64	44 (S)	S, 30, B
16	3/12	11:15	3/13	12:33	16.891	40.354	197	52 (S)	S, 30, 60, 90, 120, B
17	3/12	09:10	3/13	11:30	16.804	40.086	102	56 (S)	S, 50, B
INNER HARBOR									
11	3/12	12:10	3/13	14:30	16.480	40.947	160	50 (S)	S, 30, 60, 90, 120, B
11A	3/12	16:00	3/13	14:23	16.464	41.151	140	28 (S)	S, 30, 60, 90, 120, B
12	3/12	17:15	3/13	14:16	16.449	41.376	103	33 (Sh)	S, 50, B
13	3/11	17:10	3/13	14:09	16.304	41.841	31	23 (Sh)	S, 50, B

Notes:
[1] CDT casts were taken at the same time the samples were collected, but all stations were reoccupied after maintenance was done on the DO probe. The later set of data (3/13) is provided in this report.
[2] Coordinates are as recorded by GPS using the WGS coordinate system (see text for additional details).
[3] Water depths as recorded on the day of sample collection, correspondence with the day of the CTD casts is typically within a few feet.
[4] (S) = sunny; (Sh) = shadows and/or low sun angle

Table 2-2
PAGO PAGO HARBOR WATER QUALITY MONITORING
SAMPLE ANALYSIS AND HANDLING PROCEDURES
MARCH 1996

PARAMETER	REQUESTED ANALYTICAL METHOD	REQUESTED REPORTING DETECTION LIMIT	SAMPLE HOLDING TIME	SAMPLE CONTAINER	SAMPLE PRESERVATION
Temperature	Field Probe	0.1°C	N/A	N/A	none
Salinity	Field Probe	0.1 PSU	N/A	N/A	none
Dissolved O_2	Field Probe	0.1 mg/l	N/A	N/A	none
pH	Field Probe	0.1 SU	N/A	N/A	none
Turbidity	Field Probe	0.2 NTU	N/A	N/A	none
Turbidity[1]	EPA 180.1	0.01 NTU	48 hours [2]	500 ml plastic	none
Nitrite Nitrogen	EPA 354.1	0.001 mg/l	48 hours [2]	2 - 500 ml plastic	4°C - H_2SO_4
Nitrate + Nitrite	EPA 353.2	0.010 mg/l	28 days		
Ammonia Nitrogen	EPA 350.1	0.005 mg/l	28 days		
Total Kheldal Nitrogen	EPA 351.3	0.025 mg/l	28 days		
Total Phosphorus	EPA 365.2	0.005 mg/l	28 days		
Chlorophyll-a	SM 1002 G	0.03 mg/m^3	3 months	Whatman (0.7 micron) GF/F filter	frozen, manganese sulfate
Zinc	EPA 200.7	20 µg/l	6 months	500 ml plastic	4°C - HNO_3 to a pH of ≤ 2
Copper	EPA 220.2[3]	2 µg/l [3]			

Notes:
[1] Turbidity samples sent to lab from selected stations only to verify probe readings. Stations selected at discretion of filed team leader.
[2] Holding times for turbidity and nitrite-nitrogen are unavoidably exceeded because of logistics involved in shipping from American Samoa. The laboratory (AMTEST) agreed to test for these constituents immediately upon receipt of the samples.
[3] The laboratory was requested to use the method and achieve the detection limit shown. The laboratory used a different method (200.7) and did not achieve the requested limit (reported at < 25 µg/l).

3. DATA SUMMARY

The parameters measured, in both the field and laboratory are conveniently categorized into three classes for this study: physical and hydrographic parameters that generally describe the water column structure; nutrient and biological parameters that relate more to the health of the harbor; and trace metals. Physical and hydrographic parameters include temperature, salinity, density, DO, pH, tubidity, and Secchi depth. Nutrient and biological parameters include the various types of nitrogen, phosphorous, and chlorophyll-a. Zinc and copper were the trace metals of specific interest for this investigation. The results of the March 1996 sampling episode for each of these classes of parameters are presented below.

3.1 PHYSICAL HYDROGRAPHIC PARAMETERS.

The physical and hydrographic parameters measured in the field during the March 1996 harbor monitoring included (in addition to station location and total water depth): temperature, conductivity, dissolved oxygen, pH, turbidity, and light penetration by means of Secchi depth. All of the above parameters except for Secchi depth were measured as continuous vertical profiles. At selected stations turbidity was also measured in the laboratory using the water samples collected as described above. Salinity and density profiles were calculated from the CTD data using the SeaBird software.

Tables 3-1.a through 3-1.f summarize the vertical water column profile data collected with the profiling instrument. The data plots of the hydrographic variables are provided in Appendix III. The Secchi depth measurements are presented in Table 2-1 above. The laboratory analyses for turbidity are given in Table 3-2. A brief description of each of the hydrographic parameters of interest is given below.

3.1.1 Temperature

Temperature summaries are given in Table 3-1.a. There was very little variation in temperature throughout the harbor with measured values between 29 and 30 °C. Inner harbor temperatures were a few tenths of a degree warmer than the open ocean. The vertical temperature variations were no more than a few tenths of a degree Celsius. There was no identifiable effect of the discharge observable in or around the boundary of the mixing zone.

3.1.2 Salinity

Salinity summaries are provided in Table 3-1.b. As in the case of temperature, there was little variability longitudinally or vertically. In two cases a depression of about 7 ppt was found at the surface in the inner harbor (Stations 11 and 13) which represented a fresher surface layer. In general, however, there is little stratification with vertical variations typically less than 1 ppt. There is no discernible influence from the JCO discharge.

3.1.3 Density

Density (Table 3-1.c), in terms of σ_t, is summarized in Table 3-1.c. The water column is very well mixed with little indication of a strong density gradients except at Stations 11 and 13 mentioned above in the discussion on salinity. A relatively thin freshwater lens was observed at these locations during the time of data collection. In general the vertical changes in density are 0.5 to less than 1 σ_t unit (0.001 gm/cm^3). There is little longitudinal variation and no discernible influence from the JCO discharge.

3.1.4 Dissolved Oxygen

There is both vertical and longitudinal variability of DO indicated in the data provided in Table 3-1.d and Appendix III, as was expected. There is, however, no indication of a reduction of DO in the mixing zone. The surface DO increased slightly from the harbor entrance to the head of the harbor and the bottom values decreased in the same fashion. The water column averages were essentially the same for all locations in the harbor.

The measured DO was above the numerical American Samoa water quality standard (ASWQS) on a water column average basis at every station and on a point-by point basis at over 90 percent of the points sampled. [The ASWQS is that DO shall be "*Not less than 70 percent of saturation or less than 5.0 mg/l. If the natural level of dissolved oxygen is less than 5.0 mg/l, the natural level will become the standard.*"] The data available is insufficient to determine if those observed values below 5.0 are "natural" or result from the effluent discharge. However, the pattern observed indicates high inner harbor productivity may be a primary factor resulting in depressed DO levels in the inner harbor. The ASWQS specifies an (undefined) average value of 5 mg/l as that needed for compliance. It is noted that any type of reasonable average for the data recovered will result in compliance. Water column averages are shown in Table 3-1.d.

As noted above, the vertical profiles were initially done at the time of water sample collection and then redone following sample collection because of problems encountered with the DO probe on the CTD unit. Attempts to correct this problem by servicing the unit in the field were not particularly successful. Therefore, a side-by-side field comparison with a YSI DO meter was done to determine calibration coefficients for the SeaBird unit. The method and calculations for developing these coefficients is shown in Appendix IV. It is believed that the DO measurements are accurate to ±0.2 mg/l or better, the problem with the SeaBird probe notwithstanding.

3.1.5 pH Measurements

Table 3-1.e summarizes the pH readings obtained during the study. There are small differences observed along the harbor axis, but no distinct trends. Surface values are slightly lower than those at depth. No effect of the discharge can be observed.

Measured pH values appear to meet the ASWQS numerical standard at all locations. [The ASWQS is the "*The pH range shall be 6.5 to 8.6 and be within 0.2 pH unit of that which would occur naturally.*"] The natural value for marine waters is generally considered to be in the range of 7.5 to 8.4. For near surface waters (water in equilibrium with atmospheric CO_2, pH is typically about 8.1 to 8.2. Variability in coastal waters will be more extreme and freshwater inflows will tend to depress the natural values.

During the study, it was observed that the pH values being recorded by the profiling instrument appeared consistently lower than expected. Calibration of the instrument in the field was considered but determined to be not feasible. Therefore, pH of surface samples was measured with a calibrated pH meter and compared to the readings at the surface from the profiling instrument and a correction was developed and applied to the profile data. The details of this process are provided in Appendix IV.

3.1.6 Turbidity

Turbidity was measured throughout the water column using an OBS3 optical sensor mounted on the SeaBird CTD. Unfortunately, the turbidity sensor had been pre-set for a high turbidity range. Therefore, the minimum reading of the instrument was 0.49 NTU and the resolution was 0.49 NTU. That means any value lower than 0.49, even a value of zero, was recorded as 0.49 NTU, any value between 0.5 and 0.98 NTU was recorded as 0.98 NTU. At all stations, throughout most of the water column, values of 0.49 and 0.98 were recorded (Appendix III). A higher turbidity layer was typically observed near bottom. The maximum, minimum, and average values are summarized for each station in Table 3-1.f.

The ASWQS for turbidity is 0.75 NTU (median value). The median value for each station is was not calculated but can be approximated from the plots in Appendix III. However, it is difficult to evaluate compliance with the ASWQS based on the profile data because of the instrument characteristics. It appears that compliance is achieved. The potential problem caused by the instrument set-up was recognized in the field and turbidity analysis was requested on selected samples in and around the mixing zone. Samples from the following stations were tested: Station 5 outside the harbor mouth: Station 12 in the inner harbor, and Stations 15, 16, 17, and 18 around the periphery of the mixing zone. The data are given in Table 3-2 and indicate compliance with ASWQS.

3.1.7 Secchi Depth

Secchi depths are presented in Table 2-1 above. The values recorded show a trend, increasing from the inner harbor to the outer harbor as would be expected. This trend is somewhat confused by the differences in time of day, and thus sun angle and diurnal variations in water clarity. The Secchi depths observed in the inner harbor range from 23 to 50 feet. The Secchi depth was 23 feet at Station 13 which is the inner most station, in a total water depth of about 31 feet.

The ASWQS is in terms of light penetration, which cannot be directly converted from Secchi or turbidity readings. However, some estimates can be made with light penetration being estimated by Secchi depth using the following approximation:

$$\chi = \kappa \cdot D^{-1}$$

where

χ = extinction coefficient for visible light

κ = a constant

and

D = Secchi depth in meters for a 30 cm Secchi disk.

The constant κ is not easily determined but is often taken as 1.7 based on data from the English Channel (Sverdrup, 1942). Using the above approximation, the depth of light penetration of 1 percent corresponds to a Secchi depth of 24 feet. This is for a 30 cm Secchi disk and it is noted that a smaller disk was used for the measurements listed in Table 2-1.

The ASWQS state that light penetration of 1 percent of the incident light should penetrate to a depth of 65 feet 50 percent of the time. As calculated above this corresponds to Secchi depth of approximately 24 feet. The data indicates that ASWQS for light penetration are being satisfied throughout the harbor.

3.2 NUTRIENT AND BIOLOGICAL PARAMETERS

Parameters to evaluate potential impacts of biological productivity included nutrients and chlorophyll-a. Nutrients included total phosphorus, total Kheldal nitrogen (TKN), ammonia nitrogen, nitrate plus nitrite, and nitrite nitrogen. ASWQS apply to total nitrogen (TN) which was calculated by adding the nitrogen components, noting that ammonia is included in TKN. Table 2-2 above indicates the nutrient constituents measured and the methods used in the laboratory. Samples were prepared for chlorophyll-a analysis by filtering 2 liters of water through a filter (see Table 2.2) using a vacuum pump apparatus. The filters were treated with manganese sulfate as a preservative, frozen, and then sent to the laboratory for analysis.

The laboratory used for the analyses was AMTEST, located in Redmond, WA. Samples were stored on ice in American Samoa and shipped on ice via DHL to the laboratory. Laboratory results and chain of custody forms for the laboratory are provided in Appendices V and VI. Each of the nutrient and parameters are discussed below based on the data summarized in Table 3-3.

3.2.1 Total Nitrogen

The numerical standard (median value) for total nitrogen (TN) is 200 µg/l. Of the 102 measurements 20 were above this value, which is a surprising high number level based on the previous monitoring done in the harbor. The harbor-wide median value is well below 200

μg/l, and the median value is greater than 200 μg/l at only two stations. The two stations are Station 14 which is the station at the discharge point (within the mixing zone), and Station 13 which is the innermost station, at which elevated levels of nutrients are commonly seen and are attributable to run off from Pago Pago Creek. These two stations account for seven of the twenty values exceeding 200 μg/l. It is noted that the other two stations within the mixing zone (Stations 8 and 8A) had no measurements over 200 μg/l. The locations of the other values over 200 μg/l include:

- Transition Zone Station 5A at all depths except near surface and 90 feet: The increased values at this station are difficult to explain and are not reflected, for example at Station 5. Values at this station ranged from < 25 to 392 μg/l. Whether or not these values are related to high values at some depths at other outer harbor stations cannot be determined.
- Outer Harbor Station 6 at 30 feet: A value of 260 μg/l was observed at this depth, the other five depths are below 200 μg/l.
- Outer Harbor Station 6A at near surface: A value of 760 μg/l was observed at this depth, the other two depths are below 200 μg/l.
- Outer Harbor Station 7 at 120 feet: A value of 280 μg/l was observed at this depth, the other five depths are below 200 μg/l.
- Middle Harbor Station 9A at a depth of 90 feet: A value of 200 μg/l was observed at this depth, the other four depths are below 200 μg/l.
- Middle Harbor Station 10A at depths of near surface and 60 feet: Values of 340 and 290 μg/l, respectively, were observed at these depths, the other three depths at this station are below 200 μg/l.
- Inner Harbor Station 11 at depths of 90 and 120 feet: Values of 270 and 300 μg/l, respectively, were observed at these depths, the other four depths at this station are below 200 μg/l.
- ZOM Boundary Station 15 near surface: A value of 200 μg/l was observed at this depth, the other two depths are below 40 μg/l.
- ZOM Boundary Station 18 at depths of 60 and 90 feet: Values of 240 and 230 μg/l, respectively, were observed at these depths, the other three depths at this station are below 121 μg/l.

Although there are isolated values above 200 μg/l, the ASWQS appear to be met throughout the harbor at the time of sampling, except for a very small area within the mixing zone.

3.2.2 Total Phosphorus

The numerical standard for total phosphorus (median value) is 30 μg/l. As shown in Table 3-3, 97 of the 102 measurements were below the ASWQS, and 1 measurement equaled the standard (near bottom at Station 16). Only near bottom measurements at Stations 7, 8A,

11A, and 18 exceeded the value of 30 μg/l. The highest value was 43 μg/l at Station 7, near bottom. In all cases the water column average and median was below the ASWQS. It is noted that Stations 14 and 8A are within the mixing zone.

3.2.3 Chlorophyll-a

The numerical standard (median) for chlorophyll-a is 1 μg/l. Thirty seven (37) of the 102 measurements for chlorophyll-a indicated values higher than 1.0. The highest value was 3.2 with most of the values over 1.0 μg/l being below 2.0 μg/l . The median value for the harbor was less than 1.0 μg/l and the median value for each station was below 1.0 μg/l except for Stations 8, 13, 18, and 9. The median values for near surface, 30 feet, 60 feet, and 90 feet were all below 1.0 μg/l. In fact, the pattern is unexpected with most of the high values being in the deepest water. This would not compromise water clarity or, as verified by the Secchi readings, the standard for light penetration. Six stations had concentrations higher than 1.0 μg/l at depths of 60 feet or less, including the four listed above. All other occurrences of concentrations of more than 1.0 μg/l are described below (all other occurrences were at depths of 90 feet or greater). The six stations with concentrations over 1.0 μg/l <u>at depths of 60 feet or less</u> were as follows:

- Middle Harbor Station 9 at near surface: A chlorophyll-a concentration of 2.0 μg/l was measured near surface. Concentrations were below 1.0 at depths of 30 and 60 feet.
- Middle Harbor Station 9A at near surface: A chlorophyll-a concentration of 1.4 μg/l was measured near surface. Concentrations were at or below 1.0 at depths of 30 and 60 feet and all other depths.
- Middle Harbor Station 11 at 60 feet: A chlorophyll-a concentration of 1.5 μg/l was measured at 60 feet. Concentrations were below 1.0 μg/l at near surface and depths of 30 and 90 feet.
- Inner harbor Station 13 at 50 feet: A chlorophyll-a concentration of 1.3 μg/l was measured at 50 feet. Concentrations were 1.0 μg/l at near surface and depths and 1.3 μg/l at the bottom.
- Mixing Zone Station 8 at near surface and 30 feet: Chlorophyll-a concentrations of 1.1 μg/l were measured at both depths. Concentrations were below 1.0 μg/l were measured at 60 feet.
- ZOM Boundary Station 18 at 30 feet: A chlorophyll-a concentration of 1.2 μg/l was measured at 30 feet. Concentrations were below 1.0 μg/l at near surface and 60 feet.

It appears that many of the elevated values are attributable to runoff through Pago Pago Creek, other streams around the harbor. The elevated near bottom values are counter intuitive and could arise from a number of sources including resuspension of nutrients from inner harbor sediments, collection of phytoplankton or detrital material falling from the surface layer, and interactions with harbor circulation. Downwelling caused by strong winds from a southerly direction could be responsible for moving material into the deep layers, but there is

no way to assess whether or not this factor was important just prior to the time of sampling. The values probably cannot be attributed to the JCO effluent discharge in the outer harbor, and are not consistent with nutrient distributions. Overall, regardless of the higher values in certain locations, the ASWQS appear to be met throughout the harbor with the possible exception of the far inner harbor, which is attributable to causes other than the JCO discharge as mentioned above.

3.3 Zinc and Copper Concentrations

Zinc and copper were measured at specified stations and depths. Samples were collected and preserved as described above and in the SAP/SOP (Appendix II). Table 3-4 summarizes the results of the metals analyses. The chain of custody forms and laboratory results are provided in Appendices V and VII, respectively. All analyses resulted in reported values less than detection limits. The reason for conducting these analyses is to provide receiving water data for the assessment of a mixing zone for these two metals. The data for zinc is adequate for this purpose with values of <20 μg/l as requested and well below the water quality criteria. However, the laboratory, contrary to their initial quote, was not able to meet the requested detection limit for copper (2 μg/l) and reported all values as <25 μg/l, which is unacceptable. We will either resolve this issue with the existing laboratory or find an alternate laboratory for the next round of sampling.

Table 3-1.a Summary of Temperature Measurements (°C) 13 March 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Transition Zone				
5	29.59	29.21	29.33	0.08
5A	29.46	29.28	29.33	0.04
Outer Harbor				
6	29.73	28.86	29.25	0.22
6A	29.57	29.30	29.44	0.05
7	29.85	28.98	29.32	0.24
Mixing Zone - Interior				
8	29.78	29.00	29.31	0.22
8A	29.83	29.08	29.36	0.21
14	29.82	29.00	29.33	0.23
Mixing Zone - Edge				
15	29.83	29.28	29.36	0.21
16	29.77	28.99	29.29	0.18
17	29.86	29.42	29.51	0.11
18	29.82	28.97	29.29	0.23
Middle Harbor				
9	29.84	29.41	29.54	0.14
9A	29.86	29.39	29.50	0.13
10	29.77	29.08	29.35	0.16
10A	29.67	29.34	29.49	0.12
Inner Harbor				
11	29.73	29.19	29.39	0.12
11A	29.95	29.21	29.44	0.15
12	29.98	29.24	29.48	0.18
13	29.84	29.72	29.74	0.03

Table 3-1.b Summary of Salinity Measurements (PSU) 13 March 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Transition Zone				
5	34.93	34.53	34.77	0.13
5A	34.92	34.51	34.77	0.14
Outer Harbor				
6	35.12	34.48	34.85	0.18
6A	34.76	34.47	34.64	0.10
7	35.06	34.20	34.84	0.19
Mixing Zone - Interior				
8	35.05	34.51	34.83	0.18
8A	35.03	34.36	34.81	0.18
14	35.06	34.41	34.81	0.19
Mixing Zone - Edge				
15	35.03	34.36	34.81	0.18
16	35.06	34.36	34.86	0.17
17	34.84	34.50	34.68	0.13
18	35.07	34.47	34.85	0.18
Middle Harbor				
9	34.87	34.36	34.71	0.15
9A	34.90	34.31	34.75	0.16
10	35.03	34.43	34.83	0.16
10A	34.91	34.46	34.69	0.16
Inner Harbor				
11	34.99	27.58	34.76	0.51
11A	34.98	34.32	34.80	0.15
12	34.97	34.21	34.78	0.17
13	34.66	27.30	34.51	0.82

Table 3-1.c Summary of Sigma-t Measurements 13 March 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Transition Zone				
5	21.94	21.52	21.78	0.13
5A	21.91	21.56	21.78	0.11
Outer Harbor				
6	22.20	21.48	21.87	0.21
6A	21.74	21.49	21.65	0.07
7	22.12	21.19	21.84	0.22
Mixing Zone - Interior				
8	22.10	21.47	21.84	0.21
8A	22.06	21.31	21.80	0.20
14	22.11	21.35	21.82	0.21
Mixing Zone - Edge				
15	22.06	21.31	21.80	0.20
16	22.12	21.33	21.87	0.18
17	21.81	21.43	21.66	0.12
18	22.13	21.43	21.86	0.21
Middle Harbor				
9	21.83	21.31	21.67	0.15
9A	21.86	21.27	21.71	0.16
10	22.06	21.38	21.82	0.17
10A	21.88	21.44	21.67	0.16
Inner Harbor				
11	21.99	16.44	21.75	0.39
11A	21.98	21.24	21.77	0.17
12	21.96	21.15	21.74	0.19
13	21.57	16.06	21.45	0.61

Table 3-1.d Summary of Dissolved Oxygen Measurements (mg/l) 13 March 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Transition Zone				
5	6.06	5.37	5.78	0.13
5A	5.73	5.23	5.57	0.12
Outer Harbor				
6	5.81	5.20	5.53	0.16
6A	5.77	4.84	5.47	0.24
7	6.16	4.36	5.59	0.19
Mixing Zone - Interior				
8	5.79	5.01	5.41	0.26
8A	6.22	4.59	5.53	0.28
14	6.03	5.09	5.51	0.28
Mixing Zone - Edge				
15	6.22	4.59	5.53	0.28
16	6.13	4.24	5.61	0.23
17	6.11	5.35	5.79	0.20
18	5.96	5.24	5.58	0.20
Middle Harbor				
9	6.05	5.00	5.64	0.17
9A	6.38	4.72	5.78	0.23
10	6.19	4.64	5.68	0.29
10A	5.92	5.56	5.74	0.06
Inner Harbor				
11	6.01	4.24	5.56	0.27
11A	6.54	4.66	5.68	0.29
12	6.38	4.20	5.55	0.37
13	6.14	4.07	5.53	0.40

Table 3-1.e Summary of pH Measurements (SU) 13 March 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Transition Zone				
5	7.97	7.95	7.96	0.01
5A	8.14	8.10	8.13	0.01
Outer Harbor				
6	8.17	8.12	8.15	0.02
6A	8.11	8.03	8.09	0.02
7	8.04	8.00	8.01	0.01
Mixing Zone - Interior				
8	8.06	7.99	8.02	0.02
8A	8.01	7.95	7.98	0.02
14	8.04	7.98	8.01	0.02
Mixing Zone - Edge				
15	8.12	8.06	8.09	0.02
16	7.95	7.89	7.92	0.02
17	8.00	7.96	7.98	0.01
18	7.96	7.91	7.93	0.02
Middle Harbor				
9	8.10	8.06	8.07	0.01
9A	8.13	8.07	8.10	0.01
10	7.96	7.90	7.93	0.02
10A	7.80	7.77	7.79	0.01
Inner Harbor				
11	8.10	8.04	8.08	0.02
11A	8.09	8.02	8.06	0.02
12	8.11	8.04	8.08	0.02
13	8.05	8.02	8.03	0.01

Table 3-1.f Summary of Turbidity Measurements (NTU) 13 March 1996				
Station	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Transition Zone				
5	0.98	0.49	0.62	0.21
5A	0.98	0.49	0.83	0.23
Outer Harbor				
6	3.91	0.49	1.00	0.73
6A	1.47	0.49	0.90	0.19
7	4.88	0.49	1.09	0.39
Mixing Zone - Interior				
8	5.86	0.49	2.14	1.66
8A	5.86	0.49	1.70	0.92
14	6.84	0.98	2.32	1.87
Mixing Zone - Edge				
15	5.86	0.49	1.70	0.92
16	5.37	0.49	1.52	0.85
17	0.98	0.49	0.92	0.16
18	5.86	0.49	1.48	1.03
Middle Harbor				
9	2.44	0.98	1.23	0.33
9A	2.93	0.00	0.80	0.44
10	3.91	0.49	1.44	0.76
10A	1.47	0.49	1.03	0.15
Inner Harbor				
11	18.07	0.49	2.21	2.26
11A	10.74	0.49	1.49	1.05
12	45.91	0.49	2.17	3.06
13	7.33	0.98	3.06	1.44

Table 3-2
Results of Laboratory Analyses of Turbidity
for Selected Stations
March 1996

	Turbidity at Station Depths Indicated (NTU)							
Depth (feet)[1]	**S**	**30**	**60**	**90**	**120**	**B**	**Average**	**Median**
Stations								
Transition Zone								
5	0.47	0.08	0.30	0.14	0.50	0.46	0.33	0.30-0.46
Inner Harbor								
12 [2]	0.34	-	0.21	-	-	0.67	0.41	0.34
ZOM Boundary								
15 [3]	0.33	0.18	-	-	-	1.4	0.63	0.33
16	0.11	0.05	0.40	0.12	0.23	2.2	0.52	0.12-0.23
17[3]	0.16	-	0.18	-	-	0.24	0.19	0.18
18	0.19	0.20	0.53	0.08	0.24	6.9	1.36	0.20-0.24

Notes:
[1] S = Near Surface (within 1 meter of the surface); B= Near Bottom (within 1 meter of the bottom)
[2] Station 12 sampled at three depths, note that the mid-depth sample was at 50 feet.
[3] Stations 15 and 17 were sampled at only three depths as shown.

Table 3-3
March 1996, Pago Pago Harbor Water Quality Monitoring
Nutrients and Chlorophyll-a

Station	Depth	Chlorophyll-a (mg/m^3)	Ammonia Nitrogen (mg/l)	TKN (mg/l)	Nitrate + Nitrite (mg/l)	Nitrite Nitrogen (mg/l)	Total Phosphorus (mg/l)
5	SURF	0.33	<0.005	<0.025	<0.01	<0.001	0.025
5	30	0.34	<0.005	<0.025	<0.01	<0.001	0.016
5	60	0.33	<0.005	<0.025	<0.01	<0.001	0.010
5	90	0.43	<0.005	<0.025	<0.01	<0.001	0.012
5	120	1.8	0.006	<0.025	<0.01	0.008	0.021
5	BOTM	1.7	<0.005	0.095	0.016	0.011	0.026
5A	SURF	0.81	<0.005	0.14	<0.01	<0.001	0.009
5A	30	0.36	0.007	0.27	<0.01	<0.001	0.008
5A	60	0.71	0.011	0.35	<0.01	<0.001	0.012
5A	90	0.56	0.012	<0.025	<0.01	<0.001	0.007
5A	120	0.94	0.013	0.38	0.012	<0.001	0.007
5A	BOTM	1.2	0.010	0.18	0.030	0.019	0.011
6	SURF	0.67	0.009	0.079	<0.01	0.001	0.007
6	30	0.34	0.006	0.26	<0.01	<0.001	0.008
6	60	0.45	0.009	0.12	<0.01	<0.001	0.009
6	90	0.66	<0.005	0.063	<0.01	<0.001	0.010
6	120	0.91	<0.005	0.13	<0.01	<0.001	0.013
6	BOTM	0.75	<0.005	0.061	0.016	0.021	0.021
6A	SURF	0.43	<0.005	0.76	0.025	<0.001	0.010
6A	30	0.65	0.008	0.055	<0.01	0.002	0.010
6A	BOTM	0.45	0.006	0.080	<0.01	0.004	0.008
7	SURF	0.66	<0.005	0.12	<0.01	0.004	0.017
7	30	<0.03	<0.005	<0.025	<0.01	0.001	0.022
7	60	0.85	<0.005	<0.025	<0.01	<0.001	0.020
7	90	1.3	<0.005	0.10	<0.01	<0.001	0.019
7	120	2.7	0.016	0.28	<0.01	<0.001	0.028
7	BOTM	1.9	0.013	<0.025	<0.01	0.037	0.043
8	SURF	1.1	<0.005	0.054	<0.01	<0.001	0.024
8	30	1.1	<0.005	0.074	<0.01	<0.001	0.015
8	60	0.69	<0.005	<0.025	<0.01	<0.001	0.013
8	90	1.2	<0.005	0.049	<0.01	0.004	0.025
8	120	1.5	0.009	0.12	<0.01	0.008	0.030
8	BOTM	1.5	<0.005	0.087	<0.01	0.005	0.024
8A	SURF	0.40	<0.005	<0.025	<0.01	0.002	0.018
8A	30	0.52	<0.005	0.089	<0.01	0.001	0.022
8A	60	0.57	<0.005	0.039	<0.01	<0.001	0.022
8A	90	1.3	0.010	<0.025	<0.01	<0.001	0.015
8A	120	1.5	0.008	<0.025	<0.01	<0.001	0.014
8A	BOTM	1.9	0.008	0.077	0.011	0.015	0.032
9	SURF	2.0	<0.005	<0.025	<0.01	0.005	0.016
9	30	0.75	<0.005	0.047	<0.01	<0.001	0.015
9	60	0.96	<0.005	<0.025	<0.01	<0.001	0.018
9	90	2.3	<0.005	0.039	<0.01	<0.001	0.021
9	BOTM	3.2	<0.005	<0.025	<0.01	<0.001	0.024
9A	SURF	1.4	<0.005	0.099	<0.01	<0.001	0.021
9A	30	0.77	<0.005	0.037	<0.01	<0.001	0.025
9A	60	1.0	<0.005	0.15	<0.01	<0.001	0.018
9A	90	0.94	0.006	0.20	<0.01	0.005	0.026
9A	BOTM	0.63	<0.005	<0.025	<0.01	0.005	0.029

Table 3-3 continued							
Station	**Depth**	**Chlorophyll-a (mg/m^3)**	**Ammonia Nitrogen (mg/l)**	**TKN (mg/l)**	**Nitrate + Nitrite (mg/l)**	**Nitrite Nitrogen (mg/l)**	**Total Phosphorus (mg/l)**
10	SURF	0.50	0.007	<0.025	<0.01	0.003	0.025
10	30	0.32	<0.005	<0.025	<0.01	<0.001	0.027
10	60	0.87	0.006	0.087	<0.01	<0.001	0.020
10	90	0.84	<0.005	0.17	<0.01	<0.001	0.016
10	120	0.62	<0.005	0.058	<0.01	<0.001	0.019
10	BOTM	2.2	<0.005	0.051	<0.01	<0.001	0.022
10A	SURF	0.71	0.019	0.34	<0.01	<0.001	0.013
10A	30	0.57	0.008	0.14	<0.01	<0.001	0.010
10A	60	0.47	0.009	0.29	<0.01	<0.001	0.012
10A	90	0.67	0.009	0.11	<0.01	<0.001	0.007
10A	BOTM	0.81	0.018	0.13	<0.01	<0.001	0.012
11	SURF	0.90	0.011	0.069	<0.01	<0.001	0.007
11	30	0.34	0.009	0.068	<0.01	<0.001	0.012
11	60	1.5	0.009	0.047	<0.01	<0.001	0.009
11	90	<0.03	0.010	0.27	<0.01	<0.001	0.009
11	120	1.3	0.010	0.30	<0.01	<0.001	0.010
11	BOTM	1.3	0.014	0.049	0.022	0.016	0.025
11A	SURF	0.73	0.024	0.13	<0.01	<0.001	0.009
11A	30	0.92	0.016	<0.025	<0.01	<0.001	0.008
11A	60	0.89	0.016	0.17	<0.01	<0.001	0.008
11A	90	0.90	0.016	0.11	<0.01	<0.001	0.010
11A	120	1.4	0.017	0.065	<0.01	<0.001	0.011
11A	BOTM	1.8	0.018	0.028	<0.01	<0.001	0.043
12	SURF	0.79	<0.005	0.063	<0.01	<0.001	0.018
12	50	0.59	<0.005	<0.025	<0.01	<0.001	0.027
12	BOTM	1.2	<0.005	<0.025	<0.01	<0.001	0.024
13	SURF	1.0	0.016	0.30	<0.01	<0.001	0.014
13	50 (15)	1.3	0.021	0.17	<0.01	<0.001	0.010
13	BOTM	1.3	0.027	0.30	<0.01	<0.001	0.011
14	SURF	0.71	0.009	0.42	<0.01	<0.001	0.009
14	30	0.70	0.012	0.21	<0.01	<0.001	0.011
14	60	0.71	0.011	0.35	<0.01	<0.001	0.013
14	90	2.0	0.034	0.25	<0.01	<0.001	0.019
14	120	1.4	0.017	0.14	<0.01	0.005	0.010
14	BOTM	1.2	0.020	0.45	0.012	0.018	0.025
15	SURF	0.46	<0.005	0.20	<0.01	0.004	0.018
15	30	0.89	<0.005	<0.025	<0.01	0.022	0.022
15	BOTM	1.3	0.006	<0.025	0.014	0.003	0.026
16	SURF	0.42	<0.005	0.10	<0.01	0.007	0.022
16	30	0.48	0.007	0.11	<0.01	0.005	0.022
16	60	0.94	<0.005	<0.025	<0.01	<0.001	0.021
16	90	0.74	0.006	0.075	<0.01	0.004	0.014
16	120	1.1	<0.005	0.061	<0.01	0.003	0.017
16	BOTM	1.5	<0.005	<0.025	0.012	0.024	0.030
17	SURF	0.74	<0.005	0.035	<0.01	0.004	0.021
17	50	0.29	<0.005	0.17	<0.01	0.004	0.016
17	BOTM	0.98	0.011	0.17	<0.01	<0.001	0.020
18	SURF	0.54	<0.005	0.031	<0.01	0.003	0.013
18	30	1.2	<0.005	0.078	<0.01	<0.001	0.017
18	60	0.77	<0.005	0.24	<0.01	<0.001	0.023
18	90	1.3	<0.005	0.23	<0.01	<0.001	0.014
18	120	1.8	<0.005	0.17	<0.01	<0.001	0.017
18	BOTM	1.4	<0.005	0.097	0.024	0.037	0.032

Table 3-4 Zinc and Copper Analysis Results			
Station	**Depth**	**Zinc Concentration (μg/l)**	**Copper Concentration (μg/l)**
Transition Zone			
5	30	<20	<25
	120	<20	<25
	Near Bottom	<20	<25
5A	30	<20	<25
	120	<20	<25
	Near Bottom	<20	<25
Inner Harbor			
11	30	<20	<25
	120	<20	<25
	Near Bottom	<20	<25
13	Near Surface	<20	<25
	Near Bottom	<20	<25
ZOM Boundary			
15	30	<20	<25
	120	<20	<25
	Near Bottom	<20	<25
16	30	<20	<25
	120	<20	<25
	Near Bottom	<20	<25
18	30	<20	<25
	120	<20	<25
	Near Bottom	<20	<25

4. CONCLUSIONS AND RECOMMENDATIONS

The first semiannual Receiving Water Quality Monitoring study was successfully completed with only minor deviations from the SAP/SOP. The data indicate compliance with ASWQS throughout the harbor. The water quality standards are based on median values of many constituent concentrations, and the standards were fully achieved on this basis. The numerical criteria, on which the standards are based, are occasionally exceeded at individual stations (although this does not necessarily mean water quality standards are violated). However, in no instance outside the mixing zone, can the individual excursions above the criteria be attributed to the JCO discharge. The canneries are in compliance with the applicable conditions of the NPDES permits.

Other than specific points described in the report, no general recommendations are made for conducting future sampling episodes of water quality monitoring. Summarizing specific points for detailed field and laboratory work the following recommendations are made, and will be followed in the future:

[1] Side-by-side tests of the profiling DO probe and a field calibrated unit should be conducted prior to and following the profiling casts and prior to the collection of samples. Therefore, if the profiling DO instrument is malfunctioning it can be repaired (if possible), readings can be reliably adjusted, or DO can be measured in each grab sample as collected. The same procedure is recommended for the profiling temperature probe. Similar procedures should be done for pH and salinity, which can be measured during the filtering process for chlorophyll samples for each grab sample.

[2] A different turbidity sensor, or a similar sensor configured for more sensitivity and/or a lower range of turbidity (better resolution), should be used. Concurrent with the "dock side" verification testing for other profiling instruments, the readings from the turbidity sensor should be examined before and after the sampling and profiling. If problems are encountered, then a selected set of samples, or all samples, can be listed for laboratory testing for turbidity. No additional sample volume is required, so this decision can be made after sampling is completed. It is noted that the same procedure could be used for salinity and pH.

[3] Better copper results (lower detection) must be achieved. A concerted effort to achieve such results will be instituted. However, at this time, there is no reason to increase the number of samples to be analyzed during the next field data collection episode.

5. REFERENCES

CH2M HILL, 1991. Engineering and Environmental Feasibility Evaluation of Waste Disposal Alternatives. Prepared for StarKist Samoa, Final Report, March 1991.

CH2M HILL and Glatzel and Associates, 1995. Results of March 1995 Harbor Water Quality Monitoring, Pago Pago American Samoa.

D&A Instrument Company, 1991. Instruction manual: OBS-1 & 3 Suspended Solids & Turbidity Monitor. Port Townsend, WA Revised March 1991.

Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000019, Issued to StarKist Samoa, Inc., 24 September 1992.

Environmental Protection Agency, Region 10, 1992. Authorization to Discharge Under the National Pollution Discharge Elimination System; Permit No. AS0000027, Issued to VCS Samoa packing Company, 24 September 1992.

Environmental Protection Agency, Region 10, 1992. Modification of Receiving Water Qaulity Monitoring Requirements of NPDES Permit AS000019 for StarKist Samoa, Inc. and NPDES Permit AS0000027 for VCS Samoa Packing Company. November 8, 1995.

Sea-Bird Electronics, Inc., 1993. CDT Data Acquisition Software: SEASOFT, Version 4.026. Bellevue, WA, May 1993.

Sverdrup, H.U. et al., 1942. The Oceans. Prentice-hall, Englewood Cliffs NJ.

Appendix I

USEPA Permit Modification for Receiving Water Quality Monitoring

Appendix II

Combined Sampling and Analysis Plan and Standard Operating Procedures

Appendix III

Vertical Profile Data for Each Station

Appendix IV

Corrections to Dissolved Oxygen and pH Measurements

Appendix V

Chain of Custody Records

Appendix VI

Laboratory Report for Nutrients and Biological Parameters

Appendix VII

Laboratory Results for Zinc and Copper

EFFLUENT TESTING SUMMARY

for

Section D Priority Pollutant and Bioassay Studies

StarKist Samoa

NPDES Permit AS0000019

VCS Samoa Packing

NPDES Permit AS0000027

Test Conducted
February 1993 - September 1997

Prepared by

CH2MHILL

and

gdc

November 1997

Combined Effluent Bioassay Results

Joint Cannery Outfall
StarKist Samoa and VCS Samoa Packing
Summary of Combined Effluent Bioassay Results

Date	*Species*	Parameters			Reference Toxicant sodium dodecyl sulfonate (SDS)		Comments
		LC_{50}	NOEC	LOEC	LC_{50} (mg/l)	Laboratory Mean (mg/l)	
2/93	*Penaeus vannami*	4.8%	3.1%	6.25%			1
10/93	*Penaeus vannami*	15.67%	3.1%	6.25%			
2/94	*Penaeus vannami*	15.76%	<1.6%	1.6%	26.69		
10/94	*Mysidopsis bahia*	31.2%	25%	50%	9.43	13.52	2
3/95	*Penaeus vannami*	14.8%	6.25%	12.5%	19.47	20.38	
3/95	*Mysidopsis bahia*	10.8%	6.25%	12.5%	13.8	12.5	3
2/96	*Penaeus vannami*	>50%	>50%	>50%	24	21.59	
2/96	*Mysidopsis bahia*	28.36%	12.5%	25%	18.3	14.29±4.11	3
3/96	*Penaeus vannami*	44.4%	25%	50%	42.9	26.39	4
11/96	*Penaeus vannami*	7.11%	3.1%	6.25%	15.6	29.6	4, 5
03/97	*Penaeus vannami*	39.36%	12.5%	25%	20.19	24.66±10.6	
09/97	*Penaeus vannami*	12.3%	6.25%	12.5%	20.8	23.47±8.92	6

1. The February 1993 samples were not aerated until after the first day of the test. For subsequent tests the samples were aerated for the entire duration of the tests.
2. *Mysidopsis bahia* substitutes as *Penaeus vannami* not available, as directed by U. S. EPA.
3. *Mysidopsis bahia* used in addition to *Penaeus vannami* as described in text. Only one species is required by the permit conditions.
4. All reference toxicant tests were within 1 standard deviation of the laboratory mean except 3/96 and 11/96 which were within 2 standard deviations of the mean.
5. A test was initiated using *Penaeus vannami* received at the lab that day. Control survival was inadequate on day 2 and the test was discontinued. The apparent problem appeared to be the use of the animals immediately upon receipt. The animals were maintained and fed at the lab for 5 days and a new test using the same batch of was conducted.
6. Stage 1 (3 mm) *Penaeus vannami* were used for testing as older Stage 7 and 8 (8-10 mm) *Penaeus vannami* were not available.

StarKist Samoa Metals Results

StarKist Samoa Effluent - Metals Results

Antimony (Sb)										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	-	-	-	-	Analytical Resources, Inc	-
Method Requested	6010	6010	6010	6010	-	-	-	-	200.7	-
Method Used	6010	200.7	6010	6010	-	-	-	-	200.7	-
DL Requested (µg/L)	100	100	50	50	-	-	-	-	50	-
DL Achieved (µg/L)	100	100	50	50	-	-	-	-	200	-
Conc. Measured (µg/L)	N.D.	N.D.	<50	<50	-	-	-	-	N.D.	-
Duplicate					-	-	-	-	-	-
Matrix Blank (µg/L)	N.D.	N.D.	<50	<50	-	-	-	-	N.D.	-
Matrix Spike										
Conc. added (µg/L)	1000	1000			-	-	-	-	500	-
Recovery (%)	92	68			-	-	-	-	80	-

Arsenic										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	7060	7060	7060	7060	206.2	206.2	206.2	206.2	206.2	206.2
Method Used	7060	200.7	7060	7060	206.2	206.2	200.7	206.2	200.9	206.2
DL Requested (µg/L)	5	200 (4)	50	5	50	5	5	5	5	5
DL Achieved (µg/L)	5	200	50	5	5	10	400	5	5	5
Conc. Measured (µg/L)	6	N.D. (14)	<50	9	<50	<10	<400	10	15	12
Duplicate								11		11
Matrix Blank (µg/L)	N.D.	N.D.	<50	<5	<50	0	N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	50	1000					1000	40	40	44
Recovery (%)	104	74					97.2	102	92.5	80

StarKist Samoa Effluent - Metals Results

Beryllium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	-	-	-	-	Analytical Resources, Inc	-
Method Requested	6010	6010	6010	6010	-	-	-	-	200.7	-
Method Used	6010	200.7	6010	6010	-	-	-	-	200.7	-
DL Requested (µg/L)	10	10	5	5	-	-	-	-	5	-
DL Achieved (µg/L)	10	10	5	5	-	-	-	-	5	-
Conc. Measured (µg/L)	N.D.	N.D.	<5	<5	-	-	-	-	N.D.	-
Duplicate					-	-	-	-		-
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	-	-	-	-	N.D.	-
Matrix Spike										
Conc. added (µg/L)	1000	1000			-	-	-	-	50	-
Recovery (%)	97	76			-	-	-	-	90	-

Cadmium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
Method Used	6010	200.7	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
DL Requested (µg/L)	5	5	5	5	5	5	5	5	5	5
DL Achieved (µg/L)	5	5	5	5	5	20	20	2	10	4
Conc. Measured (µg/L)	N.D.	N.D.	10	<5	<5	<20	<20	N.D.	N.D.	N.D.
Duplicate								N.D.		
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	<5	0	N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					1000	50	50	50
Recovery (%)	90	75					98.1	82	80	94

StarKist Samoa Effluent - Metals Results

Chromium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
Method Used	6010	200.7	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
DL Requested (µg/L)	20	20	10	10	10	10	10	10	10	10
DL Achieved (µg/L)	20	20	10	10	10	30	30	5	20	10
Conc. Measured (µg/L)	N.D.	N.D.	<10	<10	<10	<30	<30	N.D.	N.D.	N.D.
Duplicate								N.D.		
Matrix Blank (µg/L)	N.D.	N.D.	<10	<10	<10	0	N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					996	200	200	200
Recovery (%)	92	73					99.2	81.5	90	85

Copper										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	220.2	220.2	220.2	200.7	220.2	220.2
Method Used	6010	200.7	6010	6010	220.2	220.2	200.7	200.7	200.7	200.7
DL Requested (µg/L)	10	10	10	10	2	2	2	2	2	2
DL Achieved (µg/L)	10	10	10	10	2	5	25	2	0.5	4
Conc. Measured (µg/L)	N.D.	N.D.	15	<10	6	13	<25	5	4.7	4
Duplicate								4		
Matrix Blank (µg/L)	N.D.	N.D.	<10	<10	<2	0	N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					1000	250	2.5	250
Recovery (%)	98	76					98.7	88.8	92	94

StarKist Samoa Effluent - Metals Results

Lead										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	7421	7421	7421	7421	239.2	239.2	239.2	239.2	239.2	239.2
Method Used	7421	200.7	7421	7421	239.2	239.2	239.2	239.2	200.9	239.2
DL Requested (µg/L)	2	100 (2)	5	5	5	5	5	5	5	5
DL Achieved (µg/L)	2	100	5	5	5	4	4	5	5	5
Conc. Measured (µg/L)	N.D.	N.D.	<5	<5	<5	<4.0	<4.0	N.D.	N.D.	N.D.
Duplicate								N.D.		N.D.
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	<5	0	N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	25	1000					20	20	20	20
Recovery (%)	82	77					106	100	100	85

Mercury										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	7470 mod	7470 mod	7470	7470	245.1	245.1	245.1	245.1	245.1	245.1
Method Used	7471 mod	245.2 Mod	7470	7470	245.1	245.1	245.1	245.1	245.1	245.1
DL Requested (µg/L)	100	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
DL Achieved (µg/L)	100	0.5	0.4	0.4	0.4	0.5	0.5	0.1	0.1	0.2
Conc. Measured (µg/L)	N.D.	N.D.	<0.4	<0.4	<0.4	<1.0	<1.0	N.D.	0.1	N.D.
Duplicate								N.D.		N.D.
Matrix Blank (µg/L)	N.D.	N.D.	<0.4	<0.4	<0.4	0	N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	5	0.25					4	1	1	2
Recovery (%)	86	84					101	70	60	100

StarKist Samoa Effluent - Metals Results

Nickel										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	-	-	-	-	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	-	-	-	-	200.7	-
Method Used	6010	200.7	6010	6010	-	-	-	-	200.7	-
DL Requested (µg/L)	50	50	20	20	-	-	-	-	20	-
DL Achieved (µg/L)	50	50	20	20	-	-	-	-	50	-
Conc. Measured (µg/L)	N.D.	N.D.	<20	<20	-	-	-	-	N.D.	-
Duplicate					-	-	-	-		-
Matrix Blank (µg/L)	N.D.	N.D.	<20	<20	-	-	-	-	N.D.	-
Matrix Spike										
Conc. added (µg/L)	1000	1000			-	-	-	-	500	-
Recovery (%)	93	73			-	-	-	-	90	-

Selenium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	7740	7740	270.1	270.1	270.1	270.1	270.1	270.1
Method Used	6010	200.7	7740	6010	270.2	270.2	200.7	270.2	200.9	270.2
DL Requested (µg/L)	100	150	50	50	50	5	5	5	5	5
DL Achieved (µg/L)	100	150	50	50	5	10	200	5	5	10
Conc. Measured (µg/L)	N.D.	N.D.	<50	<50	<50	<200	<200	15	N.D.	10
Duplicate								20		N.D.
Matrix Blank (µg/L)	N.D.	N.D.	<50	<50	<5	0	N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					1000	10	10	10
Recovery (%)	79	72					97	180	110	100

StarKist Samoa Effluent - Metals Results

Silver										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	7760	7760	7760	7760	272.2	272.2	272.2	272.2	272.2	272.2
Method Used	7760	272.1	6010	6010	272.2	272.2	272.2	272.2	200.9	272.2
DL Requested (µg/L)	20	20	10	10	2	2	2	2	2	2
DL Achieved (µg/L)	20	20	10	10	2	2	2	1	1	1
Conc. Measured (µg/L)	130	33 (39)	<10	<10	<2	<2.0	<2.0	N.D.	1	N.D.
Duplicate								N.D.		N.D.
Matrix Blank (µg/L)	N.D.	N.D.	<10	<10	<2	0	N.D.	0.2	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					2	20	20	20
Recovery (%)	110	80					99	95	75	85

Thallium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	-	-	-	-	Analytical Resources, Inc	-
Method Requested	6010	6010	7841	7841	-	-	-	-	200.7	-
Method Used	6010	200.7	7841	7841	-	-	-	-	200.7	-
DL Requested (µg/L)	100	150	50	5	-	-	-	-	5	-
DL Achieved (µg/L)	100	150	50	5	-	-	-	-	200	-
Conc. Measured (µg/L)	N.D.	N.D.	<50	<5	-	-	-	-	N.D.	-
Duplicate					-	-	-	-		-
Matrix Blank (µg/L)	N.D.	N.D.	<50	<5	-	-	-	-	N.D.	-
Matrix Spike										
Conc. added (µg/L)	1000	1000			-	-	-	-	2000	-
Recovery (%)	92	60			-	-	-	-	100	-

StarKist Samoa Effluent - Metals Results

Zinc										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
Method Used	6010	200.7	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
DL Requested (µg/L)	40	40 (20)	20	20	20	20	20	20	20	29
DL Achieved (µg/L)	40	40	20	20	20	20	20	4	20	8
Conc. Measured (µg/L)	92	130 (180)	140	84	120	63	81	117	150	154
Duplicate								117		
Matrix Blank (µg/L)	N.D.	N.D.	<20	<20	<20	0	N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000						500	500	500
Recovery (%)	91	81						88.6	94	91.6

VCS Samoa Packing Metals Results

VCS Samoa Packing Effluent - Metals Results

Antimony (Sb)										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	-	-	-	Analytical Resources, Inc	-
Method Requested	6010	6010	6010	6010	-	-	-	-	200.7	-
Method Used	6010	200.7	6010	6010	-	-	-	-	200.7	-
DL Requested (µg/L)	100	100	50	50	-	-	-	-	50	-
DL Achieved (µg/L)	100	100	50	50	-	-	-	-	50	-
Conc. Measured (µg/L)	N.D.	N.D.	<50	<50	-	-	-	-	N.D.	-
Duplicate	-	-	-	-	-	-	-	-	N.D.	-
Matrix Blank (µg/L)	N.D.	N.D.	<50	<50	-	-	-	-	N.D.	-
Matrix Spike			-	-	-	-	-	-		-
Conc. added (µg/L)	1000	1000							500	
Recovery (%)	92	68							96	

Arsenic										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	7060	7060	7060	7060	206.2	206.2	206.2	206.2	206.2	206.2
Method Used	7060	200.7	7060	7060	206.2	206.2	200.7	206.2	200.9	200.7
DL Requested (µg/L)	5	200 (4)	5	5	5	5	5	5	5	5
DL Achieved (µg/L)	5	200	5	5	50	10	400	5	5	5
Conc. Measured (µg/L)	9.8	N.D. (15)	25	25	32	14	<400	16	24	24
Duplicate	-	-	-	-	-	-		19	22	24
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	<50	-	N.D.	N.D.	N.D.	N.D.
Matrix Spike			-	-	-	-				
Conc. added (µg/L)	50	1000					1000	40	40	40
Recovery (%)	104	74					97.2	77.5	85	85

VCS Samoa Packing Effluent - Metals Results

Beryllium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	- -	- -	- -	- -	Analytical Resources, Inc	-
Method Requested	6010	6010	6010	6010	-	-	-	-	200.7	-
Method Used	6010	200.7	6010	6010	-	-	-	-	200.7	-
DL Requested (µg/L)	10	10	5	5	-	-	-	-	5	-
DL Achieved (µg/L)	10	10	5	5	-	-	-	-	1	-
Conc. Measured (µg/L)	N.D.	N.D.	<5	<5	-	-	-	-	N.D.	-
Duplicate	-	-	-	-	-	-	-	-	N.D.	-
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	-	-	-	-	N.D.	-
Matrix Spike			-	-	-	-	-	-		-
Conc. added (µg/L)	1000	1000							50	
Recovery (%)	97	76							94	

Cadmium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
Method Used	6010	200.7	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
DL Requested (µg/L)	5	5	5	5	5	5	5	5	5	5
DL Achieved (µg/L)	5	5	5	5	5	20	20	2	2	2
Conc. Measured (µg/L)	N.D.	N.D.	<5	<5	<5	<20	<20	4	3	2
Duplicate								3	4	2
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	<5		N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					1000	50	50	50
Recovery (%)	90	75					98.1	94	94	84

VCS Samoa Packing Effluent - Metals Results

Chromium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
Method Used	6010	200.7	6010	6010	200.7	200.7	220.7	200.7	200.7	200.7
DL Requested (µg/L)	20	20	10	10	10	10	10	10	10	10
DL Achieved (µg/L)	20	20	10	10	10	30	30	5	5	5
Conc. Measured (µg/L)	N.D.	N.D.	<10	<10	<5	<30	<30	N.D.	N.D.	N.D.
Duplicate								N.D.	N.D.	N.D.
Matrix Blank (µg/L)	N.D.	N.D.	<10	<10	<10		N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					996	200	200	200
Recovery (%)	92	73					99.2	98.5	99	95.5

Copper										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	220.2	220.2	220.2	220.2	220.2	220.2
Method Used	6010	200.7	6010	6010	220.2	220.2	220.7	200.7	200.7	200.7
DL Requested (µg/L)	10	10	10	10	2	2	2	2	2	2
DL Achieved (µg/L)	10	10	10	10	2	25	25	2	2	2
Conc. Measured (µg/L)	21	N.D.	13	23	9	54	<25	11	11	12
Duplicate								10	11	11
Matrix Blank (µg/L)	N.D.	N.D.	<10	<10	<2		N.D.	N.D.	N.D.	N.D
Matrix Spike										
Conc. added (µg/L)	1000	1000					1000	250	250	250
Recovery (%)	98	76					98.7	94.4	101	96

VCS Samoa Packing Effluent - Metals Results

Lead										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	7421	7421	7421	7421	239.2	239.2	239.2	239.2	239.2	239.2
Method Used	7421	200.7	7421	7421	239.2	239.2	239.2	239.2	200.9	200.7
DL Requested (µg/L)	2	100 (2)	5	5	5	5	5	5	5	5
DL Achieved (µg/L)	2	100	5	5	5	4	4	5	1	5
Conc. Measured (µg/L)	4.3	N.D. (2.4)	<5	<5	<5	5.4	<4.0	N.D.	2	N.D.
Duplicate								N.D.	2	N.D.
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	<5		N.D.	1	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	25	1000					20	20	20	20
Recovery (%)	102	77					106	140	110	125

Mercury										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	7470 Mod.	7470 mod	7470 mod	7470	245.1	245.1	245.1	245.1	245.1	245.1
Method Used	7470 Mod.	245.2 Mod	7470		245.1	245.1	245.1	245.1	245.1	245.1
DL Requested (µg/L)	100	0.05	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
DL Achieved (µg/L)	1	0.5	0.4		0.4	1	1	0.1	0.1	0.2
Conc. Measured (µg/L)	N.D.	N.D.	<0.4		<0.4	<1.0	<1.0	N.D.	N.D.	N.D
Duplicate								N.D.	N.D.	N.D
Matrix Blank (µg/L)	N.D.	N.D.	<0.4		<0.4		N.D.	N.D.	N.D.	N.D
Matrix Spike										
Conc. added (µg/L)	5	0.25					4	1	1	2
Recovery (%)	86	84					101	40	40	85

VCS Samoa Packing Effluent - Metals Results

Nickel										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	-	-	-	-	Analytical Resources, Inc	-
Method Requested	6010	6010	6010	6010	-	-	-	-	200.7	-
Method Used	6010	200.7	6010	6010	-	-	-	-	200.7	-
DL Requested (µg/L)	50	50	20	20	-	-	-	-	20	-
DL Achieved (µg/L)	50	50	20	20	-	-	-	-	10	-
Conc. Measured (µg/L)	N.D.	N.D.	<20	<20	-	-	-	-	N.D.	-
Duplicate					-	-	-	-	N.D.	-
Matrix Blank (µg/L)	N.D.	N.D.	<20	<20	-	-	-	-	N.D.	-
Matrix Spike					-	-	-	-		-
Conc. added (µg/L)	1000	1000							500	
Recovery (%)	93	73							96	

Selenium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	7740	270.1	270.1	270.1	270.1	270.1	270.1
Method Used	6010	200.7	7740	7740	270.2	270.2	220.7	270.2	200.9	200.7
DL Requested (µg/L)	100	150	50	5	5	5	5	5	5	5
DL Achieved (µg/L)	100	150	50	5	5	50	200	5	5	10
Conc. Measured (µg/L)	N.D.	N.D.	22	16	33	<50	<200	27	19	30
Duplicate								27	27	20
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	<5		N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					1000	10	10	10
Recovery (%)	79	72					97	100	80	100

VCS Samoa Packing Effluent - Metals Results

Silver										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	7760	7760	7760	7760	272.2	272.2	272.2	272.2	272.2	272.2
Method Used	7760	272.1	6010	6010	272.2	272.2	272.2	272.2	200.9	200.7
DL Requested (µg/L)	20	20	10	10	2	2	2	2	2	2
DL Achieved (µg/L)	20	20	10	10	2	2	2	0.2	0.2	1
Conc. Measured (µg/L)	N.D.	N.D.	<10	<10	<2	<2.0	<2.0	N.D.	N.D.	N.D.
Duplicate								N.D.	N.D.	N.D.
Matrix Blank (µg/L)	N.D.	N.D.	<10	<10	<2		N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					2	20	20	20
Recovery (%)	110	80					99	92	86	95

Thallium										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	-	-	-	-	Analytical Resources, Inc	-
Method Requested	6010	6010	6010	7841	-	-	-	-	200.7	-
Method Used	6010	200.7	7841	7841	-	-	-	-	200.7	-
DL Requested (µg/L)	100	150	5	5	-	-	-	-	5	-
DL Achieved (µg/L)	100	150	5	5	-	-	-	-	50	-
Conc. Measured (µg/L)	N.D.	N.D.	<5	<5	-	-	-	-	N.D.	-
Duplicate					-	-	-	-	N.D.	-
Matrix Blank (µg/L)	N.D.	N.D.	<5	<5	-	-	-	-	N.D.	-
Matrix Spike					-	-	-	-		-
Conc. added (µg/L)	1000	1000							2000	
Recovery (%)	92	60							89.5	

VCS Samoa Packing Effluent - Metals Results

Zinc										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL itchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	6010	6010	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
Method Used	6010	200.7	6010	6010	200.7	200.7	200.7	200.7	200.7	200.7
DL Requested (µg/L)	40	40 (20)	20	20	20	20	20	20	20	20
DL Achieved (µg/L)	40	40	20	20	20	20	20	4	4	4
Conc. Measured (µg/L)	380	400 (540)	660	760	570	440	740	471	484	585
Duplicate								477	482	579
Matrix Blank (µg/L)	N.D.	N.D.	<20	<20	<20		N.D.	N.D.	N.D.	N.D.
Matrix Spike										
Conc. added (µg/L)	1000	1000					1000	500	500	500
Recovery (%)	91	81					99.8	102	96	89

StarKist Samoa Phenol and Miscellaneous Results

StarKist Samoa Phenolics and Miscellaneous Results

Phenol										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested				420.1	420.1	420.1	420.1	420.1	420.1	420.1
Method Used		420.1	420.1	420.1	420.1	420.1	420.1	420.1	420.1	420.1
DL Requested (µg/L)				13	0.02	13	10	10	10	10
DL Achieved (µg/L)		25	8	13	20	5	10	40	40	40
Conc. Measured (µg/L)		1300	120	15	34	72	510	440	290	140
Duplicate									290	-
Matrix Blank (µg/L)		N.D.	<8		<10		<10	<40	<40	<40
Matrix Spike										
LCS Conc. added (µg/L)		100						400	400	400
MS Recovery (%)		110						72.5	70	87.5
LCS Recovery (%)										

Total Cyanide										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Witchita, KS	-	-	-	-	Analytical Resources, Inc	-
Method Requested	335	335.2	335.2	335.2	-	-	-	-	335.2	-
Method Used	9010	335.2	335.2	335.2	-	-	-	-	335.2	-
DL Requested (µg/L)	10	10	10	20	-	-	-	-	10	-
DL Achieved (µg/L)	10	10	10	20	-	-	-	-	4	-
Conc. Measured (µg/L)	N.D.	N.D.	<10	<20	-	-	-	-	4	-
Duplicate					-	-	-	-		-
Matrix Blank (µg/L)	N.D.	N.D.	<10		-	-	-	-	N.D.	-
Matrix Spike										
LCS Conc. added (µg/L)	400	400			-	-	-	-	145	-
LCS Recovery (%)	103	90			-	-	-	-	95.2	-

StarKist Samoa Phenolics and Miscellaneous Results

Asbestos										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	Med-Tox Northwest	-	-	-	-	-	-	-	-	-
Method Requested	Polar Light Microscopy	-	-	-	-	-	-	-	-	-
Method Used	600/ M8-82-020	-	-	-	-	-	-	-	-	-
DL Requested (µg/L)	N/A	-	-	-	-	-	-	-	-	-
DL Achieved (µg/L)	N/A	-	-	-	-	-	-	-	-	-
Conc. Measured (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Duplicate		-	-	-	-	-	-	-	-	-
Matrix Blank (µg/L)		-	-	-	-	-	-	-	-	-
Matrix Spike										
Conc. added (µg/L)		-	-	-	-	-	-	-	-	-
Recovery (%)		-	-	-	-	-	-	-	-	-

2,3,7,8-TCDF (furans)										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	Enesco A Corning Co.	-	-	-	-	-	-	-	-	-
Method Requested	NCASI Method 551	-	-	-	-	-	-	-	-	-
Method used	NCASI Method 551	-	-	-	-	-	-	-	-	-
DL Requested (ng/L)	1-10 ng/l	-	-	-	-	-	-	-	-	-
DL Achieved (pg/L)	5.2	-	-	-	-	-	-	-	-	-
Conc. Measured (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Duplicate		-	-	-	-	-	-	-	-	-
Matrix Blank (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Matrix Spike										
Conc. added (µg/L)	25	-	-	-	-	-	-	-	-	-
Recovery (%)	120	-	-	-	-	-	-	-	-	-

StarKist Samoa Phenolics and Miscellaneous Results

2,3,7,8-TCDD (dioxins)										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	Enesco A Corning Co.	-	-	-	-	-	-	-	-	-
Method Requested	NCASI Method 551	-	-	-	-	-	-	-	-	-
Method used	NCASI Method 551	-	-	-	-	-	-	-	-	-
DL Requested (ng/L)	1-10 ng/l	-	-	-	-	-	-	-	-	-
DL Achieved (pg/L)	9.9	-	-	-	-	-	-	-	-	-
Conc. Measured (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Duplicate		-	-	-	-	-	-	-	-	-
Matrix Blank (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Matrix Spike										
Conc. added (pg/L)	10	-	-	-	-	-	-	-	-	-
Recovery (%)	108	-	-	-	-	-	-	-	-	-

VCS Samoa Packing Phenol and Miscellaneous Results

VCS Samoa Packing Phenolics and Miscellaneous Results

Phenol										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested				420.1	420.1	420.1	420.1	420.1	420.1	420.1
Method Used		420.1	420.1	420.1	420.1	420.1	420.1	420.1	420.1	420.1
DL Requested (µg/L)				13	0.02	13	10	10	10	10
DL Achieved (µg/L)		25	8	13	20	5	10	40	40	40
Conc. Measured (µg/L)		570	84	280	150	170	170	140	80	70
Duplicate						-	-	150	-	80
Matrix Blank (µg/L)		N.D.	<8		<10	-	<10	<40	<40	<40
Matrix Spike						-				
LCS Conc. added (µg/L)		100					400	120		
MS Recovery (%)							93.9	83.3		
LCS Recovery (%)		113								

Total Cyanide										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Witchita, KS	-	-	-	-	Analytical Resources, Inc	-
Method Requested	335	335.2	335.2	335.2	-	-	-	-	335.2	-
Method Used	9010	335.2	335.2	335.2	-	-	-	-	335.2	-
DL Requested (µg/L)	10	10	10	20	-	-	-	-	10	-
DL Achieved (µg/L)	10	10	10	20	-	-	-	-	4	-
Conc. Measured (µg/L)	N.D.	N.D.	<10	<20	-	-	-	-	12	-
Duplicate	-	-	-	-	-	-	-	-		-
Matrix Blank (µg/L)	N.D.	N.D.	<10	-	-	-	-	-	N.D.	-
Matrix Spike										
LCS Conc. added (µg/L)	400	400			-	-	-	-		-
LCS Recovery (%)	103	90			-	-	-	-		-

VCS Samoa Packing Phenolics and Miscellaneous Results

Asbestos										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	Med-Tox Northwest	-	-	-	-	-	-	-	-	-
Method Requested	Polar Light Microscopy	-	-	-	-	-	-	-	-	-
Method Used	600/ M8-82-020	-	-	-	-	-	-	-	-	-
DL Requested (µg/L)	N/A	-	-	-	-	-	-	-	-	-
DL Achieved (µg/L)	N/A	-	-	-	-	-	-	-	-	-
Conc. Measured (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Duplicate		-	-	-	-	-	-	-	-	-
Matrix Blank (µg/L)		-	-	-	-	-	-	-	-	-
Matrix Spike										
Conc. added (µg/L)		-	-	-	-	-	-	-	-	-
Recovery (%)		-	-	-	-	-	-	-	-	-

2,3,7,8-TCDF (furans)										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	Enesco A Corning Co.	-	-	-	-	-	-	-	-	-
Method Requested	NCASI Method 551	-	-	-	-	-	-	-	-	-
Method used	NCASI Method 551	-	-	-	-	-	-	-	-	-
DL Requested (ng/L)	1-10 ng/l	-	-	-	-	-	-	-	-	-
DL Achieved (pg/L)	4.8	-	-	-	-	-	-	-	-	-
Conc. Measured (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Duplicate		-	-	-	-	-	-	-	-	-
Matrix Blank (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Matrix Spike										
Conc. added (µg/L)	25	-	-	-	-	-	-	-	-	-
Recovery (%)	120	-	-	-	-	-	-	-	-	-

VCS Samoa Packing Phenolics and Miscellaneous Results

2,3,7,8-TCDD (dioxins)										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	Enesco A Corning Co.	-	-	-	-	-	-	-	-	-
Method Requested	NCASI Method 551	-	-	-	-	-	-	-	-	-
Method used	NCASI Method 551	-	-	-	-	-	-	-	-	-
DL Requested (ng/L)	1-10 ng/l	-	-	-	-	-	-	-	-	-
DL Achieved (pg/L)	6.7	-	-	-	-	-	-	-	-	-
Conc. Measured (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Duplicate		-	-	-	-	-	-	-	-	-
Matrix Blank (µg/L)	N.D.	-	-	-	-	-	-	-	-	-
Matrix Spike										
Conc. added (pg/L)	10	-	-	-	-	-	-	-	-	-
Recovery (%)	108	-	-	-	-	-	-	-	-	-

StarKist Samoa Semi-Volatiles Results

StarKist Samoa Effluent Semi-volatile Analysis Results

SEMI-VOLATILE ORGANICS										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	8270	625	625	8270/625	8270/625	8270/625	625	625	625	625
Method Used	8270	625	8270/625	625	625	625	625	625	625	625
Concentrations in µg/L										
N-Nitrosodimethlamine	<20	<500	-	-	<50	<100	<10	<52	<25	
Aniline	<20	<500	<10	<10	<50	<100	<10	10	<5	
Phenol	**500**	**430**	**45**	**140**	**32**	**32**	**320**	**500**	**270**	**630**
Bis(2-Chloroethyl) ether (Oxybis(1-chloropropane)	<20	<500	<10	<10	<50	<100	<10	<21	<10	<6
2-Chlorophenol	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
1,3-Dichlorobenzene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
1,4-Dichlorobenzene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzyl Alcohol	<20	<500	<10	<10	<50	<100	<10	<52	<25	<15
1,2-Dichlorobenzene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
2-Methylphenol	<20	<500	<10	<10	<50	<100	<10	<21	<10	<6
Bis-(2-chloroisopropyl)ether	<20	<500	<10	<10	<50	<100	<10	<10		
4-Methylphenol	**260**	**530**	**360**	**290**	**310**	**130**	**370**	**490**	**310**	**240**
N-Nitrosodi-n-propylamine	<20	<500	<10	<10	<50	<100	<10	<21	<10	<6
Hexachloroethane	<20	<500	<10	<10	<50	<100	<10	<21	<10	<6
Nitrobenzene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Isophorone	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2-Nitrophenol	<20	<500	<10	<10	<50	<100	<10	<52	<25	<15
2,4-Dimethylphenol	<20	<500	<10	<10	<50	<100	<10	<31	<15	<9
Benzoic Acid	<100	<500	<50	<50	<250	<500	<50	<100	<50	**34**
bis(2-Chloroethoxy)methane	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2,4-Dichlorophenol	<100	<500	<10	<10	<50	<100	<10	<31	<15	<9
1,2,4-Trichlorobenzene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Naphthalene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
4-Chloroaniline	<20	<250	<10	<10	<50	<500	<50	<31	<15	<9
Hexachlorobutadiene	<20	<250	<10	<10	<50	<100	<10	<21	<10	<6
4-Chloro-3-methylphenol	<20	<500	<10	<10	<50	<200	<20	<21	<10	<6
2-Methylnaphthalene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Hexachlorocyclopentadiene	<20	<250	<10	<10	<50	<100	<10	<52	<25	<15
2,4,6-Trichlorophenol	<20	<500	<10	<10	<50	<100	<10	<52	<25	<15
2,4,5-Trichlorophenol	<100	<500	<50	<50	<250	<100	<10	<52	<25	<15
2-Chloronapthalene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2-Nitroaniline	<100	<1000	<50	<50	<250	<500	<50	<52	<25	<15
Dimethyl Phthalate	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Acenaphthylene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
3-Nitoaniline	<100	<500	<50	<50	<250	<100	<10	<62	<30	<18

StarKist Samoa Effluent Semi-volatile Analysis Results

SEMI-VOLATILE ORGANICS										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	8270	625	625	8270/625	8270/625	8270/625	625	625	625	625
Method Used	8270	625	8270/625	625	625	625	625	625	625	625
Concentrations in µg/L										
Acenaphthene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2,4-Dinitrophenol	<20	<500	<50	<50	<250	<500	<50	<100	<50	<30
4-Nitrophenol	<100	<500	<50	<50	<250	<500	<50	<52	<25	<15
Dibenzofuran	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2,4-Dinitrotoluene	<20	<500	<10	<10	<50	<100	<10	<52	<25	<15
2,6-Dinitrotoluene	<20	<500	<10	<10	<50	<100	<10	-	<25	<15
Diethyl phthalate	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
4-Chlorophenyl phenyl ether	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Fluorene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
4-Nitroaniline	<100	<500	<50	<50	<250	<500	<50	<52	<25	<15
4,6-Dinitro-2-methylphenol	<100	<500	<50	<50	<250	<500	<50	<100	<50	<30
N-Nitrosodiphenylamine	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
1,2-Diphenylhydrazine (quantified as azobenzene)	-	-	-	-	-	<500	<50	<10	<5	
4-Bromophenyl phenyl ether	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Hexachlorobenzene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Pentachlorophenol	<100	<500	<50	<50	<250	<500	<50	<52	<25	<15
Phenanthrene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Anthracene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Carbazole	<20	-	-	-	<50	<100	<10	<10	<5	<3
Di-n-butyl phthalate	<100	<250	<10	<10	<50	<100	<10	<10	<5	<3
Flouranthene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Pyrene	<20	<250	<10	<10	<50	<500	<10	<10	<5	<3
Butyl benzyl phthalate	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
3,3'-Dichlorobenzidine	<100	<500	<20	<20	<100	<200	<20	<52	<25	<15
Benzo(a)anthracene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
bis(2-Ethylhexyl) phthalate	<100	<1000	<10	<10	<50	<100	<10	<10	<5	<3
Chysene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Di-n-octyl phthalate	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzo(b)fluoranthene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzo(k)fluoranthene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzidine	<500	<2500	<20	N.D.	<100	<500	<50	<100	<50	
Benzo(a)pyrene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Indeno(1,2,3-cd)pyrene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Dibenz(a,h)anthracene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3

StarKist Samoa Effluent Semi-volatile Analysis Results

SEMI-VOLATILE ORGANICS										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	8270	625	625	8270/625	8270/625	8270/625	625	625	625	625
Method Used	8270	625	8270/625	625	625	625	625	625	625	625
Concentrations in µg/L										
Benzo(g,h,i)perylene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3

VCS Samoa Packing Semi-Volatiles Results

VCS Samoa Packing Effluent Semi-volatile Analysis Results

SEMI-VOLATILE ORGANICS										
Test No.	1	2	3	4	5	6	7	8	9	10
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	8270	625	625	8270/625	625	8270/625	625	625	625	625
Method Used	8270	625	8270/625	625	625	625	625	625	625	625
Concentrations in µg/L										
N-Nitrosodimethlamine	<20	<500	-	-	<50	<100	<10	<51	<25	
Aniline	<20	<500	<10	<10	<50	<100	<10	10	<5	
Phenol	**110**	<500	**69**	**120**	**150**	**110**	**89**	**150**	**73**	**52**
Bis(2-Chloroethyl) ether (Oxybis(1-chloropropane)	<20	<500	<10	<10	<50	<100	<10	<20	<10	<6
2-Chlorophenol	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
1,3-Dichlorobenzene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
1,4-Dichlorobenzene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzyl Alcohol	<20	<500	<10	<10	<50	<100	<10	<51	<25	<15
1,2-Dichlorobenzene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
2-Methylphenol	<20	<500	<10	<10	<50	<100	<10	<20	<10	<6
Bis-(2-chloroisopropyl)ether	<20	<500	<10	<10	<50	<100	<10	<10		
4-Methylphenol	**670**	**1600**	**770**	**2800**	**2400**	**1600**	**6800**	**1800**	**860**	**1600**
N-Nitrosodi-n-propylamine	<20	<500	<10	<10	<50	<100	<10	<20	<10	<6
Hexachloroethane	<20	<500	<10	<10	<50	<100	<10	<20	<10	<6
Nitrobenzene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Isophorone	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2-Nitrophenol	<20	<500	<10	<10	<50	<100	<10	<51	<25	<15
2,4-Dimethylphenol	<20	<500	<10	<10	<50	<100	<10	<30	<15	<9
Benzoic Acid	**120**	<500	<50	<50	<250	<500	<50	<100	<50	**53**
bis(2-Chloroethoxy)methane	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2,4-Dichlorophenol	<100	<500	<10	<10	<50	<100	<10	<30	<15	<9
1,2,4-Trichlorobenzene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Naphthalene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
4-Chloroaniline	<20	<250	<10	<10	<50	<500	<50	<30	<15	<9
Hexachlorobutadiene	<20	<250	<10	<10	<50	<100	<10	<20	<10	<6
4-Chloro-3-methylphenol	<20	<500	<10	<10	<50	<200	<20	<20	<10	<6
2-Methylnaphthalene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Hexachlorocyclopentadiene	<20	<250	<10	<10	<50	<100	<10	<51	<25	<15
2,4,6-Trichlorophenol	<20	<500	<10	<10	<50	<100	<10	<51	<25	<15
2,4,5-Trichlorophenol	<100	<500	<50	<50	<250	<100	<10	<51	<25	<15
2-Chloronapthalene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2-Nitroaniline	<100	<1000	<50	<50	<250	<500	<50	<51	<25	<15
Dimethyl Phthalate	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Acenaphthylene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
3-Nitoaniline	<100	<500	<50	<50	<250	<100	<10	<61	<30	<18
Acenaphthene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3

VCS Samoa Packing Effluent Semi-volatile Analysis Results

SEMI-VOLATILE ORGANICS										
Test No.	1	2	3	4	5	6	7	8	9	10
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA	GTEL Concord, CA	GTEL Witchita, KS	GTEL Witchita, KS	Analytical Resources, Inc	Analytical Resources, Inc	Analytical Resources, Inc
Method Requested	8270	625	625	8270/625	625	8270/625	625	625	625	625
Method Used	8270	625	8270/625	625	625	625	625	625	625	625
Concentrations in µg/L										
2,4-Dinitrophenol	<20	<500	<50	<50	<250	<500	<50	<100	<50	<30
4-Nitrophenol	<100	<500	<50	<50	<250	<500	<50	<51	<25	<15
Dibenzofuran	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
2,4-Dinitrotoluene	<20	<500	<10	<10	<50	<100	<10	<51	<25	<15
2,6-Dinitrotoluene	<20	<500	<10	<10	<50	<100	<10	-	<25	<15
Diethyl phthalate	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
4-Chlorophenyl phenyl ether	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Fluorene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
4-Nitroaniline	<100	<500	<50	<50	<250	<500	<50	<51	<25	<15
4,6-Dinitro-2-methylphenol	<100	<500	<50	<50	<250	<500	<50	<100	<50	<30
N-Nitrosodiphenylamine	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
1,2-Diphenylhydrazine (quantified as azobenzene)	-	-	-	-	-	<500	<50	<10	<5	
4-Bromophenyl phenyl ether	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Hexachlorobenzene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Pentachlorophenol	<100	<500	<50	<50	<250	<500	<50	<51	<5	<15
Phenanthrene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Anthracene	<20	<500	<10	<10	<50	<100	<10	<10	<5	<3
Carbazole	<20	-	-	-	<50	<100	<10	<10	<5	<3
Di-n-butyl phthalate	<100	<250	<10	<10	<50	<100	<10	<10	<5	**39**
Flouranthene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Pyrene	<20	<250	<10	<10	<50	<500	<10	<10	<5	<3
Butyl benzyl phthalate	<20	<250	<20	<10	<50	<100	<10	<10	<5	<3
3,3'-Dichlorobenzidine	<100	<500	<10	<20	<100	<200	<20	<51	<25	<15
Benzo(a)anthracene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
bis(2-Ethylhexyl) phthalate	<100	<1000	<10	<10	<50	<100	<10	<10	5.5	**19**
Chysene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Di-n-octyl phthalate	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzo(b)fluoranthene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzo(k)fluoranthene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzidine	<500	<2500	<20	N.D.	<100	<500	<50	<100	<50	
Benzo(a)pyrene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Indeno(1,2,3-cd)pyrene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Dibenz(a,h)anthracene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3
Benzo(g,h,i)perylene	<20	<250	<10	<10	<50	<100	<10	<10	<5	<3

StarKist Samoa Volatiles Results

SrtarKist Samoa Effluent Volatiles Analysis Results

VOLATILE ORGANICS													
Test No.	**1**	**2**	**3**	**4**				**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94				Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA				- -	- -	- -	- -	Analytical Resources, Inc	- -
Method Requested	8240/8260	624	624	624								624	
Method Used	8240/8261	624	624	624								624	
Concentrations in µg/L													
				1	2	3	4						
Acetone	**24**	**28**	<20	<20	<20	<20	<20	-	-	-	-	38.111	-
Benezene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Bromodichloromethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Bromoform	**6.4**	**7.7**	**7**	<5	<5	**7.8**	**6.4**	-	-	-	-	<10	-
Bromomethane	<2	<4	<10	<10	<10	<10	<10	-	-	-	-	<10	-
2-Butanone	<10	<20	-	-	-	-	-	-	-	-	-	<10	-
Carbon Disulphide	<2	<4	-	-	-	-	-	-	-	-	-	<10	-
Carbon tetrachloride	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Chlorobenzene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Chlorodibromomethane	-	<4	-	-	-	-	-	-	-	-	-	<10	-
Chloroethane	<2	<4	<10	<10	<10	<10	<10	-	-	-	-	<10	-
2-Chloroethylvinyl ether	<10	-	<10	<10	<10	<10	<10	-	-	-	-	-	-
Chloroform	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Chloromethane	<2	<4	<10	<10	<10	<10	<10	-	-	-	-	<10	-
Dibromochloromethane	<2	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
1,2-Dichlorobenzene	-	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
1,3-Dichlorobenzene	-	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
1,1-Dichloroethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
1,2-Dichloroethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
1,1-Dichloroethene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
cis-1,2-Dichloroethene	<2	<4	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethene, total	-	-	<5	<5	<5	<5	<5	-	-	-	-	<10	-
trans 1,2-Dichloroethene	<2	<4	-	-	-	-	-	-	-	-	-		-
1,2-Dichloropropane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
cis-1,3-Dichloropropene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
tran-1,3-Dichloropropene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	-	-
Ethylbenzene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
2-Hexanone	<10	<20	<20	<20	<20	<20	<20	-	-	-	-	<10	-
4-methyl-2Pentanone	<10	<20	<20	<20	<20	<20	<20	-	-	-	-	<10	-
Methylene chloride	<10	<20	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Styrene	<2	<4	-	-	-	-	-	-	-	-	-	<10	-
Tetrachloroethene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
1,1,2,2-Tetrachloroethene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Toluene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	10.724	-

SrtarKist Samoa Effluent Volatiles Analysis Results

VOLATILE ORGANICS													
Test No.	**1**	**2**	**3**	**4**				**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94				Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA				- -	- -	- -	- -	Analytical Resources, Inc	- -
Method Requested	8240/8260	624	624	624								624	
Method Used	8240/8261	624	624	624								624	
Concentrations in µg/L													
				1	2	3	4						
1,1,1-Trichloroethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
1,1,2-Trichloroethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Trichloroethene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Trichlorofluoromethane	<2	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
Vinyl acetate	-	<4	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	<4	<10	<10	<10	<10	<10	-	-	-	-	<10	-
Xylenes, total	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-

VCS Samoa Packing Volatiles Results

VCS Samoa Packing Effluent Volatiles Analysis Results

VOLATILE ORGANICS													
Test No.	**1**	**2**	**3**	**4**				**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94				Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA				- -	- -	- -	- -	Analytical Resources, Inc	- -
Method Requested	8240/8260	624	624	624								624	
Method Used	8240/8261	624	624	624								624	
Concentrations in µg/L													
				1	2	3	4						
Acetone	**45**	**38**	<20	<20	<20	**73***	<20	-	-	-	-	12.300	-
Benezene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Bromodichloromethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Bromoform	<2	**27**	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Bromomethane	<2	<4	<10	<10	<10	<10	<10	-	-	-	-	<10	-
2-Butanone	**11**	<20	-	-	-	-	-	-	-	-	-	10.391	-
Carbon Disulphide	<2	<4	-	-	-	-	-	-	-	-	-	<10	-
Carbon tetrachloride	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Chlorobenzene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Chlorodibromomethane	-	<4	-	-	-	-	-	-	-	-	-	<10	-
Chloroethane	<2	<4	<10	<10	<10	<10	<10	-	-	-	-	<10	-
2-Chloroethylvinyl ether	<10	-	<10	<10	<10	<10	<10	-	-	-	-	-	-
Chloroform	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Chloromethane	<2	<4	<10	<10	<10	<10	<10	-	-	-	-	<10	-
Dibromochloromethane	<2	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
1,2-Dichlorobenzene	-	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
1,3-Dichlorobenzene	-	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
1,1-Dichloroethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
1,2-Dichloroethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
1,1-Dichloroethene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
cis-1,2-Dichloroethene	<2	<4	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethene, total	-	-	<5	<5	<5	<5	<5	-	-	-	-	<10	-
trans 1,2-Dichloroethene	<2	<4	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
cis-1,3-Dichloropropene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
tran-1,3-Dichloropropene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	-	-
Ethylbenzene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
2-Hexanone	<10	<20	<20	<20	<20	<20	<20	-	-	-	-	<10	-
4-methyl-2Pentanone	<10	<20	<20	<20	<20	<20	<20	-	-	-	-	<10	-
Methylene chloride	<10	<20	<5	<5	<5	<5	<5	-	-	-	-	<10	-

VCS Samoa Packing Effluent Volatiles Analysis Results

VOLATILE ORGANICS													
Test No.	**1**	**2**	**3**	**4**				**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94				Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Concord, CA	GTEL Concord, CA				- -	- -	- -	- -	Analytical Resources, Inc	- -
Method Requested	8240/8260	624	624	624								624	
Method Used	8240/8261	624	624	624								624	
Concentrations in µg/L													
				1	2	3	4						
Styrene	<2	<4	-	-	-	-	-	-	-	-	-	<10	-
Tetrachloroethene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
1,1,2,2-Tetrachloroethene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Toluene	<2	**6.2**	<5	<5	<5	<5	<5	-	-	-	-	10.724	-
1,1,1-Trichloroethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
1,1,2-Trichloroethane	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Trichloroethene	<2	<4	<5	<5	<5	<5	<5	-	-	-	-	<10	-
Trichlorofluoromethane	<2	-	<5	<5	<5	<5	<5	-	-	-	-	-	-
Vinyl acetate	-	<4	-	-	-	-	-	-	-	-	-	-	-
Vinyl Chloride	<2	<4	<10	<10	<10	<10	<10	-	-	-	-	<10	-
Xylenes, total	<2	<4	**16**	<5	<5	<5	<5	-	-	-	-	<10	-

*** The laboritory trip blank demonstrated contamination.**

StarKist Samoa Pesticides and PCBs Results

StarKist Samoa Effluent Pesticides and PCBs Results

Organochlorine Pesticides and PCB's										
Test No.	1	2	3	4	5	6	7	8	9	10
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Witchita, KS	GTEL Witchita, KS	- -	- -	- -	- -	Analytical Resources, Inc	- -
Method Requested	8080	608	608	608					608	
Method Used	8080	608	608	608					608	
Concentrations in µg/L										
Aldrin	<0.10	<0.04	<0.02	<0.02	-	-	-	-	<0.050	-
alpha-BHC	<0.05	<0.02	<0.02	<0.02	-	-	-	-	<0.050	-
beta-BHC	<0.05	<0.03	<0.02	<0.02	-	-	-	-	<0.050	-
delta-BHC	<0.05	<0.02	<0.02	<0.02	-	-	-	-	<0.050	-
gamma-BHC (Lindane)	<0.40	<0.03	<0.02	<0.02	-	-	-	-	0.065	-
Chlordane	<0.15	<0.15	<0.20	<0.20	-	-	-	-	-	-
gamma Chlordane	-	-	-	-	-	-	-	-	<0.050	-
alpha Chlordane	-	-	-	-	-	-	-	-	<0.050	-
4,4'-DDD	<0.10	<0.04	<0.02	<0.02	-	-	-	-	<0.10	-
4,4'-DDE	<0.05	<0.03	<0.02	<0.02	-	-	-	-	<0.10	-
4,4'-DDT	<0.10	<0.09	<0.02	<0.02	-	-	-	-	<0.10	-
Dieldrin	<0.10	<0.07	<0.02	NA	-	-	-	-	<0.10	-
Endosulfan I	<0.15	<0.03	<0.02	NA	-	-	-	-	<0.050	-
Endosulfan II	<0.10	<0.05	<0.02	NA	-	-	-	-	<0.10	-
Endosulfan sulfate	<0.75	<0.07	<0.02	<0.02	-	-	-	-	<0.10	-
Endrin	<0.01	<0.08	<0.02	NA	-	-	-	-	<0.10	-
Endrin Keytone	-	-	-	-	-	-	-	-	<0.10	-
Endrin aldehyde	<0.25	<0.08	<0.02	NA	-	-	-	-	<0.10	-
Heptachlor	<0.10	<0.03	<0.02	<0.02	-	-	-	-	0.061	-
Heptachlor expoxide	<0.10	<0.03	<0.02	<0.02	-	-	-	-	<0.050	-
Methoxychlor	<10.00	<5.00	<0.02	NA	-	-	-	-	<0.50	-
Toxaphene	<0.50	<0.50	<0.40	<0.40	-	-	-	-	<5.0	-
(Aroclor) PCB-1016	<0.10	<0.50	<0.20	<0.20	-	-	-	-	<1.0	-
(Aroclor) PCB-1221	<0.10	<0.50	<0.20	<0.20	-	-	-	-	-	-
(Aroclor) PCB-1232	<0.10	<0.50	<0.20	<0.20	-	-	-	-	-	-
(Aroclor) PCB-1242	<0.10	<0.50	<0.20	<0.20	-	-	-	-	3.6	-
(Aroclor) PCB-1248	<0.10	<0.50	<0.20	<0.20	-	-	-	-	<1.0	-
(Aroclor) PCB-1254	<0.10	<0.50	<0.20	<0.20	-	-	-	-	<1.0	-
(Aroclor) PCB-1260	<0.10	<0.50	<0.20	<0.20	-	-	-	-	<1.0	-

NA Sample was inadvertently cleaned with acid during sample preparation, and these analytes do not survive this treatment

VCS Samoa Packing Pesticides and PCBs Results

VCS Samoa Packing Effluent Pesticides and PCBs Results

Organochlorine Pesticides and PCB's										
Test No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date Sampled	Feb-93	Oct-93	Feb-94	Oct-94	Mar-95	Feb-96	Mar-96	Nov-96	Mar-97	Sep-97
Laboratory	North Creek Analytical	North Creek Analytical	GTEL Witchita, KS	GTEL Witchita, KS	- -	- -	- -	- -	Analytical Resources, Inc	- -
Method Requested	8080	608	608	608					608	
Method Used	8080	608	608	608					608	
Concentrations in µg/L										
Aldrin	<0.10	<0.04	<0.02	<0.02	-	-	-	-	<0.050	-
alpha-BHC	<0.05	<0.02	<0.02	<0.02	-	-	-	-	0.097	-
beta-BHC	<0.05	<0.03	<0.02	<0.02	-	-	-	-	0.078	-
delta-BHC	<0.05	<0.02	<0.02	<0.02	-	-	-	-	0.073	-
gamma-BHC (Lindane)	<0.40	<0.03	<0.02	<0.02	-	-	-	-	0.067	-
Chlordane	<0.15	<0.15	<0.20	<0.20	-	-	-	-	-	-
gamma Chlordane	-	-	-	-	-	-	-	-	<0.050	-
alpha Chlordane	-	-	-	-	-	-	-	-	<0.050	-
4,4-DDD	<0.10	<0.04	<0.02	<0.02	-	-	-	-	<0.10	-
4,4-DDE	<0.05	<0.03	<0.02	<0.02	-	-	-	-	<0.10	-
4,4-DDT	<0.10	<0.09	<0.02	<0.02	-	-	-	-	<0.10	-
Dieldrin	<0.10	<0.07	<0.02	NA	-	-	-	-	<0.10	-
Endosulfan I	<0.15	<0.03	<0.02	NA	-	-	-	-	<0.050	-
Endosulfan II	<0.10	<0.05	<0.02	NA	-	-	-	-	<0.10	-
Endosulfan sulfate	<0.75	<0.07	<0.02	<0.02	-	-	-	-	<0.10	-
Endrin	<0.01	<0.08	<0.02	NA	-	-	-	-	0.28	-
Endrin Keytone	-	-	-	-	-	-	-	-	<0.10	-
Endrin aldehyde	<0.25	<0.08	<0.02	NA	-	-	-	-	<0.10	-
Heptachlor	<0.10	<0.03	<0.02	<0.02	-	-	-	-	-	-
Heptachlor expoxide	<0.10	<0.03	<0.02	<0.02	-	-	-	-	<0.050	-
Methoxychlor	<10.00	<5.00	<0.02	NA	-	-	-	-	<0.50	-
Toxaphene	<0.50	<0.50	<0.40	<0.40	-	-	-	-	<5.0	-
(Aroclor) PCB-1016	<0.10	<0.50	<0.20	<0.20	-	-	-	-	<1.0	-
(Aroclor) PCB-1221	<0.10	<0.50	<0.20	<0.20	-	-	-	-	-	-
(Aroclor) PCB-1232	<0.10	<0.50	<0.20	<0.20	-	-	-	-	-	-
(Aroclor) PCB-1242	<0.10	<0.50	<0.20	<0.20	-	-	-	-	3.6	-
(Aroclor) PCB-1248	<0.10	<0.50	<0.20	<0.20	-	-	-	-	1.5	-
(Aroclor) PCB-1254	<0.10	<0.50	<0.20	<0.20	-	-	-	-	2.6	-
(Aroclor) PCB-1260	<0.10	<0.50	<0.20	<0.20	-	-	-	-	1.0	-

NA **Sample was inadvertently cleaned with acid during sample preparation, and these analytes do not survive this treatment**

gdc

COASTAL ENVIRONMENTAL ANALYSTS

5 November 1997

Ms Pat Young
American Samoa Program Manager
Office of Pacific Islands
and Native American Programs
U.S. Environmental Protection Agency
75 Hawthorne Street (E-4)
San Francisco, CA 94105

Ms Sheila Wiegman
American Samoa
Environmental Protection Agency
American Samoa Government
Pago Pago, American Samoa 96799

Re: Effluent Chemistry (September 1997 Sampling)
StarKist Samoa (NPDES Permit AS0000019)
Samoa Packing (NPDES Permit AS0000027)

Dear Pat and Sheila:

Enclosed are two copies of the reports for the effluent chemistry for each of the canneries. This is the final scheduled effluent chemistry sampling under the current permit. At this time we have no additional tests scheduled.

Sincerely,

Steve Costa

(originals signed by)
Steve Costa

enclosure 1: Chemical Analysis of Effluent: September 1997 Sampling - StarKist Samoa
enclosure 2: Chemical Analysis of Effluent: September 1997 Sampling - VCS Samoa Packing

cc: Norman Wei/StarKist Foods (w/enclosures 1)
Jim Cox/Van Camp Seafood (w/enclosures 2)
Barry Mills/StarKist Samoa (w/enclosures 1)
Herman Gebauer/VCS Samoa Packing (w/enclosures 2)
David Wilson/CH2M Hill/SEA (w/enclosures 1 and 2)
Karin Noack/CH2M Hill/SFO (w/enclosures 1 and 2)

copy sent to Doug Linder 11/12/97.

P.O. BOX 1125 • ARCATA, CA • 95518
PHONE: 707-826-0717 or 7662 • FAX: 707-822-0567
EMAIL: GLATZELDACOSTA@SPRINTMAIL.COM

TECHNICAL MEMORANDUM CH2M HILL

PREPARED FOR: VCS Samoa Packing Company, Inc. (NPDES Permit AS0000027)

PREPARED BY: Steve Costa and Karen Glatzel/gdc
Karin Noack/CH2M HILL/SFO

DATE: 5 November 1997

SUBJECT: **Chemical Analysis of Effluent: September 1997 Sampling**

PROJECT: 141753.EL.97

Purpose

This memorandum presents the results of the chemical analyses of VCS Samoa Packing effluent samples that were collected in September 1997. This was the tenth sampling and analysis episode conducted under the current NPDES permit.

Study Objectives

Section D.2 of VCS Samoa Packing's NPDES permit (AS0000027) requires that semiannual priority pollutant analyses be conducted on the cannery effluent. Each effluent sampling event must coincide with effluent sampling for acute biomonitoring. Effluent samples are collected as composite samples as described below. The purpose of these analyses is to identify the chemicals present in the effluent, and provide data to determine whether the wastewater discharge complies with water quality standards.

Effluent priority pollutant analyses include those chemical constituents listed in 40 CFR 401.15. As documented in the Technical Memorandum describing the results of the March 1995 sampling (CH2M HILL, 20 June 1995) the U.S. Environmental Protection Agency Region 9 has allowed VCS Samoa Packing to exclude a number of previously measured constituents in the priority pollutant list. The constituents currently included in the effluent chemistry analyses are listed in Table 1.

Methods

Between 0900 on 3 September and 0600 on 4 September 1997, a 24-hour, flow-weighted composite sample of final effluent was collected from the VCS Samoa Packing treatment plant discharge. Effluent composite samples were collected simultaneously for chemistry and bioassay analyses. Table 1 lists the chemical analyses, detection limits, sample holding times, sample containers, and sample preservations for the effluent sample collected for chemical analysis. The standard operating procedures (SOP) for the joint cannery outfall chemistry sampling is provided in the Technical Memorandum describing the bioassay tests conducted with the March 1995 effluent sample (CH2M HILL, 20 June 1995).

Effluent Chemical Analysis
September 1997 Sampling
VCS Samoa Packing

Samples were collected from the established effluent sampling site following the established composite sample collection schedule for the priority pollutant analyses. A total of eight individual grab samples were collected into pre-cleaned glass containers at approximately three-hour intervals over a 24 hour period. The samples were stored on ice until the completion of the 24-hour sampling period, and then a flow-weighted composite sample was prepared. The grab sample collection times and the calculated individual volumes of each grab sample used to create the composite sample, based on VCS Samoa Packing's flow records, are summarized in Table 2. The final composite sample was used to fill the sample containers sent to the laboratory for analyses. The pH of the samples for analysis of metals and total phenol was measured prior to shipping and was less than 2.0 SU. A duplicate sample was taken and shipped without preservative for copper analysis using co-precipitation.

Sample containers were wrapped in bubble-wrap, placed in zip-lock bags, and packed on ice for shipment to the laboratory. Sample chain of custody forms were completed, sealed into zip-lock bags, and taped inside the lid of the ice chest. Samples were shipped to the laboratory via DHL. Samples that were composited on 4 September, were received at Analytical Resources, Incorporated (ARI) on 8 September 1997.

Results

Laboratory data sets, laboratory quality control data reports, and chain-of-custody form are attached to this memorandum. The chain-of-custody form is included as Attachment I and the laboratory analytical data sheets and quality control data reports are included as Attachment II. Table 1 indicates the detection limits requested from the analytical laboratory along with those achieved during the analysis. The laboratory indicated, prior to sample analysis, that the requested detection limits could be achieved.

Semivolatile organics were all at the non-detect level with the exception of phenol, 4-methylphenol, and benzoic acid, di-n-butylphthalate, and bis (2-ethylhexyl) phthalate. Phenol, 4-methylphenol, and benzoic acid are compared with past sample results in Table 3. For di-n-butylphthalate the detection was 39 µg/l and for bis (2-ethylhexyl) phthalate the detection was 19 µg/l. Bis (2-ethylhexyl) phthalate and butylbenzylphtalate were present in the method blank indicating laboratory phalate infererence. ARI also ran a semivolatile organic dilution duplicate at 1:40 and phenol, benzoic acid and bis (2-ethylhexyl) phthalate were all non-detect.

Requested detection limits were achieved for the inorganics. To achieve the requested detection limits, arsenic, lead, selenium, and silver were analyzed using method EPA 200.9. ARI employed a modification for the method EPA 200.9 for the graphite furnace atomic absorption (GFAA) analysis. ARI's sample preparation for GFAA determination uses only nitric acid rather than the mixed usage of hydrochloric and nitric acids as stipulated in EPA Method 200.9. ARI uses the EPA CLP criteria of 90 to 110% for recovery of the Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) standards rather than the

EPA Method 200.9 criteria of 95 to 105%. Copper was analyzed using method EPA 200.7, following extraction by co-precipitation.

Table 3 summarizes the sample results for substances detected for the September 1997 effluent sample analysis compared to those detected during previous analyses. The analyses detected five chemical parameters in the effluent from VCS Samoa Packing. Arsenic, copper, selenium, and zinc were detected at comparable levels with those previously reported. Cadmium was detected at the reported limit of detection (2 μg/l).

Table 1
Effluent Sample Analyses and Handling Procedures
at VCS Samoa Packing, 03 - 04 September 1997

Chemical Parameter	Analytical Method Requested	Detection Limits, µg/l		Sample Holding Time	Sample Container	Sample Preservation
		Requested	Achieved			
Semivolatile Organics	EPA 625	10-50	3-30	7 days	1 liter amber glass	4 °C
Phenols	EPA 420.1	10	40		500 ml plastic	4 °C, 5 ml H_2SO_4[1]
Inorganics [2]						
Arsenic	EPA 206.2	5	5[3]	"	"	"
Cadmium	EPA 200.7	5	2	"	"	"
Chromium	EPA 200.7	10	5	"	"	"
Copper	EPA 220.2	2	2[4]	"	"	"
Lead	EPA 239.2	5	5[3]	"	"	"
Mercury	EPA 245.1	0.4	0.2	"	"	"
Selenium	EPA 270.1	5	10[3]	"	"	"
Silver	EPA 272.2	2	1[3]	"	"	"
Zinc	EPA 200.7	20	4	"	"	"

[1] Additional HNO_3 and H_2SO_4 was added to the sample as necessary to bring pH equal to or less than 2 at the time of composting the sample.
[2] All Inorganics were from one 500 ml plastic sample container, preserved with 5 ml 2N HNO_3, with pH of filled sample bottle measured at 1.65. An un-preserved duplicate sample was taken for Copper analysis using co-precipitation.
[3] Modified method EPA 200.9 used to achieve this detection limit (see text for modifications).
[4] Method EPA 200.7 used to achieve this detection limit following extraction by co-precipitation.

Table 2
Effluent Chemistry 24-hour Composite Sample Collection at VCS Samoa Packing, 03 - 04 September 1997

Grab Sample Number	Sampling Time	Sampling Date	Effluent Flow Rate (mgd)[1]	Percent of Total Flow	Volume of Sample (ml)	
					1 liter	500 ml
1	0900	09/03/97	1.10	13.6	136	68
2	1200	09/03/97	1.20	14.8	148	74
3	1500	09/03/97	0.90	11.1	111	55
4	1800	09/03/97	0.90	11.1	111	55.5
5	2100	09/03/97	0.90	11.1	111	55.5
6	0000	09/04/97	1.10	13.6	136	68
7	0300	09/04/97	1.00	12.35	124	62
8	0600	09/04/97	1.00	12.35	124	62
TOTALS			8.10	100	1000	500

[1] Mean effluent flow rate 1.01 mgd.

Table 3
Summary of VCS Samoa Effluent Chemistry Sample Results
03 - 04 September 1997

Substance	Previous Sample Results, µg/L (ppb)									September 1997 Sample Results, µg/L (ppb)
	February 1993	October 1993 [1]	February 1994	October 1994	March 1995	February 1996	March 1996	November 1996	March 1997	
Inorganics										
Arsenic	9.8	ND (15)	25	25	32	14	ND [2]	16	24	24
Copper	21	(ND) (ND)	13	23	9	54	ND [3]	11	11	12
Lead	4.3	ND (2.5)	ND	ND	ND	5.4	ND	ND	2	ND
Silver	ND	ND	22	16	33	<50 [4]	ND [5]	ND	ND	ND
Zinc	380	400 (540)	660	760	570	440	740	471	484	585
Semivolatile Organics										
Benzoic Acid	120	ND	ND	ND	ND	ND	ND	ND	ND	53[6]
Phenol	110	ND	69	120	32	110	89	150	73	52
4-Methylphenol	670	1600	770	2800	2400	1600	6800	1800	860	1600
Total Recoverable Phenols	NA	570	84	280	150	170	170	140	80	70

ND = Not Detected NA = Not Analyzed
[1] Values in parentheses are results of reanalyzed samples (see Technical Memorandum for October 1993 sampling episode).
[2] Detection limit raised to 400 µg/l because of matrix interference, with the resultant concentration <400 µg/l each time.
[3] Detection limit raised to 25 µg/l because of matrix interference, with the resultant concentration <25 µg/l.
[4] Detection limit raised to 50 µg/l because of matrix interference, with the resultant concentration <50 µg/l each time.
[5] Detection limit raised to 200 µg/l because of matrix interference, with the resultant concentration <200 µg/l.
[6] Detected at dilution 1:3, ND at dilution 1:40.

ATTACHMENT I

CHAIN-OF-CUSTODY FORMS

VCS Samoa Packing Company, Inc. Effluent Sample

03 - 04 September 1997

1616

97-[illegible] TO 97-157

COOLER TEMP 12 °C

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 EL 97

Purchase Order #:

Project Name: VCS SAMOA PACKING NPDES

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA– FOR LAB USE ONLY: Lab 1 # | Lab 2 # | Quote # | Kit Request # | Project # | No. of Samples | Page of | Login | LIMS Ver

ANALYSES REQUESTED

Sampling 97 Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	ARSENIC (206.2) (or 200.9)	CADMIUM (200.7)	CHROMIUM (200.7)	*COPPER (220.2)	LEAD (239.2) (or 200.9)	MERCURY (245.1)	SELENIUM (270.1) (OR 200.9)	SILVER (272.2) (or 200.9)	ZINC (200.7)	TOTAL PHENOLS (420.1)	SEMI-VOLATILES (625)	REMARKS	LAB 1 ID	LAB 2 ID
9/4		X		X			VCS-10MT	2	X	X	X	X	X	X	X	X	X			1 preserved HNO3 1 unpreserved		
↓		↓		↓			VCS-10SV	1											X			
							VCS-10PH	1										X				
							REQUESTED DETECTION LIMITS ug/l		5	5	10	2	5	0.4	5	2	20	10	10-50			

Sampled By & Title (Please sign and print name)	Date/Time 9/3-9/4	Relinquished By (Please sign and print name) S Costa	Date/Time 9/5
Received By (Please sign and print name) Derrick J. Burke DERRICK BURKE	Date/Time 9/8/97 1200	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via UPS BUS Fed-Ex Hand Other DHL	Shipping #
Work Authorized By (Please sign and print name)	Remarks * Copper DLR 2 ug/l using coprecipitation if required (unpreserved sample provided)		

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

00003

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 240

ATTACHMENT II

LABORATORY DATA REPORT
Analytical Resources, Inc.

VCS Samoa Packing Company, Inc. Effluent Sample

03 - 04 September 1997

ANALYTICAL
RESOURCES
INCORPORATED

Final Report
Laboratory Analysis of Conventional Parameters

Sample No: VCS-10

Lab Sample ID: T696A
LIMS ID: 97-15760
Matrix: Water

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

Analyte	Analysis Date & Batch	Method	RL	Units	Result
Phenol	09/15/97 091597#1	EPA 420.1	0.04	mg/L	0.07

RL Analytical reporting limit
U Undetected at reported detection limit

Report for T696 received 09/08/97

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Method Blank Analysis

QC Report No: T696-Ch2MHill
Matrix: Water
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: NA

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

METHOD BLANK RESULTS
CONVENTIONALS

Analysis Date & Batch	Constituent	Units	Result	
09/15/97 091597#1	Phenol	mg/L	< 0.04	U

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Laboratory Control Samples

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: NA

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

LABORATORY CONTROL SAMPLES
CONVENTIONALS

Constituent	Units	Measured Value	True Value	Recovery
Laboratory Control Sample				
Phenol	mg/L	0.11	0.12	91.7%

Date analyzed: 09/15/97 Batch ID: 091597#1

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Replicate Analysis

QC Report No: T696-Ch2MHill
Matrix: Water
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: 09/08/97

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

DUPLICATE ANALYSIS RESULTS
CONVENTIONALS

Constituent	Units	Sample Value	Duplicate Value	RPD
ARI ID: 97-15760, T696 A	**Client Sample ID: VCS-10**			
Phenol	mg/L	0.07	0.08	RPD: 13.3%

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Matrix Spike/Matrix Spike Duplicate Analysis

QC Report No: T696-Ch2MHill
Matrix: Water
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: 09/08/97

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

MATRIX SPIKE QA/QC REPORT
CONVENTIONALS

Constituent	Units	Sample Value	Spike Value	Spike Added	Recovery
ARI ID: 97-15761, T696 B	**Client Sample ID: SKS-10**				
Phenol	mg/L	0.14	0.49	0.40	87.5%

MS/MSD Recovery Limits: 75 - 125 %

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: VCS-10

Lab Sample ID: T696A
LIMS ID: 97-15760
Matrix: Water
Data Release Authorized: PM
Reported: 10/15/97

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES 107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Date extracted: 09/10/97
Date analyzed: 09/15/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:3

CAS Number	Analyte	ug/L
108-95-2	**Phenol**	**52**
111-44-4	Bis-(2-Chloroethyl) Ether	6.0 U
95-57-8	2-Chlorophenol	3.0 U
541-73-1	1,3-Dichlorobenzene	3.0 U
106-46-7	1,4-Dichlorobenzene	3.0 U
100-51-6	Benzyl Alcohol	15 U
95-50-1	1,2-Dichlorobenzene	3.0 U
95-48-7	2-Methylphenol	6.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	3.0 U
106-44-5	**4-Methylphenol**	**1,600 E**
621-64-7	N-Nitroso-Di-N-Propylamine	6.0 U
67-72-1	Hexachloroethane	6.0 U
98-95-3	Nitrobenzene	3.0 U
78-59-1	Isophorone	3.0 U
88-75-5	2-Nitrophenol	15 U
105-67-9	2,4-Dimethylphenol	9.0 U
65-85-0	**Benzoic Acid**	**53**
111-91-1	bis(2-Chloroethoxy) Methane	3.0 U
120-83-2	2,4-Dichlorophenol	9.0 U
120-82-1	1,2,4-Trichlorobenzene	3.0 U
91-20-3	Naphthalene	3.0 U
106-47-8	4-Chloroaniline	9.0 U
87-68-3	Hexachlorobutadiene	6.0 U
59-50-7	4-Chloro-3-methylphenol	6.0 U
91-57-6	2-Methylnaphthalene	3.0 U
77-47-4	Hexachlorocyclopentadiene	15 U
88-06-2	2,4,6-Trichlorophenol	15 U
95-95-4	2,4,5-Trichlorophenol	15 U
91-58-7	2-Chloronaphthalene	3.0 U
88-74-4	2-Nitroaniline	15 U
131-11-3	Dimethylphthalate	3.0 U
208-96-8	Acenaphthylene	3.0 U
99-09-2	3-Nitroaniline	18 U
83-32-9	Acenaphthene	3.0 U
51-28-5	2,4-Dinitrophenol	30 U
100-02-7	4-Nitrophenol	15 U
132-64-9	Dibenzofuran	3.0 U
606-20-2	2,6-Dinitrotoluene	15 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: VCS-10

Lab Sample ID: T696A
LIMS ID: 97-15760
Matrix: Water
Data Release Authorized: JMC
Reported: 10/15/97

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Date extracted: 09/10/97
Date analyzed: 09/15/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:3

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	15 U
84-66-2	Diethylphthalate	3.0 U
7005-72-3	4-Chlorophenyl-phenylether	3.0 U
86-73-7	Fluorene	3.0 U
100-01-6	4-Nitroaniline	15 U
534-52-1	4,6-Dinitro-2-Methylphenol	30 U
86-30-6	N-Nitrosodiphenylamine	3.0 U
101-55-3	4-Bromophenyl-phenylether	3.0 U
118-74-1	Hexachlorobenzene	3.0 U
87-86-5	Pentachlorophenol	15 U
85-01-8	Phenanthrene	3.0 U
86-74-8	Carbazole	3.0 U
120-12-7	Anthracene	3.0 U
84-74-2	**Di-n-Butylphthalate**	**39**
206-44-0	Fluoranthene	3.0 U
129-00-0	Pyrene	3.0 U
85-68-7	Butylbenzylphthalate	3.0 U
91-94-1	3,3'-Dichlorobenzidine	15 U
56-55-3	Benzo(a)anthracene	3.0 U
117-81-7	**bis(2-Ethylhexyl)phthalate**	**19 B**
218-01-9	Chrysene	3.0 U
117-84-0	Di-n-Octyl phthalate	3.0 U
205-99-2	Benzo(b)fluoranthene	3.0 U
207-08-9	Benzo(k)fluoranthene	3.0 U
50-32-8	Benzo(a)pyrene	3.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	3.0 U
53-70-3	Dibenz(a,h)anthracene	3.0 U
191-24-2	Benzo(g,h,i)perylene	3.0 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	87.0%	d5-Phenol	69.0%
2-Fluorobiphenyl	73.1%	2-Fluorophenol	86.1%
d14-p-Terphenyl	79.0%	2,4,6-Tribromophenol	92.5%
d4-1,2-Dichlorobenzene	63.4%	d4-2-Chlorophenol	63.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: **VCS-10**
DILUTION

Lab Sample ID: T696A-DL
LIMS ID: 97-15760
Matrix: Water
Data Release Authorized: JR
Reported: 10/15/97

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Date extracted: 09/10/97
Date analyzed: 09/16/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:40

CAS Number	Analyte	ug/L
108-95-2	Phenol	80 U
111-44-4	Bis-(2-Chloroethyl) Ether	80 U
95-57-8	2-Chlorophenol	40 U
541-73-1	1,3-Dichlorobenzene	40 U
106-46-7	1,4-Dichlorobenzene	40 U
100-51-6	Benzyl Alcohol	200 U
95-50-1	1,2-Dichlorobenzene	40 U
95-48-7	2-Methylphenol	80 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	40 U
106-44-5	**4-Methylphenol**	**2,000**
621-64-7	N-Nitroso-Di-N-Propylamine	80 U
67-72-1	Hexachloroethane	80 U
98-95-3	Nitrobenzene	40 U
78-59-1	Isophorone	40 U
88-75-5	2-Nitrophenol	200 U
105-67-9	2,4-Dimethylphenol	120 U
65-85-0	Benzoic Acid	400 U
111-91-1	bis(2-Chloroethoxy) Methane	40 U
120-83-2	2,4-Dichlorophenol	120 U
120-82-1	1,2,4-Trichlorobenzene	40 U
91-20-3	Naphthalene	40 U
106-47-8	4-Chloroaniline	120 U
87-68-3	Hexachlorobutadiene	80 U
59-50-7	4-Chloro-3-methylphenol	80 U
91-57-6	2-Methylnaphthalene	40 U
77-47-4	Hexachlorocyclopentadiene	200 U
88-06-2	2,4,6-Trichlorophenol	200 U
95-95-4	2,4,5-Trichlorophenol	200 U
91-58-7	2-Chloronaphthalene	40 U
88-74-4	2-Nitroaniline	200 U
131-11-3	Dimethylphthalate	40 U
208-96-8	Acenaphthylene	40 U
99-09-2	3-Nitroaniline	240 U
83-32-9	Acenaphthene	40 U
51-28-5	2,4-Dinitrophenol	400 U
100-02-7	4-Nitrophenol	200 U
132-64-9	Dibenzofuran	40 U
606-20-2	2,6-Dinitrotoluene	200 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: **VCS-10**
DILUTION

Lab Sample ID: T696A-DL
LIMS ID: 97-15760
Matrix: Water
Data Release Authorized:
Reported: 10/15/97

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Date extracted: 09/10/97
Date analyzed: 09/16/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:40

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	200 U
84-66-2	Diethylphthalate	40 U
7005-72-3	4-Chlorophenyl-phenylether	40 U
86-73-7	Fluorene	40 U
100-01-6	4-Nitroaniline	200 U
534-52-1	4,6-Dinitro-2-Methylphenol	400 U
86-30-6	N-Nitrosodiphenylamine	40 U
101-55-3	4-Bromophenyl-phenylether	40 U
118-74-1	Hexachlorobenzene	40 U
87-86-5	Pentachlorophenol	200 U
85-01-8	Phenanthrene	40 U
86-74-8	Carbazole	40 U
120-12-7	Anthracene	40 U
84-74-2	**Di-n-Butylphthalate**	**51**
206-44-0	Fluoranthene	40 U
129-00-0	Pyrene	40 U
85-68-7	Butylbenzylphthalate	40 U
91-94-1	3,3'-Dichlorobenzidine	200 U
56-55-3	Benzo(a)anthracene	40 U
117-81-7	bis(2-Ethylhexyl)phthalate	40 U
218-01-9	Chrysene	40 U
117-84-0	Di-n-Octyl phthalate	40 U
205-99-2	Benzo(b)fluoranthene	40 U
207-08-9	Benzo(k)fluoranthene	40 U
50-32-8	Benzo(a)pyrene	40 U
193-39-5	Indeno(1,2,3-cd)pyrene	40 U
53-70-3	Dibenz(a,h)anthracene	40 U
191-24-2	Benzo(g,h,i)perylene	40 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	75.2%	d5-Phenol	78.9%
2-Fluorobiphenyl	84.8%	2-Fluorophenol	86.4%
d14-p-Terphenyl	92.8%	2,4,6-Tribromophenol	77.9%
d4-1,2-Dichlorobenzene	73.6%	d4-2-Chlorophenol	78.9%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: Method Blank

Lab Sample ID: T696MB
LIMS ID: 97-15760
Matrix: Water
Data Release Authorized: JMR
Reported: 10/15/97

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES 107091 EL 97
Date Sampled: NA
Date Received: NA

Date extracted: 09/10/97
Date analyzed: 09/15/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
108-95-2	Phenol	2.0 U
111-44-4	Bis-(2-Chloroethyl) Ether	2.0 U
95-57-8	2-Chlorophenol	1.0 U
541-73-1	1,3-Dichlorobenzene	1.0 U
106-46-7	1,4-Dichlorobenzene	1.0 U
100-51-6	Benzyl Alcohol	5.0 U
95-50-1	1,2-Dichlorobenzene	1.0 U
95-48-7	2-Methylphenol	2.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	1.0 U
106-44-5	4-Methylphenol	1.0 U
621-64-7	N-Nitroso-Di-N-Propylamine	2.0 U
67-72-1	Hexachloroethane	2.0 U
98-95-3	Nitrobenzene	1.0 U
78-59-1	Isophorone	1.0 U
88-75-5	2-Nitrophenol	5.0 U
105-67-9	2,4-Dimethylphenol	3.0 U
65-85-0	Benzoic Acid	10 U
111-91-1	bis(2-Chloroethoxy) Methane	1.0 U
120-83-2	2,4-Dichlorophenol	3.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0 U
91-20-3	Naphthalene	1.0 U
106-47-8	4-Chloroaniline	3.0 U
87-68-3	Hexachlorobutadiene	2.0 U
59-50-7	4-Chloro-3-methylphenol	2.0 U
91-57-6	2-Methylnaphthalene	1.0 U
77-47-4	Hexachlorocyclopentadiene	5.0 U
88-06-2	2,4,6-Trichlorophenol	5.0 U
95-95-4	2,4,5-Trichlorophenol	5.0 U
91-58-7	2-Chloronaphthalene	1.0 U
88-74-4	2-Nitroaniline	5.0 U
131-11-3	Dimethylphthalate	1.0 U
208-96-8	Acenaphthylene	1.0 U
99-09-2	3-Nitroaniline	6.0 U
83-32-9	Acenaphthene	1.0 U
51-28-5	2,4-Dinitrophenol	10 U
100-02-7	4-Nitrophenol	5.0 U
132-64-9	Dibenzofuran	1.0 U
606-20-2	2,6-Dinitrotoluene	5.0 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: Method Blank

Lab Sample ID: T696MB
LIMS ID: 97-15760
Matrix: Water
Data Release Authorized: JMC
Reported: 10/15/97

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES 107091 EL 97
Date Sampled: NA
Date Received: NA

Date extracted: 09/10/97
Date analyzed: 09/15/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	5.0 U
84-66-2	Diethylphthalate	1.0 U
7005-72-3	4-Chlorophenyl-phenylether	1.0 U
86-73-7	Fluorene	1.0 U
100-01-6	4-Nitroaniline	5.0 U
534-52-1	4,6-Dinitro-2-Methylphenol	10 U
86-30-6	N-Nitrosodiphenylamine	1.0 U
101-55-3	4-Bromophenyl-phenylether	1.0 U
118-74-1	Hexachlorobenzene	1.0 U
87-86-5	Pentachlorophenol	5.0 U
85-01-8	Phenanthrene	1.0 U
86-74-8	Carbazole	1.0 U
120-12-7	Anthracene	1.0 U
84-74-2	Di-n-Butylphthalate	1.0 U
206-44-0	Fluoranthene	1.0 U
129-00-0	Pyrene	1.0 U
85-68-7	**Butylbenzylphthalate**	**1.0**
91-94-1	3,3'-Dichlorobenzidine	5.0 U
56-55-3	Benzo(a)anthracene	1.0 U
117-81-7	**bis(2-Ethylhexyl)phthalate**	**6.4**
218-01-9	Chrysene	1.0 U
117-84-0	Di-n-Octyl phthalate	1.0 U
205-99-2	Benzo(b)fluoranthene	1.0 U
207-08-9	Benzo(k)fluoranthene	1.0 U
50-32-8	Benzo(a)pyrene	1.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	1.0 U
53-70-3	Dibenz(a,h)anthracene	1.0 U
191-24-2	Benzo(g,h,i)perylene	1.0 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	73.9%	d5-Phenol	70.7%
2-Fluorobiphenyl	65.1%	2-Fluorophenol	75.3%
d14-p-Terphenyl	100%	2,4,6-Tribromophenol	75.7%
d4-1,2-Dichlorobenzene	56.6%	d4-2-Chlorophenol	74.2%

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: VCS-10**
TOTAL METALS

Lab Sample ID: T696A
LIMS ID: 97-15760
Matrix: Water

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Data Release Authorized:
Reported: 10/13/97

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	09/22/97	200.7	09/23/97	**7440-38-2**	**Arsenic**	0.005	**0.024**
200.7	09/22/97	200.7	09/24/97	**7440-43-9**	**Cadmium**	0.002	**0.002**
200.7	09/22/97	200.7	09/24/97	7440-47-3	Chromium	0.005	0.005 U
200.7	09/22/97	200.7	09/24/97	**7440-50-8**	**Copper**	0.002	**0.012**
200.7	09/22/97	200.7	09/23/97	7439-92-1	Lead	0.005	0.005 U
245.1	09/23/97	245.1	09/23/97	7439-97-6	Mercury	0.0002	0.0002 U
200.7	09/22/97	200.7	09/24/97	**7782-49-2**	**Selenium**	0.01	**0.03**
200.7	09/22/97	200.7	09/30/97	7440-22-4	Silver	0.001	0.001 U
200.7	09/22/97	200.7	09/24/97	**7440-66-6**	**Zinc**	0.004	**0.585**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: Method Blank**
TOTAL METALS

Lab Sample ID: T696MB
LIMS ID: 97-15760
Matrix: Water

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 10/13/97

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
200.7	09/22/97	200.7	09/23/97	7440-38-2	Arsenic	0.001	0.001 U
200.7	09/22/97	200.7	09/24/97	7440-43-9	Cadmium	0.002	0.002 U
200.7	09/22/97	200.7	09/24/97	7440-47-3	Chromium	0.005	0.005 U
200.7	09/22/97	200.7	09/24/97	7440-50-8	Copper	0.002	0.002 U
200.7	09/22/97	200.7	09/23/97	7439-92-1	Lead	0.001	0.001 U
245.1	09/23/97	245.1	09/23/97	7439-97-6	Mercury	0.0001	0.0001 U
200.7	09/22/97	200.7	09/24/97	7782-49-2	Selenium	0.001	0.001 U
200.7	09/22/97	200.7	09/23/97	7440-22-4	Silver	0.0002	0.0002 U
200.7	09/22/97	200.7	09/24/97	7440-66-6	Zinc	0.004	0.004 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

ANALYTICAL RESOURCES INCORPORATED

Sample No: VCS-10
QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: 09/08/97

Lab Sample ID: T696A
LIMS ID: 97-15760
Matrix: Water

Data Release Authorized:
Reported: 10/09/97

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Duplicate mg/L	RPD	Control Limit	Q
Arsenic	0.024	0.024	0.0%	+/- 0.005	L
Cadmium	0.002	0.002	0.0%	+/- 0.002	L
Chromium	0.005 U	0.005 U	0.0%	+/- 0.005	L
Copper	0.012	0.011	8.7%	+/- 20 %	
Lead	0.005 U	0.005 U	0.0%	+/- 0.005	L
Mercury	0.0002 U	0.0002 U	0.0%	+/- 0.0002	L
Selenium	0.03	0.02	40.0%	+/- 0.01	L
Silver	0.0010 U	0.0010 U	0.0%	+/- 0.0010	L
Zinc	0.585	0.579	1.0%	+/- 20 %	

'Q' codes: * = control limit not met
L = RPD not valid, alternate limit = detection limit

FORM-VI

ANALYTICAL
RESOURCES
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INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: VCS-10
Lab Sample ID: T696A
QC Report No: T696-Ch2MHill
LIMS ID: 97-15760
Project: VCS Samoa Packing NPDES
Matrix: Water
107091 EL 97
Date Received: 09/08/97

Data Release Authorized:
Reported: 10/09/97

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Spike mg/L	Spike Added	% Recovery	Q
Arsenic	0.024	0.058	0.040	85.0%	
Cadmium	0.002	0.044	0.050	84.0%	
Chromium	0.005 U	0.191	0.200	95.5%	
Copper	0.012	0.252	0.250	96.0%	
Lead	0.005 U	0.025	0.020	125%	
Mercury	0.0002 U	0.0017	0.0020	85.0%	
Selenium	0.03	0.04	0.01	100%	
Silver	0.001 U	0.019	0.020	95.0%	
Zinc	0.585	1.03	0.500	89.0%	

'Q' codes:
N = control limit not met
H = %R not applicable, sample concentration too high
* = RPD control limit not met
NA = Not applicable - analyte not spiked

Control Limits:
Percent Recovery: 75-125%
RPD: +/-20%

FORM-V

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Lab Sample ID: T696LCS
LIMS ID: 97-15760
Matrix: Water

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97

Data Release Authorized:
Reported: 10/09/97

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Mercury	0.0020	0.0020	100%	

'Q' codes: N = control limit not met

Control Limits: 80-120%

FORM-VII

ANALYTICAL
RESOURCES
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INORGANICS ANALYSIS DATA SHEET

Sample No: **STD REFERENCE**
I.V. Lots 889-1 and 869-6

Lab Sample ID: T696LCS
LIMS ID: 97-15760
Matrix: Water

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 10/09/97

Analyte	STD Value	Value Found	Recovery
Arsenic	0.100	0.100	100%
Cadmium	1.00	0.917	91.7%
Chromium	1.00	0.977	97.7%
Copper	1.00	0.991	99.1%
Lead	0.100	0.108	108%
Selenium	0.100	0.105	105%
Silver	0.020	0.021	105%
Zinc	1.00	0.946	94.6%

Recovery Limits 80-120

Values reported in parts per million (mg/L)

I.V. Lot 869-6 used for GFA. I.V. Lot 889-1 used for ICP.

FORM-III-R

TECHNICAL MEMORANDUM

PREPARED FOR: StarKist Samoa, Inc. (NPDES Permit AS0000019)

PREPARED BY: Steve Costa and Karen Glatzel /gdc
Karin Noack/CH2M HILL/SFO

DATE: 5 November 1997

SUBJECT: **Chemical Analysis of Effluent: September 1997 Sampling**

PROJECT: 141753.EL.97

Purpose

This memorandum presents the results of the chemical analyses of StarKist Samoa effluent samples that were collected in September 1997. This was the tenth sampling and analysis episode conducted under the current NPDES permit.

Study Objectives

Section D.2 of StarKist Samoa's NPDES permit (AS0000019) requires that semiannual priority pollutant analyses be conducted on the cannery effluent. Each effluent sampling event must coincide with effluent sampling for acute biomonitoring. Effluent samples are collected as composite samples as described below. The purpose of these analyses is to identify the chemicals present in the effluent, and provide data to determine whether the wastewater discharge complies with water quality standards.

Effluent priority pollutant analyses include those chemical constituents listed in 40 CFR 401.15. As documented in the Technical Memorandum describing the results of the March 1995 sampling (CH2M HILL, 20 June 1995) the U.S. Environmental Protection Agency Region 9 has allowed StarKist Samoa to exclude a number of previously measured constituents in the priority pollutant list. The constituents currently included in the effluent chemistry analyses are listed in Table 1.

Methods

Between 0915 on 3 September and 0610 on 4 September 1997, a 24-hour, flow-weighted composite sample of final effluent was collected from the StarKist Samoa treatment plant discharge. Effluent composite samples were collected simultaneously for chemistry and

bioassay analyses. Table 1 lists the chemical analyses, detection limits, sample holding times, sample containers, and sample preservations for the effluent sample collected for chemical analysis. The standard operating procedures (SOP) for the joint cannery outfall chemistry sampling is provided in the Technical Memorandum describing the bioassay tests conducted with the March 1995 effluent sample (CH2M HILL, 20 June 1995).

Samples were collected from the established effluent sampling site following the established composite sample collection schedule for the priority pollutant analyses. A total of eight individual grab samples were collected into pre-cleaned glass containers at approximately three-hour intervals over a 24 hour period. The samples were stored on ice until the completion of the 24-hour sampling period, and then a flow-weighted composite sample was prepared. The grab sample collection times and the calculated individual volumes of each grab sample used to create the composite sample, based on StarKist Samoa's flow records, are summarized in Table 2. The final composite sample was used to fill the sample containers sent to the laboratory for analyses. The pH of the samples for analysis of metals and total phenols was measured prior to shipping and was less than 2.0 SU. A duplicate sample was taken and shipped without preservative for copper analysis using co-precipitation.

Sample containers were wrapped in bubble-wrap, placed in zip-lock bags, and packed on ice for shipment to the laboratory. Sample chain of custody forms were completed, sealed into zip-lock bags, and taped inside the lid of the ice chest. Samples were shipped to the laboratory via DHL. Samples that were composited on 4 September, were received at Analytical Resources, Incorporated (ARI) on 8 September 1997.

Results

Laboratory data sets, laboratory quality control data reports, and chain-of-custody form are attached to this memorandum. The chain-of-custody form is included as Attachment I and the laboratory analytical data sheets and quality control data reports are included as Attachment II. Table 1 indicates the detection limits requested from the analytical laboratory along with those achieved during the analysis. The laboratory indicated, prior to sample analysis, that the requested detection limits could be achieved.

Semivolatile organics were all at the non-detect level with the exception of phenol, 4-methylphenol, benzoic acid. Phenol and 4-methylphenol are compared with past sample results in Table 3. Benzoic acid was detected at 34 µg/l at a dilution of 1:3 but was non-detect at a dilution duplicate of 1:15.

Requested detection limits were achieved for the inorganics. To achieve the requested detection limits, arsenic, lead, selenium, and silver were analyzed using method EPA 200.9. ARI employed a modification for the method EPA 200.9 for the graphite furnace atomic absorption (GFAA) analysis. ARI's sample preparation for GFAA determination uses only nitric acid

rather than the mixed usage of hydrochloric and nitric acids as stipulated in EPA Method 200.9. ARI uses the EPA CLP criteria of 90 to 110% for recovery of the Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) standards rather than the EPA Method 200.9 criteria of 95 to 105%. Copper was analyzed using method EPA 200.7, following extraction by co-precipitation.

The metals duplicate QC sample that was prepared for the inductively coupled plasma atomic absorption (ICP) analysis for copper was dropped and broken in the laboratory. No additional sample volume remained to re-prepare the duplicate therefore the metals duplicate QC samples results are not included in Attachment II.

The inorganics analyses detected four chemical parameters in the effluent from StarKist Samoa. Arsenic, copper, selenium, and zinc were detected at comparable levels with those previously reported. Table 3 summarizes the sample results for these three substances detected for the September 1997 effluent sample analysis compared to those detected during previous analyses. Copper was detected at 4 μg/l and selenium was detected at 10 μg/l which is equal to the reporting limit. Cadmium and silver were not detected in the September 1997 sampling.

Table 1
Effluent Sample Analyses and Handling Procedures
at StarKist Samoa, 03 - 04 September 1997

Chemical Parameter	Analytical Method Requested	Detection Limits, µg/l		Sample Holding Time	Sample Container	Sample Preservation
		Requested	Achieved			
Semivolatile Organics	EPA 625	10-50	3-15	7 days	1 liter amber glass	4 °C
Phenols	EPA 420.1	10	40		500 ml plastic	4 °C 5 ml H_2SO_4[1]
Inorganics [2]						
Arsenic	EPA 206.2	5	5[3]	6 months	500 ml plastic	4 °C, 5 ml 2N HNO_3 [1]
Cadmium	EPA 200.7	5	4	"	"	"
Chromium	EPA 200.7	10	10	"	"	"
Copper	EPA 220.2	2	4[4]	"	"	"
Lead	EPA 239.2	5	5[3]	"	"	"
Mercury	EPA 245.1	0.4	0.2	"	"	"
Selenium	EPA 270.1	5	10[3]	"	"	"
Silver	EPA 272.2	2	1[3]	"	"	"
Zinc	EPA 200.7	20	8	"	"	"

[1] Additional HNO_3 and H_2SO_4 was added to the sample as necessary to bring pH equal to or less than 2 at the time of composting the sample.
[2] All Inorganics were from one 500 ml plastic sample container, preserved with 5 ml 2N HNO_3, with pH of filled sample bottle measured at 1.65. An un-preserved duplicate sample was taken for Copper analysis using co-precipitation.
[3] Modified method EPA 200.9 used to achieve this detection limit (see text for description).
[4] Method EPA 200.7 used to achieve this detection limit following extraction by co-precipitation.

Table 2
Effluent Chemistry 24-hour Composite Sample Collection at StarKist Samoa, 03 - 04 September 1997

Grab Sample Number	Sampling Time	Sampling Date	Effluent Flow Rate (mgd)[1]	Percent of Total Flow	Volume of Sample (ml)	
					1 liter	500 ml
1	0915	09/03/97	1.62	12.2	122	61
2	1218	09/03/97	1.50	11.3	113	56.5
3	1516	09/03/97	1.50	11.3	113	56.5
4	1805	09/03/97	1.74	13.0	130	65
5	2118	09/03/97	1.98	14.8	148	74
6	0010	09/04/97	1.74	13.0	130	65
7	0316	09/04/97	1.62	12.2	122	61
8	0610	09/04/97	1.62	12.2	122	61
TOTALS			13.32	100	1000	500

[1] Mean Effluent Flow Rate = 1.66 mgd.

Table 3
Summary of StarKist Samoa Effluent Chemistry Sample Results
03 - 04 September 1997

Substance	Previous Sample Results, µg/L (ppb)									September 1997 Sample Results, µg/L (ppb)
	February 1993	October 1993 [1]	February 1994	October 1994	March 1995	February 1996	March 1996	November 1996	March 1997	
Inorganics										
Arsenic	6.0	ND (14)	ND	9	ND [2]	ND	ND [3]	10	15	12
Cadmium	ND	ND	10	ND	ND	ND	ND	ND	ND	ND
Copper	ND	(ND)	15	ND	6	13	ND [4]	5	4.7	4
Selenium	ND	ND	ND [5]	ND [5]	ND [5]	ND [6]	ND [6]	15	ND	10
Silver	130	33 (39)	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	92	130 (180)	140	84	120	63	81	117	150	154
Semivolatile Organics										
Phenol	500	430	45	140	32	32	320	500	270	630
4-Methylphenol	260	530	360	290	310	130	370	490	310	240
Total Recoverable Phenols	NA	1300	120	15	34	72	510	440	290	140

ND = Not Detected NA = Not Analyzed

[1] Values in parentheses are results of reanalyzed samples (see Technical Memorandum for October 1993 sampling episode).

[2] Detection limit raised to 50 µg/l because of matrix interference.

[3] Detection limit raised to 400 µg/l because of matrix interference, with the resultant concentration <400 µg/l each time.

[4] Detection limit raised to 25 µg/l because of matrix interference, with the resultant concentration <25 µg/l.

[5] Detection limit raised to 50 µg/l because of matrix interference, with the resultant concentration <50 µg/l each time.

[6] Detection limit raised to 200 µg/l because of matrix interference, with the resultant concentration <200 µg/l.

ATTACHMENT I

CHAIN-OF-CUSTODY FORMS

StarKist Samoa, Inc. Effluent Sample

03 - 04 September 1997

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: 107091 EL 97

Purchase Order #:

Project Name: STARKIST SAMOA NPDES

Company Name/CH2M HILL Office:

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] STEVE COSTA 707-826-0717

Report Copy to: SAME

Requested Completion Date:

Sampling Requirements: SDWA [ ] NPDES [X] RCRA [ ] OTHER ____

Sample Disposal: Dispose [ ] Return [ ]

LAB TEST CODES

SHADED AREA-- FOR LAB USE ONLY: Lab 1 # / Lab 2 # / Quote # / Kit Request # / Project # / No. of Samples / Page of / Login / LIMS Ver

ANALYSES REQUESTED

Sampling Date (97)	Time	Type: COMP	Type: GRAB	Matrix: WATER	Matrix: SOIL	Matrix: AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	ARSENIC (206.2) (OR 200.9)	CADMIUM (200.7)	CHROMIUM (200.7)	*COPPER (220.2)	LEAD (239.2) (OR 200.9)	MERCURY (245.1)	SELENIUM (270.1) (OR 200.9)	SILVER (272.2) (or 200.9)	ZINC (200.7)	TOTAL PHENOLS (420.1)	SEMI VOLITILES (625)	REMARKS	LAB 1 ID	LAB 2 ID
9/4		X		X			SKS-10MT	2	X	X	X	X	X	X	X	X	X			1 preserved HNO3 1 unpreserved		
↓		↓		↓			SKS-10SV	1											X			
↓		↓		↓			SKS-10PH	1										X				
							REQUESTED DETECTION LIMITS µg/l		5	5	10	2	5	0.4	5	2	20	10	10-50			

Sampled By & Title (Please sign and print name): Date/Time 9/3-9/4

Relinquished By (Please sign and print name): [signature] Date/Time 9/5

Received By (Please sign and print name): [signature] DERRICK BURGE Date/Time 9/3/97 1700

Relinquished By (Please sign and print name): Date/Time

Received By (Please sign and print name): Date/Time

Relinquished By (Please sign and print name): Date/Time

Received By (Please sign and print name): Date/Time

Shipped Via: UPS BUS Fed-Ex Hand Other DHL

Shipping #:

Work Authorized By (Please sign and print name)

Remarks: *COPPER DL @ 2µg/l using coprecipitation if required - unpreserved sample provided / SAMPLES ARE APPROX 40-50% SEAWATER

QC Level: 1 2 3 Other: ____

COC Rec | ICE
Ana Req | TEMP
Cust Seal | Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB; Yellow - LAB; Pink - Client

ATTACHMENT II

LABORATORY DATA REPORT
Analytical Resources, Inc.

StarKist Samoa, Inc. Effluent Sample

03 - 04 September 1997

ANALYTICAL
RESOURCES
INCORPORATED

Final Report
Laboratory Analysis of Conventional Parameters

Sample No: SKS-10

Lab Sample ID: T696B
LIMS ID: 97-15761
Matrix: Water

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

Analyte	Analysis Date & Batch	Method	RL	Units	Result
Phenol	09/15/97 091597#1	EPA 420.1	0.04	mg/L	0.14

RL Analytical reporting limit
U Undetected at reported detection limit

Report for T696 received 09/08/97

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Method Blank Analysis

QC Report No: T696-Ch2MHill
Matrix: Water
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: NA

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

METHOD BLANK RESULTS
CONVENTIONALS

Analysis Date & Batch	Constituent	Units	Result	
09/15/97 091597#1	Phenol	mg/L	< 0.04	U

ANALYTICAL
RESOURCES
INCORPORATE

QA Report - Laboratory Control Samples

QC Report No: T696-Ch2MHill
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: NA

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

LABORATORY CONTROL SAMPLES
CONVENTIONALS

Constituent	Units	Measured Value	True Value	Recovery
Laboratory Control Sample				
Phenol	mg/L	0.11	0.12	91.7%

Date analyzed: 09/15/97 Batch ID: 091597#1

ANALYTICAL
RESOURCES
INCORPORATED

QA Report - Replicate Analysis

QC Report No: T696-Ch2MHill
Matrix: Water
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: 09/08/97

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

DUPLICATE ANALYSIS RESULTS
CONVENTIONALS

Constituent	Units	Sample Value	Duplicate Value	RPD
ARI ID: 97-15760, T696 A	**Client Sample ID: VCS-10**			
Phenol	mg/L	0.07	0.08	RPD: 13.3%

ANALYTICAL
RESOURCES
INCORPORATE

QA Report - Matrix Spike/Matrix Spike Duplicate Analysis

QC Report No: T696-Ch2MHill
Matrix: Water
Project: VCS Samoa Packing NPDES
107091 EL 97
Date Received: 09/08/97

Data Release Authorized:
Reported: 09/25/97 Dr. M.A. Perkins

MATRIX SPIKE QA/QC REPORT
CONVENTIONALS

Constituent	Units	Sample Value	Spike Value	Spike Added	Recovery
ARI ID: 97-15761, T696 B	**Client Sample ID: SKS-10**				
Phenol	mg/L	0.14	0.49	0.40	87.5%

MS/MSD Recovery Limits: 75 - 125 %

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: SKS-10

Lab Sample ID: T696B
LIMS ID: 97-15761
Matrix: Water
Data Release Authorized: TM
Reported: 10/17/97

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES 107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Date extracted: 09/10/97
Date analyzed: 09/15/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:3

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	15 U
84-66-2	Diethylphthalate	3.0 U
7005-72-3	4-Chlorophenyl-phenylether	3.0 U
86-73-7	Fluorene	3.0 U
100-01-6	4-Nitroaniline	15 U
534-52-1	4,6-Dinitro-2-Methylphenol	30 U
86-30-6	N-Nitrosodiphenylamine	3.0 U
101-55-3	4-Bromophenyl-phenylether	3.0 U
118-74-1	Hexachlorobenzene	3.0 U
87-86-5	Pentachlorophenol	15 U
85-01-8	Phenanthrene	3.0 U
86-74-8	Carbazole	3.0 U
120-12-7	Anthracene	3.0 U
84-74-2	Di-n-Butylphthalate	3.0 U
206-44-0	Fluoranthene	3.0 U
129-00-0	Pyrene	3.0 U
85-68-7	Butylbenzylphthalate	3.0 U
91-94-1	3,3'-Dichlorobenzidine	15 U
56-55-3	Benzo(a)anthracene	3.0 U
117-81-7	bis(2-Ethylhexyl)phthalate	3.0 U
218-01-9	Chrysene	3.0 U
117-84-0	Di-n-Octyl phthalate	3.0 U
205-99-2	Benzo(b)fluoranthene	3.0 U
207-08-9	Benzo(k)fluoranthene	3.0 U
50-32-8	Benzo(a)pyrene	3.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	3.0 U
53-70-3	Dibenz(a,h)anthracene	3.0 U
191-24-2	Benzo(g,h,i)perylene	3.0 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	74.5%	d5-Phenol	89.1%
2-Fluorobiphenyl	70.2%	2-Fluorophenol	95.4%
d14-p-Terphenyl	74.6%	2,4,6-Tribromophenol	101%
d4-1,2-Dichlorobenzene	62.2%	d4-2-Chlorophenol	82.6%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: **SKS-10**
DILUTION

Lab Sample ID: T696B-DL
LIMS ID: 97-15761
Matrix: Water
Data Release Authorized:
Reported: 10/17/97

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Date extracted: 09/10/97
Date analyzed: 09/16/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:15

CAS Number	Analyte	ug/L
108-95-2	**Phenol**	**580**
111-44-4	Bis-(2-Chloroethyl) Ether	30 U
95-57-8	2-Chlorophenol	15 U
541-73-1	1,3-Dichlorobenzene	15 U
106-46-7	1,4-Dichlorobenzene	15 U
100-51-6	Benzyl Alcohol	75 U
95-50-1	1,2-Dichlorobenzene	15 U
95-48-7	2-Methylphenol	30 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	15 U
106-44-5	**4-Methylphenol**	**220**
621-64-7	N-Nitroso-Di-N-Propylamine	30 U
67-72-1	Hexachloroethane	30 U
98-95-3	Nitrobenzene	15 U
78-59-1	Isophorone	15 U
88-75-5	2-Nitrophenol	75 U
105-67-9	2,4-Dimethylphenol	45 U
65-85-0	Benzoic Acid	150 U
111-91-1	bis(2-Chloroethoxy) Methane	15 U
120-83-2	2,4-Dichlorophenol	45 U
120-82-1	1,2,4-Trichlorobenzene	15 U
91-20-3	Naphthalene	15 U
106-47-8	4-Chloroaniline	45 U
87-68-3	Hexachlorobutadiene	30 U
59-50-7	4-Chloro-3-methylphenol	30 U
91-57-6	2-Methylnaphthalene	15 U
77-47-4	Hexachlorocyclopentadiene	75 U
88-06-2	2,4,6-Trichlorophenol	75 U
95-95-4	2,4,5-Trichlorophenol	75 U
91-58-7	2-Chloronaphthalene	15 U
88-74-4	2-Nitroaniline	75 U
131-11-3	Dimethylphthalate	15 U
208-96-8	Acenaphthylene	15 U
99-09-2	3-Nitroaniline	90 U
83-32-9	Acenaphthene	15 U
51-28-5	2,4-Dinitrophenol	150 U
100-02-7	4-Nitrophenol	75 U
132-64-9	Dibenzofuran	15 U
606-20-2	2,6-Dinitrotoluene	75 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: **SKS-10**
DILUTION

Lab Sample ID: T696B-DL
LIMS ID: 97-15761
Matrix: Water
Data Release Authorized:
Reported: 10/17/97

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Date extracted: 09/10/97
Date analyzed: 09/16/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:15

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	75 U
84-66-2	Diethylphthalate	15 U
7005-72-3	4-Chlorophenyl-phenylether	15 U
86-73-7	Fluorene	15 U
100-01-6	4-Nitroaniline	75 U
534-52-1	4,6-Dinitro-2-Methylphenol	150 U
86-30-6	N-Nitrosodiphenylamine	15 U
101-55-3	4-Bromophenyl-phenylether	15 U
118-74-1	Hexachlorobenzene	15 U
87-86-5	Pentachlorophenol	75 U
85-01-8	Phenanthrene	15 U
86-74-8	Carbazole	15 U
120-12-7	Anthracene	15 U
84-74-2	Di-n-Butylphthalate	15 U
206-44-0	Fluoranthene	15 U
129-00-0	Pyrene	15 U
85-68-7	Butylbenzylphthalate	15 U
91-94-1	3,3'-Dichlorobenzidine	75 U
56-55-3	Benzo(a)anthracene	15 U
117-81-7	bis(2-Ethylhexyl)phthalate	15 U
218-01-9	Chrysene	15 U
117-84-0	Di-n-Octyl phthalate	15 U
205-99-2	Benzo(b)fluoranthene	15 U
207-08-9	Benzo(k)fluoranthene	15 U
50-32-8	Benzo(a)pyrene	15 U
193-39-5	Indeno(1,2,3-cd)pyrene	15 U
53-70-3	Dibenz(a,h)anthracene	15 U
191-24-2	Benzo(g,h,i)perylene	15 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	76.2%	d5-Phenol	85.6%
2-Fluorobiphenyl	72.0%	2-Fluorophenol	87.6%
d14-p-Terphenyl	70.2%	2,4,6-Tribromophenol	79.2%
d4-1,2-Dichlorobenzene	63.6%	d4-2-Chlorophenol	80.0%

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: Method Blank

Lab Sample ID: T696MB
LIMS ID: 97-15760
Matrix: Water
Data Release Authorized:
Reported: 10/17/97

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES 107091 EL 97
Date Sampled: NA
Date Received: NA

Date extracted: 09/10/97
Date analyzed: 09/15/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
108-95-2	Phenol	2.0 U
111-44-4	Bis-(2-Chloroethyl) Ether	2.0 U
95-57-8	2-Chlorophenol	1.0 U
541-73-1	1,3-Dichlorobenzene	1.0 U
106-46-7	1,4-Dichlorobenzene	1.0 U
100-51-6	Benzyl Alcohol	5.0 U
95-50-1	1,2-Dichlorobenzene	1.0 U
95-48-7	2-Methylphenol	2.0 U
108-60-1	2,2'-Oxybis(1-Chloropropane)	1.0 U
106-44-5	4-Methylphenol	1.0 U
621-64-7	N-Nitroso-Di-N-Propylamine	2.0 U
67-72-1	Hexachloroethane	2.0 U
98-95-3	Nitrobenzene	1.0 U
78-59-1	Isophorone	1.0 U
88-75-5	2-Nitrophenol	5.0 U
105-67-9	2,4-Dimethylphenol	3.0 U
65-85-0	Benzoic Acid	10 U
111-91-1	bis(2-Chloroethoxy) Methane	1.0 U
120-83-2	2,4-Dichlorophenol	3.0 U
120-82-1	1,2,4-Trichlorobenzene	1.0 U
91-20-3	Naphthalene	1.0 U
106-47-8	4-Chloroaniline	3.0 U
87-68-3	Hexachlorobutadiene	2.0 U
59-50-7	4-Chloro-3-methylphenol	2.0 U
91-57-6	2-Methylnaphthalene	1.0 U
77-47-4	Hexachlorocyclopentadiene	5.0 U
88-06-2	2,4,6-Trichlorophenol	5.0 U
95-95-4	2,4,5-Trichlorophenol	5.0 U
91-58-7	2-Chloronaphthalene	1.0 U
88-74-4	2-Nitroaniline	5.0 U
131-11-3	Dimethylphthalate	1.0 U
208-96-8	Acenaphthylene	1.0 U
99-09-2	3-Nitroaniline	6.0 U
83-32-9	Acenaphthene	1.0 U
51-28-5	2,4-Dinitrophenol	10 U
100-02-7	4-Nitrophenol	5.0 U
132-64-9	Dibenzofuran	1.0 U
606-20-2	2,6-Dinitrotoluene	5.0 U

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625/CLP

Sample No: Method Blank

Lab Sample ID: T696MB
LIMS ID: 97-15760
Matrix: Water
Data Release Authorized: PM
Reported: 10/17/97

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES 107091 EL 97
Date Sampled: NA
Date Received: NA

Date extracted: 09/10/97
Date analyzed: 09/15/97
Instrument: nt1

Sample Amount: 500 mL
Final Extract Volume: 0.5 mL
Dilution Factor: 1:1

CAS Number	Analyte	ug/L
121-14-2	2,4-Dinitrotoluene	5.0 U
84-66-2	Diethylphthalate	1.0 U
7005-72-3	4-Chlorophenyl-phenylether	1.0 U
86-73-7	Fluorene	1.0 U
100-01-6	4-Nitroaniline	5.0 U
534-52-1	4,6-Dinitro-2-Methylphenol	10 U
86-30-6	N-Nitrosodiphenylamine	1.0 U
101-55-3	4-Bromophenyl-phenylether	1.0 U
118-74-1	Hexachlorobenzene	1.0 U
87-86-5	Pentachlorophenol	5.0 U
85-01-8	Phenanthrene	1.0 U
86-74-8	Carbazole	1.0 U
120-12-7	Anthracene	1.0 U
84-74-2	Di-n-Butylphthalate	1.0 U
206-44-0	Fluoranthene	1.0 U
129-00-0	Pyrene	1.0 U
85-68-7	**Butylbenzylphthalate**	**1.0**
91-94-1	3,3'-Dichlorobenzidine	5.0 U
56-55-3	Benzo(a)anthracene	1.0 U
117-81-7	**bis(2-Ethylhexyl)phthalate**	**6.4**
218-01-9	Chrysene	1.0 U
117-84-0	Di-n-Octyl phthalate	1.0 U
205-99-2	Benzo(b)fluoranthene	1.0 U
207-08-9	Benzo(k)fluoranthene	1.0 U
50-32-8	Benzo(a)pyrene	1.0 U
193-39-5	Indeno(1,2,3-cd)pyrene	1.0 U
53-70-3	Dibenz(a,h)anthracene	1.0 U
191-24-2	Benzo(g,h,i)perylene	1.0 U

Semivolatiles Surrogate Recovery

d5-Nitrobenzene	73.9%	d5-Phenol	70.7%
2-Fluorobiphenyl	65.1%	2-Fluorophenol	75.3%
d14-p-Terphenyl	100%	2,4,6-Tribromophenol	75.7%
d4-1,2-Dichlorobenzene	56.6%	d4-2-Chlorophenol	74.2%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
Semivolatiles by EPA 625
Page 1 of 1

Lab Sample ID: T696LCS
LIMS ID: 97-15760
Matrix: Water

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES
107091 EL 97

Data Release Authorized: PM
Reported: 10/17/97

LCS/LCS DUPLICATE RECOVERY
Date extracted: 09/10/97
Date analyzed: 09/15/97

	SPIKE VALUE	SPIKE ADDED	% RECOVERY	RPD
Phenol	33.8	37.5	90.1%	
2-Chlorophenol	34.2	37.5	91.2%	
1,4-Dichlorobenzene	17.0	25.0	68.0%	
N-Nitroso-Di-N-Propylamine	17.3	25.0	69.2%	
1,2,4-Trichlorobenzene	17.3	25.0	69.2%	
4-Chloro-3-methylphenol	31.6	37.5	84.3%	
Acenaphthene	18.6	25.0	74.4%	
4-Nitrophenol	31.8	37.5	84.8%	
2,4-Dinitrotoluene	22.5	25.0	90.0%	
Pentachlorophenol	35.1	37.5	93.6%	
Pyrene	24.4	25.0	97.6%	
LCS DUPLICATE				
Phenol	27.9	37.5	74.4%	19.0%
2-Chlorophenol	29.3	37.5	78.1%	15.0%
1,4-Dichlorobenzene	12.3	25.0	49.2%	32.0%
N-Nitroso-Di-N-Propylamine	14.7	25.0	58.8%	16.0%
1,2,4-Trichlorobenzene	12.9	25.0	51.6%	29.0%
4-Chloro-3-methylphenol	30.6	37.5	81.6%	3.2%
Acenaphthene	15.7	25.0	62.8%	17.0%
4-Nitrophenol	37.1	37.5	98.9%	15.0%
2,4-Dinitrotoluene	22.2	25.0	88.8%	1.3%
Pentachlorophenol	35.8	37.5	95.5%	2.0%
Pyrene	21.5	25.0	86.0%	13.0%

Lab Control Surrogate Recoveries

d5-Nitrobenzene	81.0%	d5-Phenol	80.6%
2-Fluorobiphenyl	71.6%	2-Fluorophenol	80.5%
d14-p-Terphenyl	90.1%	2,4,6-Tribromophenol	73.0%
d4-1,2-Dichlorobenzene	61.5%	d4-2-Chlorophenol	81.5%

LCSDuplicate Surrogate Recoveries

d5-Nitrobenzene	67.6%	d5-Phenol	69.2%
2-Fluorobiphenyl	58.9%	2-Fluorophenol	68.9%
d14-p-Terphenyl	84.3%	2,4,6-Tribromophenol	72.4%
d4-1,2-Dichlorobenzene	52.1%	d4-2-Chlorophenol	69.0%

Reported in Total ug/L

FORM-III

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: SKS-10**
TOTAL METALS

Lab Sample ID: T696B
LIMS ID: 97-15761
Matrix: Water

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES
107091 EL 97
Date Sampled: 09/04/97
Date Received: 09/08/97

Data Release Authorized:
Reported: 10/17/97

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
206.2	09/22/97	206.2	09/23/97	**7440-38-2**	**Arsenic**	0.005	**0.012**
200.7	09/22/97	200.7	09/24/97	7440-43-9	Cadmium	0.004	0.004 U
200.7	09/22/97	200.7	09/24/97	7440-47-3	Chromium	0.01	0.01 U
200.7	09/22/97	200.7	09/24/97	**7440-50-8**	**Copper**	0.004	**0.004**
239.2	09/22/97	239.2	09/23/97	7439-92-1	Lead	0.005	0.005 U
245.1	09/23/97	245.1	09/23/97	7439-97-6	Mercury	0.0002	0.0002 U
270.2	09/22/97	270.2	09/24/97	**7782-49-2**	**Selenium**	0.01	**0.01**
272.2	09/22/97	272.2	09/30/97	7440-22-4	Silver	0.001	0.001 U
200.7	09/22/97	200.7	09/24/97	**7440-66-6**	**Zinc**	0.008	**0.154**

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET **Sample No: Method Blank**
TOTAL METALS

Lab Sample ID: T696MB
LIMS ID: 97-15761
Matrix: Water

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES
107091 EL 97
Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 10/17/97

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	RL	mg/L
206.2	09/22/97	206.2	09/23/97	7440-38-2	Arsenic	0.001	0.001 U
200.7	09/22/97	200.7	09/24/97	7440-43-9	Cadmium	0.002	0.002 U
200.7	09/22/97	200.7	09/24/97	7440-47-3	Chromium	0.005	0.005 U
200.7	09/22/97	200.7	09/24/97	7440-50-8	Copper	0.002	0.002 U
239.2	09/22/97	239.2	09/23/97	7439-92-1	Lead	0.001	0.001 U
245.1	09/23/97	245.1	09/23/97	7439-97-6	Mercury	0.0001	0.0001 U
270.2	09/22/97	270.2	09/24/97	7782-49-2	Selenium	0.001	0.001 U
272.2	09/22/97	272.2	09/23/97	7440-22-4	Silver	0.0002	0.0002 U
200.7	09/22/97	200.7	09/24/97	7440-66-6	Zinc	0.004	0.004 U

U Analyte undetected at given RL

RL Reporting Limit

FORM-I

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET

Sample No: **STD REFERENCE**
I.V. Lots 889-1 and 869-6

Lab Sample ID: T696LCS
LIMS ID: 97-15761
Matrix: Water

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES
107091 EL 97
Date Sampled: NA
Date Received: NA

Data Release Authorized:
Reported: 10/17/97

Analyte	STD Value	Value Found	Recovery
Arsenic	0.100	0.104	104%
Cadmium	1.00	0.928	92.8%
Chromium	1.00	0.958	95.8%
Copper	1.00	0.961	96.1%
Lead	0.100	0.108	108%
Selenium	0.100	0.103	103%
Silver	0.020	0.020	100%
Zinc	1.00	0.944	94.4%

Recovery Limits 80-120

Values reported in parts per million (mg/L)

I.V. Lot 869-6 used for GFA. I.V. Lot 889-1 used for ICP.

FORM-III-R

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Lab Sample ID: T696LCS
LIMS ID: 97-15761
Matrix: Water

QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES
107091 EL 97

Data Release Authorized:
Reported: 10/17/97

BLANK SPIKE QUALITY CONTROL REPORT

Analyte	Spike mg/L	Spike Added	% Recovery	Q
Mercury	0.0020	0.0020	100%	

'Q' codes: N = control limit not met

Control Limits: 80-120%

FORM-VII

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: SKS-10
Lab Sample ID: T696B
QC Report No: T696-Ch2MHill
LIMS ID: 97-15761
Project: SKS Samoa Packing NPDES
Matrix: Water
107091 EL 97
Date Received: 09/08/97

Data Release Authorized:
Reported: 10/17/97

MATRIX SPIKE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Spike mg/L	Spike Added	% Recovery	Q
Arsenic	0.012	0.044	0.040	80.0%	
Cadmium	0.004 U	0.047	0.050	94.0%	
Chromium	0.01 U	0.17	0.20	85.0%	
Copper	0.004	0.239	0.250	94.0%	
Lead	0.005 U	0.017	0.020	85.0%	
Mercury	0.0002 U	0.0017	0.0020	85.0%	
Selenium	0.01	0.02	0.01	100%	
Silver	0.001 U	0.017	0.020	85.0%	
Zinc	0.154	0.612	0.500	91.6%	

'Q' codes:
N = control limit not met
H = %R not applicable, sample concentration too high
* = RPD control limit not met
NA = Not applicable - analyte not spiked

Control Limits:
Percent Recovery: 75-125%
RPD: +/-20%

FORM-V

ANALYTICAL
RESOURCES
INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS

Sample No: SKS-10
QC Report No: T696-Ch2MHill
Project: SKS Samoa Packing NPDES
107091 EL 97
Date Received: 09/08/97

Lab Sample ID: T696B
LIMS ID: 97-15761
Matrix: Water

Data Release Authorized:
Reported: 10/17/97

MATRIX DUPLICATE QUALITY CONTROL REPORT

Analyte	Sample mg/L	Duplicate mg/L	RPD	Control Limit	Q
Arsenic	0.012	0.011	8.7%	+/- 0.005	L
Lead	0.005 U	0.005 U	0.0%	+/- 0.005	L
Mercury	0.0002 U	0.0002 U	0.0%	+/- 0.0002	L
Selenium	0.01	0.01 U	0.0%	+/- 0.01	L
Silver	0.0010 U	0.0010 U	0.0%	+/- 0.0010	L

'Q' codes: * = control limit not met
L = RPD not valid, alternate limit = detection limit

FORM-VI

Steve Costa

To: Carl Goldstein
Subject: COS Samoa Packing Ocean Dumping Permit

Carl-

Per you request I sent you an email last week concerning the COS Samoa Packing Ocean Dumping monitoring for solids.
For some reason it got kicked back over the weekend. I will try this again and fax it as well. My comments are presented below.

Steve Costa

There are a number of possible reasons for recent increases in concentrations of total solids and total volatile solids in the COS Samoa Packing high strength waste (HSW) to be disposed of by ocean dumping. It should be recognized that there is a large degree of variability in the monitoring records as noted in my letter to Terry Oda, dated 12 February 1998. The standard deviation is nearly the same magnitude as the mean and the actual values vary by more than an order of magnitude for total solids and two orders of magnitude for total volatile solids. Reasons for what appears to be increased solids concentrations in the more recent data may include:

[1] There may be more efficient HSW segregation resulting in less inadvertent diversion of water and low strength waste streams to the HSW on-shore storage tank. There is a continuing effort to minimize the volumes for ocean dumping (balanced against the effort to segregate the wastes) which may result in less total volume with the same, or increased, amounts of solids delivered to the onshore storage tank. This could result in increased concentrations of solids in the HSW.

[2] It is suspected that there is stratification in the onshore storage tank which could be enhanced by the polymers that are used. Monitoring samples are collected only during a limited time during pumping from the tank to the barge. COS recently added an additional mixer to the tank. These factors could combine with other factors, such as frequency and volume of individual disposal episodes, to result in an apparent change in solids concentrations in the samples. The grab sample results are expected to be quite variable under any circumstances and recent changes in the process may exacerbate this.

[3] Changes in production or changes in the size of the fish being processed, or both, may change the nature of the HSW. It is noted that larger fish were being processed at about the time of increased solids concentration. This also resulted in increased production tonnage.

Please call or have Terry call with any questions or comments,

Thanks for your time and attention to this matter,

Steven L. Costa

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