*Radionuclides and Heavy Metals in
Rainbow Trout from Tsichomo, Nana Ka,
Wen Povi, and Pin De Lakes in
Santa Clara Canyon*

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Edited by Hector Hinojosa, Group CIC-1

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*Radionuclides and Heavy Metals in
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P. R. Fresquez
D. R. Armstrong
L. Naranjo, Jr.

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MASTER

RADIONUCLIDES AND HEAVY METALS IN RAINBOW TROUT FROM TSICHOMO, NANA KA, WEN POVI, AND PIN DE LAKES IN SANTA CLARA CANYON

by

P. R. Fresquez, D. R. Armstrong, and L. Naranjo, Jr.

ABSTRACT

Radionuclide (^3H , ^{90}Sr , ^{137}Cs , ^{238}Pu , ^{239}Pu , and total uranium) and heavy metal (Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Pb, Sb, Se, and Tl) concentrations were determined in rainbow trout collected from Tsichomo, Nana Ka, Wen Povi, and Pin De lakes in Santa Clara Canyon in 1997. Most radionuclide and heavy metal concentrations in fish collected from these four lakes were within or just above upper limit background concentrations (Abiquiu reservoir), and as a group were statistically ($p < 0.05$) similar in most parameters to background. Consequently, the committed effective dose equivalent (CEDE) from the ingestion of 46 lb of fish from Santa Clara Canyon ($0.028 \text{ mrem y}^{-1}$) was within the CEDE from the ingestion of fish from Abiquiu reservoir ($0.037 \text{ mrem y}^{-1}$). Moreover, the upper (95%) level net positive total CEDE (i.e., the CEDE + two sigma for each radioisotope minus background and then only the positive doses summed)—a dose that could potentially be attributed to Laboratory operations—was only $0.042 \text{ mrem y}^{-1}$. This dose was far below the International Commission on Radiological Protection permissible dose level of 100 mrem y^{-1} from all pathways, and corresponds to a risk of an excess cancer fatality of 2.1×10^{-8} (0.021 in a million)—also far below the Environmental Protection Agency guideline of 10^{-4} .

I. INTRODUCTION

As part of the Environmental Surveillance Program at Los Alamos National Laboratory (LANL), samples of air, water, soils, foodstuffs, and biota are routinely collected from LANL, perimeter, and regional (background)

areas to assess the Laboratory's impact (radiological and nonradiological) on the surrounding community and environment (ESP 1997). There are several Native American Pueblo communities located in the general

vicinity of LANL, and a request was made by Santa Clara Pueblo officials (Dasheno 1997) to assess fish from four lakes—Tsichomo, Nana Ka, Wen Povi, and Pin De—within Santa Clara Canyon. Santa Clara Canyon (Figure 1) is approximately 13 miles northwest and slightly downwind of LANL (the prevailing wind direction at LANL during day time and nighttime hours is northeasterly and northwesterly, respectively) (USDOE 1995). This study reports (1) the concentrations of various radionuclides and heavy metals in fish collected from these four lakes in

Fig. 1. Location of Santa Clara Canyon.

Santa Clara Canyon in 1997 and (2) the committed effective dose equivalent (CEDE) and the risk of excess cancer fatalities (RECF) to people who may consume these fish.

II. METHODS

Samples of rainbow trout (*Salmo gairdneri*) (10 each) from Tsichomo, Nana Ka, Wen Povi, and Pin De lakes, which were stocked with fish approximately one year before from Ruidoso, NM (Mescalero National Fish Hatchery) (Chavarria 1997), were collected with a rod and reel in mid-March of 1997. Background fish were collected by gill nets from Abiquiu reservoir; a reservoir on the Rio Chama approximately 30 miles upstream of the confluence of the Santa Clara river and the Rio Grande. All fish samples were placed in Ziploc bags and transferred to the Laboratory in locked ice chests. At the Laboratory, fish samples were processed—gutted and removal of heads and tails—and were rinsed with distilled water. Approximately 1000 g of wet fish muscle (and associated skeleton) were placed into tared 2-L beakers and weighed. The beaker contents were oven-dried at 80°C for 120 h, weighed,

and ashed at 500°C for 120 h. The sample ash was weighed, pulverized, and homogenized before it was submitted under full chain-of-custody to the Environmental Chemistry Group (CST-9) at LANL for the analysis of various heavy metals (Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Pb, Sb, Se, and Tl) and radionuclides (^3H , ^{90}Sr , ^{137}Cs , ^{238}Pu , ^{239}Pu , ^{241}Am , and total uranium).

Metals were digested using a nitric acid and determined by inductively coupled plasma atomic emission spectrometry (ICPES) for Ag, Ba, Be, Cd, Cr, and Ni; by inductively coupled plasma mass spectrometry (ICPMS) for Pb, Sb and Tl; by electrothermal vaporization atomic absorption (ETVAA) for As and Se; and by cold vapor atomic absorption (CVAA) for Hg. Results for heavy metals in fish were reported on a wet weight basis (wet g^{-1}) (Appendix A). All methods of radiochemical analysis in fish have been described previously (Salazar 1984) and, with the exception of ^3H in pCi mL^{-1} , were reported on an oven-dry weight basis (dry g^{-1}) (Appendix B).

The CEDE—based on all radionuclides collected in 1997 for fish from Santa Clara Canyon and Abiquiu

reservoir (background)—was calculated following procedures recommended by the Department of Energy (DOE) (USDOE 1991) and the Nuclear Regulatory Commission (NRC 1977). Public dose conversion factors used for ingestion calculations are those recommended by the DOE (DOE 1988) and are based on factors in the International Commission on Radiological Protection (ICRP) Publication 30 (ICRP 1979). When more than one ingestion factor is given for a radionuclide, the most conservative was chosen to maximize the CEDE for comparison with the ICRP public dose limit of 100 mrem y^{-1} (USDOE 1990). Radionuclide concentrations are multiplied by the estimated maximum annual consumption rate of 46 lb (NRC 1977) to obtain an adjusted intake for a particular radionuclide. Multiplication of this intake rate by the appropriate radionuclide dose conversion factor for a particular organ gives the estimated committed dose equivalent (CDE) to organs, and similarly the CEDE to the entire body (USDOE 1988).

To determine if there were any potential impacts from the Laboratory, the upper (95%) level CEDE for each

radionuclide (i.e., CEDE + 2 sigma) from background is subtracted from the upper level CEDE for each radionuclide from fish from Santa Clara Canyon. All negative dose equivalents are set to zero and only the net positive CEDEs are used. This radionuclide specific upper level net positive CEDE is summed over all the monitored radionuclides to obtain the upper level net positive total CEDE for comparison to the ICRP's 100 mrem y^{-1} public dose limit. Moreover, the upper level total CEDE and the upper level net positive total CEDE were multiplied by 5×10^{-7} excess cancer fatalities per person-mrem (USEPA 1994) to calculate the risk of excess cancer fatalities from the consumption of these fish.

III. RESULTS AND DISCUSSION

Most heavy metals in fish collected from Tschomo, Nana Ka, Wen Povi, and Pin De lakes were either below detection limits or well within concentrations in prestocked fish collected from the Mescalero National Fish Hatchery (Fresquez et al. 1996) and in fish collected from background locations (Table 1). In fact, most heavy metals, including Cr, Hg, Ni, Pb, Sb, Se,

and Tl, in fish from Abiquiu reservoir were significantly higher (using a nonparametric Wilcoxon Rank Sum Test at the 0.05 probability level) than metals in the fish collected from the Santa Clara Canyon lakes. Similarly, most radionuclides in fish collected from all four lakes in Santa Clara Canyon were within upper limit background concentrations and as a group were not statistically different from fish collected from Abiquiu reservoir (Table 2). Also, these data, compare very well with fish collected from Tschomo lake in past years (Fresquez et al., 1996) and stocked trout from other Tribal lakes (Nambe and Jemez Pueblo Lakes) in the region (Fresquez et al. 1995).

The CEDE from the ingestion of 46 lb of fish from the four lakes in Santa Clara Canyon (0.028 ± 0.040 mrem y^{-1}) was well within the CEDE from the consumption of fish collected from Abiquiu reservoir (0.037 ± 0.027 mrem y^{-1}). Moreover, the upper (95%) level net positive total CEDE (i.e., the CEDE + 2 sigma for each radioisotope minus background and then only the positive doses summed) from the ingestion of fish from Santa Clara of 0.042 mrem y^{-1} (Table 3)—a dose that could potentially

be attributed to Laboratory operations, although sources from worldwide fallout and from naturally occurring sources cannot be entirely ruled out—was far below the permissible dose limit of 100 mrem y^{-1} set by the ICRP above that received from other radiation sources (natural and anthropogenic) (USDOE 1990). A person living in the Santa Clara area, for example, can expect to receive about 300 to 350 mrem y^{-1} from other background radiation sources (e.g., cosmic, medical, radon, etc.) alone (EPG 1995). And, finally, the RECF from the ingestion of fish from Santa Clara Canyon, based on 0.042 mrem y^{-1} , was estimated to be 2.1×10^{-8} (0.021 in a million); this value is also far below any guidelines set for risk (e.g., 10^{-4}) (USEPA 1994).

ACKNOWLEDGMENT

Special thanks to Mr. Walter Dasheno and Mr. Regis Chavarria (and Staff), Santa Clara Pueblo Governor and Environmental Department Coordinator, respectively, for their assistance in this study. Paul Torrez, an undergraduate student, tabulated the data. Also, thanks to Belinda Gutierrez for the construction of Figure 1.

Table 1. Total Recoverable Trace and Heavy Metals ($\mu\text{g wet g}^{-1}$) in Rainbow Trout Collected from Four Lakes in Santa Clara Canyon as Compared to Background in 1997.

Location	Ag	As	Ba	Be	Cd	Cr	Hg	Ni	Pb	Sb	Se	Tl
Tsichomo	0.07 ^{*1}	0.02 [*]	0.66	0.03 [*]	0.10	0.110	0.042	0.15 [*]	0.03 [*]	0.03 [*]	0.12	0.03 [*]
Nana Ka	0.07 [*]	0.02 [*]	0.82	0.03 [*]	0.05 [*]	0.079	0.015	0.15 [*]	0.03 [*]	0.03 [*]	0.21	0.03 [*]
Wen Povi	0.07 [*]	0.02 [*]	0.47	0.03 [*]	0.05 [*]	0.066	0.170	0.15 [*]	0.03 [*]	0.03 [*]	0.22	0.03 [*]
Pin De	0.07 [*]	0.02 [*]	0.60	0.03 [*]	0.05 [*]	0.067	0.024	0.15 [*]	0.03 [*]	0.03 [*]	0.13	0.03 [*]
<i>Mean</i>	0.07a ²	0.02b	0.64a	0.03a	0.06a	0.081b	0.063b	0.15b	0.03b	0.03b	0.17b	0.03b
($\pm$ SD)	(0.00)	(0.00)	(0.15)	(0.00)	(0.03)	(0.021)	(0.072)	(0.00)	(0.00)	(0.00)	(0.05)	(0.00)
Background												
<i>Mean</i> ³	0.13a	0.25a	0.06b	0.05a	0.11a	0.625a	0.342a	1.13a	1.25a	1.25a	0.28a	1.25a
($\pm$ SD)	(0.00)	(0.00)	(0.00)	(0.03)	(0.05)	(0.000)	(0.100)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
RSRL ⁴	1.20	0.40	1.20	1.30	0.30	1.500	0.400	1.50	4.00	2.10	0.40	2.10

¹Results denoted with an * were less than values and were reduced by one-half concentration.

²Means within the same column followed by the same letter were not significantly different at the 0.05 probability level using a nonparametric Wilcoxon Rank sum test.

³Background fish from Abiquiu (n = 5) (ESR 1997).

⁴Regional Statistical Reference Level; this is the upper limit background (mean + 2 std dev) for fish collected from 1994 to 1996 (ESR 1997).

Table 2. Radionuclide Concentrations in Rainbow Trout from Lakes in Santa Clara Canyon as Compared to Background.

Location	³ H pCi mL ⁻¹	¹³⁷ Cs 10 ⁻² pCi dry g ⁻¹	²³⁸ Pu 10 ⁻⁵ pCi dry g ⁻¹	²³⁹ Pu 10 ⁻⁵ pCi dry g ⁻¹	^{tot} U ng dry g ⁻¹	⁹⁰ Sr 10 ⁻² pCi dry g ⁻¹	²⁴¹ Am 10 ⁻⁵ pCi dry g ⁻¹
Tsichomo	0.096 (0.233) ¹	1.00 (0.40)	-5.0 (2.0)	-2.0 (2.0)	8.0 (1.0)	-0.50 (2.30)	-6.0 (5.0)
Nana Ka	0.235 (0.287)	1.10 (0.40)	0.0 (2.0)	12.0 (3.0)	2.0 (1.0)	1.10 (0.70)	11.0 (4.0)
Wen Povi	0.127 (0.326)	0.40 (0.50)	-2.0 (1.0)	13.0 (3.0)	4.0 (1.0)	3.20 (2.00)	4.0 (3.0)
Pin De	0.255 (0.267)	1.70 (2.60)	-1.0 (5.0)	47.0 (13.0)	11.0 (1.0)	-0.70 (2.70)	47.0 (16.0)
Mean (± SD)	0.178a ² (0.079)	1.05a (0.53)	-2.0a (2.2)	17.5a (20.8)	6.3a (4.0)	0.78a (1.81)	14.0a (23.1)
Background Mean ³ (± SD)	0.400a (0.200)	1.02a (0.55)	1.5a (2.0)	3.6a (4.8)	3.4a (0.5)	2.90a (2.03)	9.2a (9.9)
RSRL ⁴	0.200	27.70	23.6	28.3	6.5	17.00	28.9

¹(+/- one counting uncertainty); values are the uncertainty in the analytical results at the 65% confidence level.

²Means within the same column followed by the same letter are not significantly different at the 0.05 probability level using a nonparametric Wilcoxon Rank sum test.

³Background fish are from Abiquiu (n = 5) (ESR 1997).

⁴Regional Statistical Reference Level; this is the upper limit background (mean + 2 std dev) from fish collected from 1981 to 1993 (Fresquez et al., 1994).

Table 3. Summary of the upper (95%) level CEDE (CEDE + two sigma) (mrem y⁻¹) from the Ingestion of Fish from Santa Clara Lakes and Background by Nuclide.

Location	³ H	¹³⁷ Cs	²³⁸ Pu	²³⁹ Pu	²³⁵ U	⁹⁰ Sr	²⁴¹ Am	Total	RECF ⁴
Santa Clara	0.00033	0.0057	0.00088	0.0140	0.0130	0.031	0.042	0.110 ²	5.3 × 10 ⁻⁸
Abiquiu Reservoir (Background)	0.00075	0.0064	0.00130	0.0034	0.0046	0.055	0.020	0.091 ²	4.5 × 10 ⁻⁸
Net									
Positive	0.00000 ¹	0.0000	0.00000	0.0100	0.0087	0.000	0.023	0.042 ³	2.1 × 10 ⁻⁸

¹Santa Clara minus Abiquiu and all negative results were set to zero.

²Upper level total CEDE (results of all radionuclides added).

³Upper level total net positive CEDE.

⁴Risk of excess cancer fatalities.

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Appendix A. CST Analytical Chemistry Reports (Heavy Metal) for Fish.

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***** CST ANALYTICAL REPORT *****

Prepared by: J.A. KENNISON on 6-Jun-1997

REQUEST NUMBER: 24712 MATRIX: BF ANALYST: OES PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: CST9223 PAGE: 35

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466	AG	ICPES	< 0.13		UG/G	6/03/97	
TSICHOMO	97.03466	BA	ICPES	0.66	0.08	UG/G	6/03/97	
TSICHOMO	97.03466	BE	ICPES	< 0.05		UG/G	6/03/97	
TSICHOMO	97.03466	CD	ICPES	< 0.096		UG/G	6/03/97	
TSICHOMO	97.03466	CR	ICPES	0.11	0.07	UG/G	6/03/97	
TSICHOMO	97.03466	NI	ICPES	< 0.3		UG/G	6/03/97	
NANA KA	97.03467	AG	ICPES	< 0.13		UG/G	6/04/97	
NANA KA	97.03467	BA	ICPES	0.82	0.4	UG/G	6/04/97	
NANA KA	97.03467	BE	ICPES	< 0.05		UG/G	6/04/97	
NANA KA	97.03467	CD	ICPES	< 0.1		UG/G	6/04/97	
NANA KA	97.03467	CR	ICPES	0.079	0.064	UG/G	6/04/97	
NANA KA	97.03467	NI	ICPES	< 0.29		UG/G	6/04/97	
WEN POVI	97.03468	AG	ICPES	< 0.13		UG/G	6/04/97	
WEN POVI	97.03468	BA	ICPES	0.47	0.04	UG/G	6/04/97	
WEN POVI	97.03468	BE	ICPES	< 0.05		UG/G	6/04/97	
WEN POVI	97.03468	CD	ICPES	< 0.1		UG/G	6/04/97	
WEN POVI	97.03468	CR	ICPES	0.066	0.064	UG/G	6/04/97	
WEN POVI	97.03468	NI	ICPES	< 0.3		UG/G	6/04/97	
PINDE	97.03469	AG	ICPES	< 0.13		UG/G	6/04/97	
PINDE	97.03469	BA	ICPES	0.6	0.04	UG/G	6/04/97	
PINDE	97.03469	BE	ICPES	< 0.05		UG/G	6/04/97	
PINDE	97.03469	CD	ICPES	< 0.1		UG/G	6/04/97	
PINDE	97.03469	CR	ICPES	0.067	0.064	UG/G	6/04/97	
PINDE	97.03469	NI	ICPES	< 0.3		UG/G	6/04/97	

CUSTOMER SAMPLE DUPLICATES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466	AG	ICPES	< 0.13		UG/G	6/03/97	
TSICHOMO	97.03466	BA	ICPES	0.68	0.04	UG/G	6/03/97	
TSICHOMO	97.03466	BE	ICPES	< 0.05		UG/G	6/03/97	
TSICHOMO	97.03466	CD	ICPES	< 0.096		UG/G	6/03/97	
TSICHOMO	97.03466	CR	ICPES	0.13	0.2	UG/G	6/03/97	
TSICHOMO	97.03466	NI	ICPES	< 0.3		UG/G	6/03/97	

MATRIX SPIKES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS TECHNIQUE	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466 AG	ICPES	6.	5.	UG/G	6/03/97	
TSICHOMO	97.03466 BA	ICPES	6.	6.5	UG/G	6/03/97	
TSICHOMO	97.03466 BE	ICPES	6.	5.8	UG/G	6/03/97	
TSICHOMO	97.03466 CD	ICPES	6.	5.1	UG/G	6/03/97	
TSICHOMO	97.03466 CR	ICPES	6.	5.7	UG/G	6/03/97	
TSICHOMO	97.03466 NI	ICPES	6.	5.	UG/G	6/03/97	

***** CST QUALITY ASSURANCE REPORT *****

Prepared by: J.A. KENNISON on 6-Jun-1997

REQUEST NUMBER: 24712 MATRIX: BF ANALYST: OES PROGRAM CODE: WE6G
 OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815
 NOTEBOOK: CST9223 PAGE: 35

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00590	AG	130.	130.	NG/G	40.	10.	6/03/97	UNDER CONTROL
00.00590	CD	500.	96.	NG/G	440.	60.	6/03/97	UNDER CONTROL
00.00590	CR	0.61	0.2	UG/G	1.		6/03/97	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

- ☐ Only qualitative data requested
- ☒ Only Open (non-blind) QC samples run with this sample batch.
- ☐ No QC samples run with this sample batch.
- ☐ No QC samples for this constituent and matrix type available within CST

REPORT NUMBER: 43955

J.A. Kennison
Analyst

M. Kirby
Reviewer

K. Dorn
Team Leader

mag
QA Officer

6/6/97
Date

6/9/97
Date

6/12/97
Date

6/13/97
Date

No Sample Discrepancies Noted by Sample Management Section

***** CST ANALYTICAL REPORT *****

Prepared by: KLAO

on 5-Jun-1997

REQUEST NUMBER: 24712 MATRIX: BF ANALYST: IMS

PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez

GROUP: ESH-20

MAIL-STOP: M887

PHONE: 7-0815

NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466 PB	ICPMS	< 0.05		UG/G	6/03/97	
TSICHOMO	97.03466 SB	ICPMS	< 0.05		UG/G	6/03/97	
TSICHOMO	97.03466 TL	ICPMS	< 0.05		UG/G	6/03/97	
NANA KA	97.03467 PB	ICPMS	< 0.05		UG/G	6/03/97	
NANA KA	97.03467 SB	ICPMS	< 0.05		UG/G	6/03/97	
NANA KA	97.03467 TL	ICPMS	< 0.05		UG/G	6/03/97	
WEN POVI	97.03468 PB	ICPMS	< 0.05		UG/G	6/03/97	
WEN POVI	97.03468 SB	ICPMS	< 0.05		UG/G	6/03/97	
WEN POVI	97.03468 TL	ICPMS	< 0.05		UG/G	6/03/97	
PINDE	97.03469 PB	ICPMS	< 0.05		UG/G	6/03/97	
PINDE	97.03469 SB	ICPMS	< 0.05		UG/G	6/03/97	
PINDE	97.03469 TL	ICPMS	< 0.05		UG/G	6/03/97	

CUSTOMER SAMPLE DUPLICATES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466 PB	ICPMS	< 0.05		UG/G	6/03/97	
TSICHOMO	97.03466 SB	ICPMS	< 0.05		UG/G	6/03/97	
TSICHOMO	97.03466 TL	ICPMS	< 0.05		UG/G	6/03/97	

MATRIX SPIKES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS TECHNIQUE	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466 PB	ICPMS	1.199	1.1	UG/G	6/03/97	
TSICHOMO	97.03466 SB	ICPMS	1.199	1.1	UG/G	6/03/97	
TSICHOMO	97.03466 TL	ICPMS	1.199	1.1	UG/G	6/03/97	

REPORT NUMBER: 43949 (continued)

***** CST QUALITY ASSURANCE REPORT *****

Prepared by: KLA0 on 5-Jun-1997

REQUEST NUMBER: 24712 MATRIX: BF ANALYST: IMS PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00590 PB		90.	50.	NG/G	140.	20.	6/03/97	UNDER CONTROL
00.00590 SB		< 50.		NG/G	3.		6/03/97	UNDER CONTROL
00.00590 TL		< 50.		NG/G	3.		6/03/97	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

- ☐ Only qualitative data requested
- ☒ Only Open (non-blind) QC samples run with this sample batch.
- ☐ No QC samples run with this sample batch.
- ☐ No QC samples for this constituent and matrix type available within CST

REPORT NUMBER: 43949

Hy Leo
Analyst

W. K. Kelly
Reviewer

130
Team Leader

mag
QA Officer

6/5/97
Date

6/5/97
Date

6/12/97
Date

6/13/97
Date

No Sample Discrepancies Noted by Sample Management Section

***** CST ANALYTICAL REPORT *****

Prepared by: MBG

on 9-Jun-1997

REQUEST NUMBER: 24712

MATRIX: BF

ANALYST: AAS

PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez

GROUP: ESH-20

MAIL-STOP: M887

PHONE: 7-0815

NOTEBOOK: Y04367 PAGE: 103

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466	AS	ETVAA	< 0.04		UG/G	5/21/97	
TSICHOMO	97.03466	HG	CVAA	0.042	0.008	UG/G	5/06/97	
TSICHOMO	97.03466	SE	ETVAA	0.12	0.06	UG/G	5/21/97	
NANA KA	97.03467	AS	ETVAA	< 0.04		UG/G	5/21/97	
NANA KA	97.03467	HG	CVAA	0.015	0.01	UG/G	5/06/97	
NANA KA	97.03467	SE	ETVAA	0.21	0.06	UG/G	5/21/97	
WEN POVI	97.03468	AS	ETVAA	< 0.04		UG/G	5/21/97	
WEN POVI	97.03468	HG	CVAA	0.17	0.006	UG/G	5/06/97	
WEN POVI	97.03468	SE	ETVAA	0.22	0.06	UG/G	5/21/97	
PINDE	97.03469	AS	ETVAA	< 0.04		UG/G	5/21/97	
PINDE	97.03469	HG	CVAA	0.027	0.01	UG/G	5/06/97	
PINDE	97.03469	SE	ETVAA	0.13	0.06	UG/G	5/22/97	

CUSTOMER SAMPLE DUPLICATES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466	AS	ETVAA	< 0.04		UG/G	5/21/97	
TSICHOMO	97.03466	HG	CVAA	0.025	0.01	UG/G	5/06/97	
TSICHOMO	97.03466	HG	CVAA	0.03	0.01	UG/G	5/06/97	
TSICHOMO	97.03466	SE	ETVAA	0.13	0.06	UG/G	5/21/97	
NANA KA	97.03467	HG	CVAA	0.032	0.02	UG/G	5/06/97	
NANA KA	97.03467	HG	CVAA	0.067	0.03	UG/G	5/06/97	
WEN POVI	97.03468	HG	CVAA	0.021	0.01	UG/G	5/06/97	
WEN POVI	97.03468	HG	CVAA	0.052	0.03	UG/G	5/06/97	
PINDE	97.03469	HG	CVAA	0.022	0.007	UG/G	5/06/97	
PINDE	97.03469	HG	CVAA	0.029	0.01	UG/G	5/06/97	

MATRIX SPIKES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03466	AS	ETVAA	1.2	0.54	UG/G	5/27/97	

11g

TSICHOMO	97.03466 SE	ETVAA	1.2	0.77	UG/G	5/27/97
PINDE	97.03469 HG	CVAA	1.	0.98	UG/G	5/06/97

11 h

REPORT NUMBER: 43957 (continued)

***** CST QUALITY ASSURANCE REPORT *****

Prepared by: MBG on 9-Jun-1997

REQUEST NUMBER: 24712 MATRIX: BF ANALYST: AAS PROGRAM CODE: WE6G
 OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815
 NOTEBOOK: Y04367 PAGE: 103

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.00590 AS		40.	40.	NG/G	47.	6.	5/22/97	UNDER CONTROL
00.00590 SE		250.	60.	NG/G	710.	70.	5/22/97	OUT OF CONTROL
00.30469 HG		4.2	0.4	MG/KG	4.85	2.4	5/22/97	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

There were no blind Quality Control materials run with the samples reported above for one of the following reasons:

- ☐ Only qualitative data requested
- ☒ Only Open (non-blind) QC samples run with this sample batch.
- ☐ No QC samples run with this sample batch.
- ☐ No QC samples for this constituent and matrix type available within CST

REPORT NUMBER: 43957

<u>Michael B. Gross</u> Analyst	<u>Mark L. Gyll</u> Reviewer	<u>[Signature]</u> Team Leader	<u>mag</u> QA Officer
<u>6-9-97</u> Date	<u>6-9-97</u> Date	<u>6/12/97</u> Date	<u>6/13/97</u> Date

No Sample Discrepancies Noted by Sample Management Section

Los Alamos

Los Alamos, New Mexico 87545

ESH-20 MS M887

Los Alamos

Los Alamos, New Mexico 87545

ESH-20 MS M887

Project Name	Date	Time	Request the following analysis:	Sample Name/Number	Request the following analysis:	Sample Location/Remarks
South China Sea Fish Subjects: 1. <i>Chelodactylus</i> 2. <i>Chelodactylus</i> 3. <i>Chelodactylus</i> 4. <i>Chelodactylus</i> 5. <i>Chelodactylus</i> 6. <i>Chelodactylus</i> 7. <i>Chelodactylus</i> 8. <i>Chelodactylus</i> 9. <i>Chelodactylus</i> 10. <i>Chelodactylus</i> 11. <i>Chelodactylus</i> 12. <i>Chelodactylus</i> 13. <i>Chelodactylus</i> 14. <i>Chelodactylus</i> 15. <i>Chelodactylus</i> 16. <i>Chelodactylus</i> 17. <i>Chelodactylus</i> 18. <i>Chelodactylus</i> 19. <i>Chelodactylus</i> 20. <i>Chelodactylus</i> 21. <i>Chelodactylus</i> 22. <i>Chelodactylus</i> 23. <i>Chelodactylus</i> 24. <i>Chelodactylus</i> 25. <i>Chelodactylus</i> 26. <i>Chelodactylus</i> 27. <i>Chelodactylus</i> 28. <i>Chelodactylus</i> 29. <i>Chelodactylus</i> 30. <i>Chelodactylus</i> 31. <i>Chelodactylus</i> 32. <i>Chelodactylus</i> 33. <i>Chelodactylus</i> 34. <i>Chelodactylus</i> 35. <i>Chelodactylus</i> 36. <i>Chelodactylus</i> 37. <i>Chelodactylus</i> 38. <i>Chelodactylus</i> 39. <i>Chelodactylus</i> 40. <i>Chelodactylus</i> 41. <i>Chelodactylus</i> 42. <i>Chelodactylus</i> 43. <i>Chelodactylus</i> 44. <i>Chelodactylus</i> 45. <i>Chelodactylus</i> 46. <i>Chelodactylus</i> 47. <i>Chelodactylus</i> 48. <i>Chelodactylus</i> 49. <i>Chelodactylus</i> 50. <i>Chelodactylus</i> 51. <i>Chelodactylus</i> 52. <i>Chelodactylus</i> 53. <i>Chelodactylus</i> 54. <i>Chelodactylus</i> 55. <i>Chelodactylus</i> 56. <i>Chelodactylus</i> 57. <i>Chelodactylus</i> 58. <i>Chelodactylus</i> 59. <i>Chelodactylus</i> 60. <i>Chelodactylus</i> 61. <i>Chelodactylus</i> 62. <i>Chelodactylus</i> 63. <i>Chelodactylus</i> 64. <i>Chelodactylus</i> 65. <i>Chelodactylus</i> 66. <i>Chelodactylus</i> 67. <i>Chelodactylus</i> 68. <i>Chelodactylus</i> 69. <i>Chelodactylus</i> 70. <i>Chelodactylus</i> 71. <i>Chelodactylus</i> 72. <i>Chelodactylus</i> 73. <i>Chelodactylus</i> 74. <i>Chelodactylus</i> 75. <i>Chelodactylus</i> 76. <i>Chelodactylus</i> 77. <i>Chelodactylus</i> 78. <i>Chelodactylus</i> 79. <i>Chelodactylus</i> 80. <i>Chelodactylus</i> 81. <i>Chelodactylus</i> 82. <i>Chelodactylus</i> 83. <i>Chelodactylus</i> 84. <i>Chelodactylus</i> 85. <i>Chelodactylus</i> 86. <i>Chelodactylus</i> 87. <i>Chelodactylus</i> 88. <i>Chelodactylus</i> 89. <i>Chelodactylus</i> 90. <i>Chelodactylus</i> 91. <i>Chelodactylus</i> 92. <i>Chelodactylus</i> 93. <i>Chelodactylus</i> 94. <i>Chelodactylus</i> 95. <i>Chelodactylus</i> 96. <i>Chelodactylus</i> 97. <i>Chelodactylus</i> 98. <i>Chelodactylus</i> 99. <i>Chelodactylus</i> 100. <i>Chelodactylus</i>	3-19-97	11:00	As, Ag, Ba, Be, Ca, Cr, Hg Ni, Pb, Sb, Se, Te	1	(10) composite fish 4th pond (top) (distill water)	upward in mg/g wet. (micro)
	3-19-97	1:30		1	(10) fish 3rd pond (distill water)	
	3-20-97	10:30		1	(10) fish 2nd pond (distill water)	
	3/20/97	2:00		1	(10) fish 1st pond (Bottoms) (distill water)	

Appendix B. CST Analytical Chemistry Reports (Radionuclide) for Fish.

***** CST ANALYTICAL REPORT *****

Prepared by: NL

on 11-Jul-1997

ANALYSIS: U

REQUEST NUMBER: 24684

MATRIX: BZ

ANALYST: EDWARD GONZALES

PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez

GROUP: ESH-20

MAIL-STOP: M887

PHONE: 7-0815

ANALYTICAL TECHNIQUE: KPA

ANALYTICAL PROCEDURE:

NOTEBOOK:

PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSCHOMO	97.03205	0.08	0.01	UG/G	7/11/97	
NANA KA	97.03206	0.02	0.01	UG/G	7/11/97	
WEN POVI	97.03207	0.04	0.01	UG/G	7/11/97	
PINDE	97.03208	0.11	0.01	UG/G	7/11/97	

***** CST ANALYTICAL REPORT *****

Prepared by: CEA

on 15-Oct-1997

REQUEST NUMBER: 24684 MATRIX: BZ ANALYST: RICHARD PETERS PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSCHOMO	97.03205 PU-238	RAS	- 0.0005	0.0002	PCI/G	10/15/97	68%
TSCHOMO	97.03205 PU-239	RAS	- 0.0002	0.0002	PCI/G	10/15/97	68%
NANA KA	97.03206 PU-238	RAS	0.0	0.0002	PCI/G	10/15/97	108%
NANA KA	97.03206 PU-239	RAS	0.0012	0.0003	PCI/G	10/15/97	108%
WEN POVI	97.03207 PU-238	RAS	- 0.0002	0.0001	PCI/G	10/15/97	118%
WEN POVI	97.03207 PU-239	RAS	0.0013	0.0003	PCI/G	10/15/97	118%
PINDE	97.03208 PU-238	RAS	- 0.0001	0.0005	PCI/G	10/15/97	105%
PINDE	97.03208 PU-239	RAS	0.0047	0.0013	PCI/G	10/15/97	105%

12C

REPORT NUMBER: 44180 (continued)

***** CST QUALITY ASSURANCE REPORT *****

Prepared by: CEA on 15-Oct-1997

REQUEST NUMBER: 24684 MATRIX: BZ ANALYST: RICHARD PETERS PROGRAM CODE: WE6G
 OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815
 NOTEBOOK: PAGE:

SUMMARY OF TRACER RECOVERY IN CUSTOMER AND QA SAMPLES

CUSTOMER NUMBER	CST SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COLLECTION DATE	COMMENT
TSCHOMO	97.03205	PU-242T	1.95	2.964	PCI/SAMPLE	4/09/97	68%
NANA KA	97.03206	PU-242T	1.95	4.7385	PCI/SAMPLE	4/09/97	108%
WEN POVI	97.03207	PU-242T	1.95	5.187	PCI/SAMPLE	4/09/97	118%
PINDE	97.03208	PU-242T	1.95	4.602	PCI/SAMPLE	4/09/97	105%
00.36193	97.03817	PU-242T	0.975	2.184	PCI/SAMPLE	4/09/97	100%

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.33824	PU-238	3.2408	0.1035	PCI/SAMPLE	3.2	0.1	7/09/97	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
97.03817	PU-238	1.674	0.0996	PCI/G	1.69	0.059	10/15/97	UNDER CONTROL
97.03817	PU-239	6.601	0.3682	PCI/G	6.6	0.21	10/15/97	UNDER CONTROL

REPORT NUMBER: 44180

CEA
Analyst

Erin
Reviewer

BS
Team Leader

mag
QA Officer

5 of 21

10/15/97
Date

10/14/97
Date

10/20/97
Date

10/21/97
Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in
'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. I, pp. 19-20.

***** CST ANALYTICAL REPORT *****

Prepared by: ROBINSON on 4-Jun-1997

ANALYSIS: H-3 REQUEST NUMBER: 24683 MATRIX: W ANALYST: RICHARD ROBINSON PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

ANALYTICAL TECHNIQUE: LS ANALYTICAL PROCEDURE: NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSICHOMO	97.03201	96.	233.	PCI/L	5/27/97	
NANA KA	97.03202	235.	287.	PCI/L	5/27/97	
WEN POVI	97.03203	127.	326.	PCI/L	5/27/97	
PINDE	97.03204	255.	267.	PCI/L	5/27/97	

REPORT NUMBER: 43934 (continued)

Page: 02

***** CST QUALITY ASSURANCE REPORT *****

Prepared by: ROBINSON on 4-Jun-1997

REQUEST NUMBER: 24683 MATRIX: W ANALYST: RICHARD ROBINSON PROGRAM CODE: WE6G
 OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.35619	687.	320.	PCI/L	0.0		5/27/97	WARNING 2-3 SIG
00.35619	218.	282.	PCI/L	0.0		5/27/97	UNDER CONTROL
00.35621	12906.	561.	PCI/L	13624.	1362.	5/27/97	UNDER CONTROL
00.35621	13620.	623.	PCI/L	13624.	1362.	5/27/97	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
97.03828	15.833	0.628	NCI/L	15.98	0.59	5/27/97	UNDER CONTROL

REPORT NUMBER: 43934

Richard Robinson
 Analyst

Erin
 Reviewer

STG
 Team Leader

mag
 QA Officer

060577
 Date

6/26/97
 Date

6/30/97
 Date

6/30/97
 Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceding data was evaluated using the standard statistical criteria set forth in
 'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. 1, pp. 19-20.

***** CST ANALYTICAL REPORT *****

Prepared by: CEA on 5-Dec-1997

REQUEST NUMBER: 24684 MATRIX: BZ ANALYST: RICHARD PETERS PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYTICAL ANALYSIS TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSCHOMO	97.03205 AM-241	RAS	- 0.0006	0.0005	PCI/G	11/04/97	42%
NANA KA	97.03206 AM-241	RAS	0.0011	0.0004	PCI/G	11/04/97	81%
WEN POVI	97.03207 AM-241	RAS	0.0004	0.0003	PCI/G	11/04/97	75%
PINDE	97.03208 AM-241	RAS	0.0047	0.0016	PCI/G	11/04/97	83%

12 h

REPORT NUMBER: 44272 (continued)

***** CST QUALITY ASSURANCE REPORT *****

Prepared by: CEA on 5-Dec-1997

REQUEST NUMBER: 24684 MATRIX: BZ ANALYST: RICHARD PETERS PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

NOTEBOOK: PAGE:

SUMMARY OF TRACER RECOVERY IN CUSTOMER AND QA SAMPLES

CUSTOMER NUMBER	CST SAMPLE NUMBER	ANALYSIS	AMOUNT SPIKED	AMOUNT RECOVERED	UNITS	COLLECTION DATE	COMMENT
TSCHOMO	97.03205	AM-243T	1.95	0.819	PCI/SAMPLE	4/09/97	42%
NANA KA	97.03206	AM-243T	1.95	1.5795	PCI/SAMPLE	4/09/97	81%
WEN POVI	97.03207	AM-243T	1.95	1.4625	PCI/SAMPLE	4/09/97	75%
PINDE	97.03208	AM-243T	1.95	1.6185	PCI/SAMPLE	4/09/97	83%
00.36193	97.03817	AM-243T	0.973	1.0119	PCI/SAMPLE	4/09/97	104%

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

There were no open (non-blind) Quality Control materials run with the samples reported above for one of the following reasons:

- ☐ Only qualitative data requested
- ☒ Only Blind QC samples run with this sample batch.
- ☐ No QC samples run with this sample batch.
- ☐ No QC samples for this constituent and matrix type available within CST

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
97.03817	AM-241	4.455	0.3038	PCI/G	4.5	0.2	11/04/97	UNDER CONTROL

4 of 22

REPORT NUMBER: 44272

SEA
Analyst

Ery
Reviewer

BS
Team Leader

mag
QA Officer

12/8/97
Date

12/8/97
Date

12/8/97
Date

12/8/97
Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in
'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. 1, pp. 19-20.

***** CST ANALYTICAL REPORT *****

Prepared by: ERG

on 17-Nov-1997

ANALYSIS: SR-90 REQUEST NUMBER: 24684 MATRIX: BZ ANALYST: EDWARD GONZALES PROGRAM CODE: WE66

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

ANALYTICAL TECHNIQUE: LS ANALYTICAL PROCEDURE: NOTEBOOK: PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUMBER	SAMPLE NUMBER	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSCHOMO	97.03205	- 0.05	0.23	PCI/G	11/05/97	
NANA KA	97.03206	0.11	0.07	PCI/G	11/05/97	
WEN POVI	97.03207	0.32	0.2	PCI/G	11/05/97	
PINDE	97.03208	- 0.07	0.27	PCI/G	11/05/97	

***** CST QUALITY ASSURANCE REPORT *****

Prepared by: ERG

on 17-Nov-1997

REQUEST NUMBER: 24684 MATRIX: BZ ANALYST: EDWARD GONZALES

PROGRAM CODE: WE6G

OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCHSUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
97.03816	0.52	0.36	PCI/G	1.69	0.054	11/05/97	OUT OF CONTROL

The following analyst QC's have no CV data for comparison

CUSTOMER NUM	SAMPLE NUM	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
00.36592	00.36592	485.13	53.16	PCI/L	11/05/97	NO DATA AVAIL.

REPORT NUMBER: 44253

Eref
AnalystEref
ReviewerES
Team Leadermag
QA Officer11-17-97
Date11-17-97
Date11/17/97
Date11/18/97
Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. 1, pp. 19-20.

***** CST ANALYTICAL REPORT *****

Prepared by: MOLT

on 13-Jun-1997

REQUEST NUMBER: 24684

MATRIX: BZ

ANALYST: SAMMY GARCIA

PROGRAM CODE: WE6G

OWNER: Phillip R. Fresquez

GROUP: ESH-20

MAIL-STOP: M887

PHONE: 7-0815

NOTEBOOK:

PAGE:

CUSTOMER SAMPLES:

CUSTOMER NUM	SAMPLE NUM	ANALYSIS	ANALYTICAL TECHNIQUE	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	COMPLETION DATE	COMMENT
TSCHOMO	97.03205	CS-137	G	0.1	0.04	PCI/G	6/13/97	
NANA KA	97.03206	CS-137	G	0.11	0.04	PCI/G	6/13/97	
WEN POVI	97.03207	CS-137	G	0.04	0.05	PCI/G	6/13/97	
PINDE	97.03208	CS-137	G	0.17	0.26	PCI/G	6/13/97	

12 M

REPORT NUMBER: 43991 (continued)

***** CST QUALITY ASSURANCE REPORT *****

Prepared by: MDLT on 13-Jun-1997

REQUEST NUMBER: 24684 MATRIX: BZ ANALYST: SAMMY GARCIA PROGRAM CODE: WE6G
OWNER: Philip R. Fresquez GROUP: ESH-20 MAIL-STOP: M887 PHONE: 7-0815
NOTEBOOK: PAGE:

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
00.22784	CS-137	0.02	0.24	PCI/G	0.0		6/13/97	UNDER CONTROL
00.33376	CS-137	4.62	0.47	PCI/G	5.04	0.17	6/13/97	UNDER CONTROL

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

SAMPLE NUM	ANALYSIS	ANALYTICAL RESULT	ANALYTICAL UNCERTAINTY	UNITS	QC VALUE	QC UNCERTAINTY	COMPLETION DATE	COMMENT
97.03815	CS-137	33.1	2.8	PCI/G	33.37	1.1	6/13/97	UNDER CONTROL

REPORT NUMBER: 43991

Analyst	Reviewer	Team Leader	QA Officer
<u>6/13/97</u> Date	<u>6/13/97</u> Date	<u>6/13/97</u> Date	<u>6/13/97</u> Date

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1992,' LA-12790-MS, Vol. I, pp. 19-20.

CHAIN-OF-CUSTODY RECORD

Los Alamos

Los Alamos National Laboratory

Los Alamos, New Mexico 87545

Soils and Foodstuffs (7C20 WE6G) 4000

P.I.# (505) 667-0815

ESH-20 MS M887

12N

Project Name		Request the following analysis:		number of containers	Sample Location/Remarks
Date	Time	Sample Name/Number			
Santa Clara - Fish Samplers (signatures) Louis Horgan Phil Horgan May Mullen Pat Volano		3H			
3-19-97	11:00	Tsichomo	1	(10) composite fish 4th pond (top) (distill water)	
3-19-97	1:30	Nama Ka	1	(10) fish 3rd pond (distill water)	
3-20-97	10:30	Wen Povi and lake	1	(10) fish 2nd pond (distill water)	
3/20/97	2:00	Pinde Pinde	1	(10) fish 1st pond (Bottom) (distill water)	
Relinquished by: (signature)		Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time
20 March 97 1326			4/9/97 10:45
Relinquished by: (signature)		Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time
Relinquished by: (signature)		Date/Time	Received for Lab. by: (signature)	Date/Time	Remarks:

120

Los Alamos, New Mexico 87545

Soils and Foodstuffs (7C20 WE6G) 4000

P.I.# (505) 667-0815

ESH-20 MS M887

Project Name		Request the following analysis:		number of containers	Sample Location/Remarks
Date	Time	Sample Name/Number			
3-19-97	11:00	Tsichomo Tsichomo	1	(10) composite fish 4th pond (top) (ashed fish)	
3-19-97	1:30	Nano Ka	1	(10) fish 3rd pond	
3-19-97	10:30	Wen Povi 2nd take by	1	(10) fish 2nd pond	
3/20/97	2:00	Pinde Pinde	1	(10) fish 1st pond (Bottom)	

Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
<i>[Signature]</i>	20 March 97 1326	<i>[Signature]</i>	<i>[Signature]</i>	4/9/97 10:45	<i>[Signature]</i>
Relinquished by: (signature)	Date/Time	Received by: (signature)	Relinquished by: (signature)	Date/Time	Received by: (signature)
Relinquished by: (signature)	Date/Time	Received for Lab. by: (signature)	Date/Time	Remarks:	

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Report Number (14) LA--13441-MS

Publ. Date (11) 199804

Sponsor Code (18) DOE/HR; DOE/MA, XF

UC Category (19) UC-902; UC-903, DOE/ER

DOE