

Lockheed Environmental Systems & Technologies Co.
Lockheed Analytical Services
975 Kelly Johnson Drive Las Vegas, Nevada 89119-3705
Telephone 702-361-0220 800-582-7605 Facsimile 702-361-8146

LK6428
0045277

LOCKHEED MARTIN 

March 5, 1996

Ms. Joan Kessner
Bechtel Hanford, Inc.
P.O. Box 969
1022 Lee Boulevard
Richland, WA 99352



RE: Log-in No: L6428
Quotation No: Q400000-B
Document File No: 0215596
BHI Document Control No: 328
SDG No.: LK6428



The attached data report contains the analytical results of samples that were submitted to Lockheed Analytical Services on 15 February 1996.

The temperature of the cooler upon receipt was 2°C. Sample containers received agree with the chain-of-custody documentation. Sample containers were received intact. Samples were received in time to meet the analytical holding time requirements.

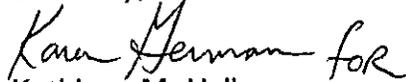
The case narratives included in the following attachments provide a detailed description of all events that occurred during sample preparation, analysis, and data review specific to the samples and analytical methods requested.

A list of data qualifiers, chain-of-custody forms, sample receiving checklist, and log-in report are also enclosed representing the samples received within this group.

If you have any questions concerning the analysis or the data please call Kathleen M. Hall at (509) 375-4741.

"I certify that this data package is in compliance with the SOW, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the Laboratory Manager or a designee, as verified by the following signature."

Sincerely,



Kathleen M. Hall

Client Services Representative

cc: Client Services
Document Control

003

**CASE NARRATIVE
RADIOCHEMICAL ANALYSES**

The routine calibration and quality control (QC) analyses performed for this batch include as applicable: instrument calibration, initial and continuing calibration verification, quench monitoring standards, instrument background analysis, method blanks, yield tracer, laboratory control samples, matrix spike samples, duplicate samples.

NOTE: Chemical recoveries and minimum detectable activities (MDAs) can be found on the preparation sheets and calculation sheets on the attached raw data for each method.

Holding Time Requirements

All holding times were met.

Gas Proportional Counter

Analytical Method Strontium-90

The strontium-90 analysis was performed using standard operating procedure, LAL-91-SOP-0196. The samples were analyzed in workgroup 34046. The instrument calibration verification met criteria. The method blank was within QC criteria. The laboratory control sample recovery was within QC criteria. The duplicate recoveries were within QC criteria. No re-analyses were performed.

Yvonne M. Jacoby
Prepared By

February 29, 1996
Date

Lockheed Analytical Services
DATA QUALIFIERS FOR RADIOCHEMICAL ANALYSES
[Revised 08/28/92]

For Use on the Analytical Data Reporting Forms	
B	Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or minimum detectable activity (MDA).
C	Presence of high TDS in sample required reduction of sample size which increased the MDA.
D	Constituent detected in the diluted sample.
E	Constituent concentration exceeded the calibration or attenuation curve range.
F	<i>For Alpha Spectrometry Only</i> -- FWHM exceeded acceptance limits.
H	Sample analysis performed outside of method-specified maximum holding time requirement.
Y	Chemical yield exceeded acceptance limits.
For Use on the QC Data Reporting Forms	
*	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
a¹	The spike recovery and/or RPD for matrix spike and duplicates cannot be evaluated due to insufficient spiking level compared to the elevated sample analyte concentration.
b¹	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

¹ Used as foot note designations on the QC summary form.

LOCKHEED ANALYTICAL SERVICES
 LOGIN CHAIN OF CUSTODY REPORT (ln01)
 Feb 15 1996, 10:53 am

Login Number: L6428
 Account: 596 Bechtel Hanford, Inc. * Richland, WA
 Project: BECHTEL-HANFORD Bechtel Hanford Project

Laboratory Sample Number	Client Sample Number	Collect Date	Receive Date	Due PR Date
L6428-1 temp 2 Location: 157 Water 1 S SCREENING	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
		Hold:11-AUG-96		
L6428-2 temp 2 Location: 157 Water 1 S SR-90 LAL-0196	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
		Hold:11-AUG-96		
L6428-3 temp 2 Location: 157	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
L6428-4 temp 2 Location: 157	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
L6428-5 temp 2 Location: 157	BOH6L5	13-FEB-96	15-FEB-96	01-MAR-96
L6428-6 Location:	REPORT TYPE	15-FEB-96	15-FEB-96	01-MAR-96
Water 1 S EDD - DISK DEL.				
Water 1 S RAD RPT TYPE 2				

Page 1

Signature: *[Handwritten Signature]*

Date: 2-15-96

0215596

Bechtel Hanford, Inc.

CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST

L6428

Data Turnaround

- Priority
- Normal

Collector <i>A. Rizzo / M. McElhorn</i>	Company Contact J.V. Borghese	Telephone (509) 373-4790
Project Designation 100-NR-2 Monthly Performance Monitoring - Feb.	Sampling Location 100 N	SAF No. B96-036
Ice Chest No. <i>6WS-056</i>	Field Logbook No. <i>EFL1058</i>	Method of Shipment Hand Delivered
Shipped To Lockheed	Offsite Property No. <i>W96-0-0640-29</i>	Bill of Lading/Air Bill No. <i>2904651285</i>

Possible Sample Hazards/Remarks	Preservation	HNO ₃	Cool 4°C				
	Type of Container	P/G	P/G				
	No. of Container(s)	4	1				
	Special Handling and/or Storage Maintain samples between 2°C and 6°C.	Volume	1L	20mL			

SAMPLE ANALYSIS

Sample No.	Matrix*	Date Sampled	Time Sampled				
BOH6L5	W	<i>2-13-96</i>	<i>1115</i>		X	X	

CHAIN OF POSSESSION	Sign/Print Names	SPECIAL INSTRUCTIONS
Relinquished By	Date/Time <i>2-14-96</i>	Received By <i>ER</i> Date/Time <i>0800</i>
<i>M. McElhorn</i>	<i>0800</i>	<i>Kee White</i> <i>B. Whitten</i> <i>2-14-96</i>
Relinquished By	Date/Time <i>0830</i>	Received By
<i>Kee White</i>	<i>2-14-96</i>	
Relinquished By	Date/Time	Received By
Relinquished By	Date/Time	Received By

- Matrix*
- S = Soil
 - SE = Sediment
 - SO = Solid
 - SL = Sludge
 - W = Water
 - O = Oil
 - A = Air
 - DS = Drum Solids
 - DL = Drum Liquids
 - T = Tissue
 - WI = Wipe
 - L = Liquid
 - V = Vegetation
 - X = Other

LABORATORY SECTION	Received By <i>A. McElhorn</i>	Title <i>Sample Custodian</i>	Date/Time <i>2-15-96/0900</i>
FINAL SAMPLE	Disposal Method	Disposed By	Date/Time

10/11/96

SAMPLE CHECK-IN LIST

Date/Time Received: 2-15-96/0900 SDG#: NH

Work Order Number: NH SAF #: B96-036

Shipping Container ID: GWS-056 Chain of Custody # NH

- 1. Custody Seals on shipping container intact? Yes No
- 2. Custody Seals dated and signed? Yes No
- 3. Sample temperature 2°C
- 4. Vermiculite/packing materials is Wet Dry
- 5. Each sample is in a plastic bag? Yes No
- 6. Sample holding times exceeded? Yes No

7. Samples have:
_____ tape _____ hazard labels
 custody seals appropriate sample labels

8. Samples are:
 in good condition _____ leaking
_____ broken _____ have air bubbles

9. Is the information on the COC and Sample bottles in agreement?
Yes No

Notes: _____

Sample Custodian/Laboratory: Amrill LAS Date: 2-15-96
Telephoned To: Kathleen Hall On 2-15-96 By Anthony Miller

MAR 5 1996

**Lockheed Analytical Services
Sample Receiving Checklist**

Client Name: Beechell-Hawford

Job No. LL 428

Cooler ID:

COOLER CONDITION UPON RECEIPT

Temperature of cooler upon receipt: 2°C

temperature of temp. blank upon receipt:

	Yes	No	* Comments/Discrepancies
custody seals intact	X		
chain of custody present	X		
blue ice (or equiv.) present/frozen	X		
rad survey completed	X		

SAMPLE CONDITION UPON RECEIPT

	Yes	No	* Comments/Discrepancies
all bottles labeled	X		
samples intact	X		
proper container used for sample type	X		
sample volume sufficient for analysis	X		
proper pres. indicated on the COC	X		
VOA's contain headspace			<u>NH</u>
are samples bi-phasic (if so, indicate sample ID'S):			<u>NH</u>

MISCELLANEOUS ITEMS

	Yes	No	* Comments/Discrepancies
samples with short holding times		X	
samples to subcontract		X	

ADDITIONAL COMMENTS/DISCREPANCIES

Completed by / date: [Signature] 2-15-96

Sent to the client (date/initials):

** Client's signature upon receipt:

Notes: * = contact the appropriate CSR of any discrepancies immediately upon receipt.

** = please review this information and return via facsimile to the appropriate CSR (702) 361-8146

021554

SAMPLE RESULT FORMS

LOCKHEED ANALYTICAL SERVICES

RAD DATA REPORT (ra01)

Bechtel Hanford, Inc. * Richland, WA

Bechtel Hanford Project (Project BECHTEL-HANFORD)

Client Sample ID: B0H6L5

LAL Sample ID: L6428-2

Date Collected: 13-FEB-96

Date Received: 15-FEB-96

Matrix: Water

Login Number: L6428

Constituent	Analyzed	Batch	Activity	Error	MDA	Dataqual	Units
Total radio-strontium	27-FEB-96	SR-90 LAL-0196_34046	373.	19.	1.0		pCi/L

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION LOG FOR STRONTIUM ANALYSIS

TOTAL RADIOSTRONTIUM - LAL-91-SOP-0196

Date Prep Started : 0-27-96
 WorkGroup : SR-90 LAL-0196 34046

Matrix : Water
 Prep Due Date : 02/27/96

CUSTOMER ID	PARENT LAL ID	NO	QC	CHILD LAL ID	ALIQOT VOLUME (g or L)	SR CARRIER (mL)	YTTRIUM SEP DATE	YTTRIUM SEP TIME	PLANCHET TARE WT (grams)	PLANCHET GROSS WT (grams)	* * *	RESIDUE WEIGHT (grams)	COMMENTS
L6428-2	34046DUP1	1	DUP1	34046-01	500 ml	0.5	2-27-96	18:20	6.85880	6.86856			
Lab Ctrl Sample	34046LCS1	2	LCS1	34046-02	↓	↓	↓	18:20	6.86980	6.87845			
Method Blank	34046MBB	3	MBB1	34046-03	↓	↓	↓	18:20	6.87470	6.88442			
B0H6L5	L6428-2	4	SMP1	34046-04	↓	↓	↓	18:20	6.83943	6.84896			
B0H0V4	L6496-7	5		34046-05	↓	↓	↓	18:20	6.84333	6.85310			
		6											
		7											
		8											
		9											
		10											
		11											
		12											
		13											
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		17											
		18											
		19											
		20											
		21											
		22											
		23											
		24											

Conc & Vol of Carrier : 0.01225g / 0.5ml ; 0.5ml
 Carrier Exp Date : 9-30-96
 Carrier ID# : 94-658-20

Act & Vol of LCS : 26.78 pCi/ml 1.0 ml
 LCS Ref Date : 4-1-94
 LCS ID# : 94-677-44-1

Prep Anlst : AW
 Start Date : 2-27-96
 Count Anlst : _____

Balance Number : 40020021 (✓)

Pipette Number : 139746 (✓)
134488 (✓)

Carrier and LCS added by : AW 2-27-96
 Witnessed by : SM 2-27-96

Comments :

810

Analyst : AW 2-27-96

Checked by : [Signature]

Cnt Rm Custody/Date : AW 2-27-96

LOCKHEED ANALYTICAL LABORATORY

SAMPLE PREPARATION LOG FOR STRONTIUM ANALYSIS TOTAL RADIOSTRONTIUM - LAL-91-SOP-0196

Date Prep Started : 2/27/96

Matrix : Water

WorkGroup : SR-90 LAL-0196 34046

Prep Due Date : 02/27/96

CUSTOMER ID	PARENT LAL ID	NO	QC	CHILD LAL ID	ALLOQUOT VOLUME (L)	SR CARRIER (mL)	YTTRIUM SEP DATE	YTTRIUM SEP TIME	PLANCHET TARE WT (grams)	PLANCHET GROSS WT (grams)	* RESIDUE WEIGHT (grams)	COMMENTS
L6428-2	34046DUP1	1	DUP1	34046-01	0.5	0.5	2/27/96	18:20	6.8588	6.86856	0.00976	
Lab Ctrl Sample	34046LCS1	2	LCS1	34046-02	0.5	0.5	2/27/96	18:20	6.8698	6.87845	0.00865	
Method Blank	34046MBB	3	MBB1	34046-03	0.5	0.5	2/27/96	18:20	6.8747	6.88442	0.00972	
BOH6L5	L6428-2	4	SMP1	34046-04	0.5	0.5	2/27/96	18:20	6.83943	6.84896	0.00953	
BOHOV4	L6496-7	5		34046-05	0.5	0.5	2/27/96	18:20	6.84333	6.85316	0.00983	
		6										
		7										
		8										
		9										
		10										
		11										
		12										
		13										
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		18										
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		21										
		22										
		23										
		24										
Conc&Vol of Carrier	24.50 mg/mL; 0.5 mL			Act & Vol of LCS	26.78 pCi/mL; 1.0 mL						Prep Anlst	AW
Carrier Exp Date	30-Sep-96			LCS Ref Date	01-Apr-94						Start Date	2/27/96
Carrier ID#	94-658-20			LCS ID#	94-677-44-1						Count Anlst	LV

Balance Number : 40020021 ()

Pipette Number : 139746 ()

Carrier and LCS added by: AW

()

134488 ()

Witnessed by : DSM 2/27/96

Comments :

019

Analyst : BY FOR AW
M.L. Smith

Checked by : [Signature]

Cnt Rm Custody/Date : _____

U.S. Environmental Protection Agency
Environmental Monitoring Systems Laboratory-Las Vegas
Nuclear Radiation Assessment Division

Calibration Certificate

Description

Principal radionuclide **Strontium-90** Half-life **28.6 years**

Nominal activity **27** nano curies

Nominal volume **5** ml in ampoule/bottle number **94003-1**

Measurement Activity of principal radionuclide

Activity per gram of this solution

5.40 nano curies of **Strontium-90**

at 0400 hours PST on **April 1, 1994**

Activity of daughter radionuclide

The principal activity was accompanied at the quoted time by

5.40 nanocuries Per gram

of the daughter nuclide **Yttrium-90**

Total mass of this solution

Approximately 5.0 grams

Method of measurement

The activity of the primary solution was measured by liquid scintillation counting.

The activity of the dilution was measured by liquid scintillation counting.

Useful Life

This radionuclide has decayed through **0.0** half lives since it was obtained by EMSL-LV

We recommend that this solution should not be used after

August 1994

This dilution was prepared for the 1994 ASTM Collaborative Study of a test method for the determination of Sr-90 in water.

Purity

The manufacturer states that activities other than that of the principal nuclide and of its daughter nuclides, if any, were estimated/known to be:

- (1) less than equal to % of the principal activity
- (2) less than equal to % of the principal activity
- (3) less than equal to % of the principal activity

The activity of impurity (1) is not (2) is not (3) is not included in the quoted figures of the principal activity.

Random Errors

The precision of this standard was such that the certified value of the radioactive concentration of the principal activity had a standard error (sm) not greater than $\pm 0.1\%$ (The 99.7% confidence limits are given by $t(sm)$ where t is obtained from the student t factor for the degree of freedom $(n-1)$).

The maximum uncertainty due to the assessable systematic errors (dilution, counting, and known uncertainty of the standard) is obtained by the separate arithmetic summation of the positive and negative systematic error $(+\delta - \delta')$. These have been estimated not to exceed

$+3.8\%$ or -3.8%

the overall uncertainty (often called accuracy) is an estimate of the possible divergence of the quoted result from the true value. It is a combination of random error $[t(sm)]$ at the 99.7% confidence limits and the worst case estimate of the systematic errors $(+\delta, -\delta')$. The overall uncertainty is therefore calculated on the basis of $+ [t(sm) + \delta], - [t(sm) + \delta]$ and is $+4.0\%$, -4.0% of the quoted radioactive concentration.

Decay Schemes

This standardization is based on the following assumptions of the principle nuclide, its daughter nuclides and impurities (no allowance for error in these assumptions or the assumption of quoted half-life have been included in the statement of accuracy above).

Strontium-90 decays 100 percent by beta emission to yttrium-90. Yttrium-90 also decays 100 percent by beta emission.

Chemical Composition of Solution

Carrier content per gram of solution:
30 micrograms strontium

Other components:
0.1 M HCl

Preservative:

Remarks

Date Certificate Prepared April 26, 1994
Approval Signature *Paul B. Fahn* 023

Sr-90

INITIAL STANDARD DILUTION RECORD

Standard Information:	
Isotopes: <u>Sr-90</u>	Vendor: <u>EPA</u>
Activity of Standard Received: <u>2.7×10^4 uCi</u>	Vendor I.D. #: <u>94003-1</u>
Weight of Standard Received (g): <u>50 g</u>	LAL I.D. #: <u>AC5281</u>
Standard Activity (pCi/g): <u>5.4×10^3 pCi/g</u>	NIST Traceable? <u>yes</u>
Half-life in Years or Days: <u>28.6 yrs</u>	Certificate #: <u>94003-1</u>
Reference Date: <u>4-1-1994</u>	Receiver's Name: <u>K. Free</u>
	Date Received: <u>5-3-94</u>

Primary Dilution	
Balance Verification?:	<u>yes</u>
Diluent Used:	<u>0.1 M HCl</u>
a: Decay Corrected Standard Activity (pCi/g):	<u>5.4×10^3 pCi/g</u>
b: Weight of the Source Transferred (g):	<u>4.9670 g</u>
c: Total diluted weight (g):	<u>49.91 g</u>
d: Total Diluted Volume (mL):	<u>50 mL</u>
e: Activity of Dilution by Weight (pCi/g) [a * b / c]:	<u>537.4 pCi/g</u>
f: Calculated Density of Solution (g/mL) [c / d]:	<u>0.9982 g/mL</u>
g: Activity of Dilution by Volume (pCi/mL) [e * f]:	<u>536.44 pCi/mL</u>
h. Dilution Logbook I.D. #:	<u>93-474-81-1 ⁷³⁻⁴⁷⁴⁻⁸²⁻¹ CP47/95</u>
Prepared By: <u>Ignes Wong</u>	Preparation Date: <u>6-15-94</u>
Reviewed By: <u>Joe Hutchison</u>	Review Date: <u>6/30/94</u>
Purity/Cross Check Performed By: _____	Check Date: _____

[Handwritten signature]

'024

SECONDARY/WORKING LEVEL STANDARD DILUTION RECORD

Dilution Source Information	
Isotope:	<u>Sr-90</u>
Ref. <u>4-1-94</u> Parent Barcode Number	<u>AC5281</u>
Vendor or Certificate I.D. # of Parent Standard:	<u>EPA 94003 - 1</u>
Diluted Source Logbook I.D. #:	<u>93-474 -82-1</u>
Balance Verification?:	<u>Yes</u>
Diluent Used:	<u>0.1 M HCl</u>

Dilution	
*Diluent:	<u>0.1 M HCl</u>
*Density of diluent (g/ml):	<u>N/A</u>
a: Parent Specific Activity:	<u>536.44 pCi/ml</u>
b: Amount of Source Transferred:	<u>5.0018</u> g
c: Total amount of Dilution:	<u>100.20</u> g
d: Total Volume of Dilution:	<u>N/A</u>
e: Activity of Dilution (a * b / c):	<u>N/A</u>
f: Activity of Dilution (a * b / d):	<u>26.78 pCi/ml</u>
Dilution Logbook I.D. #:	<u>94-677-44-1</u>
Prepared By: <u>Dynes Wong</u>	Preparation Date: <u>3-2-95</u>
Reviewed By: <u>Joe H. Hines</u>	Review Date: <u>3/3/95</u>
<small>*If the diluent remains unchanged from the diluent used for the dilution source, then a weight dilution of a volume unit source can be performed without a density conversion. If the diluent changes, a weighted proportion density conversion is necessary.</small>	

Signed

Date

Signed

Date

Dynes Wong 3-3-95 025

Strontium Carrier Standardization

Strontium Carrier (10 mg/mL):

Use commercially available 10,000 μg Sr/mL ICP Standard or equivalent. Alternately, Dissolve 24.16 g of $\text{Sr}(\text{NO}_3)_2$ in water and dilute to 1 L in a volumetric flask with water.

Perform calibration check on a 0.5 mL pipet and then carefully pipet 3 - 0.5 mL portions of the strontium carrier solution into separate cleaned dried and tared planchets. Dry the planchet under a drying lamp. Cool the planchets in a desiccator and weigh.

	Calib # 1	Calib # 2	Calib # 3
Carrier plus planchet wt. (mg)	6865.84	6562.93	6540.56
Tare wt. of planchet (mg)	6853.57	68 6550.76	6528.26 6528.26
Net wt. of carrier added (mg)	12.27	12.17	12.30

AVERAGE $\text{Sr}(\text{NO}_3)_2 \pm \text{STD DEV.} = \underline{12.25 \pm 0.0681}$ $\left(0.61225\text{g} \pm 0.0001\text{g} \right)$
per 0.5 mL

Expected mg of $\text{Sr}(\text{NO}_3)_2 = \text{cert. value} (\approx 10\text{mg of Sr/mL}) * 0.5 \text{ mL} * 2.41$

Within 3% of expected (12.08 mg/0.5 mL) value (yes/no) yes

Initial and Date: WL 10-5-95

94-658-20

Walter Lutz 10-11-95

Continued on Page _____

Read and Understood By

WL
Signed

10-4-95
Date

James Wany
Signed

1-16-96
Date



CERTIFICATE OF ANALYSIS

Catalog Number: PLSR2-3X Lot No. G3-153SR
 Element and Matrix: Sr/HNO₃/H₂O
 Starting Material: Strontium Carbonate SrCO₃
 Starting Material Lot Number: 05941D

Trace Metallic Impurities in the actual solution via ICP of the concentrate.

Element	PPM	Element	PPM	Element	PPM
Ag	<.05	Cu	<.05	P	<.05
Al	<.05	Fe	<.05	Pb	.06
As	<.05	Ga	<.05	Sb	<.10
B	<.05	In	<.05	Si	<.05
Ba	<.05	K	<.05	Sn	<.10
Be	<.05	Li	<.05	Ti	<.05
Bi	<.05	Mg	<.05	Tl	<.05
Ca	<.05	Mn	<.05	V	<.05
Cd	<.05	Mo	<.10	Zn	<.05
Co	<.05	Na	<.05	Zr	<.10
Cr	<.05	Ni	<.05		

Traceability Documentation For Solution Standard:

1. Classical Wet Assay: 10,050 ppm.

Titrimetry: EDTA titration using Methyl Thymol Blue as indicator. EDTA standardized against NIST Pb(NO₃)₂ SRM 928.

2. Instrumentation Analysis By Inductively Coupled Plasma Spectrometer[ICP]: 10,009 ppm via NIST SRM 3153a.

3. Balances are calibrated with NIST weight sets N.J. #92589 and #92550, according to NIST circular 547 3.4.3.

SPEX plasma solution standards are guaranteed stable and accurate to ± 0.5% of labeled concentration for one year from date of shipment. This value is the sum of cumulative errors associated with analytical determinations, pipetting and diluting to final volume. For these solutions we use high purity acids, 18 megohm double deionized water and triple rinsed bottles. All glassware used is class A.

Signed by: N. Kochidakota, Chemical Production Manager, Date: SEP 95



Printed on Recycled Paper