162
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MLM-2403

MLM-2403

~~Dr 1186~~
No Stock

Stable Isotope Sales:
Mound Laboratory Customer
and Shipment Summaries,
FY 1976 and FY 1976A

June 6, 1977

Monsanto

MOUND LABORATORY

Miamisburg, Ohio
operated by

MASTER

MONSANTO RESEARCH CORPORATION

a subsidiary of Monsanto Company

for the

**UNITED STATES ENERGY RESEARCH
AND DEVELOPMENT ADMINISTRATION**

U. S. Government Contract No. EY-76-C-04-0053

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Stable Isotope Sales: Mound Laboratory Customer and Shipment Summaries, FY 1976 and FY 1976A

Compiled by Albin H. Ruwe, Jr.

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MONSANTO RESEARCH CORPORATION

A Subsidiary of Monsanto Company

MOUND LABORATORY

Miamisburg, Ohio 45342

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Abstract

A listing is given of Mound Laboratory's sales of stable isotopes of noble gases, carbon, oxygen, nitrogen, chlorine, and sulfur for Fiscal Years 1976 and 1976A (the period July 1, 1975 through September 30, 1976). Purchasers are listed alphabetically and are divided into domestic and foreign groups. A cross-reference index by location is included for domestic customers. Cross-reference listings by isotope purchased are included for all customers.

Introduction

This report is the tenth in a series on Mound Laboratory customers and sales of stable isotopes and covers Fiscal Years 1976 and 1976A. Isotope separation by thermal diffusion was begun at Mound Laboratory in the late 1950's. Distribution of helium-3 directly to customers was begun in 1960; in 1964 distribution of neon, argon, krypton, and xenon stable isotopes and carbon-13 was started. The distribution of carbon-12 and oxygen-16 was started in 1970. In 1972, 20% carbon-13 was made available to supply customer needs. In 1973 distribution of nitrogen-14, nitrogen-15, oxygen-17, and oxygen-18 was started. The distribution of sulfur-34 was started in 1975. Chlorine distribution commenced in 1976.

All the noble gas isotopes were isotopically enriched by thermal diffusion in cascaded columns. Carbon-13 and carbon-12 were enriched by carbon monoxide distillation. Carbon-13 enriched methane was enriched from 90% to 97% and 99% by a thermal diffusion column cascade. Carbon isotopes were produced by both Mound Laboratory and Los Alamos Scientific Laboratory (LASL) and distributed by Mound Laboratory. The isotopes of oxygen and nitrogen were enriched by nitric oxide distillation at Los Alamos Scientific Laboratory for distribution by Mound Laboratory. Sulfur and chlorine isotopes were enriched by liquid thermal diffusion at Mound Laboratory.

This summary was compiled to present the sales of stable isotopes of the noble gases, carbon, oxygen, nitrogen, chlorine, and sulfur, which were produced for the U. S. Energy Research and Development Administration at Mound Laboratory and Los Alamos Scientific Laboratory for the Fiscal Years 1976 and 1976A (July 1, 1975 through Sept. 30, 1976).

The customer tabulations are divided into the following sections:

- An alphabetical list of customers that includes, as far as practical, contacts at the buyer's plant. This section is further subdivided into domestic and foreign listings.
- An alphabetical list of states with cross references to customer numbers.
- An alphabetical list of isotopes with cross references to customer numbers.

The sales tabulations are divided into two parts. Part one shows total sales and furnishes the isotope, total number of shipments, total quantity, and the total value (including cylinder, packaging, and handling) of isotope shipments in Fiscal Years 1976 and 1976A. Part two furnishes similar but more detailed information for carbon, nitrogen, oxygen, and sulfur isotopes.

The available concentrations of the enriched isotopes have varied over a wide range. For example, xenon-124 has been enriched to 64%, whereas helium-3 has been enriched to 99.9996%.

The stable isotopes were distributed at enrichments noted in Table 1.

The stable isotopes of carbon, nitrogen, oxygen, chlorine, and sulfur were distributed in the forms shown in Table 2.

Helium-3 continued to be the major stable isotope in terms of volume and dollar sales of the numerous stable isotopes produced at Mound Laboratory. Information on enrichments, procurement, and prices may be obtained by contacting:

Monsanto Research Corporation
Stable Isotope Sales
Mound Laboratory
Miamisburg, Ohio 45342

Commercial telephone:
513-866-7444, Ext. 3502, 7337

Federal Telecom:
774-3502, 7337

Commercial teletype:
TWX No. 810-47342974

Table 1

Isotope	Enrichment, Mole %															
	99.98	99.95	99.9	99.5	99	97	95	90	80	70	60	50	40	30	25	20
Helium-3 ^a	X		X													
Neon-20		X														
Neon-21								X								
Neon-22			X													
Argon-36				X												
Argon-37 ^b																
Argon-38							X								X	
Argon-40		X														
Krypton-78					X			X				X				X
Krypton-80								X		X						
Krypton-82								X		X						
Krypton-83										X						
Krypton-86					X											
Krypton-84								X								
Xenon-124													X			
Xenon-126																X
Xenon-129											X					
Xenon-131											X					
Xenon-134												X				
Xenon-136					X			X	X							
Carbon-12		X	X													
Carbon-13					X	X		X								X
Nitrogen-14 ^c																
Nitrogen-15					X								X			
Oxygen-16	X															
Oxygen-17													X	X		
Oxygen-18					X	X	X	X								X
Sulfur-34								X								
Chlorine-35								X								
Chlorine-37								X								
Bromine-79								X								
Bromine-80								X								

^aHelium-3 also distributed at 99.9995% enrichment.

^bArgon-37 distributed at 70-fold enrichment.

^cNitrogen-14 distributed at 99.99% enrichment.

Table 2

Compound	Isotope										
	C-12	C-13	N-14	N-15	O-16	O-17	O-18	S-34	Br-79	Br-80	Cl-35
Ammonia				X							
Ammonium nitrate			X								
Ammonium sulfate-solid				X							
Ammonium sulfate-solution			X								
Barium carbonate	X	X									
Carbon dioxide	X	X									
Carbon monoxide	X	X									
Carbon disulfide								X			
Elemental											
Carbon	X	X									
Chlorine (gas)											X
Nitrogen (gas)				X							
Oxygen (gas)					X		X				
Sulfur								X			
Hydrogen sulfide								X			
Methane		X									
Nitric acid				X							
Potassium nitrate				X							
Water					X	X	X				
Sulfur dioxide								X			
Sulfuric acid								X			
Ethyl bromide									X	X	
Chlorobenzene											X
Hydrogen chloride											X
Sodium chloride											X

FY-1976 and FY-1976A
Stable Isotope Customers

Where no isotope is listed
helium-3 was the only isotope purchased.

Domestic

1. Aerojet Nuclear Co.
550 Second Street
Idaho Falls, ID 83401
J. K. Saari
C-13 (BaCo₃), Kr-78, Kr-86
2. Aerospace Corporation
200 N. Douglas Street
El Segundo, CA 90245
D. James
O-18 (O₂)
3. Airco Industrial Gases
River & Union Landing Roads
Riverton, NJ 08077
Mr. Gussman
4. Andros, Inc.
2332 Fourth Street
Berkeley, CA 94710
C. Martin
C-13 (CO₂)
5. Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439
R. Damm, J. G. Daunt, J. Frogge
J. Blaise, E. Kwirant,
C. Rutkowski
He-3, C-13 (C, CO₂)
Kr-80, Kr-82, Kr-83, Kr-84, Kr-86
O-18 (H₂O, O₂)
6. Arizona State University
Zoology Department
Tempe, AZ 85281
N. F. Hadley
O-18 (H₂O)
7. Battelle Memorial Institute
505 King Avenue
Columbus, OH 43201
R. N. Eddy
R. Winchell
O-16 (O₂), O-18 (H₂O)
8. Battelle Northwest
P. O. Box 999
Richland, WA 99352
S. Rogers
Xe-124
9. Bell Telephone Labs, Inc.
600 Mountain Avenue
Murray Hill, NJ 07974
R. F. Dartnell
C. J. Mogab
He-3, N-15 (N₂)
10. Bio-Rad Laboratories
2400 Wright Avenue
Richmond, CA 94084
B. Llewellyn Gabel
N-15 [(NH₄)₂ SO₄]
11. Boston University
Physics Department
111 Cummington Street
Boston, MA 02215
Mr. Zimmerman
12. Brandeis University
Lab. Supp. & Services
Waltham, MA 02154
H. L. McCarthy
13. Brookhaven National Laboratory
Isotopes and Special Materials
Building T-89
Upton, LI, NY 11973
P. Van Wormer
He-3, Ar-36, Kr-78
14. Brooklyn College
Dept. of Chemistry
Bedford Ave. & Avenue H
Brooklyn, NY 11210
T. Ishida, H. Wieck
C-13 (CO₂)
15. CW Radiation, Inc.
111 Ortega Avenue
Mountain View, CA 94040
D. B. Perkins
16. C. W. Radiation, Inc.
140 Kifer Court
Sunnyvale, CA 94086
K. Sample

17. California, University of
2000 Carleton Street
Berkeley, CA 94720
Mr. Brilliant
18. California, University of
Lawrence Berkeley Laboratory
End of Hearst Avenue
Berkeley, CA 94720
J. T. Haley, J. T. Beales
He-3, Ar-36, Ne-22, O-18 (H₂O)
Kr-84, Kr-86, Xe-136
C-12 (BaCo₃), C-13 (BaCo₃)
19. California, University of
Davis, CA 95616
J. T. Huber
Dept. of Animal Science
N-15 (NH₄)₂SO₄
C. Chan
Dept. of Agronomy and Range Science
N-15 (NH₄)₂SO₄
D. J. Duthie
Chemistry Dept.
N-15 (NH₃)
S. Winebaum
Environmental Health & Safety
N-15 (KNO₃)
D. Duthie
Physics Dept.
He-3
P. Stout
Soils and Plant Nutrition
N-15 (KNO₃, N₂, (NH₄)₂SO₄);
N-14 (NH₄)₂SO₄
20. California, University of
School of Physical Science
Irvine, CA 92664
W. Hehre
L. Travis
O-18 (O₂)
21. California, University of
Physics Department
3175 Miramar Road
La Jolla, CA 92037
W. Stephens
22. California, University of
Lawrence Livermore Laboratory
7000 East Avenue
Livermore, CA 94550
C. B. Sanford
Ne-22, Kr-82, Kr-83, Xe-136,
O-18 (H₂O)
23. California, University of
Laboratory of Nuclear Medicine
900 Veteran Avenue
Los Angeles, CA 90024
E. B. Jones
He-3, Kr-82, O-18 (H₂O)
N-15 [(NH₄)₂SO₄, KNO₃]
24. California, University, at L.A.
741 Circle Drive S
Los Angeles, CA 90024
E. B. Jones
C. J. Neagle, O. L. Chapman
He-3, C-13 (BaCo₃)
25. California, University of
Los Alamos Scientific Laboratory
Los Alamos, NM 87545
R. J. Van Gemert, E. F. Wartmann,
L. Guthrie, R. Froberg
He-3, Ne-20, O-18 (O₂)
C-13, (C, CH₄)
26. University of California
3401 Watkins Drive
Riverside, CA 92507
N-15 (NH₄)₂SO₄
27. California, Institute of Technology
391 S. Holliston
Pasadena, CA 91106
R. L. Mooney, Z. E. Switkowski
R. W. Kavanagh, R. Blackwood
C-12 (C), S-34 (S)
28. California State University, L.A.
5151 State University Drive
Los Angeles, CA 90032
H. Winkler
Ne-21
29. Southern California, University of
Dept. of Physics
Los Angeles, CA 90007
H. Bozler
30. Case Western Reserve University
2232 Circle Drive
Cleveland, OH 44106
L. O. Major, Jr.
D. G. Pohlman, L. O. Major, Jr.,
G. Mateescu
He-3, O-18 (O₂)
N-15 (N₂, KNO₃)
31. Catholic University of America, N.E.
Department of Physics
Washington, DC 20064
M. T. Lunnnon
Ne-22
32. University of Chicago
933 E. 56th Street
Chicago, IL
S. Tsjero
33. Chicago, University of
Franklin McLean Mem. Res. Ins.
5827 Drexel Blvd.
Chicago, IL 60637
P. V. Harper
He-3, Kr-80

34. Clarkson College
Dept. of Physics
Potsdam, NY
A. Czanderna
He-3, Ne-20, O-18(O₂)
35. Coherent Radiation
3210 Porter Drive
Palo Alto, CA 94304
Carol Green, M. Winnburg
36. Colorado, University of
Nuclear Physics Laboratory
Boulder, CO 80309
J. L. Homan, C. D. Zafiratos
He-3, Kr-78, Kr-80, Kr-82
Kr-83, Kr-84, Xe-132
37. Colorado State University
Department of Chemistry
Fort Collins, CO 80523
C. E. Maciel, A. S. Greenberg
He-3, C-13(BaCO₃)
38. The Connecticut Agriculture
Experiment Station
Dept. of Soil and Water
123 Huntington Street
New Haven, CT 06504
N-14[(NH₄)₂SO₄]
39. Cornell University
69 Clark Hall
Ithaca, NY 14853
B. Nathan, E. Smith, R. Buhrman
40. Cutler-Hammer, Inc.
A.I.L. Division
Walt Whitman Road
Melville, NY
A. Stein
C-13(CO₂)
41. Cryogenic Rare Gas Labs., Inc.
730 South 13th Street
Newark, NJ 07103
W. Dietz
42. Drexel University
34th & Ludlow Streets
Philadelphia, PA 19104
J. C. Scanlon
C-13(CO₂), Kr-86
43. Duke University
Department of Physics
Durham, NC 27706
H. W. Newsom, H. Meyer, R. Byrd
He-3, N-15(N₂)
44. Duke Medical Center
Durham, NC 27710
J. Miller
C-13(CO)
45. EG&G, Inc.
% U. S. ERDA
130 Robin Hill Rd.
Goleta, CA 93017
D. F. McCue
46. E. I. DuPont Co.
Experimental Station
Wilmington, DE 19898
R. Brown, W. E. Yound
C-13(CO, CO₂, BaCO₃)
47. E. I. duPont de Nemours & Co.
Savannah River Plant
Aiken, SC 29801
Rodman, M. L. Hyder
J. T. Buchner
C-13(CO), O-16(O₂)
48. East Texas State University
Chemistry Dept.
Commerce, TX 75428
O-18(H₂O)
49. Eco-Control, Inc.
Key Isotopes
56 Rogers Street
Cambridge, MA 02142
N-15(NH₃), C-13(C)
50. Albert Einstein College of Medicine
1300 Morris Park Avenue
Bronx, N.Y. 10461
M. Fabry
C-13(CO₂)
51. El Don Company
USA
2876 Butternut Street
Ann Arbor, MI 48104
D. E. Gillespie
52. Energy Research & Development Adm.
%U. S. Bureau of Mines
Cochrans Mill Road
Bruceton, PA 15213
C-12(C), C-13(C), S-34(H₂S)
53. Dept. of Environmental Quality
Division of Water Quality
1234 W. Morrison
Portland, OR 97205
D. Dunnette
N-15[(NH₄)₂SO₄]
54. Exxon Research and Engineering
1600 E. Linden Avenue
Linden, NJ 07036
D. Rapp
O-18(H₂O, O₂)

55. Florida, University of
Gainesville, FL 32610
D. Silverman, College of Medicine
O-18(H₂O)
D. N. Silverman, Pharmacology
C-13(C, BaCO₃), O-18(H₂O)
E. D. Adams, Physics Dept.
He-3
J. Messer, E. Holtzclaw, J. Carr
He-3, N-15(NH₄)₂SO₄
56. Fusion Energy Corporation
3684 U. S. Route 1
Princeton, NJ 08540
J. Nering
57. GTE Sylvania, Inc.
Johnston Street
Seneca Falls, NY 13148
Ne-20
58. General Electric Company
Neutron Devices Dept.
Byran Dairy Road
St. Petersburg, FL 33733
H. I. Kolinski
59. General Electric
50 Fordham Road
Wilmington, MA 01887
Bob Maitnes
O-16(H₂O)
60. University of Georgia
Safety Services Dept.
Athens, GA 30602
L. Muse, M. J. Cormier
Physics Dept., L. Arnold
He-3, O-18(H₂O)
61. Grumman Aerospace Corp.
Bethpage, NY 11714
F. Kuehne
62. Hanscom AFB
MA 01731
ESD Bldg. 1614 LGSBR
B. Duffy
Xe-136
63. Harshaw Chemical Company
6801 Cochran Road
Solon, OH 44139
J. Zamiska
64. Harvard University
Dept. of Chemistry
12 Oxford Street
Cambridge, MA 02138
J. Knowles
O-18(H₂O)
65. Hewlett Packard Company
Santa Clara Division
5301 Stevens Clark Blvd.
Santa Clara, CA 95050
M. Hopson
He-3, Ne-20
66. Honeywell, Inc.
2600 Ridgeway
Minneapolis, MN 54413
T. L. Wallerus
He-3, Ne-21, Ne-22
67. Honeywell, Inc.
1433 Stinson Blvd.
Minneapolis, MN 55413
T. Wallerus
He-3, Ne-20
68. Hope College
Physics Dept.
Holland, MI 49423
B. Hichwa
69. John Hopkins University
622 North Washington Street
Baltimore, MD 21205
J. J. Kaufman, D. Correll
O-18(O₂), N-15 [N₂, NH₃,
(NH₄)₂SO₄, KNO₃]
70. Hughes Aircraft Co.
Centinela & Teale Streets
Culver City, CA 90230
N. Kilstein
C-13(CO₂)
71. Hughes Aircraft Company
Electron Dynamics Division
3100 West Lomita Blvd.
Torrance, CA 90509
B. McKaig, L. Freedman
He-3, Ne-20, Ne-22
72. Hughes Laser Products
6155 El Camino Real
Carlsbad, CA 92008
H. Zimmerman
He-3, Ne-22
73. IBM Corporation
6300 Diagonal Highway
Boulder, CO 80302
E. Arnold, C. B. Little
He-3, Ne-22
74. IBM Research Lab
5600 Cattle Road
San Jose, CA 95193
T. D. Sappington
75. IBM-T. J. Watson Research Center
Kitchawan Route-Route 134
Yorktown, NY 10598
R. J. Arculeo
S. E. Burks
He-3, Ne-20
76. Illinois, University of
1609 South Oak Street
Champaign, IL 61820
M. L. Szapoznik
He-3, C-13(CO, BaCO₃), O-18(H₂O)

77. Illinois, University of
Urbana, IL 61801
D. M. Ginsberg, McKinley Hosp.
A. Akerman, Nuclear Eng.
N-15 (KNO_3)
78. Indiana, University of
1025 East 11th Street
Bloomington, IN 47401
P. L. Smith
O-18(H_2O , O_2)C-13(CO_2), N-15(N_2)
79. Indiana, Univer of Pennsylvania
Weyandt Hall
Indiana, PA 15701
80. Institute of International Education
809 United Nations Plaza
New York, NY 10017
N. Brady
N-15(NH_4) $_2\text{SO}_4$
81. Jodon Engineering Assoc., Inc.
145 Enterprise Drive
Ann Arbor, MI 48103
J. W. Gillespie
Ne-22
82. Kansas State University
Department of Agronomy
Manhattan, KS 66506
R. V. Olson
N-15[(NH_4) $_2\text{SO}_4$, N_2]
C-13 (CH_4)
83. C. F. Kettering Research Laboratory
150 East South College Street
Yellow Springs, OH 45387
W. E. Newton
O-18 (H_2O)
84. Koch Isotopes, Inc.
72 Rogers Street
Cambridge, MA 02142
M. Zyberg, M. Wyman
N-15 [HNO_3 , (NH_4) $_2\text{SO}_4$, N_2]
C-13 (CO_2 , CO , C , CH_4)
C-12(CO_2 , CO), O-18(H_2O)
85. LND, Incorporated
3230 Lawson Blvd.
Oceanside, NY 11572
W. Muzzey
86. Landseas Corp.
138-01 Springfiled Blvd.
Jamaica, NY 11413
M. Freindlich
87. Lasermetrics, Inc.
111 Galway Place
Teaneck, NJ
R. Goldstein, A. Idelson
O-17(O_2), O-18(H_2O)
N-15 [(NH_4) $_2\text{SO}_4$]
C-13 (BaCO_3 , C)
88. Liconix
1400 Stierlin Road
Mountain View, CA 94043
K. Funch, Feltman
89. Litton Systems, Inc.
Guidance & Control Systems Div.
5500 Canago Avenue
Woodland Hills, CA 91364
D. Howarth, S. Norrell,
J. Schroeder
He-3, Ne-20, Ne-22
Kr-83, C-13(CO_2)
90. Lockheed Missiles & Space Co., Inc.
3251 Hanover Street
Palo Alto, CA 94304
91. Maryland, University of
College Park, MD 20742
Mr. Glover
92. University of Massachusetts
Nuclear Physics
Amherst, MA
G. A. Peterson
93. Massachusetts Inst. of Technology
Cambridge, MA 02139
D. Reed
O-18(O_2)
94. Massachusetts Inst. of Technology
Lincoln Laboratory
244 Wood Street
Lexington, MA 02173
C. Freed, A. Bernstein
C-13(CO_2 , C)
95. Matheson Gas
8800 Utica Avenue
Cucamonga, CA 91730
C-13(CO)
96. Matheson Gas Products
932 Paterson Plank Road
E. Rutherford, NJ 07073
Pat Taylor
B. Steinhardt
He-3, Ne-20, Ne-22, Kr-82
97. Metrologic Instruments, Inc.
143 Harding Avenue
Bellmawr, NJ 08030
C. H. Knowles
98. University of Michigan
3072 Phoenix Memorial Laboratory
2301 Banisteel Blvd.
Ann Arbor, MI 48109
C. W. Ricker, W. Miller
99. Michigan State University
1330 S. Harrison Road
East Lansing, MI 48824
D. R. Merritt, J. R. Snook
He-3, Ar-36
C-13(C , CO_2)

100. Midwest Research Institute
425 Volker Blvd.
Kansas City, MO 64110
W. P. Duncan
C-13(CO)
101. Minnesota, University of
Williams Lab. of Nuclear Physics
830 E. River Flats
Minneapolis, MN 55455
G. F. Schissel
J. H. Broadhurst
He-3, O-18(H₂O, O₂), N-15(N₂)
102. Minnesota, University of
Physics Depart
Chemistry Dept.
Minneapolis, MN 55455
Dr. P. Gassman
W. Weyhman
He-3, C-13(CO₂)
103. University of Minnesota
Dept. of Soil Science
St. Paul, MN 55108
G. E. Ham
N-15[(NH₄)₂SO₄]
104. University of Missouri
Dept. of Chemistry
St. Louis, MO 63121
K. W. Barnett
C-13(CO)
105. Monsanto Company
800 N. Lindberg Blvd.
St. Louis, MO 63166
J. Schaefer,
H. Frazier, M. Sadorf
N-15[(NH₄)₂SO₄], C-13(CO)
S-34(CS₂)
106. Monsanto Research Corporation
Mound Laboratory
Miamisburg, OH 45342
D. Pardieck
107. National Aeronautics & Space Admin.
Langley Research Center
Hampton, VA 23665
C. R. Lane
L. Cannon
108. National Aeronautics & Space Admin.
Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44135
J. W. Blue
Xe-131
109. National Bureau of Standards
Route 270 & Quince Orchard Road
Gaithersburg, MD 20234
R. Moler
Xe-129
110. National Institute of Health
Radioisotope Laboratory
Bldg 21
Bethesda, MD 20014
H. Kon
N-15(N₂)
111. National Institute of Neurological
and Communicative Disorders & Stroke
Laboratory of Neuropharmacology
9000 Rockville Pike
Bethesda, MD 20014
M. J. Perlow, R. Kartzinel
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Stable Isotope Sales FY 1976 and FY 1976A

Isotope	Domestic			Foreign			ERDA and Other Federal			Total		
	Ship- ments	Liters ^a	Dollars	Ship- ments	Liters ^a	Dollars	Ship- ments	Liters ^a	Dollars	Ship- ments	Liters ^a	Dollars
Argon-36	2	.225	1,027	7	2.270	8,980	4	5.145	13,411	13	7.640	23,418
Argon-37	-	-	-	1	Lot	1,238	-	-	-	1	Lot	1,238
Argon-38	1	.005	246	3	.115	3,939	-	-	-	4	.120	4,185
Carbon-12	5	91.990 ^b	1,318	5	100.350 ^b	6,124	2	7.080 ^b	200	12	199.420 ^b	7,642
Carbon-13	83	685.776 ^b	55,564	27	1680.436 ^b	114,383	20	241.190 ^b	14,254	130	2,607.402 ^b	184,201
Carbon-13, LASL ^d							2	1000g		2	1,000g	
Helium-3	135	1855.070	255,858	81	949.000	156,438	33	3987.759	336,554	249	6,791.829	748,850
Krypton-78	1	.010	441	6	.654	6,487	5	1.240	3,113	12	1.904	10,041
Krypton-80	1	.010	267	5	.134	3,319	2	.085	1,315	8	.229	4,901
Krypton-82	2	.030	383	5	.134	1,410	6	.910	4,884	13	1.074	6,677
Krypton-83	5	.330	3,289	1	.010	157	1	.100	703	7	.440	4,149
Krypton-84	1	.100	201	4	.580	1,130	3	10.040	8,145	8	10.720	9,476
Krypton-86	4	.950	964	3	.560	581	6	30.040	11,922	13	31.550	13,467
Neon-20	11	19.630	2,709	5	13.750	1,667	1	1.000	191	17	34.380	4,567
Neon-21	2	.560	7,735	-	-	-	-	-	-	2	.560	7,735
Neon-22	12	18.500	6,718	6	12.510	3,123	3	48.000	4,399	21	79.010	14,240
Nitrogen-14	4	843.520 ^c	92,911	3	13.000 ^c	2,222	3	438.940 ^c	46,640	10	1,295.460 ^c	141,773
Nitrogen-15	55	863.614 ^b	59,620	13	257.075 ^b	18,782	14	766.246 ^b	35,139	82	1,886.935	113,541
Nitrogen-15, LASL ^d							1	200.g		1	200.g	
Oxygen-16	1	171.600 ^b	533	1	42.900 ^b	236	6	2941.800 ^b	4,461	8	3,156.300 ^b	5,230
Oxygen-17	6	.573 ^b	996	1	.917 ^b	256	-	-	-	7	1.490 ^b	1,252
Oxygen-18	52	128.416 ^b	17,169	10	71.564 ^b	7,942	26	783.160 ^b	57,538	88	983.140 ^b	82,649
Oxygen-18, LASL ^d							1	100.g		1	100.g	
Sulfur-34	3	3.150	1,056	9	15.270	5,315	1	.920	361	13	19.340	6,732
Xenon-124	-	-	-	4	.780	40,261	1	.010	151	5	.790	40,412
Xenon-126	-	-	-	-	-	-	-	-	-	-	-	-
Xenon-129	-	-	-	1	.200	681	1	.100	372	2	.300	1,053
Xenon-131	-	-	-	-	-	-	1	.050	448	1	.050	448
Xenon-136	1	.015	650	1	.020	742	9	20.820	160,938	11	20.856	162,330
Mixture	22	230.422	32,472	6	125.575	19,761	5	38.600	3,880	33	394.597	56,113
Chlorine-37	1	.555	276	-	-	-	-	-	-	1	.555	276
Total	410		542,403	208		405,174	157		709,019	775		1,656,596

^aGrams or kilograms of isotope as noted.^bGrams^cKilograms^dMaterial used at Los Alamos Scientific Laboratory (LASL).

USAGE OF CARBON,NITROGEN, OXYGEN, SULFUR, AND CHLORINE ISOTOPE FORMS

Enrichment and Form	Domestic		Foreign		ERDA		Total	
	Ship- ments	Grams Isotope	Ship- ments	Grams Isotope	Ship- ments	Grams Isotope	Ship- ments	Grams Isotope
USAGE OF CARBON-12 FORMS FY 1976 AND FY 1976A								
99.95% CO	Subtotal	1	48	3	85		4	133
99.9% BaCO ₃		1	6	2	15	1	1	6
C		2	32			2	5	28
CO ₂		2					2	32
Subtotal		3	38	2	15	3	8	66
Total		4	86	5	100	3	12	199
USAGE OF CARBON-13 FORMS FY 1976 AND FY 1976A (Includes LASL use)								
99% C		4	3	1	1		5	4
CO ₂		2	2			2	4	36
CH ₄	Subtotal	6	5	1	1	2	9	40
97% BaCO ₃		5	22				5	22
C		10	14	3	4	3	16	39
CO ₂		2	9	1	3		3	12
CH ₄		1	1	1	1		2	2
Subtotal		18	46	5	8	3	26	75
90% BaCO ₃		12	51	5	600	2	19	657
C		8	79	2	7	3	13	99
CO ₂		17	225	5	527	4	26	1291
CO		17	244	7	532	3	27	1289
CH ₄		2	13	2	5	2	6	24
Subtotal		56	612	21	1671	14	91	3360
20% CO ₂		3	28			2	5	123
CO						1	1	9
Subtotal		3	28			3	6	132
Total		83	691	27	1680	22	132	3607
USAGE OF NITROGEN-14 FORMS FY 1976 AND 1976A								
99.99% (NH ₄) ₂ SO ₄		4	844	3	13	3	10	1296
USAGE OF NITROGEN-15 FORMS FY 1976 AND 1976A (Includes LASL use)								
90-99% NH ₃		8	107			1	9	108
(NH ₄) ₂ SO ₄		15	74	2	10	2	19	324
HNO ₃		1	25				1	25
N ₂		7	33	9	46	8	24	131
KNO ₃		1	1				1	1
Subtotal		32	240	11	56	11	54	589
65% KNO ₃	Subtotal	1	50	1	1	1	3	57
40% (NH ₄) ₂ SO ₄		16	504			2	18	1027
KNO ₃		4	70	1	200	3	8	414
Subtotal		20	574	1	200	5	26	1441
Total		53	864	13	257	17	83	2087
USAGE OF OXYGEN-16 FORMS FY 1976 AND 1976A								
H ₂ O		1	171	1	43	4	6	2312
O ₂						2	2	844
Total		1	171	1	43	6	8	3156
USAGE OF OXYGEN-17 FORMS FY 1976 AND FY 1976A								
H ₂ O				1	1		1	1
O ₂		6	1				6	1
Total		6	1	1	1		7	2
USAGE OF OXYGEN-18 FORMS FY 1976 AND FY 1976A (Includes LASL use)								
H ₂ O		33	95	10	72	18	61	894
O ₂		19	33			9	28	189
Total		52	128	10	72	27	89	1083
USAGE OF SULFUR-34 FORMS FY 1976 AND 1976A								
90% S		1	1	4	4		5	5
CS ₂		1	1	1	2		2	3
H ₂ S				2	6	1	3	7
Subtotal		2	2	7	12	1	10	15
75% S		1	1	2	3		3	4
Total		3	3	9	15	1	13	19
USAGE OF CHLORINE-37 FORMS FY 1976 AND 1976A								
90% NaCl		1	1				1	1
Total		1	1				1	1

Distribution

EXTERNAL

TID-4500, UC-23 (156)

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