ENCLOSURE 1

CONSENT TO ASSIGNMENT

RELEASE

AND

NOVATION

For a valuable consideration, receipt of which is hereby acknowledged, the undersigned Selma Schulz, Walter M. Pointon and Fred H. Schulz, Trustees of the Estate of Edward F. Schulz, deceased, Lessors under that certain lease dated 1 March, 1957, covering real property situated in the City of Fontana, County of San Bernardino, State of California, more particularly described in Exhibit "A" attached hereto, do hereby consent to the assignment of said lease to Grand Central Rocket Co., a partnership composed of Charles E. Bartley and Grand Central Aircraft Co., to Grand Central Rocket Co., a California corporation, and do hereby release and forever discharge the said Grand Central Rocket Co., a partnership, from any and all liability thereunder upon the assumption of such liability by the said Grand Central Rocket Co., a California corporation.

Dated: 23 October, 1957

Fred H. Schulz

Selma Schulz

Walter M. Pointon Jr.

In consideration o the foregoing consent and release, the undersigned Grand Central Rocket Co., a California corporation, does hereby assume and agree to perform all of the liabilities and obligations of the lessee under the above-described lease.

Dated: 23 October, 1957

GRAND CENTRAL ROCKET CO.

By _____
President

SEAL By _____
Secretary

SEP-16-2003 10:25AM FROM-FIRST AMERICAN T TLE +9093348463 T-875 P.03/041 F-120

BOOK 5135 PAGE 510

STATE OF California
County of San Bernardino } ss.

On October 23, 19 57 before me, the undersigned, a Notary Public in and for said County and State, personally appeared Fred H. Schulz, Selma Schulz, and Walter M. Pointon, Sr., known to me to be the person S whose name S are subscribed to the within Instrument, and acknowledged to me that I they executed the same.

WITNESS my hand and official seal.

SEAL

Notary Public in and for said County and State.

My commission expires Feb. 22, 1959

ACKNOWLEDGMENT—GENERAL—WOLFORM FORM 231

STATE OF CALIFORNIA
COUNTY OF
San Bernardino } ss

On October 23, 1957 before me, the undersigned, a Notary Public in and for said County and State, personally appeared C. E. Bartley known to me to be the President, and H. Stickney known to me to be the Secretary of the Corporation that executed the within Instrument, known to me to be the persons who executed the within Instrument on behalf of the Corporation therein named, and acknowledged to me that such corporation executed the within Instrument pursuant to its by-laws or a resolution of its board of directors.

WITNESS my hand and official seal.

(Seal) Notary Public in and for said County and State.

My commission expires Feb. 22, 1959

Acknowledgment—Corp.—Wolform Form 2245

SEAL

L E A S E

THIS AGREEMENT, made and entered into as of the first day of March, 1957, in Fontana, San Bernardino County, California, by and between SELMA SCHULZ, WALTER M. POINTON and FRED H. SCHULZ, Trustees of the Estate of Edward F. Schulz, deceased, hereinafter called "Lessor", and BY Grand Central Aircraft Company, a California corporation having its principal place of business at Glendale in Los Angeles County, California, and Charles E. Bartley, of Redlands, San Bernardino County, California, partners, doing business as GRAND CENTRAL ROCKET COMPANY at Redlands, California, hereinafter called "Lessee",

W I T N E S S E T H :

1. That the Lessor, in consideration of the rents and covenants hereinafter agreed to be paid and performed, does hereby lease to said Lessee all of that certain real property northeast of Sierra and Highland Avenues, near Fontana, described as follows:

Portions of the Northwest Quarter of Section 28, and the Northeast Quarter of Section 29, Township 1 North, Range 5 West, San Bernardino Base and Meridian, described and bounded as follows:

Igloo A-3 and the land upon which it stands and the land around it and in front of it, to-wit: Beginning at a point in the west line of Section 28, which is 716.7 feet north of a 2-inch iron pipe at the southwest corner of said northwest quarter of Section 28; thence north 79° 43' 45" east 264.2 feet; thence north 36° 17' west 275 feet; thence south 79° 43' 45" west 101.3 feet to a point in the west line of said section 28; thence south 0° 33' 45" east 250.78 feet along the westerly line of said section 28 to the point of beginning, containing one acre, more or less.

The front portion of Igloo B-2 with the land in front of it which is necessary for ingress and egress, it being fully understood that only the front portion of said igloo is the property of the Schulz Estate and that the remainder thereof belongs to someone else.

Igloo B-3 and the land upon which it stands, bounded as follows: Beginning at the Northeast corner of said section 29; thence south 89° 36' 45" West a distance of 1106.9 feet; thence South 36° 17' East a distance of 1576.31 feet to the TRUE POINT OF BEGINNING: Thence South 79° 43' 15" West a distance of 185 feet; thence South 36° 17' East a distance of 275 feet to the gravel road south of said Igloo B-3; thence North 79° 43' 45" East along said gravel road a distance of 185 feet; thence North 36° 17' West a distance of 275 feet to the TRUE POINT OF BEGINNING.

Igloo C-2 and the land upon which it stands, bounded as follows: Beginning at the Northeast corner of said Section 29; thence South 33' 45" East along the easterly boundary of said section a distance of 798.17 feet; thence South 79° 43' 45" West a distance of 479.63 feet to the TRUE POINT OF BEGINNING: Thence South 79° 43' 15" West 185 feet; thence South 36° 17' East 275 feet to the gravel road south of said Igloo C-2, thence North 79° 43' 15" East along said road a distance of 185 feet; thence North 36° 17' West a distance of 275 feet to the TRUE POINT OF BEGINNING.

Igloo E-1 and the land upon which it stands, bounded as follows: Beginning at the northeast corner of Section 29; thence South 89° 36' 45" West along the northerly boundary of said section a distance of 1106.9 feet to the TRUE POINT OF BEGINNING: Thence South 36° 17' East to the oiled road south of said Igloo E-1; thence South 79° 43' 45" West along said road a distance of 185 feet; thence North 79° 43' 45" west to the northerly boundary of said section; thence North 89° 36' 45" East along said northerly boundary of said section to the TRUE POINT OF BEGINNING.

Together with the right to use for ingress and egress, in common with the Lessor and others, the existing access roads, and the right to grade, maintain and improve such roads to the entrances of said Igloos, and the right of way for utility poles, pipes and wires along the side of said existing access roads.

TO HAVE AND TO HOLD the above described premises unto said Lessee for the term of five (5) years, from March 1, 1957 to and including February 28, 1962, for a rental of $20,250.00,

payable $675.00 upon execution hereof and $337.50 on or before April 1, 1957 and $337.50 on or before the first day of each month thereafter until said rental shall have been paid in full.

2. And said Lessee does hereby covenant and agree that he will pay the rent above specified in the manner and at the times above set forth; that he will also pay and discharge as the same may become payable, all taxes and assessments which may be levied, assessed or imposed upon improvements now or hereafter to be erected by him upon the premises hereinabove described.

3. Lessee agrees that he will pay when due all charges for light, fuel and water or other public utility upon said property.

4. Lessee agrees that any construction done by him on said premises will be paid for immediately and no liens will be allowed to attach to said property; that any and all building done upon said premises will be done in a good and workmanlike manner and maintained and kept in good repair at the sole cost of Lessee; and Lessee further agrees that he will keep the premises within, around and in front of said igloos in good and usable condition.

5. Said premises are to be used for the manufacture of chemicals. Lessee hereby represents that he has applied to and obtained from the County authorities consent and permission to use the above described premises for the manufacture of chemicals (some of which classify technically as explosives), under formulas now and hereafter owned by Lessee.

6. Lessee agrees to use all reasonable precautions in the operation of such business and to indemnify and hold Lessor harmless from any damage or loss whatever by reason

of any suit or claim for injury to person or property incurred by any person, either on said premises or on any other property in the vicinity, growing out of the Lessee's said operations.

7. Lessee indemnifies and agrees to hold Lessor harmless from any damage or loss caused by explosion, fire, fumes or pollution of air, land, or water during the term hereof.

8. Lessee agrees that said premises shall not be used by Lessee or any one else during the term hereof, or any extension hereof, for any illegal or immoral purpose, or in any illegal or immoral manner, and possession of said premises by the said Lessee shall not be construed as conveying any title thereto or ownership thereof. All laws, ordinances, rules and regulations applicable to said use of said premises will be complied with by Lessee.

9. Lessee waives all rights under Section 1942 of the Civil Code of California and releases the Lessor from any and all damages which may be sustained by the Lessee or any other party during the time Lessee may be in possession of said premises.

10. At the expiration of the term of this lease, or the sooner termination thereof, the Lessee will peacefully quit and surrender possession of said premises in as good condition as reasonable use and wear thereof will permit. At Lessor's option, Lessee will either leave all buildings erected by him upon said leased premises in good and usable condition or remove said buildings and restore the premises to the original condition.

11. Should Lessor be compelled to commence or maintain an action at law to collect said rents, or any part thereof,

or to dispossess the Lessee, or to recover possession of said premises, or to otherwise enforce the terms and provisions of this agreement, the prevailing party in said action shall be entitled to recover all costs in connection therewith, including a reasonable attorney's fee.

12. Waiver by the Lessor of any covenant or condition herein contained shall not vitiate the same or any other covenant or condition contained therein.

13. Lessee is hereby given the option to extend the term of this lease for five (5) years, beginning March 1, 1962 and ending February 28, 1967, upon the same terms and provisions, said option to be exercised by Lessee by written notice to Lessor on or before February 1, 1962, together with payment of $337.50 in payment of the rent for the month ending February 28, 1967.

14. Any notice, demand, or communication under or in connection with this lease may be served upon the parties hereto by personal service or by mailing the same by registered mail in the United States Post Office, postage prepaid, addressed to the parties hereto as follows:

Trustees of the Estate of
Edward F. Schulz, Deceased
c/o Mildred Murphy
Attorney at Law
1102 State Building
Los Angeles 12, California

Grand Central Rocket Company
P.O. Box 111
Redlands, California

15. Lessee will not assign this lease, nor let nor underlet the whole or any part of the premises without the written consent of the Lessor. Any attempted transfer by operation of law, bankruptcy, or otherwise, without Lessor's consent, shall immediately terminate all of Lessee's interest in or to said leased premises.

16. Time is of the essence of this lease and all of its provisions.

IN WITNESS WHEREOF, the parties have hereunto set their hands the day and year first above written.

580

Selma Schulz
Selma Schulz

Walter M. Pointon
Walter M. Pointon

Fred H. Schulz
Fred H. Schulz
As Trustees of the Estate of Edward F. Schulz, deceased,
LESSOR.

GRAND CENTRAL AIRCRAFT CO. SEAL

By _____ President

By _____ Secretary

(Corporate Seal)

and

Charles E. Bartley
Charles E. Bartley

doing business as
GRAND CENTRAL ROCKET CO.,
LESSEE.

580

RECORDER'S REQUEST

ASSIGNEE

MAY 12 3 44 PM '60
BOOK 5135 PAGE 509
OFFICIAL RECORDS
SAN BERNARDINO COUNTY, CALIF.
RECORDER

John C. Barbour Jr. Inc.

EXHIBIT "A"

Description of real property under lease from Selma Schulz, Walter M. Pointon and Fred H. Schulz, Trustees of the Estate of Edward F. Schulz, deceased, dated 1 March 1957, in the City of Fontana, County of San Bernardino, State of California:

All of that certain real property northeast of Sierra and Highland Avenues, near Fontana, described as follows:

Portions of the NW¼ of Sec. 28, and the NE¼ of Sec. 29, T 1 N, R 5 W, SHB&M, described and bounded as follows:

Igloo A-3 and the land upon which it stands and the land around it and in front of it, to-wit: Beginning at a point in the west line of Sec. 28, which is 716.7' north of a 2" iron pipe at the southwest corner of said NW¼ of Sec. 28; thence N 79°43'45" E 264.2'; thence N 36°17' W 275'; thence S 79°43'45" W 101.3' to a point in the west line of said Sec. 28; thence S 0°33'45" E 250.78' along the westerly line of said Sec. 28 to the point of beginning, containing one acre, more or less.

The front portion of Igloo B-2 with the land in front of it which is necessary for ingress and egress, it being fully understood that only the front portion of said igloo is the property of the Schulz Estate and that the remainder thereof belongs to someone else.

Igloo B-3 and the land upon which it stands, bounded as follows: Beginning at the NE corner of said Sec. 29; thence S 89°36'45" W a distance of 1106.9'; thence S 36°17' E a distance of 1576.31' to the TRUE POINT OF BEGINNING: Thence S 79°43'15" W a distance of 185'; thence S 36°17' E a distance of 275' to the gravel road south of said Igloo B-3; thence N 79°43'45" E along said gravel road a distance of 185'; thence N 36°17' W a distance of 275' to the TRUE POINT OF BEGINNING.

Igloo C-2 and the land upon which it stands, bounded as follows: Beginning at the NE corner of said Sec. 29; thence S 33' 45" E along the easterly boundary of said section a distance of 798.17'; thence S 79°43'45" W a distance of 479.63' to the TRUE POINT OF BEGINNING: Thence S 79°43'15" W 185'; thence S 36° 17' E 275' to the gravel road south of said Igloo C-2, thence N 79°43'15" E along said road a distance of 185'; thence N 36°17' W a distance of 275' to the TRUE POINT OF BEGINNING.

Igloo E-1 and the land upon which it stands, bounded as follows: Beginning at the NE corner of Sec. 29; thence S 89°36'45" W along the northerly boundary of said section a distance of 1106.9' to the TRUE POINT OF BEGINNING: Thence S 36°17' E to the oiled road south of said Igloo E-1; thence S 79°43'45" W along said road a distance of 185'; thence N 79°43'45" W to the northerly boundary of said section; thence N 89°36'45" E along said northerly boundary of said section to the TRUE POINT OF BEGINNING.

Together with the right to use for ingress and egress, in common with the Lessor and others, the existing access roads, and the right to grade, maintain and improve such roads to the entrances of said Igloos, and the right of way for utility poles, pipes and wires along the side of said existing access roads.

SEP-16-2003 10:25AM FROM-FIRST AMERICAN TITLE +8093848453 T-876 P.033/041 F-120

ENCLOSURE 2

VENDOR'S COPY

U.S. GOV'T. CONT. NO. L-47211

CUSTOMER'S PURCHASE ORDER NO.

CLASS | CODE

PURCHASE ORDER

GRAND CENTRAL ROCKET CO.

BILLING ADDRESS
P. O. Box 111
Redlands, California

DELIVERY ADDRESS
Corner of Madeira Ave. and Bartley Blvd.
Mentone, California

Phone PYramid 4-6775

P. O. No. 09661-363

DATE 3/8/57

REQ. NO.	D.H. App.	Exec. App.
12290	DC	

TO West Coast Loading Corporation
P.O. Box 157
Rialto, California

SHIP TO GCRCo

VIA Our Pickup F.O.B. Rialto, Calif.

VENDORS PROMISED SHIPPING DATE Work completed TERMS Net 30 days

CONFIRMING TO: Mr. Hedding PHONE: VA 25289

PURCHASE FOR RESALE YES ☒ NO ☐

CALIF. RESALE NO. E-100847

CONFIRMING ☐
NON-CONFIRMING ☐

MARK FOR Mr. White

ITEM	QUAN.	UNIT	DESCRIPTION OF ARTICLE	UNIT PRICE	DISC.	NET AMOUNT
1	1750	lbs	Process Ammonium Perchlorate to specified callout for moisture content GCRCo. supplied material .03 o/o or less moisture content Invoice 154 3/8/57	$192.50/lot	net	

ACCOUNT DISTRIBUTION

ITEM		ITEM	
1	363-04-100		

GRAND CENTRAL ROCKET CO.
By G Morrison Buye
By G. Morrison/bb Purch. Agen

PACKING LIST MUST ACCOMPANY EACH CASE OR PARCEL, SHOWING OUR ORDER NUMBER, ITEM NUMBER, REQUISITION NUMBER AND A COMPLETE DESCRIPTION OF CONTENTS.

ACKNOWLEDGMENT NECESSARY.
THIS ORDER IS INEFFECTIVE UNTIL SELLER SHALL HAVE SUPPLIED BUYER WITH SIGNED ACKNOWLEDGMENT COPY HEREOF. NO REVISIONS OF THIS ORDER SHALL BE VALID UNLESS IN WRITING & SIGNED BY AUTHORIZED REPRESENTATIVE OF BUYER.

MAIL THREE INVOICES PROMPTLY AND FORWARD ON THE FIRST OF EACH MONTH A COMPLETE ITEMIZED STATEMENT SHOWING ALL OPEN AND UNADJUSTED ACCOUNTS.

THIS PURCHASE ORDER IS SUBJECT TO THE ABOVE INSTRUCTIONS AND THE TERMS AND CONDITIONS APPEARING ON THE REVERSE HEREOF.

BILLING INSTRUCTIONS

KWK 00796

1. Please show the number of this purchase order on all invoices, packing sheets, and bills of lading.
2. Send original and 2 copies of invoice promptly for each shipment.
3. Invoice each purchase order separately.
4. Render complete itemized statement monthly.
5. Mail invoices and statements TO ADDRESS INDICATED IN HEADING

GCR Co. Form No. A4-008 Rev. 9-56

Attention: Accounts Payable Dept.

WEST COAST LOADING CORP.

POST OFFICE BOX 157 Rialto CALIFORNIA

TELEPHONE FONTANA Va 25289

Invoice No. 154

Mar. 8, 1957

Grand Central Rocket Co.
Montana, Calif.

Drying 1,750# Ammonium Perchlorate - 192.50

Your P.O. 096-61-363

KWK 00795

VENDOR'S COPY

U.S. GOV'T. CONT. NO. AF-29(600)-1056

CUSTOMER'S PURCHASE ORDER NO.

CLASS | CODE

PURCHASE ORDER

GRAND CENTRAL ROCKET CO.

BILLING ADDRESS
P. O. Box 111
Redlands, California

DELIVERY ADDRESS
Corner of Madeira Ave.
and Bartley Blvd.
Mentone, California

Phone PYramid 4-6775

P. O. No. 09660-377

DATE 3/8/57

REQ. NO. 12662 | D.H. App. DC | Exec. App.

TO West Coast Loading Corporation
P.O. Box 157
Rialto, California

CONFIRMING TO: Mr. Hedding PHONE: VA 25289

SHIP TO GCRCo

VIA Pick-up F.O.B. Rialto, Calif.

VENDORS PROMISED SHIPPING DATE Work completed TERMS Net 30 days

PURCHASE FOR RESALE YES ☒ NO ☐ CALIF. RESALE NO. E-100847

CONFIRMING ☐
NON-CONFIRMING ☐

MARK FOR Mr. Hallas

ITEM	QUAN.	UNIT	DESCRIPTION OF ARTICLE	UNIT PRICE	DISC.	NET AMOUNT
1	11250	lbs	Process Ammonium Perchlorate to specified callout for moisture content. GCRCo supplied material .03 % or less moisture content Invoice 153 3/8/57	$1,235.00/lot		net

ACCOUNT DISTRIBUTION

ITEM		ITEM	
1	377-04-100		

GRAND CENTRAL ROCKET CO.

By G Morrison Buyer

By G. Morrison/bh Purch. Agent

PACKING LIST MUST ACCOMPANY EACH CASE OR PARCEL, SHOWING OUR ORDER NUMBER, ITEM NUMBER, REQUISITION NUMBER AND A COMPLETE DESCRIPTION OF CONTENTS.

ACKNOWLEDGMENT NECESSARY. THIS ORDER IS INEFFECTIVE UNTIL SELLER SHALL HAVE SUPPLIED BUYER WITH SIGNED ACKNOWLEDGMENT COPY HEREOF. NO REVISIONS OF THIS ORDER SHALL BE VALID UNLESS IN WRITING & SIGNED BY AUTHORIZED REPRESENTATIVE OF BUYER.

MAIL THREE INVOICES PROMPTLY AND FORWARD ON THE FIRST OF EACH MONTH A COMPLETE ITEMIZED STATEMENT SHOWING ALL OPEN AND UNADJUSTED ACCOUNTS.

THIS PURCHASE ORDER IS SUBJECT TO THE ABOVE INSTRUCTIONS AND THE TERMS AND CONDITIONS APPEARING ON THE REVERSE HEREOF.

BILLING INSTRUCTIONS

KWK 00794

1. Please show the number of this purchase order on all invoices, packing sheets, and bills of lading.
2. Send original and 2 copies of invoice promptly for each shipment.
3. Invoice each purchase order separately.
4. Render complete itemized statement monthly.
5. Mail invoices and statements TO ADDRESS INDICATED IN HEADING

GCR Co. Form No. A4-008 Rev. 9-56

Attention: Accounts Payable Dept.

WEST COAST LOADING CORP.

POST OFFICE BOX 157 Rialto, CALIFORNIA

TELEPHONE FONTANA Va 25289

Invoice No. 153

Mar. 8, 1957

Grand Central Rocket Co.
Montana, Calif.

Drying 11,250# Ammonium Perchlorate - 1,235.00

Your P.O. 096-60-377

KWK 00793

VENDOR'S COPY

U.S. GOVT. CONT. NO. AF04(045)-56

CUSTOMER'S PURCHASE ORDER NO. DN 56-7239

CLASS | CODE

PURCHASE ORDER

GRAND CENTRAL ROCKET CO.

BILLING ADDRESS
P. O. Box 111
Redlands, California

DELIVERY ADDRESS
Corner of Madeira Ave. and Bartley Blvd.
Mentone, California

Phone PYramid 4-6775

P. O. No. 09659-366

DATE 3-8-57

REQ. NO. 12269 | D.H. App. WS | Exec. App.

TO West Coast Loading Corporation
P. O. Box 157
Rialto, California

CONFIRMING TO: Mr. Hedding PHONE: VA 25289

SHIP TO GCRCo

VIA Our Pickup F.O.B. Rialto, Californ

VENDORS PROMISED SHIPPING DATE Work completed TERMS Net 30 days

PURCHASE FOR RESALE YES ☐ NO ☐

CALIF. RESALE NO. E-100847

CONFIRMING ☐
NON-CONFIRMING ☐

MARK FOR Mr. Green

ITEM	QUAN.	UNIT	DESCRIPTION OF ARTICLE	UNIT PRICE	DISC.	NET AMOUNT
1	7250	lb	Process Ammonium Perchlorate to specified callout for moisture content. GCRCo supplied material.	$796.00 lot/Net		
			NOTE: .03% or less moisture content			
			Invoice 152 3-8-57			

ACCOUNT DISTRIBUTION

ITEM		ITEM	
1	366-04-100		

GRAND CENTRAL ROCKET CO.

By G Morrison Buyer
G. Morrison/pt

By [signature] Purch. Agent

PACKING LIST MUST ACCOMPANY EACH CASE OR PARCEL, SHOWING OUR ORDER NUMBER, ITEM NUMBER, REQUISITION NUMBER AND A COMPLETE DESCRIPTION OF CONTENTS.

ACKNOWLEDGMENT NECESSARY.
THIS ORDER IS INEFFECTIVE UNTIL SELLER SHALL HAVE SUPPLIED BUYER WITH SIGNED ACKNOWLEDGMENT COPY HEREOF. NO REVISIONS OF THIS ORDER SHALL BE VALID UNLESS IN WRITING & SIGNED BY AUTHORIZED REPRESENTATIVE OF BUYER.

MAIL THREE INVOICES PROMPTLY AND FORWARD ON THE FIRST OF EACH MONTH A COMPLETE ITEMIZED STATEMENT SHOWING ALL OPEN AND UNADJUSTED ACCOUNTS.

THIS PURCHASE ORDER IS SUBJECT TO THE ABOVE INSTRUCTIONS AND THE TERMS AND CONDITIONS APPEARING ON THE REVERSE HEREOF.

BILLING INSTRUCTIONS

KWK 00792

1. Please show the number of this purchase order on all invoices, packing sheets, and bills of lading.
2. Send original and 2 copies of invoice promptly for each shipment.
3. Invoice each purchase order separately.
4. Render complete itemized statement monthly.
5. Mail invoices and statements

TO ADDRESS INDICATED IN HEADING

GCR Co. Form No. A4-008 Rev. 9-56

Attention: Accounts Payable Dept.

WEST COAST LOADING CORP.

POST OFFICE BOX 157 Rialto, CALIFORNIA

TELEPHONE FONTANA 7a 25289

Invoice No. 152

Mar. 8, 1957

Grand Central Rocket Co.
Mentone, Calif.

Drying 7,250# Ammonium Perchlorate - 796.00

Your P.O. 096-59-366

VENDOR'S COPY

U.S. GOV'T. CONT. NO. AF-33(600)-29268

CUSTOMER'S PURCHASE ORDER NO. 4-6688

CLASS | CODE

PURCHASE ORDER

GRAND CENTRAL ROCKET CO.

BILLING ADDRESS
P. O. Box 111
Redlands, California

DELIVERY ADDRESS
Corner of Madeira Ave.
and Bartley Blvd.
Mentone, California

Phone PYramid 4-6775

P. O. No. 09658-313

DATE 3-8-57

REQ. NO. 12283 | D.H. App. DC | Exec. App.

TO West Coast Loading Corporation
P. O. Box 157
Rialto, California

CONFIRMING TO: Mr. Hedding PHONE: VA 25289

SHIP TO GCRCo

VIA Our Pickup F.O.B. Rialto, Californi

VENDORS PROMISED SHIPPING DATE work completed TERMS Net 30 days

PURCHASE FOR RESALE YES ☐ NO ☐

CALIF. RESALE NO. E-100847

CONFIRMING ☐
NON-CONFIRMING ☐

MARK FOR Mr. Hickox

ITEM	QUAN.	UNIT	DESCRIPTION OF ARTICLE	UNIT PRICE	DISC.	NET AMOUNT
1	5250	lb	Process Ammonium Perchlorate to specified callout for moisture content. GCRCo supplied material.	$576.00 lot/Net		
			NOTE: .03% or less Moisture Content			
			Invoice #151 3/8/57			

ACCOUNT DISTRIBUTION

ITEM		ITEM	
1	313-04-102		

GRAND CENTRAL ROCKET CO.

By G. Morrison Buyer
G. Morrison/pt

By [illegible] Purch. Agent

PACKING LIST MUST ACCOMPANY EACH CASE OR PARCEL, SHOWING OUR ORDER NUMBER, ITEM NUMBER, REQUISITION NUMBER AND A COMPLETE DESCRIPTION OF CONTENTS.

ACKNOWLEDGMENT NECESSARY.
THIS ORDER IS INEFFECTIVE UNTIL SELLER SHALL HAVE SUPPLIED BUYER WITH SIGNED ACKNOWLEDGMENT COPY HEREOF. NO REVISIONS OF THIS ORDER SHALL BE VALID UNLESS IN WRITING & SIGNED BY AUTHORIZED REPRESENTATIVE OF BUYER.

MAIL THREE INVOICES PROMPTLY AND FORWARD ON THE FIRST OF EACH MONTH A COMPLETE ITEMIZED STATEMENT SHOWING ALL OPEN AND UNADJUSTED ACCOUNTS.

THIS PURCHASE ORDER IS SUBJECT TO THE ABOVE INSTRUCTIONS AND THE TERMS AND CONDITIONS APPEARING ON THE REVERSE HEREOF.

BILLING INSTRUCTIONS

KWK 00790

1. Please show the number of this purchase order on all invoices, packing sheets, and bills of lading.
2. Send original and 2 copies of invoice promptly for each shipment.
3. Invoice each purchase order separately.
4. Render complete itemized statement monthly.
5. Mail invoices and statements TO ADDRESS INDICATED IN HEADING

GCR Co. Form No. A4-008 Rev. 9-56

Attention: Accounts Payable Dept.

WEST COAST LOADING CORP.

157 Rialto
POST OFFICE BOX [redacted], CALIFORNIA

TELEPHONE FONTANA xx Va 25289

Invoice No. 151

Mar. 8, 1957

Grand Central Rocket Co.
Montesso, Calif.

Drying 5,250# Ammonium Perchlorate - 576.00

Your P. O. 096-58-313

KWK 00789

VENDOR'S COPY

U.S. GOVT. CONT. NO. AF-33(600)-27591

CUSTOMER'S PURCHASE ORDER NO. 4-8312

CLASS | CODE

PURCHASE ORDER

GRAND CENTRAL ROCKET CO.

BILLING ADDRESS
P. O. Box 111
Redlands, California

DELIVERY ADDRESS
Corner of Madeira Ave.
and Bartley Blvd.
Mentone, California

Phone PYromid 4-6775

P. O. No. 09657-319

DATE 3-6-57

REQ. NO. 12284 | D.H. App. DS | Exec. App.

TO West Coast Loading Corporation
P. O. Box 157
Rialto, California

CONFIRMING TO: Mr. Hedding PHONE: VA 25289

SHIP TO GCRCo

VIA Our Pickup F.O.B. Rialto, California

VENDORS PROMISED SHIPPING DATE Work completed TERMS Net 30 days

PURCHASE FOR RESALE YES ☐ NO ☐

CALIF. RESALE NO. E-100847

CONFIRMING ☐
NON-CONFIRMING ☐

MARK FOR Mr. Hickox

ITEM	QUAN.	UNIT	DESCRIPTION OF ARTICLE	UNIT PRICE	DISC.	NET AMOUNT
1	12250	lb	Process Ammonium Perchlorate to specified callout for moisture content. GCRCo supplied material	$1347.00 lot	/Net	
			NOTE: .03% or less Moisture Content			
			Invoice # 150 3-13-57			

ACCOUNT DISTRIBUTION

ITEM		ITEM	
1	319-04-100		

GRAND CENTRAL ROCKET CO.
By G. Morrison Buye
By G. Morrison/pt Purch. Agen

PACKING LIST MUST ACCOMPANY EACH CASE OR PARCEL, SHOWING OUR ORDER NUMBER, ITEM NUMBER, REQUISITION NUMBER AND A COMPLETE DESCRIPTION OF CONTENTS.

ACKNOWLEDGMENT NECESSARY.
THIS ORDER IS INEFFECTIVE UNTIL SELLER SHALL HAVE SUPPLIED BUYER WITH SIGNED ACKNOWLEDGMENT COPY HEREOF. NO REVISIONS OF THIS ORDER SHALL BE VALID UNLESS IN WRITING & SIGNED BY AUTHORIZED REPRESENTATIVE OF BUYER.

MAIL THREE INVOICES PROMPTLY AND FORWARD ON THE FIRST OF EACH MONTH A COMPLETE ITEMIZED STATEMENT SHOWING ALL OPEN AND UNADJUSTED ACCOUNTS.

THIS PURCHASE ORDER IS SUBJECT TO THE ABOVE INSTRUCTIONS AND THE TERMS AND CONDITIONS APPEARING ON THE REVERSE HEREOF.

BILLING INSTRUCTIONS

KWK 00788

1. Please show the number of this purchase order on all invoices, packing sheets, and bills of lading.
2. Send original and 2 copies of invoice promptly for each shipment.
3. Invoice each purchase order separately.
4. Render complete itemized statement monthly.
5. Mail invoices and statements TO ADDRESS INDICATED IN HEADING

GCR Co. Form No. A4-008 Rev. 9-56

Attention: Accounts Payable Dept.

WEST COAST LOADING CORP.

~~POST OFFICE BOX 326 FONTANA, CALIFORNIA~~
NEW ADDRESS
TELEPHONE FONTANA ~~xxx~~ Va 25289 P.O. BOX 157, RIALTO, CALIFORNIA

Invoice No. 150

Mar. 8, 1957

Grand Central Rocket Co.
Montana, Calif.

Drying 12,250# Ammonium Perchlorate - 1,347.00

Your P. O. 096-57-319

KWK 00787

VENDOR'S COPY

U.S. GOV'T. CONT. NO. Nonr-1817(00)

CUSTOMER'S PURCHASE ORDER NO. 56-3509-CP

CLASS | CODE

PURCHASE ORDER

GRAND CENTRAL ROCKET CO.

BILLING ADDRESS
P. O. Box 111
Redlands, California

DELIVERY ADDRESS
Corner of Madeira Ave.
and Bartley Blvd.
Mentone, California

Phone PYramid 4-6775

P. O. No. 09656-350

DATE 3-8-57

REQ. NO. 13120 | D.H. App. DC | Exec. App.

TO
West Coast Loading Corporation
P. O. Box 157
Rialto, California

SHIP TO GCRCo

VIA Our Pickup F.O.B. Rialto, Calif

VENDORS PROMISED SHIPPING DATE Work Completed TERMS Net 30 days

CONFIRMING TO: Mr. Hedding PHONE: VA 25289

PURCHASE FOR RESALE YES ☒ NO ☐ CALIF. RESALE NO. E-100847

CONFIRMING ☒
NON-CONFIRMING ☐

MARK FOR Mr. Hickox

ITEM	QUAN.	UNIT	DESCRIPTION OF ARTICLE	UNIT PRICE	DISC.	NET AMOUNT
1	750	lb	Process Ammonium Perchlorate to specified callout for moisture content. GCRCo supplied material.	$82.50 lot	Net	
			NOTE: .03% or less Moisture Content			
			Invoice # 149 3-8-57			

ACCOUNT DISTRIBUTION

ITEM		ITEM	
1	350-04-101		

GRAND CENTRAL ROCKET CO.
By G Morrison Buyer
By G. Morrison/pt Purch. Agent

PACKING LIST MUST ACCOMPANY EACH CASE OR PARCEL, SHOWING OUR ORDER NUMBER, ITEM NUMBER, REQUISITION NUMBER AND A COMPLETE DESCRIPTION OF CONTENTS.

ACKNOWLEDGMENT NECESSARY.
THIS ORDER IS INEFFECTIVE UNTIL SELLER SHALL HAVE SUPPLIED BUYER WITH SIGNED ACKNOWLEDGMENT COPY HEREOF. NO REVISIONS OF THIS ORDER SHALL BE VALID UNLESS IN WRITING & SIGNED BY AUTHORIZED REPRESENTATIVE OF BUYER.

MAIL THREE INVOICES PROMPTLY AND FORWARD ON THE FIRST OF EACH MONTH A COMPLETE ITEMIZED STATEMENT SHOWING ALL OPEN AND UNADJUSTED ACCOUNTS.

THIS PURCHASE ORDER IS SUBJECT TO THE ABOVE INSTRUCTIONS AND THE TERMS AND CONDITIONS APPEARING ON THE REVERSE HEREOF.

BILLING INSTRUCTIONS

KWK 00786

1. Please show the number of this purchase order on all invoices, packing sheets, and bills of lading.
2. Send original and 2 copies of invoice promptly for each shipment.
3. Invoice each purchase order separately.
4. Render complete itemized statement monthly.
5. Mail invoices and statements TO ADDRESS INDICATED IN HEADING

Attention: Accounts Payable Dept.

GCRC Form No. A4-008 Rev. 9-56

WEST COAST LOADING CORP.

157 Rialto
POST OFFICE BOX 378 FONTANA, CALIFORNIA

TELEPHONE FONTANA Va 25289

Invoice No. 149

Mar. 8, 1957

Grand Central Rocket Co.
Mentone, Calif.

Drying 750# Ammonium Perchlorate	-	82.50

Your P.O. 096-56-350

KWK 00785

VENDOR'S COPY

U.S. GOV'T. CONT. NO. DA-04-495-ORD-684

CUSTOMER'S PURCHASE ORDER NO.

CLASS | CODE

PURCHASE ORDER

GRAND CENTRAL ROCKET CO.

BILLING ADDRESS
P. O. Box 111
Redlands, California

DELIVERY ADDRESS
Corner of Madeira Ave. and Bartley Blvd.
Mentone, California

Phone PYramid 4-6775 3-2211

P. O. No. 09174-322

DATE 3-8-57

REQ. NO. 12258 | D.H. App. HS | Exec. App.

TO West Coast Loading Corporation
P. O. Box 157
Rialto, California

CONFIRMING TO: Mr. Heading PHONE: VA 25289

SHIP TO GCRCo

VIA Our Pickup F.O.B. Rialto, California

VENDORS PROMISED SHIPPING DATE Work completed TERMS Net 30 days

PURCHASE FOR RESALE YES ☐ NO ☐

CALIF. RESALE NO. E-100847

CONFIRMING ☒
NON-CONFIRMING ☐

MARK FOR Mr. de Martinis

ITEM	QUAN.	UNIT	DESCRIPTION OF ARTICLE	UNIT PRICE	DISC.	NET AMOUNT
1	4750	lb	Process Ammonium Perchlorate to specified callout for moisture content. GCRCo supplied material.	$521.00 lot	/Net	
			Note: .03% or less moisture content			
			Invoice # 148 3-8-57			

ACCOUNT DISTRIBUTION

ITEM		ITEM	
1	322-04-103		

GRAND CENTRAL ROCKET CO.
By G Morrison Buyer
By G Morrison/ad Purch. Agent

PACKING LIST MUST ACCOMPANY EACH CASE OR PARCEL, SHOWING OUR ORDER NUMBER, ITEM NUMBER, REQUISITION NUMBER AND A COMPLETE DESCRIPTION OF CONTENTS.

ACKNOWLEDGMENT NECESSARY.
THIS ORDER IS INEFFECTIVE UNTIL SELLER SHALL HAVE SUPPLIED BUYER WITH SIGNED ACKNOWLEDGMENT COPY HEREOF. NO REVISIONS OF THIS ORDER SHALL BE VALID UNLESS IN WRITING & SIGNED BY AUTHORIZED REPRESENTATIVE OF BUYER.

MAIL THREE INVOICES PROMPTLY AND FORWARD ON THE FIRST OF EACH MONTH A COMPLETE ITEMIZED STATEMENT SHOWING ALL OPEN AND UNADJUSTED ACCOUNTS.

THIS PURCHASE ORDER IS SUBJECT TO THE ABOVE INSTRUCTIONS AND THE TERMS AND CONDITIONS APPEARING ON THE REVERSE HEREOF.

BILLING INSTRUCTIONS

KWK 00784

1. Please show the number of this purchase order on all invoices, packing sheets, and bills of lading.
2. Send original and 2 copies of invoice promptly for each shipment.
3. Invoice each purchase order separately.
4. Render complete itemized statement monthly.
5. Mail invoices and statements TO ADDRESS INDICATED IN HEADING

GCR Co. Form No. A4-008 Rev. 9-56

Attention: Accounts Payable Dept.

ENCLOSURE 3

Response of Lockheed Corporation
To EPA's Information Request

Lockheed Corporation, a Delaware Corporation, makes this response to the Environmental Protection Agency's ("EPA") Information Request, pursuant to CERCLA section 104(e), 42 U.S.C. § 9604(e), regarding the former Lockheed Propulsion Company ("LPC") plant (the "facility") at 1500 Crafton Avenue, Redlands California. This response supplements the prior response of Lockheed Corporation to this Information Request, dated January 4, 1994.

As is evident from the nature and volume of material produced in response to EPA's request, Lockheed has made a diligent and thorough effort to respond. To Lockheed's knowledge this response is complete. However, several factors have impeded Lockheed's ability to identify, locate and procure all relevant information. First, operations at the former LPC facility in Redlands began approximately 40 years ago and ended approximately 20 years ago. Because of the lengthy passage of time, it is very difficult to identify records responsive to EPA's request, and to locate and contact persons familiar with this subject matter. Second, Lockheed has a systematic records retention and destruction system and does not keep all of its records for all time. Finally, the Northridge earthquake on January 17, 1994, resulted in a significant and lengthy disruption in operations at Lockheed's Corporate Records Center -- Rye Canyon facility, located in Valencia, California. This disruption has made it impossible to determine whether all relevant documents have been accessed, although Lockheed believes they have. Consequently, Lockheed cannot presently certify that this response is complete. Lockheed's investigation of the former LPC facility is continuing. If additional responsive information is identified, it will be provided to EPA.

Future correspondence regarding this matter should be directed to :

James R. Buckley
Corporate Counsel
Lockheed Corporation
4500 Park Granada Blvd.
Calabasas, CA 91399-0410

DATED: March 7, 1994

LOCKHEED CORPORATION

By: William R. Sorenson
Vice President, Operations

58062

Gerald Opplinger
400 Rio Vista Lane
Merritt Island, FL 32952

W. F. Fuller
807 Volunteer Drive
Tuscumbia, AL 35674

J.H. Bonin
1257 Sargent Drive
Sunnyvale, CA 94807

Request No. 3.

Please provide copies of any and all deeds, leases, rental agreements, or other documents by and between LPC or Lockheed Corporation or any of its predecessors or subsidiaries and the City of Redlands relating to the Facility.

Response

Copies of all identified deeds, leases and rental agreements between LPC and the City of Redlands are enclosed as Exhibit A. Despite diligent efforts, Lockheed has not located copies of such documents other than those produced herein. If further investigation produces records responsive to this request, Lockheed will provide those records to EPA.

Request No. 4.

Describe the nature of the corporate relationship that currently exists or that existed at any time or times in the past between LPC and Lockheed Corporation or any of its predecessors or subsidiaries (e.g., parent-subsidiary, division, branch, and shared officers or directors), including Lockheed Aircraft Corporation.

Response

Lockheed Aircraft Corporation (LAC) acquired 50 percent of the shares of Grand Central Rocket Company (GCRC) in February 1960, and the remaining 50 percent in August 1961. The name of GCRC was changed to Lockheed Propulsion Company in October 1961. LPC merged with LAC in February 1963, and became a division of LAC. LAC changed its name to Lockheed Corporation in 1977.

including Lockheed Aircraft Corporation acquired some of all of the stock of Grand Central Rocket Company.

Response

See enclosed Exhibit D. Despite diligent efforts, Lockheed has not located copies of such agreements others than those produced herein. If further investigation produces records responsive to this request, Lockheed will provide those records to EPA.

Request No. 8.

Attached is a scaled map of the facility as it existed during the dates of operation of LPC. Please label the structures and features shown on the map, giving the name and or building number of each structure, and on separate sheets, provide the following information for each structure or feature:

Response

Enclosed as Exhibit E are facility maps for February 1962 and November 1968. The 1962 map identifies all structures by both number and name, while the 1968 map identifies all structures by number only. Incorporated in this response by reference are Exhibits B and E in Lockheed's previous response to this information request dated January 4, 1994. These exhibits are facility maps dated 1960, 1961, 1962 and 1974. A copy of a report entitled "Ranking of Potential Sources of TCE Contamination" was included as Exhibit F to Lockheed's January 4, 1994, response to this Information Request, and is incorporated by reference in this response. This report contains a list of all identified and known structures by both name and structure number. This report also attempts to identify the known or suspected operations which occurred at each structure. Finally, also enclosed is a historical aerial photographic analysis of the Crafton-Redlands area. This report was originally to have been included in Lockheed's January 4, 1994 response as Exhibit I, but duplicates of this report were unavailable at that time. This report is enclosed and labelled as "Exhibit I, January 4, 1994 Response." In its original form, this report included aerial photographic analyses of areas not related to the former LPC facility or the Crafton-Redlands area. These analyses are not responsive to this Information Request and are not included in this Exhibit.

Specific responses to each subsection of request number 8 are set forth below.

To the extent that this response is not fully responsive to this request, Lockheed has been unable to identify further information despite diligent efforts. If further investigation

Request 8.e.

Describe the use for each building or structure, indicating what was produced or what processes occurred within the building or structure;

Response

See the general response to this request, above.

Request 8.f.

Any and all additions, demolitions, or changes of any kind to physical structures on, under, or about the facility, or to the property itself (e.g., excavation work) and state the dates on which such changes occurred; and

Response

Lockheed objects to this request on the ground that it is overbroad and burdensome, and, as to the majority of the information sought by this request, does not call for the provision of information which is required pursuant to CERCLA section 104(e), 42 U.S.C. § 9604(e). It is not practicable to attempt to identify all of the requested information for the former LPC facility due to the very large number of structures which existed and to the lengthy duration of the operations at this facility. Subject to this objection, Lockheed provides the following response: Lockheed believes the detailed facility maps provided with this response constitute an accurate historical perspective of the property and structures at the former LPC facility.

Request 8.g.

Any catch basins, ground water recharge basins, water storage basins, or any other similar facility for capturing, storing, containing, and or recharging water.

Response

See the general response to this request, above.

Request No. 9.

Did you ever transport to the facility or use, purchase, generate, store, treat, dispose, or otherwise handle at the facility any hazardous substances? If the answer to this question

However, it cannot be determined that the list of substances identified by Lockheed is an exhaustive list of all hazardous substances used in production processes at the former LPC facility.

The following is a list of the hazardous substances identified by Lockheed that were used in LPC production processes. Unless otherwise indicated below, the requested chemical data and an Material Safety Data Sheet ("MSDS") for each chemical are enclosed as Exhibit G.

A. Solvents

1. Chlorothene (1,1,1-Trichloroethane)
2. Methylene chloride
3. Delchem 2236A (data and MSDS not available)
4. Freon TF
5. Methyl Ethyl Ketone (MEK)
6. Trichloroethylene (Blacosolv)
7. Isopropyl Alcohol

B. Propellant Components

1. Ammonium perchlorate
2. Iron Oxides (MSDS not available)
3. Aluminum (powdered) (MSDS not available)
4. N-Butyl-Ferrocene (n-BF) (data and MSDS not available)
5. Ammonium sulfate (MSDS not available)
6. PBAN (MSDS not available)
7. DOZ (data and MSDS not available)

C. Insulation Material Components

1. Epcon 828
2. LP 33 (data and MSDS not available)
3. Epcon curing agent
4. Asbestos
5. Carbon Black
6. Diammonium phosphate

D. Nitrasol Chemicals

1. HMX
2. DEGDN
3. PN (MSDS not available)
4. TMETN

Manufacturing Process Standard," dated November 1, 1962, enclosed as Exhibit H. Solvent and propellant residue was scraped out of the ponds, placed in wax cartons and burned. Waste solvents placed in drums were either burned at the Redlands facility or trucked to LPC's former Portrero facility and burned.

Request 9.e.

The time period during which each such hazardous substance was transported, used, purchased, generated, stored, treated, disposed, or otherwise handled by you;

Response

Despite diligent efforts, Lockheed has identified no information which specifically identifies the period of time each substance was used at the facility. However, it is reasonable to assume that such substances were used at the facility during the period active solid rocket propellant research, production and testing took place at the facility, from approximately 1954 to 1974.

Request 9.f.

Where each such hazardous substance was used, purchased, generated, stored, treated, disposed, or otherwise handled by you, describing the location(s) and providing a map or diagram of such location(s). Location information should include, but is not limited to, information pertaining to tanks, ponds, treatment facilities, and other units where hazardous substances were used, generated, stored, treated or disposed, but which may no longer exist;

Response

See Exhibit F of Lockheed's January 4, 1994, response, entitled "Ranking of Potential Sources of TCE Contamination," for a description of locations where hazardous substances were known or suspected to have been generated, used, stored, treated, disposed or otherwise handled. As indicated in the response to request 9.c., Lockheed has not located any information regarding the supplier of the identified substances, including where such substances were purchased.

Request 9.g.

The persons who transported and/or disposed of each such hazardous substance. If disposal at some location other than the facility occurred, provide a detailed description, including copies

g. Any and all investigations of the circumstances, nature, extent, or location of each such release, including the results of any soil, water (ground and surface), or air testing that was undertaken;

h. Whether any report(s) of any such release(s) was (were) made to any public agency, and the content of that (those) report(s);

i. All persons with information relating to subparts a. through h. of this Question.

Response

Lockheed has no information regarding reported or documented releases of hazardous substances from the former LPC facility which impacted subsurface soil or groundwater. Lockheed has information regarding the former LPC facility's operations which can be expected to have resulted in a release of hazardous substances to the air or to surface soils. However, recent environmental investigations in and around the facility indicate that such expected releases did not impact subsurface soils or groundwater.

A waste disposal practice at the former LPC facility which can be expected to have resulted in a release of hazardous substances to the environment was the discharge of waste solvents to concrete-lined evaporation ponds, described above. This method of disposal can be expected to have resulted in the release of evaporated solvent vapors to the air. It is not known when this disposal practice was first implemented, although evaporation ponds appear on facility maps as early 1960. The quantity of solvents discharged to evaporation ponds is also unknown. There are no known releases of solvents from evaporation ponds to soil, surface water or ground water.

Another operation of the former LPC facility which can be expected to have resulted in a release of hazardous substances was the burning of rocket propellant wastes in an area identified as the "burn pit." Lockheed has been informed that rocket propellant wastes, some of which may have absorbed liquid solvents, were placed in the burn pit and ignited. Efforts to procure documentation of this operation are continuing. Lockheed will provide such documentation when it has been procured. This operation can be expected to have resulted in releases to the air and possibly to the surface soil. It is not known when this disposal practice was first implemented. Lockheed believes that this waste disposal practice ceased in approximately 1972. Correspondence regarding LPC's desire to replace open burning with controlled hazardous waste incineration, dating from November 1971 to March 1972, is enclosed as Exhibit I. The quantity of wastes disposed at the burn pit is unknown. Recent surface and subsurface

Request 11.c.

Whether the storage basin, disposal system, floor drain, sump, or dry well was connected to pipes;

Response

Despite diligent efforts, Lockheed has not located information responsive to this request. If further investigation produces information responsive to this request, Lockheed will provide such information to EPA.

Request 11.d.

Where such pipes are or were located, describing the location(s) and providing a map or diagram of such location(s);

Response

See response to request 11.c.

Request 11.e.

When such pipes were installed; and

Response

See response to request 11.c.

Request 11.f.

How and when such pipes were replaced, repaired, or otherwise changed.

Response

See response to request 11.c.

Request No. 12.

At the time you acquired or leased the facility, did you know or have reason to know that any hazardous substance was disposed of on, in, or at the facility? Describe all investigations of the facility that you took prior to acquiring or leasing the facility, and all of the facts on which you base the answer to this Question.

Exhibits and Attachments

Exhibit A	Leases between City of Redlands and LPC; Response to Request No. 3
Exhibit B	Corporate structure charts; Response to Request No. 5
Exhibit C	Lockheed Articles of Incorporation and Bylaws; Response to Request No. 6
Exhibit D	Grand Central Rocket Company purchase agreements; Response to Request No. 7
Exhibit E	LPC facility maps; Response to Request No.8
Exhibit F	LPC Memorandum re: disposal of solvents by research personnel, dated June 21, 1962; Response to Request 9.b.
Exhibit G	Chemical data and MSDS; Response to Request No. 9.b.
Exhibit H	LPC Memorandum regarding degreasing metal parts; Response to Request 9.d.
Exhibit I	LPC Correspondence regarding open burning of propellant wastes, dated 1971-72; Response to Request No. 10
Attachment	Figures 2-2, 4-1, 4-2 and 4-4 to Exhibit C to Lockheed's January 4, 1994 response
Attachment	Exhibit I to Lockheed's January 4, 1994 response

58726

Lockheed Propulsion Company

INTERNAL LETTER

TO: Research Building Personnel DATE: 21 June 1962

SUBJECT: Standard Operating Procedure FROM: C. J. Barr

No SOP-11 A. Heeseman

DISPOSAL OF WASTE SOLVENTS

The purpose of this S.O.P. is to establish a safe and practical procedure of disposing of contaminated solvents according to the following description.

A. Solvents Contaminated with Rubber Base Propellant

1. All solvents in this category are to be disposed of in 30 gallon container labeled Waste Solvents (Rubber Base Propellant). One container is located at the southeast corner of Bldg. 114 (cleaning area) and a container is also available at Bldg. 16.

B. Solvents Contaminated with Double Base Propellant

1. All solvents in this category are to be disposed of in 30 gallon container labeled Waste Solvents (Nitroplastisol Propellant) located in same area as above.

2. Extreme care must be exercised to see that this container is not utilized as a disposal site for individual propellant ingredients. See S.O.P. No. 2, dated July 6, 1961, for methods of disposing of individual ingredients.

3. Barrels utilized for contaminated Nitroplastisol type solvents shall be at least 1/3 filled with sawdust before using as a waste container.

C. Solvents Used in the Analytical Labs

1. Solvents in this category are to be disposed of in 30 gallon container labeled Waste Solvents (Analytical Lab). Container is located in the cleaning area (Bldg. 114). These solvents when contaminated with other Rubber Base or Nitroplastisol type propellant must be handled according to write up under Item "A" or "B".

If any of the waste solvent containers are full, contact H. Mayse and he will make arrangements with Maintenance Office to have them picked up and replaced with empty containers.

At no time are solvents to be poured on the ground or in the water evaporation pits located south of Bldg. 114.

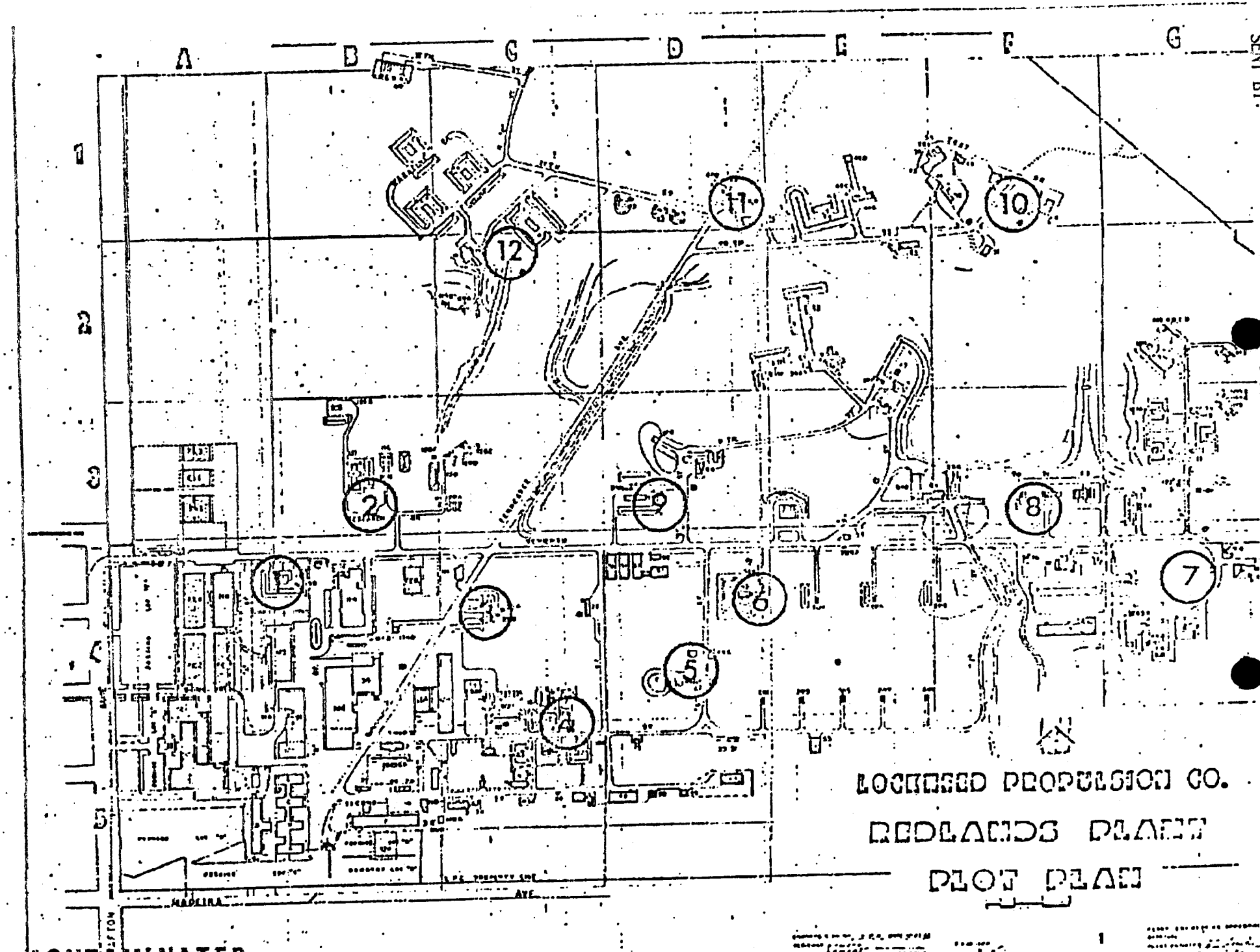
These containers are to be used for the disposal of waste solvents only.

Prepared by: H. Mayse

Approved:

C. J. Barr
Associate Director
Research Division

A. Heeseman
Safety Engineer



CONTAMINATED
WASTE PICK UP STATIONS

Exhibit H

LPC Memorandum regarding degreasing metal parts

Response to Request 9.d.

58726

MPO-605 (1962)

LOCKHEED PROPULSION COMPANY

Release Date: 1 Nov. 1962

DEGREASING METAL PARTS

MANUFACTURING PROCESS STANDARD

Number 000002

Prepared by
Manufacturing Engineering

Approved
Chief Manufacturing Engineer

Approved
Director Production

Approved
Director Engineering

Approved
Director Q. & R. A.

Approved
Safety Engineer

This document is the property of Lockheed Propulsion Company. Its use is restricted to employees of the Company.

BLDG. N. 91

MANUFACTU NG STANDARD

General Notes

MPS NO. 00B002

TITLE Degreasing Metal Parts

SEQ. NO.	OPERATION DESCRIPTION	PROD.	Q. C.
1.	General:		
	This procedure describes the method that will be used to check the degreaser solvent for purity, clean and fill the degreaser machine and operate the machine.		
2.	General Safety Precautions:		
	a. The degreaser tank shall be kept covered when not in use.		
	b. The solvent is not to be handled while hot.		
	c. Avoid drugging solvent from the degreaser during removal of parts and work.		
	d. Never use anything but galvanized iron piping on solvent lines.		
	e. Do not bring flame in contact with solvent vapors. This includes red hot metals, etc.		
	f. Solvent degreasing vapors are toxic. Extreme care must be taken to insure that operators do not breathe the vapors. Operator must wear either a Bullard Air Pac or a Scott respirator.		
	g. No smoking or flame producing device is to be used within the bldg. while the degreaser is in operation.		
	h. Solvent used to clean items with fine aluminum (chips or powder) should not be put into closed containers without first being distilled.		

Form No. LFC-0774

BLDG. N 91 **MANUFACTU...NG STANDARD**

TITLE	Degreasing Metal Parts	Purity Check	MPS NO. 00B002	
SEQ. NO.	OPERATION DESCRIPTION		PROD.	Q. C.

b. Test II:
A sample of cooled solvent from the bottom of the degreaser is to be taken to the Q.C. Lab for titration according to the procedure called out in Technical Information Bulletin No. 13, G. S. Blakeslee & Co., Chicago, Illinois (copy attached). When the acid acceptance of the solvent has dropped to 0.03% NaOH, the degreaser is to be cleaned out.

c. Test results shall be reported to production as soon as they are available. This should be within three (3) hours after the samples are taken.

d. The Q.C. Lab will supply sample bottles for use in obtaining samples by Production.

Form No. LPC-0774

BLDG. N 91 MANUFACTURING STANDARD

TITLE Degreasing Metal Parts Start-Up MPS NO. 00B002

SEQ. NO.	OPERATION DESCRIPTION	PROD.	Q.C.
	e. Check that the water valves, incoming and return, are open. These valves are located just below the floor grid at the south-west corner of the degreaser. There is an automatic temperature actuated flow control valve in the system which will adjust the water flow rate to maintain the exit water temperature within a narrow range.		
	f. Open the drain valve on the steam line to remove condensate from the line. The valve is opened by a rod projecting from the valve up through the grid floor at the south-east corner of the degreaser. When steam begins to come from the open valve, shut the valve.		
	g. Start the degreaser heat-up by pressing the "ON" button on the switch box in the middle of the west side of the degreaser. Be sure valve to the spray system is closed during start-up.		
	h. Check the steam pressure on the gauge just below the grid floor at the south end of the degreaser. A pressure of 10 psig should be sufficient for most operations. Do not exceed 15 psig at any time. The steam pressure regulator should control the steam pressure.		
	i. When the solvent begins to condense on the cooling coils, check the cooling water return line. It should feel slightly warm to the touch. The condensate will drip into the trough around the degreaser tank and flow into the storage tank until the storage tank is full after which the solvent will overflow into the degreaser tank; thus, a supply of distilled solvent is kept available for spray cleaning.		
	j. The system is now ready for use in degreasing operations.		

Form No. IFC-0774

BLDG. N 91

MANUFACTURING STANDARD

Operation

MPS NO. 00B002

TITLE Degreasing Metal Parts

SEQ. NO.	OPERATION DESCRIPTION	PROD.	Q.C.
5.	Degreaser Operation:		

a. The degreaser will be started according to the Start-Up Procedure as shown in Sequence 4.

b. The parts to be cleaned will be loaded into the degreaser basket. The parts should be positioned so they will drain and not retain solvent.

NOTE: Do not put parts into the degreaser that have just come from a sodium hydroxide or potassium hydroxide bath as these strong alkali materials will cause decomposition of the solvent. Do not put parts in the degreaser right after acid dip.

c. Using the overhead hoist, lift the basket of parts, position the basket over the degreaser and lower the basket until the parts being cleaned are below the vapor level.

d. Where needed because of heavy dirt and/or grease, the degreasing operation may be speeded by using the solvent spray system. Hold the spray nozzle below the vapor level. The operator MUST NOT get his hands below the vapor level. To start spraying, open the valve on the solvent line adjacent to the switch box on the west side of the degreaser. Spray the parts in the basket until the desired degree of cleanliness is obtained. Stop the spray by turning off the valve.

e. Leave the parts in the degreaser until the solvent has ceased to condense on the parts and the parts appear to be dry. Slowly raise the basket (no faster than 8-10 feet per minute) until

BLDG. N 91

MANUFACTU NG STANDARD

Shut-Down

MPS NO. 00B002

TITLE Degreasing Metal Parts

SEQ. NO.	OPERATION DESCRIPTION	PROD.	Q. C.
6.	Degreaser Shut-Down		

a. After the degreasing operations have been completed, note the boiling temperature of the solvent as indicated on the Blacosolv Heat Gauge at the south end of the degreaser. This temperature is to be recorded on the Degreaser Log Sheet maintained at the Manufacturing Office.

b. The shut-down of the degreaser is effected by pushing the "STOP" button on the control box on the west side of the degreaser tank. Shut off steam valve.

c. After the vapor level has dropped below the cooling coils, close the cooling water valves.

d. When the solvent in the bottom of degreaser has cooled, a sample will be taken. Lift a section of the bottom grid. Lower a sample bottle on a stout cord to get a sample of the solvent from the bottom of the tank. Stopper the bottle and label it to show that it is degreaser solvent, the date and time the sample was taken and the name of the person taking the sample. Deliver the sample to the Quality Control lab for analysis according to procedure.

e. Replace the bottom grid section and place the covers on the degreaser tank.

Form No. LPC-0774

BLDG. N 91

MANUFACTU NG STANDARD

MPS NO. 00[illegible]

TITLE Degreasing Metal Parts Cleanout

SEQ. NO.	OPERATION DESCRIPTION	PROD.	Q. C.

e. With a hoe or other similar, suitable device, scrape the mud, residue and scale from the heating coils and degreaser bottom and sides. To effect removal of this material, remove the cleanout door at the bottom of the south end of the degreaser. Materials removed from the degreaser in this operation should be removed, in covered drums, to the evaporation pits for disposal.

f. If it is necessary to enter the degreaser tank or pit at anytime during cleanout operation, the following precautions must be observed:

1). There must be no heat in the system.
2). Never enter the degreaser without a safety halter or rope and another man is watching.
3). If there is solvent or solvent fumes or matter containing solvent in the degreaser, a man entering the degreaser or degreaser pit must wear a self-contained air mask, such as a Bullard Air-Pac.

g. When the bulk of the contamination has been removed from the degreaser tank, an alkali cleaning compound such as tri-sodium phosphate, (available from stores) and water should be used to wash off the heating coils and flush out the bottom of the tank. The unit should then be thoroughly rinsed with clean water. The flushing water and rinse water may be disposed of through the drain line to the sump to the west side of the building. Wipe the degreaser dry with rags on the end of a pole.

Form No. LPC-0774

MANUFACTURING STANDARD

BLDG. N 91 | Maintenance | MPS NO. 00B002

TITLE	Degreasing Metal Parts	PROD.	Q.C.
SEQ. NO.	OPERATION DESCRIPTION		

8. Maintenance

a. At such time as the degreaser would be operated on a routine basis, cleanout of the degreaser could be scheduled according to necessity as indicated by regular analysis of the solvent during the early period of routine operation. Until then cleanout shall be done when solvent analysis indicates the need.

b. During cleanout operations the following check points shall be observed:

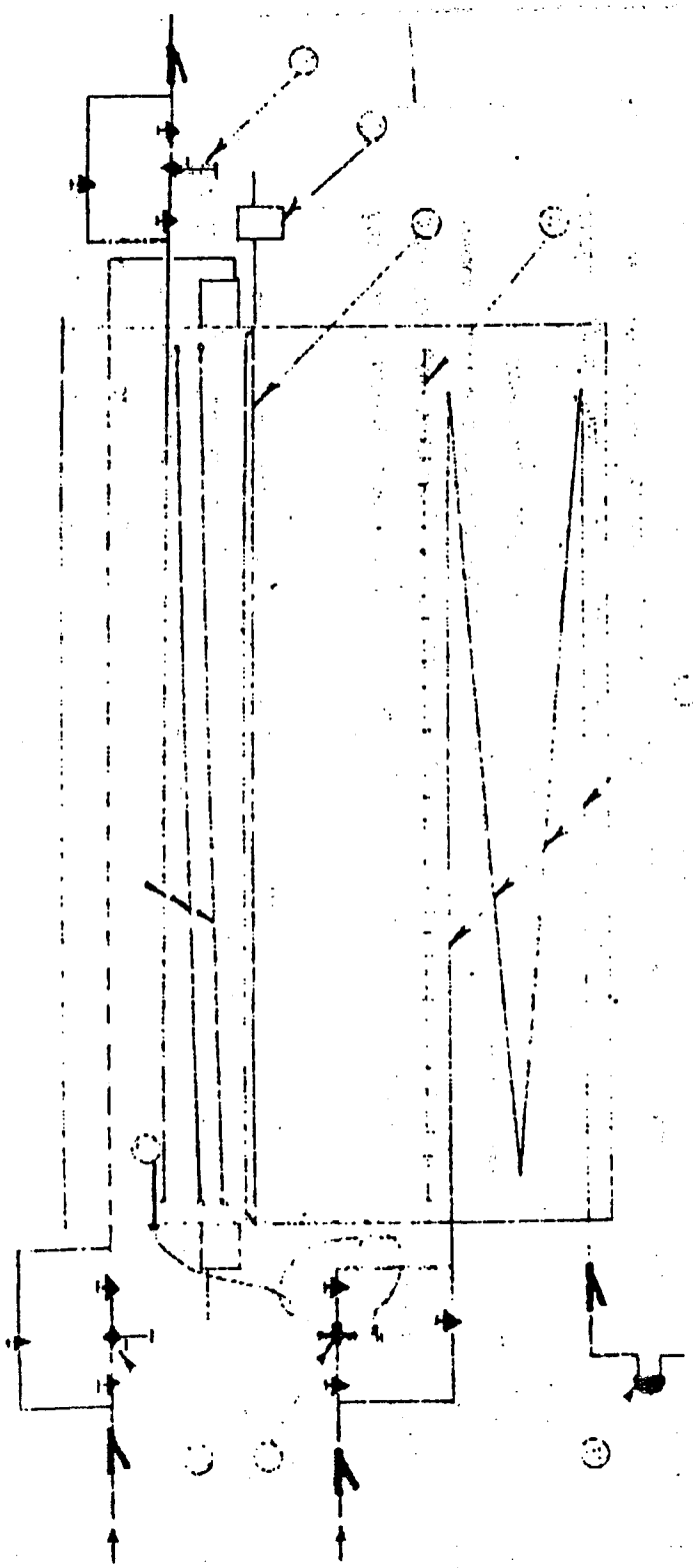
1). The sludge is to be removed from the degreaser floor and from the heating elements.
2). Contamination baked on the steam coils should be removed and parts thoroughly cleaned.
3). The water separator is to be cleaned and drained.
4). Pumps, valves, and fittings should be checked for the absence of metal fines, chips or leaks.

c. Safety thermostats (cooling water flow controller) can be checked for operation only while the degreaser is running.

d. If the thermostatic element causes the activation of the Sarco Manual Reset Valve to shut off the steam flow, it should be reset as follows:

1). Determine why the cooling water flow stopped if this is why the hot vapor reached the Sarco Safety Bulb and clear the water flow system.

Form No. LPC-0774



ENCLOSURE 4

PUBLIC HEALTH ASSESSMENT

LOCKHEED PROPULSION COMPANY
(a/k/a LOCKHEED MARTIN PROPULSION CORPORATION)
REDLANDS, SAN BERNARDINO COUNTY, CALIFORNIA

SUMMARY

The Lockheed Martin Propulsion Corporation site is located at 1500 Crafton Avenue in Redlands, California. Lockheed was in operation between 1961 to 1974, as a research and production facility of solid fuel rockets and solid rocket propellant for the military. For years the facility disposed of hazardous waste, including perchlorate, which resulted in perchlorate contamination in the groundwater.

In 1997, perchlorate was discovered in a number of domestic water supply wells that serve several water purveyors throughout San Bernardino and Riverside counties. Two of the wells in the City of Loma Linda's municipal drinking water system had been impacted by the perchlorate groundwater plume, originating from the Lockheed site.

The California Department of Health Services (CDHS) has concluded that water distributed in the past and currently, by the City of Loma Linda, poses no public health hazard. Perchlorate has not been present at levels that would cause health effects. When more toxicological information about perchlorate becomes available, CDHS may update the toxicological evaluation for the Loma Linda system.

PURPOSE AND HEALTH ISSUES

The purpose of this public health assessment is to review the groundwater data from municipal water supply wells used for the City of Loma Linda's domestic water supply, and to evaluate possible adverse health effects from exposure to perchlorate. Only the potential health impact caused by ingestion of perchlorate contaminated drinking water will be evaluated.

BACKGROUND AND STATEMENT OF ISSUES

The Environmental Health Investigations Branch (EHIB) within the California Department of Health Services (CDHS), under a cooperative agreement with the Agency for Toxic Substance and Disease Registry (ATSDR), is conducting public health assessment activities relating to contamination originating from the Lockheed Martin Propulsion Corporation hazardous waste site in San Bernardino County, California. This public health assessment will focus on perchlorate contamination in the City of Loma Linda's drinking water supply.

Lockheed Propulsion Company began operations in 1961, after acquiring the site from Grand Central Rocket Company (GCRC), which began operations in 1954. The site consists of approximately 400 acres which was leased from the City of Redlands (Attachment: Figure 1). The GCRC facility was

used for the production, testing and disposal of solid rocket propellant used in rocket engines. Lockheed used the facility for research and for production of solid fuel rockets for military and commercial use until 1974. Lockheed disposed of hazardous waste by open burning, discharge into evaporation and settling ponds, and inadvertent dumping [1]. Some of these discharged hazardous waste, including perchlorate, entered the groundwater and migrated outside the boundaries of the Lockheed site [1]. Perchlorate, in the form of ammonium perchlorate is used in the manufacture of solid rocket fuel, munitions, and pyrotechnics (fireworks).

In the 1980's, trichloroethylene (TCE), a solvent, was detected in four out of twelve groundwater wells sampled in the Redlands area. The Division of Drinking Water and Environmental Management (DDW) within the CDHS, directed that any drinking water wells which contained TCE at levels exceeding 5 parts per billion (ppb) or the maximum contaminant level (MCL), be taken off-line. In 1989, as a result of the TCE contamination, the California Regional Water Quality Control Board (CRWQCB), Santa Ana Region, and the Department of Toxic Substance Control (DTSC) provided funding for the installation of a Liquid Phase Granular Activated Carbon (GAC) groundwater treatment system to treat and clean the water from the TCE impacted wells [1]. Subsequent investigations by the CRWQCB determined that Lockheed Martin Corporation (formerly Lockheed Propulsion Company) was the source of the TCE contamination [1]. TCE had been the primary contaminant of concern emanating from the Lockheed site, until mid 1997 when the first tests for perchlorate in drinking water were performed.

In April 1997, the DDW-CDHS began sampling groundwater basins which were considered vulnerable to perchlorate. Historically, perchlorate has not been considered a common contaminant in groundwater. The expanded sampling conducted by the DDW was in response to perchlorate being found at levels of health concern in public water supply wells at another defense contractor facility in northern California.

In this public health assessment, we will focus on describing the perchlorate contamination that has reached the City of Loma Linda's public water supply and evaluate the health impact that may have occurred from exposure to perchlorate. Approximately seven water purveyors throughout San Bernardino and Riverside counties may have already been impacted by the perchlorate. Since the water sources and distribution of these water systems are different and complex, a separate public health assessment should be prepared evaluating each system. CDHS has already completed a health consultation evaluating the impact of perchlorate on the Victoria Farms Mutual Water Company system [2]. This public health assessment is the second in the series that will address the impact of perchlorate contamination on municipal water supply wells. During this process, data and information on the release of hazardous substances and their impact to the public will be evaluated.

The City of Loma Linda Water Service Description

The City of Loma Linda is one of several water districts that receive water from aquifers within the Bunker Hill Groundwater Basin. The City of Loma Linda's water system has been impacted by the perchlorate contamination which originates from the Lockheed Martin site.

The City of Loma Linda's system supplies water to 3,869 connections, approximately 23,000 people, for residential and commercial use [3]. The water supply system consists of six groundwater wells (5 active, 1 inactive), Mountain View No. 1, Mountain View No. 2, Richardson No. 1, Richardson No. 2, Richardson No. 3 and Nicks [3]. The Mountain (Mt.) View well No. 1 was taken off-line in April 1998 due to rising perchlorate levels (Attachment: Table 1) [4]. In addition, the Loma Linda system

has connections with the City of Redlands and the City of San Bernardino's water systems for supplementary needs.

The City of Loma Linda wells draw water from different depths and aquifers. The Mt. View well No. 1 draws water from a depth of 750 feet. Mt. View well No. 2 draws water from a depth of 900 feet. The Mt. View wells No. 1 and No. 2 were blended at a 1:2 ratio, with Mt. View No. 2 producing twice as much water as Mt. View No. 1 [4]. Richardson well No. 1 draws water from a depth of 1200 feet and is blended with water from Richardson well No. 2, which is drawn from a depth of 970 feet. Richardson well No. 3 draws water from a depth of 815 feet. The Nicks well draws water from a depth of 868 feet and is used for emergency backup during peak usage times [4]. With the exception of supplementary water received from the City of Redlands, the Loma Linda system does not utilize any other surface-water sources for the drinking water supply [3].

Perchlorate Measurements

In April 1997, the San Bernardino District field staff of the DDW began testing public water supply wells in areas where perchlorate contamination was suspected to exist [5]. Because Lockheed used solid rocket fuel, the DDW field staff in the San Bernardino office sampled wells located to the west, and downgradient of the Lockheed facility, including five wells in the City of Loma Linda's municipal drinking water system. The well samples were analyzed by the CDHS Sanitation and Radiation Laboratory located in Los Angeles, with a quantification limit of 4 ppb. The CDHS provisional action level for perchlorate in drinking water is 18 ppb (based on USEPA's provisional reference dose and assuming a 70 kg person drinks 2 liters per day), at which the water purveyor would have to notify their water customers [6]. Currently, there are animal studies underway which are looking at perchlorate toxicity; and as more toxicological data becomes available, a change in the provisional action level may occur (see Recommendations section, page 10).

In the April 1997 sampling, perchlorate was detected at the Mt. View No. 1 / Mtn. View No. 2 blend point (Lawton booster station) at a level of 7.6 ppb (Attachment: Table 1). Since this level did not exceed the CDHS provisional action level, regular monitoring of these wells was the course of action taken by the City of Loma Linda. Monitoring results for raw water (prior to blending and treatment) and finished water (after blending and treatment) samples are presented in the Table 1 and Table 2 at the end of this document. Levels of perchlorate in the Loma Linda system wells range from non-detect to 29 ppb, in raw water samples (Attachment: Table 1) [5]. The highest level of perchlorate measured in finished water, was from the Mt. View blend, at a level of 9.6 ppb (Attachment: Table 2.). This level does not exceed the provisional action level for perchlorate of 18 ppb.

City of Loma Linda staff have estimated that the average level of perchlorate in finished water is 6 ppb to 8 ppb [4]. The City of Loma Linda has not served drinking water to customers above the CDHS provisional action level of 18 ppb [4].

On May 28, 1997, DDW staff held a meeting with the water purveyors to inform them of the perchlorate contamination. DDW staff provided each water purveyor with the sampling results and health effects information relating to perchlorate exposure [7]. Mt. View well No. 1 is the only well in the Loma Linda system that has shown consistent levels of perchlorate (prior to blending), above the provisional action level. This is most likely due to the fact that Mt. View No. 1 is the shallowest well (750 ft.) in the system (Attachment: Table 1). Perchlorate has been detected intermittently in the deeper Mt. View well No. 2 (900 ft.) and Richardson well No. 2 (970 ft.), which is an indication that the perchlorate plume is migrating downward into deeper aquifers (Attachment: Table 1). Richardson

well No. 3 and the Nicks well have not been impacted by the perchlorate plume (Attachment: Figure 1 and Table 1). According to model data derived by Lockheed, which estimates the migration of the plume, the perchlorate should not impact the Richardson well No. 3 or the Nicks well [4].

TCE, a Lockheed site associated chemical, and dibromochloropropane (DBCP) a soil fumigant used in the citrus groves, have also been detected in the Loma Linda public water system at levels below the allowable drinking water standards or MCLs. DBCP is a contaminant commonly found in agricultural areas and is not associated with the Lockheed site. TCE has only been detected in the Loma Linda public water system (Mt.View well No. 1) within the last year. The detection of TCE in the Loma Linda system may be a result of the Texas Street (Redlands), Liquid Phase Granular Activated Carbon (GAC) groundwater treatment system, which removes TCE from groundwater, being taken off-line due to perchlorate over-load in the system. The TCE could have moved past the GAC system when it was non-operational [4].

DISCUSSION

Community Concerns

CDHS staff contacted public works department staff for the City of Loma Linda to discuss any potential health concerns expressed by their customers. CDHS staff were informed that the City of Loma Linda has not received any calls from their customers relating to health concerns [4]. The public works department staff did report receiving a few calls (approximately six) seeking general information about perchlorate (e.g., Where did the perchlorate come from and how did it get into the water?) after an article was published in The Sun (Redlands newspaper) in June, 1997 [4].

Demographics

Based on 1990 Census data and information obtained from the City of Loma Linda, the population is approximately 23,000 people [4]. The ethnic makeup of the city is: < 1% Native American, 13.6% Hispanic, 6.4% African American, 21.4% Asian or Pacific Islander, and 64% Caucasian. The age distribution of the city is approximately: 9% under 5 years, 15% 5 to 17 years, 13% 18 to 24 years, 36% 25 to 44 years, 13% 45 to 64 years, 14% 65 and older. The gender makeup is estimated to be 48% male and 52% female.

Housing occupancy consists of the following; 46% owner occupied, 50% renter occupied, 4% vacant or occasional use. The housing units for the city are as follow: 45% 1 unit detached (single family home), 11% 1 unit attached (duplex, condominium), 36% > 2 units, attached (apartments), and 18% mobile home, trailer, or other.

Exposure Pathways

For target populations to be exposed to environmental contamination, there must be a mechanism by which the contamination comes into direct contact with the target population [8]. This is called an exposure pathway. A completed exposure pathway consists of five elements: a source of contamination, an environmental medium and transport mechanism, a point of exposure, a route of exposure, and a receptor population (Attachment: Table 3). For a population to be exposed to an environmental contaminant, a completed exposure pathway (all five elements) must be present. The following is an example of a completed exposure pathway: a contaminant from a hazardous waste site

(source) leaches into groundwater (medium, transport mechanism), the groundwater is then pumped and piped to houses and businesses (point of exposure) where the occupants drink the water (route of exposure and receptor population).

Completed Exposure Pathway

CDHS has determined that a completed exposure pathway exists where there are low levels of perchlorate in the Loma Linda municipal drinking water. Table 3 in the Attachment of this document, lists the elements and the receptor populations for the completed exposure pathway to the Loma Linda drinking water system. The most important route of exposure is through ingestion of the water. Inhalation is not a pathway of concern because perchlorate is not volatile (does not become a gas). Inorganic ions, like perchlorate are non-lipophilic (i.e., chemicals with an aversion to fat-like surroundings, such as the skin). Uptake through the skin would be minimal. However, there are studies underway which may provide additional information on perchlorate's potential for dermal uptake.

The next step after recognizing a completed exposure pathway is to determine at what level and length of time the receptor population(s) have been, or are being exposed, and if the exposure presents a public health hazard. The following paragraphs will discuss how CDHS made these determinations.

It is not clear when the perchlorate contamination first reached the City of Loma Linda wells, because monitoring did not begin until 1997. As discussed earlier, the average level of perchlorate in finished drinking water has been estimated at 6 ppb to 8 ppb [4]. The DDW staff estimated that perchlorate has been a contaminant in a near-by Victoria Farms system well (not in the Loma Linda system) since 1994 [7]. The Victoria Farms well drew water from a shallower groundwater aquifer than the Loma Linda system wells, which suggests that the plume would have to migrate a greater distance requiring a longer amount of time for the perchlorate plume to impact the Loma Linda system. Also, the Loma Linda system wells are located near the southern edge (boundary) of the plume, which is delineated by perchlorate levels measuring 18 ppb (Attachment: Figure 1). Initial results (20 ppb) measured in the Loma Linda system during May 1997, are consistent with the 18 ppb plume boundary (Attachment: Table 1). Based on these facts provided by the DDW staff, it is not likely that perchlorate levels in the past (prior to 1997) were higher than what has been measured.

CDHS compared the perchlorate data to the USEPA's provisional reference dose (RfD) (0.0001 to 0.0005 milligrams per kilogram per day (mg/kg/day)) in order to determine whether a toxicological evaluation (dose estimates) was warranted. Since 1997, no water has been served above the provisional action level (18 ppb). Doses would not exceed USEPA's provisional RfD (0.0001 to 0.0005 mg/kg/day) [6]. This means that noncancer (thyroid depression) health effects should not have occurred or be occurring to individuals who drink water from the Loma Linda system. Therefore, at this time there is no need to further evaluate exposures to perchlorate in the Loma Linda municipal water system.

Toxicological Information

Even though exposures to perchlorate in the Loma Linda municipal water system are below levels of health concern, the community served by the City of Loma Linda may want a better understanding about the toxicity of perchlorate. The following section is meant to provide a general discussion on what is known about the toxicology of perchlorate.

Perchlorate inhibits the excessive synthesis and secretion of thyroid hormones by competitively inhibiting the accumulation of iodide in the thyroid [9]. Discontinued administration of potassium perchlorate to Graves' Disease patients resulted in a return to their hyperthyroid condition (above normal levels of thyroid hormone in circulation) [10]. People who have been treated with perchlorate have reported gastrointestinal irritation, skin rash, and hematological effects including agranulocytosis (a decrease in the number of granulocytic leukocytes in the peripheral blood) and lymphadenopathy (lymph node enlargement) [9]. The severe hematological effects seem to be more likely to occur when large doses of more than 1,000 milligrams per day (mg/day) (approximately 14 mg/kg/day for a 154 pound man) are used [11].

Potassium perchlorate was extensively used for treatment of Graves' Disease patients in the late 1950s and 1960s. After the reports of the severe hematological effects, potassium perchlorate was not used for many years [12]. In the early 1980s, physicians in Europe began using it again for the treatment of Graves Disease, and reporting no serious side effects occurring as long as the dose was kept below 1,000 mg/day [11]. In addition, potassium perchlorate has been used in treating thyrotoxicosis (hyperthyroidism) resulting as a side effect from other drug therapies [13-17].

There are only a few studies of short-term exposure in persons without Graves' Disease [18]. The animal studies that have been conducted have also involved short-term exposures and the doses were too high to see a level where there was no effect on the thyroid. Both human and animal studies have primarily examined the effects of perchlorate on the thyroid. Interference with the production of thyroid hormones has resulted in a below normal level of thyroid hormone in circulation (hypothyroidism). The effects of perchlorate on organ systems other than the thyroid needs to be explored, especially effects on the blood system (described above) and developmental effects (described later).

In 1992 and 1995, USEPA staff reviewed the perchlorate toxicological studies and derived a provisional reference dose (RfD) of 0.0001 to 0.0005 mg/kg/day [6, 18]. A RfD is a dose to which a person could be exposed over a long period of time without having any appreciable risk of a non-cancer health effects occurring. According to the USEPA, a perchlorate dose of 0.14 mg/kg/day or smaller would not be expected to be associated with any adverse effect on the thyroid (this is called the NOAEL or No Observable Adverse Effect Level) [18, 19]. The USEPA then applied an uncertainty factor of 300 or 1000 to the NOAEL to derive the RfD [6]. Uncertainty factors are used to account for various uncertainties when there are gaps in scientific knowledge.

There is very limited information about whether perchlorate causes cancer. The only information about the possible carcinogenicity of perchlorate has to do with cancers of the follicular thyroid cells [6]. Several animal studies found that thyroid tumors were induced in both rats and mice by long-term administration of high doses of perchlorate. However, the thyroid of rats are thought to be more sensitive to the effects of perchlorate than the human thyroid [20, 21]. Since perchlorate's possible carcinogenic effects on the thyroid are based on the same mechanism that determines its noncarcinogenic effects, it may be appropriate to consider the RfD as a dose which does not pose a significant risk of thyroid cancer [18].

It is even harder to determine whether or not perchlorate exposure can cause any other type of cancer. More toxicological information is needed to determine whether perchlorate can cause cancer and if it can, at what dose this effect may start occurring.

Children's Health

Children are not adults, their bodies are not fully developed, and they may not respond to perchlorate in the same manner as an adult. For instance, thyroid hormone is critical to normal brain development and physical development. The critical period of dependency on thyroid hormone begins in the uterus and extends up until three years of age. After the age of 3, thyroid hormone continues to play a primary role in physical development until puberty. Thus, a low level or absence of thyroid hormone in utero or in childhood could result in irreversible mental retardation and retarded physical growth.

Perchlorate can cross the placenta and thus could effect the developing fetus, though these effects have not been studied in humans. It is known, however, that drugs currently being used to treat Graves' Disease such as propylthiouracil do cross the placenta and can produce neonatal hypothyroidism and fetal in utero goiter (enlargement of the thyroid) [21, 23, 24-26]. In fact, because the developing fetus's thyroid is immature, because propylthiouracil is a more potent suppressor of thyroid function in the fetus than in the mother [27].

In a study of the effects of potassium perchlorate (740 mg/kg/day for the mother) fed to pregnant guinea pigs during pregnancy, a 15-fold enlargement of thyroid of the newborns was noted, even though no increase in the size of the mother's thyroids occurred [28]. Thyroid hormone levels of the newborn guinea pigs were not measured in this study. Another animal study in which the mother was given fairly high levels of potassium perchlorate, also resulted in increased thyroid weight in the offspring of the mother [29]. At this time, it is unclear whether lower doses of perchlorate would effect the thyroid of the developing fetus and young child and thus affect thyroid function at a time when normal thyroid hormone production is important to brain development.

Animal studies are underway which are exploring the toxicity of perchlorate, including effects on the immune system and developmental effects (see Recommendations section, page 10).

Until there is more information about perchlorate's effect on children, CDHS is not able to evaluate past exposures that occurred to child residents who received water from the Loma Linda system. To compare a child's exposure with toxicological information based on adult exposure ignores the fact that the child is not an adult.

Health Outcome Data:

Existing health databases such as cancer and birth defects registries and infant thyroid databases are generally useful if substantial exposures are documented or suspected for the neighborhoods in the vicinity of the site. A review of disease statistics would not be useful for determining potential health impact from exposure to perchlorate in the Loma Linda system because perchlorate distributed in the municipal drinking water were below levels likely to cause health effects. Even though the levels of perchlorate would not support a review of infant thyroid data for areas served by the Loma Linda system, it is possible that a California wide review of infant thyroid data may occur in the future.

Next Section **Table of Contents**

Ads by Google

Fly a Russian Fighter Jet
Break the sound barrier or fly to the edge of space in a fighter jet.
SpaceAdventures.com

Screensavers - Military
5000+ Great Screensavers. All Free. Download Many Military Screensavers
www.popularscreensavers.com

Fighter Pilots
Become a Pilot in the US Navy - Get Started & Accelerate Your Life
www.navy.com

Lockheed Martin news
Free Email News Briefing for the Aerospace Industry.
www.smartbrief.com

Lockheed Corporation

A corporate ancestor of Lockheed Martin, the **Lockheed Corporation** aerospace company was formed in 1932 by the brothers Allan and Malcom Loughhead, who had built their first plane in 1913.

The company has built both commercial and military aircraft.

In 1996, the company merged with the Martin Marietta Corporation to form Lockheed Martin.

The company's headquarters are in Bethesda, Maryland.

Planes

Some famous Lockheed planes:

- U-2 reconnaissance
- SR-71 Blackbird reconnaissance
- F-117 Nighthawk stealth fighter
- F-104 Starfighter multi-mission fighter
- P-38 Lightning two-engine fighter
- P-80 Shooting Star jet fighter
- F-94 Starfire all-weather fighter
- S-3 Viking patrol/attack
- P2V Neptune maritime patrol
- P-3 Orion ASW patrol
- Lockheed Hudson maritime patrol/bomber
- C-130 Hercules (AC-130 gunship variant) medium combat transport

- C-141 Starlifter long-range jet transport
- C-5 Galaxy heavy transport
- Lockheed Vega civil transport
- L-1011 TriStar airliner
- Lockheed Constellation civil transport
- L-188 Electra civil transport

This article is from Wikipedia. All text is available under the terms of the GNU Free Documentation License.

ENCLOSURE 5

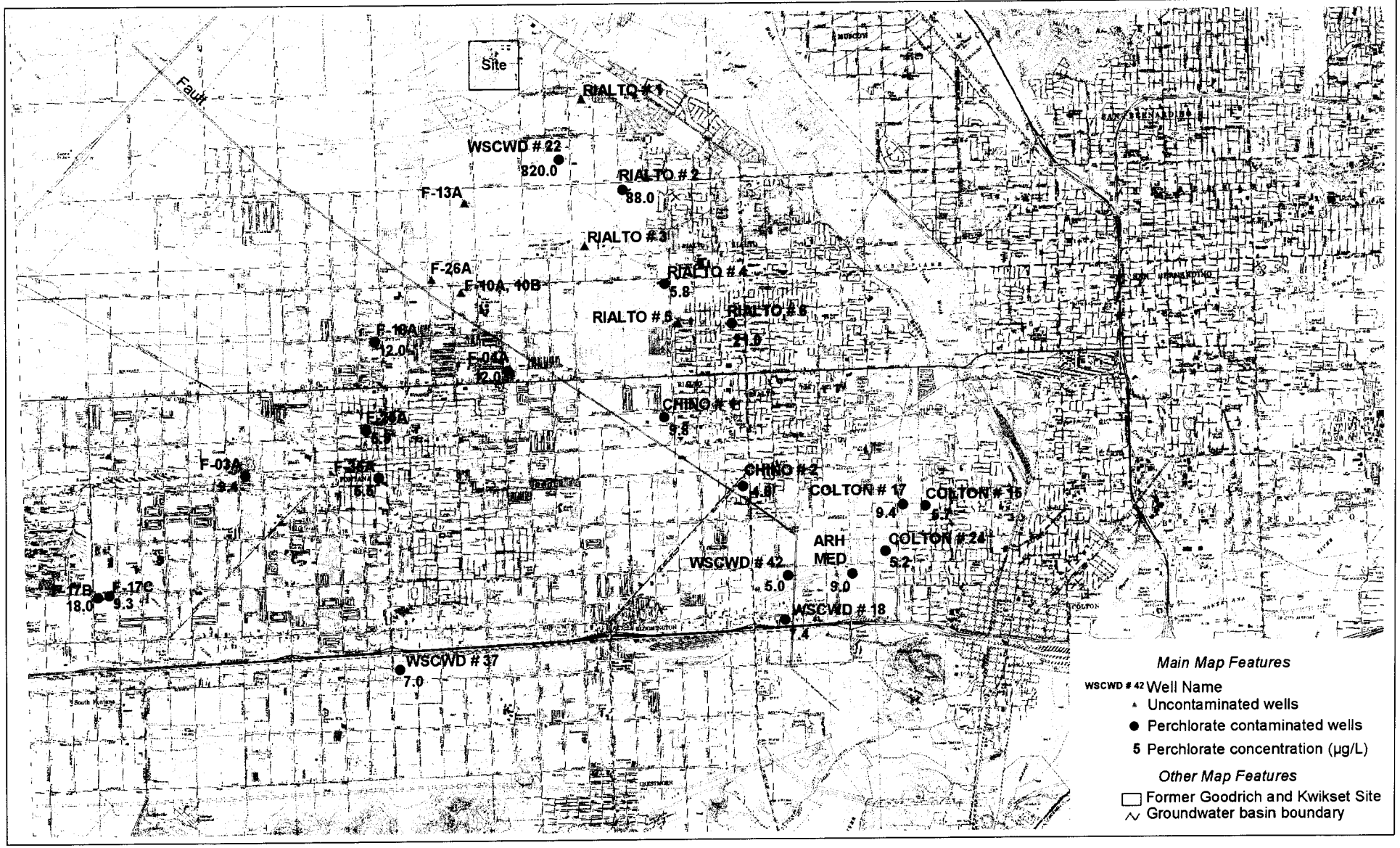
1990S

Traveling Time and Space

Lockheed-made aircraft and weapons systems and Martin Marietta-made missiles, weapons, and electronics make significant contributions to Operation Desert Storm, as do the works of heritage companies Vought, IBM Federal Systems, Loral, and Unisys. In 1995, Lockheed and Martin Marietta merge to become one of the largest aerospace, defense and technology companies in the world. The company's core efforts now also include telecommunications and information systems.

Stock Price: [53.20]

ENCLOSURE 6



WELL LOCATIONS AND PERCHLORATE CONCENTRATIONS