PREPARED FOR: StarKist Samoa, Inc
VCS Samoa Packing Company

PREPARED BY: David Wilson/CH2M HILL/SEA
Steve Costa/CH2M HILL/SFO

DATE: 29 April 1993

SUBJECT: **Sediment Monitoring Study**
February 1993 Data Collection

PROJECT: PDX30702.SM.R1

Introduction

This memorandum presents the field collection and laboratory analysis of marine sediments collected in the inner and outer regions of Pago Pago Harbor. This is the first sediment monitoring episode and provides a baseline for comparison with future measurements. This work has been conducted to comply with Section G of the StarKist Samoa and Samoa Packing NPDES permits, which state the following:

> "Sediment monitoring is conducted to determine the character of the sediments in relation to long-term high nutrient discharge by the permittee in the harbor and if harbor recovery will be affected by resuspension of the nutrients.
>
> The permittee, cooperatively with (Samoa Packing Co.; StarKist, Inc) shall undertake a yearly sediment monitoring program in Pago Pago Harbor in order to assess the concentration of nutrient and organic components, the distribution of stored nutrients, the size of the nutrient reservoir, and the rate of accumulation of nutrients. Seven sites shall be located within Pago Pago Harbor and analyzed for total nitrogen, total phosphorus, percent organics, percent solids, bulk density, oxidation-reduction potential, and sulfides. Three sites shall be located in inner Pago Pago Harbor and four sites shall be located in the outer harbor. These sites and monitoring plan shall be submitted within three months of the effective date of the permit for approval by ASEPA and EPA. Thereafter, these sites shall be approved annually by the anniversary date of the effective date of the permit. A report of the sediment monitoring program findings shall be submitted to the ASEPA and EPA 90 days after completion of sampling.
>
> After the first two studies have been performed and the results have been assessed, the permit may be reopened for the inclusion of a more frequent or less frequent monitoring schedule."

A Sediment Monitoring Study Plan was submitted for review and approval to the EPA and ASEPA on January 6, 1993. During the development and review of the Sediment Monitoring Study Plan, specific changes or clarification of the sediment analyses were agreed to with the EPA and ASEPA. Particle size analysis replaced bulk density, and the percent organics in sediments is to be provided by total volatile solids analysis. In addition, the location of one sediment sampling site (IH-3) was changed, at the request of ASEPA, and the revised location was near the mouth of Pago Pago Stream. The changes have all been incorporated into the final study plan for the initial sediment sampling and analysis.

Objectives and Approach

The objectives of the Sediment Monitoring are: (1) to evaluate the characteristics and nutrient load of the marine sediments in the vicinity of the canneries historic (abandoned) outfalls in the inner harbor; (2) to evaluate the characteristics and nutrient load of the marine sediments in the vicinity of the new joint cannery outfall diffuser into the outer harbor; and (3) to provide data for an evaluation of changes in harbor sediments over time. The sediment data presented in this document are the first data set for the Sediment Monitoring Study, and subsequent sample collections and analyses will provide data for the assessment of changes over time, as well as changes between sites within Pago Pago Harbor.

Sampling sites were located based on the predominant current directions at the outfall areas, bathymetry of the area, limited information on sediment physical characteristics, and the location of other point sources. Sediment samples were collected at the following seven sites (Figure 1) in February 1993, in accordance with the approved study plan:

- Inner harbor site IH-1: located within 100 feet of, and between, the two previous cannery outfalls in the inner harbor

- Inner harbor site IH-2: located within 500 feet directly south of, and between, the two previous cannery outfalls in the inner harbor

- Inner harbor site IH-3: located within 250 feet of the mouth of Pago Pago Stream, at the west end of the inner harbor

- Outer harbor site OH-1: located within 400 feet north-northeast of the new outfall diffuser in the outer harbor;

- Outer harbor site OH-2: located within 400 feet south-southwest of the new outfall diffuser

- Outer harbor site OH-3: located directly across the outer harbor from the new outfall diffuser and about 20 feet of the Utulei WWTP outfall

- Outer harbor site OH-4: located in the center of the outer harbor area mid-way between Tulutulu Point and Tafagamanu Point, and north of Whale Rock.

The sampling sites were located using a MiniRanger. This provides a high degree of repeatability for stationing for future sampling episodes. The MiniRanger coordinates for each Station are given in Table 1.

Methods

Sediment sampling was conducted in accordance with the approved Sediment Monitoring Study Plan, and consistent with the Procedures for Handling and Chemical Analysis of Sediment and Water Samples (U.S. EPA and Army COE, 1981).

Sediment samples were collected using a 0.0225 meter^2 petite Ponar grab sampler. The Ponar sampler is a weighted sediment grab sampler designed to penetrate and collect undisturbed samples of sediments ranging from silts to coarse gravels. Samples were collected in five separate grabs at each of the seven sites, except at OH-3. At OH-3, three grab samples were collected by a diver from the seabed within 20 feet of the Utulei outfall discharge port. Sufficient sediment materials were collected for the sediment chemistry tests and to provide archive materials.

Prior to disturbing the sample, the following were recorded in the field logbook; date, time, water depth, sediment sample penetration depth, color, texture/type, odor, depth of visible oxidation-reduction layer, and photograph and film roll number. Photographs were taken of each sediment sample. The Orion Redox Potential and pH meter was damaged during shipment, and oxidation-reduction potential measurements could not be taken. However, visual observations of the depth to anoxic sediments were made which partially compensate for the lack of direct measurements.

The surface 2 cm depth layer of each grab sample was composited into a stainless steel bowl and small (<1-oz.) sample portion of each grab was place directly into a 4-ounce jar for the sulfide analysis. The composite sample was stirred, and an 8-ounce and 16-ounce container were filled from the composite sediment sample using a pre-cleaned

stainless steel spoon. The surface sediments collected by hand by a diver at OH-3 were composited for all tests. Samples collected at each site were labeled with a unique label. All sediment sample containers were sealed into ziplock bags and stored on ice in an ice chest for transport to the laboratory. A total of seven composite sediment samples were submitted for chemical and physical analyses.

Sediment sampling was completed at IH-1, IH-2, IH-3, OH-3, and OH-4 on February 13, 1993. Sediment samples were collected at OH-1 and OH-2 on February 18, 1993, after the outfall diffuser in the outer harbor was located and marked with a buoy. All sediment samples were stored on ice until delivered to the laboratory. Sample chain of custody forms were completed and then sealed into zip-lock bags and taped inside the lid of the ice chest. Samples were shipped as checked luggage on flights from Pago to Honolulu and then to Seattle. Samples were delivered to North Creek Analytical Laboratory before 1200 on February 23rd.

Sediment samples were analyzed for the chemical and physical parameters listed in Table 2. The sample containers, sample handling requirements and sample preservation requirements were in accordance with those listed in Table 2, with the exception that sulfide samples exceeded the recommended holding time. This holding time exceedance is not considered significant, since the sulfide samples were preserved with zinc acetate and held on ice. The sediment sampling and shipping dates were extended in the field, because of unavoidable delays in obtaining field equipment in American Samoa.

Results

Complete laboratory data sets, laboratory quality control data reports, and chain-of-custody forms are attached to this memorandum. The chain-of-custody form is included in Attachment 1 and analytical data sheets and quality control data reports are included as Attachment 2. The physical characteristics and descriptions of the marine sediments collected in Pago Pago Harbor are provided in Table 3, and the results of the chemical analyses are provided in Table 4.

Physical Analysis. The physical characteristics of the sediments near the old cannery outfalls (IH-1) are very similar to those near the mouth of Pago Pago Stream (IH-3) in the inner harbor (Table 3). Sediments at both IH-1 and IH-3 consisted of grey-black sandy-silts with visible oil sheen, a strong sulfurous odor, and essentially no surface oxidized sediment layer. Both of these inner harbor sites had sediments with low densities (26 and 30 percent solids), indicating organic material depositions at these sites. Sediments collected from 500 feet south of the old cannery outfalls (IH-2)

consisted primarily of silts with a thin (1-2 cm) oxidized surface layer, a slight sulfurous odor, and 45 percent solids content.

Sediments collected from the outer harbor all consisted of oxidized sediments with varying mixes of silts and sands. These outer harbor sediments also had a much greater density (e.g. 58 to 69 percent solids). Sediment sampling sites OH-1 and -2 were located near the new canneries outfall and proximate to the coral reef slope on the east side of harbor. OH-3 was located near the Utulei sewage outfall and within 200 feet of the coral reef on the west side of the harbor. OH-4 was located in the middle of the outer harbor. Sediments collected near the joint cannery outfall (at OH-1 and -2) were predominantly tan silts with less than 20 percent sands and they were oxidized throughout the entire sample depth (6 cm). Sediments from the middle of the outer harbor (OH-4) were 56% coral sands and medium sands and 43% silts, and they were oxidized throughout the entire sample depth (6 cm). Sediments collected at the Utulei outfall (OH-3) were much coarser than the middle and eastern regions of the outer harbor, with 90% coral sands and less than 10 percent silts.

Chemical Analysis. Sediment chemical analyses results for the inner and outer harbor sites are summarized in Table 4. The sediment physical data indicates substantial differences between the inner and outer harbor areas, and these difference correlate with the sediment organic content. Sediment organics, as measured by total volatile solids, ranged from 9.3 to 19 percent in the inner harbor sites compared with 3.1 to 5.6 percent in the outer harbor sites. Sediments collected at IH-1 and IH-3 show substantially elevated values of total volatile solids (TVS), total Kjeldahl nitrogen (TKN), total phosphorus (TP), and total sulfide compared to other sites. In comparison, IH-2, located only 500 feet from the previous cannery outfalls and near the center of the inner harbor basin, had TVS, TKN, and total sulfide concentrations that were 50 percent less than at IH-1 and 30 percent less than at IH-3. An oxidized surface sediment layer was also observed at IH-2, indicating that the anoxic sediments may be localized near stream mouths and previous outfalls.

The outer harbor sediments show very little difference in organic contents between the four sites (Table 4), despite the differences in sediment physical characteristics (Table 3). The sediments at OH-1 and -2, located near the new outfall diffuser, consisted primarily of silts and these sites had total volatile solids values of 5.6 and 4.9 percent, respectively. By comparison, the sediments at OH-3 and -4 consisted mainly of sands and these sites had TVS values of 3.1 and 4.2 percent, respectively. TKN and TP values were equivalent at all sites in the outer harbor. Total sulfides concentrations were slightly above the reporting limit for samples from the two near outfall sites, and were not detected at the other two sites. Sediments from these four outer harbor

sampling sites were observed to be completely oxidized throughout the sample depth, with no oxidation-reduction layer.

Summary

The sediments near the old cannery outfalls (IH-1) have similar physical and chemical characteristics to those near the mouth of Pago Pago Stream (IH-3) in the inner harbor. Sediments at IH-1 and IH-3 consist of anoxic, grey-black sandy-silts with oil sheen, a strong sulfurous odor, and elevated levels of volatile organics, nitrogen compounds, phosphorus compounds, and sulfides. Both of these inner harbor sites have sediments that appear to consist of deposited organic materials. The sources of the organic deposits and contaminants at both sites include all activities in the inner harbor and its watershed. Sediments from IH-2, only 500 feet south of the old cannery outfalls were grey-brown silts with an oxidized surface layer. IH-2 samples had 30- to 50-percent lower volatile organics, nitrogen compounds, and sulfides, and 10- to 25-percent lower phosphorus compounds, than the sediment samples at IH-1 and IH-3. The transition into oxidized sediments at IH-2, indicates that the organic sediments appear to occur in a localized area.

Although the outer harbor sediments range from predominantly silts near the new outfall (OH-1 and -2) to mainly sands at the middle and west side sampling sites (OH-3 and -4) in the outer harbor, the data show very little difference in organic contents between the four sites. Sediments from these four outer harbor sampling sites were completely oxidized throughout the sample, and sediment nitrogen and phosphorus levels were equivalent at all sites in the outer harbor.

Table 1
Sampling Locations for Sediments in Pago Pago Harbor

Station	Sampling Location and Depth (feet)	Navigation Coordinates for MiniRanger III System (a,b)	
		Code 1	Code 4
IH-1	Between old cannery outfalls in inner harbor (60 feet)	1420 (N)	581 (N)
IH-2	500 feet South of and between old cannery outfalls in inner harbor (100 ft)	1459 (N)	731 (N)
IH-3	250 feet off mouth of Pago Pago Stream in inner harbor (25 ft)	2992 (N)	1679 (N)
OH-1	400 feet NNE of cannery outfall in outer harbor (160 ft)	1264 (S)	1504 (S)
OH-2	400 feet SSW of cannery outfall in outer harbor (180 ft)	1561 (S)	1725 (S)
OH-3	Within 20 feet of the Utulei outfall discharge (120 ft)	1596 (S)	1265 (S)
OH-4	Outer harbor between Tulutulu and Tafagamanu Pts (180 ft)	2048 (S)	1768 (S)

NOTES:

(a) The shore-based Mini-Ranger transponders were located at survey control points as follows: Code 1 - located at Pago Pago Harbor Front Range Tower (261,551.58E and 309,857.04N, State Coordinates (feet)); Code 4 - located at Fagatogo Tram Park Building (258,117.06E and 305,879.24N, State Coordinates (feet)).

(b) The navigation readings are designated as either north (N) or south (S) of the alignment between the Code 1 and Code 4 shore transponder stations.

(c) Coordinates were acquired at the time of sampling at Stations OH-1 and OH-2. At other stations coordinates were determined by revisiting the sites two days later. This procedure was followed because of delays in receiving equipment.

Table 2
Sediment Sample Analyses and Handling Procedures

Parameter	Analytical Methods (a,b,c)	Reporting Detection Limits	Sample Holding Time	Sample Container	Sample Preservation
Total Kjeldahl Nitrogen	EPA 351.3	1 mg/kg	14 days	8-oz. glass	4 deg. C
Total Phosphorus	EPA 6010	10 mg/kg	14 days	8-oz. glass	4 deg. C
Total Sulfides	EPA/COE 1981	0.12 mg/kg	7 days	4-oz. glass	4 deg. C, add 2 ml. Zn-acetate
Total Volatile Solids	EPA 160.4	0.5%	14 days	8-oz. glass	4 deg. C
Percent Solids	EPA/COE 1981; SM2540/B	N/A	14 days	8-oz. glass	None
Particle Size Analysis	ASTM D422	N/A	6 months	8-oz. glass	None

(a) EPA methods are defined in 40 CFR 136.3, Guidelines Establishing Test Procedures for the Analysis of Pollutants.
(b) U.S. EPA and Army Corps of Engineers. May 1981. Procedures for Handling and Chemical Analysis of Sediment and Water Samples.
(c) American Society for Testing Materials. 1974. Part 19:D422; Standard Method for Particle Size Analysis of Soils.

Table 3
Physical Characteristics of Pago Pago Harbor Sediments

Station	Location and Depth (feet)	Sediment Type	Redox Depth (cm)	Particle Size Distribution (Percent)			Percent Solids
				Sand	Silt	Clay	
INNER HARBOR STATIONS							
IH-1	Between old cannery outfalls in inner harbor (60 feet)	Grey-black sandy silts with visible oil sheen and strong sulfurous odor	<0.5	30	70	0	26
IH-2	500 feet South of and between old cannery outfalls in inner harbor (100 ft)	Grey-brown silts with clay, and with slight odor	1-2	8	86	6	45
IH-3	250 feet off mouth of Pago Pago Stream in inner harbor (25 ft)	Grey-black sandy silts with visible oil sheen and strong sulfurous odor	<0.5	33	67	0	30
OUTER HARBOR STATIONS							
OH-1	400 feet NNE of cannery outfall in outer harbor (160 ft)	Tan, sandy silts with clay and no odor	None	11	83	6	60
OH-2	400 feet SSW of cannery outfall in outer harbor (180 ft)	Tan, sandy silts with some clay and no odor	None	19	79	2	59
OH-3	Within 20 feet of the Utulei outfall discharge (120 ft)	Grey-white coral sands and dark gray medium sands, with no odor	None	90	9	1	58
OH-4	Outer harbor between Tulutulu Pt and Tafagamanu Pt (180 ft)	Tan, mixed coral and medium sands and silts, with no odor	None	56	43	1	69

Table 4
Results of Pago Pago Harbor Sediment Chemical Analyses

Site	Sampling Location (Depth in feet)	Percent Solids	Total Volatile Solids (percent)	Total Kjeldahl Nitrogen (mg/kg, dry)	Total Phosphorus (mg/kg, dry)	Total Sulfide (mg/kg, dry)
INNER HARBOR STATIONS						
IH-1	Between old cannery outfalls in inner harbor (60 feet)	26	19	1,700	1,200	41
IH-2	500 ft S & between old cannery outfalls in inner harbor (100 ft)	45	9.3	770	1,100	22
IH-3	250 feet off mouth of Pago Pago Stream in inner harbor (25 ft)	30	14	1,100	1,500	34
OUTER HARBOR STATIONS						
OH-1	400 feet NNE of cannery outfall in outer harbor (160 ft)	60	5.6	480	600	0.8
OH-2	400 feet SSW of cannery outfall in outer harbor (180 ft)	59	4.9	470	570	0.5
OH-3	Within 20 feet of the Utulei outfall discharge (120 ft)	58	3.1	410	530	<0.1
OH-4	Mid-outer harbor between Tulutulu Pt and Tafagamanu Pt (180 ft)	69	4.2	470	470	<0.1

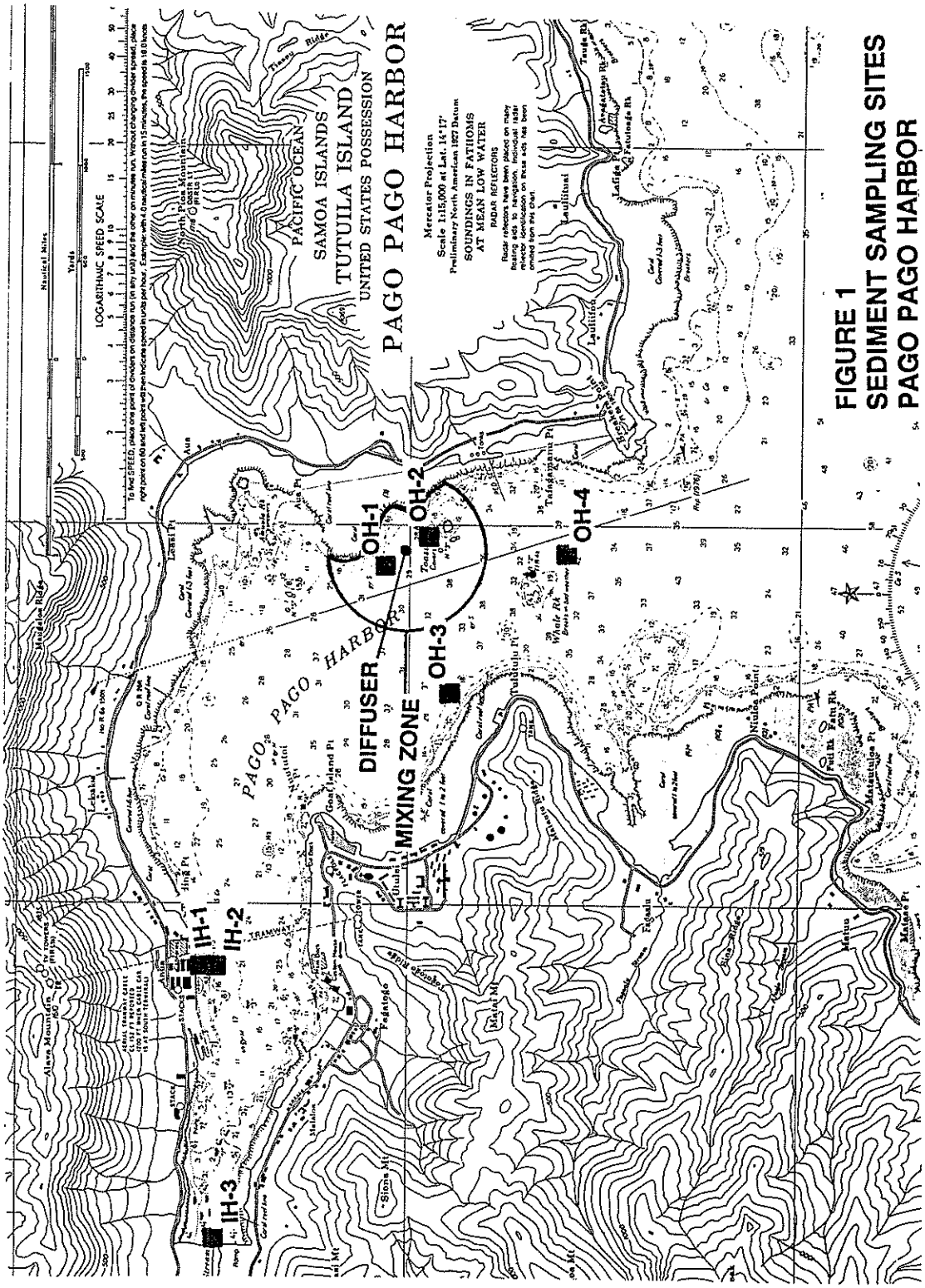

FIGURE 1
SEDIMENT SAMPLING SITES
PAGO PAGO HARBOR

ATTACHMENT I

CHAIN OF CUSTODY FORMS

Marine Sediment Samples from Pago Pago Harbor, American Samoa
February 1993

STARKIST SAMOA, Inc. and VCS SAMOA PACKING COMPANY

QUALITY ANALYTICAL LABORATORIES — **CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES**

CH2M HILL Project #: ☐☐☐☐☐☐☐☐.☐☐.☐☐

Purchase Order #:

Project Name: Starkist/Samoa NPDES

Company Name/CH2M HILL Office: CH2M-Hill SEA

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] David Wilson

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☐ 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 | COC Rev | Login | LIMS Ver | Ack Gen

ANALYSES REQUESTED

'93 Sampling Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Total Nitrogen	Total Phosphorus	Sulfides	Total Volatile Solids	Percent Solids	Partical Size	Extra Volume	REMARKS	LAB 1 ID	LAB 2 ID
2/13	1145	X	X		X	I H - 3	1	X	X		X	X	X	X	8oz Glass	3020769	
↓	↓	X	X		X	I H - 3	1			X					4oz Glass w ZnAc		
↓	↓	X	X		X	I H - 3	1							X	16oz Poly		
2/13	12:20	X	X		X	I H - 1	1	X	X		X	X	X		8oz Glass	3020770	
↓	↓	X	X		X	I H - 1	1			X					4oz Glass w ZnAc		
↓	↓	X	X		X	I H - 1	1							X	16oz Poly		
2/13	1320	X	X		X	I H - 2	1	X	X		X	X	X		8oz Glass	3020771	
↓	↓	X	X		X	I H - 2	1			X					4oz Glass w ZnAc		
↓	↓	X	X		X	I H - 2	1							X	16oz Poly		

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name)	Date/Time
[signature]	2/13/93 1340	[signature]	2/16/93
Received By (Please sign and print name): Dave Lacher DAVE LACHER	Date/Time: 2/23/93 1000	Relinquished By (Please sign and print name): Dave Lacher DAVE LACHER	Date/Time: 2/23/93 11:15
Received By (Please sign and print name): Dana Heinz DANA HEINZ NCA	Date/Time: 2/23/93 11:15	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 ____	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

HAZWRAP/NESSA: Y N

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

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REV 11/92 FORM 340

QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #

Purchase Order #

Project Name: Starkist / Samoa NPDES

Company Name/CH2M HILL Office: CH2M-Hill - SEA

Project Manager & Phone #: Mr. [ ] Ms. [ ] Dr. [ ] David Wilson

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☐ 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 | COC Rev | Login | LIMS Ver | Ack Gen

ANALYSES REQUESTED

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Sulfide	Total Nitrogen	Total Phosphorous	Total Vol. Solids	% Solids	Partial Size	Extra Volume	REMARKS	LAB 1 ID	LAB 2 ID
2/13	1400	X	X		X	O H - 3	1	X							4oz Glass w ZnAc	3020	~~769~~ 772
↓	↓	X	X		X	O H - 3	1		X	X	X	X	X		8oz Glass		
↓	↓	X	X		X	O H - 3	1							X	16oz Poly		
2/13	1440	X			X	O H - 4	1	X							4oz Glass w ZnAc	3020	773
↓	↓	X			X	O H - 4	1		X	X	X	X	X		8oz Glass		
↓	↓	X			X	O H - 4	1							X	16oz Poly		
2/18	1130	X			X	O H - 2	1	X							4oz Glass w ZnAc	3020	774
↓	↓	X			X	O H - 2	1		X	X	X	X	X		8oz Glass		
↓	↓	X			X	O H - 2	1							X	16oz Poly		

Sampled By & Title (Please sign and print name)	Date/Time 2/18/93 1140	Relinquished By (Please sign and print name)	Date/Time 2/20/93
Received By (Please sign and print name) Dave Lacher DAVE LACHER	Date/Time 2/23/93 1000	Relinquished By (Please sign and print name) Dave Lacher DAVE LACHER	Date/Time 2/23/93 11:15
Received By (Please sign and print name) Dana Heinz DANA HEINZ NCA	Date/Time 2/23/93 11:15	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____	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

HAZWRAP/NESSA: Y N

QC Level: 1 2 3 Other: ____

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

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QUALITY ANALYTICAL LABORATORIES

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M HILL Project #: ☐☐☐☐☐☐☐☐.☐☐.☐☐

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Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☐ 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 | COC Rev | Login | LIMS Ver | Ack Gen

ANALYSES REQUESTED

'93 Sampling Date	Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	Sulfides	Total Nitrogen	Total Phosphorus	Total Vol. Solids	% Solids	Particle Size	Total Vol.	REMARKS	LAB 1 ID	LAB 2 ID
2/18	12:30	X		X		O H - 1	1	X							4oz Glass w ZnA	3020	775
↓	↓	X		X		O H - 1	1		X	X	X	X	X		8oz Glass		
↓	↓	X		X		O H - 1	1							X	16oz Poly		

Sampled By & Title (Please sign and print name)	Date/Time 12/18/93 1300	Relinquished By (Please sign and print name)	Date/Time 2/23/93
Received By (Please sign and print name) Dave Lacher DAVE LACHER	Date/Time 2/23/93 1000	Relinquished By (Please sign and print name) Dave Lacher DAVE LACHER	Date/Time 2/23/93 11:10
Received By (Please sign and print name) Dana Heinz DANA HEINZ 2/23/93 NCA 11:15	Date/Time 2/23/93 11:15	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	Shipping #
Work Authorized By (Please sign and print name)	Remarks		

HAZWRAP/NESSA: Y N

QC Level: 1 2 3 Other: ____

COC Rec | ICE

Ana Req | TEMP

Cust Seal | Ph

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REV 11/92 FORM 340

ATTACHMENT II

LABORATORY DATA REPORT
North Creek Analytical Laboratory

Marine Sediment Samples from Pago Pago Harbor, American Samoa
February 1993

STARKIST SAMOA, Inc. and VCS SAMOA PACKING COMPANY

NORTH CREEK ANALYTICAL

18939 120th Avenue N.E., Suite 101 • Bothell, WA 98011-2569
Phone (206) 481-9200 • FAX (206) 485-2992

CH2M Hill	Client Project ID:	Starkist/Samoa NPDES		
777 108th Avenue NE	Matrix:	Soil		
Bellevue, WA 98009	Analysis for:	Moisture Content	Received:	Feb 23, 1993
Attention: David Wilson	First Sample #:	302-0769	Reported:	Mar 9, 1993

LABORATORY ANALYSIS FOR: Moisture Content

Sample Number	Sample Description	Total Solids %	Moisture Content %
302-0769	IH-3	30	70
302-0770	IH-1	26	74
302-0771	IH-2	45	55
302-0772	OH-3	58	42
302-0773	OH-4	69	31
302-0774	OH-2	59	41
302-0775	OH-1	60	40

The enclosed analytical results for soils, sediments and sludges have been converted to a DRY WEIGHT reporting basis.
To attain the wet weight "as received" equivalent, multiply the dry weight result by the decimal fraction of percent Total Solids.
The results in this report apply only to the samples analyzed, as indicated on the custody document.
This analytical report is to be reproduced only in its entirety.

NORTH CREEK ANALYTICAL inc

Steven G. Mayer
Project Manager

NORTH CREEK ANALYTICAL

18939 120th Avenue N.E., Suite 101 • Bothell, WA 98011-2569
Phone (206) 481-9200 • FAX (206) 485-2992

CH2M Hill	Client Project ID:	Starkist/Samoa NPDES	Sampled:	Feb 13, 1993
777 108th Avenue NE	Analysis Method:	EPA 351.3	Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis for:	Total Kjeldahl Nitrogen	Analyzed:	Mar 2, 1993
Attention: David Wilson	First Sample #:	302-0769	Reported:	Mar 9, 1993

LABORATORY ANALYSIS FOR: Total Kjeldahl Nitrogen

Sample Number	Sample Description	Reporting Limit mg/kg (ppm)	Sample Result mg/kg
302-0769	IH-3	1.0	1,100
302-0770	IH-1	1.0	1,700
302-0771	IH-2	1.0	770
302-0772	OH-3	1.0	410
302-0773	OH-4	1.0	470
302-0774	OH-2 2/18/93	1.0	470
302-0775	OH-1 2/18/93	1.0	480
BLK030293	Method Blank	1.0	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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Please Note:
Report was amended on March 23, 1993.

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CH2M Hill	Client Project ID:	Starkist/Samoa NPDES		Sampled:	Feb 13, 1993
77 108th Avenue NE	Analysis Method:	EPA 6010		Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis for:	Total Phosphorus		Analyzed:	Feb 25, 1993
Attention: David Wilson	First Sample #:	302-0769		Reported:	Mar 9, 1993

LABORATORY ANALYSIS FOR: Total Phosphorus

Sample Number	Sample Description	Reporting Limit mg/kg (ppm)	Sample Result mg/kg
302-0769	IH-3	10	1,500
302-0770	IH-1	10	1,200
302-0771	IH-2	10	1,100
302-0772	OH-3	10	530
302-0773	OH-4	10	470
302-0774	OH-2 2/18/93	10	570
302-0775	OH-1 2/18/93	10	600
BLK022593	Method Blank	10	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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CH2M Hill	Client Project ID:	Starkist/Samoa NPDES		Sampled:	Feb 13, 1993
777 108th Avenue NE	Analysis Method:	PSDDA Conventionals		Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis for:	Sulfide		Analyzed:	Feb 25, 1993
Attention: David Wilson	First Sample #:	302-0769		Reported:	Mar 9, 1993

LABORATORY ANALYSIS FOR: Sulfide

Sample Number	Sample Description	Reporting Limit mg/kg (ppm)	Sample Result mg/kg
302-0769	IH-3	0.12	34
302-0770	IH-1	0.12	41
302-0771	IH-2	0.12	22
302-0772	OH-3	0.12	N.D.
302-0773	OH-4	0.12	N.D.
302-0774	OH-2 2/18/93	0.12	0.46
302-0775	OH-1 2/18/93	0.12	0.75
BLK022593	Method Blank	0.12	N.D.

Analytes reported as N.D. were not detected above the stated Reporting Limit.
The results reported above are on a dry weight basis.

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CH2M Hill	Client Project ID:	Starkist/Samoa NPDES	Sampled:	Feb 13, 1993
777 108th Avenue NE	Sample Descript:	Sediment, IH-3	Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis Method:	ASTM D422-63	Analyzed:	Feb 24, 1993
Attention: David Wilson	Sample Number:	302-0769	Reported:	Mar 9, 1993

LABORATORY ANALYSIS: PARTICLE SIZE DISTRIBUTION

Sieve Size	Hydrometer < Phi Size	Particle Size microns	Passing %	Fractional %
4		>4750	100	0
10		4750 - 2000	98	2
20		2000 - 850	96	2
40		850 - 425	93	3
60		425 - 250	89	5
140		250 - 106	75	14
200		106 - 75	70	5
230		75 - 62.5	68	2
	4	62.5 - 31.2	22	46
	5	31.2 - 15.6	16	5
	6	15.6 - 7.8	5	11
	7	7.8 - 3.9	0	5
	8	3.9 - 1.9	0	0
	9	1.9 - 0.9	0	0
	10	<0.9	0	0

Total Solids, %: 30
Total Volatile Solids, %: 14

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CH2M Hill	Client Project ID:	Starkist/Samoa NPDES	Sampled:	Feb 13, 1993
777 108th Avenue NE	Sample Descript:	Sediment, IH-1	Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis Method:	ASTM D422-63	Analyzed:	Feb 24, 1993
Attention: David Wilson	Sample Number:	302-0770	Reported:	Mar 9, 1993

LABORATORY ANALYSIS: PARTICLE SIZE DISTRIBUTION

Sieve Size	Hydrometer < Phi Size	Particle Size microns	Passing %	Fractional %
4		>4750	97	3
10		4750 - 2000	96	1
20		2000 - 850	92	4
40		850 - 425	84	8
60		425 - 250	79	5
140		250 - 106	71	8
200		106 - 75	70	1
230		75 - 62.5	70	0
	4	62.5 - 31.2	16	54
	5	31.2 - 15.6	11	5
	6	15.6 - 7.8	5	6
	7	7.8 - 3.9	0	5
	8	3.9 - 1.9	0	0
	9	1.9 - 0.9	0	0
	10	<0.9	0	0

Total Solids, %: 27
Total Volatile Solids, %: 19

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H2M Hill	Client Project ID:	Starkist/Samoa NPDES	Sampled:	Feb 13, 1993
'7 108th Avenue NE	Sample Descript:	Sediment, IH-2	Received:	Feb 23, 1993
ellevue, WA 98009	Analysis Method:	ASTM D422-63	Analyzed:	Feb 24, 1993
tention: David Wilson	Sample Number:	302-0771	Reported:	Mar 9, 1993

LABORATORY ANALYSIS: PARTICLE SIZE DISTRIBUTION

eve Size	Hydrometer < Phi Size	Particle Size microns	Passing %	Fractional %
4		>4750	100	0
10		4750 - 2000	100	0
20		2000 - 850	100	0
40		850 - 425	99	0
60		425 - 250	99	1
140		250 - 106	96	2
200		106 - 75	94	3
230		75 - 62.5	92	2
	4	62.5 - 31.2	50	42
	5	31.2 - 15.6	22	28
	6	15.6 - 7.8	9	13
	7	7.8 - 3.9	6	3
	8	3.9 - 1.9	3	3
	9	1.9 - 0.9	0	3
	10	<0.9	0	0

Total Solids, %: 45
Total Volatile Solids, %: 9.3

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Please Note:
Report was amended on March 19, 1993.

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3020769.CHM <4>

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CH2M Hill	Client Project ID:	Starkist/Samoa NPDES	Sampled:	Feb 13, 1993
777 108th Avenue NE	Sample Descript:	Sediment, OH-3	Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis Method:	ASTM D422-63	Analyzed:	Feb 24, 1993
Attention: David Wilson	Sample Number:	302-0772	Reported:	Mar 9, 1993

LABORATORY ANALYSIS: PARTICLE SIZE DISTRIBUTION

Sieve Size	Hydrometer < Phi Size	Particle Size microns	Passing %	Fractional %
4		>4750	86	14
10		4750 - 2000	62	24
20		2000 - 850	52	10
40		850 - 425	45	7
60		425 - 250	38	7
140		250 - 106	18	20
200		106 - 75	12	6
230		75 - 62.5	10	2
	4	62.5 - 31.2	2	8
	5	31.2 - 15.6	1	1
	6	15.6 - 7.8	1	0
	7	7.8 - 3.9	1	0
	8	3.9 - 1.9	1	0
	9	1.9 - 0.9	0	1
	10	<0.9	0	0

Total Solids, %: 58
Total Volatile Solids, %: 3.1

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CH2M Hill	Client Project ID:	Starkist/Samoa NPDES	Sampled:	Feb 13, 1993
777 108th Avenue NE	Sample Descript:	Sediment, OH-4	Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis Method:	ASTM D422-63	Analyzed:	Feb 24, 1993
Attention: David Wilson	Sample Number:	302-0773	Reported:	Mar 9, 1993

LABORATORY ANALYSIS: PARTICLE SIZE DISTRIBUTION

Sieve Size	Hydrometer < Phi Size	Particle Size microns	Passing %	Fractional %
4		>4750	97	3
10		4750 - 2000	89	8
20		2000 - 850	75	14
40		850 - 425	62	13
60		425 - 250	57	5
140		250 - 106	50	7
200		106 - 75	46	4
230		75 - 62.5	44	2
	4	62.5 - 31.2	20	24
	5	31.2 - 15.6	7	13
	6	15.6 - 7.8	3	4
	7	7.8 - 3.9	1	2
	8	3.9 - 1.9	1	0
	9	1.9 - 0.9	0	1
	10	<0.9	0	0

Total Solids, %: 69
Total Volatile Solids, %: 4.2

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CH2M Hill	Client Project ID:	Starkist/Samoa NPDES	Sampled:	Feb 18, 1993
777 108th Avenue NE	Sample Descript:	Sediment, OH-2	Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis Method:	ASTM D422-63	Analyzed:	Feb 24, 1993
Attention: David Wilson	Sample Number:	302-0774	Reported:	Mar 9, 1993

LABORATORY ANALYSIS: PARTICLE SIZE DISTRIBUTION

Sieve Size	Hydrometer < Phi Size	Particle Size microns	Passing %	Fractional %
4		>4750	100	0
10		4750 - 2000	100	0
20		2000 - 850	100	0
40		850 - 425	100	0
60		425 - 250	99	1
140		250 - 106	95	4
200		106 - 75	87	8
230		75 - 62.5	82	6
	4	62.5 - 31.2	22	60
	5	31.2 - 15.6	17	5
	6	15.6 - 7.8	10	7
	7	7.8 - 3.9	2	7
	8	3.9 - 1.9	0	2
	9	1.9 - 0.9	0	0
	10	<0.9	0	0

Total Solids, %: 59
Total Volatile Solids, %: 4.9

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CH2M Hill	Client Project ID:	Starkist/Samoa NPDES	Sampled:	Feb 18, 1993
777 108th Avenue NE	Sample Descript:	Sediment, OH-1	Received:	Feb 23, 1993
Bellevue, WA 98009	Analysis Method:	ASTM D422-63	Analyzed:	Feb 24, 1993
Attention: David Wilson	Sample Number:	302-0775	Reported:	Mar 9, 1993

LABORATORY ANALYSIS: PARTICLE SIZE DISTRIBUTION

Sieve Size	Hydrometer < Phi Size	Particle Size microns	Passing %	Fractional %
4		>4750	100	0
10		4750 - 2000	100	0
20		2000 - 850	100	0
40		850 - 425	100	0
60		425 - 250	99	1
140		250 - 106	97	2
200		106 - 75	93	4
230		75 - 62.5	89	4
	4	62.5 - 31.2	30	59
	5	31.2 - 15.6	21	9
	6	15.6 - 7.8	12	9
	7	7.8 - 3.9	6	6
	8	3.9 - 1.9	3	3
	9	1.9 - 0.9	0	3
	10	<0.9	0	0

Total Solids, %: 60
Total Volatile Solids, %: 5.6

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CH2M Hill
777 108th Avenue NE
Bellevue, WA 98009
Attention: David Wilson

Client Project ID: Starkist/Samoa NPDES
Sample Matrix : Soil
Units: mg/kg (ppm)

Analyst: K. Arvon

Reported: Mar 9, 1993

INORGANIC QUALITY CONTROL DATA REPORT

ANALYTE	Phosphorus	Sulfide
EPA Method:	6010	PSDDA
Date Analyzed:	Feb 25, 1993	Feb 25, 1993
ACCURACY ASSESSMENT		
LCS Spike Conc. Added:	500	5.0
LCS Spike Result:	390	4.7
LCS Spike % Recovery:	78	94
Upper Control Limit:	125	125
Lower Control Limit:	75	75
PRECISION ASSESSMENT		
Sample #:	302-0772	302-0775
Original:	310	0.75
Duplicate:	200	0.66
Relative % Difference:	43, Q-6	13
Maximum RPD:	25	25

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Please Note:
Q-6 = The RPD value for this QC sample is outside of the NCA established control limits.

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CH2M Hill
777 108th Avenue NE
Bellevue, WA 98009
Attention: David Wilson

Client Project ID: Starkist/Samoa NPDES
Sample Matrix : Soil
Units: mg/kg (ppm)

Analyst: K. Arvon

Reported: Mar 25, 1993

INORGANIC QUALITY CONTROL DATA REPORT

ANALYTE	Total Kjeldahl Nitrogen

EPA Method: 351.3
Date Analyzed: Mar 23, 1993

ACCURACY ASSESSMENT

LCS Spike Conc. Added:	500
LCS Spike Result:	476
LCS Spike % Recovery:	95
Upper Control Limit:	125
Lower Control Limit:	75

PRECISION ASSESSMENT

Sample #:	302-0773
Original:	460
Duplicate:	460
Relative % Difference:	0.0
Maximum RPD:	25

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