37442

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MALCOLM PIRNIE

ARCS II

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CONTRACT NO. 68-W9-0051

# WELSBACH/GENERAL GAS MANTLE CONTAMINATION SITE CAMDEN, NEW JERSEY
**Work Assignment No. 050-28UC**

# DRAFT FINAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT VOLUME II

**Remedial Planning Activities at Selected Uncontrolled Hazardous Substance Disposal Sites USEPA Region II (NY, NJ, PR, VI)**

Malcolm Pirnie, Inc.
104 Corporate Park Drive
White Plains, New York 10602

January 1999

300695

A

**APPENDIX A**

**WELSBACH/GGM SITE**

**NJDEP PRELIMINARY RADIATION SURVEY PROPERTIES DATA**

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
WELSBACH/GGM SITE
CAMDEN AND GLOUCESTER CITY
CAMDEN COUNTY, NEW JERSEY

LEGEND

PROPERTIES WITH NO EVIDENCE OF CONTAMINATION
< 13 uR/h OR
< 0.02 WL RADON DECAY PRODUCTS OR
< 4 pCi/L RADON

SUSPECT PROPERTIES
13 – 30 uR/h OR
ADJACENT TO CONTAMINATED PROPERTY

POTENTIALLY CONTAMINATED
> 30 uR/h OR
> 0.02 WL RADON DECAY PRODUCTS OR
> 4 pCi/L RADON


| REVISIONS | | | |
|---|---|---|---|
| NO. | BY | DATE | REMARKS |

DES ____
DWN ____
CKD ____

MALCOLM PIRNIE

WELSBACH/GENERAL GAS MANTLE
CAMDEN/GLOUCESTER CITY
NEW JERSEY

PRELIMINARY EVALUATION OF THE WELSBACH/GENERAL GAS MANTLE INVESTIGATION
STUDY AREA 1
APPENDIX A-1
1" = 60'

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DATE AUGUST 1998
SHEET ___ OF ___
CAD REF. NO. ____

LEGEND

PROPERTIES WITH NO EVIDENCE OF CONTAMINATION
- < 13 uR/HR
- < 0.02 WL RADON DECAY PRODUCTS OR
- < 4 pCi/L RADON

SUSPECT PROPERTIES
- 13 – 30 uR/HR
- ADJACENT TO CONTAMINATED PROPERTY

POTENTIALLY CONTAMINATED
- > 30 uR/HR OR
- > 0.02 WL RADON DECAY PRODUCTS OR
- > 4 pCi/L RADON


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| REVISIONS | | | |
|---|---|---|---|
| NO. | BY | DATE | REMARKS |
| | | | |

DES ______
DWN ______
CKD ______

WELSBACH/GENERAL GAS MANTLE
CAMDEN/GLOUCESTER CITY
NEW JERSEY

PRELIMINARY EVALUATION OF THE WELSBACH/GENERAL GAS MANTLE INVESTIGATION
STUDY AREA 2
APPENDIX A–2
1" = 60'


DATE AUGUST 1998
SHEET ____ OF ____
CAD REF. NO. ______

LEGEND

PROPERTIES WITH NO EVIDENCE OF CONTAMINATION
< 13 uR/h OR
< 0.02 WL RADON DECAY PRODUCTS OR
> 4 pCi/l RADON

SUSPECT PROPERTIES
13 – 30 uR/h OR
ADJACENT TO CONTAMINATED PROPERTY

POTENTIALLY CONTAMINATED
> 30 uR/h OR
> 0.02 WL RADON DECAY PRODUCTS OR
> 4 pCi/L RADON


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| REVISIONS | | | |
|---|---|---|---|
| NO. | BY | DATE | REMARKS |
| | | | |

DES ______
DWN ______
CKD ______

WELSBACH/GENERAL GAS MANTLE
CAMDEN/GLOUCESTER CITY
NEW JERSEY

PRELIMINARY EVALUATION OF THE WELSBACH/GENERAL GAS MANTLE INVESTIGATION
STUDY AREA 3
APPENDIX A–3
1" = 100'

306003


DATE AUGUST 1998
SHEET ____ OF ____
CAD REF. NO. ______

LEGEND

**PROPERTIES WITH NO EVIDENCE OF CONTAMINATION**

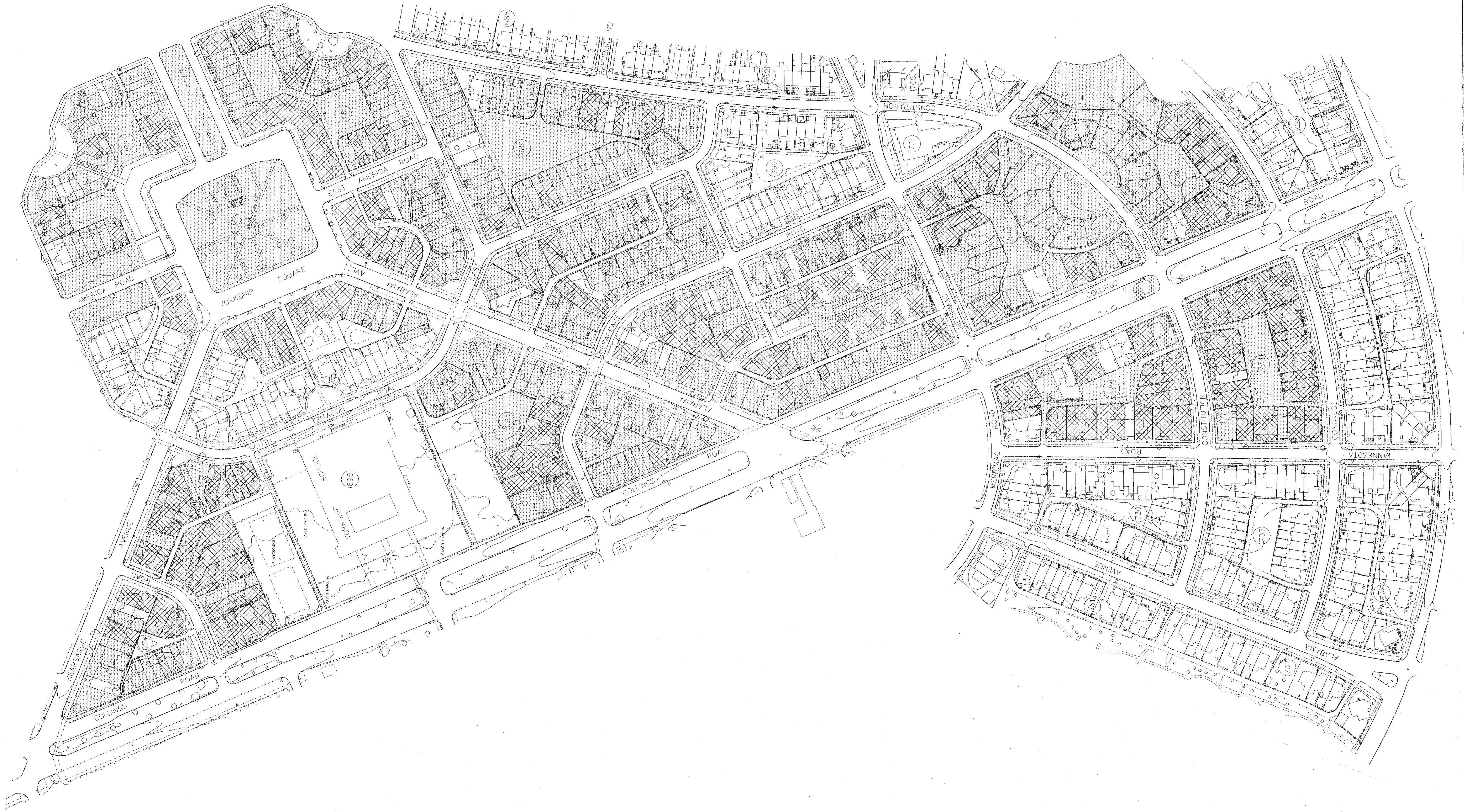
< 13 uR/h OR
< 0.02 WL RADON DECAY PRODUCTS OR
< 4 pCi/L RADON

**SUSPECT PROPERTIES**

13 – 30 uR/h OR
ADJACENT TO CONTAMINATED PROPERTY

**POTENTIALLY CONTAMINATED**

> 30 uR/h OR
> 0.02 WL RADON DECAY PRODUCTS OR
> 4 pCi/L RADON




| MALCOLM PIRNIE | | REVISIONS: NO. / BY / DATE / REMARKS | DES. / DWN / CKD | WELSBACH/GENERAL GAS MANTLE<br>CAMDEN/GLOUCESTER CITY<br>NEW JERSEY | PRELIMINARY EVALUATION OF THE WELSBACH/GENERAL GAS MANTLE INVESTIGATION<br>STUDY AREA 4<br>APPENDIX A-4<br>1" = 80' | COPYRIGHT © MALCOLM PIRNIE, INC.<br>DATE AUGUST 1998<br>SHEET ___ OF ___<br>CAD REF. NO. |
|---|---|---|---|---|---|---|

300700

LEGEND

PROPERTIES WITH NO EVIDENCE OF CONTAMINATION
< 13 uR/h OR
< 0.02 WL RADON DECAY PRODUCTS OR
< 4 pCi/L RADON

SUSPECT PROPERTIES
13 – 30 uR/h OR
ADJACENT TO CONTAMINATED PROPERTY

POTENTIALLY CONTAMINATED
> 30 uR/h OR
> 0.02 WL RADON DECAY PRODUCTS OR
> 4 pCi/L RADON


MALCOLM PIRNIE

| REVISIONS | | | |
|---|---|---|---|
| NO. | BY | DATE | REMARKS |

DES
DWN
CKD

WELSBACH/GENERAL GAS MANTLE
CAMDEN/GLOUCESTER CITY
NEW JERSEY

PRELIMINARY EVALUATION OF THE WELSBACH/GENERAL GAS MANTLE INVESTIGATION
STUDY AREA 5
APPENDIX A–5
1" = 60'

300701


DATE AUGUST 1998
SHEET ___ OF ___
CAD REF. NO.

B

**APPENDIX B**

**WELSBACH/GGM SITE**

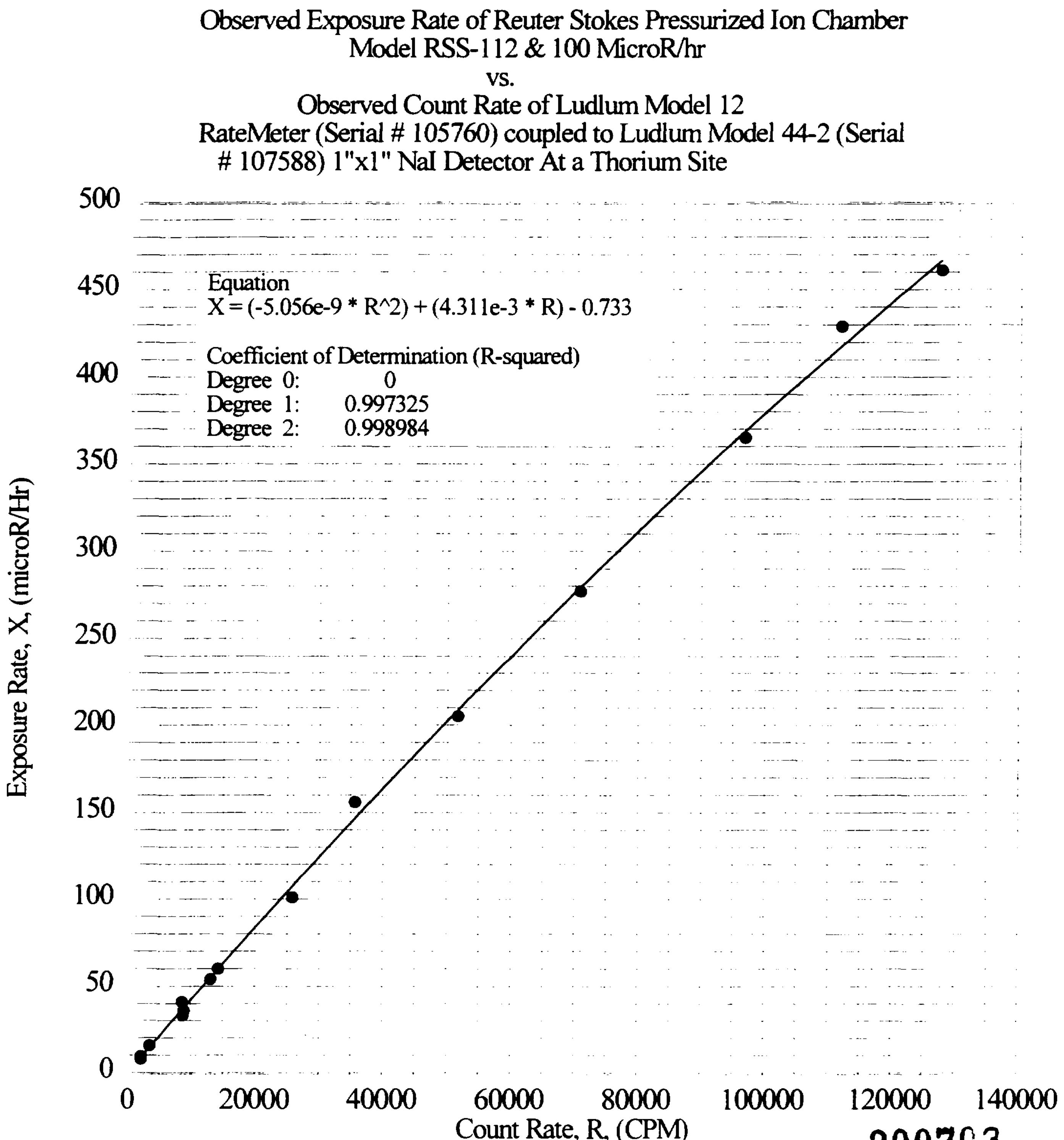
**REMEDIAL INVESTIGATION DATA**

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
WELSBACH/GGM SITE
CAMDEN AND GLOUCESTER CITY
CAMDEN COUNTY, NEW JERSEY

# APPENDIX B-1

## WELSBACH/GGM SITE

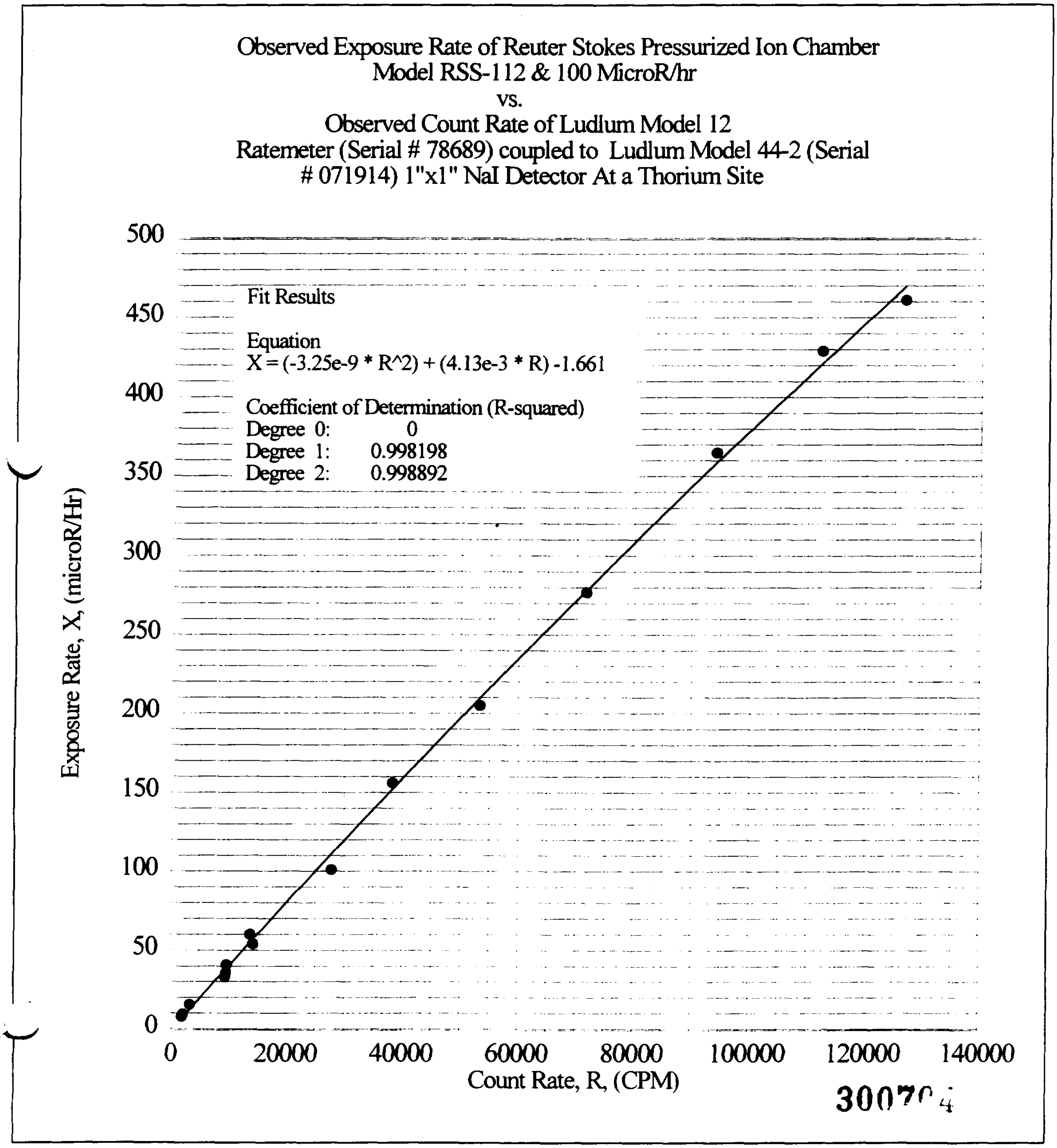
REGRESSION CURVE




300703

# APPENDIX B-2

## WELSBACH/GGM SITE
### REGRESSION CURVE



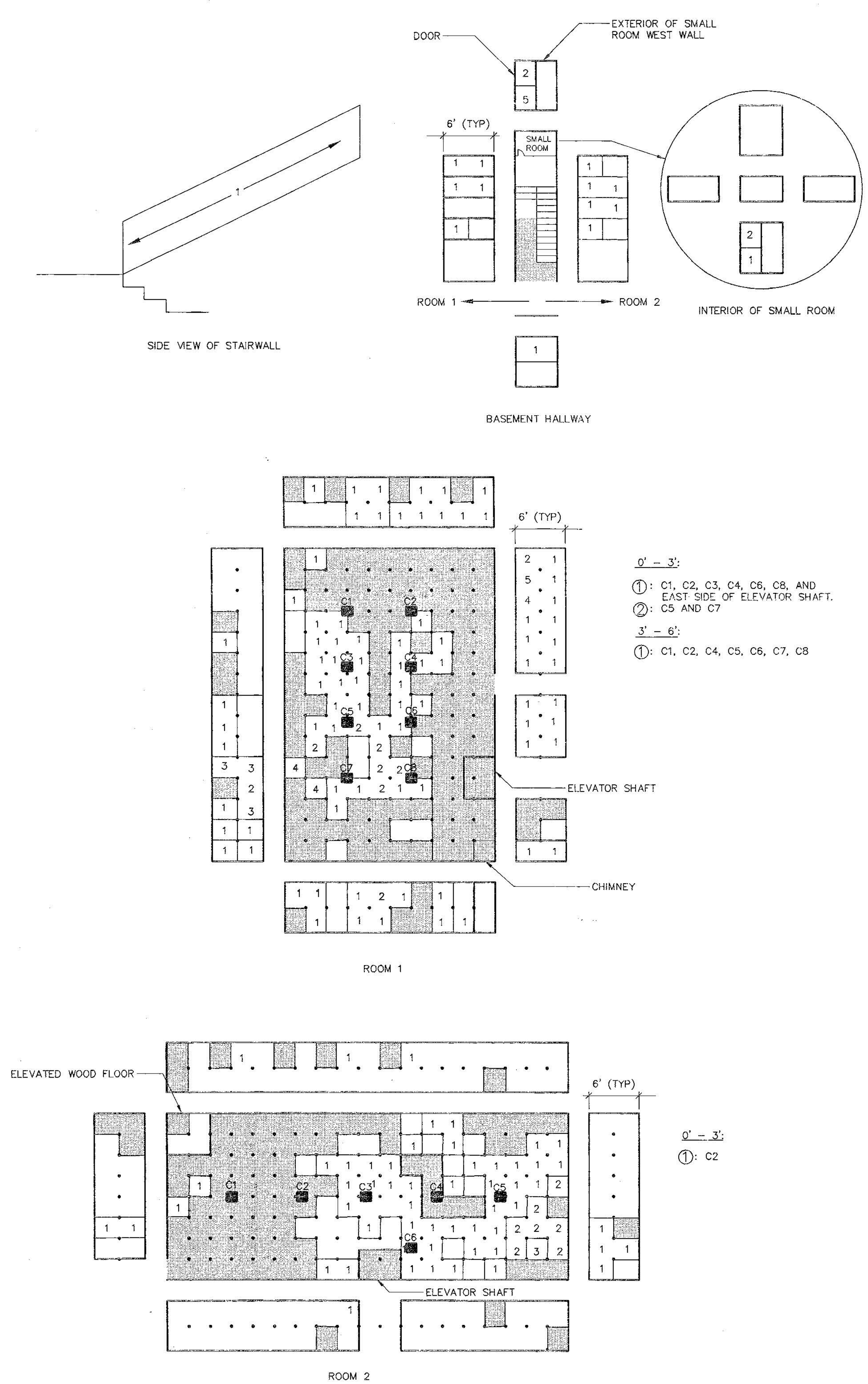

300704

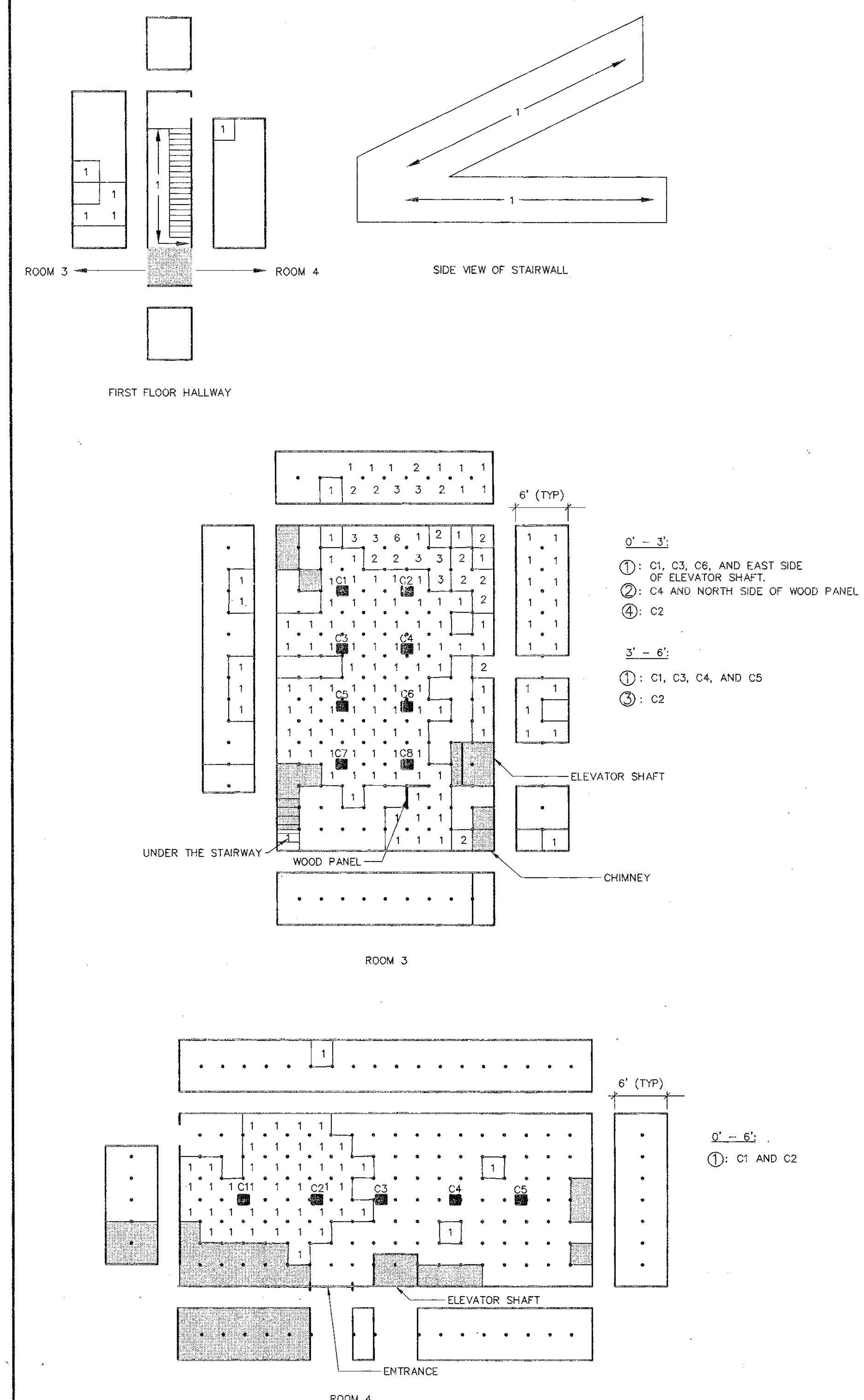
# TOTAL BETA MEASUREMENT (dpm/100 cm^2)

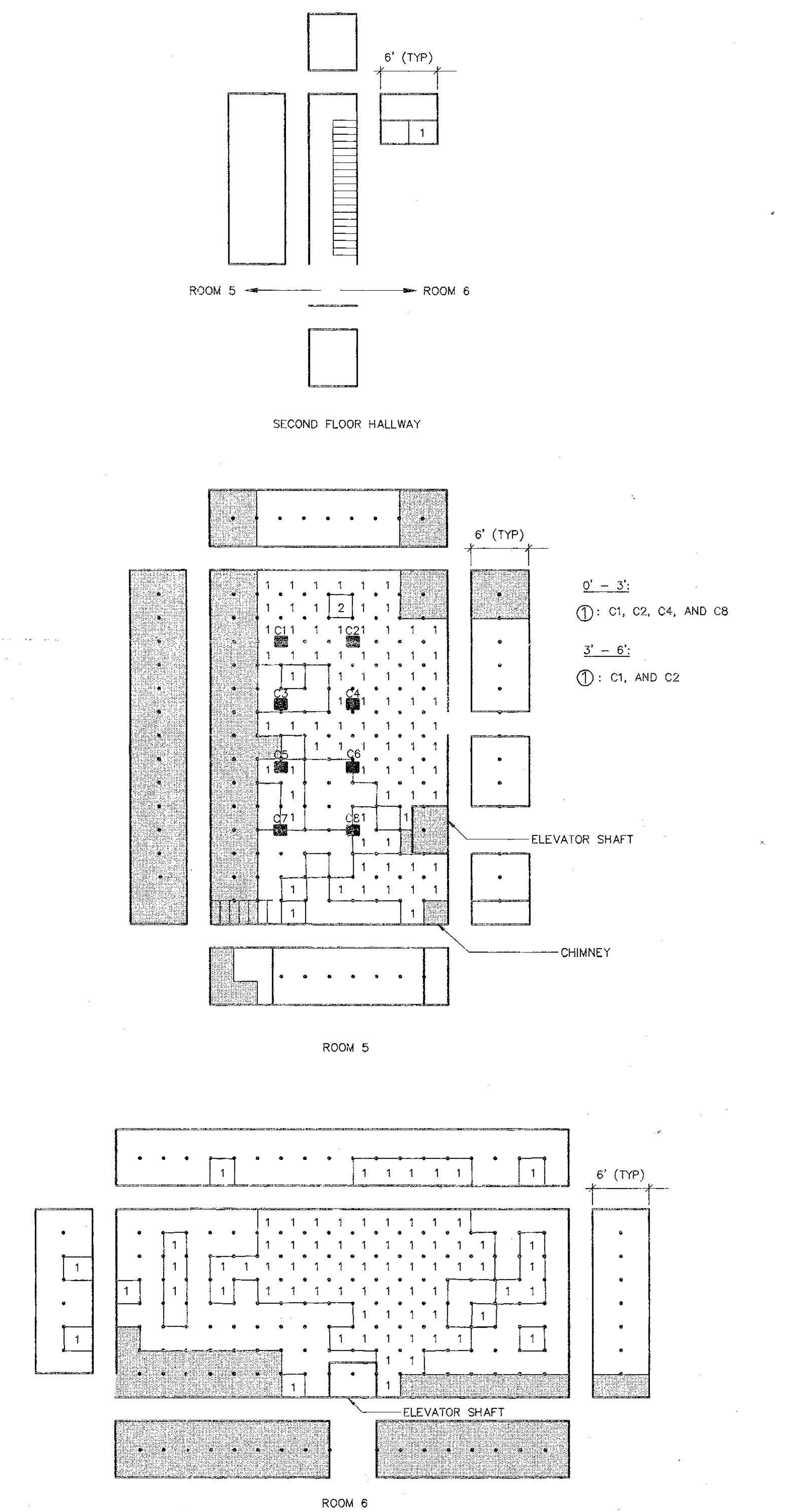
LEGEND: ▒ INACCESSIBLE ① ≥ 1,608 TO < 5,000 dpm/100 cm^2 ② ≥ 5,000 TO < 15,000 dpm/100 cm^2 ③ ≥ 15,000 TO 25,000 dpm/100 cm^2 ④ ≥ 25,000 TO < 35,000 dpm/100 cm^2 ⑤ ≥ 35,000 TO < 45,000 dpm/100 cm^2 ⑥ ≥ 45,000 TO < 55,000 dpm/100 cm^2

C : COLUMN

TOTAL BETA MEASUREMENTS ARE BELOW THE RELEASE CRITERIA (1,608 dpm/100cm^2) UNLESS WHERE NOTED

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| REVISIONS | | | |
|---|---|---|---|
| NO. | BY | DATE | REMARKS |

DES DES
DWN DWN
CKD CKD

WELSBACH/GGM SITE
TOTAL SURFACE ACTIVITY DATA
INTERIOR OF FORMER GGM BUILDING
NOT TO SCALE



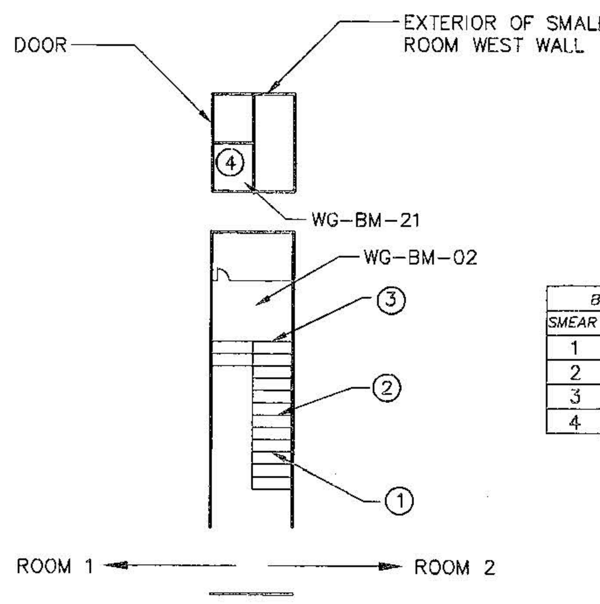
APPENDIX B-3

# LOCATION OF BUILDING MATERIAL SAMPLES AND SMEAR SURVEY

LEGEND:

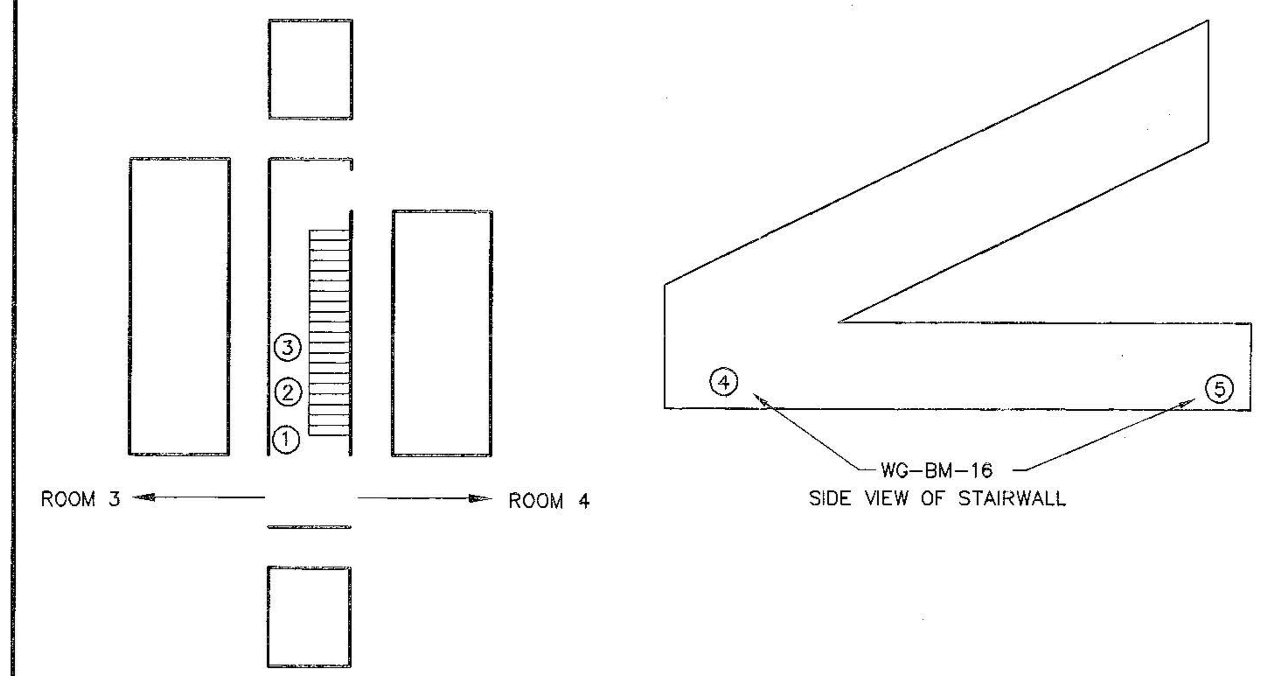
- (#) SMEAR LOCATION (dpm/100cm^2)
- WG-BM-# : BUILDING MATERIAL SAMPLE LOCATION
- C : COLUMN

WG-BM-12: COMPOSITE SAMPLE COLLECTED FROM COLUMNS (C1, C2, C5, C7, AND C8) INSIDE ROOM 1
WG-BM-18: COMPOSITE SURFACE DIRT SAMPLE COLLECTED FROM ROOMS 1 AND 2
WG-BM-20: COMPOSITE SAMPLE COLLECTED FROM COLUMNS (C1, C2, AND C4) INSIDE ROOM 5
WG-BM-22: COMPOSITE FLOOR SURFACE DIRT COLLECTED FROM ROOM 3-6



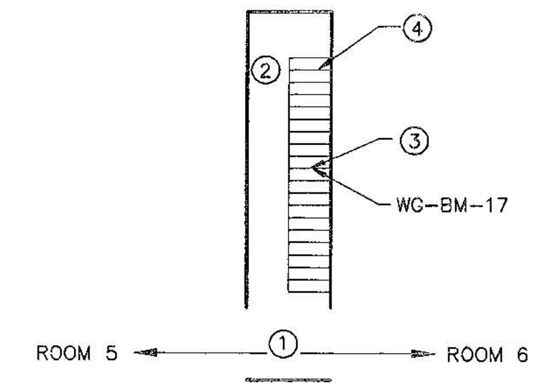

BASEMENT HALLWAY

| BASEMENT HALLWAY | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 10 | 23 |
| 2 | 13 | 18 |
| 3 | 10 | 26 |
| 4 | 123 | 102 |



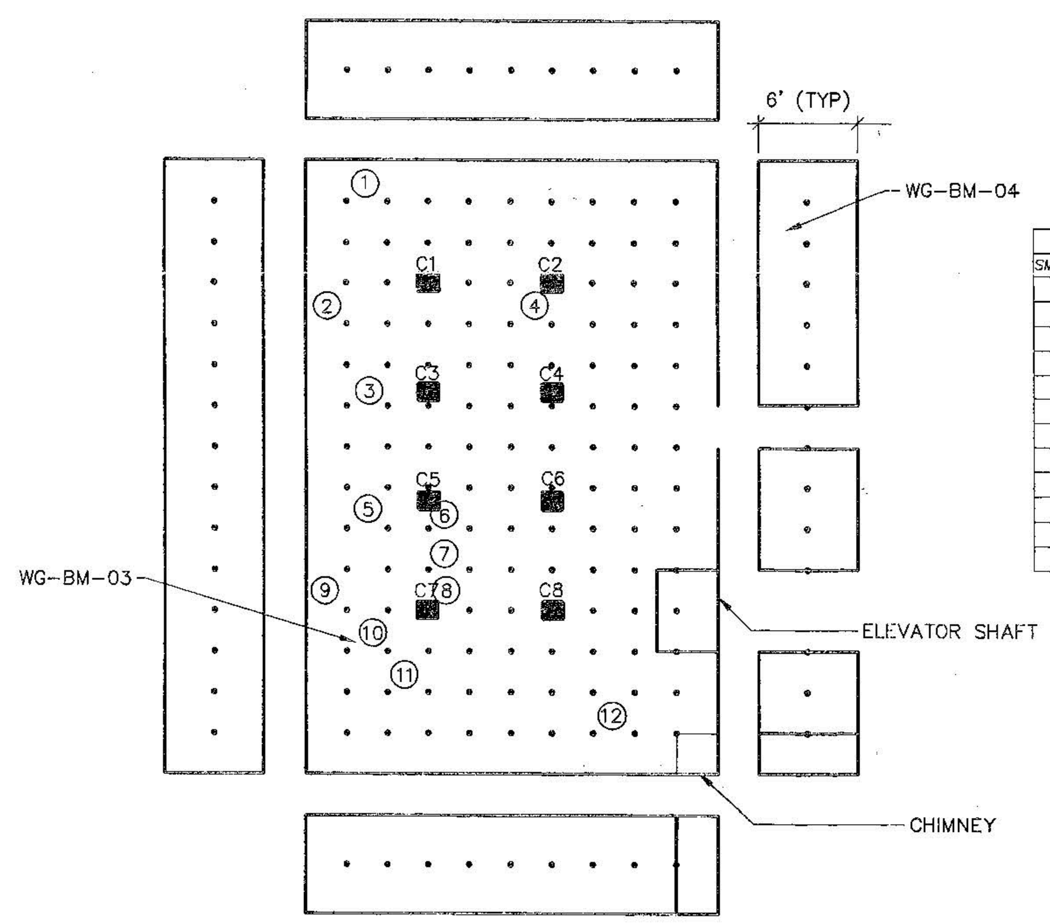

FIRST FLOOR HALLWAY

| FIRST FLOOR HALLWAY | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 11 | 12 |
| 2 | 8 | 21 |
| 3 | 5 | 12 |
| 4 | 6 | 19 |
| 5 | 3 | 13 |



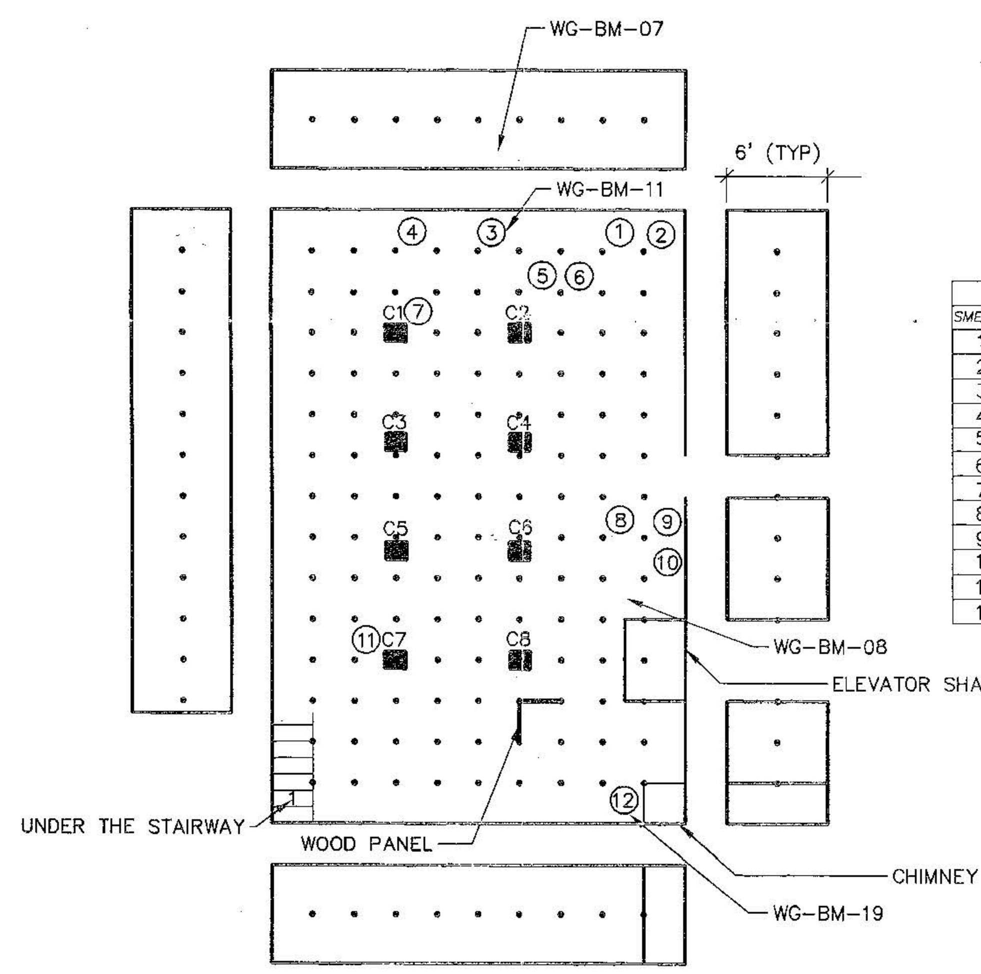

SECOND FLOOR HALLWAY

| SECOND FLOOR HALLWAY | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 12 | 22 |
| 2 | 4 | 11 |
| 3 | 14 | 17 |
| 4 | 16 | 21 |



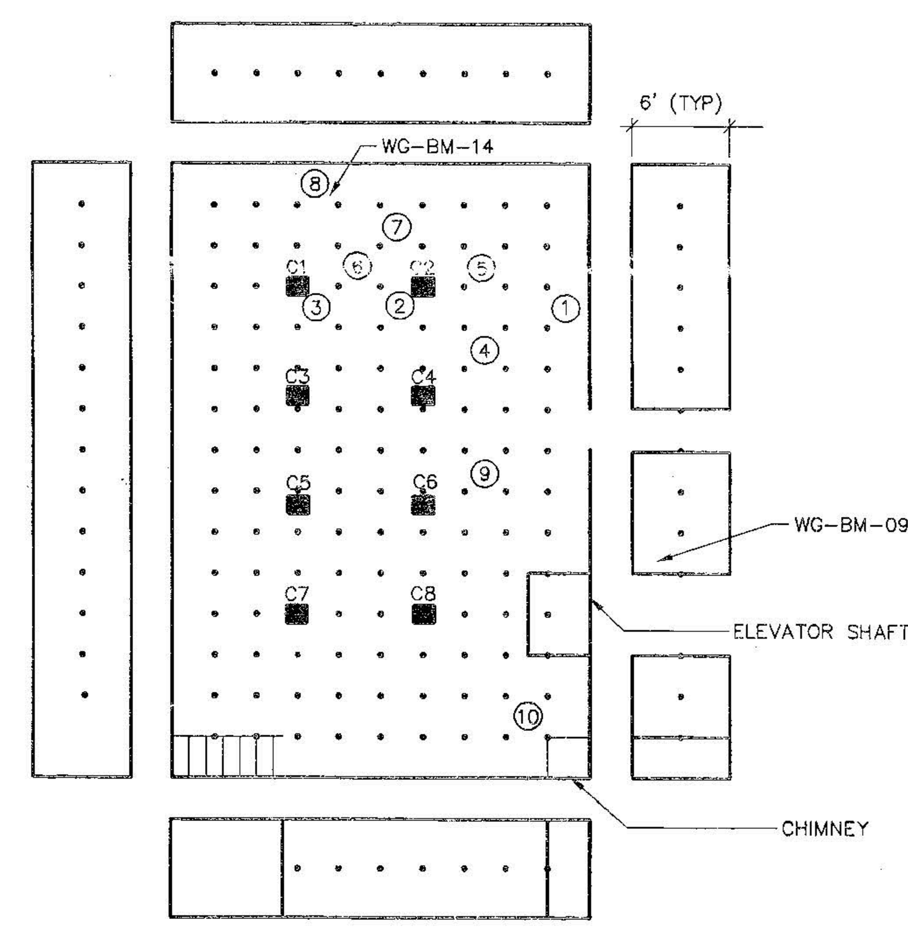

ROOM 1

| ROOM 1 | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 12 | 36 |
| 2 | 17 | 25 |
| 3 | 33 | 163 |
| 4 | 10 | 14 |
| 5 | 4 | 18 |
| 6 | 4 | 15 |
| 7 | 3 | 17 |
| 8 | 15 | 24 |
| 9 | 225 | 275 |
| 10 | 119 | 235 |
| 11 | 29 | 57 |
| 12 | 18 | 34 |



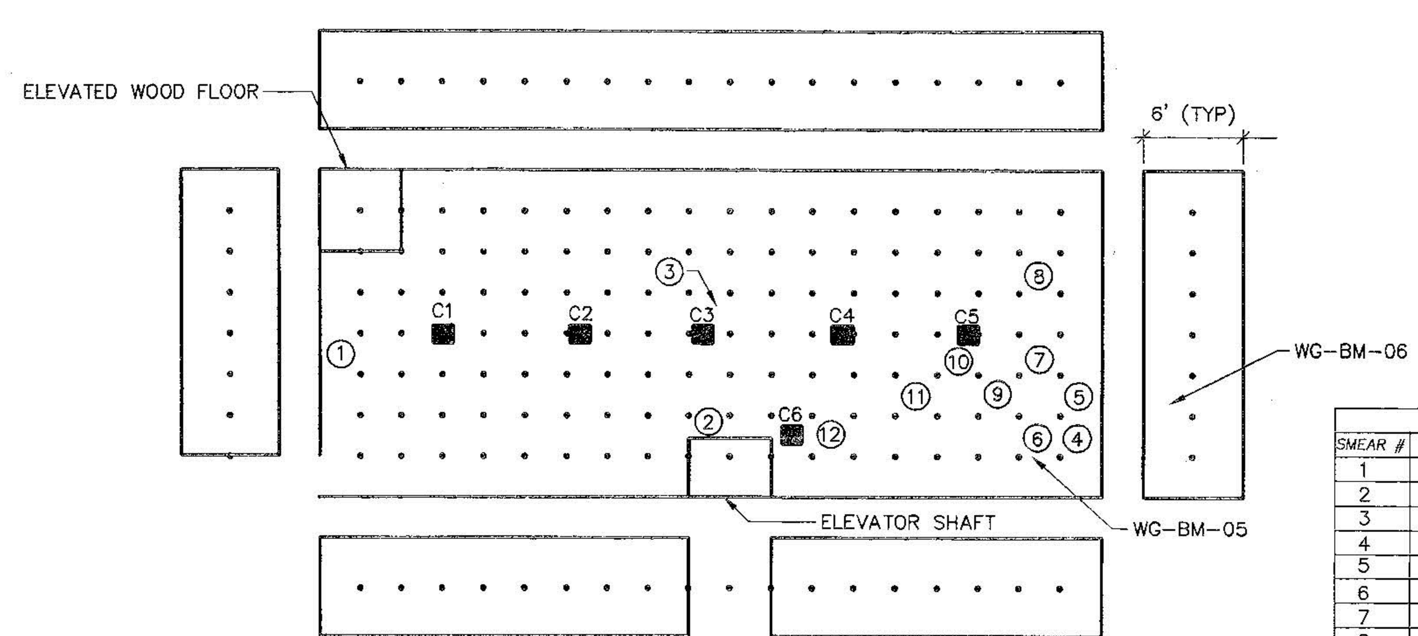

ROOM 3

| ROOM 3 | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 139 | 170 |
| 2 | 16 | 144 |
| 3 | 293 | 431 |
| 4 | 40 | 71 |
| 5 | 79 | 126 |
| 6 | 54 | 98 |
| 7 | 18 | 21 |
| 8 | 7 | 16 |
| 9 | 12 | 34 |
| 10 | 26 | 39 |
| 11 | 7 | 13 |
| 12 | 37 | 69 |



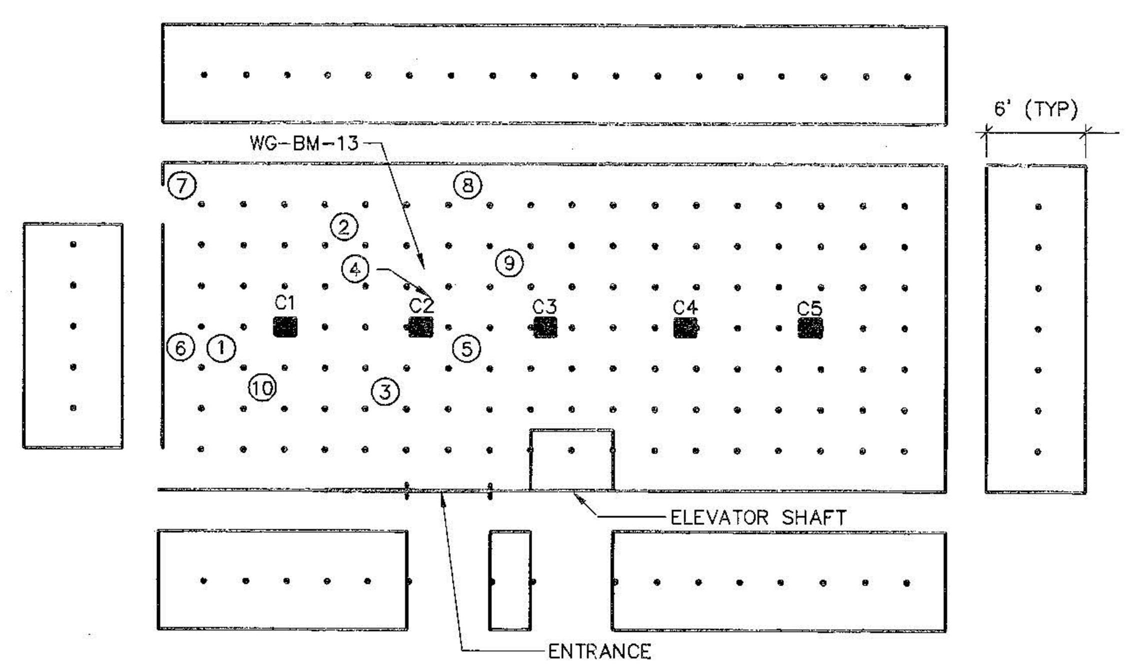

ROOM 5

| ROOM 5 | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 30 | 62 |
| 2 | 27 | 44 |
| 3 | 22 | 21 |
| 4 | 20 | 35 |
| 5 | 23 | 27 |
| 6 | 13 | 34 |
| 7 | 13 | 23 |
| 8 | 31 | 37 |
| 9 | 5 | 10 |
| 10 | 4 | 13 |



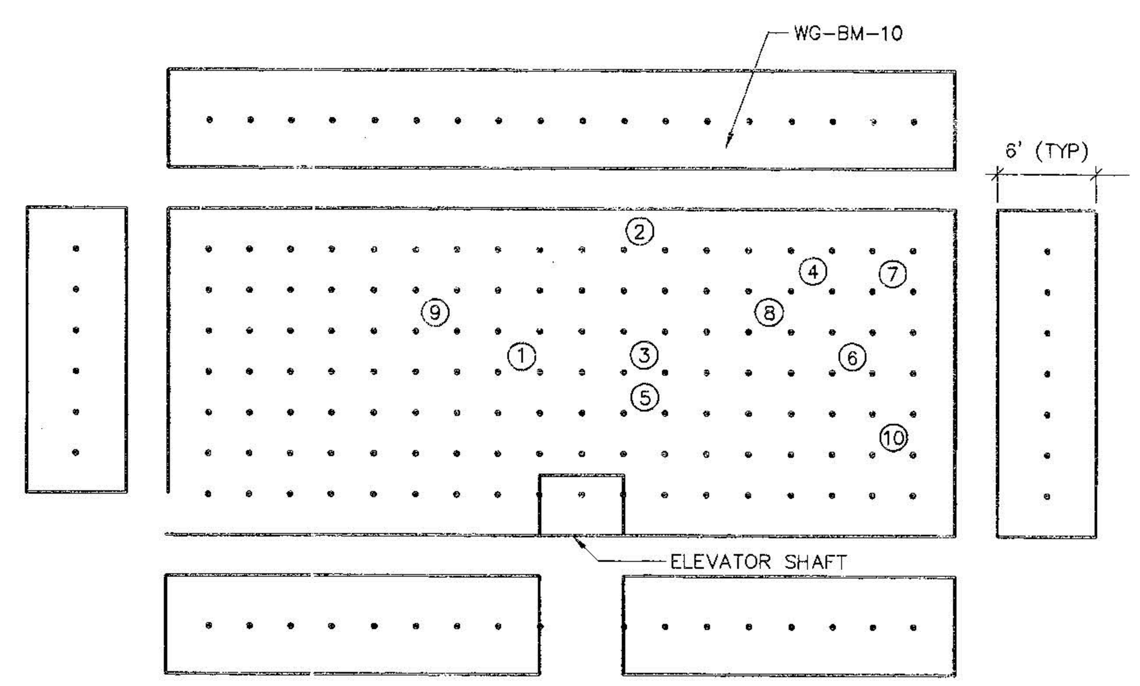

ROOM 2

| ROOM 2 | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 10 | 29 |
| 2 | 4 | 14 |
| 3 | 4 | 12 |
| 4 | 34 | 55 |
| 5 | 66 | 109 |
| 6 | 73 | 124 |
| 7 | 39 | 86 |
| 8 | 4 | 14 |
| 9 | 26 | 48 |
| 10 | 21 | 25 |
| 11 | 4 | 17 |
| 12 | 4 | 13 |




ROOM 4

| ROOM 4 | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 10 | 21 |
| 2 | 19 | 46 |
| 3 | 21 | 28 |
| 4 | 32 | 71 |
| 5 | 34 | 75 |
| 6 | 45 | 52 |
| 7 | 11 | 30 |
| 8 | 37 | 82 |
| 9 | 11 | 22 |
| 10 | 12 | 33 |




ROOM 6

| ROOM 6 | | |
|---|---|---|
| SMEAR # | ALPHA | BETA |
| 1 | 74 | 144 |
| 2 | 71 | 106 |
| 3 | 49 | 132 |
| 4 | 72 | 178 |
| 5 | 54 | 100 |
| 6 | 32 | 68 |
| 7 | 39 | 93 |
| 8 | 82 | 139 |
| 9 | 75 | 99 |
| 10 | 36 | 67 |

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REVISIONS

| NO. | BY | DATE | REMARKS |
|---|---|---|---|

DES DES
DWN DWN
CKD CKD

WELSBACH/GGM SITE
SAMPLE LOCATIONS
INTERIOR OF FORMER GGM BUILDING
NOT TO SCALE

30706

MALCOLM PIRNIE, INC.

APPENDIX B-4

**APPENDIX B-5**
**WELSBACH/GGM SITE**
**RADON SAMPLING RESULTS**

Radon air concentration measured inside the basement of various properties

| Location | Average Radon Air Concentration | |
|---|---|---|
| | Radon Gas (pCi/L) | Radon Progeny (WL) |
| General Gas Mantle | NA | 1.7 - Room 1 |
| | NA | 0.0338 - Room 6 |
| Study Area Property 1 | 0.5 | 0.0123 |
| Study Area Property 2 | 1.2- Main Office | NA |
| | 0.3 - Meeting Room | NA |
| | 4.9 - Pump Room | NA |
| Study Area Property 3 | < 0.3 | 0.0025 |
| Study Area Property 4 | 2.1 | 0.0075 |
| Study Area Property 5 | 0.7 | 0.00568 |
| Study Area Property 6 | 0.7 | 0.0066 |
| Study Area Property 7 | < 0.2 | 0.00196 |
| Study Area Property 8 | 0.7 | 0.0029 |
| Study Area Property 9 | 1.1 | NA |
| Study Area Property 10 | * | 4.96E-03 |
| Study Area Property 11 | 0.9 | 0.0076 |
| Study Area Property 12 | 0.3 | 1.27E-02 |
| Study Area Property 13 | 0.9 | 4.70E-03 |
| Study Area Property 14 | 1.0** | 0.0168 |
| Study Area Property 15 | 1.8 | 0.0056 |
| Study Area Property 16 | NA | NA |
| Study Area Property 17 | NA | NA |
| Study Area Property 18 | NA | NA |
| Study Area Property 19 | NA | 0.0092 |
| | NA | 0.0168 |
| Study Area Property 20 | NA | NA |

APPENDIX B-6
WELSBACH/GGM SITE
VICINITY PROPERTIES SAMPLING RESULTS

| Sample Information (Soils) | | | Sample Radiological Results, pCi/g** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification No. | Borehole No. | Depth (inches) | U-234 | | U-235 | | U-238 | | Ra-226 | | Ra-228 | | Th-228 | | Th-230 | | Th-232 | |
| WG-SS-SAP1-01 | 1 | 0-6 | 0.99 +/- 0.17 | E | < 0.011 | | 0.85 +/- 0.15 | | 1.51 +/- 0.281 | | 11.6 +/- 0.956 | | 12.4 +/- 1.6 | | 2.93 +/- 0.50 | | 12.4 +/- 1.6 | |
| WG-SS-SAP1-02 | | 12-18 | 0.402 +/- 0.091 | | < 0.031 | | < 0.039 | | 0.802 +/- 0.173 | | 2.73 +/- 0.354 | | 2.61 +/- 0.39 | | 0.94 +/- 0.18 | | 2.35 +/- 0.35 | |
| WG-SS-SAP1-03 | | 0-6 | 1.04 +/- 0.17 | | < 0.026 | | 1.06 +/- 0.18 | | 1.33 +/- 0.313 | | 12.6 +/- 1.06 | | 13.0 +/- 1.7 | | 3.26 +/- 0.54 | | 13.3 +/- 1.7 | |
| WG-SS-SAP1-04 | 2 | 12-18 | 1.16 +/- 0.19 | | < 0.029 | | 1.13 +/- 0.19 | | 2.55 +/- 0.414 | | 17.2 +/- 1.39 | | 13.0 +/- 1.7 | | 3.10 +/- 0.52 | | 13.4 +/- 1.7 | |
| WG-SS-SAP1-05 | | 24-30 | 0.75 +/- 0.14 | | < 0.028 | | 0.83 +/- 0.15 | | 1.49 +/- 0.192 | | 4.67 +/- 0.404 | | 4.13 +/- 0.57 | E | 1.41 +/- 0.24 | E | 4.11 +/- 0.57 | E |
| WG-SS-SAP1-06 | | 0-6 | 1.32 +/- 0.21 | | < 0.032 | | 1.24 +/- 0.20 | | 2.32 +/- 0.355 | | 36.0 +/- 2.50 | | 31.7 +/- 4.2 | | 7.6 +/- 1.3 | | 32.3 +/- 4.2 | |
| WG-SS-SAP1-07 | 3 | 6-12 | 1.19 +/- 0.19 | | <0.028 | | 1.18 +/- 0.19 | | 2.08 +/- 0.312 | | 19.7 +/- 1.46 | | 17.5 +/- 2.3 | | 5.14 +/- 0.86 | | 18.4 +/- 2.4 | |
| WG-SS-SAP1-08 | | 18-24 | 0.90 +/- 0.16 | | < 0.023 | | 0.86 +/- 0.15 | | 1.75 +/- 0.291 | | 6.01 +/- 0.653 | | 5.90 +/- 0.79 | | 1.94 +/- 0.32 | | 6.17 +/- 0.82 | |
| WG-SS-SAP1-09 | 4 | 6-12 | 1.93 +/- 0.29 | | < 0.026 | | 2.11 +/- 0.31 | | 3.55 +/- 0.571 | | 74.2 +/- 4.98 | | 77.0 +/- 10.0 | | 15.4 +/- 2.6 | | 73.3 +/- 9.5 | |
| WG-SS-SAP1-10 | | 12-18 | 1.22 +/- 0.20 | | < 0.025 | | 1.24 +/- 0.20 | | 2.24 +/- 0.409 | | 25.5 +/- 1.90 | | 25.6 +/- 3.2 | | 5.88 +/- 0.87 | | 24.8 +/- 3.1 | |
| WG-SS-SAP1-11 | 5 | 0-6 | 1.13 +/- 0.23 | | 0.025 +/- 0.029 | | 0.90 +/- 0.20 | | 1.59 +/- 0.212 | | 5.96 +/- 0.550 | | 7.7 +/- 1.0 | | 2.09 +/- 0.36 | | 7.7 +/- 1.0 | |
| WG-SS-SAP1-12 | | 6-9 | 1.22 +/- 0.24 | E | 0.063 +/- 0.045 | E | 1.01 +/- 0.21 | E | 1.42 +/- 0.203 | | 7.81 +/- 0.633 | | 8.13 +/- 1.1 | E | 2.42 +/- 0.40 | E | 8.2 +/- 1.1 | E |
| WG-SS-SAP1-13 | 6 | 0-30 | 0.57 +/- 0.14 | E | 0.020 +/- 0.029 | E | 0.53 +/- 0.14 | E | 1.20 +/- 0.157 | | 1.08 +/- 0.217 | | 1.07 +/- 0.24 | E | 0.88 +/- 0.20 | E | 1.16 +/- 0.24 | E |
| WG-SS-SAP2-01 | 1 | 0-6 | 0.82 +/- 0.17 | | < 0.042 | | 0.76 +/- 0.16 | | 2.92 +/- 0.330 | | 12.9 +/- 1.02 | | 9.2 +/- 1.2 | | 1.78 +/- 0.33 | | 8.2 +/- 1.1 | |
| WG-SS-SAP2-02 | | 12-18 | 1.31 +/- 0.25 | E | 0.084 +/- 0.054 | E | 1.17 +/- 0.23 | E | 1.55 +/- 0.241 | | 6.64 +/- 0.606 | | 14.2 +/- 1.8 | | 2.83 +/- 0.47 | | 16.2 +/- 2.0 | |
| WG-SS-SAP2-03 | | 0-6 | 1.09 +/- 0.22 | | < 0.043 | | 1.18 +/- 0.24 | | 1.83 +/- 0.238 | | 5.14 +/- 0.523 | | 5.31 +/- 0.76 | | 1.77 +/- 0.33 | | 4.76 +/- 0.69 | |
| WG-SS-SAP2-04 | 2 | 18-24 | 0.97 +/- 0.20 | E | < 0.073 | E | 1.13 +/- 0.23 | E | 1.84 +/- 0.261 | | 8.44 +/- 0.720 | | 9.1 +/- 1.2 | | 1.81 +/- 0.34 | | 7.3 +/- 1.0 | |
| WG-SS-SAP2-05 | | 24-30 | 0.69 +/- 0.16 | E | < 0.039 | E | 0.54 +/- 0.14 | E | 1.75 +/- 0.257 | | 5.66 +/- 0.580 | | 4.17 +/- 0.64 | | 1.06 +/- 0.24 | | 3.79 +/- 0.59 | |
| WG-SS-SAP2-06 | 3 | 0-6 | 2.04 +/- 0.48 | | 0.16 +/- 0.12 | | 1.95 +/- 0.46 | | 1.17 +/- 0.215 | | 2.31 +/- 0.362 | | 18.6 +/- 2.4 | | 2.38 +/- 0.48 | | 17.5 +/- 2.3 | |
| WG-SS-SAP2-07 | | 6-12 | 0.93 +/- 0.22 | E | 0.061 +/- 0.051 | E | 0.81 +/- 0.21 | E | 1.22 +/- 0.211 | | 2.29 +/- 0.348 | | 4.52 +/- 0.65 | E | 1.24 +/- 0.24 | E | 4.66 +/- 0.66 | E |
| WG-SS-SAP2-08 | | 0-6 | 1.62 +/- 0.43 | | < 0.17 | | 1.39 +/- 0.40 | | 2.42 +/- 0.342 | | 10.3 +/- 0.951 | | 120 +/- 22 | | 25.7 +/- 8.2 | | 122 +/- 22 | |
| WG-SS-SAP2-09 | 4 | 12-18 | 21.0 +/- 4.1 | E | < 0.95 | | 25.8 +/- 4.7 | E | 49.2 +/- 3.21 | | 379 +/- 24.0 | | 443 +/- 140 | | 206 +/- 77 | | 538 +/- 130 | |
| WG-SS-SAP2-10 | | 18-24 | 110 +/- 15 | E | 4.4 +/- 1.6 | | 101 +/- 14 | E | R | | R | | 1339 +/- 250 | | 197 +/- 80 | | 1185 +/- 220 | |
| WG-SS-SAP2-11 | | 24-30 | 26.5 +/- 5.1 | E | 2.0 +/- 1.1 | | 30.0 +/- 5.5 | E | R | | R | | 342 +/- 110 | | 154 +/- 63 | | 355 +/- 100 | |
| WG-SS-SAP2-12 | | 0-6 | 1.65 +/- 0.24 | | 0.073 +/- 0.033 | | 1.67 +/- 0.25 | | 3.34 +/- 0.370 | E | 20.3 +/- 1.48 | E | 16.8 +/- 2.0 | | 2.37 +/- 0.33 | | 16.1 +/- 1.9 | |
| WG-SS-SAP2-13 | 5 | 6-12 | 5.13 +/- 0.70 | E | 0.257 +/- 0.090 | | 5.73 +/- 0.77 | | 7.44 +/- 0.669 | E | 68.1 +/- 4.50 | E | 65.6 +/- 7.7 | | 9.5 +/- 1.2 | | 60.0 +/- 7.1 | |
| WG-SS-SAP2-14 | | 18-24 | 0.91 +/- 0.14 | E | 0.050 +/- 0.021 | E | 0.80 +/- 0.12 | E | 2.61 +/- 0.262 | E | 5.61 +/- 0.482 | E | 4.75 +/- 0.64 | | 1.22 +/- 0.21 | | 4.47 +/- 0.041 | |
| WG-SS-SAP2-15 | 6 | 6-12 | 0.72 +/- 0.19 | | < 0.12 | | 0.82 +/- 0.21 | | 1.38 +/- 0.222 | E | 5.19 +/- 0.537 | E | 4.93 +/- 0.71 | | 1.07 +/- 0.23 | | 3.90 +/- 0.59 | |
| WG-SS-SAP2-16 | | 18-24 | 0.91 +/- 0.16 | | < 0.024 | | 0.92 +/- 0.16 | | 3.65 +/- 0.351 | E | 13.9 +/- 1.05 | E | 10.3 +/- 1.4 | | 1.58 +/- 0.30 | | 9.3 +/- 1.2 | |
| WG-SS-SAP2-17 | | 0-6 | 1.05 +/- 0.22 | | 0.061 +/- 0.043 | | 1.00 +/- 0.21 | | 1.30 +/- 0.259 | | 9.50 +/- 0.851 | E | 8.2 +/- 1.0 | | 1.96 +/- 0.31 | | 8.2 +/- 1.0 | |
| WG-SS-SAP2-18 | 7 | 6-12 | 1.27 +/- 0.53 | | < 0.36 | | 1.40 +/- 0.53 | | 221 +/- 14.3 | | 2.77 +/- 0.966 | E | 208 +/- 25 | | 27.5 +/- 3.7 | | 209 +/- 25 | |
| WG-SS-SAP2-19 | | 18-24 | 2.43 +/- 0.72 | | < 0.29 | | 2.36 +/- 0.71 | | 2.9 +/- 0.292 | | 9.74 +/- 0.734 | E | 13.7 +/- 2.1 | | 4.59 +/- 0.90 | | 12.8 +/- 1.9 | |
| WG-SS-SAP2-20 | 8 | 0-6 | 10.5 +/- 1.7 | | 0.81 +/- 0.33 | | 10.6 +/- 1.7 | | 12.8 +/- 0.989 | | 99.5 +/- 6.48 | E | 132 +/- 16 | | 16.3 +/- 2.4 | | 132 +/- 16 | |
| WG-SS-SAP2-21 | | 6-12 | 1.30 +/- 0.20 | | 0.039 +/- 0.026 | | 1.31 +/- 0.20 | | 2.43 +/- 0.277 | | 7.81 +/- 0.700 | E | 9.6 +/- 1.2 | | 2.15 +/- 0.30 | | 9.2 +/- 1.1 | |
| WG-SS-SAP2-22 | 9 | . 0-6 | 0.84 +/- 0.15 | E | 0.028 +/- 0.021 | E | 0.65 +/- 0.12 | E | 1.55 +/- 0.245 | | 4.52 +/- 0.508 | E | 3.70 +/- 0.48 | | 1.17 +/- 0.18 | | 3.23 +/- 0.42 | |
| WG-SS-SAP2-23 | | 18-24 | 1.68 +/- 0.29 | | < 0.084 | | 1.40 +/- 0.25 | | 4.42 +/- 0.624 | | 24.9 +/- 2.07 | E | 10.8 +/- 1.5 | | 1.70 +/- 0.38 | | 8.6 +/- 1.2 | |
| WG-SS-SAP2-24 | 10 | 6-12 | 2.88 +/- 0.72 | | < 0.23 | | 2.18 +/- 0.61 | | 9.38 +/- 0.660 | | 34.6 +/- 2.27 | E | 87 +/- 11 | | 10.7 +/- 1.7 | | 86 +/- 11 | |
| WG-SS-SAP2-25 | | 12-18 | 0.64 +/- 0.35 | | < 0.26 | | 0.71 +/- 0.38 | | 1.62 +/- 0.209 | | 4.41 +/- 0.457 | E | 5.7 +/- 1.1 | | 1.84 +/- 0.51 | | 5.7 +/- 1.0 | |
| WG-SS-SAP2-26 | 11 | 0-30 | 1.32 +/- 0.19 | | 0.060 +/- 0.024 | | 1.45 +/- 0.20 | | 1.75 +/- 0.240 | | 2.25 +/- 0.363 | E | 2.68 +/- 0.33 | | 1.52 +/- 0.20 | | 2.44 +/- 0.30 | |
| WG-SS-SAP3-01 | 1 | 0-5 | 0.63 +/- 0.11 | | 0.017 +/- 0.014 | | 0.62 +/- 0.11 | | 1.11 +/- 0.202 | | 17.0 +/- 1.20 | E | 4.03 +/- 0.50 | E | 1.13 +/- 0.16 | | 2.63 +/- 0.34 | E |

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**APPENDIX B-6**
**WELSBACH/GGM SITE**
**VICINITY PROPERTIES SAMPLING RESULTS (CONTINUED)**

| Sample Information (Soils) | | | Sample Radiological Results, pCi/g** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification No. | Borehole No. | Depth (inches) | U-234 | | U-235 | | U-238 | | Ra-226 | | Ra-228 | | Th-228 | | Th-230 | | Th-232 | |
| WG-SS-SAP3-02 | | 0-6 | 0.58 +/- 0.11 | | 0.039 +/- 0.025 | | 0.61 +/- 0.11 | | 1.42 +/- 0.227 | | 4.15 +/- 0.463 | E | 13.0 +/- 1.7 | E | 2.74 +/- 0.51 | | 14.2 +/- 1.9 | |
| WG-SS-SAP3-03 | 2 | 14-20 | 0.64 +/- 0.13 | | 0.036 +/- 0.029 | | 0.77 +/- 0.15 | | 1.05 +/- 0.205 | | 16.1 +/- 1.16 | E | 176 9 +/- 22 | E | 28.4 +/- 4.9 | | 167 +/- 21 | |
| WG-SS-SAP3-04 | | 20-26 | 1.28 +/- 0.22 | | 0.03 4 +/- 0.027 | | 0.96 +/- 0.18 | | 1.17 +/- 0.320 | | 47.6 +/- 3.13 | E | 25.4 +/- 3.9 | E | 4.7 +/- 1.2 | | 26.5 +/- 4.0 | |
| WG-SS-SAP3-05 | 3 | 6-12 | 0.54 +/- 0.10 | E | < 0.023 | E | 0.423 +/- 0.088 | E | 0.601 +/- 0.120 | | 2.24 +/- 0.255 | E | 2.49 +/- 0.33 | E | 0.98 +/- 0.15 | | 2.42 +/- 0.32 | |
| WG-SS-SAP3-06 | 3 | 0-6 | 0.53 +/- 0.10 | | 0.19 +/- 0.015 | | 0.452 +/- 0.091 | | 0.916 +/- 0.156 | | 5.65 +/- 0.485 | E | 6.03 +/- 0.74 | E | 1.53 +/- 0.21 | | 5.57 +/- 0.69 | |
| WG-SS-SAP3-07 | 4 | 0-6 | 0.61 +/- 0.11 | | 0.036 +/- 0.021 | | 0.60 +/- 0.11 | | 1.49 +/- 0.172 | | 2.12 +/- 0.261 | E | 2.03 +/- 0.27 | E | 1.02 +/- 0.15 | | 1.85 +/- 0.25 | |
| WG-SS-SAP3-08 | | 6-12 | 0.66 +/- 0.11 | | 0.032 +/- 0.019 | | 0.503 +/- 0.094 | | 1.24 +/- 0.161 | | 2.53 +/- 0.282 | E | 2.89 +/- 0.38 | E | 1.10 +/- 0.16 | | 3.31 +/- 0.42 | |
| WG-SS-SAP3-09 | 5 | 0-6 | 0.59 +/- 0.11 | | 0.030 +/- 0.019 | | 0.66 +/- 0.12 | | 1.26 +/- 0.177 | | 3.46 +/- 0.370 | E | 3.21 +/- 0.41 | E | 1.01 +/- 0.15 | | 3.23 +/- 0.41 | |
| WG-SS-SAP3-10 | 6 | 0-25 | 0.61 +/- 0.11 | | < 0.022 | | 0.62 +/- 0.11 | | 0.929 +/- 0.149 | | 1.09 +/- 0.235 | E | 1.18 +/- 0.17 | E | 0.82 +/- 0.13 | | 1.16 +/- 0.17 | |
| WG-SS-SAP4-01 | 1 | 0-6 | 0.66 +/- 0.18 | | < 0.056 | | 0.64 +/- 0.18 | | 1.54 +/- 0.225 | | 1.05 +/- 0.359 | | 0.76 +/- 0.19 | | 0.69 +/- 0.17 | | 0.70 +/- 0.17 | |
| WG-SS-SAP4-02 | | 6-12 | 1.04 +/- 0.25 | E | 0.048 +/- 0.051 | E | 0.80 +/- 0.21 | E | 1.23 +/- 0.172 | | 0.915 +/- 0.239 | | 1.32 +/- 0.27 | | 0.96 +/- 0.21 | | 1.21 +/- 0.24 | |
| WG-SS-SAP4-03 | 2 | 0-6 | 0.78 +/- 0.21 | | 0.068 +/- 0.057 | | 0.78 +/- 0.21 | | 1.21 +/- 0.219 | | 1.06 +/- 0.296 | | 1.02 +/- 0.25 | E | 0.99 +/- 0.23 | E | 1.02 +/- 0.23 | E |
| WG-SS-SAP4-04 | | 6-12 | 0.79 +/- 0.20 | E | < 0.053 | E | 0.95 +/- 0.23 | E | 4.61 +/- 0.384 | | 2.74 +/- 0.373 | | 1.41 +/- 0.31 | | 1.43 +/- 0.30 | | 1.31 +/- 0.28 | |
| WG-SS-SAP4-05 | 3 | 0-6 | 1.01 +/- 0.24 | | < 0.070 | | 1.12 +/- 0.26 | | 1.01 +/- 0.216 | | 1.33 +/- 0.317 | | 1.61 +/- 0.32 | | 1.23 +/- 0.26 | | 1.59 +/- 0.31 | |
| WG-SS-SAP4-06 | 4 | 0-6 | 616 +/- 150 | | < 51 | | 580 +/- 150 | | 134 +/- 8.63 | | 61.4 +/- 4.26 | | 263 +/- 33 | | 422 +/- 51 | | 262 +/- 33 | |
| WG-SS-SAP4-07 | | 12-18 | 0.81 +/- 0.21 | | 0.045 +/- 0.044 | | 0.94 +/- 0.23 | | 1.55 +/- 0.184 | | 1.24 +/- 0.213 | | 1.26 +/- 0.26 | | 1.11 +/- 0.23 | | 1.29 +/- 0.26 | |
| WG-SS-SAP4-08 | | 0-6 | 1.90 +/- 0.78 | | < 0.40 | | 2.64 +/- 0.94 | | 361 +/- 23.0 | | < 2.21 | | 4.6 +/- 1.3 | E | 3.8 +/- 1.0 | E | 3.24 +/- 0.93 | E |
| WG-SS-SAP4-09 | 5 | 6-12 | 1.11 +/- 0.64 | E | < 0.66 | E | 1.62 +/- 0.77 | E | 442 +/- 28.0 | | < 1.55 | | 3.2 +/- 1.1 | | 2.13 +/- 0.77 | | 3.21 +/- 0.95 | |
| WG-SS-SAP4-10 | | 18-24 | 0.82 +/- 0.21 | E | < 0.066 | E | 1.01 +/- 0.24 | E | 29.1 +/- 1.92 | | 1.30 +/- 0.412 | | 1.44 +/- 0.29 | | 1.15 +/- 0.24 | | 1.31 +/- 0.26 | |
| WG-SS-SAP4-11 | 6 | 0-24 | 1.00 +/- 0.25 | E | < 0.085 | E | 1.08 +/- 0.26 | | 1.40 +/- 0.182 | | 1.08 +/- 0.279 | | 1.52 +/- 0.29 | | 1.08 +/- 0.23 | | 1.39 +/- 0.27 | |
| WG-SS-SAP5-01 | 1 | 0-6 | 1.58 +/- 0.55 | | < 0.26 | | 1.06 +/- 0.45 | | 1.93 +/- 0.333 | | 30.0 +/- 2.10 | | 35.5 +/- 4.7 | | 4.9 +/- 1.0 | | 30.6 +/- 4.2 | |
| WG-SS-SAP5-02 | | 12-18 | 0.95 +/- 0.23 | | < 0.063 | | 0.78 +/- 0.20 | | 1.54 +/- 0.211 | | 6.82 +/- 0.598 | | 7.31 +/- 0.99 | | 1.60 +/- 0.30 | | 7.5 +/- 1.0 | |
| WG-SS-SAP5-03 | 2 | 0-6 | 1.02 +/- 0.42 | | < 0.28 | | 1.82 +/- 0.38 | | 1.56 +/- 0.241 | | 9.41 +/- 0.793 | | 11.4 +/- 1.8 | E | 3.73 +/- 0.84 | E | 13.6 +/- 2.1 | E |
| WG-SS-SAP5-04 | | 12-18 | 1.19 +/- 0.47 | E | < 0.27 | E | 0.98 +/- 0.42 | E | 1.62 +/- 0.208 | | 16.3 +/- 1.12 | | 19.4 +/- 2.8 | E | 4.37 +/- 0.91 | E | 20.2 +/- 2.9 | E |
| WG-SS-SAP5-05 | 3 | 0-6 | 0.69 +/- 0.20 | | < 0.097 | | 0.77 +/- 0.21 | | 1.17 +/- 0.188 | | 6.80 +/- 0.582 | | 8.1 +/- 1.1 | | 1.85 +/- 0.33 | | 7.6 +/- 1.0 | |
| WG-SS-SAP5-06 | | 12-18 | 0.67 +/- 0.15 | | 0.024 +/- 0.024 | | 0.62 +/- 0.14 | | 0.909 +/- 0.162 | | 1.44 +/- 0.246 | | 1.77 +/- 0.29 | | 0.82 +/- 0.17 | | 1.41 +/- 0.24 | |
| WG-SS-SAP5-07 | 4 | 0-18 | 0.53 +/- 0.12 | | 0.044 +/- 0.031 | | 0.14 +/- 0.11 | | 0.889 +/- 0.138 | | 1.47 +/- 0.229 | | 1.52 +/- 0.24 | | 0.64 +/- 0.13 | | 1.41 +/- 0.23 | |
| WG-SS-SAP6-01 | | 0-6 | 0.40 +/- 0.11 | | 0.056 +/- 0.040 | | 0.45 +/- 0.12 | | 1.09 +/- 0.168 | | 2.06 +/- 0.289 | | 2.21 +/- 0.34 | | 0.65 +/- 0.14 | | 1.91 +/- 0.30 | |
| WG-SS-SAP6-02 | 1 | 6-12 | < 0.82 | | < 0.49 | | 1.15 +/- 0.60 | | 8.03 +/- 0.557 | | 43.4 +/- 2.79 | | 33.4 +/- 4.8 | | 5.1 +/- 1.2 | | 30.3 +/- 4.4 | |
| WG-SS-SAP6-03 | | 21-24 | 0.81 +/- 0.18 | | < 0.049 | | 0.84 +/- 0.18 | | 0.939 +/- 0.121 | | 1.24 +/- 0.190 | | 1.75 +/- 0.29 | | 1.01 +/- 0.19 | | 1.30 +/- 0.23 | |
| WG-SS-SAP6-04 | 2 | 0-6 | 0.82 +/- 0.19 | | 0.046 +/- 0.039 | | 0.71 +/- 0.17 | | 0.913 +/- 0.148 | | 0.672 +/- 0.199 | | 0.56 +/- 0.15 | | 0.68 +/- 0.15 | | 0.78 +/- 0.16 | |
| WG-SS-SAP6-05 | 3 | 0-24 | 0.57 +/- 0.14 | | 0.037 +/- 0.032 | | 0.64 +/- 0.15 | | 0.964 +/- 0.124 | | 0.701 +/- 0.163 | | 0.90 +/- 0.19 | | 0.75 +/- 0.16 | | 0.90 +/- 0.18 | |
| WG-SS-SAP7-01 | 1 | 0-6 | 1.00 +/- 0.24 | | 0.044 +/- 0.043 | | 0.75 +/- 0.20 | | 1.09 +/- 0.216 | | 0.832 +/- 0.361 | | 0.89 +/- 0.21 | | 1.17 +/- 0.24 | | 0.88 +/- 0.20 | |
| WG-SS-SAP7-02 | | 6-12 | 0.85 +/- 0.22 | E | 0.085 +/- 0.063 | E | 0.74 +/- 0.20 | E | 0.984 +/- 0.171 | | 0.924 +/- 0.234 | | 0.70 +/- 0.19 | E | 0.70 +/- 0.18 | E | 0.63 +/- 0.17 | E |
| WG-SS-SAP7-03 | 2 | 0-6 | 0.73 +/- 0.19 | E | < 0.081 | E | 0.57 +/- 0.17 | E | 2.11 +/- 0.216 | | 0.640 +/- 0.195 | | 0.92 +/- 0.22 | | 0.80 +/- 0.20 | | 0.79 +/- 0.19 | |
| WG-SS-SAP7-04 | | 6-12 | 0.52 +/- 0.16 | | < 0.051 | | 0.40 +/- 0.13 | | 0.775 +/- 0.155 | | 0.677 +/- 0.296 | | 0.74 +/- 0.20 | | 0.76 +/- 0.19 | | 0.68 +/- 0.18 | |
| WG-SS-SAP7-05 | 3 | 0-6 | 0.70 +/- 0.19 | | < 0.073 | | 0.62 +/- 0.18 | | 0.904 +/- 0.210 | | 0.778 +/- 0.327 | | 0.72 +/- 0.18 | | 0.81 +/- 0.19 | | 0.80 +/- 0.19 | |
| WG-SS-SAP7-06 | | 0-12 | 0.72 +/- 0.20 | | < 0.081 | | 0.44 +/- 0.16 | | 1.00 +/- 0.177 | | 0.985 +/- 0.258 | | 0.75 +/- 0.20 | | 0.73 +/- 0.18 | | 0.66 +/- 0.17 | |
| WG-SS-SAP8-01 | 1 | 0-6 | 0.77 +/- 0.20 | E | <0.073 | E | 0.55 +/- 0.17 | E | 1.26 +/- 0.192 | | 2.76 +/- 0.344 | | 2.21 +/- 0.38 | E | 0.85 +/- 0.19 | E | 1.96 +/- 0.34 | E |
| WG-SS-SAP8-02 | 2 | 0-6 | 0.87 +/- 0.22 | | < 0.084 | | 0.79 +/- 0.21 | | 1.65 +/- 0.193 | | 3.52 +/- 0.372 | | 3.62 +/- 0.56 | | 1.25 +/- 0.26 | | 3.63 +/- 0.55 | |

**APPENDIX B-6**
**WELSBACH/GGM SITE**
**VICINITY PROPERTIES SAMPLING RESULTS (CONTINUED)**

| Sample Information (Soils) | | | Sample Radiological Results, pCi/g** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification No. | Borehole No. | Depth (inches) | U-234 | | U-235 | | U-238 | | Ra-226 | | Ra-228 | | Th-228 | | Th-230 | | Th-232 | |
| WG-SS-SAP8-03 | 3 | 0-6 | 0.69 +/- 0.18 | E | < 0.058 | E | 0.52 +/- 0.15 | E | 1.06 +/- 0.175 | | 1.20 +/- 0.287 | | 1.47 +/- 0.28 | | 0.85 +/- 0.20 | | 1.46 +/- 0.28 | |
| WG-SS-SAP9-01 | 1 | 0-6 | 0.52 +/- 0.13 | E | 0.019 +/- 0.024 | E | 0.45 +/- 0.12 | E | 0.700 +/- 0.145 | | 0.784 +/- 0.227 | | 0.61 +/- 0.18 | | 0.71 +/- 0.18 | | 0.69 +/- 0.18 | |
| WG-SS-SAP9-02 | 2 | 0-6 | 0.55 +/- 0.14 | | < 0.044 | | 0.52 +/- 0.13 | | 1.26 +/- 0.177 | | 1.53 +/- 0.280 | | 1.26 +/- 0.27 | | 0.66 +/- 0.17 | | 1.26 0.26 | |
| WG-SS-SAP9-03 | 3 | 0-3 | 0.63 +/- 0.15 | | < 0.049 | | 0.75 +/- 0.17 | | 1.33 +/- 0.182 | | 0.960 +/- 0.243 | | 0.97 +/- 0.24 | E | 0.98 +/- 0.23 | E | 1.24 +/- 0.26 | E |
| WG-SS-SAP10-01 | 1 | 0-6 | 1.02 +/- 0.19 | | < 0.029 | | 0.91 +/- 0.18 | | 1.41 +/- 0.286 | | 1.11 +/- 0.384 | | 0.95 +/- 0.16 | | 0.99 +/- 0.17 | | 1.03 +/- 0.17 | |
| WG-SS-SAP10-02 | | 6-12 | 0.76 +/- 0.15 | | 0.020 +/- 0.019 | | 0.69 +/- 0.14 | | 0.929 +/- 0.264 | | 0.861 +/- 0.376 | | 0.83 +/- 0.15 | | 0.82 +/- 0.15 | | 0.91 +/- 0.16 | |
| WG-SS-SAP10-03 | 2 | 0-6 | 0.73 +/- 0.15 | | 0.034 +/- 0.028 | | 0.68 +/- 0.15 | | 1.08 +/- 0.319 | | 1.32 +/- 0.516 | | 0.71 +/- 0.14 | | 0.71 +/- 0.14 | | 0.65 +/- 0.13 | |
| WG-SS-SAP10-04 | | 6-12 | 0.64 +/- 0.14 | | 0.043 +/- 0.031 | | 0.60 +/- 0.13 | | 0.970 +/- 0.270 | | 0.982 +/- 0.409 | | 0.55 +/- 0.11 | | 0.60 +/- 0.12 | | 0.64 +/- 0.12 | |
| WG-SS-SAP11-01 | 1 | 0-6 | 0.392 +/- 0.094 | | < 0.032 | | 0.347 +/- 0.087 | | 0.633 +/- 0.257 | | 0.584 +/- 0.530 | | 0.373 +/- 0.093 | | < 0.48 | | 0.386 +/- 0.091 | |
| WG-SS-SAP11-02 | | 6-12 | 0.352 +/- 0.091 | | < 0.024 | | 0.317 +/- 0.085 | | 0.553 +/- 0.194 | | 0.711 +/- 0.393 | | 0.353 +/- 0.087 | | < 0.320 | | 0.352 +/- 0.083 | |
| WG-SS-SAP11-03 | 2 | 0-6 | 0.53 +/- 0.12 | | < 0.024 | | 0.45 +/- 0.10 | | 0.806 +/- 0.389 | | 0.988 +/- 0.406 | | 0.49 +/- 0.11 | | < 0.56 | | 0.54 +/- 0.11 | |
| WG-SS-SAP12-01 | 1 | 0-6 | 0.370 +/- 0.098 | | 0.016 +/- 0.018 | | 0.339 +/- 0.092 | | 1.14 +/- 0.243 | | 0.902 +/- 0.354 | | 0.55 +/- 0.12 | | < 0.434 | | 0.46 +/- 0.10 | |
| WG-SS-SAP12-02 | | 6-12 | 0.71 +/- 0.15 | | 0.040 +/- 0.029 | | 0.53 +/- 0.12 | | 0.790 +/- 0.253 | | 0.863 +/- 0.334 | | 0.52 +/- 0.12 | | 0.69 +/- 0.13 | | 0.57 +/- 0.12 | |
| WG-SS-SAP13-01 | 1 | 0-6 | 0.57 +/- 0.14 | | 0.045 +/- 0.036 | | 0.40 +/- 0.11 | | 0.950 +/- 0.153 | | 0.599 +/- 0.212 | | 0.56 +/- 0.17 | | 0.83 +/- 0.20 | | 0.51 +/- 0.15 | |
| WG-BM-23 | NA | 3 | 0.59 +/- 0.13 | | 0.081 +/- 0.044 | | 0.41 +/- 0.11 | | 0.60 +/- 0.22 | | 0.73 +/- 0.30 | | 0.56 +/- 0.11 | | 0.439 +/- 0.094 | | 0.464 +/- 0.097 | |
| WG-SS-SAP14-01 | 1 | 0-6 | 1.13 +/- 0.21 | | 0.033 +/- 0.028 | | 1.01 +/- 0.19 | | 4.55 +/- 0.446 | | 29.8 +/- 2.05 | | 14.7 +/- 1.8 | | 2.45 +/- 0.33 | | 13.2 +/- 1.6 | |
| WG-SS-SAP14-02 | | 6-12 | 6.39 +/- 0.85 | | 0.240 +/- 0.083 | | 5.93 +/- 0.79 | | 91.6 +/- 5.92 | | 319 +/- 20.4 | | 168 +/- 21 | | 24.5 +/- 4.4 | | 156 +/- 20 | |
| WG-SS-SAP14-03 | 2 | 6-12 | 0.42 +/- 0.11 | | < 0.50 | | 0.34 +/- 0.10 | | 0.782 +/- 0.121 | | 0.405 +/- 0.132 | | 0.94 +/- 0.15 | | 0.497 +/- 0.091 | | 0.87 +/- 0.14 | |
| WG-SS-SAP14-04 | | 0-6 | 0.69 +/- 0.15 | | 0.078 +/- 0.044 | | 0.87 +/- 0.18 | | 1.49 +/- 0.154 | | 0.898 +/- 0.152 | | 1.12 +/- 0.17 | | 1.08 +/- 0.16 | | 1.02 +/- 0.15 | |
| WG-SS-SAP14-05 | 3 | 12-18 | 0.70 +/- 0.15 | | 0.027 +/- 0.024 | | 0.80 +/- 0.16 | | 1.24 +/- 0.139 | | 0.810 +/- 0.146 | | 1.02 +/- 0.16 | | 1.04 +/- 0.16 | | 0.97 +/- 0.15 | |
| WG-SS-SAP14-06 | 4 | 6-12 | 0.65 +/- 0.14 | | 0.020 +/- 0.021 | | 0.77 +/- 0.15 | | 1.12 +/- 0.133 | | 0.811 +/- 0.140 | | 0.90 +/- 0.14 | | 0.79 +/- 0.12 | | 0.93 +/- 0.14 | |
| WG-SS-SAP14-07 | 5 | 0-6 | 0.57 +/- 0.13 | | < 0.038 | | 0.53 +/- 0.13 | | 1.18 +/- 0.135 | | 3.25 +/- 0.273 | | 3.52 +/- 0.45 | | 0.94 +/- 0.14 | | 2.67 +/- 0.35 | |
| WG-SS-SAP14-08 | | 6-10 | 2.32 +/- 0.046 | | 0.103 +/- 0.050 | | 1.88 +/- 0.30 | | 8.83 +/- 0.622 | | 48.3 +/- 3.12 | | 35.5 +/- 5.9 | | 5.5 +/- 1.7 | | 36.0 +/- 5.8 | |
| WG-SS-SAP14-09 | 6 | 6-12 | 1.44 +/- 0.53 | | < 0.13 | | 1.56 +/- 0.55 | | 9.22 +/- 0.769 | | 33.6 +/- 2.41 | | 41.3 +/- 5.4 | | 7.7 +/- 1.4 | | 54.7 +/- 7.0 | |
| WG-SS-SAP14-10 | 7 | 6-12 | 0.78 +/- 0.39 | | < 0.28 | | 1.11 +/- 0.48 | | 4.56 +/- 0.404 | | 17.2 +/- 1.25 | | 22.5 +/- 3.2 | | 2.86 +/- 0.72 | | 18.8 +/- 2.7 | |
| WG-SS-SAP14-11 | 8 | 0-8 | 0.85 +/- 0.22 | | < 0.057 | | 0.73 +/- 0.20 | | 1.31 +/- 0.168 | | 2.99 +/- 0.338 | | 8.8 +/- 1.2 | E | 1.43 +/- 0.28 | E | 9.2 +/- 1.2 | E |
| WG-SS-SAP14-12 | 9 | 0-18 | 0.77 +/- 0.16 | | < 0.017 | | 0.77 +/- 0.16 | | 1.16 +/- 0.202 | E | 0.826 +/- 0.274 | | 0.78 +/- 0.15 | | 0.72 +/- 0.14 | | 0.85 +/- 0.16 | |
| WG-SS-SAP15-01 | 1 | 0-6 | 0.99 +/- 0.19 | | 0.044 +/- 0.031 | | 0.90 +/- 0.17 | | 1.68 +/- 0.211 | | 3.74 +/- 0.386 | | 3.82 +/- 0.48 | | 1.43 +/- 0.20 | | 3.79 +/- 0.48 | |
| WG-SS-SAP15-02 | | 12-18 | 0.88 +/- 0.18 | | 0.030 +/- 0.031 | | 0.83 +/- 0.17 | | 0.881 +/- 0.143 | | 0.871 +/- 0.197 | | 1.43 +/- 0.21 | | 1.19 +/- 0.18 | | 1.46 +/- 0.21 | |
| WG-SS-SAP15-03 | 2 | 0-5 | 1.48 +/- 0.25 | | 0.081 +/- 0.43 | | 1.38 +/- 0.24 | | 2.45 +/- 0.275 | | 1.82 +/- 0.317 | | 1.45 +/- 0.21 | | 1.56 +/- 0.22 | | 1.39 +/- 0.20 | |
| WG-SS-SAP15-04 | 3 | 0-6 | 0.75 +/- 0.16 | | 0.034 +/- 0.028 | | 0.87 +/- 0.17 | | 1.05 +/- 0.186 | | 0.888 +/- 0.329 | | 0.97 +/- 0.18 | E | 0.75 +/- 0.15 | E | 0.85 +/- 0.16 | E |
| WG-SS-SAP16-01 | 1 | 0-6 | 1.00 +/- 0.20 | | < 0.063 | | 1.26 +/- 0.24 | | 2.66 +/- 0.353 | | 18.9 +/- 1.41 | E | 19.3 +/- 2.4 | | 3.10 +/- 0.51 | | 16.9 +/- 2.1 | |
| WG-SS-SAP16-02 | | 6-12 | 0.520 +/- 0.089 | E | 0.028 +/- 0.016 | E | 0.494 +/- 0.086 | E | R | | R | | 1.18 +/- 0.18 | E | 0.66 +/- 0.12 | | 0.97 +/- 0.16 | E |
| WG-SS-SAP16-03 | 2 | 0-8 | 1.27 +/- 0.25 | | < 0.094 | | 1.09 +/- 0.22 | | R | | R | | 5.70 +/- 0.84 | | 2.12 +/- 0.12 | | 5.02 +/- 0.75 | |
| WG-SS-SAP16-04 | | 0-6 | 1.84 +/- 0.56 | | < 0.24 | | 1.74 +/- 0.53 | | R | | R | | 8.7 +/- 1.9 | | 4.8 +/- 1.2 | | 8.8 +/+ 1.8 | |
| WG-SS-SAP16-05 | 3 | 6-12 | 3.6 +/- 1.6 | | < 0.87 | | 4.3 +/- 1.7 | | R | | R | | 739 +/- 90 | | 106 +/- 16 | | 722 +/-88 | |
| WG-SS-SAP16-06 | | 18-24 | 2.2 +/- 1.2 | | < 0.42 | | < 0.93 | | 377 +/- 23.9 | | 41.0 +/- 3.09 | E | 52.4 +/- 8.6 | | 10.8 +/- 3.0 | | 40.4 +/- 7.0 | |
| WG-SS-SAP16-07 | 4 | 0-6 | 1.36 +/- 0.47 | | 0.17 +/- 0.15 | | 1.73 +/- 0.52 | | 150 +/- 9.51 | | 19.0 +/- 1.35 | E | 8.0 +/- 1.7 | | 2.06 +/- 0.75 | | 5.8 +/- 1.3 | |
| WG-SS-SAP16-08 | 5 | 0-6 | 2.0 +/- 1.1 | | < 0.95 | | < 1.2 | | 2.11 +/- 0.328 | | 66.3 +/- 4.29 | E | 47.1 +/- 7.9 | | 13.0 +/- 3.3 | | 50.4 +/- 8.2 | |
| WG-SS-SAP16-09 | | 6-12 | 1.14 +/- 0.21 | | 0.037 +/- 0.024 | | 1.25 +/- 0.19 | | 2.99 +/- 0.349 | | 4.68 +/- 0.579 | E | 7.7 +/- 1.0 | E | 2.77 +/- 0.42 | E | 7.33 +/- 0.96 | E |

300710

**APPENDIX B-6**
**WELSBACH/GGM SITE**
**VICINITY PROPERTIES SAMPLING RESULTS (CONTINUED)**

| Sample Information (Soils) | | | Sample Radiological Results, pCi/g** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification No. | Borehole No. | Depth (inches) | U-234 | | U-235 | | U-238 | | Ra-226 | | Ra-228 | | Th-228 | | Th-230 | | Th-232 | |
| WG-SS-SAP16-10 | 6 | 6-12 | 1.03 +/- 0.20 | | < 1.073 | | 1.09 +/- 0.21 | | R | | R | | 4.53 +/- 0.73 | | 1.95 +/- 0.40 | | 4.01 +/- 0.66 | |
| WG-SS-SAP16-11 | | 18-24 | 9.0 +/- 2.6 | | < 1.3 | | 5.7 +/- 2.0 | | R | | R | | 1918 +/- 230 | | 265 +/- 34 | | 1562 +/- 190 | |
| WG-SS-SAP16-12 | | 30-36 | 2.0 +/- 1.2 | | < 0.79 | | 1.6 +/- 1.0 | | R | | R | | 54.5 +/- 8.8 | | 10.2 +/- 2.9 | | 53.4 +/- 8.6 | |
| WG-SS-SAP16-13 | 7 | 0-6 | 0.91 +/- 0.21 | E | < 0.064 | E | 1.07 +/- 0.24 | E | 4.24 +/- 0.371 | E | 2.36 +/- 0.386 | | 2.73 +/- 0.45 | | 1.34 +/- 0.27 | | 3.16 +/- 0.50 | |
| WG-SS-SAP16-14 | | 18-24 | 1.46 +/- 0.81 | | < 0.31 | | 1.19 +/- 0.76 | | 212 +/- 13.5 | E | 76.2 +/- 5.09 | | 123 +/- 16 | | 19.5 +/- 3.4 | | 122 +/- 16 | |
| WG-SS-SAP16-15 | | 24-30 | 0.42 +/- 0.14 | E | < 0.062 | E | 0.54 +/- 0.16 | E | 16.5 +/- 1.14 | E | 4.99 +/- 0.558 | | 4.96 +/- 0.70 | | 1.20 +/- 0.24 | | 5.05 +/- 0.71 | |
| WG-SS-SAP16-16 | 8 | 0-6 | 1.76 +/- 0.57 | | < 0.25 | | 1.04 +/- 0.44 | | 97.0 +/- 6.22 | E | 12.8 +/- 1.18 | | 17.9 +/- 2.6 | | 3.26 +/- 0.77 | | 16.5 +/- 2.4 | |
| WG-SS-SAP16-17 | | 12-18 | 1.41 +/- 0.38 | E | < 0.14 | E | 1.02 +/- 0.32 | E | 9.53 +/- 0.702 | E | 3.05 +/- 0.447 | | 3.68 +/- 0.66 | E | 1.74 +/- 0.40 | E | 3.99 +/- 0.69 | E |
| WG-SS-SAP16-18 | | 0-6 | 0.45 +/- 0.10 | E | < 0.026 | E | 0.46 +/- 0.10 | E | 0.906 +/- 0.198 | E | 0.810 +/- 0.301 | | 0.82 +/- 0.16 | | 0.69 +/- 0.14 | | 1.00 +/- 0.18 | |
| WG-SS-SAP16-19 | 9 | 6-12 | 1.04 +/- 0.51 | | < 0.35 | | 1.31 +/- 0.58 | | 47.2 +/- 3.03 | E | 7.38 +/- 0.624 | | 8.9 +/- 1.5 | E | 2.12 +/- 0.59 | E | 8.4 +/- 1.4 | E |
| WG-SS-SAP16-20 | | 18-24 | 0.69 +/- 0.19 | E | < 0.072 | E | 0.64 +/- 0.18 | E | 4.25 +/- 0.342 | E | 1.50 +/- 0.255 | | 1.49 +/- 0.29 | | 0.68 +/- 0.17 | | 1.39 +/- 0.27 | |
| WG-SS-SAP16-21 | 10 | 0-6 | 1.74 +/- 0.64 | | < 0.43 | | 1.14 +/- 0.51 | | 2.46 +/- 0.405 | E | 29.4 +/- 2.13 | | 53.8 +/- 6.9 | | 12.7 +/- 2.0 | | 52.8 +/- 6.7 | |
| WG-SS-SAP16-22 | | 6-12 | 0.66 +/- 0.18 | | < 0.062 | | 0.71 +/- 0.19 | | 1.59 +/- 0.217 | E | 2.87 +/- 0.390 | | 2.19 +/- 0.38 | | 1.04 +/- 0.23 | | 2.17 +/- 0.38 | |
| WG-SS-SAP16-23 | 11 | 0-36 | 0.81 +/- 0.29 | | < 0.19 | | 0.88 +/- 0.30 | | 1.91 +/- 0.261 | E | 1.34 +/- 0.329 | | 1.09 +/- 0.33 | | 0.94 +/- 0.28 | | 1.35 +/- 0.34 | |
| WG-SLAG-01 | - | - | 309 +/- 38 | | 13.2 +/- 2.9 | | 307 +/- 38 | | 558 +/- 44.9 | E | 28.3 +/- 3.78 | E | 27.9 +/- 4.5 | | 344 +/- 42 | | 28.8 +/- 4.6 | |
| WG-SS-SAP17-01 | 1 | 0-6 | 0.72 +/- 0.13 | | < 0.024 | | 0.69 +/- 0.13 | | 4.29 +/- 0.431 | | 19.8 +/- 1.46 | E | 1.36 +/- 0.20 | | < 0.028 | | 1.26 +/- 0.19 | |
| WG-SS-SAP17-02 | | 18-24 | [redacted] | | < 5.59 | | 748 +/- 52.4 | | 235 +/- 15.1 | | 1450 +/- 91.8 | E | 1480 +/- 93.4 | | [redacted] | | 1430 +/- 90.9 | |
| WG-SS-SAP17-03 | | 24-30 | | | < 2.90 | | 609 +/- 39.7 | | 185 +/- 11.8 | | 1230 +/- 78.1 | E | 1080 +/- 68.6 | | | | 1220 +/- 77.4 | |
| WG-SS-SAP17-04 | 2 | 6-12 | 0.58 +/- 0.11 | | 0.042 +/- 0.025 | | 0.60 +/- 0.12 | | 2.52 +/- 0.277 | | 8.53 +/- 0.716 | E | 0.76 +/- 0.13 | | < 0.027 | | 0.81 +/- 0.13 | |
| WG-SS-SAP17-05 | | 18-24 | [redacted] | | < 4.29 | | 580 +/- 39.8 | | 142 +/- 9.19 | | 1010 +/- 63.9 | E | 959 +/- 60.8 | | [redacted] | | 996 +/- 63.2 | |
| WG-SS-SAP17-06 | | 24-27 | 5.1 +/- 1.1 | E | < 0.43 | E | 5.0 +/- 1.1 | E | 45.6 +/- 3.07 | | 340 +/- 21.7 | E | 17.8 +/- 2.5 | | 3.23 +/- 0.70 | | 16.3 +/- 2.3 | |
| WG-SS-SAP17-07 | 3 | 0-6 | 0.94 +/- 0.41 | E | < 0.21 | E | 0.66 +/- 0.33 | E | 6.54 +/- 0.585 | | 41.2 +/- 2.80 | E | 17.4 +/- 2.5 | | 1.38 +/- 0.43 | | 7.6 +/- 1.3 | |
| WG-SS-SAP17-08 | | 6-12 | [redacted] | | < 179 | | 16500 +/- 1210 | | 2520 +/- 627 | | 11700 +/- 751 | E | 11000 +/- 700 | | [redacted] | | 12500 +/- 807 | |
| WG-SS-SAP17-09 | | 12-17 | | | < 128 | | 7700 +/- 657 | | < 427 | | 6150 +/- 403 | E | 5430 +/- 349 | | | | 5860 +/- 384 | |
| WG-SS-SAP17-10 | 4 | 0-6 | 0.079 +/- 0.035 | | < 0.021 | | 0.080 +/- 0.036 | | 11.8 +/- 1.29 | | 64.1 +/- 4.87 | | 2.10 +/- 0.28 | | < 0.034 | | 2.16 +/- 0.30 | |
| WG-BRICK-01 | 5 | ----- | 1.43 +/- 0.63 | | < 0.44 | | 1.54 +/- 0.66 | | 5.84 +/- 3.63 | E | 11.4 +/- 1.13 | E | 10.3 +/- 2.2 | | 2.47 +/- 0.95 | | 3.5 +/- 1.1 | |
| WG-SS-SAP17-11 | 6 | 0-2 | [redacted] | | < 3.21 | | 366 +/- 26.2 | | 86.1 +/- 5.65 | | 483 +/- 30.8 | | 468 +/- 29.7 | | [redacted] | | 478 +/- 30.4 | |
| ------ | 7 | Samples were not collected from this borehole due to auger refusal | | | | | | | | | | | | | | | | |
| WG-SS-SAP17-12 | 8 | 0-6 | 3.23 +/- 0.78 | | < 0.21 | | 2.84 +/- 0.73 | | 7.48 +/- 0.654 | | 36.8 +/- 2.57 | E | 22.3 +/- 3.1 | | 2.99 +/- 0.69 | | 19.4 +/- 2.7 | |
| WG-SS-SAP17-13 | | 6-12 | 0.75 +/- 0.37 | | < 0.21 | | 0.31 +/- 0.23 | | 4.29 +/- 0.454 | | 21.3 +/- 1.61 | E | 16.5 +/- 2.4 | | 2.86 +/- 0.70 | | 14.6 +/- 2.2 | |
| WG-SS-SAP17-14 | | 12-18 | 0.300 +/- 0.070 | | < 0.024 | | 0.289 +/- 0.069 | | 1.35 +/- 0.198 | | 3.38 +/- 0.394 | E | 1.13 +/- 0.17 | | < 0.025 | | 0.63 +/- 0.11 | |
| WG-SS-SAP17-15 | 9 | 0-6 | 0.39 +/- 0.12 | | < 0.065 | | 0.35 +/- 0.11 | | 1.83 +/- 0.305 | | 9.16 +/- 0.840 | E | 4.62 +/- 0.63 | | < 0.044 | | 4.14 +/- 0.57 | |
| WG-SS-SAP17-16 | 10 | 0-6 | 6.02 +/- 1.2 | | 0.32 +/- 0.23 | | 6.5 +/- 1.2 | | 272 +/- 17.3 | | 55.8 +/- 3.67 | E | 33.1 +/- 4.4 | | 3.83 +/- 0.82 | | 26.4 +/- 3.6 | |
| WG-SS-SAP17-17 | | 6-12 | 1.13 +/- 0.23 | | 0.053 +/- 0.042 | | 0.87 +/- 0.19 | | 3.94 +/- 0.363 | | 12.5 +/- 0.976 | E | 4.78 +/- 0.65 | | < 0.045 | | 4.30 +/- 0.59 | |
| WG-SS-SAP17-18 | 11 | 0-6 | 0.90 +/- 0.20 | | < 0.070 | | 0.93 +/- 0.20 | | 1.05 +/- 0.189 | | 2.60 +/- 0.352 | E | 1.16 +/- 0.22 | E | < 0.082 | E | 1.18 +/- 0.21 | E |
| WG-SS-SAP17-19 | | 12-18 | [redacted] | | < 82.2 | | 2460 +/- 283 | | < 256 | | 2440 +/- 168 | E | 2270 +/- 149 | | [redacted] | | 2320 +/- 160 | |
| WG-SS-SAP17-20 | | 30-36 | 0.71 +/- 0.39 | | < 0.27 | | 0.75 +/- 0.40 | | 6.05 +/- 1.02 | | 354 +/- 22.6 | E | 66.0 +/- 8.2 | E | 7.0 +/- 1.2 | E | 57.9 +/- 7.2 | E |
| WG-SS-SAP17-21 | 12 | 0-6 | 1.60 +/- 0.71 | | < 0.38 | | 1.58 +/- 0.71 | | 42.2 +/- 2.73 | | 105 +/- 6.71 | E | 88 +/- 11 | E | 11.6 +/- 2.1 | | 83 +/- 11 | |
| WG-SS-SAP17-22 | | 6-12 | 0.98 +/- 0.20 | E | < 0.054 | | 0.77 +/- 0.17 | | 3.14 +/- 0.260 | | 2.14 +/- 0.249 | E | 2.47 +/- 0.37 | E | 1.16 +/- 0.21 | E | 1.97 +/- 0.31 | E |
| WG-SS-SAP17-23 | | 0-6 | 1.03 +/- 0.19 | | 0.044 +/- 0.031 | | 0.87 +/- 0.17 | | 1.42 +/- 0.337 | | 1.08 +/- 0.442 | | 1.00 +/- 0.18 | | 0.87 +/- 0.16 | | 1.04 +/- 0.18 | |

300711

## APPENDIX B-6
## WELSBACH/GGM SITE
## VICINITY PROPERTIES SAMPLING RESULTS (CONTINUED)

| Sample Information (Soils) | | | Sample Radiological Results, pCi/g** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification No. | Borehole No. | Depth (inches) | U-234 | | U-235 | | U-238 | | Ra-226 | | Ra-228 | | Th-228 | | Th-230 | | Th-232 | |
| WG-SS-SAP17-24 | 13 | 6-12 | 0.88 +/- 0.18 | | 0.059 +/- 0.039 | | 1.01 +/- 0.20 | | 1.46 +/- 0.366 | | 1.29 +/- 0.519 | | 1.23 +/- 0.22 | | 0.99 +/- 0.18 | | 0.99 +/- 0.18 | |
| WG-SS-SAP17-25 | | 12-18 | 1.04 +/- 0.19 | | < 0.035 | | 0.94 +/- 0.18 | | 1.20 +/- 0.295 | | 1.27 +/- 0.569 | | 0.94 +/- 0.17 | | 0.94 +/- 0.17 | | 0.95 +/- 0.17 | |
| WG-SS-SAP18-01 | 1 | 6-12 | 0.62 +/- 0.16 | | < 0.050 | | 0.63 +/- 0.16 | | 0.772 +/- 0.331 | | < 2.87 | | 2.16 +/- 0.37 | | < 0.63 | | 1.73 +/- 0.31 | |
| WG-SS-SAP18-02 | | 0-6 | 8.1 +/- 1.4 | | 0.53 +/- 0.32 | | 8.0 +/- 1.4 | | 2.10 +/- 0.762 | | 29.8 +/- 2.82 | | 46.0 +/- 5.9 | | 7.0 +/- 1.3 | | 42.8 +/- 5.5 | |
| WG-SS-SAP18-03 | | 12-18 | 9.5 +/- 3.0 | | < 1.5 | | 9.7 +/- 2.8 | | 2.57 +/- 0.794 | | 31.5 +/- 2.80 | | 50.1 +/- 8.9 | | 22.1 +/- 4.6 | | 38.8 +/- 6.8 | |
| WG-SS-SAP18-04 | 2 | 30-36 | 0.46 +/- 0.13 | | < 0.058 | | 0.53 +/- 0.14 | | 1.15 +/- 0.346 | | < 0.898 | | 0.77 +/- 0.12 | | 0.92 +/- 0.136 | | 0.82 +/- 0.12 | |
| WG-SS-SAP18-05 | | 36-42 | < 0.045 | | < 0.024 | | 0.033 +/- 0.024 | | 1.35 +/- 0.315 | | < 0.972 | | 0.81 +/- 0.16 | | 0.73 +/- 0.14 | | 0.84 +/- 0.16 | |
| WG-SS-SAP18-06 | | 48-54 | 0.72 +/- 0.14 | | 0.036 +/- 0.026 | | 0.63 +/- 0.13 | | 1.05 +/- 0.360 | | < 0.618 | | 0.67 +/- 0.14 | | 0.67 +/- 0.13 | | 0.68 +/- 0.13 | |
| WG-SS-SAP18-07 | 3 | 0-36 | 0.373 +/- 0.093 | | < 0.030 | | 0.44 +/- 0.10 | | 0.697 +/- 0.178 | | < 0.498 | | 0.419 +/- 0.096 | | < 1.47 | | 0.46 +/- 0.10 | |
| WG-SS-SAP18-08 | 4 | 0-36 | 0.52 +/- 0.11 | | < 0.025 | | 0.378 +/- 0.090 | | 0.587 +/- 0.215 | | < 0.521 | | 0.48 +/- 0.11 | | < 0.44 | | 0.412 +/- 0.097 | |
| WG-SS-SAP20-01 | | 0-6 | [redacted] | | < 32.3 | | 689 +/- 139 | | 548 +/- 39.7 | | 1420 +/- 97.4 | | 1020 +/- 67.5 | | [redacted] | | 1480 +/- 102 | |
| WG-SS-SAP20-02 | 1 | 6-12 | [redacted] | | < 5.90 | | 190 +/- 27.1 | | 167 +/- 11.3 | | 316 +/- 21.3 | | 320 +/- 20.8 | | [redacted] | | 330 +/- 22.3 | |
| WG-SS-SAP20-03 | | 12-18 | 111 +/- 59 | | < 39 | | < 61 | | 284 +/- 18.7 | | 526 +/- 34.7 | | 354 +/- 120 | | 206 +/- 75 | | 427 +/- 110 | |
| WG-SS-SAP20-04 | | 0-6 | 0.84 +/- 0.55 | | < 0.67 | | 0.84 +/- 0.58 | | 7.07 +/- 0.549 | | 18.3 +/- 1.33 | | 16.9 +/- 3.0 | | 7.5 +/- 1.6 | | 18.3 +/- 3.1 | |
| WG-SS-SAP20-05 | 2 | 6-12 | < 5.6 | | < 5.6 | | < 5.6 | | 18.8 +/- 1.29 | | 77.3 +/- 5.02 | | 78 +/- 17 | | 28.3 +/- 8.8 | | 85 +/- 17 | |
| WG-SS-SAP20-06 | | 12-18 | 0.81 +/- 0.53 | | < 0.65 | | 0.89 +/- 0.57 | | 2.07 +/- 0.220 | | 5.96 +/- 0.509 | | 13.9 +/- 2.5 | | 5.3 +/- 1.3 | | 10.3 +/- 2.0 | |
| WG-SS-SAP20-07 | 3 | 0-6 | 0.43 +/- 0.12 | E | 0.085 +/- 0.054 | E | 0.47 +/- 0.13 | | 0.903 +/- 0.208 | | 1.17 +/- 0.350 | | 0.94 +/- 0.19 | | 0.83 +/- 0.17 | | 0.84 +/- 0.17 | |
| WG-SS-SAP20-08 | | 6-12 | 1.37 +/- 0.29 | | 0.29 +/- 0.12 | | 0.99 +/- 0.23 | | 1.51 +/- 0.247 | | 1.28 +/- 0.334 | | 2.25 +/- 0.35 | | 1.72 +/- 0.26 | | 2.33 +/- 0.35 | |
| WG-SS-SAP20-09 | | 0-6 | 12.1 +/- 4.9 | | < 3.2 | | 10.6 +/- 4.6 | | 55.8 +/- 4.03 | | 179 +/- 12.1 | | 237 +/- 39 | | 43 +/- 13 | | 228 +/- 37 | |
| WG-SS-SAP20-10 | 4 | 6-12 | 8.6 +/- 4.4 | | < 2.7 | | 5.7 +/- 3.6 | | 61.1 +/- 4.49 | | 276 +/- 18.3 | | 338 +/- 52 | | 46 +/- 13 | | 334 +/- 51 | |
| WG-SS-SAP20-11 | 4 | 12-18 | [redacted] | | < 2.86 | | 136 +/- 15.3 | | 47.2 +/- 3.52 | | 175 +/- 11.9 | | 172 +/- 11.1 | | [redacted] | | 177 +/- 11.9 | |
| WG-SS-SAP20-12 | | 18-24 | 11.1 +/- 1.9 | E | 0.62 +/- 0.36 | E | 9.6 +/- 1.7 | E | 25.1 +/- 1.79 | | 92.1 +/- 6.11 | | 119 +/- 15 | | 16.3 +/- 2.9 | | 116 +/- 15 | |
| WG-SS-SAP20-13 | | 18-24 | 0.96 +/- 0.45 | | < 0.39 | | 1.22 +/- 0.53 | | 3.98 +/- 0.575 | | 32.5 +/- 2.44 | | 15.6 +/- 3.0 | | 3.7 +/- 1.2 | | 16.1 +/- 2.9 | |
| WG-SS-SAP20-14 | 5 | 24-30 | 3.0 +/- 1.9 | | < 1.6 | | < 2.5 | | 6.46 +/- 0.697 | | 55.5 +/- 3.85 | | 33.0 +/- 8.4 | | 7.0 +/- 3.4 | | 26.9 +/- 7.1 | |
| WG-SS-SAP20-15 | | 30-36 | 2.04 +/- 0.74 | | < 0.40 | | 2.12 +/- 0.73 | | 8.56 +/- 0.885 | | 62.4 +/- 4.34 | | 38.3 +/- 5.6 | | 6.4 +/- 1.5 | | 36.5 +/- 5.3 | |
| WG-SS-SAP20-16 | 6 | 0-6 | 2.6 +/- 1.1 | | < 0.62 | | 2.8 +/- 1.1 | | 17.9 +/- 1.43 | | 67.1 +/- 4.70 | | 55.9 +/- 8.7 | | 8.3 +/- 2.4 | | 62.6 +/- 9.4 | |
| WG-SS-SAP20-17 | | 6-8 | 7.3 +/- 2.9 | | < 1.5 | | 6.4 +/- 2.7 | | 29.2 +/- 2.10 | | 105 +/- 6.99 | | 105 +/- 18 | E | 24.5 +/- 6.8 | E | 103 +/- 17 | E |
| WG-SS-SAP20-18 | | 0-6 | 2.8 +/- 1.1 | | < 0.59 | | 3.3 +/- 1.2 | | 34.4 +/- 2.54 | E | 143 +/- 9.57 | | 94 +/- 13 | | 14.5 +/- 3.4 | | 91 +/- 13 | E |
| WG-SS-SAP20-19 | 7 | 6-12 | [redacted] | | < 2.25 | | 80.6 +/- 9.26 | | 41.4 +/- 2.88 | | 118 +/- 7.87 | | 112 +/- 7.23 | | [redacted] | | 119 +/- 7.92 | |
| WG-SS-SAP20-20 | | 12-15 | 10.1 +/- 2.3 | | < 0.69 | | 9.0 +/- 2.1 | | 52.5 +/- 3.83 | | 182 +/- 12.3 | | 851 +/- 100 | | 105 +/- 15 | | 866 +/- 100 | |
| WG-SS-SAP20-21 | | 0-6 | [redacted] | | < 5.32 | | 168 +/- 20.8 | | 83.5 +/- 5.94 | | 248 +/- 16.7 | | 242 +/- 15.7 | | [redacted] | | 249 +/- 16.8 | |
| WG-SS-SAP20-22 | 8 | 6-12 | 5.5 +/- 3.3 | | < 2.8 | | 3.7 +/- 2.7 | | 26.2 +/- 2.17 | | 80.0 +/- 5.97 | | 79 +/- 14 | | 20.0 +/- 5.9 | | 80 +/- 14 | |
| WG-SS-SAP20-23 | | 12-18 | < 1.7 | | < 1.2 | | < 1.4 | | 7.77 +/- 0.753 | | 25.9 +/- 2.03 | | 19.8 +/- 4.4 | | 6.6 +/- 2.2 | | 17.1 +/- 3.9 | |
| WG-SS-SAP20-24 | | 0-6 | 0.62 +/- 0.17 | | < 0.077 | | 0.84 +/- 0.21 | | 1.81 +/- 0.404 | | 5.93 +/- 0.809 | | 5.33 +/- 0.75 | | 1.26 +/- 0.25 | | 5.16 +/- 0.73 | |
| WG-SS-SAP20-25 | 9 | 6-12 | 0.96 +/- 0.36 | | < 0.18 | | 0.92 +/- 0.35 | | 2.40 +/- 0.347 | | 6.34 +/- 0.755 | | 5.7 +/- 1.0 | | 1.34 +/- 0.40 | | 7.2 +/- 1.2 | |
| WG-SS-SAP20-26 | | 12-18 | 0.90 +/- 0.21 | | < 0.059 | | 0.63 +/- 0.17 | | 0.984 +/- 0.241 | E | 1.37 +/- 0.407 | E | 1.16 +/- 0.24 | | < 0.59 | | 1.10 +/- 0.22 | |
| WG-SS-SAP20-28 | | 0-6 | 0.78 +/- 0.15 | | 0.077 +/- 0.040 | | 0.74 +/- 0.15 | | 0.902 +/- 0.290 | | 0.597 +/- 0.589 | | 0.59 +/- 0.12 | | < 0.346 | | 0.410 +/- 0.090 | |
| WG-SS-SAP20-29 | 10 | 6-12 | 0.64 +/- 0.13 | | < 0.030 | | 0.62 +/- 0.13 | | 0.699 +/- 0.271 | | 0.674 +/- 0.421 | | 0.42 +/- 0.11 | | < 0.47 | | 0.351 +/- 0.093 | |
| WG-SS-SAP20-30 | | 12-18 | 0.52 +/- 0.11 | | 0.019 +/- 0.018 | | 0.387 +/- 0.095 | | 0.525 +/- 0.336 | | 0.807 +/- 0.261 | | 0.388 +/- 0.094 | | < 0.46 | | 0.363 +/- 0.087 | |
| WG-SS-SAP20-31 | 11 | 0-30 | 0.49 +/- 0.11 | | < 0.029 | | 0.46 +/- 0.10 | | 0.685 +/- 0.180 | | 0.455 +/- 0.272 | | 0.287 +/- 0.074 | | < 0.61 | | 0.290 +/- 0.075 | |

300712

APPENDIX B-6
WELSBACH/GGM SITE
VICINITY PROPERTIES SAMPLING RESULTS (CONTINUED)

| Sample Information (Soils) | | | Sample Radiological Results, pCi/g** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample Identification No. | Borehole No. | Depth (inches) | U-234 | U-235 | U-238 | Ra-226 | Ra-228 | Th-228 | Th-230 | Th-232 |
| WG-SS-SAP-BG-01 | NA | 0 - 24 | 0.68 +/- 0.14 | < 0.015 | 0.57 +/- 0.13 | 1.00 +/- 0.160 | 0.527 +/- 0.200 | 0.423 +/- 0.099 | < 0.72 | 0.354 +/- 0.086 |
| WG-SS-SAP-BG-02 | NA | 0 - 24 | 0.316 +/- 0.091 | < 0.017 | 0.345 +/- 0.095 | 0.399 +/- 0.206 | 0.544 +/- 0.412 | 0.363 +/- 0.098 | < 0.41 | 0.44 +/- 0.10 |
| WG-SS-SAP-BG-03 | NA | 0 - 24 | 0.53 +/- 0.12 | 0.021 +/- 0.020 | 0.44 +/- 0.11 | 0.978 +/- 0.161 | 0.411 +/- 0.249 | 0.66 +/- 0.14 | < 0.51 | 0.60 +/- 0.12 |
| WG-SS-SAP-BG-04 | NA | 0 - 24 | 0.72 +/- 0.15 | < 0.039 | 0.71 +/- 0.15 | 1.21 +/- 0.326 | 0.626 +/- 0.405 | 0.91 +/- 0.16 | 0.82 +/- 0.15 | 0.77 +/- 0.14 |
| WG-SS-SAP-BG-05 | NA | 0 - 24 | 0.70 +/- 0.14 | -0.015 +/- 0.016 | 0.58 +/- 0.12 | 0.848 +/- 0.324 | 0.506 +/- 0.488 | 0.60 +/- 0.12 | < 0.58 | 0.53 +/- 0.11 |

Notes:

E - Estimated Value
R - Analysis did not Pass EPA QA/QC
SAP - Study Area Property
BG - Background
- Sample not Analyzed for this Radionuclide

C

## APPENDIX C

## WELSBACH/GGM SITE

## RISK ASSESSMENT TABLES

<u>REMEDIAL INVESTIGATION AND FEASIBILITY STUDY</u>
WELSBACH/GGM SITE
CAMDEN AND GLOUCESTER CITY
CAMDEN COUNTY, NEW JERSEY

APPENDIX C
HUMAN HEALTH EVALUATION

- Data Utilization
- Respirable Particulates Model
- Home-Grown Produce Model
- Concentration-Toxicity Screen and Chemicals of Potential of Concern Selection
- Essential Nutrient Screen
- Radiological Risk - RAGS Exposure and Risk Summaries
- Radiological Risk - RESRAD/RESRAD-BUILD Exposure and Risk Summaries
- Chemical Risk - Exposure and Risk Summaries
- Toxicological Profiles

## DATA UTILIZATION

Before calculating 95% upper confidence limits (UCL) on the arithmetic average concentrations of the radionuclides of potential concern, the Shapiro and Wilk W test (for sample sizes $\geq 10$ and $\leq 50$) or D'Agostino's D test (for samples sizes > 50) were run on the data to determine if the data sets are consistent with a normal distribution (Gilbert, 1987).

If the data set was found to be consistent with the normal distribution, the 95% UCL was calculated from the following equation (USEPA, 1992):

$$UCL = x + t(s/n^{1/2})$$

where:

| | |
|---|---|
| x | = the arithmetic average of the data |
| s | = the standard deviation of the data |
| t | = Student-t statistic |
| n | = sample size |

If the data set was not found to be consistent with the normal distribution, the 95% UCL concentration was calculated from the following equation (USEPA, 1992):

$$UCL = e^{\{x + 0.5s^2 + sH_{(n-1)}{}^{1/2}\}}$$

where:

| | |
|---|---|
| UCL | = 95% upper confidence limit on the arithmetic average |
| e | = constant (base of the natural log) |
| x | = the arithmetic average of the transformed data |
| s | = the standard deviation of the transformed data |
| H | = statistic for a one-sided 95% confidence limit on a lognormal average |
| n | = sample size |

The results of the W or D tests, the maximum detected concentration, the appropriate 95% UCL concentration, and the exposure point concentration for each chemical and radionuclide of potential concern with a sample size $\geq 10$ in each medium for the Sites are presented in their respective Standard Table 3 on the proceeding pages. For the chemical analysis, the calculation of a 95% UCL is inappropriate due to the limited number of samples; hence, the maximum detected concentration is used.

<u>References</u>

Gilbert, R.O. 1987. <u>Statistical Methods for Environmental Pollution Monitoring</u>. New York, NY: Van Nostrand Reinhold. 320 p.

U.S. Environmental Protection Agency. 1992. Supplemental Guidance to RAGS: Calculating the

Concentration Term. Publication 9285.7-08. Washington, DC: Office of Solid Waste and Emergency Response.

## RESPIRABLE PARTICULATES MODEL

The methodology to evaluate the potential exposure of workers to respirable particulates emitted during the course of excavating soil during construction or utility maintenance activities is described below. The modeling required determination of an emission rate, an emission flux, and the concentration of respirable particulates in the ambient air at the excavation.

### Emission Rate and Emission Flux

The emission rate calculation considered the digging of an 1.5 m wide x 5.0 m long x 5.0 m deep excavation by a bulldozer. A bulldozer was assumed for this analysis since an emission rate equation is available for a bulldozer and not a backhoe. Only emissions from the digging of the excavation were calculated; the soil removed from the excavation was assumed to be placed on the side of the excavation and covered to prevent wind-generated respirable particulates.

The following equation (USEPA, 1989) was used to derive an emission rate (in g/s) for respirable particulates:

$$[0.45\ (s)^{1.5}\ (M)^{-1.4}]$$

where:

s = silt content of the soil in weight %
M = moisture content of the soil in weight %

Since soil particle size analyses were not conducted during the RI, a silt content of 16 % is assumed: this value represents the average of data for Camden and Gloucester Counties (NJDEP 1993). A moisture content of 10.2 % is used; this value represents the average moisture content, as reported for chemical analyses, of all subsurface soil samples collected during the RI. Solving the above equation resulted in a respirable particulate emission rate of 0.31 g/s, as presented below:

$$= [0.45\ (16)^{1.5}\ (10.2)^{-1.4}]$$
$$= [0.45\ (64)\ (0.039)]$$
$$= 1.12 \text{ kg/hour}$$
$$= 0.31 \text{ g/s}$$

An emission flux of 0.04 g/s-m$^2$ was derived by dividing the emission rate by the surface area of the excavation (0.31 g/s ÷ 7.5 m$^2$).

### Air Concentrations

Ambient air concentrations for workers exposed to the excavation emissions were determined using the USEPA-approved Point, Area and Line source (PAL2.1) model, version 89272, (USEPA, 1987) assuming that the excavation represents an area source of emissions. Unlike other area source models, such as the Industrial Source Complex (ISC) model and SCREEN3, PAL2.1 has the capability of determining impacts above area sources, as well as downwind of a source. PAL2.1 is a diverse model that can be used to estimate dispersion for point, area and line sources using Gaussian-plume steady-state assumptions. Simultaneous modeling of multiple sources and source types can be performed to calculate impacts of non-reactive chemicals at a large number of receptors. Also, user-specified meteorological options allow for input of site-specific conditions that are representative of the site being modeled.

For this analysis, the source was modeled as a 1.5 m x 5.0 m flat area source. Nine receptors were used in the analysis. Eight receptors were placed along the edge of the excavation; one at each of the four corners, and one at the center of each side. In addition, one receptor was placed over the center of the excavation. All receptors were placed at a height of 1.8 m to simulate the height of a worker. The meteorological data consisted of an array of 54 meteorological conditions as used in the USEPA-approved screening level model, SCREEN3 (USEPA, 1995a). These conditions represented 54 combinations of stability classes (1 to 6) and wind speeds (1 m/s to 20 m/s) that could occur in the atmosphere. The wind directions were set so that the wind would blow directly towards each of the receptors. Model options selected for the analysis included: a typical anemometer height of 6.1 meters, a mixing height of 5000 m, and an average temperature of 293 °K. The wind was assumed to be constant below 10 meters (as fixed by PAL2.1). The analysis was performed for both the rural and urban land use classifications. The emission rate of the area source was set at 1 g/s-m$^2$. Output was then in the form of g/m$^3$ per g/s-m$^2$.

**Results**

The rural and urban modeling analyses predicted maximum 1-hour average unitized impacts of 0.0268 and 0.1302 g/m$^3$ per g/s-m$^2$, respectively, at the corners of the excavation. The maximum 1-hour average respirable particulate concentration (in kg/m$^3$) in the ambient air at the excavation was calculated from the following equation.

C = [1-hour unitized impact in g/m$^3$ per g/s-m$^2$] x [emission flux in g/s-m$^2$] x [0.001 kg/g]

Based on the urban land use classification, the maximum 1-hour average respirable particulate concentration is 5.21E-06 kg/m$^3$, as presented below.

= [0.1302 g/m$^3$ per g/s-m$^2$] * [0.04 g/s-m$^2$] * [0.001 kg/g]
= 0.00000521 kg/m$^3$

Concentrations of the non-volatile radionuclides and chemicals of potential concern associated with this respirable particulate concentration are calculated in the Human Health Evaluation.

**References**

New Jersey Department of Environmental Protection and Energy. 1993. A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey. Site

Remediation Program and Division of Science and Research, Trenton, NJ.

U.S. Environmental Protection Agency. 1995a. SCREEN3 Model User's Guide. EPA-454/B-95-004. Research Triangle Park, NC: U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency. 1989. Estimation of Air Emissions from Clean-up Activities at Superfund Sites, Report ASF-3. Air Superfund National Technical Guidance Study Series. Volume. 3. Research Triangle Park, NC: U.S. Environmental Protection Agency.

U.S. Environmental Protection Agency. 1987. User's Guide for PAL 2.0. EPA-600/8-87/009. Research Triangle Park, NC: U. S. Environmental Protection Agency.

## HOME-GROWN PRODUCE MODEL

### Root Vegetables

The carrot serves as a surrogate for root vegetables grown in home gardens. Carrots are assumed to accumulate radionuclides of potential concern only through uptake from soil. It is further assumed that the carrots are washed before eaten, so that soil adherence to the carrots will not contribute to the chemical intake. To calculate radionuclide concentrations in carrots, the 95% UCL concentration or the maximum concentration in soil is multiplied by a radionuclide-specific root uptake factor (RUF).

RUFS for the radionulclides are based upon transfer coefficients developed by Baes et al. (1984) for tuber crops. The values presented in the following table have been adjusted to reflect the wet weight of each vegetable or fruit. For carrots, the moisture content accounts for approximately 88% of the total wet weight (Baes et al., 1984). Therefore the transfer coefficient is multiplied by 12%. Additional factors affect the bioavailabilty of radionuclides and the extent of root uptake including characteristics of the plant (species, age) and the soil properties (pH, organic content, cation exchange capacity, concentration of other metals, temperature, and aeration). Thus, in the absence of information regarding site-specific soil characteristics, the calculated RUFS should be considered best approximations.

### Above-Ground Vegetables

To evaluate the potential exposure from eating "above-ground" vegetables and fruits (i.e., lettuce and tomatoes), the accumulation of radionuclides in the edible parts of the plant must be considered. The effective uptake of radionuclides from the soil depends upon the efficiency of root absorption and translocation to the edible portions. The radionuclide concentration in the edible portions of lettuce and tomato plants can be estimated by multiplying the 95% UCL concentrations or the maximum concentrations of each radionuclide of potential concern in soil by a plant uptake factor (PUF). Similarly to the roots, the potential for radionuclide translocation to the above-ground plant parts depends largely upon the characteristics of the radionuclide and the plant.

The PUFs for the uptake and translocation of the radionuclides to above-ground plant parts are based on transfer coefficients developed by Baes et al. (1984), similarly to those applied in evaluating carrots. Presented PUFs for radionuclides in lettuce are based upon transfer coefficients developed for vegetative plant parts (leaves and stems). The values presented in Table O-1 incorporate a dry-wet weight conversion factor assuming that lettuce typically has a 95% moisture content (Baes et al., 1984). For tomatoes, transfer coefficients developed for fruits were used in the intake estimates, assuming that the typical tomato has a 94% moisture content (Baes et al., 1984).

| ROOT AND PLANT UPTAKE FACTORS | | | |
|---|---|---|---|
| RADIONUCLIDE | PUF LETTUCE | RUF CARROTS | PUF TOMATOES |
| Uranium-234 | 4.25E-04 | 4.80E-04 | 5.10-04 |
| Uranium-238 | 4.25E-04 | 4.80E-04 | 5.10-04 |
| Radium-226 | 7.50E-04 | 1.56E-04 | 9.00E-04 |
| Radium-228 | 7.50E-04 | 1.56E-04 | 9.00E-04 |
| Thorium-228 | 4.25E-05 | 1.02E-05 | 5.10-05 |
| Thorium-230 | 4.25E-05 | 1.02E-05 | 5.10-05 |
| Thorium-232 | 4.25E-05 | 1.02E-05 | 5.10-05 |
| Lead-210 | 2.25E-03 | 1.08E-03 | 2.70E-03 |

References

Baes, C.F., III, R.D. Sharp, A.L. Sjoreen and R.W. Shor. 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radio nuclides through Agriculture. ORNL-5786. Oak Ridge, TN: Oak Ridge National Laboratory.

## CONCENTRATION-TOXICITY SCREEN AND CHEMICALS OF POTENTIAL CONCERN SELECTION

A concentration-toxicity screen was performed in accordance with USEPA guidance (USEPA. 1989). The purpose of the screen is to identify chemicals in a particular medium that most likely contribute significantly to the risk estimates. The screen is based on the maximum detected concentrations and USEPA toxicity criteria as represented by reference doses for non-carcinogenic effects and slope factors for carcinogenic effects. Individual chemical scores or risk factors are calculated by dividing the maximum detected concentration by the reference dose or multiplying by the slope factor. The individual risk factors are summed for a total risk factor and then the ratio of the individual risk factors to the total risk factor approximates the relative risk of each individual chemical. Chemicals with relative risks greater than 1% (0.01) are selected as chemicals of potential concern (COPC). Chemicals with relative risks less than 1% are eliminated from the human health evaluation.

The screen was performed using only oral toxicity criteria since no air quality data were collected. However, since inhalation of respirable particulates is a pathway of concern, for those chemicals with inhalation toxicity criteria a second concentration/toxicity screen was performed to determine if chemicals in a particular medium may be likely to contribute significantly to the risk estimates for the inhalation pathway.

Chemicals without toxicity criteria were selected as chemicals of potential concern if they could not be eliminated based on the other criteria (i.e., frequency of detection, background concentration, or nutrient screening concentration); they are evaluated qualitatively in the human health evaluation.

The results of the screen, including the reason for selection or elimination as chemicals of potential concern where not based solely on the screen, are presented on the following pages.

References

U.S. Environmental Protection Agency. 1989. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part A). Interim Final. EPA/540/1-89/002. Washington, DC: Office of Emergency and Remedial Response.

## CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
## SUBSURFACE SOIL WELSBACH

| CHEMICAL | Frequency of Detection | Detected Concentrations Range mg/kg | Average mg/kg | Oral Reference Dose mg/kg-day | Risk Factor | Relative Risk | Screen | Oral Slope Factor (mg/kg-day)$^{-1}$ | Weight of Evidence Classification | Risk Factor | Relative Risk | Screen | Background Screen Published Average Concentrations[1] mg/kg | 2X Average mg/kg | Nutrient Screen Child/Adult mg/kg | Other Reason for Selection or Elimination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acetone | 3 / 10 | 0.076 - 0.15 | | 1E-01 | 1.50 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Acenaphthene | 2 / 10 | 0.4 - 17 | | 6E-02 | 283.33 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Acenapthylene | 1 / 10 | 1.2 - 1.2 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Anthracene | 4 / 10 | 0.54 - 7.8 | | 3E-01 | 26.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Benzo(a)Anthracene | 6 / 10 | 0.3 - 5.2 | | -- | 0.00 | 0.00 | NO | 7.3E-01 | B2 | 3.80 | 0.01 | YES | | | | |
| Benzo(b)Fluoranthene | 6 / 10 | 0.4 - 9.3 | | -- | 0.00 | 0.00 | NO | 7.3E-01 | B2 | 6.79 | 0.01 | YES | | | | |
| **Benzo(a)Pyrene** | **6 / 10** | **0.25 - 5.1** | | **--** | **0.00** | **0.00** | **NO** | **7.3E+00** | **B2** | **37.23** | **0.08** | **YES** | | | | |
| Benzo(g,h,i)Perylene | 4 / 10 | 0.47 - 1.5 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Bis(2-Ethylhexyl)Phthalate | 2 / 10 | 0.049 - 2.7 | | 2E-02 | 135.00 | 0.00 | NO | 1.4E-02 | B2 | 0.04 | 0.00 | NO | | | | |
| Chrysene | 6 / 10 | 0.3 - 4.8 | | -- | 0.00 | 0.00 | NO | 7.3E-03 | B2 | 0.04 | 0.00 | NO | | | | |
| Dibenzofuran | 1 / 10 | 16 - 16 | | 4E-03 | 4000.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| 1,2-Dichlorobenzene | 1 / 10 | 0.85 - 0.85 | | 3E-01 | 2.83 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Fluoranthene | 6 / 10 | 0.59 - 12 | | 4E-02 | 300.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Fluorene | 1 / 10 | 14 - 14 | | 4E-02 | 350.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Indeno(1,2,3-cd)Pyrene | 4 / 10 | 0.57 - 1.9 | | -- | 0.00 | 0.00 | NO | 7.3E-01 | B2 | 1.39 | 0.00 | NO | | | | |
| Naphthalene | 1 / 10 | 44 - 44 | | 4E-02 | 1100.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| 2-Methylnaphthalene | 1 / 10 | 29 - 29 | | 4E-02 | 725.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Phenanthrene | 6 / 10 | 0.51 - 25 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Pyrene | 6 / 10 | 0.64 - 11 | | 3E-02 | 366.67 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Aroclor-1248 | 1 / 9 | 0.3 - 0.3 | | 2E-05 | 15000.00 | 0.01 | YES | 2.0E+00 | -- | 0.60 | 0.00 | NO | | | | |
| **Aroclor-1254** | **1 / 9** | **0.33 - 0.33** | | **2E-05** | **16500.00** | **0.02** | **YES** | 2.0E+00 | -- | 0.66 | 0.00 | NO | | | | |
| Aluminum | 9 / 9 | 1220 - 9100 | 3686.667 | 1.00E+00 | 9100.00 | 0.01 | YES | -- | -- | 0.00 | 0.00 | NO | *57000 | 114000 | | No; <2X |
| **Antimony** | **1 / 9** | **1.8 - 1.8** | **1.8** | **4.00E-04** | **4500.00** | **0.00** | **NO** | **--** | **--** | **0.00** | **0.00** | **NO** | 0.07 | 0.14 | | **Yes; >2X** |
| **Arsenic** | **9 / 9** | **2.7 - 272** | **46.43333** | **3.00E-04** | **906666.67** | **0.87** | **YES** | **1.50E+00** | **A** | **408.00** | **0.89** | **YES** | 8.26 | 16.52 | | **Yes; >2X** |
| Barium | 9 / 9 | 5.2 - 208 | 47.74444 | 7.00E-02 | 2971.43 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *229 | 458 | | No; <2X |
| Beryllium | 8 / 9 | 0.09 - 1.2 | 0.4375 | 2.00E-03 | 600.00 | 0.00 | NO | -- | B1 | 0.00 | 0.00 | NO | 1.07 | 2.14 | | No; <2X |
| Cadmium | 3 / 9 | 0.08 - 0.19 | 0.143333 | 1.00E-03 | 190.00 | 0.00 | NO | -- | B1 | 0.00 | 0.00 | NO | 0.65 | 1.3 | | No; <2X |
| Calcium | 9 / 9 | 148 - 19700 | 4311.889 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *6300 | 12600 | >1E+6 | No; nsc |
| Chromium | 9 / 9 | 4.1 - 17.4 | 10.5 | 1.00E+00 | 17.40 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 12.1 | 24.2 | | No; <2X |
| Cobalt | 9 / 9 | 0.52 - 4.2 | 2.72 | 6.00E-02 | 70.00 | 0.00 | NO | -- | ND | 0.00 | 0.00 | NO | *5.3 | 10.6 | | No; <2X |
| Copper | 9 / 9 | 1.9 - 62.3 | 22.72222 | 3.70E-02 | 1683.78 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 42.2 | 84.4 | | No; <2X |
| Iron | 9 / 9 | 4020 - 18300 | 8905.556 | 3.00E-01 | 61000.00 | 0.06 | YES | -- | -- | 0.00 | 0.00 | NO | *33 | 66 | 50,000 / 200,000 | No; nsc |
| Lead | 9 / 9 | 1.7 - 617 | 169.9556 | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | 177.7 | 355.4 | | No; <2X, <EPA criteria[2] |
| Magnesium | 9 / 9 | 89 - 9040 | 2012.222 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *4600 | 9200 | 400,000 / >1E+6 | No; nsc |
| Manganese | 9 / 9 | 3 - 147 | 74.12222 | 2.30E-02 | 6391.30 | 0.01 | YES | -- | D | 0.00 | 0.00 | NO | 335 | 670 | | No; <2X |
| Mercury | 7 / 9 | 0.03 - 0.91 | 0.377143 | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 0.5 | 1 | | No; <2X |
| Nickel | 9 / 9 | 0.71 - 23 | 6.69 | 2.00E-02 | 1150.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 16.6 | 33.2 | | No; <2X |
| Potassium | 9 / 9 | 297 - 832 | 537 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *12000 | 24000 | >1E+6 | No; nsc |
| **Selenium** | **1 / 9** | **0.77 - 0.77** | **0.77** | **5.00E-03** | **154.00** | **0.00** | **NO** | **--** | **D** | **0.00** | **0.00** | **NO** | 0.06 | 0.12 | | **Yes; >2X** |
| Sodium | 9 / 9 | 4.6 - 145 | 68.77778 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 7800 | 15600 | >1E+6 | No; nsc |
| Vanadium | 9 / 9 | 7.3 - 34.5 | 16.71111 | 7.00E-03 | 4928.57 | 0.00 | NO | -- | ND | 0.00 | 0.00 | NO | 22.6 | 45.2 | | No; <2X |
| Zinc | 7 / 9 | 5.3 - 89 | 41.7 | 3.00E-01 | 296.67 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 162.3 | 324.6 | | No; <2X |
| | | | | | | | | | | | | | | | | |
| | | | Total Relative Risk: | | 1038510 | | | | Total Relative Risk: | 458.53 | | | | | | |

1 = New Jersey Department of Environmental Protection and Energy Site Remediation Program and Division of Science and Research. 1993. A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersy.

2 = USEPA, 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. Technical Review Workgroup for Lead.

* = Dragun and Chiasson 1991.

no toxcrit = Oral toxicity information is not available.

2X = Two times average background.

nsc = Nutrient screening concentration.

f/d = Frequency of detection.

## CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
## SUBSURFACE SOIL WELSBACH

| CHEMICAL | Frequency of Detection | Detected Concentrations Range mg/kg | Detected Concentrations Average mg/kg | Inhalation Reference Dose mg/kg-day | Risk Factor | Relative Risk | Screen | Inhalation Slope Factor (mg/kg-day)$^{-1}$ | Weight of Evidence Classification | Risk Factor | Relative Risk | Screen | Background Screen Published Average Concentrations[1] mg/kg | Background Screen 2X Average mg/kg | Nutrient Screen Child/Adult mg/kg | Other Reason for Selection or Elimination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acetone | 3 / 10 | 0.076 - 0.15 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Acenaphthene | 2 / 10 | 0.4 - 17 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Acenapthylene | 1 / 10 | 1.2 - 1.2 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Anthracene | 4 / 10 | 0.54 - 7.8 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Benzo(a)Anthracene | 6 / 10 | 0.3 - 5.2 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | |
| Benzo(b)Fluoranthene | 6 / 10 | 0.4 - 9.3 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | |
| Benzo(a)Pyrene | 6 / 10 | 0.25 - 5.1 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | |
| Benzo(g,h,i)Perylene | 4 / 10 | 0.47 - 1.5 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Bis(2-Ethylhexyl)Phthalate | 2 / 10 | 0.049 - 2.7 | | -- | 0.00 | 0.00 | NO | 1.4E-02 | B2 | 0.04 | 0.00 | NO | | | | |
| Chrysene | 6 / 10 | 0.3 - 4.8 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | |
| Dibenzofuran | 1 / 10 | 16 - 16 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| 1,2-Dichlorobenzene | 1 / 10 | 0.85 - 0.85 | | 6E-02 | 14.17 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Fluoranthene | 6 / 10 | 0.59 - 12 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Fluorene | 1 / 10 | 14 - 14 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Indeno(1,2,3-cd)Pyrene | 4 / 10 | 0.57 - 1.9 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | |
| Naphthalene | 1 / 10 | 44 - 44 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| 2-Methylnaphthalene | 1 / 10 | 29 - 29 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Phenanthrene | 6 / 10 | 0.51 - 25 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Pyrene | 6 / 10 | 0.64 - 11 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | |
| Aroclor-1248 | 1 / 9 | 0.3 - 0.3 | | -- | 0.00 | 0.00 | NO | 2.0E+00 | -- | 0.60 | 0.00 | NO | | | | |
| Aroclor-1254 | 1 / 9 | 0.33 - 0.33 | | -- | 0.00 | 0.00 | NO | 2.0E+00 | -- | 0.66 | 0.00 | NO | | | | |
| Aluminum | 9 / 9 | 1220 - 9100 | 3686.667 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *57000 | 114000 | | No; <2X |
| **Antimony** | **1 / 9** | **1.8 - 1.8** | **1.8** | **--** | **0.00** | **0.00** | **NO** | **--** | **--** | **0.00** | **0.00** | **NO** | **0.07** | **0.14** | | **Yes; >2X** |
| **Arsenic** | **9 / 9** | **2.7 - 272** | **46.43333** | **--** | **0.00** | **0.00** | **NO** | **1.50E+01** | **A** | **4080.00** | **1.00** | **YES** | **8.26** | **16.52** | | **Yes; >2X** |
| Barium | 9 / 9 | 5.2 - 208 | 47.74444 | 1.00E-04 | 2080000.00 | 0.16 | YES | -- | -- | 0.00 | 0.00 | NO | *229 | 458 | | No; <2X |
| Beryllium | 8 / 9 | 0.09 - 1.2 | 0.4375 | 6.00E-03 | 200.00 | 0.00 | NO | 8.40E+00 | B1 | 10.08 | 0.00 | NO | 1.07 | 2.14 | | No; <2X |
| Cadmium | 3 / 9 | 0.08 - 0.19 | 0.143333 | -- | 0.00 | 0.00 | NO | 6.30E+00 | B1 | 1.20 | 0.00 | NO | 0.65 | 1.3 | | No; <2X |
| Calcium | 9 / 9 | 148 - 19700 | 4311.889 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *6300 | 12600 | >1E+6 | No; nsc |
| Chromium | 9 / 9 | 4.1 - 17.4 | 10.5 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 12.1 | 24.2 | | No; <2X |
| Cobalt | 9 / 9 | 0.52 - 4.2 | 2.72 | 5.71E-06 | 735551.66 | 0.06 | YES | -- | ND | 0.00 | 0.00 | NO | *5.3 | 10.6 | | No; <2X |
| Copper | 9 / 9 | 1.9 - 62.3 | 22.72222 | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 42.2 | 84.4 | | No; <2X |
| Iron | 9 / 9 | 4020 - 18300 | 8905.556 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *33 | 66 | 50,000 / 200,000 | No; nsc |
| Lead | 9 / 9 | 1.7 - 617 | 169.9556 | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | 177.7 | 355.4 | | No; <2X, <EPA criteria[2] |
| Magnesium | 9 / 9 | 89 - 9040 | 2012.222 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *4600 | 9200 | 400,000 / >1E+6 | No; nsc |
| Manganese | 9 / 9 | 3 - 147 | 74.12222 | 1.43E-05 | 10279720.28 | 0.78 | YES | -- | D | 0.00 | 0.00 | NO | 335 | 670 | | No; <2X |
| Mercury | 7 / 9 | 0.03 - 0.91 | 0.377143 | 9.00E-05 | 10111.11 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 0.5 | 1 | | No; <2X |
| Nickel | 9 / 9 | 0.71 - 23 | 6.69 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 16.6 | 33.2 | | No; <2X |
| Potassium | 9 / 9 | 297 - 832 | 537 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | *12000 | 24000 | >1E+6 | No; nsc |
| **Selenium** | **1 / 9** | **0.77 - 0.77** | **0.77** | **--** | **0.00** | **0.00** | **NO** | **--** | **D** | **0.00** | **0.00** | **NO** | **0.06** | **0.12** | | **Yes; >2X** |
| Sodium | 9 / 9 | 4.6 - 145 | 68.77778 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 7800 | 15600 | >1E+6 | No; nsc |
| Vanadium | 9 / 9 | 7.3 - 34.5 | 16.71111 | -- | 0.00 | 0.00 | NO | -- | ND | 0.00 | 0.00 | NO | 22.6 | 45.2 | | No; <2X |
| Zinc | 7 / 9 | 5.3 - 89 | 41.7 | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 162.3 | 324.6 | | No; <2X |
| | | | | | | | | | | | | | | | | |
| | | | Total Relative Risk: | | 13105597 | | | Total Relative Risk: | | 4092.57 | | | | | | |

1 = New Jersey Department of Environmental Protection and Energy Site Remediation Program and Division of Science and Research. 1993. A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersey.
2 = USEPA, 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. Technical Review Workgroup for Lead.
* = Dragun and Chiasson 1991.
2X = Two times average background.
nsc = Nutrient screening concentration.
f/d = Frequency of detection.

## CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
## SUBSURFACE SOIL GENERAL GAS MANTLE

| CHEMICAL | Frequency of Detection | Detected Concentrations Range mg/kg | Detected Concentrations Average mg/kg | Oral Reference Dose mg/kg-day | Risk Factor | Relative Risk | Screen | Oral Slope Factor (mg/kg-day)$^{-1}$ | Weight of Evidence Classification | Risk Factor | Relative Risk | Screen | Background Screen: Site-Specific Average Concentration[1] mg/kg | Background Screen: 2X Average mg/kg | Background Screen: Published Average Concentrations[2] mg/kg | Nutrient Screen Child/Adult mg/kg | Other Reason for Selection or Elimination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-Butanone | 1 / 7 | 0.017 - 0.017 | | 6E-01 | 0.03 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Ethylbenzene | 1 / 7 | 0.13 - 0.13 | | 1.00E-01 | 1.30 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Xylenes (total) | 1 / 7 | 0.47 - 0.47 | | 2E+00 | 0.24 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Anthracene | 1 / 7 | 0.045 - 0.045 | | 3E-01 | 0.15 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| **Benzo(a)Anthracene** | **1 / 7** | **0.17 - 0.17** | | **--** | **0.00** | **0.00** | **NO** | **7.3E-01** | **B2** | **0.12** | **0.01** | **YES** | | | | | |
| Benzo(b)Fluoranthene | 1 / 7 | 0.11 - 0.11 | | -- | 0.00 | 0.00 | NO | 7.3E-01 | B2 | 0.08 | 0.00 | NO | | | | | |
| Benzo(k)Fluoranthene | 1 / 7 | 0.22 - 0.22 | | -- | 0.00 | 0.00 | NO | 7.3E-02 | B2 | 0.02 | 0.00 | NO | | | | | |
| **Benzo(a)Pyrene** | **1 / 7** | **0.17 - 0.17** | | **--** | **0.00** | **0.00** | **NO** | **7.3E+00** | **B2** | **1.24** | **0.07** | **YES** | | | | | |
| Benzo(g,h,i)Perylene | 1 / 7 | 0.082 - 0.082 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Chrysene | 1 / 7 | 0.18 - 0.18 | | -- | 0.00 | 0.00 | NO | 7.3E-03 | B2 | 0.00 | 0.00 | NO | | | | | |
| Di-n-butylphthalate | 1 / 7 | 0.043 - 0.043 | | 1E-01 | 0.43 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Fluoranthene | 1 / 7 | 0.34 - 0.34 | | 4E-02 | 8.50 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Indeno(1,2,3-cd)Pyrene | 1 / 7 | 0.1 - 0.1 | | -- | 0.00 | 0.00 | NO | 7.3E-01 | B2 | 0.07 | 0.00 | NO | | | | | |
| 2-Methylnaphthalene | 1 / 7 | 0.53 - 0.53 | | 4E-02 | 13.25 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| N-Nitrosodiphenylamine | 1 / 7 | 0.62 - 0.62 | | 2E-02 | 31.00 | 0.00 | NO | 4.9E-03 | B2 | 0.00 | 0.00 | NO | | | | | |
| Phenanthrene | 2 / 7 | 0.19 - 0.65 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Pyrene | 1 / 7 | 0.32 - 0.32 | | 3E-02 | 10.67 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| **Aroclor-1248** | **1 / 7** | **0.028 - 0.028** | | **2E-05** | **1400.00** | **0.01** | **YES** | 2.0E+00 | -- | 0.06 | 0.00 | NO | | | | | |
| Aluminum | 7 / 7 | 3800 - 7140 | 5168.571 | 1.00E+00 | 7140.00 | 0.07 | YES | -- | -- | 0.00 | 0.00 | NO | 6930 | 13860 | *57000 | | No, <2X |
| **Arsenic** | **7 / 7** | **1.1 - 11.3** | **4.071429** | **3.00E-04** | **37666.67** | **0.38** | **YES** | **1.50E+00** | **A** | **16.95** | **0.91** | **YES** | 3 | 6 | 8.26 | | Yes, <2X but A carcinogen |
| Barium | 7 / 7 | 12.1 - 38.7 | 21.65714 | 7.00E-02 | 552.86 | 0.01 | YES | -- | -- | 0.00 | 0.00 | NO | 19.3 | 38.6 | *229 | | No; <2X |
| Beryllium | 7 / 7 | 0.3 - 0.7 | 0.408571 | 2.00E-03 | 350.00 | 0.00 | NO | -- | B1 | 0.00 | 0.00 | NO | 0.44 | 0.88 | 1.07 | | No; <2X |
| Calcium | 7 / 7 | 168 - 520 | 344.1429 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 408 | 816 | *6300 | >1E+6 | No; nsc, <2X |
| Chromium | 7 / 7 | 5.2 - 14.5 | 8.7 | 1.00E+00 | 14.50 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 10 | 20 | 12.1 | | No; <2X |
| Cobalt | 7 / 7 | 2.7 - 5.2 | 3.614286 | 6.00E-02 | 86.67 | 0.00 | NO | -- | ND | 0.00 | 0.00 | NO | 4.2 | 8.4 | *5.3 | | No; <2X |
| Copper | 7 / 7 | 3.1 - 8.6 | 4.785714 | 3.70E-02 | 232.43 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 5.6 | 11.2 | 42.2 | | No, <2X |
| Iron | 7 / 7 | 6370 - 13100 | 8761.429 | 3.00E-01 | 43666.67 | 0.44 | YES | -- | -- | 0.00 | 0.00 | NO | 10200 | 20400 | *25000 | 50,000 / 200,000 | No, nsc, <2X |
| Lead | 7 / 7 | 3.6 - 71.2 | 14.81429 | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | 7 | 14 | 177.7 | | No, <EPA criteria[3] |
| Magnesium | 7 / 7 | 953 - 1510 | 1246.143 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 1660 | 3320 | *4600 | 400,000 / >1E+6 | No; nsc; <2X |
| Manganese | 7 / 7 | 49.5 - 90.4 | 66.54286 | 2.30E-02 | 3930.43 | 0.04 | YES | -- | D | 0.00 | 0.00 | NO | 82.5 | 165 | 335 | | No; <2X |
| Nickel | 7 / 7 | 7.4 - 10.9 | 8.971429 | 2.00E-02 | 545.00 | 0.01 | YES | -- | -- | 0.00 | 0.00 | NO | 10.8 | 21.6 | 16.6 | | No; <2X |
| Potassium | 7 / 7 | 398 - 786 | 573.5714 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 786 | 1572 | *12000 | >1E+6 | No; nsc; <2X |
| **Selenium** | **1 / 7** | **0.68 - 0.68** | **0.68** | **5.00E-03** | **136.00** | **0.00** | **NO** | **--** | **D** | **0.00** | **0.00** | **NO** | | | **0.06** | | **Yes; >2X** |
| Sodium | 2 / 7 | 22.1 - 123 | 72.55 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | | | *7800 | >1E+6 | No, nsc, <2X |
| **Thallium** | **1 / 7** | **1.9 - 1.9** | **1.9** | **--** | **0.00** | **0.00** | **NO** | **--** | **ND** | **0.00** | **0.00** | **NO** | | | **0.1** | | **Yes; >2X** |
| Vanadium | 7 / 7 | 6.7 - 22.5 | 11.91429 | 7.00E-03 | 3214.29 | 0.03 | YES | -- | -- | 0.00 | 0.00 | NO | 13.8 | 27.6 | 22.6 | | No; <2X |
| Zinc | 7 / 7 | 24.7 - 34.5 | 29.41429 | 3.00E-01 | 115.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 42.4 | 84.8 | 162.3 | | No, <2X |
| | | | | | | | | | | | | | | | | | |
| | | | Total Relative Risk: | | 99116 | | | | Total Relative Risk: | 18.54 | | | | | | | |

1 = From WG-SB-40-04

2 = New Jersey Department of Environmental Protection and Energy Site Remediation Program and Division of Science and Research 1993. A Summary of Selected Soil Constituents and Contaminants at Background Locations in New Jersy.

3 = USEPA, 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil. Technical Review Workgroup for Lead.

* = Dragun and Chiasson 1991.

no toxcrit = Oral toxicity information is not available.

2X = Two times average background.

nsc = Nutrient screening concentration

f/d = Frequency of detection.

## CONCENTRATION/TOXICITY SCREEN AND SELECTION OF COPC
## SUBSURFACE SOIL GENERAL GAS MANTLE

| CHEMICAL | Frequency of Detection | Detected Concentrations Range mg/kg | Detected Concentrations Average mg/kg | Inhalation Reference Dose mg/kg-day | Risk Factor | Relative Risk | Screen | Inhalation Slope Factor (mg/kg-day)^-1 | Weight of Evidence Classification | Risk Factor | Relative Risk | Screen | Background Screen: Site-Specific Average Concentration[1] mg/kg | Background Screen: 2X Average mg/kg | Background Screen: Published Average Concentrations[2] mg/kg | Nutrient Screen Child/Adult mg/kg | Other Reason for Selection or Elimination |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-Butanone | 1 / 7 | 0.017 - 0.017 | | 3E-01 | 0.06 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Ethylbenzene | 1 / 7 | 0.13 - 0.13 | | 2.86E-01 | 0.45 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Xylenes (total) | 1 / 7 | 0.47 - 0.47 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Anthracene | 1 / 7 | 0.045 - 0.045 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Benzo(a)Anthracene | 1 / 7 | 0.17 - 0.17 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | | |
| Benzo(b)Fluoranthene | 1 / 7 | 0.11 - 0.11 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | | |
| Benzo(k)Fluoranthene | 1 / 7 | 0.22 - 0.22 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | | |
| Benzo(a)Pyrene | 1 / 7 | 0.17 - 0.17 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | | |
| Benzo(g,h,i)Perylene | 1 / 7 | 0.082 - 0.082 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Chrysene | 1 / 7 | 0.18 - 0.18 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | | |
| Di-n-Butyl Phthalate | 1 / 7 | 0.043 - 0.043 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Fluoranthene | 1 / 7 | 0.34 - 0.34 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Indeno(1,2,3-cd)Pyrene | 1 / 7 | 0.1 - 0.1 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | | |
| 2-Methylnaphthalene | 1 / 7 | 0.53 - 0.53 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| N-Nitrosodiphenylamine | 1 / 7 | 0.62 - 0.62 | | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | | | | | |
| Phenanthrene | 2 / 7 | 0.19 - 0.65 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Pyrene | 1 / 7 | 0.32 - 0.32 | | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | | | | | |
| Aroclor-1248 | 1 / 7 | 0.028 - 0.028 | | -- | 0.00 | 0.00 | NO | 2.0E+00 | -- | 0.06 | 0.00 | NO | | | | | |
| Aluminum | 7 / 7 | 3800 - 7140 | 5168.571 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 6930 | 13860 | *57000 | | No; <2X |
| **Arsenic** | **7 / 7** | **1.1 - 11.3** | **4.071429** | **--** | **0.00** | **0.00** | **NO** | **1.50E+01** | **A** | **169.50** | **0.97** | **YES** | 3 | 6 | 8.26 | | Yes; <2X but A carcinogen |
| Barium | 7 / 7 | 12.1 - 38.7 | 21.65714 | 1.00E-04 | 387000.00 | 0.05 | YES | -- | -- | 0.00 | 0.00 | NO | 19.3 | 38.6 | *229 | | No; <2X |
| Beryllium | 7 / 7 | 0.3 - 0.7 | 0.408571 | 6.00E-03 | 116.67 | 0.00 | NO | 8.40E+00 | B1 | 5.88 | 0.03 | YES | 0.44 | 0.88 | 1.07 | | No; <2X |
| Calcium | 7 / 7 | 168 - 520 | 344.1429 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 408 | 816 | | >1E+6 | No; nsc; <2X |
| Chromium | 7 / 7 | 5.2 - 14.5 | 8.7 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 10 | 20 | 12.1 | | No; <2X |
| Cobalt | 7 / 7 | 2.7 - 5.2 | 3.614286 | 5.71E-06 | 910683.01 | 0.12 | YES | -- | ND | 0.00 | 0.00 | NO | 4.2 | 8.4 | *5.3 | | No; <2X |
| Copper | 7 / 7 | 3.1 - 8.6 | 4.785714 | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 5.6 | 11.2 | 42.2 | | No, <2X |
| Iron | 7 / 7 | 6370 - 13100 | 8761.429 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 10200 | 20400 | *25000 | 50,000 / 200,000 | No, nsc, <2X |
| Lead | 7 / 7 | 3.6 - 71.2 | 14.81429 | -- | 0.00 | 0.00 | NO | -- | B2 | 0.00 | 0.00 | NO | 7 | 14 | 177.7 | | No; <EPA criteria[3] |
| Magnesium | 7 / 7 | 953 - 1510 | 1246.143 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 1660 | 3320 | *4600 | 400,000 / >1E+6 | No, nsc; <2X |
| Manganese | 7 / 7 | 49.5 - 90.4 | 66.54286 | 1.43E-05 | 6321678 | 0.83 | YES | -- | D | 0.00 | 0.00 | NO | 82.5 | 165 | 335 | | No; <2X |
| Nickel | 7 / 7 | 7.4 - 10.9 | 8.971429 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 10.8 | 21.6 | 16.6 | | No; <2X |
| Potassium | 7 / 7 | 398 - 786 | 573.5714 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 786 | 1572 | *12000 | >1E+6 | No, nsc, <2X |
| **Selenium** | **1 / 7** | **0.68 - 0.68** | **0.68** | **--** | **0.00** | **0.00** | **NO** | **--** | **D** | **0.00** | **0.00** | **NO** | | | 0.06 | | **Yes; >2X** |
| Sodium | 2 / 7 | 22.1 - 123 | 72.55 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | | | *7800 | >1E+6 | No; nsc; <2X |
| **Thallium** | **1 / 7** | **1.9 - 1.9** | **1.9** | **--** | **0.00** | **0.00** | **NO** | **--** | **ND** | **0.00** | **0.00** | **NO** | | | 0.1 | | **Yes; >2X** |
| Vanadium | 7 / 7 | 6.7 - 22.5 | 11.91429 | -- | 0.00 | 0.00 | NO | -- | -- | 0.00 | 0.00 | NO | 13.8 | 27.6 | 22.6 | | No, <2X |
| Zinc | 7 / 7 | 24.7 - 34.5 | 29.41429 | -- | 0.00 | 0.00 | NO | -- | D | 0.00 | 0.00 | NO | 42.4 | 84.8 | 162.3 | | No; <2X |
| | | | | | | | | | | | | | | | | | |
| | | | Total Relative Risk: | | 7619479 | | | | Total Relative Risk: | 175.44 | | | | | | | |

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* = Dragun and Chiasson 1991.

no toxcrit = Oral toxicity information is not available.

2X = Two times average background.

nsc = Nutrient screening concentration.

f/d = Frequency of detection.

## ESSENTIAL NUTRIENT SCREEN

Nutrient screening concentrations to evaluate the concentrations of essential nutrients (i.e., calcium, iron, magnesium, potassium, and sodium) in soil were derived from Recommended Daily Allowances (RDAs) and exposure parameters in the models used by the USEPA, Region III in their derivation of risk-based concentrations (USEPA, 1998). Based on the exposure scenarios considered in the human health risk evaluation, reference concentrations for soil were derived for ingestion by a child in a residential setting and an adult in an industrial setting. (ESHA Research, 1990).

Nutrient Screening Concentrations for Soil- Child

$$RC_s = RDA_a / IR_s * CF$$

where

$RC_s$ = nutrient screening concentration for soil (mg/Kg)
$RDA_a$ = recommended daily allowance for an adult (mg/day)
$IR_s$ = soil ingestion rate (200 mg/day)
CF = conversion factor ($10^{-6}$ Kg/mg)

| Essential Nutrient | Recommended Daily Allowance (mg/day; male child) | Nutrient Screening Concentration for Soil (mg/Kg) |
|---|---|---|
| Calcium | 800 | > 1E+06 |
| Iron | 10 | 50,000 |
| Magnesium | 80 | 400,000 |
| Potassium | 1000 | > 1E+06 |
| Sodium | 975 | > 1E+06 |

Nutrient Screening Concentrations for Soil-Adult

$$RC_s = RDA_a / IR_s * FI * CF$$

where

$RC_s$ = nutrient screening concentration for soil (mg/Kg)
$RDA_a$ = recommended daily allowance for an adult (mg/day)
$IR_s$ = soil ingestion rate (100 mg/day)
RI = fraction ingested (0.5)
CF = conversion factor ($10^{-6}$ Kg/mg)

| Essential Nutrient | Recommended Daily Allowance (mg/day; male adult) | Nutrient Screening Concentration for Soil (mg/Kg) |
|---|---|---|
| Calcium | 800 | > 1E+06 |
| Iron | 10 | 200,000 |
| Magnesium | 350 | > 1E+06 |
| Potassium | 2000 | > 1E+06 |
| Sodium | 2400 | > 1E+06 |

<u>References</u>

U.S. Environmental Protection Agency. 1998. Risk-Based Concentration Table, April 1998. Philadelphia, PA: USEPA Region III, Technical Support Section.

ESHA Research. 1990. The Food Processor II. Nutrient Analysis System.

TABLE C-1-1

SELECTION OF EXPOSURE PATHWAYS

WELSBACH: RADIOLOGICAL EXPOSURE

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | On-Site/ Off-Site | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|---|
| Current | Soil | Soil | Holt Cargo | Worker | Adult | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in soil is possible |
| | | | | | | Ingestion | On-Site | None | Site is completely paved |
| | | | | Other Worker | Adults | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in soil is possible |
| | | | | | | Ingestion | On-Site | None | Site is completely paved |
| | | Particulates | Holt Cargo | Worker | Adult | Inhalation | On-Site | None | Site is completely paved |
| | | | | Other Worker | Adults | Inhalation | On-Site | None | Site is completely paved |
| Future | Soil | Soil | Holt Cargo | Worker | Adult | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in soil is possible |
| | | | | | | Ingestion | On-Site | None | Site will remain completely paved |
| | | | | Other Worker | Adults | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in soil is possible |
| | | | | | | Ingestion | On-Site | None | Site is completely paved |
| | | | | Construction Worker | Adult | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in soil is possible |
| | | | | | | Ingestion | On-Site | Quant | Contaminated soil may be encountered by construction workers during excavation activities |
| | | | | Resident | Adult | External Radiation | On-Site | None | Future use of land will remain industrial |
| | | | | | | Ingestion | On-Site | None | Future use of land will remain industrial |
| | | | | | Child | External Radiation | On-Site | None | Future use of land will remain industrial |
| | | | | | | Ingestion | On-Site | None | Future use of land will remain industrial |
| | | Particulates | Holt Cargo | Worker | Adult | Inhalation | On-Site | None | Future use of land will remain industrial |
| | | | | Other Worker | Adults | Inhalation | On-Site | None | Site is completely paved |
| | | | | Construction Worker | Adult | Inhalation | On-Site | Quant | Contaminated soil may be encountered by construction workers during excavation activities |
| | | | | Resident | Adult | Inhalation | Off-Site | None | Future use of land will remain industrial |
| | | | | | Child | Inhalation | Off-Site | None | Future use of land will remain industrial |

TABLE C-1-2 1
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
WELSBACH-WORKER

Scenario Timeframe: Current / Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo

| Radionuclide (1) | Minimum Concentration (2) | Maximum Concentration (2) | Units | Location of Maximum Concentration | Concentration Used for Screening | Maximum Background Value (3) | ROPC Flag (4) | Rationale for Radionuclide Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|
| Uranium 234 | 0.119 | 852 | pCi/g | WG-SB-05-01 | 852 | 1.32 | YES | TX, ASL |
| Uranium 238 + D | 0.096 | 852 | pCi/g | WG-SB-05-01 | 852 | 1.45 | YES | TX, ASL |
| Radium 226 + D | 0.262 | 455 | pCi/g | WG-SB-32-01 | 455 | 1.91 | YES | TX, ASL |
| Radium 228 + D | 0.332 | 1280 | pCi/g | WG-SB-05-01 | 1280 | 2.25 | YES | TX, ASL |
| Thorium 228 + D | 0.32 | 1260 | pCi/g | WG-SB-05-01 | 1260 | 2.68 | YES | TX, ASL |
| Thorium 230 | 0.44 | 852 | pCi/g | WG-SB-05-01 | 852 | 1.52 | YES | TX, ASL |
| Thorium 232 | 0.321 | 1340 | pCi/g | WG-SB-05-01 | 1340 | 2.44 | YES | TX, ASL |
| Lead 210 + D | 0.262 | 455 | pCi/g | WG-SB-32-01 | 455 | 1.91 | YES | TX, ASL |

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead-210 and Radium-226

(2) Minimum/maximum detected concentration.

(3) Maximum concentrations from background samples. See text.

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

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TABLE C-1-2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
WELSBACH - CONSTRUCTION WORKER

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo

| Radionuclide (1) | Minimum Concentration (2) | Maximum Concentration (2) | Units | Location of Maximum Concentration | Concentration Used for Screening | Maximum Background Value (3) | ROPC Flag (4) | Rationale for Radionuclide Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|
| Uranium 234 | 0.76 | 852 | pCi/g | WG-SB-05-01 | 852 | 1.32 | YES | TX, ASL |
| Uranium 238 + D | 0.82 | 852 | pCi/g | WG-SB-05-01 | 852 | 1.45 | YES | TX, ASL |
| Radium 226 + D | 0.826 | 455 | pCi/g | WG-SB-32-01 | 455 | 1.91 | YES | TX, ASL |
| Radium 228 + D | 2.21 | 1280 | pCi/g | WG-SB-05-01 | 1280 | 2.25 | YES | TX, ASL |
| Thorium 228 + D | 1.55 | 1260 | pCi/g | WG-SB-05-01 | 1260 | 2.68 | YES | TX, ASL |
| Thorium 230 | 1.8 | 852 | pCi/g | WG-SB-05-03 | 852 | 1.52 | YES | TX, ASL |
| Thorium 232 | 1.5 | 1340 | pCi/g | WG-SB-05-01 | 1340 | 2.44 | YES | TX, ASL |
| Lead 210 + D | 0.826 | 455 | pCi/g | WG-SB-32-01 | 455 | 1.91 | YES | TX, ASL |

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead-210 and Radium-226

(2) Minimum/maximum detected concentration.

(3) Maximum concentrations from background samples. See text.

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

TABLE C-1-2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
WELSBACH - CONSTRUCTION WORKER

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: Holt Cargo

| Radionuclide (1) | Minimum Concentration (2) | Maximum Concentration (2) | Units | Location of Maximum Concentration | Concentration Used for Screening | Maximum Background Value (3) | ROPC Flag (4) | Rationale for Radionuclide Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|
| Uranium 234 | 0.76 | 852 | pCi/g | WG-SB-05-01 | 852 | 1.32 | YES | TX, ASL |
| Uranium 238 + D | 0.82 | 852 | pCi/g | WG-SB-05-01 | 852 | 1.45 | YES | TX, ASL |
| Radium 226 + D | 0.826 | 455 | pCi/g | WG-SB-32-01 | 455 | 1.91 | YES | TX, ASL |
| Radium 228 + D | 2.21 | 1280 | pCi/g | WG-SB-05-01 | 1280 | 2.25 | YES | TX, ASL |
| Thorium 228 + D | 1.55 | 1260 | pCi/g | WG-SB-05-01 | 1260 | 2.68 | YES | TX, ASL |
| Thorium 230 | 1.8 | 852 | pCi/g | WG-SB-05-03 | 852 | 1.52 | YES | TX, ASL |
| Thorium 232 | 1.5 | 1340 | pCi/g | WG-SB-05-01 | 1340 | 2.44 | YES | TX, ASL |
| Lead 210 + D | 0.826 | 455 | pCi/g | WG-SB-32-01 | 455 | 1.91 | YES | TX, ASL |

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead-210 and Radium-226

(2) Minimum/maximum detected concentration.

(3) Maximum concentrations from background samples. See text.

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC)

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

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TABLE C-1-3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
WELSBACH-WORKER

Scenario Timeframe: Current / Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo

| Radionuclide of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Uranium 234 | pCi/g | 6.76E+01 | 2.09E+02 | 852 | pCi/g | 2.09E+02 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Uranium 238 + D | pCi/g | 5.69E+01 | 1.43E+02 | 852 | pCi/g | 1.43E+02 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Radium 226 + D | pCi/g | 2.70E+01 | 6.98E+01 | 455 | pCi/g | 6.98E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Radium 228 + D | pCi/g | 1.33E+02 | 2.38E+03 | 1280 | pCi/g | 1.28E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 228 + D | pCi/g | 1.31E+02 | 3.36E+03 | 1260 | pCi/g | 1.26E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 230 | pCi/g | 7.93E+01 | 2.19E+03 | 852 | pCi/g | 8.52E+02 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 232 | pCi/g | 1.47E+02 | 3.85E+03 | 1340 | pCi/g | 1.34E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Lead 210 + D [1] | pCi/g | 2.70E+01 | 6.98E+01 | 455 | pCi/g | 6.98E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |

For non-detects, sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: *Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive* 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Lead-210 assumed in equilibrium with Radium-226.
(2) Shapiro-Wilk W Test indicates data do not follow a normal distribution.
(3) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

300724

TABLE C-1-3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
WELSBACH - CONSTRUCTION WORKER

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo

| Radionuclide of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Uranium 234 | pCi/g | 1.47E+02 | 1.95E+03 | 852 | pCi/g | 8.52E+02 | Max | W-Test (2,3) | -- | -- | -- |
| Uranium 238 + D | pCi/g | 1.24E+02 | 8.55E+02 | 852 | pCi/g | 8.52E+02 | Max | W-Test (2,3) | -- | -- | -- |
| Radium 226 + D | pCi/g | 4.80E+01 | 2.35E+02 | 455 | pCi/g | 2.35E+02 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Radium 228 + D | pCi/g | 2.81E+02 | 2.92E+03 | 1280 | pCi/g | 1.28E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 228 + D | pCi/g | 2.67E+02 | 1.90E+03 | 1260 | pCi/g | 1.26E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 230 | pCi/g | 1.66E+02 | 1.21E+03 | 852 | pCi/g | 8.52E+02 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 232 | pCi/g | 3.11E+02 | 2.78E+03 | 1340 | pCi/g | 1.34E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Lead 210 + D [1] | pCi/g | 4.80E+01 | 2.35E+02 | 455 | pCi/g | 2.35E+02 | 95% UCL-T | W-Test (2) | -- | -- | -- |

For non-detects, sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Lead-210 assumed in equilibrium with Radium-226.
(2) Shapiro-Wilk W Test indicates data do not follow a normal distribution.
(3) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

300725

TABLE C-1-3.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
WELSBACH - CONSTRUCTION WORKER

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: Holt Cargo

| Radionuclide of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Uranium 234 | pCi/g | 1.47E+02 | 1.95E+03 | 852 | pCi/g | 8.52E+02 | Max | W-Test (2,3) | -- | -- | -- |
| Uranium 238 + D | pCi/g | 1.24E+02 | 8.55E+02 | 852 | pCi/g | 8.52E+02 | Max | W-Test (2,3) | -- | -- | -- |
| Radium 226 + D | pCi/g | 4.80E+01 | 2.35E+02 | 455 | pCi/g | 2.35E+02 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Radium 228 + D | pCi/g | 2.81E+02 | 2.92E+03 | 1280 | pCi/g | 1.28E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 228 + D | pCi/g | 2.67E+02 | 1.90E+03 | 1260 | pCi/g | 1.26E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 230 | pCi/g | 1.66E+02 | 1.21E+03 | 852 | pCi/g | 8.52E+02 | Max | W-Test (2,3) | -- | -- | -- |
| Thorium 232 | pCi/g | 3.11E+02 | 2.78E+03 | 1340 | pCi/g | 1.34E+03 | Max | W-Test (2,3) | -- | -- | -- |
| Lead 210 + D [1] | pCi/g | 4.80E+01 | 2.35E+02 | 455 | pCi/g | 2.35E+02 | 95% UCL-T | W-Test (2) | -- | -- | -- |

For non-detects, sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Lead-210 assumed in equilibrium with Radium-226.
(2) Shapiro-Wilk W Test indicates data do not follow a normal distribution.
(3) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

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TABLE C-1-4.1

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

WELSBACH

Scenario Timeframe: Current / Future
Medium: Soil
*Exposure Medium: Soil*
Exposure Point: Holt Cargo
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Exposure (pCi-year/g) = |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | RS x ET x EF x GSFo x ED x CF1 |
| | EF | Exposure Frequency | days/year | 250 | EPA, 1991 | -- | -- | |
| | GSFo | Gamma Shielding Factor Outdoors | -- | 0.8 [2] | EPA, 1997 | -- | -- | |
| | ED | Exposure Duration | years | 25 | EPA, 1991 | -- | -- | |
| | CF1 | Conversion Factor 1 | year/hours | 1.14E-04 | -- | -- | -- | |

[1] Professional Judgement.

[2] Due to pavement.

*Sources:*

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

USEPA, 1997: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

300737

TABLE C-1-4.2

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

WELSBACH

Scenario Timeframe: Current /Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo
Receptor Population: Other Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Exposure (pCi-year/g) = |
| | ET | Exposure Time | hours/day | 4 | [1] | -- | -- | RS x ET x EF x GSFo x ED x CF1 |
| | EF | Exposure Frequency | days/year | 125 | [1] | -- | -- | |
| | GSFo | Gamma Shielding Factor Outdoors | -- | 0.8 [2] | EPA, 1997 | -- | -- | |
| | ED | Exposure Duration | years | 25 | EPA, 1991 | -- | -- | |
| | CF1 | Conversion Factor 1 | year/hours | 1.14E-04 | -- | -- | -- | |

[1] Professional Judgement.

[2] Due to pavement.

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

USEPA, 1997: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

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TABLE C-1-4.3

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Exposure (pCi-year/g) = |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | RS x ET x EF x GSFo x ED x CF1 |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | GSFo | Gamma Shielding Factor Outdoors | -- | 1 [2] | EPA, 1997 | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |
| | CF1 | Conversion Factor 1 | year/hours | 1.14E-04 | -- | -- | -- | |
| Ingestion | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | CF2 | Conversion Factor 2 | g/mg | 1.00E-03 | -- | -- | -- | RS x CF2 x IR-S x FI x EF x ED |
| | IR-S | Ingestion Rate of Soil | mg/day | 480 | EPA, 1991 | -- | -- | |
| | FI | Fraction Ingested | -- | 1 | -- | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |

[1] Professional Judgement.

[2] 1 for exposed soil

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

USEPA, 1997: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

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TABLE C-1-4.4

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

WELSBACH

| |
|---|
| Scenario Timeframe: Future |
| Medium: Soil |
| Exposure Medium: Particulates |
| Exposure Point: Holt Cargo |
| Receptor Population: Construction Worker |
| Receptor Age: Adult |

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| Inhalation | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | PEF | Particulate Emission Factor | $kg/m^3$ | 5.21E-06 | See Appendix C | -- | -- | RS x PEF x CF x IN x ET x EF x ED |
| | CF3 | Conversion Factor 3 | g/kg | 1000 | – | -- | -- | |
| | IN | Inhalation Rate | $m^3$/hour | 2.3 | EPA, 1991 | -- | -- | |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |

[1] Professional Judgement.

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

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TABLE C-1-5.1

CANCER TOXICITY DATA – EXTERNAL

WELSBACH-RADIONUCLIDES OF POTENTIAL CONCERN

| Radionuclide of Potential Concern (1) | External Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (MM/DD/YY) |
|---|---|---|---|---|---|
| Uranium 234 | 2.14E-11 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Uranium 238 + D | 6.57E-08 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Radium 226 + D | 6.74E-06 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Radium 228 + D | 3.28E-06 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Thorium 228 + D | 6.20E-06 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Thorium 230 | 4.40E-11 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Thorium 232 | 1.97E-11 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Lead 210 + D | 1.45E-10 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |

(1) Risk from decay products (+D) included as appropriate.

HEAST= Health Effects Assessment Summary Tables

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

30074

TABLE C-1-5.2

CANCER TOXICITY DATA -- ORAL

WELSBACH-RADIONUCLIDES OF POTENTIAL CONCERN

| Radionuclide of Potential Concern (1) | Oral Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (MM/DD/YY) |
|---|---|---|---|---|---|
| Uranium 234 | 4.44E-11 | Risk/pCi | A | HEAST | 11/01/95 |
| Uranium 238 + D | 6.20E-11 | Risk/pCi | A | HEAST | 11/01/95 |
| Radium 226 + D | 2.96E-10 | Risk/pCi | A | HEAST | 11/01/95 |
| Radium 228 + D | 2.48E-10 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 228 + D | 2.31E-10 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 230 | 3.75E-11 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 232 | 3.28E-11 | Risk/pCi | A | HEAST | 11/01/95 |
| Lead 210 + D | 1.01E-09 | Risk/pCi | A | HEAST | 11/01/95 |

(1) Risk from decay products (+D) included as appropriate.

HEAST= Health Effects Assessment Summary Tables

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

300742

TABLE C-1-5.3

CANCER TOXICITY DATA – INHALATION

WELSBACH-RADIONUCLIDES OF POTENTIAL CONCERN

| Radionuclide of Potential Concern (1) | Inhalation Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (MM/DD/YY) |
|---|---|---|---|---|---|
| Uranium 234 | 1.40E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Uranium 238 + D | 1.24E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Radium 226 + D | 2.75E-09 | Risk/pCi | A | HEAST | 11/01/95 |
| Radium 228 + D | 9.94E-10 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 228 + D | 9.68E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 230 | 1.72E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 232 | 1.93E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Lead 210 + D | 3.86E-09 | Risk/pCi | A | HEAST | 11/01/95 |

(1) Risk from decay products (+D) included as appropriate.

HEAST= Health Effects Assessment Summary Tables

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

300743

TABLE C-1-6.1
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

Scenario Timeframe: Current / Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 2.09E+02 | pCi/g | 2.09E+02 | pCi/g | M | 9.51E+02 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 2.0E-08 |
| | Uranium 238 + D | 1.43E+02 | pCi/g | 1.43E+02 | pCi/g | M | 6.52E+02 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 4.3E-05 |
| | Radium 226 + D | 6.98E+01 | pCi/g | 6.98E+01 | pCi/g | M | 3.18E+02 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 2.1E-03 |
| | Radium 228 + D | 1.28E+03 | pCi/g | 1.28E+03 | pCi/g | M | 5.84E+03 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 1.9E-02 |
| | Thorium 228 + D | 1.26E+03 | pCi/g | 1.26E+03 | pCi/g | M | 5.75E+03 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 3.6E-02 |
| | Thorium 230 | 8.52E+02 | pCi/g | 8.52E+02 | pCi/g | M | 3.89E+03 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 1.7E-07 |
| | Thorium 232 | 1.34E+03 | pCi/g | 1.34E+03 | pCi/g | M | 6.11E+03 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 1.2E-07 |
| | Lead 210 + D | 6.98E+01 | pCi/g | 6.98E+01 | pCi/g | M | 3.18E+02 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 4.6E-08 |
| | | | | | | | | | | Total Risk-All ROPC | 5.7E-02 |

(1) M = Medium-Specific

300744

TABLE C-1-6.2
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

Scenario Timeframe: Current / Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 2.98E+00 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 6.4E-11 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 2.82E+00 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 1.9E-07 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 4.78E+00 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 3.2E-05 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 4.18E+00 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 1.4E-05 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 4.28E+00 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 2.7E-05 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 3.62E+00 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 1.6E-10 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 4.19E+00 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 8.2E-11 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 4.78E+00 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 6.9E-10 |
| | | | | | | | | | | Total Risk-All ROPC | 7.3E-05 |

N/A = Not Applicable
(1) M = Medium-Specific

300745

TABLE C-1-6.3
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

Scenario Timeframe: Current / Future
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Exposure Medium | Exposure Point | Gross Risk | Background Risk | Net Risk |
|---|---|---|---|---|---|
| External | Soil | Holt Cargo | 5.7E-02 | 7.3E-05 | 5.7E-02 |
| | | | | Total Risk | 5.7E-02 |

300746

TABLE C-1-6.4
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Soil |
| Exposure Medium: Soil |
| Exposure Point: Holt Cargo |
| Receptor Population: Other Worker |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 2.09E+02 | pCi/g | 2.09E+02 | pCi/g | M | 2.38E+02 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 5.1E-09 |
| | Uranium 238 + D | 1.43E+02 | pCi/g | 1.43E+02 | pCi/g | M | 1.63E+02 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 1.1E-05 |
| | Radium 226 + D | 6.98E+01 | pCi/g | 6.98E+01 | pCi/g | M | 7.95E+01 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 5.4E-04 |
| | Radium 228 + D | 1.28E+03 | pCi/g | 1.28E+03 | pCi/g | M | 1.46E+03 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 4.8E-03 |
| | Thorium 228 + D | 1.26E+03 | pCi/g | 1.26E+03 | pCi/g | M | 1.44E+03 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 8.9E-03 |
| | Thorium 230 | 8.52E+02 | pCi/g | 8.52E+02 | pCi/g | M | 9.71E+02 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 4.3E-08 |
| | Thorium 232 | 1.34E+03 | pCi/g | 1.34E+03 | pCi/g | M | 1.53E+03 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 3.0E-08 |
| | Lead 210 + D | 6.98E+01 | pCi/g | 6.98E+01 | pCi/g | M | 7.95E+01 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 1.2E-08 |
| | | | | | | | | | | Total Risk-All ROPC | 1.4E-02 |

(1) M = Medium-Specific

3007[illegible]

TABLE C-1-6.5
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Background Soil |
| Exposure Medium: Background Soil |
| Exposure Point: N/A |
| Receptor Population: Other Worker |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 7.46E-01 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 1.6E-11 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 7.04E-01 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 4.6E-08 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 1.19E+00 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 8.1E-06 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 1.04E+00 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 3.4E-06 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 1.07E+00 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 6.6E-06 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 9.06E-01 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 4.0E-11 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 1.05E+00 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 2.1E-11 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 1.19E+00 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 1.7E-10 |
| | | | | | | | | | | Total Risk-All ROPC | 1.8E-05 |

N/A = Not Applicable
(1) M = Medium-Specific

300748

TABLE C-1-6.6
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

| |
|---|
| Scenario Timeframe: Current / Future |
| Receptor Population: Other Worker |
| Receptor Age: Adult |

| Exposure Route | Exposure Medium | Exposure Point | Gross Risk | Background Risk | Net Risk |
|---|---|---|---|---|---|
| External | Soil | Holt Cargo | 1.4E-02 | 1.8E-05 | 1.4E-02 |
| | | | | Total Risk | 1.4E-02 |

300719

TABLE C-1-6.7

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 8.52E+02 | pCi/g | 8.52E+02 | pCi/g | M | 4.66E+01 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 1.0E-09 |
| | Uranium 238 + D | 8.52E+02 | pCi/g | 8.52E+02 | pCi/g | M | 4.66E+01 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 3.1E-06 |
| | Radium 226 + D | 2.35E+02 | pCi/g | 2.35E+02 | pCi/g | M | 1.29E+01 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 8.7E-05 |
| | Radium 228 + D | 1.28E+03 | pCi/g | 1.28E+03 | pCi/g | M | 7.00E+01 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 2.3E-04 |
| | Thorium 228 + D | 1.26E+03 | pCi/g | 1.26E+03 | pCi/g | M | 6.89E+01 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 4.3E-04 |
| | Thorium 230 | 8.52E+02 | pCi/g | 8.52E+02 | pCi/g | M | 4.66E+01 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 2.1E-09 |
| | Thorium 232 | 1.34E+03 | pCi/g | 1.34E+03 | pCi/g | M | 7.33E+01 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 1.4E-09 |
| | Lead 210 + D | 2.35E+02 | pCi/g | 2.35E+02 | pCi/g | M | 1.29E+01 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 1.9E-09 |
| | (Total) | | | | | | | | | | 7.5E-04 |
| Ingestion | Uranium 234 | 8.52E+02 | pCi/g | 8.52E+02 | pCi/g | M | 2.45E+04 | pCi | 4.44E-11 | Risk/pCi | 1.1E-06 |
| | Uranium 238 + D | 8.52E+02 | pCi/g | 8.52E+02 | pCi/g | M | 2.45E+04 | pCi | 6.20E-11 | Risk/pCi | 1.5E-06 |
| | Radium 226 + D | 2.35E+02 | pCi/g | 2.35E+02 | pCi/g | M | 6.78E+03 | pCi | 2.96E-10 | Risk/pCi | 2.0E-06 |
| | Radium 228 + D | 1.28E+03 | pCi/g | 1.28E+03 | pCi/g | M | 3.69E+04 | pCi | 2.48E-10 | Risk/pCi | 9.1E-06 |
| | Thorium 228 + D | 1.26E+03 | pCi/g | 1.26E+03 | pCi/g | M | 3.63E+04 | pCi | 2.31E-10 | Risk/pCi | 8.4E-06 |
| | Thorium 230 | 8.52E+02 | pCi/g | 8.52E+02 | pCi/g | M | 2.45E+04 | pCi | 3.75E-11 | Risk/pCi | 9.2E-07 |
| | Thorium 232 | 1.34E+03 | pCi/g | 1.34E+03 | pCi/g | M | 3.86E+04 | pCi | 3.28E-11 | Risk/pCi | 1.3E-06 |
| | Lead 210 + D | 2.35E+02 | pCi/g | 2.35E+02 | pCi/g | M | 6.78E+03 | pCi | 1.01E-09 | Risk/pCi | 6.8E-06 |
| | (Total) | | | | | | | | | | 3.1E-05 |

TABLE C-1-6.8
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

| |
|---|
| Scenario Timeframe: Future |
| Medium: Soil |
| Exposure Medium: Particulates |
| Exposure Point: Holt Cargo |
| Receptor Population: Construction Worker |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value (1) | Route EPC Units | EPC Selected for Risk Calculation (2) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Uranium 234 | 8.52E+02 | pCi/g | 4.44E+00 | pCi/m$^3$ | R | 4.90E+03 | pCi | 1.40E-08 | Risk/pCi | 6.9E-05 |
| | Uranium 238 + D | 8.52E+02 | pCi/g | 4.44E+00 | pCi/m$^3$ | R | 4.90E+03 | pCi | 1.24E-08 | Risk/pCi | 6.1E-05 |
| | Radium 226 + D | 2.35E+02 | pCi/g | 1.23E+00 | pCi/m$^3$ | R | 1.35E+03 | pCi | 2.75E-09 | Risk/pCi | 3.7E-06 |
| | Radium 228 + D | 1.28E+03 | pCi/g | 6.67E+00 | pCi/m$^3$ | R | 7.36E+03 | pCi | 9.94E-10 | Risk/pCi | 7.3E-06 |
| | Thorium 228 + D | 1.26E+03 | pCi/g | 6.56E+00 | pCi/m$^3$ | R | 7.25E+03 | pCi | 9.68E-08 | Risk/pCi | 7.0E-04 |
| | Thorium 230 | 8.52E+02 | pCi/g | 4.44E+00 | pCi/m$^3$ | R | 4.90E+03 | pCi | 1.72E-08 | Risk/pCi | 8.4E-05 |
| | Thorium 232 | 1.34E+03 | pCi/g | 6.98E+00 | pCi/m$^3$ | R | 7.71E+03 | pCi | 1.93E-08 | Risk/pCi | 1.5E-04 |
| | Lead 210 + D | 2.35E+02 | pCi/g | 1.23E+00 | pCi/m$^3$ | R | 1.35E+03 | pCi | 3.86E-09 | Risk/pCi | 5.2E-06 |
| | (Total) | | | | | | | | | | 1.1E-03 |
| | | | | | | | | | | Total Risk-All ROPC | 1.9E-03 |

(1) See respirable particulates model in Appendix C.
(2) R = Route-Specific

300751

TABLE C-1-6.9

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

WELSBACH

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 3.58E-02 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 7.7E-13 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 3.38E-02 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 2.2E-09 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 5.74E-02 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 3.9E-07 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 5.02E-02 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 1.6E-07 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 5.14E-02 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 3.2E-07 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 4.35E-02 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 1.9E-12 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 5.02E-02 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 9.9E-13 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 5.74E-02 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 8.3E-12 |
| | (Total) | | | | | | | | | | 8.7E-07 |
| Ingestion | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 1.88E+01 | pCi | 4.44E-11 | Risk/pCi | 8.4E-10 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 1.78E+01 | pCi | 6.20E-11 | Risk/pCi | 1.1E-09 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 3.02E+01 | pCi | 2.96E-10 | Risk/pCi | 8.9E-09 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 2.64E+01 | pCi | 2.48E-10 | Risk/pCi | 6.5E-09 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 2.70E+01 | pCi | 2.31E-10 | Risk/pCi | 6.2E-09 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 2.29E+01 | pCi | 3.75E-11 | Risk/pCi | 8.6E-10 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 2.64E+01 | pCi | 3.28E-11 | Risk/pCi | 8.7E-10 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 3.02E+01 | pCi | 1.01E-09 | Risk/pCi | 3.0E-08 |
| | (Total) | | | | | | | | | | 5.6E-08 |

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TABLE C-1-6.10
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

| |
|---|
| Scenario Timeframe: Future |
| Medium: Background Soil |
| Exposure Medium: Particulates |
| Exposure Point: N/A |
| Receptor Population: Construction Worker |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value (1) | Route EPC Units | EPC Selected for Risk Calculation (2) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Uranium 234 | 6.54E-01 | pCi/g | 3.41E-03 | pCi/m$^3$ | R | 3.76E+00 | pCi | 1.40E-08 | Risk/pCi | 5.3E-08 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 3.22E-03 | pCi/m$^3$ | R | 3.55E+00 | pCi | 1.24E-08 | Risk/pCi | 4.4E-08 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 5.46E-03 | pCi/m$^3$ | R | 6.03E+00 | pCi | 2.75E-09 | Risk/pCi | 1.7E-08 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 4.78E-03 | pCi/m$^3$ | R | 5.27E+00 | pCi | 9.94E-10 | Risk/pCi | 5.2E-09 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 4.89E-03 | pCi/m$^3$ | R | 5.40E+00 | pCi | 9.68E-08 | Risk/pCi | 5.2E-07 |
| | Thorium 230 | 7.94E-01 | pCi/g | 4.14E-03 | pCi/m$^3$ | R | 4.57E+00 | pCi | 1.72E-08 | Risk/pCi | 7.9E-08 |
| | Thorium 232 | 9.18E-01 | pCi/g | 4.78E-03 | pCi/m$^3$ | R | 5.28E+00 | pCi | 1.93E-08 | Risk/pCi | 1.0E-07 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 5.46E-03 | pCi/m$^3$ | R | 6.03E+00 | pCi | 3.86E-09 | Risk/pCi | 2.3E-08 |
| | (Total) | | | | | | | | | | 8.4E-07 |
| | | | | | | | | | | Total Risk-All ROPC | 1.8E-06 |

N/A = Not Applicable
(1) See respirable particulates model in Appendix C.
(2) R = Route-Specific

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TABLE C-1-6.11
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

| |
|---|
| Scenario Timeframe: Current / Future |
| Receptor Population: Construction Worker |
| Receptor Age: Adult |

| Exposure Route | Exposure Medium | Exposure Point | Gross Risk | Background Risk | Net Risk |
|---|---|---|---|---|---|
| External | Soil | Holt Cargo | 7.5E-04 | 8.7E-07 | 7.5E-04 |
| Ingestion | Soil | Holt Cargo | 3.1E-05 | 5.6E-08 | 3.1E-05 |
| Inhalation | Particulates | Holt Cargo | 1.1E-03 | 8.4E-07 | 1.1E-03 |
| | | | | Total Risk | 1.9E-03 |

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TABLE C-2-1

SELECTION OF EXPOSURE PATHWAYS

GENERAL GAS MANTLE: RADIOLOGICAL EXPOSURE

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | On-Site/ Off-Site | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|---|
| Current | Soil | Soil | GGM | Worker | Adult | External Radiation | On-Site | None | Building is currently unoccupied |
| | | | | | | Ingestion | On-Site | None | Building is currently unoccupied |
| | | | | Trespasser | Adolescent | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in soil is possible |
| | | | | | | Ingestion | On-Site | Quant | Contaminated soil may be encountered by adolescent trespassers |
| | | Particulates | GGM | Worker | Adult | Inhalation | On-Site | None | Building is currently unoccupied |
| | | | | Trespasser | Adolescent | Inhalation | On-Site | None | Vegatation hinders the resuspension of contaminated particles |
| | Building | Building Materials | GGM | Worker | Adult | External Radiation | On-Site | None | Building is currently unoccupied |
| | | | | Trespasser | Adolescent | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in building materials is possible |
| | | Particulates | GGM | Worker | Adult | Inhalation | On-Site | None | Building is currently unoccupied |
| | | | | Trespasser | Adolescent | Inhalation | On-Site | Quant | Contaminated particles may become airborne |
| | | Radon Decay Products | GGM | Worker | Adult | Inhalation | On-Site | None | Building is currently unoccupied |
| | | | | Trespasser | Adolescent | Inhalation | On-Site | Quant | Presence of radon decay products in building is possible |
| Future | Soil | Soil | GGM | Worker | Adult | External Radiation | On-Site | None | Workday assumed to be spent indoors |
| | | | | | | Ingestion | On-Site | None | Workday assumed to be spent indoors |
| | | | | Trespasser | Adolescent | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in soil is possible |
| | | | | | | Ingestion | On-Site | Quant | Contaminated soil may be encountered by adolescent trespassers |
| | | | | Construction Worker | Adult | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in soil is possible |
| | | | | | | Ingestion | On-Site | Quant | Contaminated soil may be encountered by construction workers during excavation activities |
| | | | | Resident | Adult | External Radiation | On-Site | Quant | Residential land development is possible |
| | | | | | | Ingestion | On-Site | Quant | Residential land development is possible |
| | | | | | Child | External Radiation | On-Site | Quant | Residential land development is possible |
| | | | | | | Ingestion | On-Site | Quant | Residential land development is possible |
| | | Home Grown Produce | GGM | Resident | Adult | Ingestion | On-Site | Quant | Residential land development is possible |
| | | | | | Child | Ingestion | On-Site | Quant | Residential land development is possible |
| | | Particulates | GGM | Worker | Adult | Inhalation | On-Site | None | Workday assumed to be spent indoors |
| | | | | Trespasser | Adolescent | Inhalation | On-Site | None | Vegatation hinders the resuspension of contaminated particles |
| | | | | Construction Worker | Adult | Inhalation | On-Site | Quant | Contaminated soil may be encountered by construction workers during excavation activities |
| | | | | Resident | Adult | Inhalation | On-Site | None | Vegatation hinders the resuspension of contaminated particles |
| | | | | | Child | Inhalation | On-Site | None | Vegatation hinders the resuspension of contaminated particles |
| | | Radon Decay Products | GGM | Resident | Adult | Inhalation | On-Site | Quant | Residential land development is possible |
| | | | | | Child | Inhalation | On-Site | Quant | Residential land development is possible |
| | Building | Building Materials | GGM | Worker | Adult | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in building materials is possible |
| | | | | Trespasser | Adolescent | External Radiation | On-Site | Quant | Presence of gamma-emitting radionuclides in building materials is possible |
| | | Particulates | GGM | Worker | Adult | Inhalation | On-Site | Quant | Contaminated particles may become airborne |
| | | | | Trespasser | Adolescent | Inhalation | On-Site | Quant | Contaminated particles may become airborne |
| | | Radon Decay Products | GGM | Worker | Adult | Inhalation | On-Site | Quant | Presence of radon decay products in building is possible |
| | | | | Trespasser | Adolescent | Inhalation | On-Site | Quant | Presence of radon decay products in building is possible |

TABLE C-2-2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM

| Radionuclide (1) | Minimum Concentration (2) | Maximum Concentration (2) | Units | Location of Maximum Concentration | Concentration Used for Screening to Background | Maximum Background Value (3) | ROPC Flag (4) | Rationale for Radionuclide Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|
| Uranium 234 | 0.33 | 3.96 | pCi/g | WG-SB-37-01 | 3.96 | 1.32 | YES | TX, ASL |
| Uranium 238 + D | 0.35 | 3.5 | pCi/g | WG-SB-37-01 | 3.5 | 1.45 | YES | TX, ASL |
| Radium 226 + D | 0.478 | 172 | pCi/g | WG-SB-42-01 | 172 | 1.91 | YES | TX, ASL |
| Radium 228 + D | 0.5 | 140 | pCi/g | WG-SB-37-01 | 140 | 2.25 | YES | TX, ASL |
| Thorium 228 + D | 0.42 | 149 | pCi/g | WG-SB-37-01 | 149 | 2.68 | YES | TX, ASL |
| Thorium 230 | 0.61 | 28 | pCi/g | WG-SB-37-01 | 28 | 1.52 | YES | TX, ASL |
| Thorium 232 | 0.279 | 132 | pCi/g | WG-SB-37-01 | 132 | 2.44 | YES | TX, ASL |
| Lead 210 + D | 0.478 | 172 | pCi/g | WG-SB-42-01 | 172 | 1.91 | YES | TX, ASL |

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead-210 and Radium-226

(2) Minimum/maximum detected concentration.

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC).

(3) Maximum concentrations from background samples. See text.

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)

TABLE C-2-2.2
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN
GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: GGM

| Radionuclide (1) | Minimum Concentration (2) | Maximum Concentration (2) | Units | Location of Maximum Concentration | Concentration Used for Screening to Background | Maximum Background Value (3) | ROPC Flag (4) | Rationale for Radionuclide Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|
| Uranium 234 | 0.33 | 3.96 | pCi/g | WG-SB-37-01 | 3.96 | 1.32 | YES | TX, ASL |
| Uranium 238 + D | 0.35 | 3.5 | pCi/g | WG-SB-37-01 | 3.5 | 1.45 | YES | TX, ASL |
| Radium 226 + D | 0.478 | 172 | pCi/g | WG-SB-42-01 | 172 | 1.91 | YES | TX, ASL |
| Radium 228 + D | 0.5 | 140 | pCi/g | WG-SB-37-01 | 140 | 2.25 | YES | TX, ASL |
| Thorium 228 + D | 0.42 | 149 | pCi/g | WG-SB-37-01 | 149 | 2.68 | YES | TX, ASL |
| Thorium 230 | 0.61 | 28 | pCi/g | WG-SB-37-01 | 28 | 1.52 | YES | TX, ASL |
| Thorium 232 | 0.279 | 132 | pCi/g | WG-SB-37-01 | 132 | 2.44 | YES | TX, ASL |
| Lead 210 + D | 0.478 | 172 | pCi/g | WG-SB-42-01 | 172 | 1.91 | YES | TX, ASL |

(1) Risk from decay products (+D) included as appropriate; secular equilibrium assumed between Lead-210 and Radium-226

(2) Minimum/maximum detected concentration.

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC).

(3) Maximum concentrations from background samples. See text.

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)

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TABLE C-2-2.3
OCCURRENCE, DISTRIBUTION AND SELECTION OF RADIONUCLIDES OF POTENTIAL CONCERN - INDOOR EXPOSURE RATES
GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Building
Exposure Medium: Building Materials
Exposure Point: GGM

| Radionuclide (1) | Minimum (2) | Maximum (2) | Units | Location of Maximum Concentration | Concentration Used for Screening to Background | Maximum Background Value (3) | ROPC Flag (4) | Rationale for Radionuclide Selection or Deletion (5) |
|---|---|---|---|---|---|---|---|---|
| Indoor Exposure Rate | 15 | 234 | uR/hr | Basement at (25,20) | 234 | 7 | YES | TX, ASL |

(1) Indoor exposure rate survey from the basement of General Gas Mantle

(2) Minimum/maximum detected.

(3) Exposure rate due to naturally occurring radiation.

(4) Selection (YES) or deletion (NO) of radionuclides of potential concern (ROPC).

(5) Rationale Codes

Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)

Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)

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TABLE C-2-3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM

| Radionuclide of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Uranium 234 | pCi/g | 1.39E+00 | 1.74E+00 | 3.96 | pCi/g | 1.74E+00 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Uranium 238 + D | pCi/g | 1.32E+00 | 1.62E+00 | 3.5 | pCi/g | 1.62E+00 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Radium 226 + D | pCi/g | 6.20E+00 | 4.08E+00 | 172 | pCi/g | 6.20E+00 | Mean-N | W-Test (2) | -- | -- | -- |
| Radium 228 + D | pCi/g | 1.35E+01 | 2.91E+01 | 140 | pCi/g | 2.91E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Thorium 228 + D | pCi/g | 1.64E+01 | 3.87E+01 | 149 | pCi/g | 3.87E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Thorium 230 | pCi/g | 4.66E+00 | 1.24E+01 | 28 | pCi/g | 1.24E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Thorium 232 | pCi/g | 1.49E+01 | 3.71E+01 | 132 | pCi/g | 3.71E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Lead 210 + D [1] | pCi/g | 6.20E+00 | 4.08E+00 | 172 | pCi/g | 6.20E+00 | Mean-N | W-Test (2) | -- | -- | -- |

For non-detects, sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Lead-210 assumed in equilibrium with Radium-226.

(2) *Shapiro-Wilk W Test indicates data do not follow a normal distribution.*

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TABLE C-2-3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: GGM

| Radionuclide of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Uranium 234 | pCi/g | 1.39E+00 | 1.74E+00 | 3.96 | pCi/g | 1.74E+00 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Uranium 238 + D | pCi/g | 1.32E+00 | 1.62E+00 | 3.5 | pCi/g | 1.62E+00 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Radium 226 + D | pCi/g | 6.20E+00 | 4.08E+00 | 172 | pCi/g | 6.20E+00 | Mean-N | W-Test (2) | -- | -- | -- |
| Radium 228 + D | pCi/g | 1.35E+01 | 2.91E+01 | 140 | pCi/g | 2.91E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Thorium 228 + D | pCi/g | 1.64E+01 | 3.87E+01 | 149 | pCi/g | 3.87E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Thorium 230 | pCi/g | 4.66E+00 | 1.24E+01 | 28 | pCi/g | 1.24E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Thorium 232 | pCi/g | 1.49E+01 | 3.71E+01 | 132 | pCi/g | 3.71E+01 | 95% UCL-T | W-Test (2) | -- | -- | -- |
| Lead 210 + D [1] | pCi/g | 6.20E+00 | 4.08E+00 | 172 | pCi/g | 6.20E+00 | Mean-N | W-Test (2) | -- | -- | -- |

For non-detects, sample quantitation limit was used as a proxy concentration; for duplicate sample results, the maximum value was used in the calculation.

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) Lead-210 assumed in equilibrium with Radium-226.
(2) Shapiro-Wilk W Test indicates data do not follow a normal distribution.

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TABLE C-2-3.3
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Building |
| Exposure Medium: Building Materials |
| Exposure Point: GGM |

| Radionuclide of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Indoor Exposure Rate | uR/hr | 4.02E+01 | 4.2E+01 | 234 | uR/hr | 4.2E+01 | 95% UCL-T | D'Agostino Test (1) | -- | -- | -- |
| Radon Decay Products | WL | 1.70E+00 | -- | -- | WL | 1.7E+00 | -- | -- | -- | -- | -- |

For duplicate sample results, the maximum value was used in the calculation.

D' Agostino Test: Developed by D' Agostino (Gilbert 1987).

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) D' Agostino Test indicates data do not follow a normal distribution.

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TABLE C-2-3.4
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Building |
| Exposure Medium: Building Materials |
| Exposure Point: GGM |

| Radionuclide of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Columns | dpm/100 $cm^2$ | 2.64E+03 | 3.39E+03 | 1.00E+04 | dpm/100 $cm^2$ | 3.39E+03 | 95% UCL-T | D'Agostino Test (1) | -- | -- | -- |
| Walls | dpm/100 $cm^2$ | 2.59E+03 | 2.39E+03 | 4.48E+04 | dpm/100 $cm^2$ | 2.59E+03 | Mean-N | D'Agostino Test (1) | -- | -- | -- |
| Floor | dpm/100 $cm^2$ | 3.71E+03 | 3.85E+03 | 2.73E+04 | dpm/100 $cm^2$ | 3.85E+03 | 95% UCL-T | D'Agostino Test (1) | -- | -- | -- |
| Radon | pCi/L | 8.77E-01 | 1.16E+00 | 2.10E+00 | pCi/L | 1.16E+00 | 95% UCL-N | W-Test (2) | -- | -- | -- |

For duplicate sample results, the maximum value was used in the calculation.

D' Agostino Test: Developed by D' Agostino (Gilbert 1987).

W - Test: Developed by Shapiro and Wilk, refer to Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

(1) D' Agostino Test indicates data do not follow a normal distribution.
(2) Shapiro-Wilk W Test indicates data follow a normal distribution.

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TABLE C-2-4.1

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Soil |
| Exposure Medium: Soil |
| Exposure Point: GGM |
| Receptor Population: Trespasser |
| Receptor Age: Adolescent |

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Exposure (CDI) (pCi-year/g) = |
| | ET | Exposure Time | hours/day | 1 | [1] | -- | -- | RS x ET x EF x GSFo x ED x CF1 |
| | EF | Exposure Frequency | days/year | 120 | [1] | -- | -- | |
| | GSFo | Gamma Shielding Factor Outdoors | - - | 1 [2] | EPA, 1997 | -- | -- | |
| | ED | Exposure Duration | years | 6 | [1] | -- | -- | |
| | CF1 | Conversion Factor 1 | year/hours | 1.14E-04 | - - | -- | -- | |
| Ingestion | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | CF2 | Conversion Factor 2 | g/mg | 1.00E-03 | -- | -- | -- | RS x CF2 x IR-S x FI x EF xED |
| | IR-S | Ingestion Rate of Soil | mg/day | 100 | EPA, 1991 | -- | -- | |
| | FI | Fraction Ingested | - - | 1 | - - | -- | -- | |
| | EF | Exposure Frequency | days/year | 120 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 6 | [1] | -- | -- | |

[1] Professional Judgment.

[2] 1 for exposed soil.

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

USEPA, 1997: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

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TABLE C-2-4.2

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Building
Exposure Medium: Building Materials
Exposure Point: GGM
Receptor Population: Trespasser
Receptor Age: Adolescent

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | ER | Exposure Rate | uR/hour | See Table 3 | See Table 3 | -- | -- | Exposure expressed as dose equivalent (urem) = |
| | ET | Exposure Time | hours/day | 1 | [1] | -- | -- | ER x ET x EF x ED x CF3 |
| | EF | Exposure Frequency | days/year | 120 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 6 | [1] | -- | -- | |
| | CF | Conversion Factor 3 | urem/uR | 0.97 | [2] | | | |

[1] Professional Judgement.

Sources:

[2] Pharm, B.S., Terpilak, M.S., 1984. The Health Physics and Radiological Health Handbook. Nucleon Lectern Associates.

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TABLE C-2-4.3

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Building
Exposure Medium: Particulates
Exposure Point: GGM
Receptor Population: Trespasser
Receptor Age: Adolescent

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| Inhalation | -- | -- | -- | -- | -- | -- | -- | Intake (pCi)<br>Intake will be modeled with RESRAD-BUILD |

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TABLE C-2-4.4

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Building
Exposure Medium: Radon Decay Products
Exposure Point: GGM
Receptor Population: Trespasser
Receptor Age: Adolescent

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| Inhalation | WL | Working Level Concentration | WL | See Table 3 | See Table 3 | -- | -- | Exposure (WLM) = |
| | ET | Exposure Time | hours/day | 1 | [1] | -- | -- | WL x ET x EF x ED x 1/CF4 |
| | EF | Exposure Frequency | days/year | 120 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 6 | [1] | -- | -- | |
| | CF | Conversion Factor 4 | hours/work-month | 170 | -- | -- | -- | |

[1] Professional Judgment.

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TABLE C-2-4.5

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Exposure (pCi-year/g) = |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | RS x ET x EF x GSFo x ED x CF1 |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | GSFo | Gamma Shielding Factor Outdoors | - - | 1 [2] | EPA, 1997 | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |
| | CF1 | Conversion Factor 1 | year/hours | 1.14E-04 | - - | -- | -- | |
| Ingestion | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | CF2 | Conversion Factor 2 | g/mg | 1.00E-03 | -- | -- | -- | RS x CF2 x IR-S x FI x EF x ED |
| | IR-S | Ingestion Rate of Soil | mg/day | 480 | EPA, 1991 | -- | -- | |
| | FI | Fraction Ingested | - - | 1 | -- | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |

[1] Professional Judgement.

[2] 1 for exposed soil.

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

USEPA, 1997: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

TABLE C-2-4.6

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| Inhalation | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | PEF | Particulate Emission Factor | $kg/m^3$ | 5.21E-06 | See Appendix C | -- | -- | RS x PEF x CF4 x IN x ET x EF x ED |
| | CF4 | Conversion Factor 5 | g/kg | 1000 | -- | -- | -- | |
| | IN | Inhalation Rate | $m^3/hr$ | 2.3 | EPA, 1991 | -- | -- | |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |

[1] Professional Judgement.

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

TABLE C-2-4.7

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Future |
| Medium: Soil |
| Exposure Medium: Soil |
| Exposure Point: GGM |
| Receptor Population: Resident |
| Receptor Age: Adult |

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Exposure (CDI) (pCi-year/g) = |
| | ET | Exposure Time | hours/day | 24 | [1] | -- | -- | RS x ET x EF x [(Fi x GSFi) + (Fo x GSFo)] x ED x CF1 |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | -- | -- | |
| | Fi | Time Fraction Indoors | -- | 0.875 | EPA, 1997 | -- | -- | |
| | Fo | Time Fraction Outdoors | -- | 0.125 | EPA, 1997 | -- | -- | |
| | GSFi | Gamma Shielding Factor Indoors | -- | 0.8 [2] | EPA, 1997 | -- | -- | |
| | GSFo | Gamma Shielding Factor Outdoors | -- | 1 [2] | EPA, 1997 | -- | -- | |
| | ED | Exposure Duration | years | 30 | EPA, 1991 | -- | -- | |
| | CF1 | Conversion Factor 1 | year/hours | 1.14E-04 | -- | -- | -- | |
| Ingestion | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | CF2 | Conversion Factor 2 | g/mg | 1.00E-03 | -- | -- | -- | RS x CF2 x IR-S x FI x EF xED |
| | IR-S | Ingestion Rate of Soil | mg/day | 100 | EPA, 1991 | -- | -- | |
| | FI | Fraction Ingested | -- | 1 | -- | -- | -- | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | -- | -- | |
| | ED | Exposure Duration | years | 30 | EPA, 1991 | -- | -- | |
| Home Grown Produce | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | IR-L | Ingestion Rate of Lettuce | g/day | 17 | Baes, 1984 | -- | -- | RS x [(IR-L x PUF-L) + (IR-C x RUF-C) + (IR-T x PUF-T)] x EF x ED |
| | PUF-L | Plant Uptake Factor-Lettuce | -- | See Appendix O | See Appendix C | -- | -- | |
| | IR-C | Ingestion Rate of Carrots | g/day | 48 | Baes, 1984 | -- | -- | |
| | RUF-C | Radionuclide -Specific Root Uptake Factor-Carrot | -- | See Appendix O | See Appendix C | -- | -- | |
| | IR-T | Ingestion Rate of Tomatoes | g/day | 57 | Baes, 1984 | -- | -- | |
| | PUF-T | Plant Uptake Factor-Tomatoes | -- | See Appendix O | See Appendix C | -- | -- | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | -- | -- | |
| | ED | Exposure Duration | years | 30 | EPA, 1991 | -- | -- | |

[1] Professional Judgment.

[2] 1 for exposed soil, 0.8 for pavement.

Sources:

Baes et al., 1984: A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture. ORNL-5786. Oak Ridge, TN. Oak Ridge National Laboratory.

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03

USEPA, 1997: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

TABLE C-2-4.8

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Future |
| Medium: Soil |
| Exposure Medium: Soil |
| Exposure Point: GGM |
| Receptor Population: Resident |
| Receptor Age: Child |

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Exposure (CDI) (pCi-year/g) = |
| | ET | Exposure Time | hours/day | 24 | [1] | -- | -- | RS x ET x EF x [(Fi x GSFi) + (Fo x GSFo)] x ED x CF1 |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | -- | -- | |
| | Fi | Time Fraction Indoors | -- | 0.75 | EPA, 1997 | -- | -- | |
| | Fo | Time Fraction Outdoors | -- | 0.25 | EPA, 1997 | -- | -- | |
| | GSFi | Gamma Shielding Factor Indoors | -- | 0.8 [2] | EPA, 1997 | -- | -- | |
| | GSFo | Gamma Shielding Factor Outdoors | -- | 1 [2] | EPA, 1997 | -- | -- | |
| | ED | Exposure Duration | years | 6 | EPA, 1991 | -- | -- | |
| | CF1 | Conversion Factor 1 | year/hours | 1.14E-04 | -- | -- | -- | |
| Ingestion | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | CF2 | Conversion Factor 2 | g/mg | 1.00E-03 | -- | -- | -- | RS x CF2 x IR-S x FI x EF xED |
| | IR-S | Ingestion Rate of Soil | mg/day | 200 | EPA, 1991 | -- | -- | |
| | FI | Fraction Ingested | -- | 1 | -- | -- | -- | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | -- | -- | |
| | ED | Exposure Duration | years | 6 | EPA, 1991 | -- | -- | |
| Home Grown Produce | RS | Radionuclide Concentration in Soil | pCi/g | See Table 3 | See Table 3 | -- | -- | Intake (pCi) = |
| | IR-L | Ingestion Rate of Lettuce | g/day | 4 | Baes, 1984 | -- | -- | RS x [(IR-L x PUF-L) + (IR-C x RUF-C) + (IR-T x PUF-T)] x EF x ED |
| | PUF-L | Plant Uptake Factor-Lettuce | -- | See Appendix O | See Appendix C | -- | -- | |
| | IR-C | Ingestion Rate of Carrots | g/day | 27 | Baes, 1984 | -- | -- | |
| | RUF-C | Radionuclide -Specific Root Uptake Factor-Carrot | -- | See Appendix O | See Appendix C | -- | -- | |
| | IR-T | Ingestion Rate of Tomatoes | g/day | 24 | Baes, 1984 | -- | -- | |
| | PUF-T | Plant Uptake Factor-Tomatoes | -- | See Appendix O | See Appendix C | -- | -- | |
| | EF | Exposure Frequency | days/year | 350 | EPA, 1991 | -- | -- | |
| | ED | Exposure Duration | years | 6 | EPA, 1991 | -- | -- | |

[1] Professional Judgment.

[2] 1 for exposed soil; 0.8 for pavement.

Sources:

Baes et al., 1984: A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture. ORNL-5786. Oak Ridge, TN: Oak Ridge National Laboratory

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285 6-03

USEPA, 1997: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa

TABLE C-2-4.9

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Radon Decay Products

Exposure Point: GGM

Receptor Population: Resident

Receptor Age: Adult, Child

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| Inhalation | -- | -- | -- | -- | -- | -- | -- | Intake (pCi)<br>Intakes will be modeled with RESRAD |

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TABLE C-2-4.10

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Building
Exposure Medium: Building Materials
Exposure Point: GGM
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| External (Radiation) | ER | Exposure Rate | uR/hour | See Table 3 | See Table 3 | -- | -- | Exposure expressed as dose equivalent (urem) = |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | ER x ET x EF x ED x CF3 |
| | EF | Exposure Frequency | days/year | 250 | EPA, 1991 | -- | -- | |
| | ED | Exposure Duration | years | 25 | EPA, 1991 | -- | -- | |
| | CF | Conversion factor 3 | urem/uR | 0.97 | [2] | -- | -- | |

[1] Professional Judgement.

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

[2] Pharm, B.S., Terpilak, M.S., 1984. The Health Physics and Radiological Health Handbook. Nucleon Lectern Associates.

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TABLE C-2-4.11

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Building
Exposure Medium: Particulates
Exposure Point: GGM
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| Inhalation | -- | -- | -- | -- | -- | -- | -- | Intake (pCi)<br>Intakes will be modeled with RESRAD-BUILD |

TABLE C-2-4.12

VALUES USED FOR EXPOSURE AND INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Building
Exposure Medium: Radon Decay Products
Exposure Point: GGM
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Equation |
|---|---|---|---|---|---|---|---|---|
| Radon Decay Products | WL | Working Level Concentration | WL | See Table 3 | See Table 3 | -- | -- | Exposure (WLM) = |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | WL x ET x EF x ED x 1/CF3 |
| | EF | Exposure Frequency | days/year | 250 | EPA, 1991 | -- | -- | |
| | ED | Exposure Duration | years | 25 | EPA, 1991 | -- | -- | |
| | CF | Conversion Factor 3 | hours/work-month | 170 | -- | -- | -- | |

[1] Professional Judgment.

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

TABLE C-2-5.1
CANCER TOXICITY DATA -- EXTERNAL
GENERAL GAS MANTLE-RADIONUCLIDES OF POTENTIAL CONCERN

| Radionuclide of Potential Concern (1) | External Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (MM/DD/YY) |
|---|---|---|---|---|---|
| Uranium 234 | 2.14E-11 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Uranium 238 + D | 6.57E-08 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Radium 226 + D | 6.74E-06 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Radium 228 + D | 3.28E-06 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Thorium 228 + D | 6.20E-06 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Thorium 230 | 4.40E-11 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Thorium 232 | 1.97E-11 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Lead 210 + D | 1.45E-10 | Risk/yr per pCi/g soil | A | HEAST | 11/01/95 |
| Exposure Rate Survey | 7.00E-10 | Risk/urem | A | NCRP | 1993 |

(1) Risk from decay products (+D) included as appropriate.
HEAST= Health Effects Assessment Summary Tables
NCRP = National Council on Radiation Protection and Measurements
Report No. 115, 1993. Risk Estimates for Radiation Protection.

EPA Group:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

Weight of Evidence:
- Known/Likely
- Cannot be Determined
- Not Likely

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TABLE C-2-5.2
CANCER TOXICITY DATA -- ORAL
GENERAL GAS MANTLE-RADIONUCLIDES OF POTENTIAL CONCERN

| Radionuclide of Potential Concern (1) | Oral Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (MM/DD/YY) |
|---|---|---|---|---|---|
| Uranium 234 | 4.44E-11 | Risk/pCi | A | HEAST | 11/01/95 |
| Uranium 238 + D | 6.20E-11 | Risk/pCi | A | HEAST | 11/01/95 |
| Radium 226 + D | 2.96E-10 | Risk/pCi | A | HEAST | 11/01/95 |
| Radium 228 + D | 2.48E-10 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 228 + D | 2.31E-10 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 230 | 3.75E-11 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 232 | 3.28E-11 | Risk/pCi | A | HEAST | 11/01/95 |
| Lead 210 + D | 1.01E-09 | Risk/pCi | A | HEAST | 11/01/95 |

(1) Risk from decay products (+D) included as appropriate.
HEAST= Health Effects Assessment Summary Tables

EPA Group:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

Weight of Evidence:
- Known/Likely
- Cannot be Determined
- Not Likely

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TABLE C-2-5.3
CANCER TOXICITY DATA -- INHALATION
GENERAL GAS MANTLE-RADIONUCLIDES OF POTENTIAL CONCERN

| Radionuclide of Potential Concern (1) | Inhalation Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (MM/DD/YY) |
|---|---|---|---|---|---|
| Uranium 234 | 1.40E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Uranium 238 + D | 1.24E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Radium 226 + D | 2.75E-09 | Risk/pCi | A | HEAST | 11/01/95 |
| Radium 228 + D | 9.94E-10 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 228 + D | 9.68E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 230 | 1.72E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Thorium 232 | 1.93E-08 | Risk/pCi | A | HEAST | 11/01/95 |
| Lead 210 + D | 3.86E-09 | Risk/pCi | A | HEAST | 11/01/95 |
| Radon Decay Products | 3.50E-04 | Risk/WLM | A | BEIR IV | 1988 |

(1) Risk from decay products (+D) included as appropriate.
HEAST= Health Effects Assessment Summary Tables
BEIR IV, 1988. Health Effects of Radon and Other Internally Deposited Alpha-Emitters.

EPA Group:
- A - Human carcinogen
- B1 - Probable human carcinogen - indicates that limited human data are available
- B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
- C - Possible human carcinogen
- D - Not classifiable as a human carcinogen
- E - Evidence of noncarcinogenicity

Weight of Evidence:
- Known/Likely
- Cannot be Determined
- Not Likely

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TABLE C-2-6.1

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM
Receptor Population: Trespasser
Receptor Age: Adolescent

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 1.43E-01 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 3.1E-12 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 1.33E-01 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 8.7E-09 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 5.09E-01 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 3.4E-06 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 2.39E+00 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 7.8E-06 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 3.17E+00 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 2.0E-05 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 1.02E+00 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 4.5E-11 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 3.04E+00 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 6.0E-11 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 5.09E-01 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 7.4E-11 |
| | (Total) | | | | | | | | | | 3.1E-05 |
| Ingestion | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 1.25E+02 | pCi | 4.44E-11 | Risk/pCi | 5.6E-09 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 1.16E+02 | pCi | 6.20E-11 | Risk/pCi | 7.2E-09 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 4.46E+02 | pCi | 2.96E-10 | Risk/pCi | 1.3E-07 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 2.09E+03 | pCi | 2.48E-10 | Risk/pCi | 5.2E-07 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 2.78E+03 | pCi | 2.31E-10 | Risk/pCi | 6.4E-07 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 8.93E+02 | pCi | 3.75E-11 | Risk/pCi | 3.3E-08 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 2.67E+03 | pCi | 3.28E-11 | Risk/pCi | 8.8E-08 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 4.46E+02 | pCi | 1.01E-09 | Risk/pCi | 4.5E-07 |
| | (Total) | | | | | | | | | | 1.9E-06 |

TABLE C-2-6.1.1 (continued)
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Building |
| Exposure Medium: Building Materials |
| Exposure Point: GGM |
| Receptor Population: Trespasser |
| Receptor Age: Adolescent |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Indoor Exposure Rate | 4.17E+01 | uR/hr | 4.17E+01 | uR/hr | M | 2.91E+04 | urem | 7.00E-10 | Risk/urem | 2.0E-05 |
| Inhalation | Radon Decay Products | 1.70E+00 | WL | 1.70E+00 | WL | M | 7.20E+00 | WLM | 3.50E-04 | Risk/WLM | 2.5E-03 |
| | (Total) | | | | | | | | | | 2.5E-03 |
| | | | | | | | | | | Total Risk-All ROPC | 2.6E-03 |

(1) M = Medium-Specific

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TABLE C-2-6.1.2
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Trespasser
Receptor Age: Adolescent

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 5.37E-02 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 1.1E-12 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 5.07E-02 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 3.3E-09 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 8.60E-02 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 5.8E-07 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 7.52E-02 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 2.5E-07 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 7.70E-02 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 4.8E-07 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 6.52E-02 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 2.9E-12 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 7.53E-02 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 1.5E-12 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 8.60E-02 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 1.2E-11 |
| | (Total) | | | | | | | | | | 1.3E-06 |
| Ingestion | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 4.71E+01 | pCi | 4.44E-11 | Risk/pCi | 2.1E-09 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 4.45E+01 | pCi | 6.20E-11 | Risk/pCi | 2.8E-09 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 7.55E+01 | pCi | 2.96E-10 | Risk/pCi | 2.2E-08 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 6.60E+01 | pCi | 2.48E-10 | Risk/pCi | 1.6E-08 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 6.76E+01 | pCi | 2.31E-10 | Risk/pCi | 1.6E-08 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 5.72E+01 | pCi | 3.75E-11 | Risk/pCi | 2.1E-09 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 6.61E+01 | pCi | 3.28E-11 | Risk/pCi | 2.2E-09 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 7.55E+01 | pCi | 1.01E-09 | Risk/pCi | 7.6E-08 |
| | (Total) | | | | | | | | | | 1.4E-07 |

300730

TABLE C-2-6.1.2 (continued)
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Background Building |
| Exposure Medium: Background Building Materials |
| Exposure Point: N/A |
| Receptor Population: Trespasser |
| Receptor Age: Adolescent |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Indoor Exposure Rate | 7.00E+00 | uR/hr | 7.00E+00 | uR/hr | M | 4.89E+03 | urem | 7.00E-10 | Risk/urem | 3.4E-06 |
| Inhalation | Radon Decay Products | 5.00E-03 | WL | 5.00E-03 | WL | M | 2.12E-02 | WLM | 3.50E-04 | Risk/WLM | 7.4E-06 |
| | (Total) | | | | | | | | | | 1.1E-05 |
| | | | | | | | | | | Total Risk-All ROPC | 1.2E-05 |

N/A = Not Applicable
(1) M = Medium-Specific

3007831

TABLE C-2-6.1.3
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Current / Future
Receptor Population: Trespasser
Receptor Age: Adolescent

| Exposure Route | Exposure Medium | Exposure Point | Gross Risk | Background Risk | Net Risk |
|---|---|---|---|---|---|
| External | Soil<br>Building Materials | GGM | 3.1E-05<br>2.0E-05 | 1.3E-06<br>3.4E-06 | 3.0E-05<br>1.7E-05 |
| Ingestion | Soil | GGM | 1.9E-06 | 1.4E-07 | 1.8E-06 |
| Inhalation | Particulates [1]<br>Radon Decay Products | GGM | 0.0E+00<br>2.5E-03 | 0.0E+00<br>7.4E-06 | 0.0E+00<br>2.5E-03 |
| | | | | Total Risk | 2.5E-03 |

1 = From RESRAD-BUILD

300782

TABLE C-2-6.2.1

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 9.51E-02 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 2.0E-12 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 8.85E-02 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 5.8E-09 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 3.39E-01 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 2.3E-06 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 1.59E+00 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 5.2E-06 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 2.12E+00 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 1.3E-05 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 6.79E-01 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 3.0E-11 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 2.03E+00 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 4.0E-11 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 3.39E-01 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 4.9E-11 |
| | (Total) | | | | | | | | | | 2.1E-05 |
| Ingestion | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 5.01E+01 | pCi | 4.44E-11 | Risk/pCi | 2.2E-09 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 4.66E+01 | pCi | 6.20E-11 | Risk/pCi | 2.9E-09 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 1.79E+02 | pCi | 2.96E-10 | Risk/pCi | 5.3E-08 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 8.38E+02 | pCi | 2.48E-10 | Risk/pCi | 2.1E-07 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 1.11E+03 | pCi | 2.31E-10 | Risk/pCi | 2.6E-07 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 3.57E+02 | pCi | 3.75E-11 | Risk/pCi | 1.3E-08 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 1.07E+03 | pCi | 3.28E-11 | Risk/pCi | 3.5E-08 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 1.79E+02 | pCi | 1.01E-09 | Risk/pCi | 1.8E-07 |
| | (Total) | | | | | | | | | | 7.5E-07 |

TABLE C-2-6.2.1 (continued)
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value (1) | Route EPC Units | EPC Selected for Risk Calculation (2) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Uranium 234 | 1.74E+00 | pCi/g | 9.06E-03 | pCi/m$^3$ | R | 1.00E+01 | pCi | 1.40E-08 | Risk/pCi | 1.4E-07 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 8.42E-03 | pCi/m$^3$ | R | 9.30E+00 | pCi | 1.24E-08 | Risk/pCi | 1.2E-07 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 3.23E-02 | pCi/m$^3$ | R | 3.57E+01 | pCi | 2.75E-09 | Risk/pCi | 9.8E-08 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 1.52E-01 | pCi/m$^3$ | R | 1.67E+02 | pCi | 9.94E-10 | Risk/pCi | 1.7E-07 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 2.01E-01 | pCi/m$^3$ | R | 2.22E+02 | pCi | 9.68E-08 | Risk/pCi | 2.2E-05 |
| | Thorium 230 | 1.24E+01 | pCi/g | 6.46E-02 | pCi/m$^3$ | R | 7.13E+01 | pCi | 1.72E-08 | Risk/pCi | 1.2E-06 |
| | Thorium 232 | 3.71E+01 | pCi/g | 1.93E-01 | pCi/m$^3$ | R | 2.13E+02 | pCi | 1.93E-08 | Risk/pCi | 4.1E-06 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 3.23E-02 | pCi/m$^3$ | R | 3.57E+01 | pCi | 3.86E-09 | Risk/pCi | 1.4E-07 |
| | (Total) | | | | | | | | | | 2.8E-05 |
| | | | | | | | | | | Total Risk-All ROPC | 4.9E-05 |

(1) See respirable particulates model in Appendix C.
(2) R = Route-Specific

300704

TABLEC-2-6.2.2

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 3.58E-02 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 7.7E-13 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 3.38E-02 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 2.2E-09 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 5.74E-02 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 3.9E-07 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 5.02E-02 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 1.6E-07 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 5.14E-02 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 3.2E-07 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 4.35E-02 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 1.9E-12 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 5.02E-02 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 9.9E-13 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 5.74E-02 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 8.3E-12 |
| | (Total) | | | | | | | | | | 8.7E-07 |
| Ingestion | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 1.88E+01 | pCi | 4.44E-11 | Risk/pCi | 8.4E-10 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 1.78E+01 | pCi | 6.20E-11 | Risk/pCi | 1.1E-09 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 3.02E+01 | pCi | 2.96E-10 | Risk/pCi | 8.9E-09 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 2.64E+01 | pCi | 2.48E-10 | Risk/pCi | 6.5E-09 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 2.70E+01 | pCi | 2.31E-10 | Risk/pCi | 6.2E-09 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 2.29E+01 | pCi | 3.75E-11 | Risk/pCi | 8.6E-10 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 2.64E+01 | pCi | 3.28E-11 | Risk/pCi | 8.7E-10 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 3.02E+01 | pCi | 1.01E-09 | Risk/pCi | 3.0E-08 |
| | (Total) | | | | | | | | | | 5.6E-08 |

TABLE C-2-6.2.2 (continued)

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Future |
| Medium: Background Soil |
| Exposure Medium: Particulates |
| Exposure Point: N/A |
| Receptor Population: Construction Worker |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value (1) | Route EPC Units | EPC Selected for Risk Calculation (2) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Uranium 234 | 6.54E-01 | pCi/g | 3.41E-03 | $pCi/m^3$ | R | 3.76E+00 | pCi | 1.40E-08 | Risk/pCi | 5.3E-08 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 3.22E-03 | $pCi/m^3$ | R | 3.55E+00 | pCi | 1.24E-08 | Risk/pCi | 4.4E-08 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 5.46E-03 | $pCi/m^3$ | R | 6.03E+00 | pCi | 2.75E-09 | Risk/pCi | 1.7E-08 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 4.78E-03 | $pCi/m^3$ | R | 5.27E+00 | pCi | 9.94E-10 | Risk/pCi | 5.2E-09 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 4.89E-03 | $pCi/m^3$ | R | 5.40E+00 | pCi | 9.68E-08 | Risk/pCi | 5.2E-07 |
| | Thorium 230 | 7.94E-01 | pCi/g | 4.14E-03 | $pCi/m^3$ | R | 4.57E+00 | pCi | 1.72E-08 | Risk/pCi | 7.9E-08 |
| | Thorium 232 | 9.18E-01 | pCi/g | 4.78E-03 | $pCi/m^3$ | R | 5.28E+00 | pCi | 1.93E-08 | Risk/pCi | 1.0E-07 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 5.46E-03 | $pCi/m^3$ | R | 6.03E+00 | pCi | 3.86E-09 | Risk/pCi | 2.3E-08 |
| | (Total) | | | | | | | | | | 8.4E-07 |
| | | | | | | | | | | Total Risk-All ROPC | 1.8E-06 |

300786

N/A = Not Applicable

(1) See respirable particulates model in Appendix C.

(2) R = Route-Specific

TABLE C-2-6.2.3
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Exposure Medium | Exposure Point | Gross Risk | Background Risk | Net Risk |
|---|---|---|---|---|---|
| External | Soil | GGM | 2.1E-05 | 8.7E-07 | 2.0E-05 |
| Ingestion | Soil | GGM | 7.5E-07 | 5.6E-08 | 6.9E-07 |
| Inhalation | Particulates | GGM | 2.8E-05 | 8.4E-07 | 2.7E-05 |
| | | | | Total Risk | 4.8E-05 |

3007787

TABLE C-2-6.3

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 4.12E+01 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 8.8E-10 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 3.83E+01 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 2.5E-06 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 1.47E+02 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 9.9E-04 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 6.89E+02 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 2.3E-03 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 9.16E+02 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 5.7E-03 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 2.94E+02 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 1.3E-08 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 8.79E+02 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 1.7E-08 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 1.47E+02 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 2.1E-08 |
| | (Total) | | | | | | | | | | 8.9E-03 |
| Ingestion | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 1.83E+03 | pCi | 4.44E-11 | Risk/pCi | 8.1E-08 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 1.70E+03 | pCi | 6.20E-11 | Risk/pCi | 1.1E-07 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 6.51E+03 | pCi | 2.96E-10 | Risk/pCi | 1.9E-06 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 3.05E+04 | pCi | 2.48E-10 | Risk/pCi | 7.6E-06 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 4.06E+04 | pCi | 2.31E-10 | Risk/pCi | 9.4E-06 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 1.30E+04 | pCi | 3.75E-11 | Risk/pCi | 4.9E-07 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 3.89E+04 | pCi | 3.28E-11 | Risk/pCi | 1.3E-06 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 6.51E+03 | pCi | 1.01E-09 | Risk/pCi | 6.6E-06 |
| | (Total) | | | | | | | | | | 2.7E-05 |

TABLE C-2-6.3.1 (continued)
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Home Grown Produce
Exposure Point: GGM
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 1.08E+03 | pCi | 4.44E-11 | Risk/pCi | 4.8E-08 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 1.01E+03 | pCi | 6.20E-11 | Risk/pCi | 6.2E-08 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 4.66E+03 | pCi | 2.96E-10 | Risk/pCi | 1.4E-06 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 2.18E+04 | pCi | 2.48E-10 | Risk/pCi | 5.4E-06 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 1.67E+03 | pCi | 2.31E-10 | Risk/pCi | 3.9E-07 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 5.36E+02 | pCi | 3.75E-11 | Risk/pCi | 2.0E-08 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 1.60E+03 | pCi | 3.28E-11 | Risk/pCi | 5.3E-08 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 1.59E+04 | pCi | 1.01E-09 | Risk/pCi | 1.6E-05 |
| | (Total) | | | | | | | | | | 2.3E-05 |
| | | | | | | | | | | Total Risk-All ROPC | 9.0E-03 |

(1) M = Medium-Specific

TABLE C-2-6.3.2
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Future |
| Medium: Background Soil |
| Exposure Medium: Background Soil |
| Exposure Point: N/A |
| Receptor Population: Resident |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 1.55E+01 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 3.3E-10 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 1.46E+01 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 9.6E-07 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 2.48E+01 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 1.7E-04 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 2.17E+01 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 7.1E-05 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 2.22E+01 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 1.4E-04 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 1.88E+01 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 8.3E-10 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 2.18E+01 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 4.3E-10 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 2.48E+01 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 3.6E-09 |
| | (Total) | | | | | | | | | | 3.8E-04 |
| Ingestion | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 6.87E+02 | pCi | 4.44E-11 | Risk/pCi | 3.1E-08 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 6.49E+02 | pCi | 6.20E-11 | Risk/pCi | 4.0E-08 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 1.10E+03 | pCi | 2.96E-10 | Risk/pCi | 3.3E-07 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 9.62E+02 | pCi | 2.48E-10 | Risk/pCi | 2.4E-07 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 9.85E+02 | pCi | 2.31E-10 | Risk/pCi | 2.3E-07 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 8.34E+02 | pCi | 3.75E-11 | Risk/pCi | 3.1E-08 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 9.64E+02 | pCi | 3.28E-11 | Risk/pCi | 3.2E-08 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 1.10E+03 | pCi | 1.01E-09 | Risk/pCi | 1.1E-06 |
| | (Total) | | | | | | | | | | 2.0E-06 |

TABLE C-2-6.3.2 (continued)
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Home Grown Produce
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 4.08E+02 | pCi | 4.44E-11 | Risk/pCi | 1.8E-08 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 3.85E+02 | pCi | 6.20E-11 | Risk/pCi | 2.4E-08 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 7.87E+02 | pCi | 2.96E-10 | Risk/pCi | 2.3E-07 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 6.89E+02 | pCi | 2.48E-10 | Risk/pCi | 1.7E-07 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 4.06E+01 | pCi | 2.31E-10 | Risk/pCi | 9.4E-09 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 3.44E+01 | pCi | 3.75E-11 | Risk/pCi | 1.3E-09 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 3.97E+01 | pCi | 3.28E-11 | Risk/pCi | 1.3E-09 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 2.69E+03 | pCi | 1.01E-09 | Risk/pCi | 2.7E-06 |
| | (Total) | | | | | | | | | | 3.2E-06 |
| | | | | | | | | | | Total Risk-All ROPC | 3.8E-04 |

N/A = Not Applicable
(1) M = Medium-Specific

TABLE C-2-6.3.3
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

| Exposure Route | Exposure Medium | Exposure Point | Gross Risk | Background Risk | Net Risk |
|---|---|---|---|---|---|
| External | Soil | GGM | 8.9E-03 | 3.8E-04 | 8.5E-03 |
| Ingestion | Soil | GGM | 2.7E-05 | 2.0E-06 | 2.5E-05 |
| | Home Grown Produce | | 2.3E-05 | 3.2E-06 | 2.0E-05 |
| Inhalation | Radon Decay Products [1] | GGM | 4.9E-03 | 8.0E-04 | 4.1E-03 |
| | | | | Total Risk | 1.3E-02 |

1 = From RESRAD

300792

TABLE C-2-6.4.

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 8.49E+00 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 1.8E-10 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 7.90E+00 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 5.2E-07 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 3.03E+01 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 2.0E-04 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 1.42E+02 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 4.7E-04 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 1.89E+02 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 1.2E-03 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 6.06E+01 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 2.7E-09 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 1.81E+02 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 3.6E-09 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 3.03E+01 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 4.4E-09 |
| | (Total) | | | | | | | | | | 1.8E-03 |
| Ingestion | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 7.30E+02 | pCi | 4.44E-11 | Risk/pCi | 3.2E-08 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 6.79E+02 | pCi | 6.20E-11 | Risk/pCi | 4.2E-08 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 2.60E+03 | pCi | 2.96E-10 | Risk/pCi | 7.7E-07 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 1.22E+04 | pCi | 2.48E-10 | Risk/pCi | 3.0E-06 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 1.62E+04 | pCi | 2.31E-10 | Risk/pCi | 3.8E-06 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 5.21E+03 | pCi | 3.75E-11 | Risk/pCi | 2.0E-07 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 1.56E+04 | pCi | 3.28E-11 | Risk/pCi | 5.1E-07 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 2.60E+03 | pCi | 1.01E-09 | Risk/pCi | 2.6E-06 |
| | (Total) | | | | | | | | | | 1.1E-05 |

TABLE C-2-6.4.1 (continued)
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Home Grown Produce
Exposure Point: GGM
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Uranium 234 | 1.74E+00 | pCi/g | 1.74E+00 | pCi/g | M | 9.82E+01 | pCi | 4.44E-11 | Risk/pCi | 4.4E-09 |
| | Uranium 238 + D | 1.62E+00 | pCi/g | 1.62E+00 | pCi/g | M | 9.13E+01 | pCi | 6.20E-11 | Risk/pCi | 5.7E-09 |
| | Radium 226 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 3.75E+02 | pCi | 2.96E-10 | Risk/pCi | 1.1E-07 |
| | Radium 228 + D | 2.91E+01 | pCi/g | 2.91E+01 | pCi/g | M | 1.76E+03 | pCi | 2.48E-10 | Risk/pCi | 4.4E-07 |
| | Thorium 228 + D | 3.87E+01 | pCi/g | 3.87E+01 | pCi/g | M | 1.36E+02 | pCi | 2.31E-10 | Risk/pCi | 3.1E-08 |
| | Thorium 230 | 1.24E+01 | pCi/g | 1.24E+01 | pCi/g | M | 4.35E+01 | pCi | 3.75E-11 | Risk/pCi | 1.6E-09 |
| | Thorium 232 | 3.71E+01 | pCi/g | 3.71E+01 | pCi/g | M | 1.30E+02 | pCi | 3.28E-11 | Risk/pCi | 4.3E-09 |
| | Lead 210 + D | 6.20E+00 | pCi/g | 6.20E+00 | pCi/g | M | 1.34E+03 | pCi | 1.01E-09 | Risk/pCi | 1.4E-06 |
| | (Total) | | | | | | | | | | 1.9E-06 |
| | | | | | | | | | | Total Risk-All ROPC | 1.9E-03 |

(1) M = Medium-Specific

TABLE C-2-6.4
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Background Soil
Exposure Medium: Background Soil
Exposure Point: N/A
Receptor Population: Resident
Receptor Age: Child

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 3.20E+00 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 6.8E-11 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 3.02E+00 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 2.0E-07 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 5.12E+00 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 3.5E-05 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 4.48E+00 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 1.5E-05 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 4.58E+00 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 2.8E-05 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 3.88E+00 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 1.7E-10 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 4.48E+00 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 8.8E-11 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 5.12E+00 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 7.4E-10 |
| | (Total) | | | | | | | | | | 7.8E-05 |
| Ingestion | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 2.75E+02 | pCi | 4.44E-11 | Risk/pCi | 1.2E-08 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 2.60E+02 | pCi | 6.20E-11 | Risk/pCi | 1.6E-08 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 4.40E+02 | pCi | 2.96E-10 | Risk/pCi | 1.3E-07 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 3.85E+02 | pCi | 2.48E-10 | Risk/pCi | 9.5E-08 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 3.94E+02 | pCi | 2.31E-10 | Risk/pCi | 9.1E-08 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 3.34E+02 | pCi | 3.75E-11 | Risk/pCi | 1.3E-08 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 3.86E+02 | pCi | 3.28E-11 | Risk/pCi | 1.3E-08 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 4.40E+02 | pCi | 1.01E-09 | Risk/pCi | 4.4E-07 |
| | (Total) | | | | | | | | | | 8.1E-07 |

TABLE C-2-6.4.2 (continued)

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Future |
| Medium: Background Soil |
| Exposure Medium: Home Grown Produce |
| Exposure Point: N/A |
| Receptor Population: Resident |
| Receptor Age: Child |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Uranium 234 | 6.54E-01 | pCi/g | 6.54E-01 | pCi/g | M | 3.70E+01 | pCi | 4.44E-11 | Risk/pCi | 1.6E-09 |
| | Uranium 238 + D | 6.18E-01 | pCi/g | 6.18E-01 | pCi/g | M | 3.49E+01 | pCi | 6.20E-11 | Risk/pCi | 2.2E-09 |
| | Radium 226 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 6.34E+01 | pCi | 2.96E-10 | Risk/pCi | 1.9E-08 |
| | Radium 228 + D | 9.17E-01 | pCi/g | 9.17E-01 | pCi/g | M | 5.55E+01 | pCi | 2.48E-10 | Risk/pCi | 1.4E-08 |
| | Thorium 228 + D | 9.38E-01 | pCi/g | 9.38E-01 | pCi/g | M | 3.29E+00 | pCi | 2.31E-10 | Risk/pCi | 7.6E-10 |
| | Thorium 230 | 7.94E-01 | pCi/g | 7.94E-01 | pCi/g | M | 2.79E+00 | pCi | 3.75E-11 | Risk/pCi | 1.0E-10 |
| | Thorium 232 | 9.18E-01 | pCi/g | 9.18E-01 | pCi/g | M | 3.22E+00 | pCi | 3.28E-11 | Risk/pCi | 1.1E-10 |
| | Lead 210 + D | 1.05E+00 | pCi/g | 1.05E+00 | pCi/g | M | 2.27E+02 | pCi | 1.01E-09 | Risk/pCi | 2.3E-07 |
| | (Total) | | | | | | | | | | 2.7E-07 |
| | | | | | | | | | | Total Risk-All ROPC | 7.9E-05 |

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N/A = Not Applicable

(1) M = Medium-Specific

TABLE C-2-6.4.3
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Future |
| Receptor Population: Resident |
| Receptor Age: Child |

| Exposure Route | Exposure Medium | Exposure Point | Gross Risk | Background Risk | Net Risk |
|---|---|---|---|---|---|
| External | Soil | GGM | 1.8E-03 | 7.8E-05 | 1.7E-03 |
| Ingestion | Soil | GGM | 1.1E-05 | 8.1E-07 | 1.0E-05 |
| | Home Grown Produce | | 1.9E-06 | 2.7E-07 | 1.6E-06 |
| Inhalation | Radon Decay Products [1] | GGM | 5.6E-04 | 9.2E-05 | 4.7E-04 |
| | | | | Total Risk | 2.2E-03 |

1 = From RESRAD

TABLE C-2-6.5.1
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Future |
| Medium: Building |
| Exposure Medium: Building Materials |
| Exposure Point: GGM |
| Receptor Population: Worker |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Indoor Exposure Rate | 4.17E+01 | uR/hr | 4.17E+01 | uR/hr | M | 2.02E+06 | urem | 7.00E-10 | Risk/urem | 1.4E-03 |
| Inhalation | Radon Decay Products | 1.70E+00 | WL | 1.70E+00 | WL | M | 5.00E+02 | WLM | 3.50E-04 | Risk/WLM | 1.8E-01 |
| | | | | | | | | | | Total Risk-All ROPC | 1.8E-01 |

(1) M = Medium-Specific

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TABLE C-2-6.5.2

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Background Building |
| Exposure Medium: Background Building Materials |
| Exposure Point: N/A |
| Receptor Population: Worker |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Background Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Indoor Exposure Rate | 7.00E+00 | uR/hr | 7.00E+00 | uR/hr | M | 3.40E+05 | urem | 7.00E-10 | Risk/urem | 2.4E-04 |
| Inhalation | Radon Decay Products | 5.00E-03 | WL | 5.00E-03 | WL | M | 1.47E+00 | WLM | 3.50E-04 | Risk/WLM | 5.1E-04 |
| | | | | | | | | | | Total Risk-All ROPC | 2.4E-04 |

N/A = Not Applicable

(1) M = Medium-Specific

TABLE C-2-6.5.3
RME
SUMMARY OF RECEPTOR RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Exposure Medium | Exposure Point | Gross Risk | Background Risk | Net Risk |
|---|---|---|---|---|---|
| External | Building Materials | GGM | 1.4E-03 | 2.4E-04 | 1.2E-03 |
| Inhalation | Particulates [1]<br>Radon Decay Products | GGM | 0.0E+00<br>1.8E-01 | 0.0E+00<br>5.1E-04 | 0.0E+00<br>1.8E-01 |
| | | | | Total Risk | 1.8E-01 |

1 = From RESRAD-BUILD

300800

TABLE I

SELECTION OF EXPOSURE PATHWAYS

WELSBACH: CHEMICAL EXPOSURE

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | On-Site/ Off-Site | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|---|
| Current | Soil | Soil | Holt Cargo | Worker | Adult | Ingestion | On-Site | None | Site is completely paved |
| | | | | | | Dermal | On-Site | None | Site is completely paved |
| | | | | | | Inhalation | On-Site | None | Site is completely paved |
| | | | | Other Worker | Adults | Ingestion | On-Site | None | Site is completely paved |
| | | | | | | Dermal | On-Site | None | Site is completely paved |
| | | | | | | Inhalation | On-Site | None | Site is completely paved |
| | | Particulates | Holt Cargo | Worker | Adult | Inhalation | On-Site | None | Site is completely paved |
| | | | | Other Worker | Adults | Inhalation | On-Site | None | Site is completely paved |
| Future | Soil | Soil | Holt Cargo | Worker | Adult | Ingestion | On-Site | None | Site will remain completely paved |
| | | | | | | Dermal | On-Site | None | Site will remain completely paved |
| | | | | | | Inhalation | On-Site | None | Site will remain completely paved |
| | | | | Other Worker | Adults | Ingestion | On-Site | None | Site is completely paved |
| | | | | | | Dermal | On-Site | None | Site is completely paved |
| | | | | | | Inhalation | On-Site | None | Site is completely paved |
| | | | | Construction Worker | Adult | Ingestion | On-Site | Quant | Contaminated soil may be encountered by construction workers during construction activities |
| | | | | | | Dermal | On-Site | Quant | Contaminated soil may be encountered by construction workers during construction activities |
| | | | | Resident | Adult | Ingestion | On-Site | None | Future use of land will remain industrial |
| | | | | | | Dermal | On-Site | None | Future use of land will remain industrial |
| | | | | | | Inhalation | On-Site | None | Future use of land will remain industrial |
| | | | | | Child | Ingestion | On-Site | None | Future use of land will remain industrial |
| | | | | | | Dermal | On-Site | None | Future use of land will remain industrial |
| | | | | | | Inhalation | On-Site | None | Future use of land will remain industrial |
| | | Particulates | Holt Cargo | Construction Worker | Adult | Inhalation | On-Site | Quant | Contaminated particles may become airborne |
| | | | | Worker | Adult | Inhalation | On-Site | None | Site will remain completely paved |
| | | | | Other Worker | Adults | Inhalation | On-Site | None | Site is completely paved |
| | | | | Resident | Adult | Inhalation | Off-Site | None | Site will remain completely paved |
| | | | | | Child | Inhalation | Off-Site | None | Site will remain completely paved |

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo

| CAS Number | Chemical | Minimum Concentration (1) | Minimum Qualifier | Maximum Concentration (1) | Maximum Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening | Background Value | Screening Toxicity Value (3) | Potential ARAR/TBC Value (4) | Potential ARAR/TBC Source | COPC Flag | Rationale for Contaminant Deletion or Selection (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 67-64-1 | Acetone | 0.076 | E | 0.15 | E | mg/kg | WG-SB-18-02 | 3/10 | 0.1-0.12 | 0.15 | N/A | 2.00E+05 N | 16 | SSL | NO | BCTS, BSL |
| 83-32-9 | Acenaphthene | 0.4 | J | 17 | -- | mg/kg | WG-SB-18-05 | 2/10 | 3.5-80.1 | 17 | N/A | 1.20E+05 N | 570 | SSL | NO | BCTS, BSL |
| 208-96-8 | Acenapthylene | 1.2 | J | 1.2 | J | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 1.2 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 120-12-7 | Anthracene | 0.54 | J | 7.8 | J | mg/kg | WG-SB-18-05 | 5/10 | 3.5-80.1 | 7.8 | N/A | 6.10E+05 N | 12000 | SSL | NO | BCTS, BSL |
| 56-55-3 | Benzo(a)Anthracene | 0.3 | J | 5.2 | E | mg/kg | WG-SB-15-05 | 6/10 | 3.5-80.1 | 5.2 | N/A | 7.80E+00 C | 2 | SSL | YES | ACTS |
| 205-99-2 | Benzo(b)Fluoranthene | 0.4 | J | 9.3 | E | mg/kg | WG-SB-15-05 | 6/10 | 3.5-80.1 | 9.3 | N/A | 7.80E+00 C | 5 | SSL | YES | ACTS, ASL |
| 50-32-8 | Benzo(a)Pyrene | 0.25 | J | 5.1 | E | mg/kg | WG-SB-15-05 | 6/10 | 3.5-80.1 | 5.1 | N/A | 7.80E-01 C | 8 | SSL | YES | ACTS, ASL |
| 191-24-2 | Benzo(g,h,i)Perylene | 0.47 | J | 1.5 | J | mg/kg | WG-SB-15-05 | 4/10 | 3.5-80.1 | 1.5 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 117-81-7 | Bis(2-Ethylhexyl)Phthalate | 0.049 | J | 2.7 | J | mg/kg | WG-SB-18-05 | 2/10 | 3.5-80.1 | 2.7 | N/A | 4.10E+02 C | 3600 | SSL | NO | BCTS, BSL |
| 218-01-9 | Chrysene | 0.3 | J | 4.8 | E | mg/kg | WG-SB-15-05 | 6/10 | 3.5-80.1 | 4.8 | N/A | 7.80E+02 C | 160 | SSL | NO | BCTS, BSL |
| 132-64-9 | Dibenzofuran | 16 | -- | 16 | - | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 16 | N/A | 8.20E+03 N | N/A | N/A | NO | BCTS, BSL |
| 95-50-1 | 1,2-Dichlorobenzene | 0.85 | J | 0.85 | J | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 0.85 | N/A | 1.80E+05 N | 17 | SSL | NO | BCTS, BSL |
| 206-44-0 | Fluoranthene | 0.59 | J | 12 | -- | mg/kg | WG-SB-18-05 | 6/10 | 3.5-80.1 | 12 | N/A | 8.20E+04 N | 4300 | SSL | NO | BCTS, BSL |
| 86-73-7 | Fluorene | 14 | -- | 14 | -- | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 14 | N/A | 8.20E+04 N | 560 | SSL | NO | BCTS, BSL |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 0.57 | J | 1.9 | J | mg/kg | WG-SB-15-05 | 4/10 | 3.5-80.1 | 1.9 | N/A | 7.80E+00 C | 14 | SSL | NO | BCTS, BSL |
| 91-20-3 | Naphthalene | 44 | -- | 44 | -- | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 44 | N/A | 8.20E+04 N | 84 | SSL | NO | BCTS, BSL |
| 91-57-6 | 2-Methylnaphthalene | 29 | -- | 29 | -- | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 29 | N/A | 8.20E+04 N | N/A | N/A | NO | BCTS, BSL |
| 85-01-8 | Phenanthrene | 0.51 | J | 25 | -- | mg/kg | WG-SB-18-05 | 6/10 | 3.5-80.1 | 25 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 129-00-0 | Pyrene | 0.64 | J | 11 | E | mg/kg | WG-SB-18-05 | 6/10 | 3.5-80.1 | 11 | N/A | 6.10E+04 N | 4200 | SSL | NO | BCTS, BSL |
| 12672-29-6 | Aroclor-1248 | 0.3 | -- | 0.3 | -- | mg/kg | WG-SB18-02 | 1/9 | 0.35-1.84 | 0.3 | N/A | 2.90E+00 C | 1 | SSL | YES | ACTS, ASL |
| 11097-69-1 | Aroclor-1254 | 0.33 | -- | 0.33 | -- | mg/kg | WG-SB-18-02 | 1/9 | 0.35-1.84 | 0.33 | N/A | 2.90E+00 C | 1 | SSL | YES | ACTS, ASL |
| 7429-90-5 | Aluminum | 1220 | E | 9100 | -- | mg/kg | WG-SB-15-05 | 9/9 | 41.67-46.67 | 9100 | (2) | 2.00E+06 N | N/A | N/A | NO | BBKG, BSL |
| 7440-36-0 | Antimony | 1.8 | J | 1.8 | J | mg/kg | WG-SB-25-05 | 1/9 | 12.5-14.0 | 1.8 | (2) | 8.20E+02 N | 5 | SSL | YES | ABKG |
| 7440-38-2 | Arsenic | 2.7 | B | 272 | E | mg/kg | WG-SB-15-05 | 9/9 | 2.08-2.33 | 272 | (2) | 3.80E+00 C | 29 | SSL | YES | ACTS, ASL, ABKG |
| 7440-39-3 | Barium | 5.2 | J | 208 | E | mg/kg | WG-SB-15-05 | 9/9 | 41.67-46.67 | 208 | (2) | 1.40E+05 N | 1600 | SSL | NO | BCTS, BSL, BBKG |
| 7440-41-7 | Beryllium | 0.09 | J | 1.2 | -- | mg/kg | WG-SB-06-03 | 8/9 | 1.04-1.17 | 1.2 | (2) | 4.10E+03 N | 63 | SSL | NO | BCTS, BSL, BBKG |
| 7440-43-9 | Cadmium | 0.08 | J | 0.19 | J | mg/kg | WG-SB-32-03 | 3/9 | 1.04-1.17 | 0.19 | (2) | 2.00E+03 N | 8 | SSL | NO | BCTS, BSL, BBKG |
| 7440-70-2 | Calcium | 148 | J | 19700 | E | mg/kg | WG-SB-15-05 | 9/9 | 1041.7-1166.9 | 19700 | (2) | -- | N/A | N/A | NO | NUT, BBKG |
| 16065-83-1 | Chromium | 4.1 | E | 17.4 | -- | mg/kg | WG-SB-15-05 | 9/9 | 2.08-2.33 | 17.4 | (2) | 2.00E+06 N | 38 | SSL | NO | BCTS, BSL, BBKG |
| 7440-48-4 | Cobalt | 0.52 | J | 4.2 | J | mg/kg | WG-SB-18-02 | 9/9 | 10.42-11.67 | 4.2 | (2) | 1.20E+05 N | N/A | N/A | NO | BCTS, BSL, BBKG |
| 7440-50-8 | Copper | 1.9 | J | 62.3 | E | mg/kg | WG-SB-06-03 | 9/9 | 5.21-5.83 | 62.3 | (2) | 8.20E+04 N | N/A | N/A | NO | BCTS, BSL, BBKG |
| 7439-89-6 | Iron | 4020 | -- | 18300 | -- | mg/kg | WG-SB-15-05 | 9/9 | 20.83-23.34 | 18300 | (2) | 6.10E+05 N | N/A | N/A | NO | NUT, BSL |
| 7439-92-1 | Lead | 1.7 | -- | 617 | E | mg/kg | WG-SB-15-05 | 9/9 | 0.63-0.7 | 617 | (2) | -- | 400 | SSL | NO | BCTS, BBKG |
| 7439-95-4 | Magnesium | 89 | J | 9040 | E | mg/kg | WG-SB-15-05 | 9/9 | 1041.7-1166.9 | 9040 | (2) | -- | N/A | N/A | NO | BCTS, NUT |
| 7439-96-5 | Manganese | 3 | J | 147 | E | mg/kg | WG-SB-12-01 | 9/9 | 3.13-3.5 | 147 | (2) | 4.10E+04 N | N/A | N/A | NO | BSL, BBKG |
| 7439-97-6 | Mercury | 0.03 | J | 0.91 | -- | mg/kg | WG-SB-06-03 | 9/9 | 0.1-0.12 | 0.91 | (2) | -- | N/A | N/A | NO | BCTS, BBKG |
| 7440-02-0 | Nickel | 0.71 | J | 23 | -- | mg/kg | WG-SB-06-03 | 9/9 | 8.33-9.33 | 23 | (2) | 4.10E+04 N | 130 | SSL | NO | BCTS, BSL, BBKG |
| 7440-09-7 | Potassium | 297 | J | 832 | J | mg/kg | WG-SB-18-02 | 9/9 | 1041.7-1166.9 | 832 | (2) | -- | N/A | N/A | NO | BCTS, NUT |
| 7782-49-2 | Selenium | 0.77 | J | 0.77 | J | mg/kg | WG-SB-03-05 | 1/9 | 1.04-1.17 | 0.77 | (2) | 1.00E+04 N | 5 | SSL | YES | ABKG |
| 7440-23-5 | Sodium | 4.6 | J | 145 | J | mg/kg | WG-SB-06-03 | 9/9 | 1041.7-1166.9 | 145 | (2) | -- | N/A | N/A | NO | BCTS, NUT |
| 7440-62-2 | Vanadium | 7.3 | J | 34.5 | E | mg/kg | WG-SB-31-05 | 9/9 | 10.42-11.67 | 34.5 | (2) | 1.40E+04 N | 6000 | SSL | NO | BCTS, BSL, BBKG |
| 7440-66-6 | Zinc | 5.3 | -- | 89 | E | mg/kg | WG-SB-15-05 | 7/9 | 4.17-4.67 | 89 | (2) | 6.10E+05 N | 12000 | SSL | NO | BCTS, BSL, BBKG |

(1) Minimum/maximum detected concentration.
(2) Average background values. See Appendix C
(3) U.S. EPA Region III, 1998, Risk-Based Concentration Table, Soil Industrial RBCs
(Cancer benchmark value = 1E-06, HQ = 1.0)
(4) Soil Screening Levels Migration to Groundwater 20 DAF (mg/kg)
(5) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Above Background Levels (ABKG)
Above CTS (ACTS)
Deletion Reason: Infrequent Detection (IFD)
Below Background Levels (BBKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below CTS (BCTS)

Definitions:
N/A = Not Applicable
CRQL = Contract Required Quantitation Limit
CRDL = Contract Required Detection Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
RBC = Risk-Based Concentration
CTS = Concentration / Toxicity Screen (See Appendix C)
E = Estimated Value
J = Estimated Value, compound present below CRQL but above IDL
C = Carcinogenic
N = Non-Carcinogenic

300802

OCCURRENCE, DISTRIBUTION AND SEL[illegible] CHEMICALS OF POTENTIAL CONCERN

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: Holt Cargo

| CAS Number | Chemical | Minimum Concentration (1) | Minimum Qualifier | Maximum Concentration (1) | Maximum Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening | Background Value | Screening Toxicity Value (3) | Potential ARAR/TBC Value (4) | Potential ARAR/TBC Source | COPC Flag | Rationale for Contaminant Deletion or Selection (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 67-64-1 | Acetone | 0.076 | E | 0.15 | E | mg/kg | WG-SB-18-02 | 3/10 | 0.1-0.12 | 0.15 | N/A | 2.00E+05 N | 16 | SSL | NO | BCTS, BSL |
| 83-32-9 | Acenaphthene | 0.4 | J | 17 | -- | mg/kg | WG-SB-18-05 | 2/10 | 3.5-80.1 | 17 | N/A | 1.20E+05 N | 570 | SSL | NO | BCTS, BSL |
| 208-96-8 | Acenapthylene | 1.2 | J | 1.2 | J | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 1.2 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 120-12-7 | Anthracene | 0.54 | J | 7.8 | J | mg/kg | WG-SB-18-05 | 5/10 | 3.5-80.1 | 7.8 | N/A | 6.10E+05 N | 12000 | SSL | NO | BCTS, BSL |
| 56-55-3 | Benzo(a)Anthracene | 0.3 | J | 5.2 | E | mg/kg | WG-SB-15-05 | 6/10 | 3.5-80.1 | 5.2 | N/A | 7.80E+00 C | 2 | SSL | YES | ACTS |
| 205-99-2 | Benzo(b)Fluoranthene | 0.4 | J | 9.3 | E | mg/kg | WG-SB-15-05 | 6/10 | 3.5-80.1 | 9.3 | N/A | 7.80E+00 C | 5 | SSL | YES | ACTS, ASL |
| 50-32-8 | Benzo(a)Pyrene | 0.25 | J | 5.1 | E | mg/kg | WG-SB-15-05 | 6/10 | 3.5-80.1 | 5.1 | N/A | 7.80E-01 C | 8 | SSL | YES | ACTS, ASL |
| 191-24-2 | Benzo(g,h,i)Perylene | 0.47 | J | 1.5 | J | mg/kg | WG-SB-15-05 | 4/10 | 3.5-80.1 | 1.5 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 117-81-7 | Bis(2-Ethylhexyl)Phthalate | 0.049 | J | 2.7 | J | mg/kg | WG-SB-18-05 | 2/10 | 3.5-80.1 | 2.7 | N/A | 4.10E+02 C | 3600 | SSL | NO | BCTS, BSL |
| 218-01-9 | Chrysene | 0.3 | J | 4.8 | E | mg/kg | WG-SB-15-05 | 6/10 | 3.5-80.1 | 4.8 | N/A | 7.80E+02 C | 160 | SSL | NO | BCTS, BSL |
| 132-64-9 | Dibenzofuran | 16 | -- | 16 | - | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 16 | N/A | 8.20E+03 N | N/A | N/A | NO | BCTS, BSL |
| 95-50-1 | 1,2-Dichlorobenzene | 0.85 | J | 0.85 | J | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 0.85 | N/A | 1.80E+05 N | 17 | SSL | NO | BCTS, BSL |
| 206-44-0 | Fluoranthene | 0.59 | J | 12 | -- | mg/kg | WG-SB-18-05 | 6/10 | 3.5-80.1 | 12 | N/A | 8.20E+04 N | 4300 | SSL | NO | BCTS, BSL |
| 86-73-7 | Fluorene | 14 | -- | 14 | -- | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 14 | N/A | 8.20E+04 N | 560 | SSL | NO | BCTS, BSL |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 0.57 | J | 1.9 | J | mg/kg | WG-SB-15-05 | 4/10 | 3.5-80.1 | 1.9 | N/A | 7.80E+00 C | 14 | SSL | NO | BCTS, BSL |
| 91-20-3 | Naphthalene | 44 | -- | 44 | -- | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 44 | N/A | 8.20E+04 N | 84 | SSL | NO | BCTS, BSL |
| 91-57-6 | 2-Methylnaphthalene | 29 | -- | 29 | -- | mg/kg | WG-SB-18-05 | 1/10 | 3.5-80.1 | 29 | N/A | 8.20E+04 N | N/A | N/A | NO | BCTS, BSL |
| 85-01-8 | Phenanthrene | 0.51 | J | 25 | -- | mg/kg | WG-SB-18-05 | 6/10 | 3.5-80.1 | 25 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 129-00-0 | Pyrene | 0.64 | J | 11 | E | mg/kg | WG-SB-18-05 | 6/10 | 3.5-80.1 | 11 | N/A | 6.10E+04 N | 4200 | SSL | NO | BCTS, BSL |
| 12672-29-6 | Aroclor-1248 | 0.3 | -- | 0.3 | -- | mg/kg | WG-SB18-02 | 1/9 | 0.35-1.84 | 0.3 | N/A | 2.90E+00 C | 1 | SSL | YES | ACTS, ASL |
| 11097-69-1 | Aroclor-1254 | 0.33 | -- | 0.33 | -- | mg/kg | WG-SB-18-02 | 1/9 | 0.35-1.84 | 0.33 | N/A | 2.90E+00 C | 1 | SSL | YES | ACTS, ASL |
| 7429-90-5 | Aluminum | 1220 | E | 9100 | -- | mg/kg | WG-SB-15-05 | 9/9 | 41.67-46.67 | 9100 | (2) | 2.00E+06 N | N/A | N/A | NO | BBKG, BSL |
| 7440-36-0 | Antimony | 1.8 | J | 1.8 | J | mg/kg | WG-SB-25-05 | 1/9 | 12.5-14.0 | 1.8 | (2) | 8.20E+02 N | 5 | SSL | YES | ABKG |
| 7440-38-2 | Arsenic | 2.7 | E | 272 | E | mg/kg | WG-SB-15-05 | 9/9 | 2.08-2.33 | 272 | (2) | 3.80E+00 C | 29 | SSL | YES | ACTS, ASL, ABKG |
| 7440-39-3 | Barium | 5.2 | J | 208 | E | mg/kg | WG-SB-15-05 | 9/9 | 41.67-46.67 | 208 | (2) | 1.40E+05 N | 1600 | SSL | NO | BCTS, BSL, BBKG |
| 7440-41-7 | Beryllium | 0.09 | J | 1.2 | -- | mg/kg | WG-SB-06-03 | 8/9 | 1.04-1.17 | 1.2 | (2) | 4.10E+03 N | 63 | SSL | NO | BCTS, BSL, BBKG |
| 7440-43-9 | Cadmium | 0.08 | J | 0.19 | J | mg/kg | WG-SB-32-03 | 3/9 | 1.04-1.17 | 0.19 | (2) | 2.00E+03 N | 8 | SSL | NO | BCTS, BSL, BBKG |
| 7440-70-2 | Calcium | 148 | J | 19700 | E | mg/kg | WG-SB-15-05 | 9/9 | 1041.7-1166.9 | 19700 | (2) | -- | N/A | N/A | NO | NUT, BBKG |
| 16065-83-1 | Chromium | 4.1 | E | 17.4 | -- | mg/kg | WG-SB-15-05 | 9/9 | 2.08-2.33 | 17.4 | (2) | 2.00E+06 N | 38 | SSL | NO | BCTS, BSL, BBKG |
| 7440-48-4 | Cobalt | 0.52 | J | 4.2 | J | mg/kg | WG-SB-18-02 | 9/9 | 10.42-11.67 | 4.2 | (2) | 1.20E+05 N | N/A | N/A | NO | BCTS, BSL, BBKG |
| 7440-50-8 | Copper | 1.9 | J | 62.3 | E | mg/kg | WG-SB-06-03 | 9/9 | 5.21-5.83 | 62.3 | (2) | 8.20E+04 N | N/A | N/A | NO | BCTS, BSL, BBKG |
| 7439-89-6 | Iron | 4020 | -- | 18300 | -- | mg/kg | WG-SB-15-05 | 9/9 | 20.83-23.34 | 18300 | (2) | 6.10E+05 N | N/A | N/A | NO | NUT, BSL |
| 7439-92-1 | Lead | 1.7 | -- | 617 | E | mg/kg | WG-SB-15-05 | 9/9 | 0.63-0.7 | 617 | (2) | -- | 400 | SSL | NO | BCTS, BBKG |
| 7439-95-4 | Magnesium | 89 | J | 9040 | E | mg/kg | WG-SB-15-05 | 9/9 | 1041.7-1166.9 | 9040 | (2) | -- | N/A | N/A | NO | BCTS, NUT |
| 7439-96-5 | Manganese | 3 | J | 147 | E | mg/kg | WG-SB-12-01 | 9/9 | 3.13-3.5 | 147 | (2) | 4.10E+04 N | N/A | N/A | NO | BSL, BBKG |
| 7439-97-6 | Mercury | 0.03 | J | 0.91 | -- | mg/kg | WG-SB-06-03 | 9/9 | 0.1-0.12 | 0.91 | (2) | -- | N/A | N/A | NO | BCTS, BBKG |
| 7440-02-0 | Nickel | 0.71 | J | 23 | -- | mg/kg | WG-SB-06-03 | 9/9 | 8.33-9.33 | 23 | (2) | 4.10E+04 N | 130 | SSL | NO | BCTS, BSL, BBKG |
| 7440-09-7 | Potassium | 297 | J | 832 | J | mg/kg | WG-SB-18-02 | 9/9 | 1041.7-1166.9 | 832 | (2) | -- | N/A | N/A | NO | BCTS, NUT |
| 7782-49-2 | Selenium | 0.77 | J | 0.77 | J | mg/kg | WG-SB-03-05 | 1/9 | 1.04-1.17 | 0.77 | (2) | 1.00E+04 N | 5 | SSL | YES | ABKG |
| 7440-23-5 | Sodium | 4.6 | J | 145 | J | mg/kg | WG-SB-06-03 | 9/9 | 1041.7-1166.9 | 145 | (2) | -- | N/A | N/A | NO | BCTS, NUT |
| 7440-62-2 | Vanadium | 7.3 | J | 34.5 | E | mg/kg | WG-SB-31-05 | 9/9 | 10.42-11.67 | 34.5 | (2) | 1.40E+04 N | 6000 | SSL | NO | BCTS, BSL, BBKG |
| 7440-66-6 | Zinc | 5.3 | -- | 89 | E | mg/kg | WG-SB-15-05 | 7/9 | 4.17-4.67 | 89 | (2) | 6.10E+05 N | 12000 | SSL | NO | BCTS, BSL, BBKG |

(1) Minimum/maximum detected concentration.
(2) Average background values. See Appendix C.
(3) U.S. EPA Region III, 1998, Risk-Based Concentration Table, Soil Industrial RBCs
(Cancer benchmark value = 1E-06, HQ = 1.0)
(4) Soil Screening Levels Migration to Groundwater 20 DAF (mg/kg)
(5) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Above Background Levels (ABKG)
Above CTS (ACTS)
Deletion Reason: Infrequent Detection (IFD)
Below Background Levels (BBKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below CTS (BCTS)

Definitions:
N/A = Not Applicable
CRQL = Contract Required Quantitation Limit
CRDL = Contract Required Detection Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
RBC = Risk-Based Concentration
CTS = Concentration / Toxicity Screen (See Appendix C)
E = Estimated Value
J = Estimated Value, compound present below CRQL but above IDL
C = Carcinogenic
N = Non-Carcinogenic

300803

TABLE 3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Benzo(a)Anthracene | mg/kg | N/A | N/A | 5.2E+00 | E | mg/kg | 5.2E+00 | Max | Site-Specific | N/A | N/A | N/A |
| Benzo(b)Fluoranthene | mg/kg | N/A | N/A | 9.3E+00 | E | mg/kg | 9.3E+00 | Max | Site-Specific | N/A | N/A | N/A |
| Benzo(a)Pyrene | mg/kg | N/A | N/A | 5.1E+00 | E | mg/kg | 5.1E+00 | Max | Site-Specific | N/A | N/A | N/A |
| Aroclor-1248 | mg/kg | N/A | N/A | 3.0E-01 | -- | mg/kg | 3.0E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Aroclor-1254 | mg/kg | N/A | N/A | 3.3E-01 | -- | mg/kg | 3.3E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Antimony | mg/kg | N/A | N/A | 1.8E+00 | J | mg/kg | 1.8E+00 | Max | Site-Specific | N/A | N/A | N/A |
| Arsenic | mg/kg | N/A | N/A | 2.7E+02 | E | mg/kg | 2.7E+02 | Max | Site-Specific | N/A | N/A | N/A |
| Selenium | mg/kg | N/A | N/A | 7.7E-01 | J | mg/kg | 7.7E-01 | Max | Site-Specific | N/A | N/A | N/A |

N/A = Not Applicable

For duplicate sample results, the maximum value was used.

Statistics: Maximum Detected Value (Max)

300804

TABLE 3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: Holt Cargo

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Benzo(a)Anthracene | mg/kg | N/A | N/A | 5.2E+00 | E | mg/kg | 5.2E+00 | Max | Site-Specific | N/A | N/A | N/A |
| Benzo(b)Fluoranthene | mg/kg | N/A | N/A | 9.3E+00 | E | mg/kg | 9.3E+00 | Max | Site-Specific | N/A | N/A | N/A |
| Benzo(a)Pyrene | mg/kg | N/A | N/A | 5.1E+00 | E | mg/kg | 5.1E+00 | Max | Site-Specific | N/A | N/A | N/A |
| Aroclor-1248 | mg/kg | N/A | N/A | 3.0E-01 | -- | mg/kg | 3.0E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Aroclor-1254 | mg/kg | N/A | N/A | 3.3E-01 | -- | mg/kg | 3.3E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Antimony | mg/kg | N/A | N/A | 1.8E+00 | J | mg/kg | 1.8E+00 | Max | Site-Specific | N/A | N/A | N/A |
| Arsenic | mg/kg | N/A | N/A | 2.7E+02 | E | mg/kg | 2.7E+02 | Max | Site-Specific | N/A | N/A | N/A |
| Selenium | mg/kg | N/A | N/A | 7.7E-01 | J | mg/kg | 7.7E-01 | Max | Site-Specific | N/A | N/A | N/A |

N/A = Not Applicable

*For duplicate sample results, the maximum value was used.*

Statistics: Maximum Detected Value (Max)

300825

TABLE 4.1

VALUES USED FOR DAILY INTAKE CALCULATIONS

WELSBACH

| |
|---|
| Scenario Timeframe: Future |
| Medium: Soil |
| Exposure Medium: Soil |
| Exposure Point: Holt Cargo |
| Receptor Population: Construction Worker |
| Receptor Age: Adult |

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | See Table 3 | See Table 3 | -- | -- | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CF1 | Conversion Factor 1 | kg/mg | 1.00E-06 | -- | -- | -- | CS x CF1 x IR-S x FI x EF x ED x 1/BW x 1/AT |
| | IR-S | Ingestion Rate of Soil | mg/day | 480 | EPA, 1997a | -- | -- | |
| | FI | Fraction Ingested | -- | 1 | -- | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [2] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [2] | -- | -- | |
| | BW | Body Weight | kg | 70 | EPA, 1997a | -- | -- | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | -- | -- | -- | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | -- | -- | -- | |
| Dermal | CS | Chemical Concentration in Soil | mg/kg | See Table 3 | See Table 3 | -- | -- | CDI (mg/kg-day) = |
| | CF1 | Conversion Factor 1 | kg/mg | 1.00E-06 | -- | -- | -- | CS x CF1 x SSAF x DABS x SA x EF x ED x 1/BW x 1/AT |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$ | 1 | EPA, 1997a | -- | -- | |
| | DABS | Dermal Absorption Factor (Solid) | -- | [1] | EPA, 1993a; 1996a | -- | -- | |
| | SA | Skin Surface Area Available for Contact | $cm^2$/event | 2570 | EPA, 1997a | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [2] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [2] | -- | -- | |
| | BW | Body Weight | kg | 70 | EPA, 1997a | -- | -- | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | -- | -- | -- | |
| | AT-C | Averaging Time (Cancer) | days | 25550 | -- | -- | -- | |

[1] 0.14 for Aroclors 1248 and 1254; 0.03 for Arsenic.

[2] Professional Judgement

Sources:


USEPA, 1993a: Memo from John Schaum and Kim Hoang to Janine Dinan, 15 December.

USEPA, 1996a: PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures. EPA/600/P-96/001F. Washington, DC: Office of Research and Development, National Center for Environmental Assessment.

USEPA, 1997a: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.


300906

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: Holt Cargo
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | See Table 3 | See Table 3 | -- | -- | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | PEF | Particulate Emission Factor | $kg/m^3$ | 5.21E-06 | See Appendix C | -- | -- | CS x PEF x IN x ET x EF x ED x 1/BW x 1/AT |
| | IN | Inhalation Rate | $m^3$/hour | 2.3 | EPA, 1991a | -- | -- | |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |
| | BW | Body Weight | kg | 70 | EPA, 1997a | -- | -- | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | -- | -- | -- | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | -- | -- | -- | |

[1] Professional Judgement.

Sources:

EPA, 1991a: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

EPA, 1997a: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

WELSBACH

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD Value | Oral RfD Units | Oral to Dermal Adjustment Factor (1) | Adjusted Dermal RfD (2) | Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ (3) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)Anthracene | Chronic | NA | mg/kg-day | N/A | N/A | N/A | N/A | -- | IRIS; HEAST | N/A |
| Benzo(b)Fluoranthene | Chronic | NA | mg/kg-day | N/A | N/A | N/A | N/A | -- | N/A | N/A |
| Benzo(a)Pyrene | Chronic | NA | mg/kg-day | N/A | N/A | N/A | N/A | -- | IRIS; HEAST | N/A |
| Aroclor-1248 | Chronic | 2E-05 | mg/kg-day | 100% | 2E-05 | mg/kg-day | NOEL | -- | IRIS; HEAST | 03/01/97 |
| Aroclor-1254 | Chronic | 2E-05 | mg/kg-day | 100% | 2E-05 | mg/kg-day | Eye | 300 | IRIS | 03/01/97 |
| Antimony | Chronic | 4E-04 | mg/kg-day | N/A | N/A | N/A | Longevity | 1000 | IRIS | 03/01/91 |
| Arsenic | Chronic | 3E-04 | mg/kg-day | 95% | 2.9E-04 | mg/kg-day | Skin | 3 | IRIS | 04/10/98 |
| Selenium | Chronic | 5E-03 | mg/kg-day | N/A | N/A | N/A | Liver | 3 | IRIS | 03/01/97 |

NA = Not Available

N/A = Not Applicable

(1) USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A, Interim Final. EPA/540/1-89/002, Office of Emergency and Remedial Response, Washington, DC.

(2) Oral RfD x Oral to Dermal Adjustment Factor = Adjusted Dermal RfD

(3) IRIS searched 7/20/98

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

WELSBACH

| Chemical of Potential Concern | Chronic/ Subchronic | Value Inhalation RfC | Units | Adjusted Inhalation RfD | Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of RfC:RfD: Target Organ | Dates (1) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)Anthracene | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Benzo(b)Fluoranthene | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Benzo(a)Pyrene | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Aroclor-1248 | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Aroclor-1254 | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Antimony | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Arsenic | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Selenium | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

NA = Not Available

N/A = Not Applicable

(1) IRIS searched 7/20/98

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

WELSBACH

| Chemical of Potential Concern | Chronic/ Subchronic | Value | Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of Primary Target Organ | Date (MM/DD/YY) |
|---|---|---|---|---|---|---|---|
| -- | -- | -- | -- | -- | -- | -- | -- |

300810

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

WELSBACH

| Chemical of Potential Concern | Oral Cancer Slope Factor | Oral to Dermal Adjustment Factor | Adjusted Dermal Cancer Slope Factor (1) | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (2) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|
| Benzo(a)Anthracene | 7.30E-01 | N/A | N/A | $(mg/kg\text{-}day)^{-1}$ | B2 | IRIS | 04/01/97 |
| Benzo(b)Fluoranthene | 7.30E-01 | N/A | N/A | $(mg/kg\text{-}day)^{-1}$ | B2 | IRIS | 03/01/97 |
| Benzo(a)Pyrene | 7.30E+00 | N/A | N/A | $(mg/kg\text{-}day)^{-1}$ | B2 | IRIS | 03/01/97 |
| Aroclor-1248 | 2.00E+00 | 100% | 2.00E+00 | $(mg/kg\text{-}day)^{-1}$ | -- | IRIS; HEAST | 03/01/97 |
| Aroclor-1254 | 2.00E+00 | 100% | 2.00E+00 | $(mg/kg\text{-}day)^{-1}$ | -- | IRIS; HEAST | 03/01/97 |
| Antimonmy | NA | N/A | N/A | N/A | -- | IRIS | 03/01/97 |
| Arsenic | 1.50E+00 | 95% | 1.58E+00 | $(mg/kg\text{-}day)^{-1}$ | A | IRIS | 04/10/98 |
| Selenium | NA | N/A | N/A | N/A | D | IRIS | 03/01/97 |

*IRIS = Integrated Risk Information System*

HEAST= Health Effects Assessment Summary Tables

NA = Not Available

N/A = Not Applicable

(1) OSF / Oral ABS = Adjusted Dermal Cancer Slope Factor

(2) IRIS searched 7/20/98

*EPA Group:*

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

WELSBACH

| Chemical of Potential Concern | Unit Risk | Units | Adjustment | Inhalation Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (1) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|
| Benzo(a)Anthracene | NA | N/A | N/A | NA | N/A | N/A | IRIS | 04/01/97 |
| Benzo(b)Fluoranthene | NA | N/A | N/A | NA | N/A | N/A | IRIS | 03/01/97 |
| Benzo(a)Pyrene | NA | N/A | N/A | NA | N/A | N/A | IRIS | 03/01/97 |
| Aroclor-1248 | NA | N/A | N/A | 2.00E+00 | (mg/kg-day)$^{-1}$ | B2 | IRIS | 03/01/97 |
| Aroclor-1254 | NA | N/A | N/A | 2.00E+00 | (mg/kg-day)$^{-1}$ | B2 | IRIS | 03/01/97 |
| Antimonmy | NA | N/A | N/A | NA | N/A | N/A | IRIS; HEAST | 03/01/97 |
| Arsenic | 4.30E-03 | ug/m$^3$ | 3500 | 1.50E+01 | (mg/kg-day)$^{-1}$ | A | IRIS | 04/10/98 |
| Selenium | NA | N/A | N/A | NA | N/A | N/A | IRIS | 03/01/97 |

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

NA = Not Available

N/A = Not Applicable

(1) IRIS searched 7/20/98

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

TABLE 6.3

CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

WELSBACH

| Chemical of Potential Concern | Value | Units | Source | Date MM/DD/YY |
|---|---|---|---|---|
| -- | -- | -- | -- | -- |

300813

TABLE 7.1.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Benzo(a)Anthracene | 5.20E+00 | mg/kg | 5.20E+00 | mg/kg | M | 5.9E-06 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(b)Fluoranthene | 9.30E+00 | mg/kg | 9.30E+00 | mg/kg | M | 1.0E-05 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 5.10E+00 | mg/kg | 5.10E+00 | mg/kg | M | 5.7E-06 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 3.00E-01 | mg/kg | 3.00E-01 | mg/kg | M | 3.4E-07 | mg/kg-day | 2.0E-05 | mg/kg-day | N/A | N/A | 2E-02 |
| | Aroclor-1254 | 3.30E-01 | mg/kg | 3.30E-01 | mg/kg | M | 3.7E-07 | mg/kg-day | 2.0E-05 | mg/kg-day | N/A | N/A | 2E-02 |
| | Antimony | 1.80E+00 | mg/kg | 1.80E+00 | mg/kg | M | 2.0E-06 | mg/kg-day | 4.0E-04 | mg/kg-day | N/A | N/A | 5E-03 |
| | Arsenic | 2.72E+02 | mg/kg | 2.72E+02 | mg/kg | M | 3.1E-04 | mg/kg-day | 3.0E-04 | mg/kg-day | N/A | N/A | 1E+00 |
| | Selenium | 7.70E-01 | mg/kg | 7.70E-01 | mg/kg | M | 8.7E-07 | mg/kg-day | 5.0E-03 | mg/kg-day | N/A | N/A | 2E-04 |
| | (Total) | | | | | | | | | | | | 1E+00 |
| Dermal | Benzo(a)Anthracene | 5.20E+00 | mg/kg | 5.20E+00 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(b)Fluoranthene | 9.30E+00 | mg/kg | 9.30E+00 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 5.10E+00 | mg/kg | 5.10E+00 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 3.00E-01 | mg/kg | 3.00E-01 | mg/kg | M | 2.5E-07 | mg/kg-day | 2.0E-05 | mg/kg-day | N/A | N/A | 1E-02 |
| | Aroclor-1254 | 3.30E-01 | mg/kg | 3.30E-01 | mg/kg | M | 2.8E-07 | mg/kg-day | 2.0E-05 | mg/kg-day | N/A | N/A | 1E-02 |
| | Antimony | 1.80E+00 | mg/kg | 1.80E+00 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | Arsenic | 2.72E+02 | mg/kg | 2.72E+02 | mg/kg | M | 4.9E-05 | mg/kg-day | 2.9E-04 | mg/kg-day | N/A | N/A | 2E-01 |
| | Selenium | 7.70E-01 | mg/kg | 7.70E-01 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | (Total) | | | | | | | | | | | | 2E-01 |
| Total Hazard Index Across All Exposure Routes/Pathways | | | | | | | | | | | | | 1E+00 |

(1) M = Medium-Specific

300814

TABLE 7.2.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: Holt Cargo
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value (1) | Route EPC Units | EPC Selected for Hazard Calculation (2) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Benzo(a)Anthracene | 5.20E+00 | mg/kg | 2.71E-05 | mg/m$^3$ | R | 1.2E-06 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(b)Fluoranthene | 9.30E+00 | mg/kg | 4.85E-05 | mg/m$^3$ | R | 2.1E-06 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 5.10E+00 | mg/kg | 2.66E-05 | mg/m$^3$ | R | 1.1E-06 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 3.00E-01 | mg/kg | 1.56E-06 | mg/m$^3$ | R | 6.8E-08 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1254 | 3.30E-01 | mg/kg | 1.72E-06 | mg/m$^3$ | R | 7.4E-08 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| - | Antimony | 1.80E+00 | mg/kg | 9.38E-06 | mg/m$^3$ | R | 4.1E-07 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Arsenic | 2.72E+02 | mg/kg | 1.42E-03 | mg/m$^3$ | R | 6.1E-05 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Selenium | 7.70E-01 | mg/kg | 4.01E-06 | mg/m$^3$ | R | 1.7E-07 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | (Total) | | | | | | | | | | | | -- |

Total Hazard Index Across All Exposure Routes/Pathways | --

(1) See respirable particulates model in Appendix C.
(2) R = Route-Specific

300245

TABLE 8.1.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Benzo(a)Anthracene | 5.20E+00 | mg/kg | 5.20E+00 | mg/kg | M | 8.4E-08 | mg/kg-day | 7.30E-01 | (mg/kg-day)$^{-1}$ | 6E-08 |
| | Benzo(b)Fluoranthene | 9.30E+00 | mg/kg | 9.30E+00 | mg/kg | M | 1.5E-07 | mg/kg-day | 7.30E-01 | (mg/kg-day)$^{-1}$ | 1E-07 |
| | Benzo(a)Pyrene | 5.10E+00 | mg/kg | 5.10E+00 | mg/kg | M | 8.2E-08 | mg/kg-day | 7.30E+00 | (mg/kg-day)$^{-1}$ | 6E-07 |
| | Aroclor-1248 | 3.00E-01 | mg/kg | 3.00E-01 | mg/kg | M | 4.8E-09 | mg/kg-day | 2.00E+00 | (mg/kg-day)$^{-1}$ | 1E-08 |
| | Aroclor-1254 | 3.30E-01 | mg/kg | 3.30E-01 | mg/kg | M | 5.3E-09 | mg/kg-day | 2.00E+00 | (mg/kg-day)$^{-1}$ | 1E-08 |
| | Antimony | 1.80E+00 | mg/kg | 1.80E+00 | mg/kg | M | 2.9E-08 | mg/kg-day | N/A | N/A | No Tox Data |
| | Arsenic | 2.72E+02 | mg/kg | 2.72E+02 | mg/kg | M | 4.4E-06 | mg/kg-day | 1.50E+00 | (mg/kg-day)$^{-1}$ | 7E-06 |
| | Selenium | 7.70E-01 | mg/kg | 7.70E-01 | mg/kg | M | N/A | N/A | N/A | N/A | |
| | (Total) | | | | | | | | | | 7E-06 |
| Dermal | Benzo(a)Anthracene | 5.20E+00 | mg/kg | 5.20E+00 | mg/kg | M | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(b)Fluoranthene | 9.30E+00 | mg/kg | 9.30E+00 | mg/kg | M | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 5.10E+00 | mg/kg | 5.10E+00 | mg/kg | M | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 3.00E-01 | mg/kg | 3.00E-01 | mg/kg | M | 3.6E-09 | mg/kg-day | 2.00E+00 | (mg/kg-day)$^{-1}$ | 7E-09 |
| | Aroclor-1254 | 3.30E-01 | mg/kg | 3.30E-01 | mg/kg | M | 4.0E-09 | mg/kg-day | 2.00E+00 | (mg/kg-day)$^{-1}$ | 8E-09 |
| | Antimony | 1.80E+00 | mg/kg | 1.80E+00 | mg/kg | M | N/A | N/A | N/A | N/A | No Tox Data |
| | Arsenic | 2.72E+02 | mg/kg | 2.72E+02 | mg/kg | M | 7.0E-07 | mg/kg-day | 1.58E+00 | (mg/kg-day)$^{-1}$ | 1E-06 |
| | Selenium | 7.70E-01 | mg/kg | 7.70E-01 | mg/kg | M | N/A | N/A | N/A | N/A | |
| | (Total) | | | | | | | | | | 1E-06 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 8E-06 |

(1) M = Medium-Specific

300816

TABLE 8.2.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

| |
|---|
| Scenario Timeframe: Future |
| Medium: Soil |
| Exposure Medium: Particulates |
| Exposure Point: Holt Cargo |
| Receptor Population: Construction Worker |
| Receptor Age: Adult |

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value (1) | Route EPC Units | EPC Selected for Risk Calculation (2) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Benzo(a)Anthracene | 5.20E+00 | mg/kg | 2.71E-05 | $mg/m^3$ | R | 1.7E-08 | mg/kg-day | N/A | N/A | No Tox Data |
| | Benzo(b)Fluoranthene | 9.30E+00 | mg/kg | 4.85E-05 | $mg/m^3$ | R | 3.0E-08 | mg/kg-day | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 5.10E+00 | mg/kg | 2.66E-05 | $mg/m^3$ | R | 1.6E-08 | mg/kg-day | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 3.00E-01 | mg/kg | 1.56E-06 | $mg/m^3$ | R | 9.6E-10 | mg/kg-day | 2.00E+00 | $(mg/kg\text{-}day)^{-1}$ | 2E-09 |
| | Aroclor-1254 | 3.30E-01 | mg/kg | 1.72E-06 | $mg/m^3$ | R | 1.1E-09 | mg/kg-day | 2.00E+00 | $(mg/kg\text{-}day)^{-1}$ | 2E-09 |
| | Antimony | 1.80E+00 | mg/kg | 9.38E-06 | $mg/m^3$ | R | 5.8E-09 | mg/kg-day | N/A | N/A | No Tox Data |
| | Arsenic | 2.72E+02 | mg/kg | 1.42E-03 | $mg/m^3$ | R | 8.7E-07 | mg/kg-day | 1.50E+01 | $(mg/kg\text{-}day)^{-1}$ | 1E-05 |
| | Selenium | 7.70E-01 | mg/kg | 4.01E-06 | $mg/m^3$ | R | N/A | N/A | N/A | N/A | |
| | (Total) | | | | | | | | | | 1E-05 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 1E-05 |

(1) See respirable particulates model in Appendix C.
(2) R = Route-Specific

300217

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELSBACH

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Soil | Holt Cargo | Benzo(a)Anthracene | 6E-08 | -- | No Tox Data | 6E-08 | Benzo(a)Anthracene | N/A | No Tox Data | -- | No Tox Data | -- |
| | | | Benzo(b)Fluoranthene | 1E-07 | -- | No Tox Data | 1E-07 | Benzo(b)Fluoranthene | N/A | No Tox Data | -- | No Tox Data | -- |
| | | | Benzo(a)Pyrene | 6E-07 | -- | No Tox Data | 6E-07 | Benzo(a)Pyrene | N/A | No Tox Data | -- | No Tox Data | -- |
| | | | Aroclor-1248 | 1E-08 | -- | 7E-09 | 2E-08 | Aroclor-1248 | NOEL | 2E-02 | -- | 1E-02 | 3E-02 |
| | | | Aroclor-1254 | 1E-08 | -- | 8E-09 | 2E-08 | Aroclor-1254 | Eye | 2E-02 | -- | 1E-02 | 3E-02 |
| | | | Antimony | No Tox Data | -- | No Tox Data | -- | Antimony | Longevity | 5E-03 | -- | No Tox Data | 5E-03 |
| | | | Arsenic | 7E-06 | -- | 1E-06 | 8E-06 | Arsenic | Skin | 1E+00 | -- | 2E-01 | 1E+00 |
| | | | Selenium | | -- | | -- | Selenium | Liver | 2E-04 | -- | No Tox Data | 2E-04 |
| | | | (Total) | 7E-06 | -- | 1E-06 | 8E-06 | (Total) | | 1E+00 | -- | 2E-01 | 1E+00 |
| | Particulates | | Benzo(a)Anthracene | -- | No Tox Data | -- | -- | Benzo(a)Anthracene | N/A | -- | No Tox Data | -- | -- |
| | | | Benzo(b)Fluoranthene | -- | No Tox Data | -- | -- | Benzo(b)Fluoranthene | N/A | -- | No Tox Data | -- | -- |
| | | | Benzo(a)Pyrene | -- | No Tox Data | -- | -- | Benzo(a)Pyrene | N/A | -- | No Tox Data | -- | -- |
| | | | Aroclor-1248 | -- | 2E-09 | -- | 2E-09 | Aroclor-1248 | N/A | -- | No Tox Data | -- | -- |
| | | | Aroclor-1254 | -- | 2E-09 | -- | 2E-09 | Aroclor-1254 | N/A | -- | No Tox Data | -- | -- |
| | | | Antimony | -- | No Tox Data | -- | -- | Antimony | N/A | -- | No Tox Data | -- | -- |
| | | | Arsenic | -- | 1E-05 | -- | 1E-05 | Arsenic | N/A | -- | No Tox Data | -- | -- |
| | | | Selenium | -- | | -- | -- | Selenium | N/A | -- | No Tox Data | -- | -- |
| | | | (Total) | -- | 1E-05 | -- | 1E-05 | (Total) | | -- | -- | -- | -- |

Total Risk Across Soil: 2E-05

Total Risk Across All Media and All Exposure Routes: 2E-05

otal Hazard Index Across All Media and All Exposure Routes: 1E+00

Total Liver HI = 2E-04

Total Skin HI = 1E+00

otal Eye HI = 3E-02

300213

TABLE 10.1.RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

WELSBACH

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Soil | Holt Cargo | Benzo(a)Anthracene | 6E-08 | -- | No Tox Data | 6E-08 | Arsenic | Skin | 1E+00 | -- | 2E-01 | 1E+00 |
| | | | Benzo(b)Fluoranthene | 1E-07 | -- | No Tox Data | 1E-07 | | | | | | |
| | | | Benzo(a)Pyrene | 6E-07 | -- | No Tox Data | 6E-07 | | | | | | |
| | | | Aroclor-1248 | 1E-08 | -- | 7E-09 | 2E-08 | | | | | | |
| | | | Aroclor-1254 | 1E-08 | -- | 8E-09 | 2E-08 | | | | | | |
| | | | Antimony | No Tox Data | -- | No Tox Data | -- | | | | | | |
| | | | Arsenic | 7E-06 | -- | 1E-06 | 8E-06 | | | | | | |
| | | | Selenium | | -- | | -- | | | | | | |
| | | | (Total) | 7E-06 | -- | 1E-06 | 8E-06 | (Total) | | 1E+00 | -- | 2E-01 | 1E+00 |
| | Particulates | | Benzo(a)Anthracene | -- | No Tox Data | -- | -- | | | -- | -- | -- | -- |
| | | | Benzo(b)Fluoranthene | -- | No Tox Data | -- | -- | | | -- | -- | -- | -- |
| | | | Benzo(a)Pyrene | -- | No Tox Data | -- | -- | | | -- | -- | -- | -- |
| | | | Aroclor-1248 | -- | 2E-09 | -- | 2E-09 | | | -- | -- | -- | -- |
| | | | Aroclor-1254 | -- | 2E-09 | -- | 2E-09 | | | -- | -- | -- | -- |
| | | | Antimony | -- | No Tox Data | -- | -- | | | -- | -- | -- | -- |
| | | | Arsenic | -- | 1E-05 | -- | 1E-05 | | | -- | -- | -- | -- |
| | | | Selenium | -- | | -- | -- | | | -- | -- | -- | -- |
| | | | (Total) | -- | 1E-05 | -- | 1E-05 | (Total) | | -- | -- | -- | -- |

Total Risk Across Soil: 2E-05

Total Risk Across All Media and All Exposure Routes: 2E-05

Total Hazard Index Across All Media and All Exposure Routes: 1E+00

Total Skin HI = 1E+00

1/7/99

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

GENERAL GAS MANTLE: CHEMICAL EXPOSURE

| Scenario Timeframe | Medium | Exposure Medium | Exposure Point | Receptor Population | Receptor Age | Exposure Route | On-Site/ Off-Site | Type of Analysis | Rationale for Selection or Exclusion of Exposure Pathway |
|---|---|---|---|---|---|---|---|---|---|
| Current | Soil | Soil | GGM | Worker | Adult | Ingestion | On-Site | None | Site is unoccupied |
| | | | | | | Dermal | On-Site | None | Site is unoccupied |
| | | | | | | Inhalation | On-Site | None | Site is unoccupied |
| | | | | Trespasser | Adolescent | Ingestion | On-Site | None | Contaminated soil in the subsurface |
| | | | | | | Dermal | On-Site | None | Contaminated soil in the subsurface |
| | | | | | | Inhalation | On-Site | None | Contaminated soil in the subsurface |
| | | Particulates | GGM | Worker | Adult | Inhalation | On-Site | None | Site is unoccupied |
| | | | | Trespasser | Adolescent | Inhalation | On-Site | None | Contaminated soil in the subsurface |
| Future | Soil | Soil | GGM | Worker | Adult | Ingestion | On-Site | None | Contaminated soil in the subsurface |
| | | | | | | Dermal | On-Site | None | Contaminated soil in the subsurface |
| | | | | | | Inhalation | On-Site | None | Contaminated soil in the subsurface |
| | | | | Trespasser | Adolescent | Ingestion | On-Site | None | Contaminated soil in the subsurface |
| | | | | | | Dermal | On-Site | None | Contaminated soil in the subsurface |
| | | | | | | Inhalation | On-Site | None | Contaminated soil in the subsurface |
| | | | | Construction Worker | Adult | Ingestion | On-Site | Quant | Contaminated soil may be encountered by construction workers during construction activities |
| | | | | | | Dermal | On-Site | Quant | Contaminated soil may be encountered by construction workers during construction activities |
| | | | | Resident | Adult | Ingestion | On-Site | None | Future use of land will remain industrial |
| | | | | | | Dermal | On-Site | None | Future use of land will remain industrial |
| | | | | | | Inhalation | On-Site | None | Future use of land will remain industrial |
| | | | | | Child | Ingestion | On-Site | None | Future use of land will remain industrial |
| | | | | | | Dermal | On-Site | None | Future use of land will remain industrial |
| | | | | | | Inhalation | On-Site | None | Future use of land will remain industrial |
| | | Particulates | GGM | Worker | Adult | Inhalation | On-Site | None | Contaminated soil in the subsurface |
| | | | | Trespasser | Adolescent | Inhalation | On-Site | None | Contaminated soil in the subsurface |
| | | | | Construction Worker | Adult | Inhalation | On-Site | Quant | Contaminated soil may be encountered by construction workers during construction activities |
| | | | | Resident | Adult | Inhalation | Off-Site | None | Future use of land will remain industrial |
| | | | | | Child | Inhalation | Off-Site | None | Future use of land will remain industrial |

300820

OCCURRENCE, DISTRIBUTION AND SELE[illegible] CHEMICALS OF POTENTIAL CONCERN
GENERA[illegible] ANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM

| CAS Number | Chemical | (1) Minimum Concentration | Minimum Qualifier | (1) Maximum Concentration | Maximum Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening | Background Value | (3) Screening Toxicity Value | Potential ARAR/TBC Value (4) | Potential ARAR/TBC Source | COPC Flag | (5) Rationale for Contaminant Deletion or Selection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 78-93-3 | 2-Butanone | 0.017 | -- | 0.017 | -- | mg/kg | WG-SB-34-03 | 1/7 | 0.11-0.12 | 0.017 | N/A | 1.20E+06 N | N/A | N/A | NO | BCTS, BSL |
| 100-41-4 | Ethylbenzene | 0.13 | -- | 0.13 | -- | mg/kg | WG-SB-34-03 | 1/7 | 0.11-0.12 | 0.13 | N/A | 2.00E+05 N | 13 | SSL | NO | BCTS, BSL |
| 133-20-7 | Xylenes (total) | 0.47 | -- | 0.47 | -- | mg/kg | WG-SB-34-03 | 1/7 | 0.11-0.12 | 0.47 | N/A | 4.10E+06 N | 210 | SSL | NO | BCTS, BSL |
| 120-12-7 | Anthracene | 0.045 | J | 0.045 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.045 | N/A | 6.10E+05 N | 12000 | SSL | NO | BCTS, BSL |
| 56-55-3 | Benzo(a)Anthracene | 0.17 | J | 0.17 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.17 | N/A | 7.80E+00 C | 2 | SSL | YES | ACTS |
| 205-99-2 | Benzo(b)Fluoranthene | 0.11 | J | 0.11 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.11 | N/A | 7.80E+00 C | 5 | SSL | NO | BCTS, BSL |
| 207-08-9 | Benzo(k)Fluoranthene | 0.22 | J | 0.22 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.22 | N/A | 7.80E+01 C | 49 | SSL | NO | BCTS, BSL |
| 50-32-8 | Benzo(a)Pyrene | 0.17 | J | 0.17 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.17 | N/A | 7.80E-01 C | 8 | SSL | YES | ACTS, ASL |
| 191-24-2 | Benzo(g,h,i)Perylene | 0.082 | J | 0.082 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.082 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 218-01-9 | Chrysene | 0.18 | J | 0.18 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.18 | N/A | 7.80E+02 C | 160 | SSL | NO | BCTS, BSL |
| 84-74-2 | Di-n-butylphthalate | 0.043 | J | 0.043 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.043 | N/A | 2.00E+05 N | 2300 | SSL | NO | BCTS, BSL |
| 206-44-0 | Fluoranthene | 0.34 | J | 0.34 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.34 | N/A | 8.20E+04 N | 4300 | SSL | NO | BCTS, BSL |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 0.1 | J | 0.1 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.1 | N/A | 7.80E+00 C | 14 | SSL | NO | BCTS, BSL |
| 91-57-6 | 2-Methylnaphthalene | 0.53 | J | 0.53 | J | mg/kg | WG-SB-34-03 | 1/7 | 3.5-37.6 | 0.53 | N/A | 8.20E+04 N | N/A | N/A | NO | BCTS, BSL |
| 86-30-6 | N-nitrosodiphenylamine | 0.62 | J | 0.62 | J | mg/kg | WG-SB-34-03 | 1/7 | 3.5-37.6 | 0.62 | N/A | 1.20E+03 C | 1 | SSL | NO | BCTS, BSL |
| 85-01-8 | Phenanthrene | 0.19 | J | 0.65 | J | mg/kg | WG-SB-34-03 | 1/7 | 3.5-37.6 | 0.65 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 129-00-0 | Pyrene | 0.32 | J | 0.32 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.32 | N/A | 6.10E+04 N | 4200 | SSL | NO | BCTS, BSL |
| 12672-29-6 | Aroclor-1248 | 0.028 | J | 0.028 | J | mg/kg | WG-SB-42-04 | 1/7 | 0.353-0.382 | 0.028 | N/A | 2.90E+00 C | 1 | SSL | YES | ACTS, ASL |
| 7429-90-5 | Aluminum | 3800 | -- | 7140 | -- | mg/kg | WG-SB-42-04 | 7/7 | 44.0-46.35 | 7140 | (2) | 2.00E+06 N | N/A | N/A | NO | BSL, BBKG |
| 7440-38-2 | Arsenic | 1.1 | J | 11.3 | -- | mg/kg | WG-SB-36-04 | 7/7 | 2.14-2.32 | 11.3 | (2) | 3.80E+00 C | 29 | SSL | YES | ACTS, ASL, TX |
| 7440-39-3 | Barium | 12.1 | J | 38.7 | J | mg/kg | WG-SB-42-04 | 7/7 | 42.8-46.4 | 38.7 | (2) | 1.40E+05 N | 1600 | SSL | NO | BSL, BBKG |
| 7440-41-7 | Beryllium | 0.3 | J | 0.7 | J | mg/kg | WG-SB-42-04 | 7/7 | 1.07-1.16 | 0.7 | (2) | 4.10E+03 N | 63 | SSL | NO | BCTS, BSL, BBKG |
| 7440-70-2 | Calcium | 168 | J | 520 | J | mg/kg | WG-SB-42-04 | 7/7 | 1069.5-1158.8 | 520 | (2) | -- | N/A | N/A | NO | BCTS, NUT |
| 16065-83-1 | Chromium | 5.2 | E | 14.5 | E | mg/kg | WG-SB-42-04 | 7/7 | 2.14-2.32 | 14.5 | (2) | 2.00E+06 N | 38 | SSL | NO | BCTS, BSL, BBKG |
| 7440-48-4 | Cobalt | 2.7 | J | 5.2 | J | mg/kg | WG-SB-42-04 | 7/7 | 10.7-11.6 | 5.2 | (2) | 1.20E+05 N | N/A | N/A | NO | BCTS, BSL, BBKG |
| 7440-50-8 | Copper | 3.1 | J | 8.6 | E | mg/kg | WG-SB-42-04 | 7/7 | 5.4-5.8 | 8.6 | (2) | 8.20E+04 N | N/A | N/A | NO | BCTS, BSL, BBKG |
| 7439-89-6 | Iron | 6370 | -- | 13100 | -- | mg/kg | WG-SB-42-04 | 7/7 | 21.4-23.2 | 13100 | (2) | 6.10E+05 N | N/A | N/A | NO | NUT, BBKG |
| 7439-92-1 | Lead | 3.6 | E | 71.2 | E | mg/kg | WG-SB-36-04 | 7/7 | 0.64-0.7 | 71.2 | (2) | -- | 400 | SSL | NO | BCTS |
| 7439-95-4 | Magnesium | 953 | J | 1510 | -- | mg/kg | WG-SB-41-03 | 7/7 | 1069.5-1158.8 | 1510 | (2) | -- | N/A | N/A | NO | BCTS, NUT, BBKG |
| 7439-96-5 | Manganese | 49.5 | -- | 90.4 | -- | mg/kg | WG-SB-42-04 | 7/7 | 3.21-3.48 | 90.4 | (2) | 4.10E+04 N | N/A | N/A | NO | BSL, BBKG |
| 7440-02-0 | Nickel | 7.4 | J | 10.9 | -- | mg/kg | WG-SB-42-04 | 7/7 | 8.56-9.27 | 10.9 | (2) | 4.10E+04 N | 130 | SSL | NO | BSL, BBKG |
| 7440-09-7 | Potassium | 398 | J | 786 | J | mg/kg | WG-SB-42-04 | 7/7 | 1069.5-1158.8 | 786 | (2) | -- | N/A | N/A | NO | BCTS, NUT, BBKG |
| 7782-49-2 | Selenium | 0.68 | J | 0.68 | J | mg/kg | WG-SB-42-04 | 1/7 | 1.07-1.16 | 0.68 | (2) | 1.00E+04 N | 5 | SSL | YES | ABKG |
| 7440-23-5 | Sodium | 22.1 | J | 123 | J | mg/kg | WG-SB-36-04 | 2/7 | 1069.5-1158.8 | 123 | (2) | -- | N/A | N/A | NO | BCTS, NUT, BBKG |
| 7440-28-0 | Thallium | 1.9 | J | 1.9 | J | mg/kg | WG-SB-34-03 | 1/7 | 2.14-2.32 | 1.9 | (2) | 1.40E+02 N | 0.7 | SSL | YES | ABKG |
| 7440-62-2 | Vanadium | 6.7 | J | 22.5 | -- | mg/kg | WG-SB-42-04 | 7/7 | 10.7-11.59 | 22.5 | (2) | 1.40E+04 N | 6000 | SSL | NO | BSL, BBKG |
| 7440-66-6 | Zinc | 24.7 | -- | 34.5 | -- | mg/kg | WG-SB-42-04 | 7/7 | 4.28-4.63 | 34.5 | (2) | 6.10E+05 N | 12000 | SSL | NO | BCTS, BSL, BBKG |

(1) Minimum/maximum detected concentration.
(2) Background values from WG-SB-40-04. See Appendix C
(3) U.S. EPA Region III, 1998, Risk-Based Concentration Table, Soil Industrial RBCs
(Cancer benchmark value = 1E-06, HQ = 1.0)
(4) Soil Screening Levels Migration to Groundwater 20 DAF (mg/kg)
(5) Rationale Codes: Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Above Background Levels (ABKG)
Above CTS (ACTS)
Deletion Reason: Infrequent Detection (IFD)
Below Background Levels (BBKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below CTS (BCTS)

Definitions:
N/A = Not Applicable
CRQL = Contract Required Quantitation Limit
CRDL = Contract Required Detection Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
RBC = Risk-Based Concentration
CTS = Concentration Toxicity Screen (See Appendix C)
E = Estimated Value
J = Estimated Value, compound present below CRQL but above IDL
C = Carcinogenic
N = Non-Carcinogenic

OCCURRENCE, DISTRIBUTION AND SELE CHEMICALS OF POTENTIAL CONCERN
GENERA ANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: GGM

| CAS Number | Chemical | Minimum Concentration (1) | Minimum Qualifier | Maximum Concentration (1) | Maximum Qualifier | Units | Location of Maximum Concentration | Detection Frequency | Range of Detection Limits | Concentration Used for Screening | Background Value | Screening Toxicity Value (3) | Potential ARAR/TBC Value (4) | Potential ARAR/TBC Source | COPC Flag | Rationale for Contaminant Deletion or Selection (5) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 78-93-3 | 2-Butanone | 0.017 | -- | 0.017 | -- | mg/kg | WG-SB-34-03 | 1/7 | 0.11-0.12 | 0.017 | N/A | 1.20E+06 N | N/A | N/A | NO | BCTS, BSL |
| 100-41-4 | Ethylbenzene | 0.13 | -- | 0.13 | -- | mg/kg | WG-SB-34-03 | 1/7 | 0.11-0.12 | 0.13 | N/A | 2.00E+05 N | 13 | SSL | NO | BCTS, BSL |
| 133-20-7 | Xylenes (total) | 0.47 | -- | 0.47 | -- | mg/kg | WG-SB-34-03 | 1/7 | 0.11-0.12 | 0.47 | N/A | 4.10E+06 N | 210 | SSL | NO | BCTS, BSL |
| 120-12-7 | Anthracene | 0.045 | J | 0.045 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.045 | N/A | 6.10E+05 N | 12000 | SSL | NO | BCTS, BSL |
| 56-55-3 | Benzo(a)Anthracene | 0.17 | J | 0.17 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.17 | N/A | 7.80E+00 C | 2 | SSL | YES | ACTS |
| 205-99-2 | Benzo(b)Fluoranthene | 0.11 | J | 0.11 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.11 | N/A | 7.80E+00 C | 5 | SSL | NO | BCTS, BSL |
| 207-08-9 | Benzo(k)Fluoranthene | 0.22 | J | 0.22 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.22 | N/A | 7.80E+01 C | 49 | SSL | NO | BCTS, BSL |
| 50-32-8 | Benzo(a)Pyrene | 0.17 | J | 0.17 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.17 | N/A | 7.80E-01 C | 8 | SSL | YES | ACTS, ASL |
| 191-24-2 | Benzo(g,h,i)Perylene | 0.082 | J | 0.082 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.082 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 218-01-9 | Chrysene | 0.18 | J | 0.18 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.18 | N/A | 7.80E+02 C | 160 | SSL | NO | BCTS, BSL |
| 84-74-2 | Di-n-butylphthalate | 0.043 | J | 0.043 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.043 | N/A | 2.00E+05 N | 2300 | SSL | NO | BCTS, BSL |
| 206-44-0 | Fluoranthene | 0.34 | J | 0.34 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.34 | N/A | 8.20E+04 N | 4300 | SSL | NO | BCTS, BSL |
| 193-39-5 | Indeno(1,2,3-cd)Pyrene | 0.1 | J | 0.1 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.1 | N/A | 7.80E+00 C | 14 | SSL | NO | BCTS, BSL |
| 91-57-6 | 2-Methylnaphthalene | 0.53 | J | 0.53 | J | mg/kg | WG-SB-34-03 | 1/7 | 3.5-37.6 | 0.53 | N/A | 8.20E+04 N | N/A | N/A | NO | BCTS, BSL |
| 86-30-6 | N-nitrosodiphenylamine | 0.62 | J | 0.62 | J | mg/kg | WG-SB-34-03 | 1/7 | 3.5-37.6 | 0.62 | N/A | 1.20E+03 C | 1 | SSL | NO | BCTS, BSL |
| 85-01-8 | Phenanthrene | 0.19 | J | 0.65 | J | mg/kg | WG-SB-34-03 | 1/7 | 3.5-37.6 | 0.65 | N/A | -- | N/A | N/A | NO | BCTS, BSL |
| 129-00-0 | Pyrene | 0.32 | J | 0.32 | J | mg/kg | WG-SB-41-03 | 1/7 | 3.5-37.6 | 0.32 | N/A | 6.10E+04 N | 4200 | SSL | NO | BCTS, BSL |
| 12672-29-6 | Aroclor-1248 | 0.028 | J | 0.028 | J | mg/kg | WG-SB-42-04 | 1/7 | 0.353-0.382 | 0.028 | N/A | 2.90E+00 C | 1 | SSL | YES | ACTS, ASL |
| 7429-90-5 | Aluminum | 3800 | -- | 7140 | -- | mg/kg | WG-SB-42-04 | 7/7 | 44.0-46.35 | 7140 | (2) | 2.00E+06 N | N/A | N/A | NO | BSL, BBKG |
| 7440-38-2 | Arsenic | 1.1 | J | 11.3 | -- | mg/kg | WG-SB-36-04 | 7/7 | 2.14-2.32 | 11.3 | (2) | 3.80E+00 C | 29 | SSL | YES | ACTS, ASL, TX |
| 7440-39-3 | Barium | 12.1 | J | 38.7 | J | mg/kg | WG-SB-42-04 | 7/7 | 42.8-46.4 | 38.7 | (2) | 1.40E+05 N | 1600 | SSL | NO | BSL, BBKG |
| 7440-41-7 | Beryllium | 0.3 | J | 0.7 | J | mg/kg | WG-SB-42-04 | 7/7 | 1.07-1.16 | 0.7 | (2) | 4.10E+03 N | 63 | SSL | NO | BCTS, BSL, BBKG |
| 7440-70-2 | Calcium | 168 | J | 520 | J | mg/kg | WG-SB-42-04 | 7/7 | 1069.5-1158.8 | 520 | (2) | -- | N/A | N/A | NO | BCTS, NUT |
| 16065-83-1 | Chromium | 5.2 | E | 14.5 | E | mg/kg | WG-SB-42-04 | 7/7 | 2.14-2.32 | 14.5 | (2) | 2.00E+06 N | 38 | SSL | NO | BCTS, BSL, BBKG |
| 7440-48-4 | Cobalt | 2.7 | J | 5.2 | J | mg/kg | WG-SB-42-04 | 7/7 | 10.7-11.6 | 5.2 | (2) | 1.20E+05 N | N/A | N/A | NO | BCTS, BSL, BBKG |
| 7440-50-8 | Copper | 3.1 | J | 8.6 | E | mg/kg | WG-SB-42-04 | 7/7 | 5.4-5.8 | 8.6 | (2) | 8.20E+04 N | N/A | N/A | NO | BCTS, BSL, BBKG |
| 7439-89-6 | Iron | 6370 | -- | 13100 | -- | mg/kg | WG-SB-42-04 | 7/7 | 21.4-23.2 | 13100 | (2) | 6.10E+05 N | N/A | N/A | NO | NUT, BBKG |
| 7439-92-1 | Lead | 3.6 | E | 71.2 | E | mg/kg | WG-SB-36-04 | 7/7 | 0.64-0.7 | 71.2 | (2) | -- | 400 | SSL | NO | BCTS |
| 7439-95-4 | Magnesium | 953 | J | 1510 | -- | mg/kg | WG-SB-41-03 | 7/7 | 1069.5-1158.8 | 1510 | (2) | -- | N/A | N/A | NO | BCTS, NUT, BBKG |
| 7439-96-5 | Manganese | 49.5 | -- | 90.4 | -- | mg/kg | WG-SB-42-04 | 7/7 | 3.21-3.48 | 90.4 | (2) | 4.10E+04 N | N/A | N/A | NO | BSL, BBKG |
| 7440-02-0 | Nickel | 7.4 | J | 10.9 | -- | mg/kg | WG-SB-42-04 | 7/7 | 8.56-9.27 | 10.9 | (2) | 4.10E+04 N | 130 | SSL | NO | BSL, BBKG |
| 7440-09-7 | Potassium | 398 | J | 786 | J | mg/kg | WG-SB-42-04 | 7/7 | 1069.5-1158.8 | 786 | (2) | -- | N/A | N/A | NO | BCTS, NUT, BBKG |
| 7782-49-2 | Selenium | 0.68 | J | 0.68 | J | mg/kg | WG-SB-42-04 | 1/7 | 1.07-1.16 | 0.68 | (2) | 1.00E+04 N | 5 | SSL | YES | ABKG |
| 7440-23-5 | Sodium | 22.1 | J | 123 | J | mg/kg | WG-SB-36-04 | 2/7 | 1069.5-1158.8 | 123 | (2) | -- | N/A | N/A | NO | BCTS, NUT, BBKG |
| 7440-28-0 | Thallium | 1.9 | J | 1.9 | J | mg/kg | WG-SB-34-03 | 1/7 | 2.14-2.32 | 1.9 | (2) | 1.40E+02 N | 0.7 | SSL | YES | ABKG |
| 7440-62-2 | Vanadium | 6.7 | J | 22.5 | -- | mg/kg | WG-SB-42-04 | 7/7 | 10.7-11.59 | 22.5 | (2) | 1.40E+04 N | 6000 | SSL | NO | BSL, BBKG |
| 7440-66-6 | Zinc | 24.7 | -- | 34.5 | -- | mg/kg | WG-SB-42-04 | 7/7 | 4.28-4.63 | 34.5 | (2) | 6.10E+05 N | 12000 | SSL | NO | BCTS, BSL, BBKG |

(1) Minimum/maximum detected concentration

(2) Background values from WG-SB-40-04. See Appendix C.

(3) U.S. EPA Region III, 1998, Risk-Based Concentration Table, Soil Industrial RBCs
(Cancer benchmark value = 1E-06, HQ = 1.0)

(4) Soil Screening Levels Migration to Groundwater 20 DAF (mg/kg)

(5) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Above Background Levels (ABKG)
Above CTS (ACTS)

Deletion Reason: Infrequent Detection (IFD)
Below Background Levels (BBKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)
Below CTS (BCTS)

Definitions:
N/A = Not Applicable
CRQL = Contract Required Quantitation Limit
CRDL = Contract Required Detection Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
RBC = Risk-Based Concentration
CTS = Concentration - Toxicity Screen (See Appendix C)
E = Estimated Value
J = Estimated Value, compound present below CRQL but above IDL
C = Carcinogenic
N = Non-Carcinogenic

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TABLE 3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Benzo(a)Anthracene | mg/kg | N/A | N/A | 1.7E-01 | J | mg/kg | 1.7E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Benzo(a)Pyrene | mg/kg | N/A | N/A | 1.7E-01 | J | mg/kg | 1.7E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Aroclor-1248 | mg/kg | N/A | N/A | 2.8E-02 | J | mg/kg | 2.8E-02 | Max | Site-Specific | N/A | N/A | N/A |
| Selenium | mg/kg | N/A | N/A | 6.8E-01 | J | mg/kg | 6.8E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Thallium | mg/kg | N/A | N/A | 1.9E+00 | J | mg/kg | 1.9E+00 | Max | Site-Specific | N/A | N/A | N/A |

N/A = Not Applicable

For duplicate sample results, the maximum value was used.

Statistics: Maximum Detected Value (Max)

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TABLE 3.2
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: GGM

| Chemical of Potential Concern | Units | Arithmetic Mean | 95% UCL of Normal Data | Maximum Detected Concentration | Maximum Qualifier | EPC Units | Reasonable Maximum Exposure | | | Central Tendency | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale | Medium EPC Value | Medium EPC Statistic | Medium EPC Rationale |
| Benzo(a)Anthracene | mg/kg | N/A | N/A | 1.7E-01 | J | mg/kg | 1.7E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Benzo(a)Pyrene | mg/kg | N/A | N/A | 1.7E-01 | J | mg/kg | 1.7E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Aroclor-1248 | mg/kg | N/A | N/A | 2.8E-02 | J | mg/kg | 2.8E-02 | Max | Site-Specific | N/A | N/A | N/A |
| Selenium | mg/kg | N/A | N/A | 6.8E-01 | J | mg/kg | 6.8E-01 | Max | Site-Specific | N/A | N/A | N/A |
| Thallium | mg/kg | N/A | N/A | 1.9E+00 | J | mg/kg | 1.9E+00 | Max | Site-Specific | N/A | N/A | N/A |

N/A = Not Applicable

For duplicate sample results, the maximum value was used.

Statistics: Maximum Detected Value (Max)

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TABLE 4 1

VALUES USED FOR DAILY INTAKE CALCULATIONS

GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Ingestion | CS | Chemical Concentration in Soil | mg/kg | See Table 3 | See Table 3 | -- | -- | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | CF1 | Conversion Factor 1 | kg/mg | 1.00E-06 | -- | -- | -- | CS x CF1 x IR-S x FI x EF x ED x 1/BW x 1/AT |
| | IR-S | Ingestion Rate of Soil | mg/day | 480 | EPA, 1997a | -- | -- | |
| | FI | Fraction Ingested | -- | 1 | -- | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |
| | BW | Body Weight | kg | 70 | EPA, 1997a | -- | -- | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | -- | -- | -- | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | -- | -- | -- | |
| Dermal | CS | Chemical Concentration in Soil | mg/kg | See Table 3 | See Table 3 | -- | -- | CDI (mg/kg-day) = |
| | CF1 | Conversion Factor 1 | kg/mg | 1.00E-06 | -- | -- | -- | CS x CF1 x SSAF x DABS x SA x EF x ED x 1/BW x 1/AT |
| | SSAF | Soil to Skin Adherence Factor | $mg/cm^2$ | 1 | EPA, 1997a | -- | -- | |
| | DABS | Dermal Absorption Factor (Solid) | -- | [2] | EPA, 1996a | -- | -- | |
| | SA | Skin Surface Area Available for Contact | $cm^2$/event | 2570 | EPA, 1997a | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |
| | BW | Body Weight | kg | 70 | EPA, 1997a | -- | -- | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | -- | -- | -- | |
| | AT-C | Averaging Time (Cancer) | days | 25550 | -- | -- | -- | |

[1] Professional Judgement

[2] 0 14 for Aroclor 1248

Sources:

USEPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1. Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285 6-03

USEPA, 1996a: PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures. EPA/600/P-96/001F. Washington, DC. Office of Research and Development, National Center for Environmental Assessment.

USEPA, 1997a: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

TABLE 4.2

VALUES USED FOR DAILY INTAKE CALCULATIONS

GENERAL GAS MANTLE

| |
|---|
| Scenario Timeframe: Future |
| Medium: Soil |
| Exposure Medium: Particulates |
| Exposure Point: GGM |
| Receptor Population: Construction Worker |
| Receptor Age: Adult |

| Exposure Route | Parameter Code | Parameter Definition | Units | RME Value | RME Rationale/ Reference | CT Value | CT Rationale/ Reference | Intake Equation/ Model Name |
|---|---|---|---|---|---|---|---|---|
| Inhalation | CS | Chemical Concentration in Soil | mg/kg | See Table 3 | See Table 3 | -- | -- | Chronic Daily Intake (CDI) (mg/kg-day) = |
| | PEF | Particulate Emission Factor | $kg/m^3$ | 5.21E-06 | See Appendix C | -- | -- | CA x PEF x IN x ET x EF x ED x 1/BW x 1/AT |
| | IN | Inhalation Rate | $m^3$/hour | 2.3 | EPA, 1991 | -- | -- | |
| | ET | Exposure Time | hours/day | 8 | [1] | -- | -- | |
| | EF | Exposure Frequency | days/year | 60 | [1] | -- | -- | |
| | ED | Exposure Duration | years | 1 | [1] | -- | -- | |
| | BW | Body Weight | kg | 70 | EPA, 1997a | -- | -- | |
| | AT-N | Averaging Time (Non-Cancer) | days | 365 | -- | -- | -- | |
| | AT-C | Averaging Time (Cancer) | days | 25,550 | -- | -- | -- | |

[1] Professional Judgement.

Sources:

EPA, 1991: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER. Directive 9285.6-03.

EPA, 1997a: Exposure Factors Handbook. OHEA. EPA/600/P-95/002Fa.

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

GENERAL GAS MANTLE

| Chemical of Potential Concern | Chronic/ Subchronic | Value Inhalation RfC | Units | Adjusted Inhalation RfD | Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of RfC:RfD: Target Organ | Dates (1) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)Anthracene | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Benzo(a)Pyrene | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Aroclor-1248 | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Selenium | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Thallium | Chronic | NA | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

NA = Not Available

N/A = Not Applicable

(1) IRIS searched 7/20/98

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TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

GENERAL GAS MANTLE

| Chemical of Potential Concern | Chronic/ Subchronic | Oral RfD Value | Oral RfD Units | Oral to Dermal Adjustment Factor (1) | Adjusted Dermal RfD (2) | Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of RfD: Target Organ | Dates of RfD: Target Organ (3) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|---|---|
| Benzo(a)Anthracene | Chronic | NA | mg/kg-day | N/A | N/A | N/A | N/A | -- | IRIS; HEAST | 04/01/97 |
| Benzo(a)Pyrene | Chronic | NA | mg/kg-day | N/A | N/A | N/A | N/A | -- | IRIS; HEAST | 03/01/97 |
| Aroclor-1248 | Chronic | 2E-05 | mg/kg-day | 100% | 2E-05 | mg/kg-day | NOEL | -- | IRIS; HEAST | 03/01/97 |
| Selenium | Chronic | 5E-03 | mg/kg-day | N/A | N/A | N/A | Liver | 3 | IRIS | 03/01/97 |
| Thallium | Chronic | 8E-05 | mg/kg-day | N/A | N/A | N/A | NOEL | 3000 | IRIS | 03/01/97 |

NA = Not Available

N/A = Not Applicable

(1) USEPA, 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A, Interim Final. EPA/540/1-89/002, Office of Emergency and Remedial Response, Washington, DC.

(2) Oral RfD x Oral to Dermal Adjustment Factor = Adjusted Dermal RfD

(3) IRIS searched 7/20/98

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

GENERAL GAS MANTLE

| Chemical of Potential Concern | Chronic/ Subchronic | Value | Units | Primary Target Organ | Combined Uncertainty/Modifying Factors | Sources of Primary Target Organ | Date (MM/DD/YY) |
|---|---|---|---|---|---|---|---|
| -- | -- | -- | -- | -- | -- | -- | -- |

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TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

GENERAL GAS MANTLE

| Chemical of Potential Concern | Oral Cancer Slope Factor | Oral to Dermal Adjustment Factor | Adjusted Dermal Cancer Slope Factor (1) | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (2) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|
| Benzo(a)Anthracene | 7.30E-01 | N/A | N/A | (mg/kg-day)$^{-1}$ | B2 | IRIS | 04/01/97 |
| Benzo(a)Pyrene | 7.30E+00 | N/A | N/A | (mg/kg-day)$^{-1}$ | B2 | IRIS | 03/01/97 |
| Aroclor-1248 | 2.00E+00 | 100% | 2.00E+00 | (mg/kg-day)$^{-1}$ | -- | IRIS; HEAST | 03/01/97 |
| Selenium | NA | N/A | N/A | N/A | D | IRIS | 03/01/97 |
| Thallium | NA | N/A | N/A | N/A | D | IRIS | 03/01/97 |

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

NA = Not Available

N/A = Not Applicable

(1) OSF / Oral ABS = Adjusted Dermal Cancer Slope Factor

(2) IRIS searched 7/20/98

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

300930

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

GENERAL GAS MANTLE

| Chemical of Potential Concern | Unit Risk | Units | Adjustment | Inhalation Cancer Slope Factor | Units | Weight of Evidence/ Cancer Guideline Description | Source | Date (1) (MM/DD/YY) |
|---|---|---|---|---|---|---|---|---|
| Benzo(a)Anthracene | NA | N/A | N/A | NA | N/A | N/A | N/A | N/A |
| Benzo(a)Pyrene | NA | N/A | N/A | NA | N/A | N/A | N/A | N/A |
| Aroclor-1248 | NA | N/A | N/A | 2.00E+00 | $(mg/kg\text{-}day)^{-1}$ | B2 | IRIS | 03/01/97 |
| Selenium | NA | N/A | N/A | NA | N/A | N/A | N/A | N/A |
| Thallium | NA | N/A | N/A | NA | N/A | N/A | N/A | N/A |

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

NA = Not Available

N/A = Not Applicable

(1) IRIS searched 7/20/98

EPA Group:

A - Human carcinogen

B1 - Probable human carcinogen - indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

TABLE 6.3

CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

GENERAL GAS MANTLE

| Chemical of Potential Concern | Value | Units | Source | Date MM/DD/YY |
|---|---|---|---|---|
| -- | -- | -- | -- | -- |

300833

TABLE 7.1.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Hazard Calculation (1) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Benzo(a)Anthracene | 1.70E-01 | mg/kg | 1.70E-01 | mg/kg | M | 1.9E-07 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 1.70E-01 | mg/kg | 1.70E-01 | mg/kg | M | 1.9E-07 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 2.80E-02 | mg/kg | 2.80E-02 | mg/kg | M | 3.2E-08 | mg/kg-day | 2.0E-05 | mg/kg-day | N/A | N/A | 2E-03 |
| | Selenium | 6.80E-01 | mg/kg | 6.80E-01 | mg/kg | M | 7.7E-07 | mg/kg-day | 5.0E-03 | mg/kg-day | N/A | N/A | 2E-04 |
| | Thallium | 1.90E+00 | mg/kg | 1.90E+00 | mg/kg | M | 2.1E-06 | mg/kg-day | 8.0E-05 | mg/kg-day | N/A | N/A | 3E-02 |
| | (Total) | | | | | | | | | | | | 3E-02 |
| Dermal | Benzo(a)Anthracene | 1.70E-01 | mg/kg | 1.70E-01 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 1.70E-01 | mg/kg | 1.70E-01 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 2.80E-02 | mg/kg | 2.80E-02 | mg/kg | M | 2.4E-08 | mg/kg-day | 2.0E-05 | mg/kg-day | N/A | N/A | 1E-03 |
| | Selenium | 6.80E-01 | mg/kg | 6.80E-01 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | Thallium | 1.90E+00 | mg/kg | 1.90E+00 | mg/kg | M | N/A | N/A | N/A | N/A | N/A | N/A | No Tox Data |
| | (Total) | | | | | | | | | | | | 1E-03 |
| | | | | | | | | | | | | Total Hazard Index Across All Exposure Routes/Pathways | 3E-02 |

(1) M = Medium-Specific

300823

TABLE 7.2.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value (1) | Route EPC Units | EPC Selected for Hazard Calculation (2) | Intake (Non-Cancer) | Intake (Non-Cancer) Units | Reference Dose | Reference Dose Units | Reference Concentration | Reference Concentration Units | Hazard Quotient |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Benzo(a)Anthracene | 1.70E-01 | mg/kg | 8.86E-07 | mg/m$^3$ | R | 3.8E-08 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 1.70E-01 | mg/kg | 8.86E-07 | mg/m$^3$ | R | 3.8E-08 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 2.80E-02 | mg/kg | 1.46E-07 | mg/m$^3$ | R | 6.3E-09 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Selenium | 6.80E-01 | mg/kg | 3.54E-06 | mg/m$^3$ | R | 1.5E-07 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | Thallium | 1.90E+00 | mg/kg | 9.90E-06 | mg/m$^3$ | R | 4.3E-07 | mg/kg-day | N/A | N/A | N/A | N/A | No Tox Data |
| | (Total) | | | | | | | | | | | | -- |

Total Hazard Index Across All Exposure Routes/Pathways: --

(1) See respirable particulates model in Appendix C.
(1) R = Route-Specific

300224

TABLE 8.1.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ingestion | Benzo(a)Anthracene | 1.70E-01 | mg/kg | 1.70E-01 | mg/kg | M | 2.7E-09 | mg/kg-day | 7.30E-01 | $(mg/kg\text{-}day)^{-1}$ | 2E-09 |
| - | Benzo(a)Pyrene | 1.70E-01 | mg/kg | 1.70E-01 | mg/kg | M | 2.7E-09 | mg/kg-day | 7.30E+00 | $(mg/kg\text{-}day)^{-1}$ | 2E-08 |
| | Aroclor-1248 | 2.80E-02 | mg/kg | 2.80E-02 | mg/kg | M | 4.5E-10 | mg/kg-day | 2.00E+00 | $(mg/kg\text{-}day)^{-1}$ | 9E-10 |
| | Selenium | 6.80E-01 | mg/kg | 6.80E-01 | mg/kg | M | N/A | N/A | N/A | N/A | |
| | Thallium | 1.90E+00 | mg/kg | 1.90E+00 | mg/kg | M | N/A | N/A | N/A | N/A | |
| | (Total) | | | | | | | | | | 2E-08 |
| Dermal | Benzo(a)Anthracene | 1.70E-01 | mg/kg | 1.70E-01 | mg/kg | M | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 1.70E-01 | mg/kg | 1.70E-01 | mg/kg | M | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 2.80E-02 | mg/kg | 2.80E-02 | mg/kg | M | 3.4E-10 | mg/kg-day | 2.00E+00 | $(mg/kg\text{-}day)^{-1}$ | 7E-10 |
| | Selenium | 6.80E-01 | mg/kg | 6.80E-01 | mg/kg | M | N/A | N/A | N/A | N/A | |
| | Thallium | 1.90E+00 | mg/kg | 1.90E+00 | mg/kg | M | N/A | N/A | N/A | N/A | |
| | (Total) | | | | | | | | | | 7E-10 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 2E-08 |

(1) M = Medium-Specific

TABLE 8.2.RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
GENERAL GAS MANTLE

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: GGM
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Chemical of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value (1) | Route EPC Units | EPC Selected for Risk Calculation (2) | Intake (Cancer) | Intake (Cancer) Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Benzo(a)Anthracene | 1.70E-01 | mg/kg | 8.86E-07 | $mg/m^3$ | R | N/A | N/A | N/A | N/A | No Tox Data |
| | Benzo(a)Pyrene | 1.70E-01 | mg/kg | 8.86E-07 | $mg/m^3$ | R | N/A | N/A | N/A | N/A | No Tox Data |
| | Aroclor-1248 | 2.80E-02 | mg/kg | 1.46E-07 | $mg/m^3$ | R | 9.0E-11 | mg/kg-day | 2.00E+00 | $(mg/kg\text{-}day)^{-1}$ | 2E-10 |
| | Selenium | 6.80E-01 | mg/kg | 3.54E-06 | $mg/m^3$ | R | N/A | N/A | N/A | N/A | |
| | Thallium | 1.90E+00 | mg/kg | 9.90E-06 | $mg/m^3$ | R | N/A | mg/kg-day | N/A | N/A | |
| | (Total) | | | | | | | | | | 2E-10 |
| | | | | | | | | | | Total Risk Across All Exposure Routes/Pathways | 2E-10 |

(1) See respirable particulates model in Appendix C.
(1) R = Route-Specific

300826

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

GENERAL GAS MANTLE

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Soil | GGM | Benzo(a)Anthracene | 2E-09 | -- | No Tox Data | 2E-09 | Benzo(a)Anthracene | N/A | No Tox Data | -- | No Tox Data | -- |
| | | | Benzo(a)Pyrene | 2E-08 | -- | No Tox Data | 2E-08 | Benzo(a)Pyrene | N/A | No Tox Data | -- | No Tox Data | -- |
| | | | Aroclor-1248 | 9E-10 | -- | 7E-10 | 2E-09 | Aroclor-1248 | N/A | 2E-03 | -- | 1E-03 | 3E-03 |
| | | | Selenium | | -- | | -- | Selenium | Liver | 2E-04 | -- | No Tox Data | 2E-04 |
| | | | Thallium | | -- | | -- | Thallium | N/A | 3E-02 | -- | No Tox Data | -- |
| | | | (Total) | 2E-08 | -- | 7E-10 | 2E-08 | (Total) | | 3E-02 | 0E+00 | 1E-03 | 3E-02 |
| | Particulates | GGM | Benzo(a)Anthracene | -- | No Tox Data | -- | -- | Benzo(a)Anthracene | N/A | -- | No Tox Data | -- | -- |
| | | | Benzo(a)Pyrene | -- | No Tox Data | -- | -- | Benzo(a)Pyrene | N/A | -- | No Tox Data | -- | -- |
| | | | Aroclor-1248 | -- | 2E-10 | -- | 2E-10 | Aroclor-1248 | N/A | -- | No Tox Data | -- | -- |
| | | | Selenium | -- | | -- | -- | Selenium | N/A | -- | No Tox Data | -- | -- |
| | | | Thallium | -- | | -- | -- | Thallium | N/A | -- | No Tox Data | -- | -- |
| | | | (Total) | -- | 2E-10 | -- | 2E-10 | (Total) | | -- | -- | -- | -- |

*Total Risk Across Soil* 2E-08

Total Risk Across All Media and All Exposure Routes 2E-08

*Total Hazard Index Across All Media and All Exposure Routes* 3E-02

Total Liver HI = 2E-04

300837

1/7/99

TABLE 10.1.RME

RISK ASSESSMENT SUMMARY

GENERAL GAS MANTLE

Scenario Timeframe: Future
Receptor Population: Construction Worker
Receptor Age: Adult

| Medium | Exposure Medium | Exposure Point | Chemical | Carcinogenic Risk | | | | Chemical | Non-Carcinogenic Hazard Quotient | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ingestion | Inhalation | Dermal | Exposure Routes Total | | Primary Target Organ | Ingestion | Inhalation | Dermal | Exposure Routes Total |
| Soil | Soil | Holt Cargo | Benzo(a)Anthracene | 2E-09 | -- | No Tox Data | 2E-09 | Aroclor-1248 | N/A | 2E-03 | -- | 1E-03 | 3E-03 |
| | | | Benzo(a)Pyrene | 2E-08 | -- | No Tox Data | 2E-08 | Selenium | Liver | 2E-04 | -- | No Tox Data | 2E-04 |
| | | | Aroclor-1248 | 9E-10 | -- | 7E-10 | 2E-09 | | | | | | |
| | | | Selenium | | -- | | -- | | | | | | |
| | | | Thallium | | -- | | -- | | | | | | |
| | | | (Total) | 2E-08 | -- | 7E-10 | 2E-08 | (Total) | | 2E-03 | -- | 1E-03 | 3E-03 |
| | Particulates | | Benzo(a)Anthracene | -- | No Tox Data | -- | -- | | | -- | -- | -- | -- |
| | | | Benzo(a)Pyrene | -- | No Tox Data | -- | -- | | | -- | -- | -- | -- |
| | | | Aroclor-1248 | -- | 2E-10 | -- | 2E-10 | | | -- | -- | -- | -- |
| | | | Selenium | -- | | -- | -- | | | -- | -- | -- | -- |
| | | | Thallium | -- | | -- | -- | | | -- | -- | -- | -- |
| | | | (Total) | -- | 2E-10 | -- | 2E-10 | (Total) | | -- | -- | -- | -- |

Total Risk Across Soil: 2E-08

Total Risk Across All Media and All Exposure Routes: 2E-08

Total Hazard Index Across All Media and All Exposure Routes: 3E-03

Total Liver HI = 2E-04

**DATA USEABILITY WORKSHEET**
**Site: Welsbach/General Gas Mantle**
**Medium: Soil - Radiological**

| Requirement | Comment |
|---|---|
| **Field Sampling** | |
| Discuss sampling problems and field conditions that affect data useability. | None. |
| Are samples representative of receptor exposure for this medium (e.g., sample depth, grab vs. composite, filtered vs. unfiltered, low flow, etc.)? | Yes. |
| Assess the effect of field QC results on data useability. | In general, the field QC results did not affect data useability. |
| Summarize the effect of field sampling issues on the risk assessment, if applicable. | NA |
| **Analytical Techniques** | |
| Were the analytical methods appropriate for quantitative risk assessment? | Yes. |
| Were detection limits adequate? | In general, the detection limits were adequate. In a few instances, the MDCs were elevated (i.e., > 0.3 pCi/g). |
| Summarize the effect of analytical technique issues on the risk assessment, if applicable. | NA |

**DATA USEABILITY WORKSHEET (continued)**
**Site: Welsbach/General Gas Mantle**
**Medium: Soil - Radiological**

| Requirement | Comment |
|---|---|
| **Data Quality Objectives** | |
| Precision - How were duplicates handled? | Two types of duplicates were collected; field blind duplicates and matrix spike/matrix spike duplicates (MS/MSDs). Both the field blind duplicate and MS/MSD samples were collected at a rate of one per 20 environmental samples. |
| Accuracy - How were split samples handled? | Split samples were not collected. |
| Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, COC problems, etc.). | In general, there were no recurring problems with data representativeness. |
| Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.). | In general, there were no problems with data completeness. |
| Comparability - Indicate any problems associated with data comparability. | NA |
| Were the DQOs specified in the QAPP satisfied? | Yes. |
| Summarize the effect of DQO issues on the risk assessment, if applicable. | NA |

## DATA USEABILITY WORKSHEET (continued)
## Site: Welsbach/General Gas Mantle
## Medium: Soil - Radiological

| Requirement | Comment |
|---|---|
| **Data Validation and Interpretation** | |
| What are the data validation requirements for this region? | There are no radiological validation requirements for this region. The radiological data for this project were validated using the following QC:<br><br>alpha spectroscopy-<br>1) initial calibration (yearly)<br>2) calibration verification (weekly)<br>3) detector background check (monthly)<br>4) tracer analysis<br>5) method blank and rinsate blank<br>6) laboratory control sample (LCS)<br>7) laboratory duplicate analysis<br>8) field duplicate analysis<br>9) matrix spike/matrix spike duplicate analysis<br><br>gamma spectroscopy-<br>1) initial calibration (yearly)<br>2) calibration verification (weekly)<br>3) detector background check (monthly)<br>4) method blank and rinsate blank<br>5) laboratory duplicate analysis<br>6) field duplicate analysis<br>7) percent dead time<br>8) photopeaks/reference library |
| What method or guidance was used to validate the data? | There are no regional data validation guidelines. Therefore, the validation requirements were specified in the site-specific Quality Assurance Project Plan (QAPP). |
| Was the data validation method consistent with regional guidance? Discuss any discrepancies. | NA |
| Were all data qualifiers defined? Discuss those which were not. | Yes. |

**DATA USEABILITY WORKSHEET (continued)**
**Site: Welsbach/General Gas Mantle**
**Medium: Soil - Radiological**

| Requirement | Comment |
|---|---|
| Which qualifiers represent usable data? | All data except rejected "R" data are useable. |
| Which qualifiers represent unusable data? | "R". |
| How are tentatively identified compounds handled? | NA |
| Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable. | Any data that is qualified as rejected "R" is not used in the risk assessment. |
| Additional notes: | |

## DATA USEABILITY WORKSHEET
## Site: Welsbach/General Gas Mantle
## Medium: Soil - Chemical

| Requirement | Comment |
|---|---|
| **Field Sampling** | |
| Discuss sampling problems and field conditions that affect data useability. | None. |
| Are samples representative of receptor exposure for this medium (e.g., sample depth, grab vs. composite, filtered vs. unfiltered, low flow, etc.)? | Yes. |
| Assess the effect of field QC results on data useability. | In general, the field QC results did not affect data useability. In some instances, the rinsate blanks had contamination; however, the majority of the contaminants were common laboratory contaminants (e.g., methylene chloride). Therefore, rinsate blanks had only a very minor effect on the data. |
| Summarize the effect of field sampling issues on the risk assessment, if applicable. | NA |
| **Analytical Techniques** | |
| Were the analytical methods appropriate for quantitative risk assessment? | Yes. |
| Were detection limits adequate? | In general, the detection limits were adequate. In a few instances, some sample fractions were excessively diluted which resulted in high detection limits. |
| Summarize the effect of analytical technique issues on the risk assessment, if applicable. | NA |

**DATA USEABILITY WORKSHEET (continued)**
**Site: Welsbach/General Gas Mantle**
**Medium: Soil - Chemical**

| Requirement | Comment |
|---|---|
| **Data Quality Objectives** | |
| Precision - How were duplicates handled? | Two types of duplicates were collected; field blind duplicates and matrix spike/matrix spike duplicates (MS/MSDs) (organics)/matrix spike/matrix duplicates (MS/MDs) (inorganics). Both the field blind duplicate and MS/MSD/MS/MD samples were collected at a rate of one per 20 environmental samples. |
| Accuracy - How were split samples handled? | Split samples were not collected. |
| Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, COC problems, etc.). | In general, there were no recurring problems with data representativeness. In some instances, there was contamination detected in the trip and rinsate blanks; however, this did not seriously affect the data. |
| Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.). | In general, there were no problems with data representativeness. |
| Comparability - Indicate any problems associated with data comparability. | NA |
| Were the DQOs specified in the QAPP satisfied? | Yes. |

## DATA USEABILITY WORKSHEET (continued)
## Site: Welsbach/General Gas Mantle
## Medium: Soil - Chemical

| Requirement | Comment |
|---|---|
| Summarize the effect of DQO issues on the risk assessment, if applicable. | NA |
| **Data Validation and Interpretation** | |
| What are the data validation requirements for this region? | Organic: The organic data were analyzed following USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) OLM03.2. They were validated following USEPA CLP National Functional Guidelines for Organic Data Review, Multi-Media, Multi-Concentration (OLM01.0) and Low Concentration Water, December 1990, Revised June 1991, for data prepared under USEPA CLP SOW for Organic Analysis Multi-Media, Multi-Concentration, Doc. No. OLM03.2, or most recent and USEPA Region II Standard Operating Procedures and Checklists for Organic Analysis (SOP HW-6, Revision 11 of 6/96).<br><br>Inorganic: The inorganic data were analyzed following USEPA CLP SOW ILM04.0. They were validated following Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analysis, October 1989 Revision for Data Prepared Under USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, Doc. No. ILM04.0, or most recent and USEPA Region II Standard Operating Procedures and Checklists for Inorganic Analysis (SOP HW-2, Revision 11 of 1/92). |
| What method or guidance was used to validate the data? | The validation requirements described above were used to validate the data. |
| Was the data validation method consistent with regional guidance? Discuss any discrepancies. | Yes. |

**DATA USEABILITY WORKSHEET (continued)**
**Site: Welsbach/General Gas Mantle**
**Medium: Soil - Chemical**

| Requirement | Comment |
|---|---|
| Were all data qualifiers defined? Discuss those which were not. | Yes, they are defined in CLP SOWs described above. |
| Which qualifiers represent useable data? | All data except rejected "R" data are useable. |
| Which qualifiers represent unuseable data? | "R". |
| How are tentatively identified compounds handled? | Any tentatively identified compounds (TICs) that are detected in the blanks or are instrument artifacts are rejected "R". For the remaining TICs, all calculations and spectra are reviewed. Non-identified TICs are qualified as both estimated "J" and tentatively identified "N". |
| Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable. | Any data that is qualified as rejected "R" is not used in the risk assessment. |
| Additional notes:<br><br>Why were the Semi-Volatile, Pesticide/PCBs, and Inorganic fractions of sample WG-SB-18-04 and the Pesticide/PCBs and Inorganic fractions of sample WG-SB-18-05 not analyzed, respectively?<br><br>Why were certain Semi-Volatile Organic compounds qualified as rejected ("R") in the data results for sample WG-SB-18-05? | <br><br>The fractions were not analyzed due to insufficient sample volume.<br><br>The compounds were rejected since the chemical analysis did not pass USEPA QA/QC due to low surrogate recoveries. |

ATSDR ToxFAQs

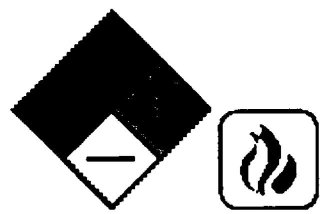
# Antimony

CAS# 7440-36-0

September 1995

**Antimony**
Sb
GIF Image
XYZ File

Search ChemFinder



NFPA Label Key

Material Safety Data Sheet
(University of Utah)

## Agency for Toxic Substances and Disease Registry

***This fact sheet answers the most frequently asked health questions about antimony. For more information, you may call the ATSDR Information Center at 1-800-447-1544. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.***

**SUMMARY:** Exposure to antimony occurs in the workplace or from skin contact with soil at hazardous waste sites. Breathing high levels of antimony for a long time can irritate the eyes and lungs, and can cause problems with the lungs, heart, and stomach. This chemical has been found in at least 403 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

### What is antimony?
### (Pronounced an'ti-mo-nee)

Antimony is a silvery-white metal that is found in the earth's crust. Antimony ores are mined and then mixed with other metals to form antimony alloys or combined with oxygen to form antimony oxide.

Little antimony is currently mined in the United States. It is brought into this country from other countries for processing. However, there are companies in the United States that produce antimony as a by-product of smelting lead and other metals.

Antimony isn't used alone because it breaks easily, but when mixed into alloys, it is used in lead storage batteries, solder, sheet and pipe metal, bearings, castings, and pewter. Antimony oxide is added to

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textiles and plastics to prevent them from catching fire. It is also used in paints, ceramics, and fireworks, and as enamels for plastics, metal, and glass.

### What happens to antimony when it enters the environment?

- Antimony is released to the environment from natural sources and from industry.
- In the air, antimony is attached to very small particles that may stay in the air for many days.
- Most antimony ends up in soil, where it attaches strongly to particles that contain iron, manganese, or aluminum.
- Antimony is found at low levels in some rivers, lakes, and streams.

### How might I be exposed to antimony?

- Because antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air.
- It may be found in air near industries that process or release it, such as smelters, coal-fired plants, and refuse incinerators.
- In polluted areas containing high levels of antimony, it may be found in the air, water, and soil.
- Workers in industries that process it or use antimony ore may be exposed to higher levels.

### How can antimony affect my health?

Exposure to antimony at high levels can result in a variety of adverse health effects.

Breathing high levels for a long time can irritate your eyes and lungs and can cause heart and lung problems, stomach pain, diarrhea, vomiting, and stomach ulcers.

In short-term studies, animals that breathed very high levels of antimony died. Animals that breathed high levels had lung, heart, liver, and kidney damage. In long-term studies, animals that breathed very low levels of antimony had eye irritation, hair loss, lung damage, and heart problems. Problems with fertility were also noted. In animal studies, problems with fertility have been seen when rats breathed very high levels of antimony for a few months.

Ingesting large doses of antimony can cause vomiting. We don't know what other effects may be caused by ingesting it. Long-term animal studies have reported liver damage and blood changes when animals ingested antimony. Antimony can irritate the skin if it is left on it.

Antimony can have beneficial effects when used for medical reasons. It has been used as a medicine to treat people infected with parasites.

### How likely is antimony to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified antimony as to its human carcinogenicity.

Lung cancer has been observed in some studies of rats that breathed high levels of antimony. No human studies are available. We don't know whether antimony will cause cancer in people.

### Is there a medical test to show whether I've been exposed to antimony?

Tests are available to measure antimony levels in the body. Antimony can be measured in the urine, feces, and blood for several days after exposure. However, these tests cannot tell you how much antimony you have been exposed to or whether you will experience any health effects. Some tests are not usually performed in most doctors' offices and may require special equipment to conduct them.

### Has the federal government made recommendations to protect human health?

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The EPA allows 0.006 parts of antimony per million parts of drinking water (0.006 ppm). The EPA requires that discharges or spills into the environment of 5,000 pounds or more of antimony be reported.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 0.5 milligrams of antimony per cubic meter of air (0.5 $mg/m^3$) for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) currently recommend the same guidelines for the workplace as OSHA.

**Glossary**

Carcinogenicity:
Ability to cause cancer.
Ingestion:
Taking food or drink into your body.
Long-term:
Lasting one year or more.
Milligram (mg):
One thousandth of a gram.
Parasite:
An organism living in or on another organism.
PPM:
Parts per million.
Short-term:
Lasting 14 days or less.

**References**

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for antimony. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?**

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

**For more information, contact:**

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333
Phone: 1-800-447-1544
FAX: 404-639-6315

**U.S. Department of Health and Human Services**
**Public Health Service**
**Agency for Toxic Substances and Disease Registry**

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Last Update: September 1, 1995

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ATSDR ToxFAQs

# Arsenic

CAS# 7440-38-2

April 1993

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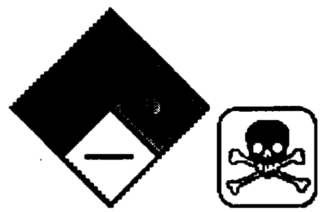
**Arsenic**
As
GIF Image
XYZ File

Search ChemFinder



NFPA Label Key

Material Safety Data Sheet
(University of Utah)

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## Agency for Toxic Substances and Disease Registry

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***This fact sheet answers the most frequently asked health questions about arsenic. For more information, you may call the ATSDR Information Center at 1-800-447-1544. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.***

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**SUMMARY:** Exposure to higher than average levels of arsenic happens mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. Arsenic is a powerful poison. At high levels, it can cause death or illness. This chemical has been found in at least 781 of 1.300 National Priorities List sites identified by the Environmental Protection Agency.

### What is arsenic?
### (Pronounced ar' se-nik)

Arsenic is found in nature at low levels. It's mostly in compounds with oxygen, chlorine, and sulfur. These are called inorganic arsenic compounds. Arsenic in plants and animals combines with carbon and hydrogen. This is called organic arsenic. Organic arsenic is usually less harmful than inorganic arsenic.

Most arsenic compounds have no smell or special taste.

Inorganic arsenic compounds are mainly used to preserve wood. They are also used to make insecticides and weed killers. You can check the labels of treated wood and insecticides to see if they contain arsenic.

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Copper and lead ores contain small amounts of arsenic.

**What happens to arsenic when it enters the environment?**

- It doesn't evaporate.
- Most arsenic compounds can dissolve in water.
- It gets into air when contaminated materials are burned.
- It settles from the air to the ground.
- It doesn't break down, but can change from one form to another.
- Fish and shellfish build up organic arsenic in their tissues, but most of the arsenic in fish isn't toxic.

**How might I be exposed to arsenic?**

- Breathing sawdust or burning smoke from wood containing arsenic
- Breathing workplace air
- Ingesting contaminated water, soil, or air at waste sites
- Ingesting contaminated water, soil, or air near areas naturally high in arsenic

**How can arsenic affect my health?**

Inorganic arsenic is a human poison. Organic arsenic is less harmful.

**High levels** of inorganic arsenic in food or water can be fatal. A high level is 60 parts of arsenic per million parts of food or water (60 ppm). Arsenic damages many tissues including nerves, stomach and intestines, and skin. Breathing high levels can give you a sore throat and irritated lungs.

**Lower levels** of exposure to inorganic arsenic may cause:

- Nausea, vomiting, and diarrhea
- Decreased production of red and white blood cells
- Abnormal heart rhythm
- Blood vessel damage
- A "pins and needles" sensation in hands and feet

**Long term exposure** to inorganic arsenic may lead to a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

**Direct skin contact** may cause redness and swelling,

**How likely is arsenic to cause cancer?**

The Department of Health and Human Services (DHHS) has determined that arsenic is a known carcinogen. Breathing inorganic arsenic increases the risk of lung cancer. Ingesting inorganic arsenic increases the risk of skin cancer and tumors of the bladder, kidney, liver, and lung.

**Is there a medical test to show whether I've been exposed to arsenic?**

Tests can measure your exposure to high levels of arsenic. These tests are not routinely performed in a doctor's office.

Arsenic can be measured in your urine. This is the most reliable test for arsenic exposure. Since arsenic stays in the body only short time, you must have the test soon after exposure.

Tests on hair or fingernails can measure your exposure to highlevels of arsenic over the past 6-12 months. These tests are not very useful for low level exposures.

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These tests do not predict whether you will have any harmful health effects.

**Has the federal government made recommendations to protect human health?**

**The Environmental Protection Agency** (EPA) sets limits on the amount of arsenic that industrial sources can release. It restricted or canceled many uses of arsenic in pesticides and may restrict more. EPA set a limit of 0.05 parts per million (ppm) for arsenic in drinking water. EPA may lower this further.

**The Occupational Safety and Health Administration** (OSHA) established a maximum permissible exposure limit for workplace airborne arsenic of 10 micrograms per cubic meter ($\mu g/m^3$).

**Glossary**

Carcinogen:
: Substance that can cause cancer.

Ingesting:
: Taking food or drink into your body.

PPM:
: Parts per million.

Microgram ($\mu g$):
: One millionth of a gram.

**References**

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Toxicological profile for arsenic. Atlanta: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1993. Case studies in environmental medicine: Arsenic toxicity. Atlanta: U.S. Department of Health and Human Services, Public Health Service.

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**Where can I get more information?**

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns. For more information, contact:

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FAX: 404-639-6315

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ATSDR ToxFAQs

# Polycyclic Aromatic Hydrocarbons (PAHs)

CAS# 130498-29-2

September 1996

**Polycyclic Aromatic Hydrocarbons**
There is no molecular representation since this substance is a mixture of many compounds.

Search ChemFinder

## Agency for Toxic Substances and Disease Registry

***This fact sheet answers the most frequently asked health questions about polycyclic aromatic hydrocarbons. For more information, you may call the ATSDR Information Center at 1-800-447-1544. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.***

**SUMMARY:** Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

### What are polycyclic aromatic hydrocarbons?

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

### What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.

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- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

**How might I be exposed to PAHs?**

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

**How can PAHs affect my health?**

Mice that were fed **high levels** of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both **short-** and **long-term** exposure. But these effects have not been seen in people.

**How likely are PAHs to cause cancer?**

The **Department of Health and Human Services (DHHS)** has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for **long periods** of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

**Is there a medical test to show whether I've been exposed to PAHs?**

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

**Has the federal government made recommendations to protect human health?**

The **Occupational Safety and Health Administration (OSHA)** has set a limit of 0.2 milligrams of

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PAHs per cubic meter of air (0.2 mg/m$^3$). The **OSHA** Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m$^3$ averaged over an 8-hour exposure period.

The **National Institute for Occupational Safety and Health (NIOSH)** recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m$^3$ for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

**Glossary**

Carcinogen:
    A substance that can cause cancer.
Ingest:
    Take food or drink into your body.

**References**

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?**

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

**For more information, contact**

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**U.S. Department of Health and Human Services**
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ATSDR ToxFAQs

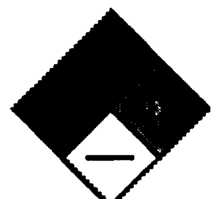
# Polychlorinated Biphenyls (PCBs)

CAS# 1336-36-3

September 1997

**Octachlorobiphenyl**
$C_{12}H_2Cl_8$
Stereo Image
XYZ File

Search ChemFinder



NFPA Label Key

## Agency for Toxic Substances and Disease Registry

***This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls (PCBs). For more information, call the ATSDR Information Center at 1-800-447-1544. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.***

**HIGHLIGHTS:** Polychlorinated biphenyls are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Polychlorinated biphenyls can cause irritation of the nose and throat, and acne and rashes. They have been shown to cause cancer in animal studies. Polychlorinated biphenyls have been found in at least 383 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

### What are polychlorinated biphenyls?

Polychlorinated biphenyls (PCBs) are a group of manufactured organic chemicals that contain 209 individual chlorinated chemicals (known as congeners). PCBs are either oily liquids or solids and are colorless to light yellow in color. They have no known smell or taste. There are no known natural sources of PCBs. Some commercial PCB mixtures are known in the United States by their industrial trade name, Aroclor.

PCBs don't burn easily and are good insulating material. They have been used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs stopped in the United States in 1977 because of evidence that they build up in the environment and cause harmful effects. Products containing PCBs are old fluorescent lighting fixtures, electrical appliances

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containing PCB capacitors, old microscope oil, and hydraulic fluids.

**What happens to PCBs when they enter the environment?**

- Before 1977, PCBs entered the air, water, and soil during their manufacture and use.
- Today, PCBs can be released into the environment from hazardous waste sites that contain PCBs, illegal or improper dumping of PCB wastes, and leaks from electrical transformers containing PCBs.
- PCBs may be carried long distances in the air; they remain in the air for approximately 10 days.
- In water, a small amount of the PCBs may remain dissolved, but most sticks to organic particles and sediments.
- PCBs in water build up in fish and marine mammals and can reach levels thousands of times higher than the levels in water.

**How might I be exposed to PCBs?**

- Using old fluorescent lighting fixtures and old appliances such as television sets and refrigerators; these may leak small amounts of PCBs into the air when they get hot during operation
- Eating food, including fish, meat and dairy products containing PCBs
- Breathing air near hazardous waste sites that contain PCBs
- Drinking PCB-contaminated well water
- Repairing or maintaining PCB transformers

**How can PCBs affect my health?**

Animal testing is sometimes necessary to find out how toxic substances might harm people or to treat those who have been exposed. Laws today protect the welfare of research animals and scientists must follow strict guidelines.

People exposed to PCBs in the air for a long time have experienced irritation of the nose and lungs, and skin irritations, such as acne and rashes.

It is not known whether PCBs may cause birth defects or reproductive problems in people. Some studies have shown that babies born to women who consumed PCB-contaminated fish had problems with their nervous systems at birth. However, it is not known whether these problems were definitely due to PCBs or other chemicals.

Animals that breathed very high levels of PCBs had liver and kidney damage, while animals that ate food with large amounts of PCBs had mild liver damage. Animals that ate food with smaller amounts of PCBs had liver, stomach, and thyroid gland injuries, and anemia, acne, and problems with their reproductive systems. Skin exposure to PCBs in animals resulted in liver, kidney, and skin damage.

**How likely are PCBs to cause cancer?**

It is not known whether PCBs causes cancer in people. In a long-term (365 days or longer) study, PCBs caused cancer of the liver in rats that ate certain PCB mixtures.

The **Department of Health and Human Services (DHHS)** has determined that PCBs may reasonably be anticipated to be carcinogens.

**Is there a medical test to show whether I've been exposed to PCBs?**

There are tests to find out if PCBs are in your blood, body fat, and breast milk. Blood tests are probably the easiest, safest, and best method for detecting recent exposures to large amounts of PCBs.

However, since all people in the industrial countries have some PCBs in their bodies, these tests can only show if you have been exposed to higher-than-normal levels of PCBs. However, these measurements cannot determine the exact amount or type of PCBs you have been exposed to or how

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long you have been exposed. In addition, they cannot predict whether you will experience any harmful health effects.

**Has the federal government made recommendations to protect human health?**

The **EPA** has set a maximum contaminant level of 0.0005 milligrams PCBs per liter of drinking water (0.0005 mg/L). The **EPA** requires that spills or accidental releases into the environment of 1 pound or more of PCBs be reported to the **EPA**.

The **Food and Drug Administration (FDA)** requires that milk, eggs, other dairy products, poultry fat, fish, shellfish, and infant foods contain not more that 0.2–3 parts of PCBs per million parts (0.2–3 ppm) of food.

**Glossary**

Carcinogen:
    A substance with the ability to cause cancer
CAS:
    Chemical Abstracts Service
Milligram (mg):
    One thousandth of a gram
PPM:
    Parts per million

**Reference**

Agency for Toxic Substances and Disease Registry. 1996. Toxicological profile for polychlorinated biphenyls (update). Atlanta, GA; U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?**

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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ATSDR ToxFAQs

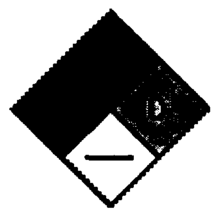
# Selenium

CAS# 7782-49-2

September 1997

**Selenium**
Se
GIF Image
XYZ File

Search ChemFinder



NFPA Label Key

Material Safety Data Sheet
(University of Utah)

## Agency for Toxic Substances and Disease Registry

***This fact sheet answers the most frequently asked health questions (FAQs) about selenium. For more information, call the ATSDR Information Center at 1-800-447-1544. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.***

**HIGHLIGHTS:** Selenium is an essential metal that helps prevent damage caused by oxygen. Most diets in the United States provide selenium at or above the daily requirement. Too much selenium can cause brittle hair, deformed nails, and loss of feeling and control in the arms and legs. Selenium has been found in at least 367 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

**What is selenium?**

Selenium is a metal commonly found in rocks and soil. In the environment, selenium is not often found in the pure form. Much of the selenium in rocks is combined with sulfide minerals or with silver, copper, lead, and nickel minerals. Selenium and oxygen combine to form several compounds.

Selenium sulfide is a bright red-yellow powder used in anti-dandruff shampoo. Industrially produced hydrogen selenide is a colorless gas with a disagreeable odor. It is probably the only selenium compound that might pose a health concern in the workplace.

Selenium dioxide is an industrially produced compound that dissolves in water to form selenious acid.

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Selenious acid can be found in gun blueing (a solution used to clean the metal parts of a gun).

**What happens to selenium when it enters the environment?**

- Small selenium particles in the air settle to the ground or are taken out of the air in rain.
- Soluble selenium compounds in agricultural fields can leave the field in irrigation drainage water.
- Selenium can collect in animals that live in water containing high levels of it.

**How might I be exposed to selenium?**

- By breathing air that contains selenium
- By eating food, drinking water, or taking dietary supplements that contain it

**How can selenium affect my health?**

People exposed to very high levels of selenium in have reported dizziness, fatigue, irritation, collection of fluid in the lungs, and severe bronchitis. The exact levels at which these effects occur are not known. Upon contact with skin, selenium compounds have caused rashes, swelling, and pain.

In the United States, selenium in most diets is usually enough to meet the daily requirement of this essential metal. In regions of China where soil levels of selenium are very low, diets lacking selenium have resulted in heart problems and muscle pain.

Selenium compounds can be harmful at daily dietary levels 5–10 times higher than the daily requirement. Accidentally swallowing a large amount of selenium (for example, a very large quantity of selenium supplement pills) could be life-threatening without immediate medical treatment.

If too much selenium is eaten over long periods of time, brittle hair and deformed nails can develop. People may also lose feeling and control in the arms and legs.

Very high amounts of selenium resulted in reproductive effects in rats and monkeys. It is not known if reproductive effects would occur in humans exposed to similar levels.

Exposure to high levels of selenium compounds caused malformations in birds, but selenium has not been shown to cause birth defects in humans or in other mammals.

**How likely is selenium to cause cancer?**

The **Department of Health and Human Services (DHHS)** has determined that selenium sulfide is reasonably anticipated to be a carcinogen. This compound has produced liver tumors in rats and mice and lung tumors in mice fed daily at very high levels.

Selenium sulfide is very different from the selenium compounds found in foods and in the environment. Selenium sulfide has not caused cancer in animals when it is placed on the skin, and the use of anti-dandruff shampoos containing selenium sulfide is considered safe.

The **EPA** believes that other selenium compounds are not classifiable with regard to their carcinogenicity. Studies of laboratory animals and people show that most selenium compounds probably do not cause cancer. In fact, studies of cancer in humans suggest that lower-than-normal selenium levels in the diet might increase the risk of cancer and studies in animals have shown that selenium has anticarcinogenic effects.

**Is there a medical test to show whether I've been exposed to selenium?**

Selenium can be measured in blood, urine, and nails of exposed individuals. However, since selenium is essential and normally present in foods, low levels are always found in body tissues and urine.

Tests are most useful for people who have recently been exposed to high levels. Urine is used to

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determine short-term exposure. Nail clippings can be used to determine longer-term exposure. These tests aren't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

### Has the federal government made recommendations to protect human health?

The **EPA** maximum contaminant level (MCL) for selenium in drinking water is 50 parts of selenium per billion parts of water (50 ppb). The **Occupational Safety and Health Administration (OSHA)** exposure limit for selenium compounds in workplace air is 0.2 milligrams of selenium per cubic meter of air (0.2 mg/m$^3$) for an 8-hour day over a 40-hour workweek.

### Glossary

Anticarcinogenic:
: The ability to prevent cancer

Carcinogen:
: A substance with the ability to cause cancer

CAS:
: Chemical Abstracts Service

### Source of Information

This ToxFAQs information is taken from the 1996 Toxicological Profile for Selenium produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Animal testing is sometimes necessary to find out how toxic substances might harm people and how to treat people who have been exposed. Laws today protect the welfare of research animals and scientists must follow strict guidelines.

### Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

### For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333
Phone: 1-800-447-1544
Fax: 404-639-6359

**U.S. Department of Health and Human Services**
**Public Health Service**
**Agency for Toxic Substances and Disease Registry**

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*ATSDR Information Center / ATSDRIC@cdc.gov / 1-800-447-1544*

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ATSDR ToxFAQs

# Thallium

CAS# 7440-28-0

September 1995

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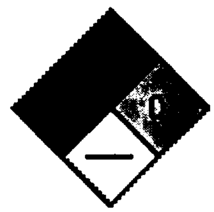
**Thallium**
Tl
GIF Image
XYZ File

Search ChemFinder



NFPA Label Key

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## Agency for Toxic Substances and Disease Registry

***This fact sheet answers the most frequently asked health questions about thallium. For more information, you may call the ATSDR Information Center at 1-800-447-1544. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.***

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**SUMMARY:** Exposure to thallium occurs mainly from eating food. Exposure to higher levels of thallium may occur in the workplace. Breathing high levels of thallium may result in effects on the nervous system, while ingesting high levels of it results in vomiting, diarrhea, temporary hair loss, and other effects. This chemical has been found in at least 210 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

### What is thallium?
### (Pronounced thal'e-um)

Pure thallium is a bluish-white metal that is found in trace amounts in the earth's crust. In the past, thallium was obtained as a by-product from smelting other metals; however, it has not been produced in the United States since 1984. Currently, all the thallium is obtained from imports and from thallium reserves.

In its pure form, thallium is odorless and tasteless. It can also be found combined with other substances such as bromine, chlorine, fluorine, and iodine. When it's combined, it appears colorless-to-white or yellow.

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Thallium is used mostly in manufacturing electronic devices, switches, and closures, primarily for the semiconductor industry. It also has limited use in the manufacture of special glass and for certain medical procedures.

**What happens to thallium when it enters the environment?**

- Thallium enters the environment primarily from coal-burning and smelting, in which it is a trace contaminant of the raw materials.
- It stays in the air, water, and soil for a long time and is not broken down.
- Some thallium compounds are removed from the atmosphere in rain and snow.
- It's absorbed by plants and enters the food chain.
- It builds up in fish and shellfish.

**How might I be exposed to thallium?**

- Eating food contaminated with thallium may be a major source of exposure for most people
- Breathing workplace air in industries that use thallium
- Smoking cigarettes
- Living near hazardous waste sites containing thallium (may result in higher than normal exposures)
- Touching or, for children, eating soil contaminated with thallium
- Breathing low levels of thallium in air and water.

**How can thallium affect my health?**

Exposure to high levels of thallium can result in harmful health effects. A study on workers exposed on the job over several years reported nervous system effects, such as numbness of fingers and toes, from breathing thallium.

Studies in people who ingested large amounts of thallium over a short time have reported vomiting, diarrhea, temporary hair loss, and effects on the nervous system, lungs, heart, liver, and kidneys. It has caused death. It is not known what the effects are from ingesting low levels of thallium over a long time.

Birth defects were not reported in the children of mothers exposed to low levels from eating vegetables and fruits contaminated with thallium. Studies in rats, however, exposed to high levels of thallium, showed adverse developmental effects.

It is not known if breathing or ingesting thallium affects human reproduction. Studies showed that rats that ingested thallium for several weeks had some adverse reproductive effects. Animal data suggest that the male reproductive system may be susceptible to damage by low levels of thallium.

There is no information available on the health effects of skin contact with thallium in people or animals.

**How likely is thallium to cause cancer?**

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified thallium as to its human carcinogenicity.

No studies are available in people or animals on the carcinogenic effects of breathing, ingesting, or touching thallium.

**Is there a medical test to show whether I've been exposed to thallium?**

There are medical tests available to measure levels of thallium in urine and hair. In addition, thallium can also be measured in blood; however, this is not a good indicator of exposure since thallium only stays in blood a very short time.

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These tests require special equipment that is not usually available in most doctor's offices. In addition, these tests cannot determine if adverse health effects will occur from the exposure to thallium.

**Has the federal government made recommendations to protect human health?**

The EPA requires that discharges or accidental spills into the environment of 1,000 pounds or more of thallium be reported.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 0.1 milligrams per cubic meter (0.1 mg/m$^3$) for thallium in workplace air.

The American Conference of Governmental Industrial Hygienists (ACGIH) has established the same guidelines as OSHA for the workplace.

The National Institute for Occupational Safety and Health (NIOSH) has recommended that 15 mg/m$^3$ of thallium be considered immediately dangerous to life and health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

**Glossary**

Carcinogenicity:
    Ability to cause cancer.
Ingesting:
    Taking food or drink into your body.
Milligram (mg):
    One thousandth of a gram.

**References**

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for thallium. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?**

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

**For more information, contact:**

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop E-29
Atlanta, GA 30333
Phone: 1-800-447-1544
FAX: 404-639-6315

**U.S. Department of Health and Human Services**
**Public Health Service**
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## TABLE C-3-1
## RESRAD PARAMETER VALUES

| PARAMETER | VALUE | SOURCE |
|---|---|---|
| Contaminated Zone | | |
| Area (commercial, recreational) | 10,000 $m^2$ | Default |
| Area (residential) | 1,000 $m^2$ | Site-Specific |
| Thickness | 1 m | Site-Specific |
| Length parallel to aquifer flow | 100 m | Site-Specific |
| Density | 1.5 $g/cm^3$ | Site-Specific |
| Erosion Rate | 0.001 m/y | Site-Specific |
| Total Porosity | 0.41 | Site-Specific |
| Effective Porosity | 0.32 | Site-Specific |
| Hydraulic Conductivity | 1,100 m/y | Default |
| Zone b parameter | 4.05 | Site-Specific |
| Evapotranspiration coefficient | 0.5 | Default |
| Precipitation | 1.1 m/y | Default |
| Irrigation | 0.2 m/y | Default |
| Runoff coefficient | 0.8 | Default |
| Watershed area for nearby stream or pond | 362,600 $m^2$ | Site-Specific |
| Accuracy for water/soil computations | 0.001 | Default |
| Cover Zone | | |
| Depth | 0/0.08 m | Site-Specific |
| Density | 2.34 $g/cm^3$ | Site-Specific |
| Erosion Rate | 0 | Site-Specific |
| Saturated Zone | | |
| Density | 1.5 $g/m^3$ | Default |
| Total Porosity | 0.41 | Site-Specific |
| Effective Porosity | 0.32 | Site-Specific |
| Hydraulic Conductivity | 11,000 m/y | Site-Specific |
| Hydraulic Gradient | 0.02 | Default |
| Zone b parameter | 4.05 | Site-Specific |
| Water table drop rate | 0.001 m/y | Default |
| Well Pump Intake Depth | 0.00001 m below water table | Default |
| Well Pump Rate | 0 $cm^3/y$ | Site-Specific |
| Unsaturated Zone | | |
| Thickness | 4 m | Default |
| Density | 1.5 $g/cm^3$ | Default |
| Total Porosity | 0.41 | Site-Specific |
| Effective Porosity | 0.32 | Site-Specific |
| Hydraulic Conductivty | 1,100 m/y | Site-Specific |
| Zone b parameter | 4.05 | Site-Specific |

| TABLE C-3-1 (continued)<br>RESRAD PARAMETER VALUES | | |
|---|---|---|
| **Inhalation** | | |
| Mass loading | 0.0002 g/m$^3$ | Default |
| Dilution length for airborne dust | 3 m | Default |
| Inhalation-Shielding Factor | 0.4 | Default |
| **External Radiation** | | |
| External Gamma Shielding Fraction | 0.8 | RAGS Default |
| **Ingestion** | | |
| Fruit, vegetable, grain | 36.75 kg/y adult | RAGS Default |
| | 17.85 kg/y | RAGS Default |
| Leafy vegetables | 5.95 kg/y child | RAGS Default |
| | 1.4 kg/y | RAGS Default |
| Soil | 100 mg/d adult | RAGS Default |
| | 200 mg/d child | RAGS Default |
| Mass loading for foliar deposition | 0.0001 g/m$^3$ | Default |
| Depth of soil mixing layer | 0.15 m | Default |
| Depth of roots | 0.9 m | Default |
| **Radon** | defaults used for all parameters | |

**TABLE C-3-2**
**RESRAD - PARAMETER VALUES**

| PARAMETER | VALUE | SOURCE |
|---|---|---|
| Building | | |
| Number of Rooms | 1 | Site-Specific |
| Deposition Velocity | 0.01 m/s | Default |
| Resuspension Rate | 0.0000005/s | Default |
| Air Exchange Rate | 0.8/h | Default |
| Area | 375 $m^2$ | Site-Specific |
| Height | 4 m | Site-Specific |
| Receptor Location | 12.5, 7.5, 1 m (middle of room) | Site-Specific |
| Sources (all Area Sources) | | |
| Walls | 4 | Site-Specific |
| Floor | 1 | Site-Specific |
| Columns | 4 | Site-Specific |

## TABLE C-3-3
## RAGS / RESRAD COMPARISON OF RESULTS
## WELSBACH

| POPULATION | PATHWAY | NET RISK | |
|---|---|---|---|
| | | RAGS | RESRAD |
| CONSTRUCTION WORKER | External | 7.5E-04 | 7.3E-04 |
| | Inhalation of Particulates | 1.1E-03 | 4.1E-05 |
| | Ingestion of Soil | 3.1E-05 | 1.7E-06 |
| SITE WORKER | External | 5.7E-02 | 1.5E-02 |
| OTHER WORKER | External | 1.4E-02 | 4.0E-03 |

## TABLE C-3-4
## RAGS / RESRAD COMPARISON OF RESULTS
## GENERAL GAS MANTLE

| POPULATION | PATHWAY | NET RISK | |
|---|---|---|---|
| | | RAGS | RESRAD |
| TRESPASSER | External | 4.7E-05 | 2.0E-05 |
| | Inhalation of Radon | 2.5E-03 | 7.3E-06 * |
| | Ingestion of Soil | 1.8E-06 | 2.3E-08 |
| CONSTRUCTION WORKER | External | 2.0E-05 | 1.9E-05 |
| | Inhalation of Particulates | 2.7E-05 | 9.4E-07 |
| | Ingestion of Soil | 6.9E-07 | 3.9E-08 |
| SITE WORKER | External | 1.2E-03 | 1.0E-04 |
| | Inhalation of Radon | 1.8E-01 | 3.7E-04 * |
| RESIDENT ADULT | External | 8.5E-03 | 8.3E-03 |
| | Inhalation of Radon | 4.1E-03 | 4.1E-03 |
| | Ingestion of Home Grown Produce | 2.0E-05 | 5.2E-04 |
| | Ingestion of Soil | 2.5E-05 | 2.4E-05 |
| RESIDENT CHILD | External | 1.7E-03 | 1.6E-03 |
| | Inhalation of Radon | 4.7E-04 | 4.7E-04 |
| | Ingestion of Home Grown Produce | 1.6E-06 | 4.7E-05 |
| | Ingestion of Soil | 1.0E-05 | 9.7E-06 |

* = Calculated with RESRAD-BUILD.

TABLE C-3-5.1.

RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

WELSBACH

Scenario Timeframe: Current / Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo
Receptor Population: Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 2.09E+02 | pCi/g | 2.09E+02 | pCi/g | M | 9.51E+02 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 2.0E-08 |
| | Uranium 238 + D | 1.43E+02 | pCi/g | 1.43E+02 | pCi/g | M | 6.52E+02 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 4.3E-05 |
| | Radium 226 + D | **6.98E+01** | pCi/g | 6.98E+01 | pCi/g | M | 3.18E+02 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 2.1E-03 |
| | Radium 228 + D | **1.33E+02** | pCi/g | 1.33E+02 | pCi/g | M | 6.05E+02 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 2.0E-03 |
| | Thorium 228 + D | **1.31E+02** | pCi/g | 1.31E+02 | pCi/g | M | 5.97E+02 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 3.7E-03 |
| | Thorium 230 | **7.93E+01** | pCi/g | 7.93E+01 | pCi/g | M | 3.62E+02 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 1.6E-08 |
| | Thorium 232 + D | **1.47E+02** | pCi/g | 1.47E+02 | pCi/g | M | 6.72E+02 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 1.3E-08 |
| | Lead 210 + D | 6.98E+01 | pCi/g | 6.98E+01 | pCi/g | M | 3.18E+02 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 4.6E-08 |
| | | | | | | | | | | Total Risk-All ROPC | 7.9E-03 |

(1) M = Medium-Specific

**BOLD** = Arithmetic Average Concentration.

TABLE C-3-5.2.
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

| |
|---|
| Scenario Timeframe: Current / Future |
| Medium: Soil |
| Exposure Medium: Soil |
| Exposure Point: Holt Cargo |
| Receptor Population: Other Worker |
| Receptor Age: Adult |

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | 2.09E+02 | pCi/g | 2.09E+02 | pCi/g | M | 2.38E+02 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 5.1E-09 |
| | Uranium 238 + D | 1.43E+02 | pCi/g | 1.43E+02 | pCi/g | M | 1.63E+02 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 1.1E-05 |
| | Radium 226 + D | 6.98E+01 | pCi/g | 6.98E+01 | pCi/g | M | 7.95E+01 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 5.4E-04 |
| | Radium 228 + D | 1.33E+02 | pCi/g | 1.33E+02 | pCi/g | M | 1.51E+02 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 5.0E-04 |
| | Thorium 228 + D | 1.31E+02 | pCi/g | 1.31E+02 | pCi/g | M | 1.49E+02 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 9.2E-04 |
| | Thorium 230 | 7.93E+01 | pCi/g | 7.93E+01 | pCi/g | M | 9.04E+01 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 4.0E-09 |
| | Thorium 232 + D | 1.47E+02 | pCi/g | 1.47E+02 | pCi/g | M | 1.68E+02 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 3.3E-09 |
| | Lead 210 + D | 6.98E+01 | pCi/g | 6.98E+01 | pCi/g | M | 7.95E+01 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 1.2E-08 |
| | | | | | | | | | | Total Risk-All ROPC | 2.0E-03 |

(1) M = Medium-Specific
BOLD = Arithmetic Average Concentration.

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TABLE C-3-5.3
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil
Exposure Point: Holt Cargo
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| External | Uranium 234 | **1.47E+02** | pCi/g | 1.47E+02 | pCi/g | M | 8.05E+00 | pCi-year/g | 2.14E-11 | Risk/yr per pCi/g soil | 1.7E-10 |
| | Uranium 238 + D | **1.24E+02** | pCi/g | 1.24E+02 | pCi/g | M | 6.77E+00 | pCi-year/g | 6.57E-08 | Risk/yr per pCi/g soil | 4.4E-07 |
| | Radium 226 + D | 2.35E+02 | pCi/g | 2.35E+02 | pCi/g | M | 1.29E+01 | pCi-year/g | 6.74E-06 | Risk/yr per pCi/g soil | 8.7E-05 |
| | Radium 228 + D | **2.81E+02** | pCi/g | 2.81E+02 | pCi/g | M | 1.54E+01 | pCi-year/g | 3.28E-06 | Risk/yr per pCi/g soil | 5.0E-05 |
| | Thorium 228 + D | **2.67E+02** | pCi/g | 2.67E+02 | pCi/g | M | 1.46E+01 | pCi-year/g | 6.20E-06 | Risk/yr per pCi/g soil | 9.1E-05 |
| | Thorium 230 | **1.66E+02** | pCi/g | 1.66E+02 | pCi/g | M | 9.06E+00 | pCi-year/g | 4.40E-11 | Risk/yr per pCi/g soil | 4.0E-10 |
| | Thorium 232 + D | **3.11E+02** | pCi/g | 3.11E+02 | pCi/g | M | 1.70E+01 | pCi-year/g | 1.97E-11 | Risk/yr per pCi/g soil | 3.4E-10 |
| | Lead 210 + D | 2.35E+02 | pCi/g | 2.35E+02 | pCi/g | M | 1.29E+01 | pCi-year/g | 1.45E-10 | Risk/yr per pCi/g soil | 1.9E-09 |
| | (Total) | | | | | | | | | | 2.3E-04 |
| Ingestion | Uranium 234 | **1.47E+02** | pCi/g | 1.47E+02 | pCi/g | M | 4.24E+03 | pCi | 4.44E-11 | Risk/pCi | 1.9E-07 |
| | Uranium 238 + D | **1.24E+02** | pCi/g | 1.24E+02 | pCi/g | M | 3.56E+03 | pCi | 6.20E-11 | Risk/pCi | 2.2E-07 |
| | Radium 226 + D | 2.35E+02 | pCi/g | 2.35E+02 | pCi/g | M | 6.78E+03 | pCi | 2.96E-10 | Risk/pCi | 2.0E-06 |
| | Radium 228 + D | **2.81E+02** | pCi/g | 2.81E+02 | pCi/g | M | 8.09E+03 | pCi | 2.48E-10 | Risk/pCi | 2.0E-06 |
| | Thorium 228 + D | **2.67E+02** | pCi/g | 2.67E+02 | pCi/g | M | 7.69E+03 | pCi | 2.31E-10 | Risk/pCi | 1.8E-06 |
| | Thorium 230 | **1.66E+02** | pCi/g | 1.66E+02 | pCi/g | M | 4.77E+03 | pCi | 3.75E-11 | Risk/pCi | 1.8E-07 |
| | Thorium 232 + D | **3.11E+02** | pCi/g | 3.11E+02 | pCi/g | M | 8.96E+03 | pCi | 3.28E-11 | Risk/pCi | 2.9E-07 |
| | Lead 210 + D | 2.35E+02 | pCi/g | 2.35E+02 | pCi/g | M | 6.78E+03 | pCi | 1.01E-09 | Risk/pCi | 6.8E-06 |
| | (Total) | | | | | | | | | | 1.4E-05 |

(1) M = Medium-Specific
**BOLD** = Arithmetic Average Concentration

TABLE C-3-5.3 (continued)
RME
CALCULATION OF CANCER RISKS
REASONABLE MAXIMUM EXPOSURE
WELSBACH

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Particulates
Exposure Point: Holt Cargo
Receptor Population: Construction Worker
Receptor Age: Adult

| Exposure Route | Radionuclide of Potential Concern | Medium EPC Value | Medium EPC Units | Route EPC Value | Route EPC Units | EPC Selected for Risk Calculation (1) | Exposure | Exposure Units | Cancer Slope Factor | Cancer Slope Factor Units | Cancer Risk |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inhalation | Uranium 234 | **1.47E+02** | pCi/g | 7.66E-01 | pCi/m$^3$ | R | 8.46E+02 | pCi | 1.40E-08 | Risk/pCi | 1.2E-05 |
| | Uranium 238 + D | **1.24E+02** | pCi/g | 6.45E-01 | pCi/m$^3$ | R | 7.12E+02 | pCi | 1.24E-08 | Risk/pCi | 8.8E-06 |
| | Radium 226 + D | 2.35E+02 | pCi/g | 1.23E+00 | pCi/m$^3$ | R | 1.35E+03 | pCi | 2.75E-09 | Risk/pCi | 3.7E-06 |
| | Radium 228 + D | **2.81E+02** | pCi/g | 1.46E+00 | pCi/m$^3$ | R | 1.61E+03 | pCi | 9.94E-10 | Risk/pCi | 1.6E-06 |
| | Thorium 228 + D | **2.67E+02** | pCi/g | 1.39E+00 | pCi/m$^3$ | R | 1.54E+03 | pCi | 9.68E-08 | Risk/pCi | 1.5E-04 |
| | Thorium 230 | **1.66E+02** | pCi/g | 8.63E-01 | pCi/m$^3$ | R | 9.53E+02 | pCi | 1.72E-08 | Risk/pCi | 1.6E-05 |
| | Thorium 232 + D | **3.11E+02** | pCi/g | 1.62E+00 | pCi/m$^3$ | R | 1.79E+03 | pCi | 1.93E-08 | Risk/pCi | 3.5E-05 |
| | Lead 210 + D | 2.35E+02 | pCi/g | 1.23E+00 | pCi/m$^3$ | R | 1.35E+03 | pCi | 3.86E-09 | Risk/pCi | 5.2E-06 |
| | (Total) | | | | | | | | | | 2.3E-04 |
| | | | | | | | | | | Total Risk-All ROPC | 4.7E-04 |

R = Route-Specific
**BOLD** = Arithmetic Average Concentration.

**TABLE C-3-6**
**COMPARISON OF RISK RESULTS WHEN MAXIMUM DETECTED CONCENTRATIONS* ARE REPLACED WITH ARITHMETIC AVERAGE CONCENTRATIONS**
**WELSBACH**

| POPULATION | ROPC | EXPOSURE POINT CONCENTRATION | | TOTAL NET RISK | |
|---|---|---|---|---|---|
| | | MAXIMUM pCi/g | AVERAGE pCi/g | MAXIMUM | AVERAGE |
| CONSTRUCTION WORKER | U-234 | 852 | 147 | 7.0E-05 | 1.2E-05 |
| | U-238 | 852 | 124 | 6.6E-05 | 9.4E-06 |
| | Ra-228 | 1280 | 281 | 2.5E-04 | 5.4E-05 |
| | Th-228 | 1260 | 267 | 1.1E-03 | 2.4E-04 |
| | Th-230 | 852 | 166 | 8.5E-05 | 1.6E-05 |
| | Th-232 | 1340 | 311 | 1.5E-04 | 3.4E-05 |
| SITE WORKER | Ra-228 | 1280 | 133 | 1.9E-02 | 2.1E-03 |
| | Th-228 | 1260 | 131 | 3.6E-02 | 3.6E-03 |
| | Th-230 | 852 | 79 | 1.7E-07 | 1.6E-08 |
| | Th-232 | 1340 | 147 | 1.2E-07 | 1.3E-08 |
| OTHER WORKER | Ra-228 | 1280 | 133 | 4.8E-03 | 4.9E-04 |
| | Th-228 | 1260 | 131 | 8.9E-03 | 9.1E-04 |
| | Th-230 | 852 | 79 | 4.3E-08 | 3.9E-09 |
| | Th-232 | 1340 | 147 | 3.0E-08 | 3.3E-09 |

* = Maximum detected concentration used as exposure point concentration when less than the calculated 95% UCL on the arithmetic average concentration.

**TABLE C-3-7**
**COMPARISON OF RISK RESULTS**
**RAGS vs. RAGS-ADJUSTED**
**WELSBACH**

| POPULATION | TOTAL NET RISK | |
|---|---|---|
| | RAGS | RAGS-ADJUSTED |
| CONSTRUCTION WORKER | 1.9E-03 | 4.7E-04 |
| SITE WORKER | 5.7E-02 | 7.7E-03 |
| OTHER WORKER | 1.4E-02 | 1.9E-03 |

**TABLE C-6-1**
**EXPOSURE POINT CONCENTRATION AT VICINITY PROPERTIES**

| LOCATION | RADIONUCLIDE | EXPOSURE POINT CONCENTRATION (pCi/g) | BASIS (pCi/g) |
|---|---|---|---|
| RESIDENTIAL PROPERTIES | | | |
| | U-234 | 9.03E+00 | MEAN |
| | U-238 | 8.54E+00 | MEAN |
| | Ra-226 | 1.61E+01 | MEAN |
| | Ra-228 | 1.68E+01 | 95% UCL |
| | Th-228 | 2.11E+01 | 95% UCL |
| | Th-230 | 8.22E+00 | MEAN |
| | Th-232 | 2.07E+01 | 95% UCL |
| POPCORN FACTORY | | | |
| | U-234 | 2.28E+00 | 95% UCL |
| | U-238 | 1.82E+00 | 95% UCL |
| | Ra-226 | 3.77E+02 | MAX |
| | Ra-228 | 7.62E+01 | MAX |
| | Th-228 | 5.35E+02 | 95% UCL |
| | Th-230 | 4.38E+01 | 95% UCL |
| | Th-232 | 4.42E+02 | 95% UCL |
| SWIM CLUB | | | |
| | U-234 | 1.16E+01 | 95% UCL |
| | U-238 | 1.21E+01 | 95% UCL |
| | Ra-226 | 1.82E+01 | 95% UCL |
| | Ra-228 | 5.44E+01 | 95% UCL |
| | Th-228 | 3.29E+02 | 95% UCL |
| | Th-230 | 6.54E+01 | 95% UCL |
| | Th-232 | 3.53E+02 | 95% UCL |
| LAND PRESERVE | | | |
| | U-234 | 2.29E+02 | 95% UCL |
| | U-238 | 1.94E+02 | 95% UCL |
| | Ra-226 | 2.88E+02 | 95% UCL |
| | Ra-228 | 1.42E+03 | MAX |
| | Th-228 | 1.02E+03 | MAX |
| | Th-230 | 5.36E+02 | 95% UCL |
| | Th-232 | 1.48E+03 | MAX |
| MARTINS LAKE | | | |
| | U-234 | 9.50E+00 | MAX |
| | U-238 | 9.70E+00 | MAX |
| | Ra-226 | 2.57E+00 | MAX |
| | Ra-228 | 3.15E+01 | MAX |
| | Th-228 | 5.01E+01 | MAX |
| | Th-230 | 2.21E+01 | MAX |
| | Th-232 | 4.28E+01 | MAX |
| PUBLIC PARK | | | |
| | U-234 | 1.65E+04 | MAX |
| | U-238 | 1.65E+04 | MAX |
| | Ra-226 | 1.74E+03 | 95 % UCL |
| | Ra-228 | 1.17E+04 | MAX |
| | Th-228 | 1.10E+04 | MAX |
| | Th-230 | 1.65E+04 | MAX |
| | Th-232 | 1.25E+04 | MAX |
| DYNAMIC BLENDING | | | |
| | EXPOSURE RATE | uR/hr | |
| | | 1.08E+01 | 95 % UCL |
| | RADON DECAY PRODUCTS | WL | |
| | | 1.68E-02 | MAX |

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## TABLE C-6-2.1

## RESRAD PARAMETER VALUES AT VICINITY PROPERTIES
## RESIDENTIAL PROPERTIES

| MEDIUM | EXPOSURE PARAMETER | UNITS | SYMBOL | OFF-SITE RESIDENT ADULT | OFF-SITE RESIDENT CHILD |
|---|---|---|---|---|---|
| **SOIL - INGESTION** | | | | | |
| | Ingestion Rate | mg/day | IR | 100 [1] | 200 [1] |
| | Fraction Ingested | unitless | FI | 1 | 1 |
| **HOME GROWN PRODUCE - INGESTION** | | | | | |
| | Ingestion Rate-Lettuce | g/day | IR | 17 [3] | 4 [3] |
| | Ingestion Rate-Carrots | g/day | IR | 48 [3] | 27 [3] |
| | Ingestion Rate-Tomatoes | g/day | IR | 57 [3] | 24 [3] |
| | Plant and Root Uptake Factors | | | See Appendix O | |
| **OTHER PARAMETERS** | | | | | |
| | Exposure Frequency | days/year | EF | 350 [1] | 350 [1] |
| | Exposure Duration | years | ED | 30 [1] | 6 [1] |
| | Exposure Time | hrs/day | ET | 24 [4] | 24 [4] |
| | Inhalation Rate-Radon* | cu.m/hour | IN | 0.55 [2] | 0.27 [2] |
| | Indoor/Outdoor Time Fractions | unitless | Fi/Fo | 0.875/0.125 [2] | 0.75/0.25 [2] |
| | Gamma Shielding factor | unitless | GSF | 0.8/1.0 | 0.8/1.0 |

**REFERENCES**


[1] USEPA, 1991
[2] USEPA, 1997
[3] Baes, 1984
[4] Professional judgement


* = Average of male / female long term exposure.

TABLE C-6-2.2

RESRAD PARAMETER VALUES AT VICINITY PROPERTIES
POPCORN FACTORY

| MEDIUM | EXPOSURE PARAMETER | UNITS | SYMBOL | TRESPASSER | CONSTRUCTION WORKER | SITE WORKER | RESIDENT ADULT |
|---|---|---|---|---|---|---|---|
| SOIL - INGESTION | | | | | | | |
| | Ingestion Rate | mg/day | IR | 100 [1] | 480 [1] | 50 [1] | 50 [3] |
| | Fraction Ingested | unitless | FI | 1 | 1 | 1 | 1 |
| OTHER PARAMETERS | | | | | | | |
| | Exposure Frequency | days/year | EF | 120 [3] | 60 [1] | 250 [1] | 365 [3] |
| | Exposure Duration | years | ED | 6 [3] | 1 [1] | 25 [1] | 10 [3] |
| | Exposure Time | hrs/day | ET | 2 [3] | 8 [3] | 8 [3] | 24 [3] |
| | Inhalation Rate-Radon and Particulates | cu.m/hour | IN | 2.3 [2] | 2.3 [2] | 0.83 [2] | 0.55* [2] |
| | Indoor/Outdoor Time Fractions | unitless | Fi/Fo | 0/1 [3] | 0/1 [2] | 0.875/0.125 [2] | 0.875/0.125 [2] |
| | Gamma Shielding factor | unitless | GSF | 0.8/1 | 1 | 0.8/1 | 0.8/1 |

REFERENCES

[1] USEPA, 1991
[2] USEPA, 1997
[3] Professional judgement
* = Average of male / female long term exposure.

TABLE C-6-2.3

RESRAD PARAMETER VALUES AT VICINITY PROPERTIES
SWIM CLUB

| MEDIUM | EXPOSURE PARAMETER | UNITS | SYMBOL | SITE WORKER | ADULT MEMBER | CHILD MEMBER |
|---|---|---|---|---|---|---|
| **IL - INGESTION** | | | | | | |
| | Ingestion Rate | mg/day | IR | 50 [1] | 50 [3] | 50 [3] |
| | Fraction Ingested | unitless | FI | 1 | 1 | 1 |
| **OTHER PARAMETERS** | | | | | | |
| | Exposure Frequency | days/year | EF | 100 [3] | 100 [3] | 100 [3] |
| | Exposure Duration | years | ED | 25 [1] | 30 [1] | 6 [1] |
| | Exposure Time | hrs/day | ET | 8 [3] | 8 [3] | 8 [3] |
| | Inhalation Rate-Radon and Particulates* | cu.m/hour | IN | 0.83 [2] | 0.75 [2] | 0.7 [2] |
| | Indoor/Outdoor Time Fractions | unitless | Fi/Fo | 0.5/0.5 [4] | 0/1 [4] | 0/1 [4] |
| | Gamma Shielding factor | unitless | GSF | 0.8/1 | 0.8/1 | 0.8/1 |

**REFERENCES**

[1] USEPA, 1991
[2] USEPA, 1997
[3] Professional judgement

* = Average of light and sedentary activities for adult and child short term exposure

**TABLE C-6-2.4**

**RESRAD PARAMETER VALUES AT VICINITY PROPERTIES**
**LAND PRESERVE**

| MEDIUM | EXPOSURE PARAMETER | UNITS | SYMBOL | TRESPASSER | CONSTRUCTION WORKER | SITE WORKER | RESIDENT ADULT | RESIDENT CHILD |
|---|---|---|---|---|---|---|---|---|
| **SOIL - INGESTION** | | | | | | | | |
| | Ingestion Rate | mg/day | IR | 100 [1] | 480 [1] | 10 [3] | 100 [1] | 200 [1] |
| | Fraction Ingested | unitless | FI | 1 | 1 | 1 | 1 | 1 |
| **...ME GROWN PRODUCE - INGESTION** | | | | | | | | |
| | Ingestion Rate-Lettuce | g/day | IR | N/A | N/A | N/A | 17 [4] | 4 [4] |
| | Ingestion Rate-Carrots | g/day | IR | N/A | N/A | N/A | 48 [4] | 27 [4] |
| | Ingestion Rate-Tomatoes | g/day | IR | N/A | N/A | N/A | 57 [4] | 24 [4] |
| | Plant and Root Uptake Factors | | | | | | See Appendix O | |
| **OTHER PARAMETERS** | | | | | | | | |
| | Exposure Frequency | days/year | EF | 120 [3] | 60 [1] | 250 [1] | 350 [1] | 350 [1] |
| | Exposure Duration | years | ED | 6 [3] | 1 [1] | 25 [1] | 30 [1] | 6 [1] |
| | Exposure Time | hrs/day | ET | 2 [3] | 8 [3] | 8 [3] | 24 [3] | 24 [3] |
| | Inhalation Rate-Radon and Particulates | cu.m/hour | IN | 2.3 [2] | 2.3 [2] | 0.83 [2] | 0.55* [2] | 0.27* [2] |
| | Indoor/Outdoor Time Fractions | unitless | Fi/Fo | 0/1 [3] | 0/1 [3] | 1/0 [3] | 0.75/0.25 [2] | 0.875/0.125 [2] |
| | Gamma Shielding factor | unitless | GSF | 1 | 1 | 0.8/1 | 0.8/1 | 0.8/1 |

**REFERENCES**

[1] USEPA, 1991
[2] USEPA, 1997
[3] Professional judgement
[4] Baes, 1984
N/A = Not Applicable
* = Average of male / female long term exposure.

TABLE C-6-2.5

RESRAD PARAMETER VALUES AT VICINITY PROPERTIES
MARTIN'S LAKE

| MEDIUM | EXPOSURE PARAMETER | UNITS | SYMBOL | ADULT RECREATIONALIST | CHILD RECREATIONALIST |
|---|---|---|---|---|---|
| **SOIL - INGESTION** | | | | | |
| | Ingestion Rate | mg/day | IR | 100 [1] | 200 [1] |
| | Fraction Ingested | unitless | FI | 1 | 1 |
| **OTHER PARAMETERS** | | | | | |
| | Exposure Frequency | days/year | EF | 250 [3] | 250 [3] |
| | Exposure Duration | years | ED | 30 [3] | 6 [3] |
| | Exposure Time | hrs/day | ET | 2 [3] | 2 [3] |
| | Inhalation Rate-Particulates* | cu.m/hour | IN | 0.75 [2] | 0.7 [2] |
| | Indoor/Outdoor Time Fractions | unitless | Fi/Fo | 0/1 [3] | 0/1 [3] |
| | Gamma Shielding factor | unitless | GSF | 1 | 1 |

**REFERENCES**

[1] USEPA, 1991
[2] USEPA, 1997
[3] Professional Judgement
* = Average of light and sedentary activities for adult and child short term exposure

TABLE C-6-2.6

RESRAD PARAMETER VALUES AT VICINITY PROPERTIES
PUBLIC PARK

| MEDIUM | EXPOSURE PARAMETER | UNITS | SYMBOL | SITE WORKER | ADULT RECREATIONALIST | CHILD RECREATIONALIST |
|---|---|---|---|---|---|---|
| **IL - INGESTION** | | | | | | |
| | Ingestion Rate | mg/day | IR | 200 [3] | 100 [1] | 200 [1] |
| | Fraction Ingested | unitless | FI | 1 | 1 | 1 |
| **OTHER PARAMETERS** | | | | | | |
| | Exposure Frequency | days/year | EF | 250 [3] | 250 [3] | 250 [3] |
| | Exposure Duration | years | ED | 25 [1] | 30 [1] | 6 [1] |
| | Exposure Time | hrs/day | ET | 8 [3] | 2 [3] | 2 [3] |
| | Inhalation Rate-Particulates* | cu.m/hour | IN | 1.3 [2] | 1.3 [2] | 1.1 2] |
| | Indoor/Outdoor Time Fractions | unitless | Fi/Fo | 0/1 [3] | 0/1 [3] | 0/1 [3] |
| | Gamma Shielding factor | unitless | GSF | 1 | 1 | 1 |

**REFERENCES**


[1] USEPA, 1991
[2] USEPA, 1997
[3] Professional judgement


* = Average of moderate and light activities for adult and child short term exposure; hourly average for outdoor worker

TABLE C-6-2.7

RESRAD PARAMETER VALUES AT VICINITY PROPERTIES
DYNAMIC BLENDING

| MEDIUM | EXPOSURE PARAMETER | UNITS | SYMBOL | SITE WORKER |
|---|---|---|---|---|
| **OTHER PARAMETERS** | | | | |
| | Exposure Frequency | days/year | EF | 250 [3] |
| | Exposure Duration | years | ED | 25 [1] |
| | Exposure Time | hrs/day | ET | 8 [3] |
| | Inhalation Rate-Radon | cu.m/hour | IN | 0.83 [2] |
| | Indoor/Outdoor Time Fractions | unitless | Fi/Fo | 1/0 [1] |
| | Gamma Shielding factor | unitless | GSF | 0.8 |

**REFERENCES**


[1] USEPA, 1991
[2] USEPA, 1997
[3] Professional judgement

**TABLE C-6-3**
**VICINITY RESIDENTIAL PROPERTIES**
**LIFETIME RISK**

| POPULATION | PATHWAY | RISK | | |
|---|---|---|---|---|
| | | GROSS | BACKGROUND | NET |
| RESIDENT ADULT | External | 6.5E-03 | 3.5E-04 | 6.2E-03 |
| | Inhalation of Radon | 1.2E-02 | 7.9E-04 | 1.1E-02 |
| | Ingestion of Home Grwon Produce | 6.8E-04 | 4.2E-05 | 6.4E-04 |
| | Ingestion of Soil | 3.2E-05 | 2.0E-06 | 3.0E-05 |
| | **Total:** | 1.9E-02 | 1.1E-03 | 1.7E-02 |
| RESIDENT CHILD | External | 1.3E-03 | 6.8E-05 | 1.2E-03 |
| | Inhalation of Radon | 1.4E-03 | 9.0E-05 | 1.3E-03 |
| | Ingestion of Home Grwon Produce | 6.2E-05 | 3.8E-06 | 5.8E-05 |
| | Ingestion of Soil | 3.0E-05 | 7.8E-07 | 2.9E-05 |
| | **Total:** | 2.7E-03 | 1.6E-04 | 2.5E-03 |

**TABLE C-6-4**
**VICINITY PROPERTIES - POPCORN FACTORY**
**LIFETIME RISK**

| POPULATION | PATHWAY | RISK | | |
|---|---|---|---|---|
| | | GROSS | BACKGROUND | NET |
| TRESPASSER | External | 9.9E-04 | 2.5E-06 | 9.9E-04 |
| | Inhalation of Particulates | 3.4E-05 | 9.4E-08 | 3.4E-05 |
| | Ingestion of Soil | 1.3E-06 | 3.8E-09 | 1.3E-06 |
| | **Total:** | 1.0E-03 | 2.6E-06 | 1.0E-03 |
| CONSTRUCTION WORKER | External | 3.3E-04 | 8.3E-07 | 3.3E-04 |
| | Inhalation of Particulates | 1.1E-05 | 3.1E-08 | 1.1E-05 |
| | Ingestion of Soil | 1.1E-06 | 3.1E-09 | 1.1E-06 |
| | **Total:** | 3.4E-04 | 8.6E-07 | 3.4E-04 |
| SITE WORKER | External | 2.7E-02 | 7.1E-05 | 2.7E-02 |
| | Inhalation of Particulates | 1.0E-01 | 2.8E-04 | 1.0E-01 |
| | Inhalation of Radon | 2.4E-04 | 5.6E-07 | 2.4E-04 |
| | Ingestion of Soil | 4.6E-05 | 1.4E-07 | 4.6E-05 |
| | **Total:** | 1.3E-01 | 3.5E-04 | 1.3E-01 |
| RESIDENT ADULT | External | 4.7E-02 | 3.5E-04 | 4.7E-02 |
| | Inhalation of Radon | 1.2E-01 | 7.9E-04 | 1.2E-01 |
| | Ingestion of Soil | 1.2E-04 | 2.0E-06 | 1.2E-04 |
| | **Total:** | 1.7E-01 | 1.1E-03 | 1.7E-01 |

**TABLE C-6-5**
**VICINITY PROPERTIES - SWIM CLUB**
**LIFETIME RISK**

| POPULATION | PATHWAY | RISK | | |
|---|---|---|---|---|
| | | GROSS | BACKGROUND | NET |
| SITE WORKER | External | 4.5E-03 | 3.1E-05 | 4.5E-03 |
| | Inhalation of Particulates | 7.7E-05 | 6.5E-05 | 1.2E-05 |
| | Inhalation of Radon | 1.4E-03 | 3.3E-07 | 1.4E-03 |
| | Ingestion of Soil | 1.3E-06 | 2.2E-08 | 1.3E-06 |
| | **Total:** | 6.0E-03 | 9.6E-05 | 5.9E-03 |
| ADULT MEMBER | External | 6.0E-03 | 4.1E-05 | 6.0E-03 |
| | Inhalation of Particulates | 1.2E-04 | 5.1E-07 | 1.2E-04 |
| | Ingestion of Soil | 1.6E-06 | 2.7E-08 | 1.6E-06 |
| | **Total:** | 6.1E-03 | 4.2E-05 | 6.1E-03 |
| CHILD MEMBER | External | 1.2E-03 | 8.2E-06 | 1.2E-03 |
| | Inhalation of Particulates | 2.2E-05 | 9.6E-08 | 2.2E-05 |
| | Ingestion of Soil | 3.2E-07 | 5.3E-09 | 3.1E-07 |
| | **Total:** | 1.2E-03 | 8.3E-06 | 1.2E-03 |

## TABLE C-6-6
## VICINITY PROPERTIES - LAND PRESERVE
## LIFETIME RISK

| POPULATION | PATHWAY | RISK | | |
|---|---|---|---|---|
| | | GROSS | BACKGROUND | NET |
| TRESSPASSER | External | 2.4E-03 | 2.5E-06 | 2.4E-03 |
| | Inhalation of Particulates | 1.2E-04 | 9.4E-08 | 1.2E-04 |
| | Ingestion of Soil | 2.3E-06 | 3.8E-09 | 2.3E-06 |
| | **Total:** | 2.5E-03 | 2.6E-06 | 2.5E-03 |
| CONSTRUCTION WORKER | External | 8.1E-04 | 8.3E-07 | 8.1E-04 |
| | Inhalation of Particulates | 4.0E-05 | 3.1E-08 | 4.0E-05 |
| | Ingestion of Soil | 1.8E-06 | 3.1E-09 | 1.8E-06 |
| | **Total:** | 8.5E-04 | 8.6E-07 | 8.5E-04 |
| SITE WORKER | External | 6.7E-02 | 6.9E-05 | 6.7E-02 |
| | Inhalation of Particulates | 6.0E-04 | 4.7E-07 | 6.0E-04 |
| | Inhalation of Radon | 8.8E-02 | 3.2E-04 | 8.8E-02 |
| | Ingestion of Soil | 1.6E-05 | 2.8E-08 | 1.6E-05 |
| | **Total:** | 1.6E-01 | 3.9E-04 | 1.6E-01 |
| RESIDENT ADULT | External | 3.6E-01 | 3.5E-04 | 3.6E-01 |
| | Inhalation of Radon | 2.2E-01 | 7.9E-04 | 2.2E-01 |
| | Ingestion of Home Grown Produce | 2.7E-02 | 4.2E-05 | 2.7E-02 |
| | Ingestion of Soil | 1.2E-03 | 2.0E-06 | 1.2E-03 |
| | **Total:** | 6.1E-01 | 1.2E-03 | 6.1E-01 |
| RESIDENT CHILD | External | 7.0E-02 | 6.8E-05 | 7.0E-02 |
| | Inhalation of Radon | 2.5E-02 | 9.0E-05 | 2.5E-02 |
| | Ingestion of Home Grown Produce | 2.5E-03 | 3.8E-06 | 2.5E-03 |
| | Ingestion of Soil | 4.6E-04 | 7.8E-07 | 4.6E-04 |
| | **Total:** | 9.8E-02 | 1.6E-04 | 9.8E-02 |

**TABLE C-6-7**
**VICINITY PROPERTIES - MARTIN'S LAKE**
**LIFETIME RISK**

| POPULATION | PATHWAY | RISK | | |
|---|---|---|---|---|
| | | GROSS | BACKGROUND | NET |
| ADULT RECREATIONALIST | External | 7.0E-04 | 2.6E-05 | 6.7E-04 |
| | Inhalation of Particulates | 1.4E-05 | 3.2E-07 | 1.4E-05 |
| | Ingestion of Soil | 1.1E-06 | 8.3E-08 | 1.0E-06 |
| | **Total:** | 7.2E-04 | 2.6E-05 | 6.9E-04 |
| CHILD RECREATIONALIST | External | 1.4E-04 | 5.1E-06 | 1.3E-04 |
| | Inhalation of Particulates | 2.6E-06 | 6.0E-08 | 2.5E-06 |
| | Ingestion of Soil | 4.5E-07 | 3.3E-08 | 4.2E-07 |
| | **Total:** | 1.4E-04 | 5.2E-06 | 1.4E-04 |

**TABLE C-6-8**
**VICINITY PROPERTIES - PUBLIC PARK**
**LIFETIME RISK**

| POPULATION | PATHWAY | RISK | | |
|---|---|---|---|---|
| | | GROSS | BACKGROUND | NET |
| SITE WORKER | External | 7.3E-01 | 8.6E-05 | 7.3E-01 |
| | Inhalation of Particulates | 2.3E-02 | 1.8E-06 | 2.3E-02 |
| | Ingestion of Soil | 3.0E-03 | 5.5E-07 | 3.0E-03 |
| | **Total:** | 7.6E-01 | 8.8E-05 | 7.6E-01 |
| ADULT RECREATIONALIST | External | 2.2E-01 | 2.6E-05 | 2.2E-01 |
| | Inhalation of Particulates | 6.9E-03 | 5.5E-07 | 6.9E-03 |
| | Ingestion of Soil | 4.5E-04 | 8.3E-08 | 4.5E-04 |
| | **Total:** | 2.3E-01 | 2.7E-05 | 2.3E-01 |
| CHILD RECREATIONALIST | External | 4.4E-02 | 5.1E-06 | 4.4E-02 |
| | Inhalation of Particulates | 1.2E-03 | 9.4E-08 | 1.2E-03 |
| | Ingestion of Soil | 1.8E-04 | 3.3E-08 | 1.8E-04 |
| | **Total:** | 4.5E-02 | 5.2E-06 | 4.5E-02 |

| TABLE C-6-9<br>VICINITY PROPERTIES - DYNAMIC BLENDING<br>LIFETIME RISK | | | | |
|---|---|---|---|---|
| POPULATION | PATHWAY | RISK | | |
| | | GROSS | BACKGROUND | NET |
| SITE WORKER | External | 3.7E-04 | 2.0E-04 | 1.7E-04 |
| | Inhalation of Radon | 1.7E-03 | 5.2E-04 | 1.2E-03 |
| | Total: | 2.1E-03 | 7.2E-04 | 1.4E-03 |

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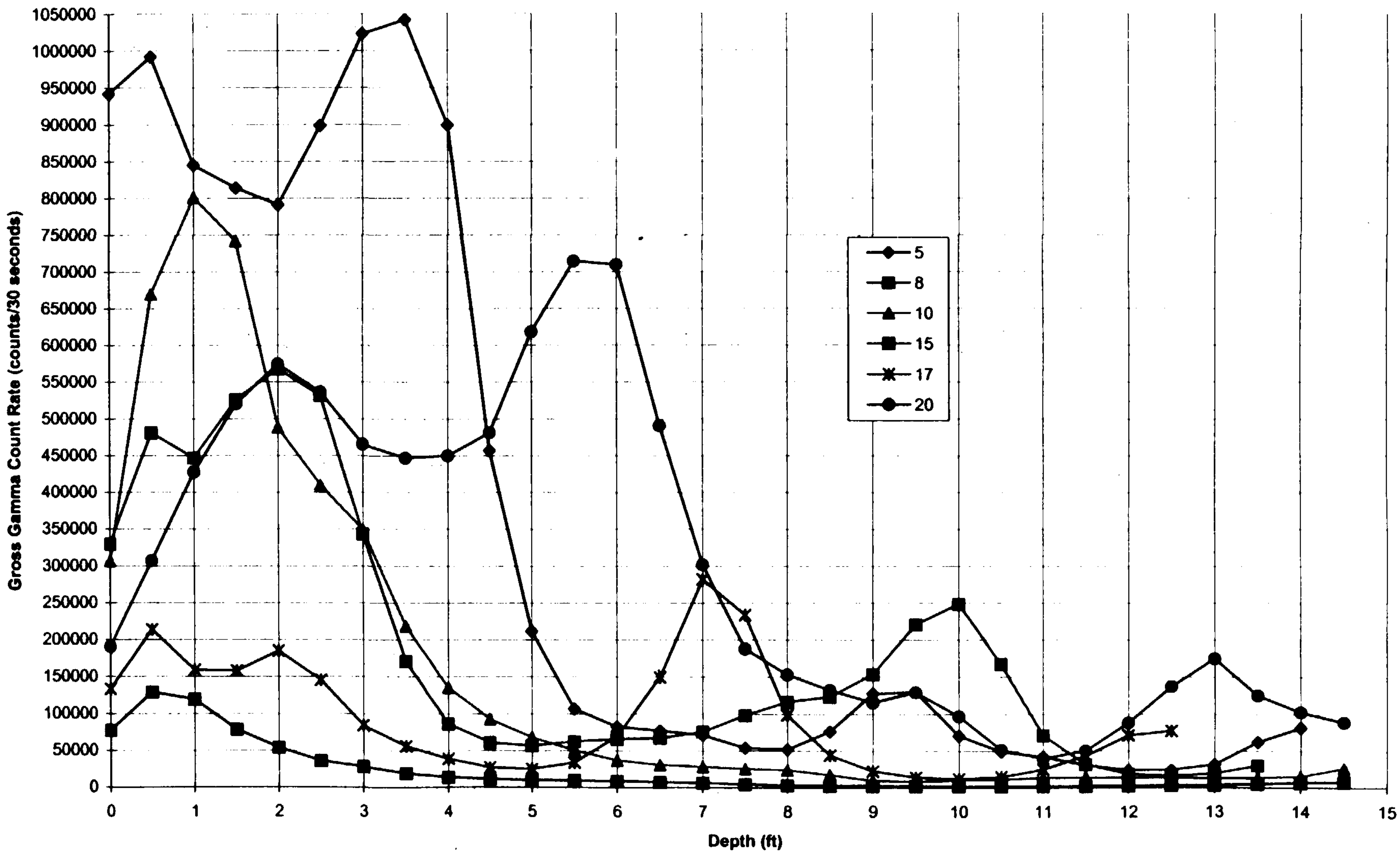
**APPENDIX D**

**WELSBACH/GGM SITE**

**DOWNHOLE GAMMA LOGGING PROFILE CHARTS**

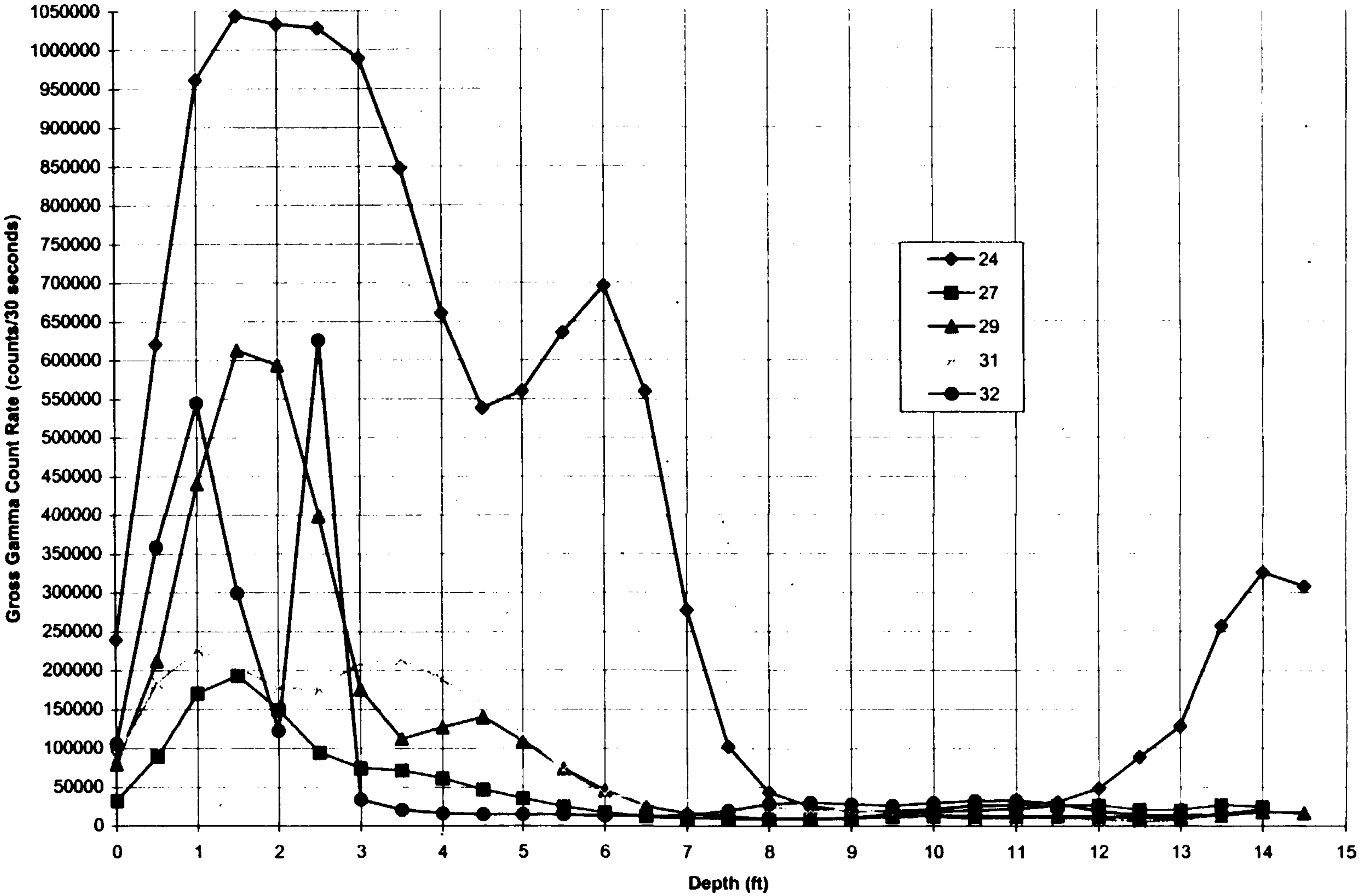
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
WELSBACH/GGM SITE
CAMDEN AND GLOUCESTER CITY
CAMDEN COUNTY, NEW JERSEY

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (FORMER WELSBACH FACILITY)
## APPENDIX D-1

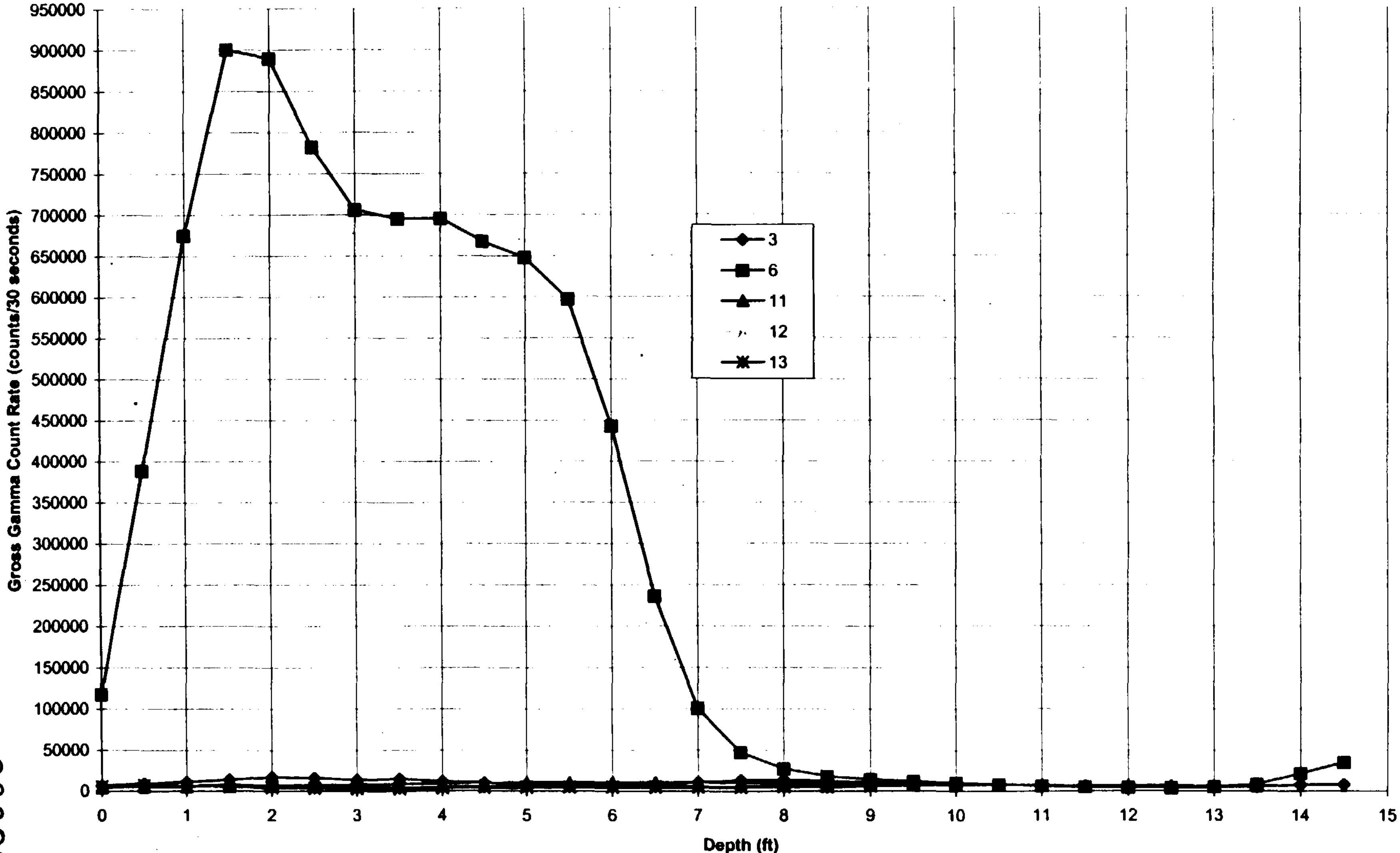



300897

**WELSBACH/GGM SITE**
**DOWNHOLE GAMMA LOGGING RESULTS (FORMER WELSBACH FACILITY)**
**APPENDIX D-1**

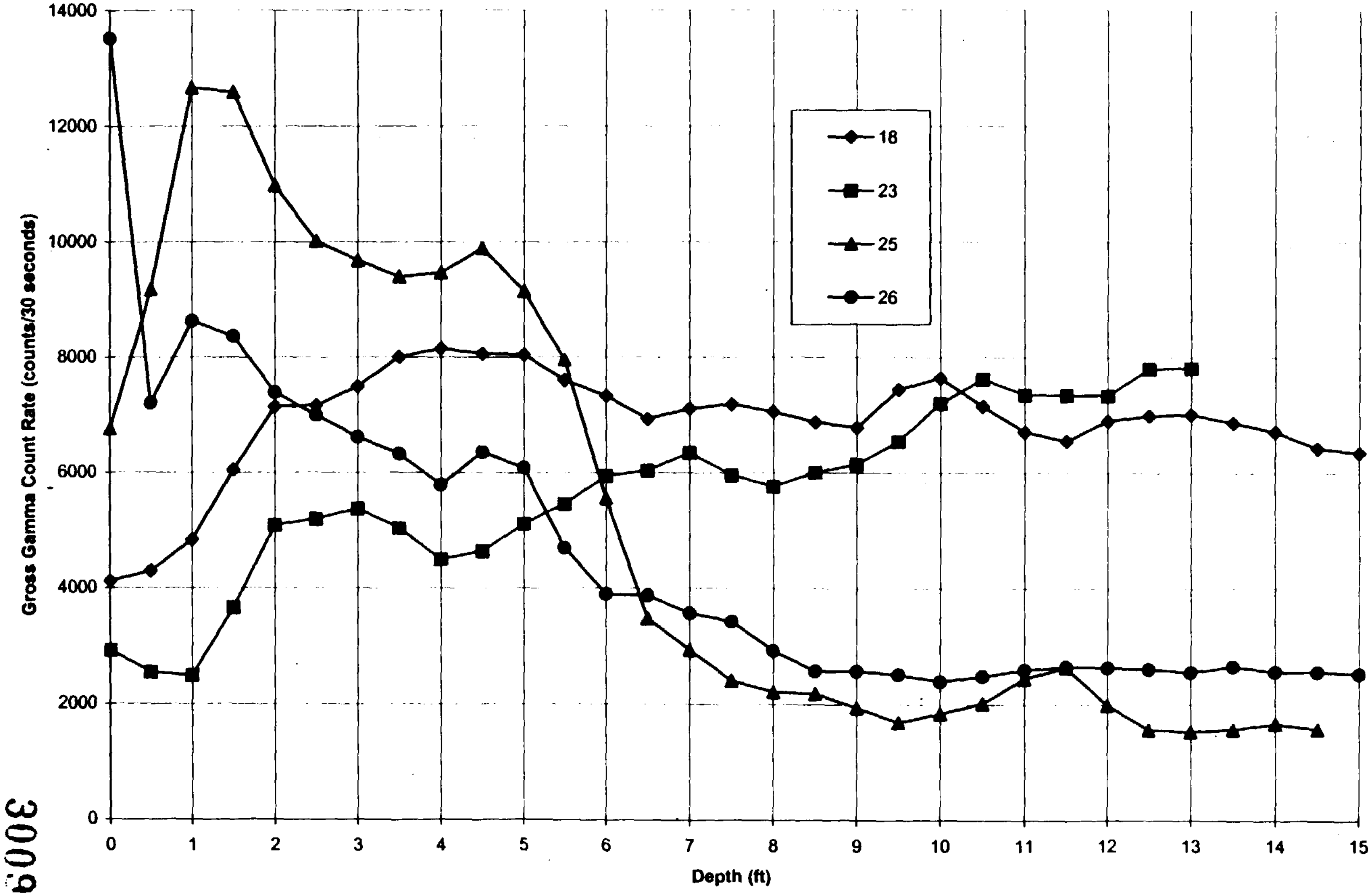


## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (FORMER WELSBACK FACILITY)
## APPENDIX D-1



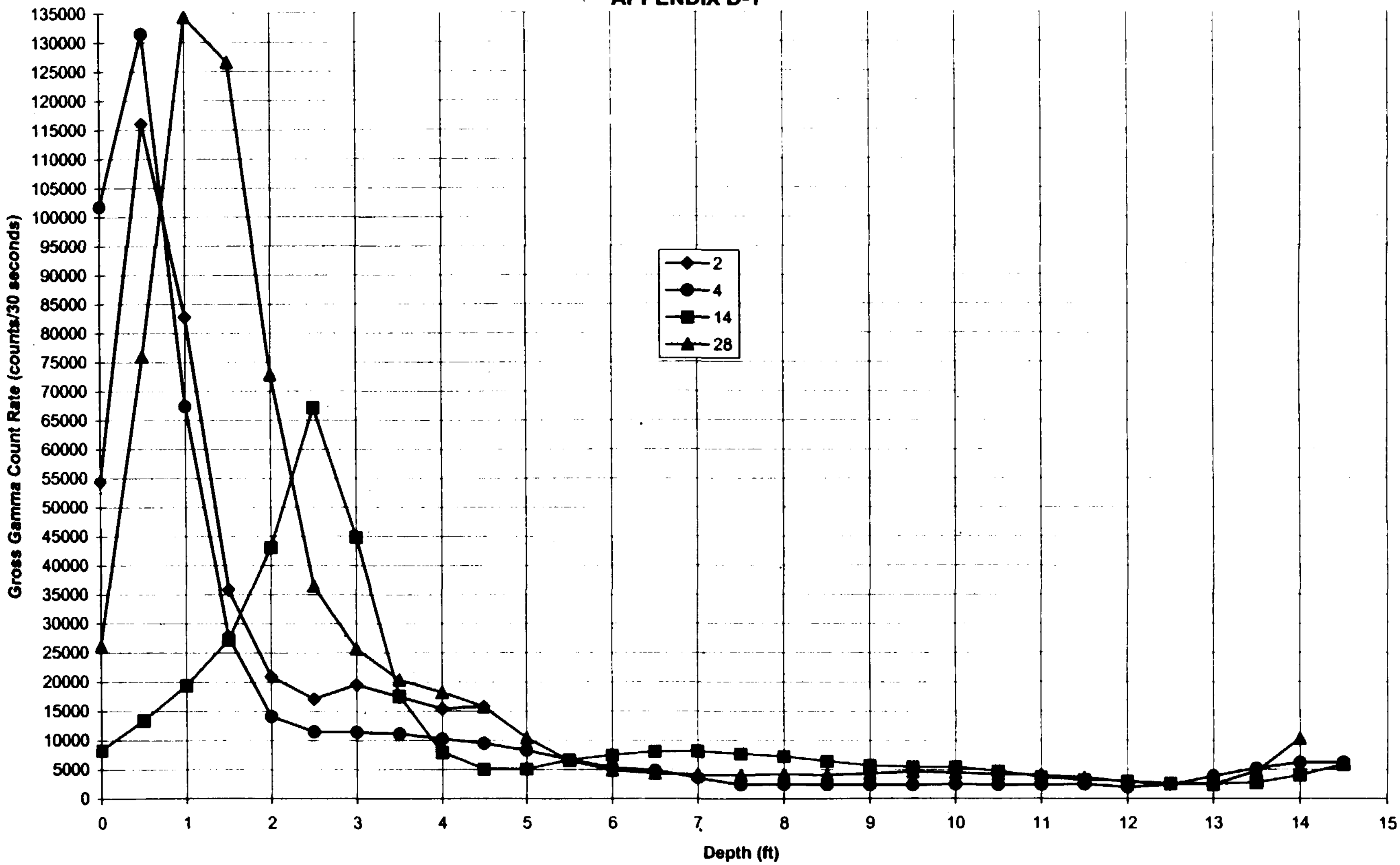

300003

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (FORMER WELSBACH FACILITY)
## APPENDIX D-1



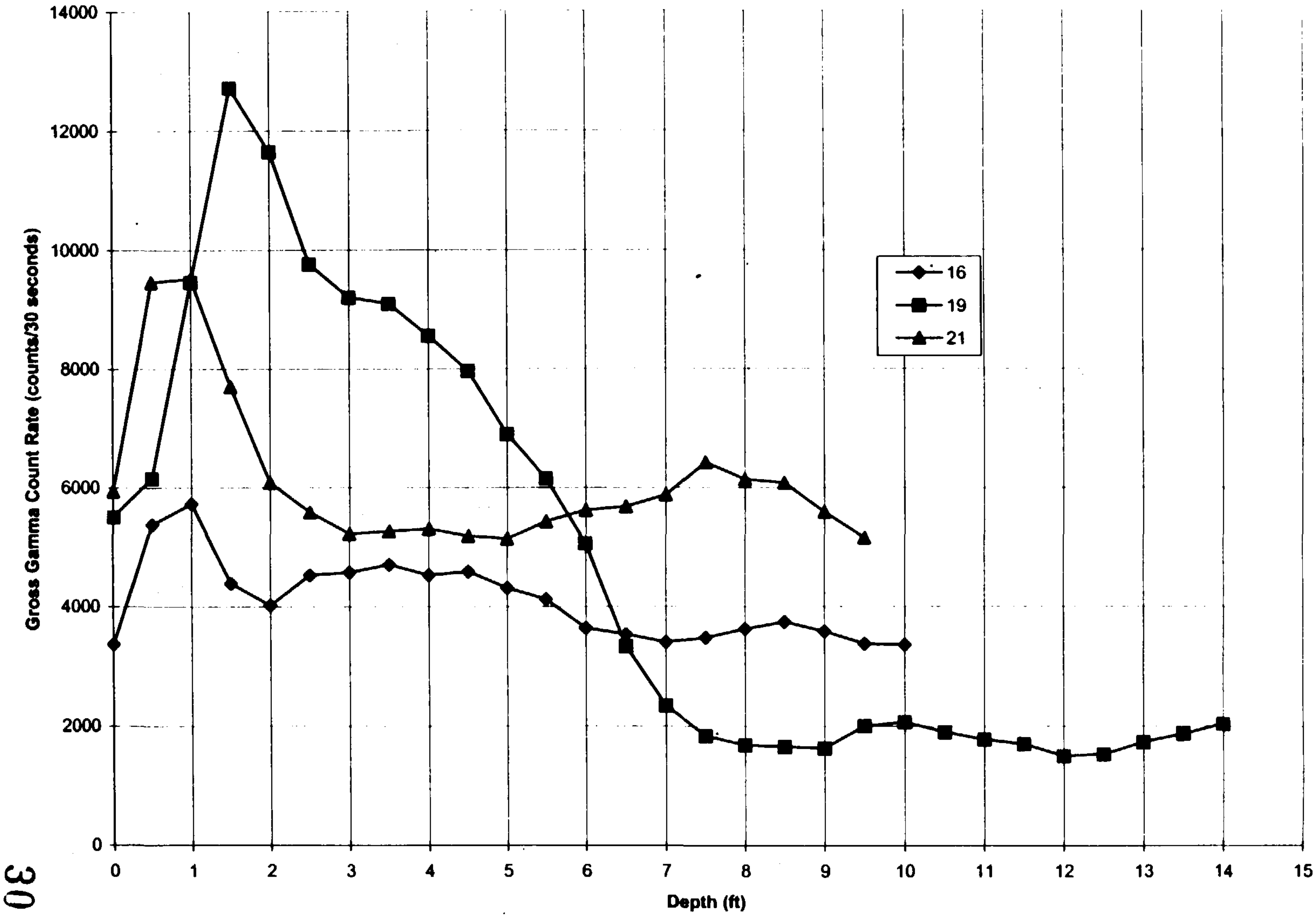

300906

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (FORMER WELSBACH FACILITY)
APPENDIX D-1



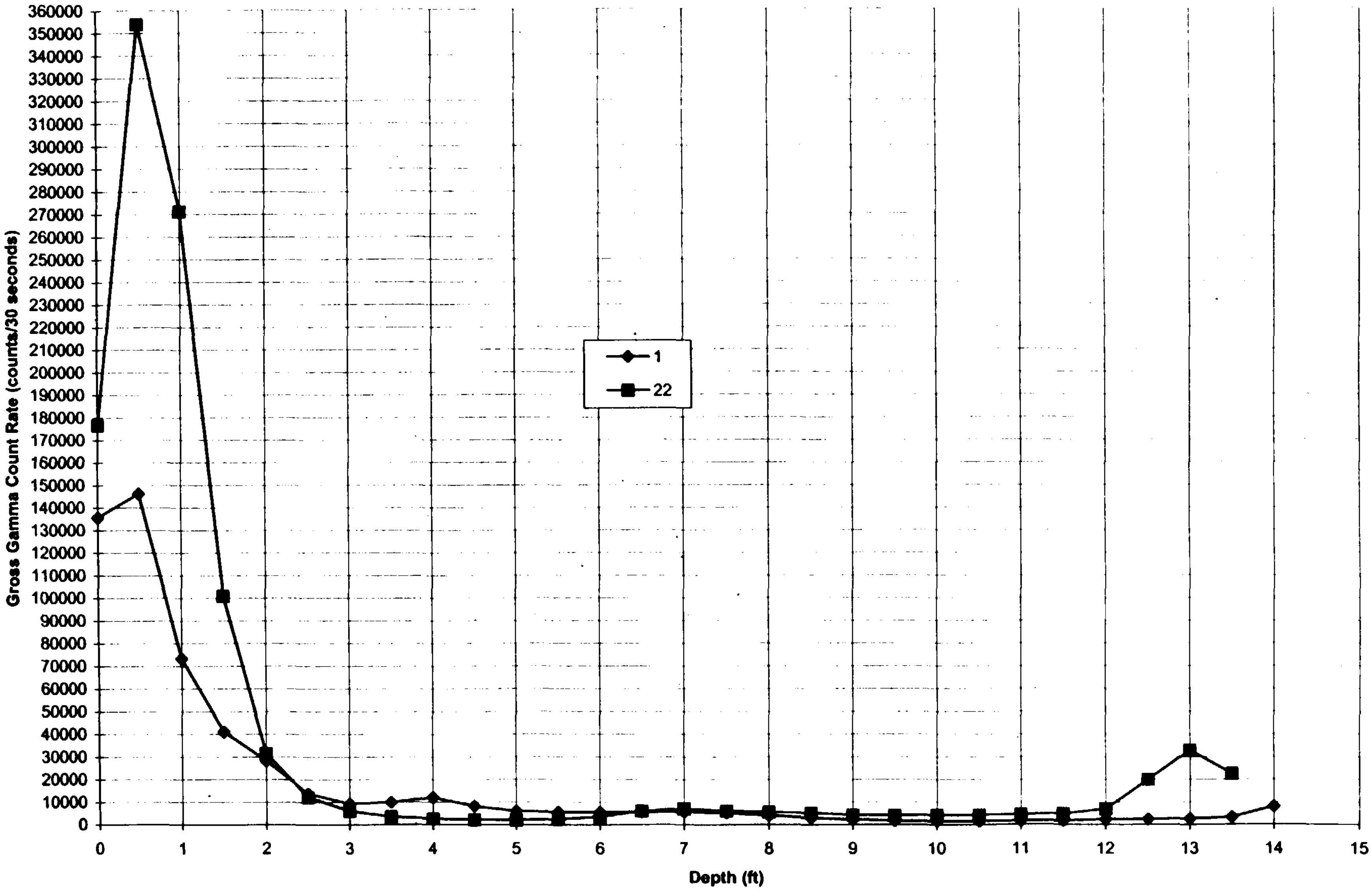

300907

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (FORMER WELSBACH FACILITY)
## APPENDIX D-1

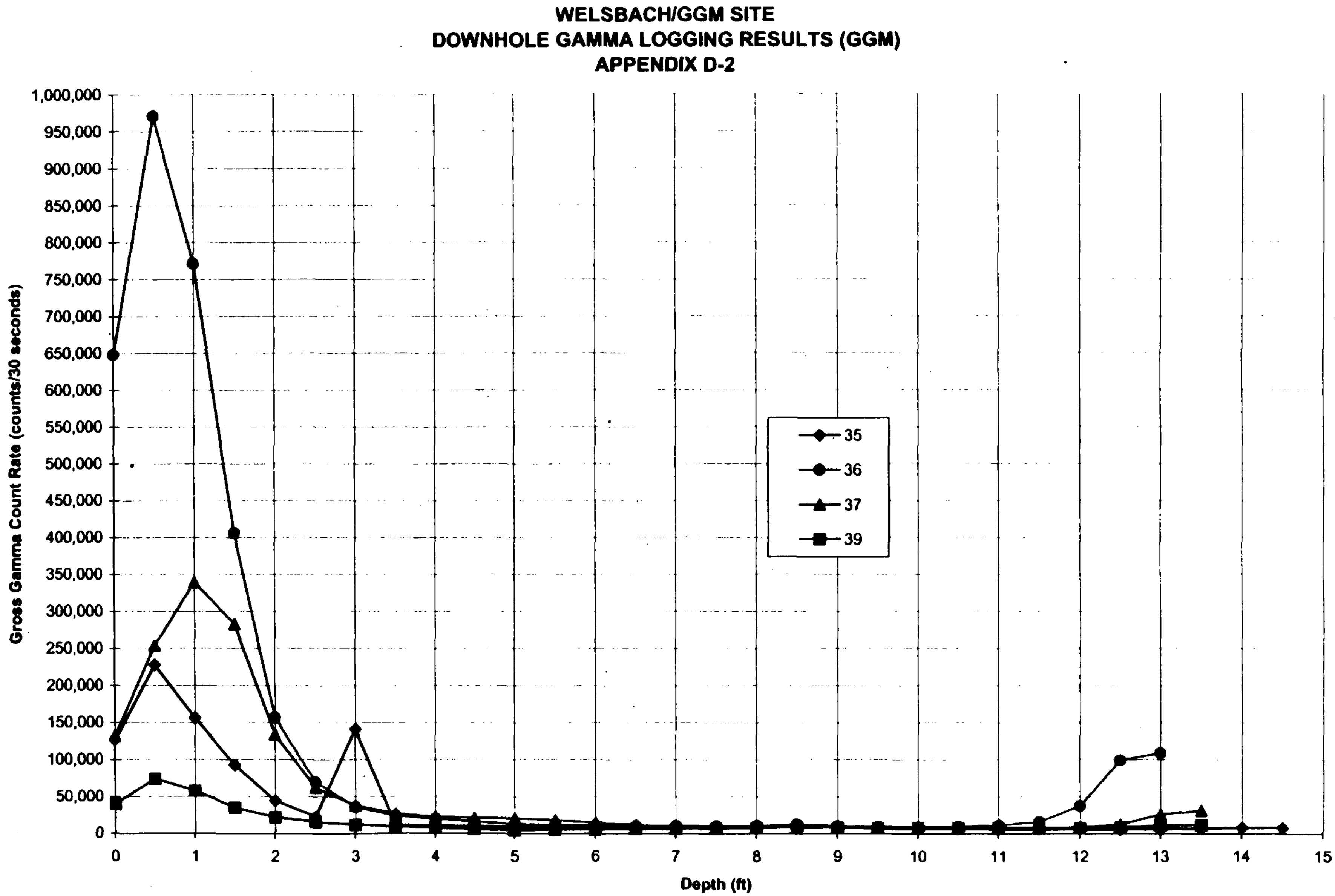



300900

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (FORMER WELSBACH FACILITY)
## APPENDIX D-1



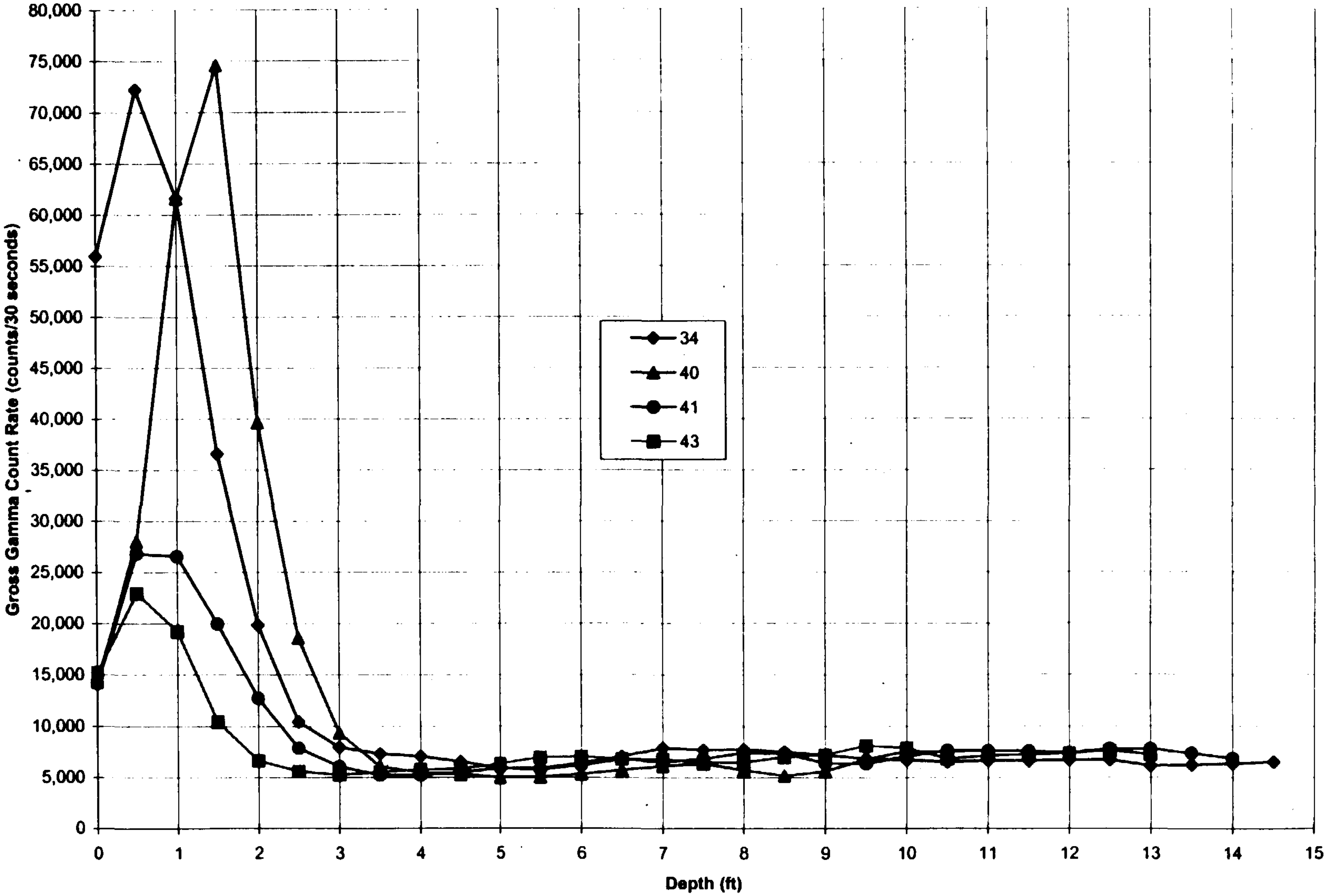

300903


WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (GGM)
APPENDIX D-2
Gross Gamma Count Rate (counts/30 seconds)
1,000,000
950,000
900,000
850,000
800,000
750,000
700,000
650,000
600,000
550,000
500,000
450,000
400,000
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Depth (ft)
35
36
37
39

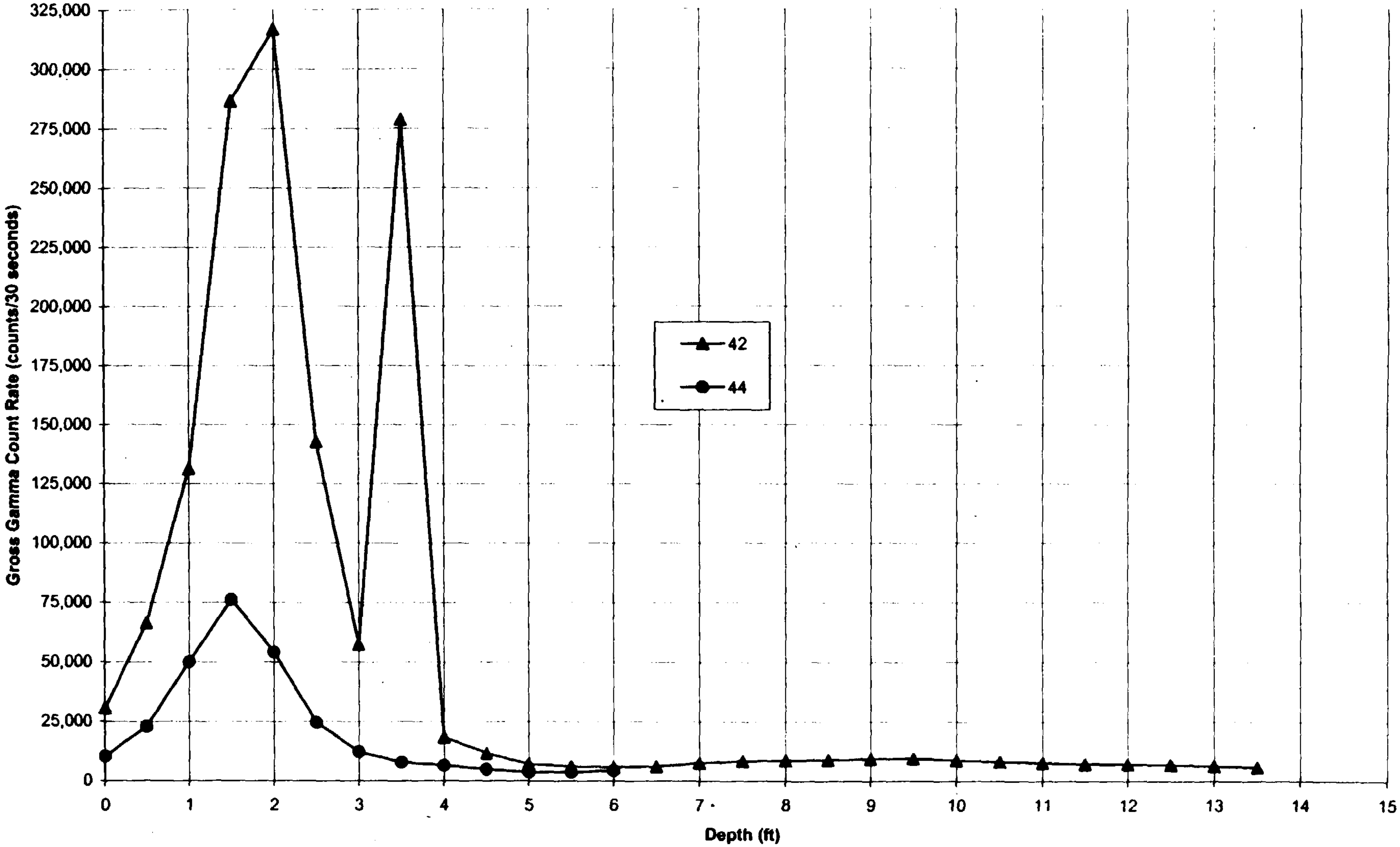


300024

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (GGM)
## APPENDIX D-2

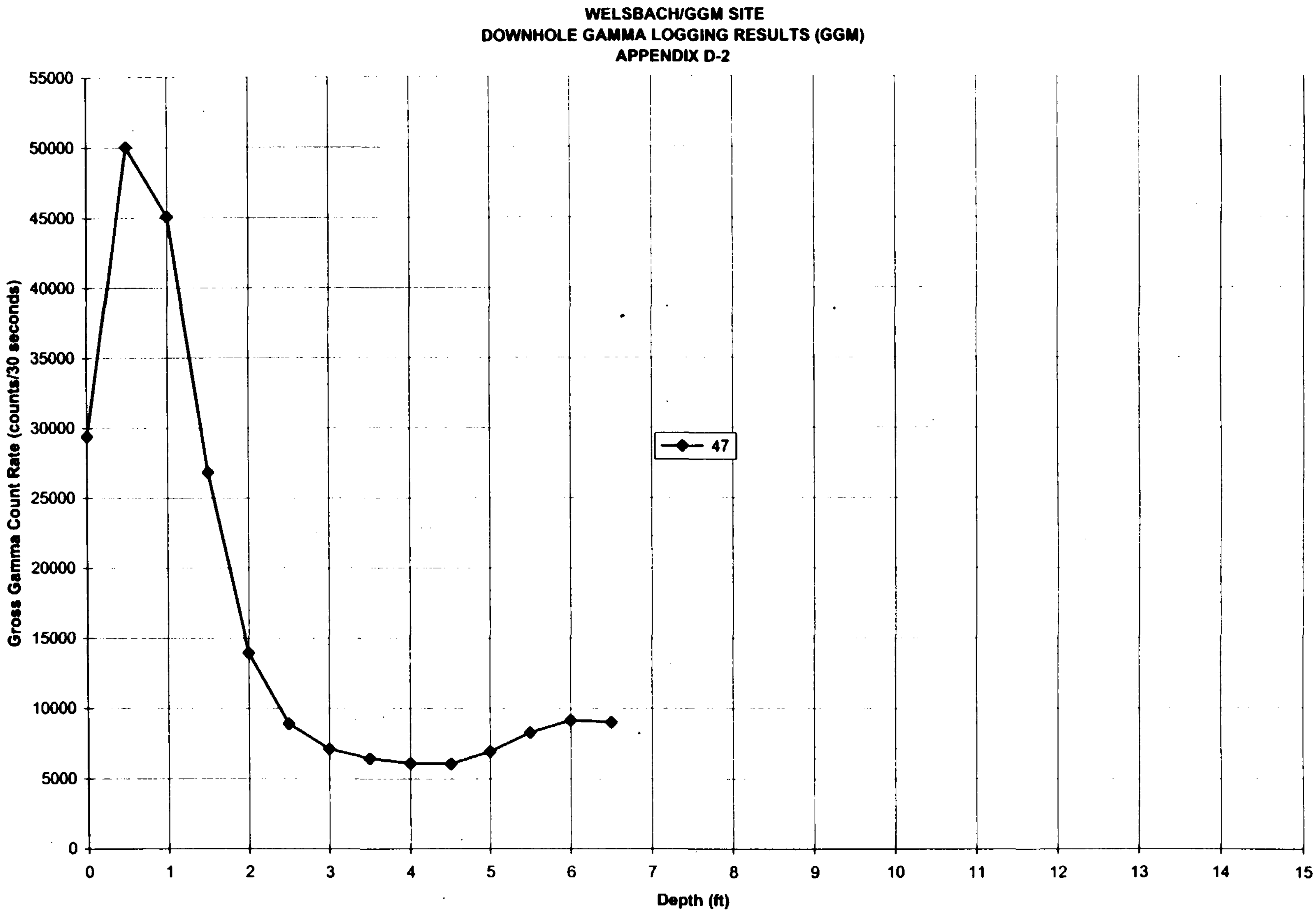


## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (GGM)
## APPENDIX D-2



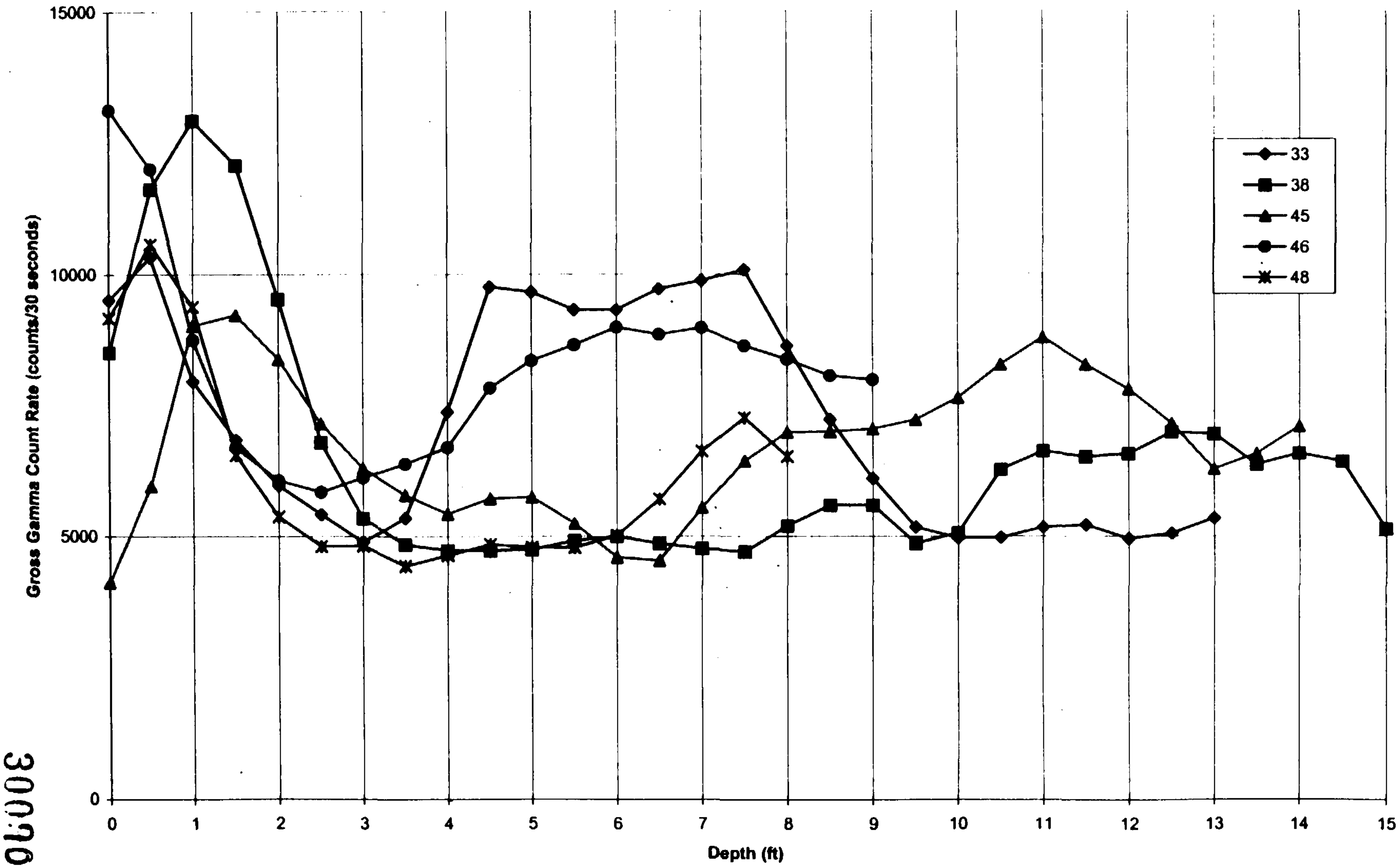



300006


WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (GGM)
APPENDIX D-2
Gross Gamma Count Rate (counts/30 seconds)
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Depth (ft)
47

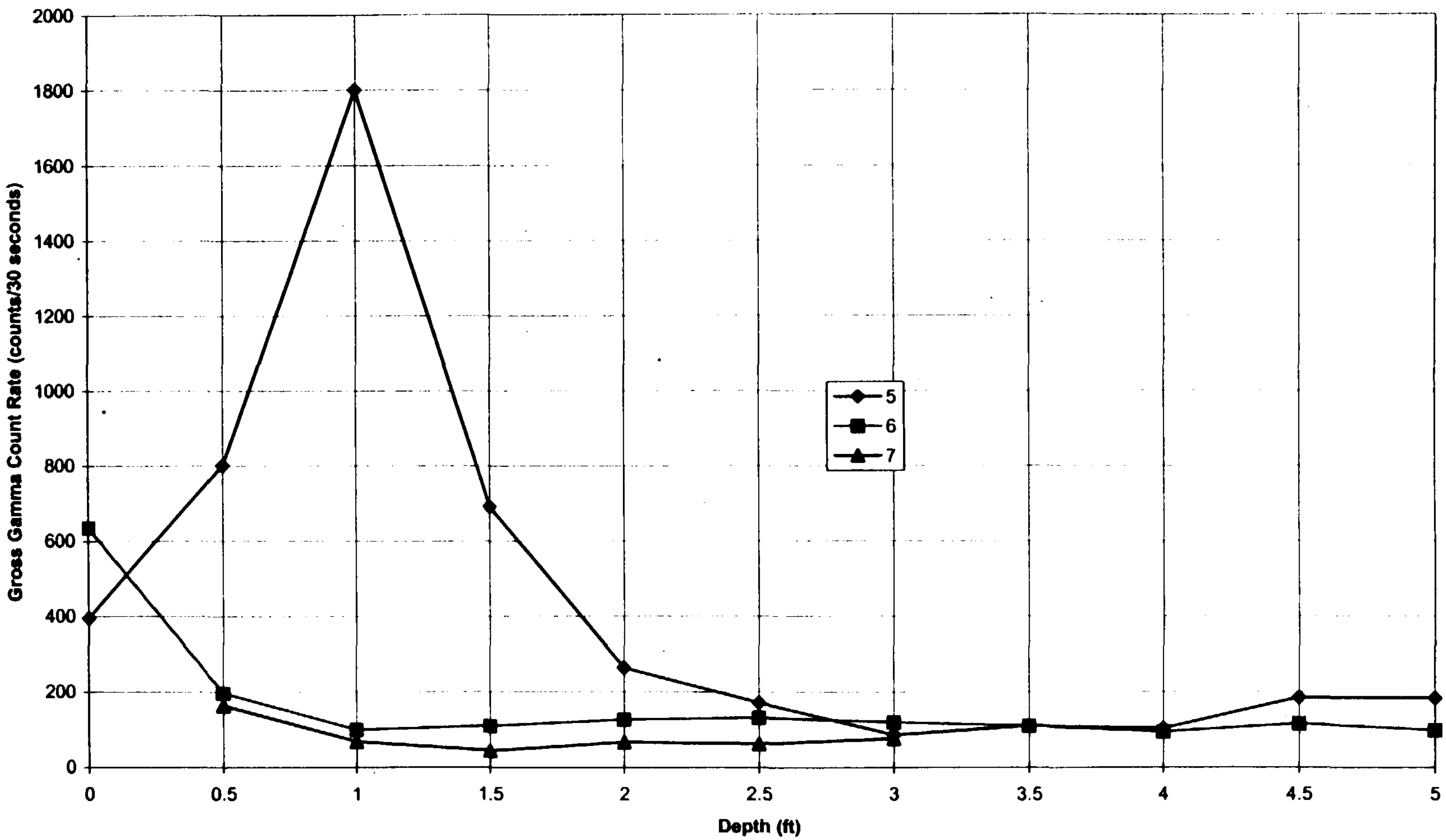
300007

**WELSBACH/GGM SITE**
**DOWNHOLE GAMMA LOGGING RESULTS (GGM)**
**APPENDIX D-2**

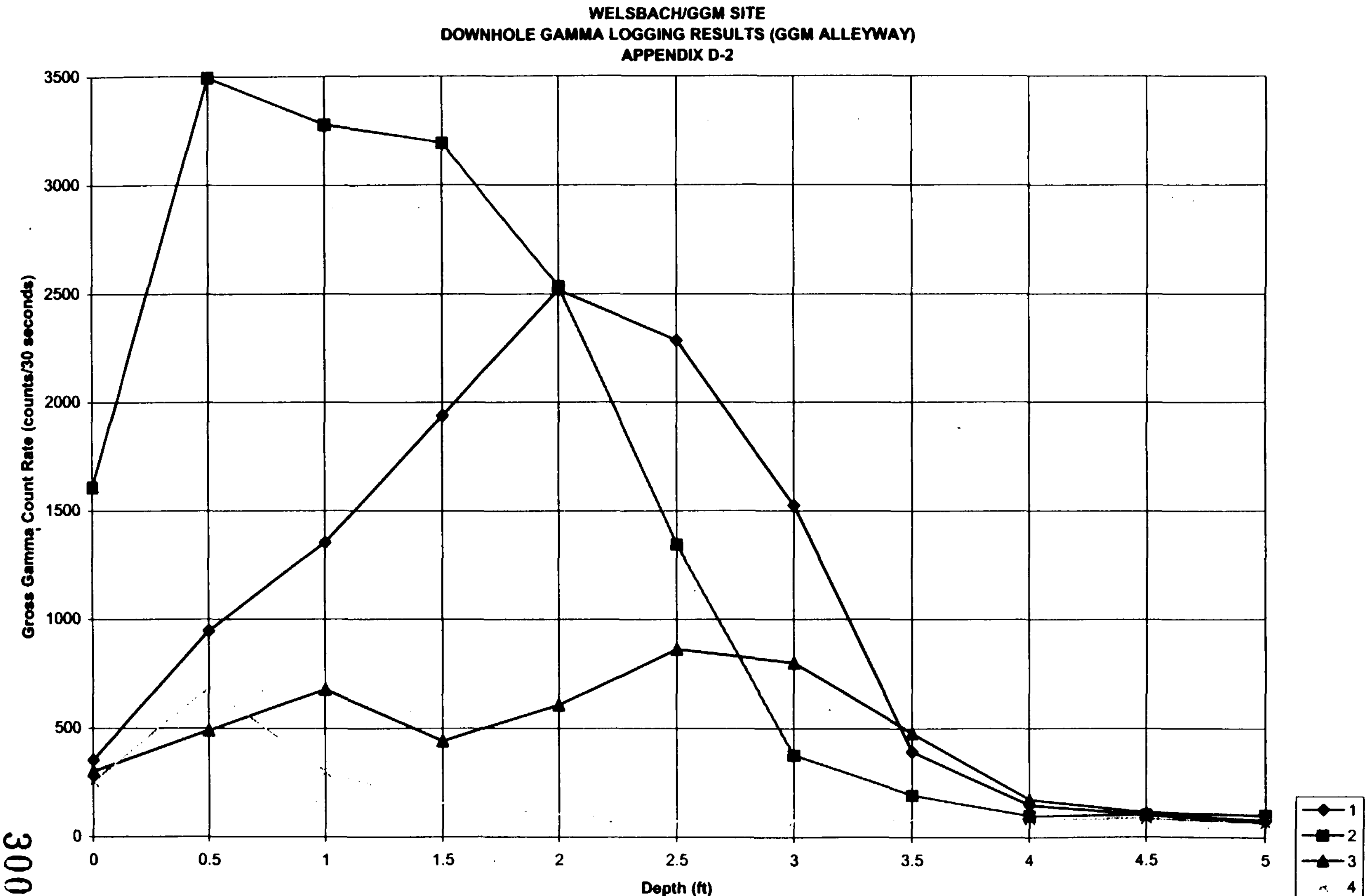



300706

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (GGM BASEMENT)
APPENDIX D-3

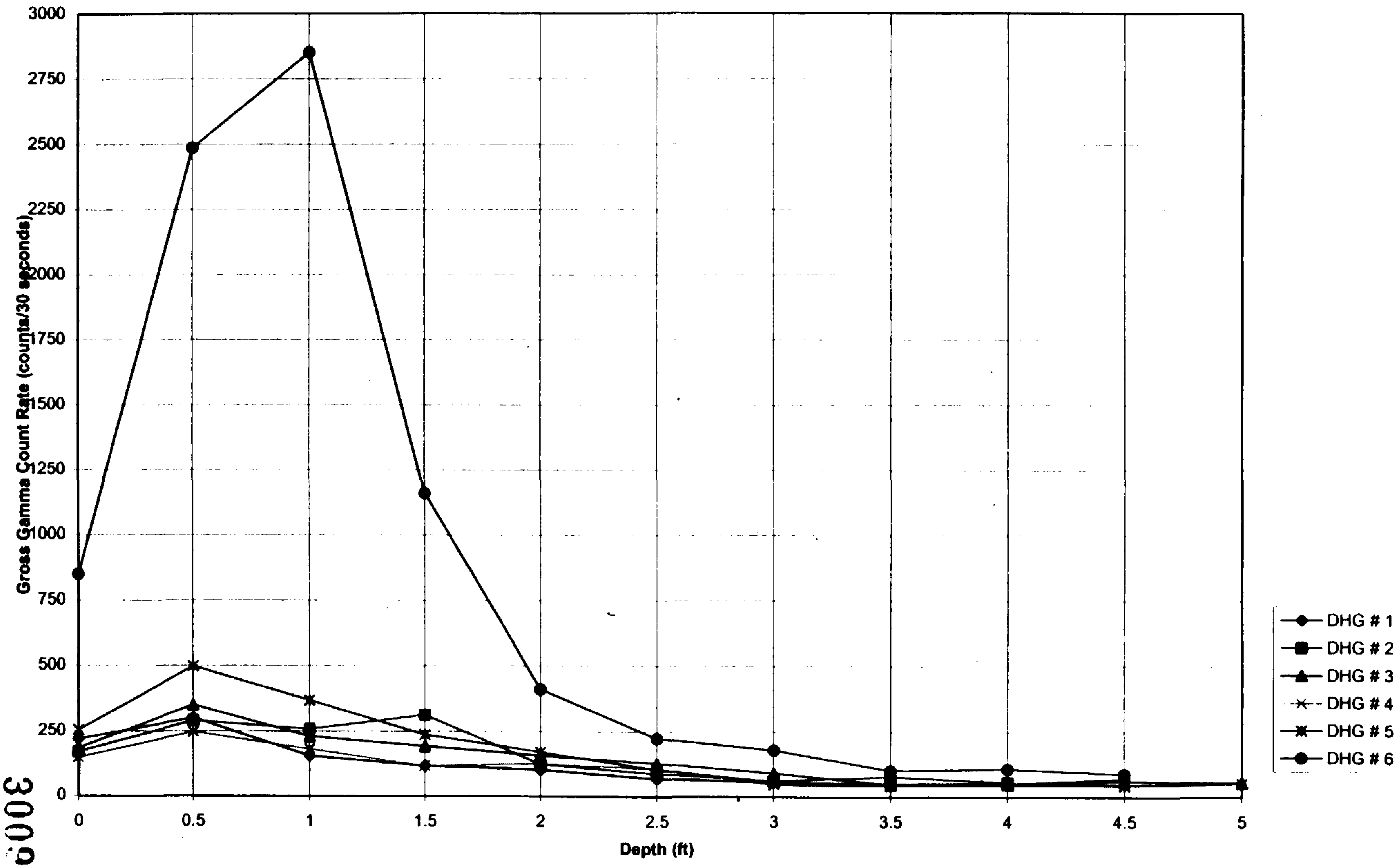



300206


WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (GGM ALLEYWAY)
APPENDIX D-2
Gross Gamma Count Rate (counts/30 seconds)
0
500
1000
1500
2000
2500
3000
3500
Depth (ft)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
1
2
3
4

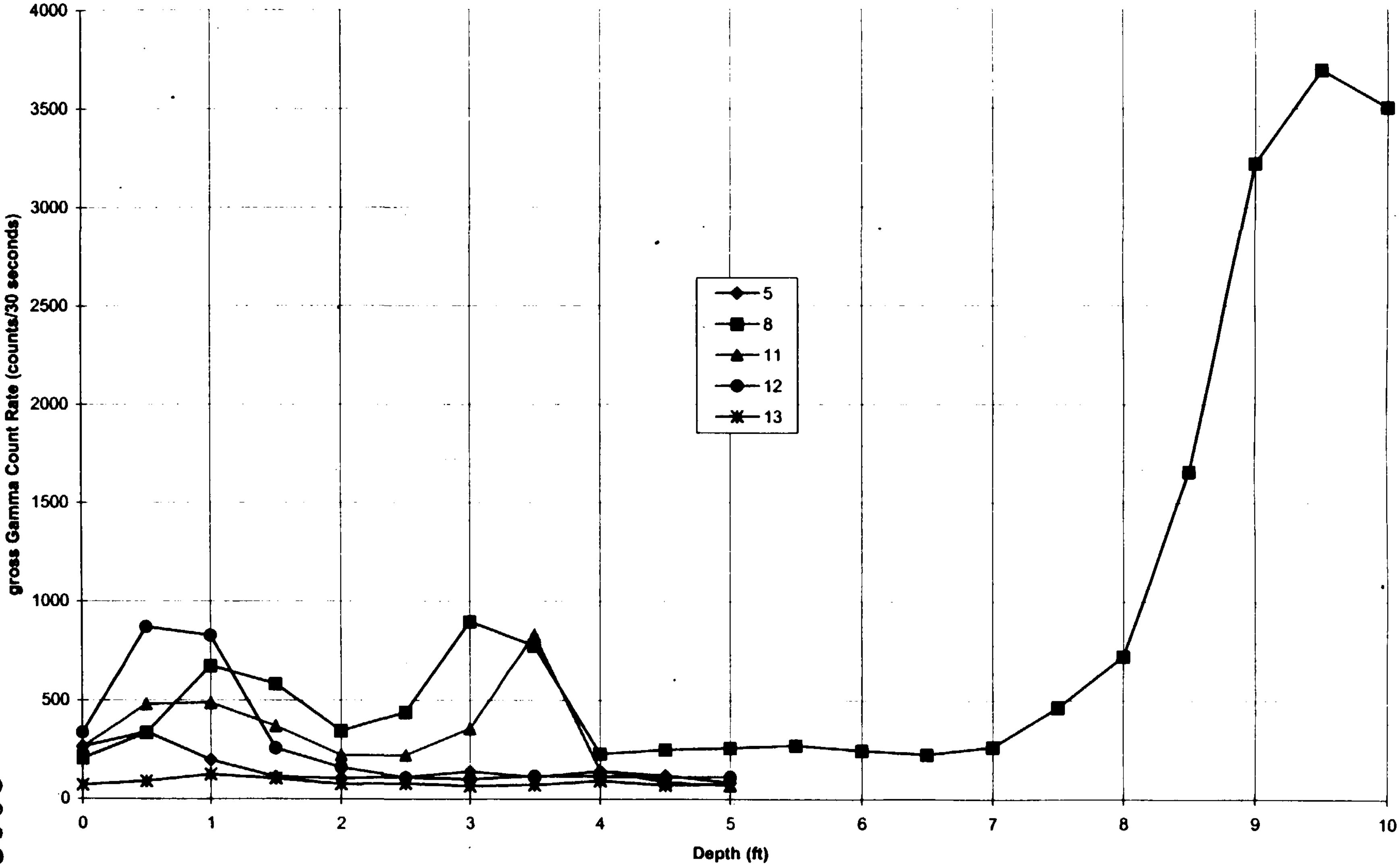
300910

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 1)
## APPENDIX D-3



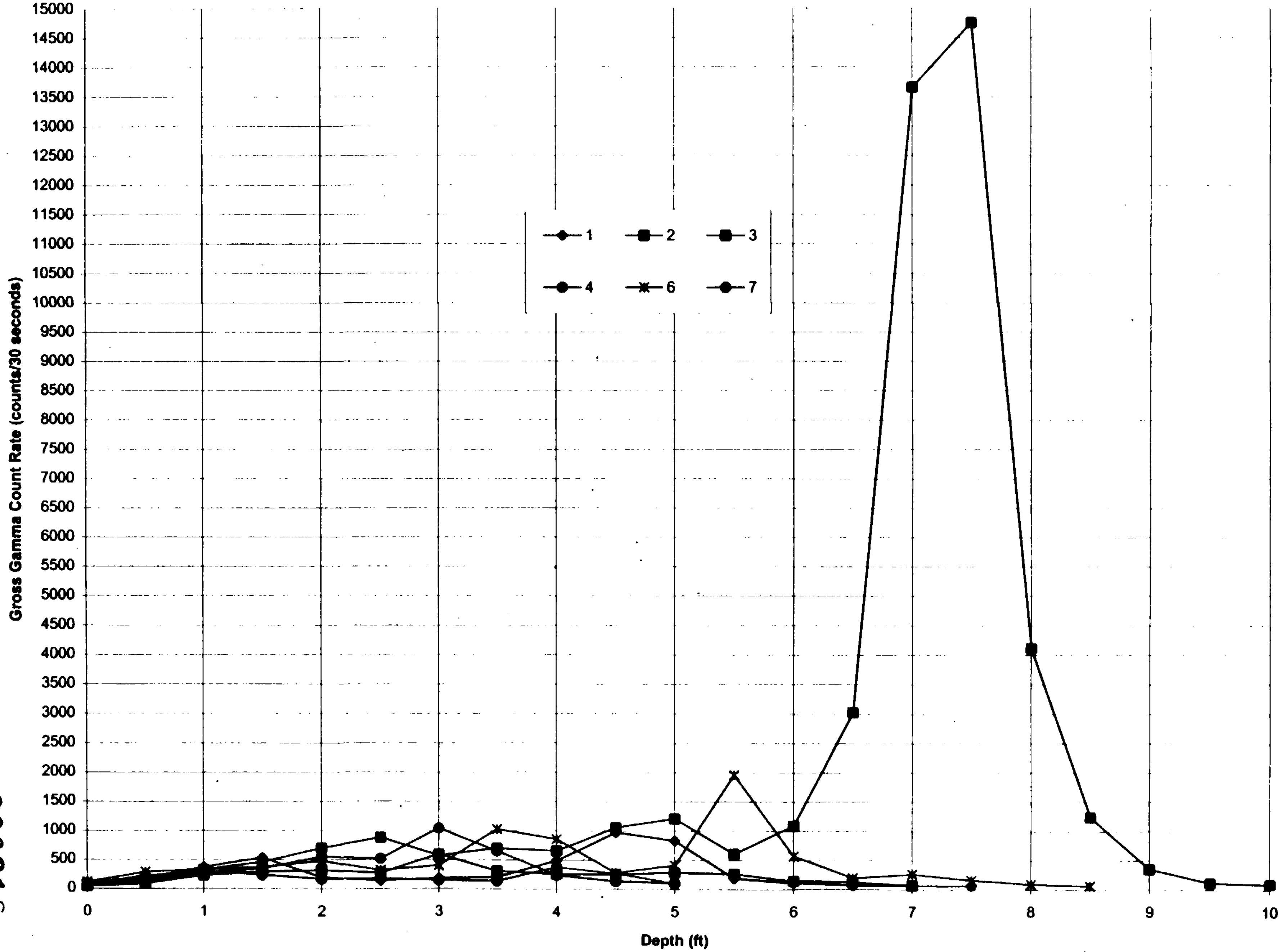

300911

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 2)
## APPENDIX D-3

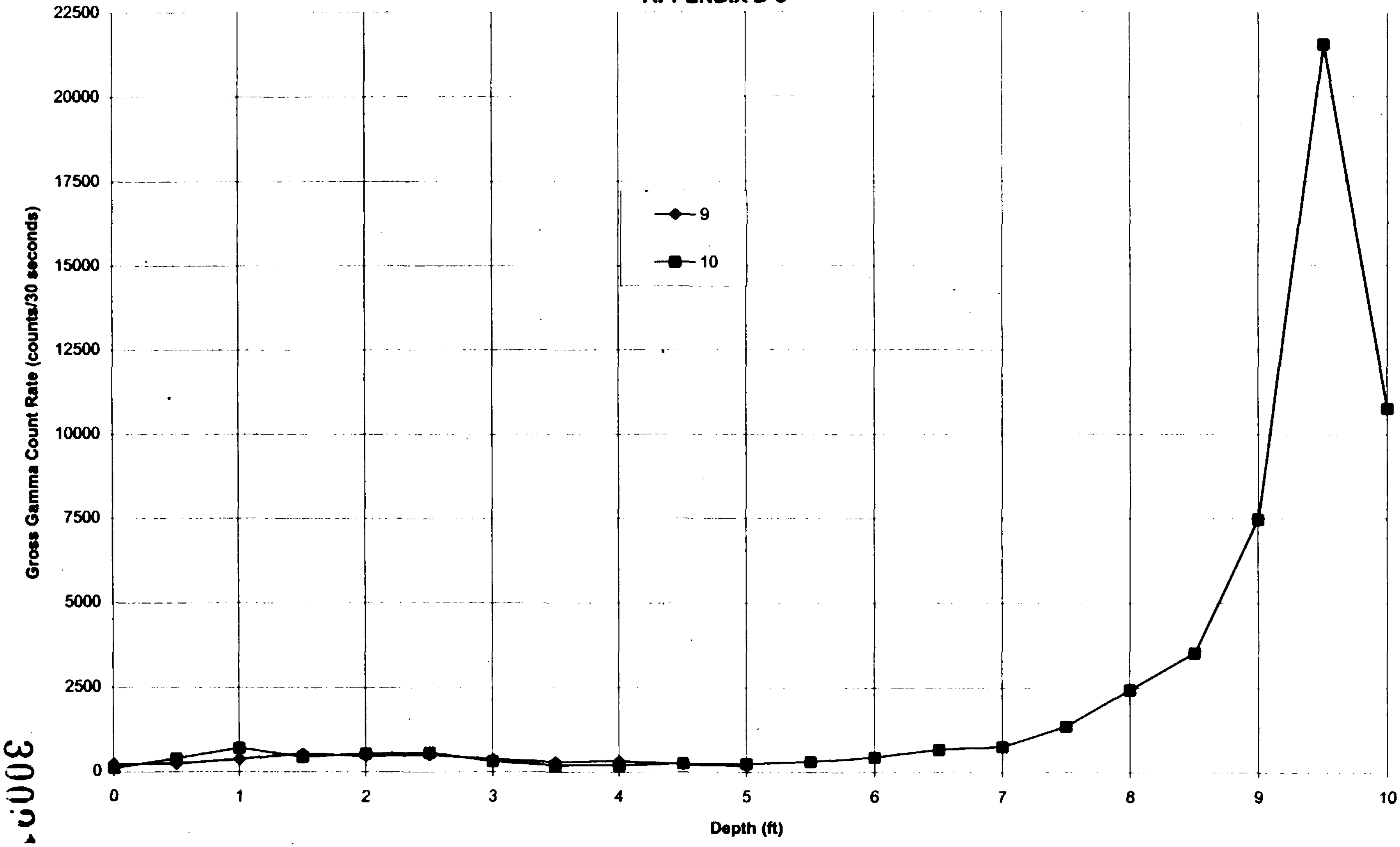



300912

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 2)
APPENDIX D-3

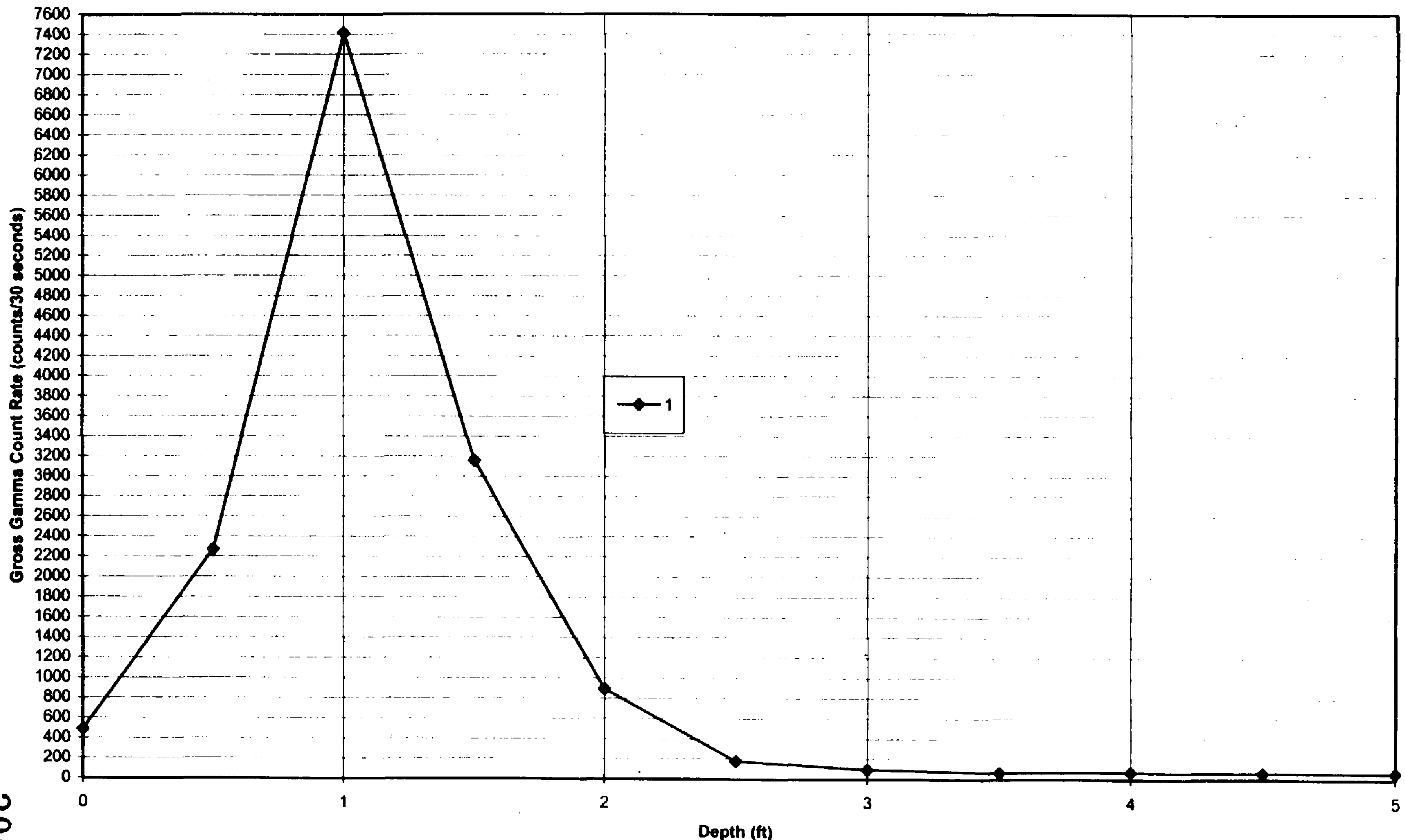


**WELSBACH/GGM SITE**
**DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 2)**
**APPENDIX D-3**



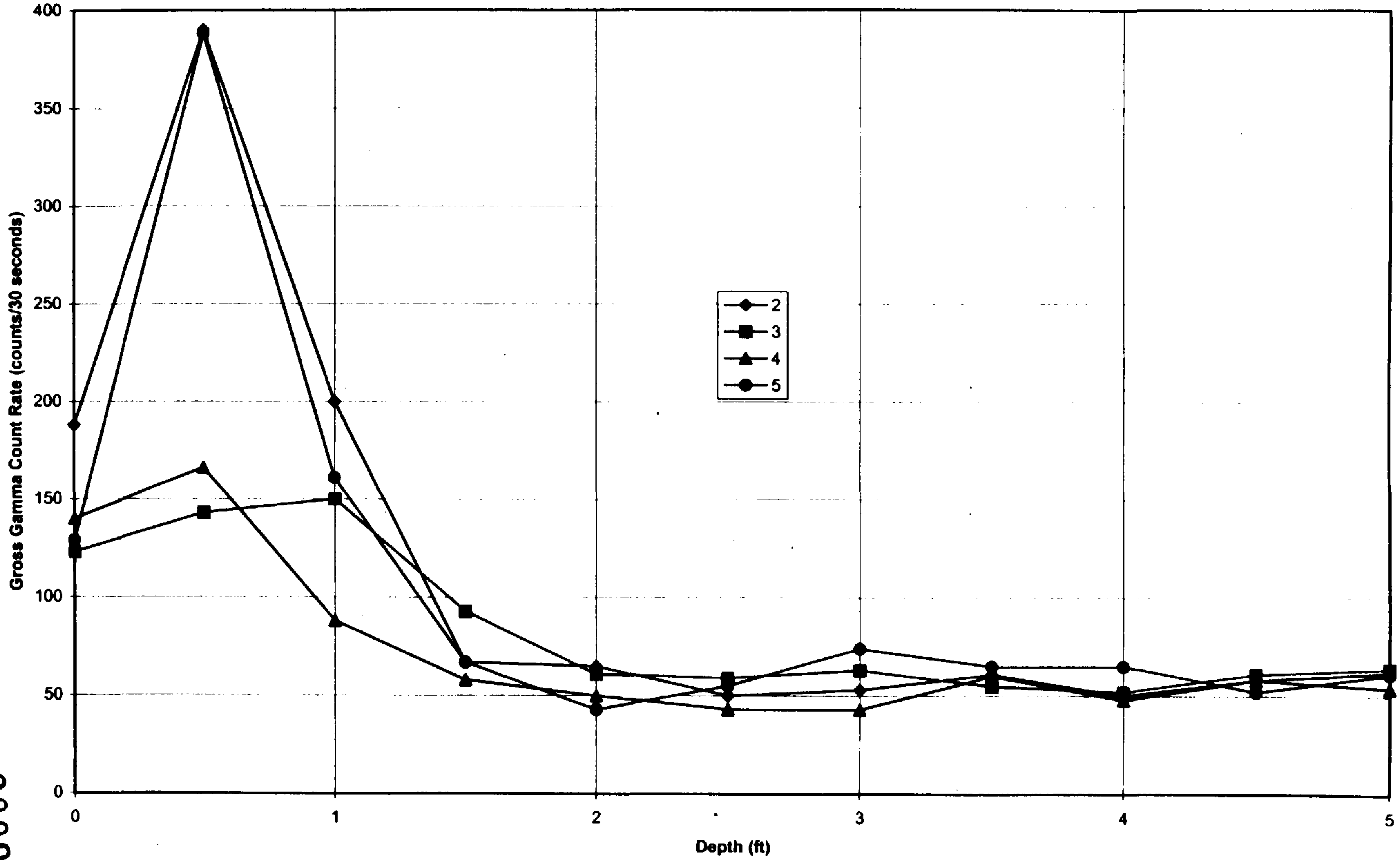

300214

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 3)
## APPENDIX D-3



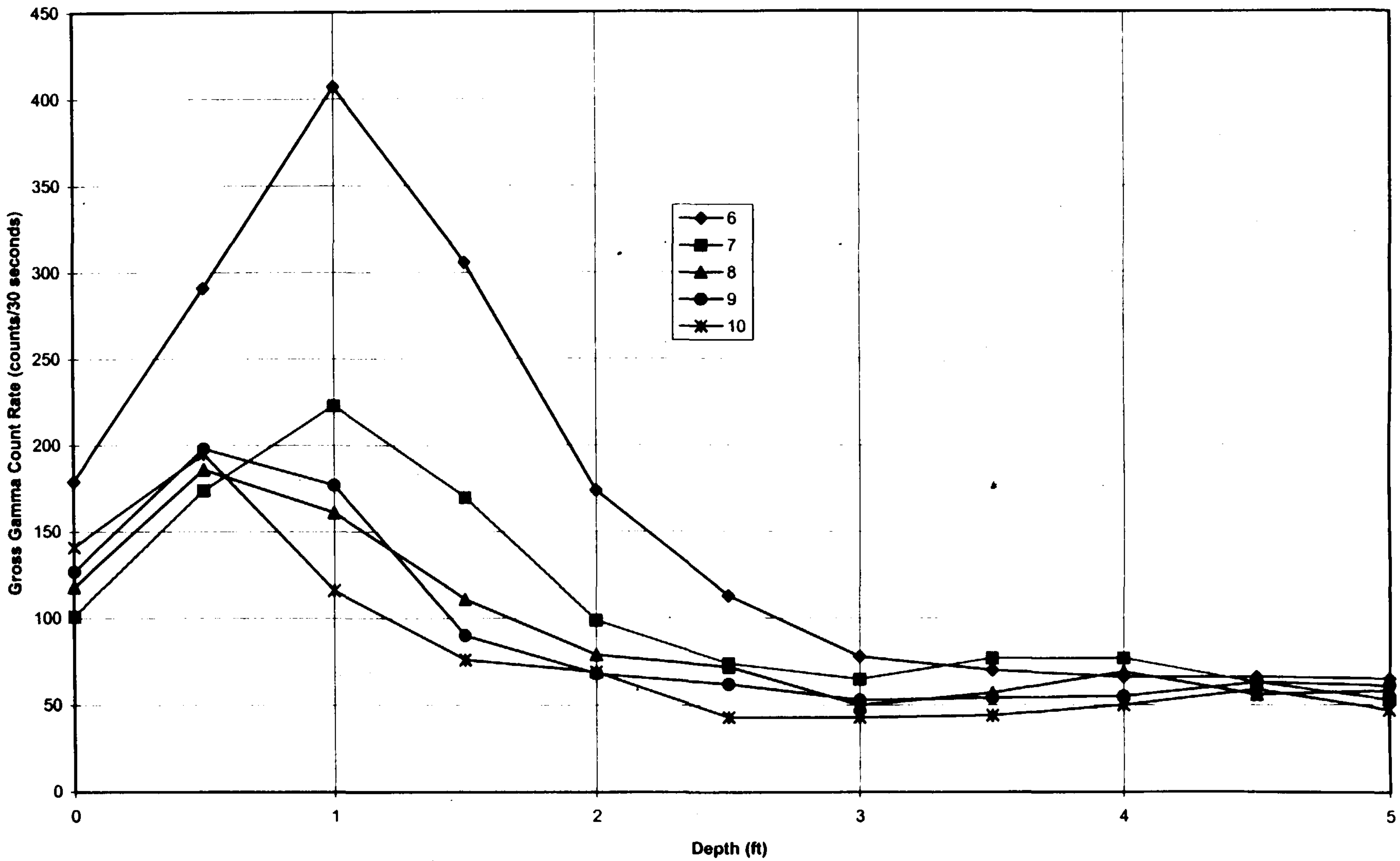

300015

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 3)
APPENDIX D-3



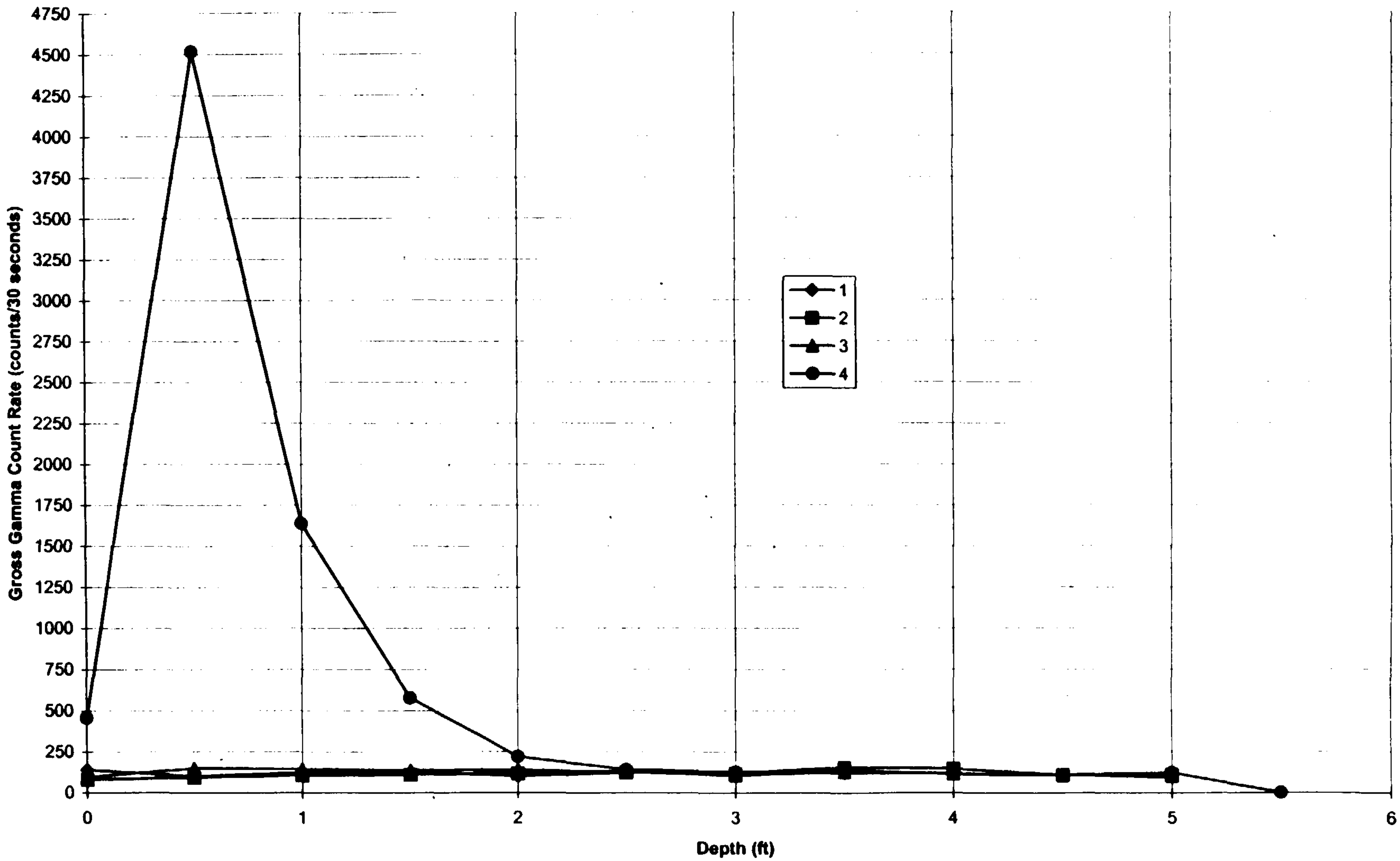

300916

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 3)
## APPENDIX D-3



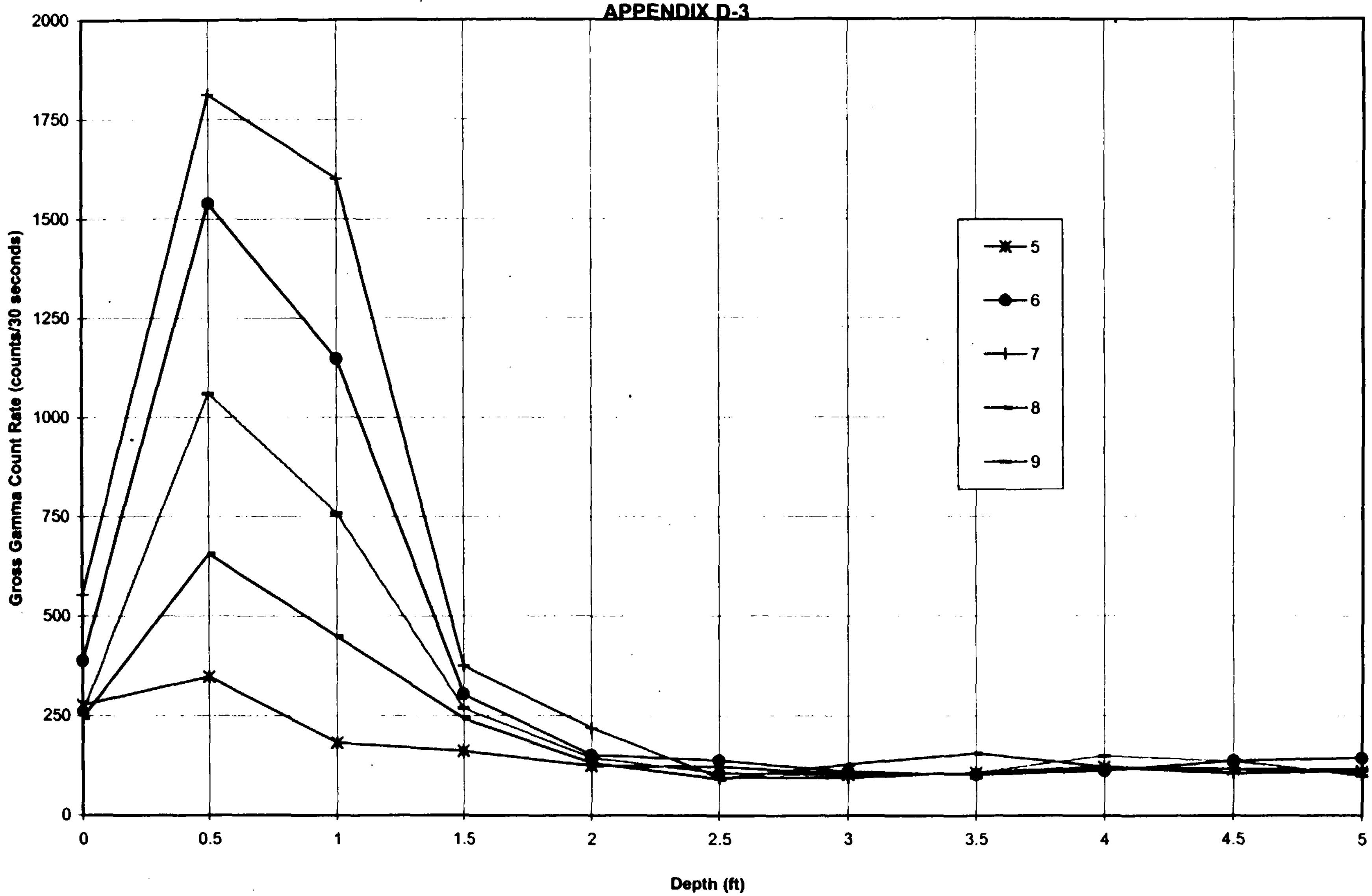

300915

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY4)
## APPENDIX D-3



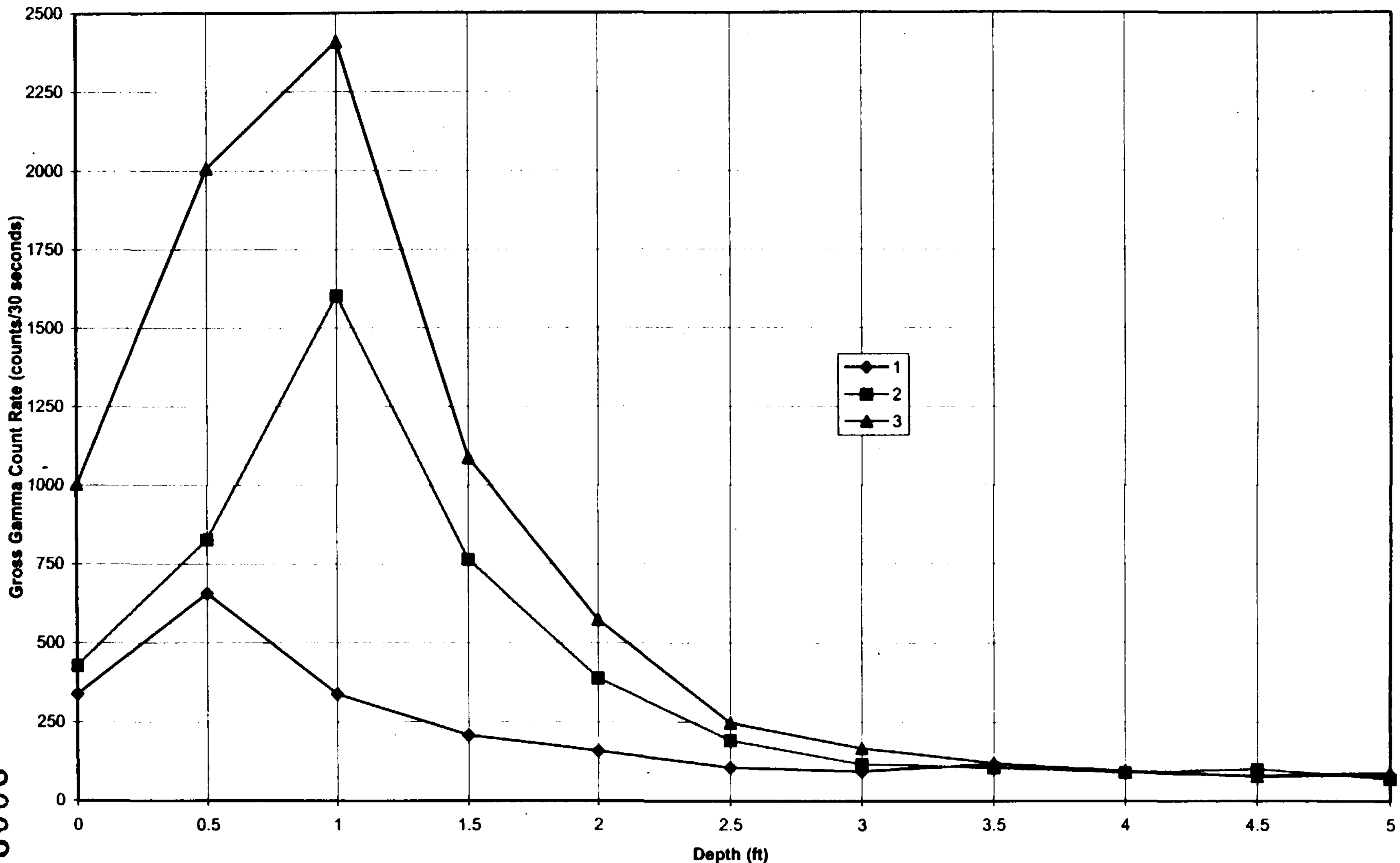

300913

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY4)
APPENDIX D-3



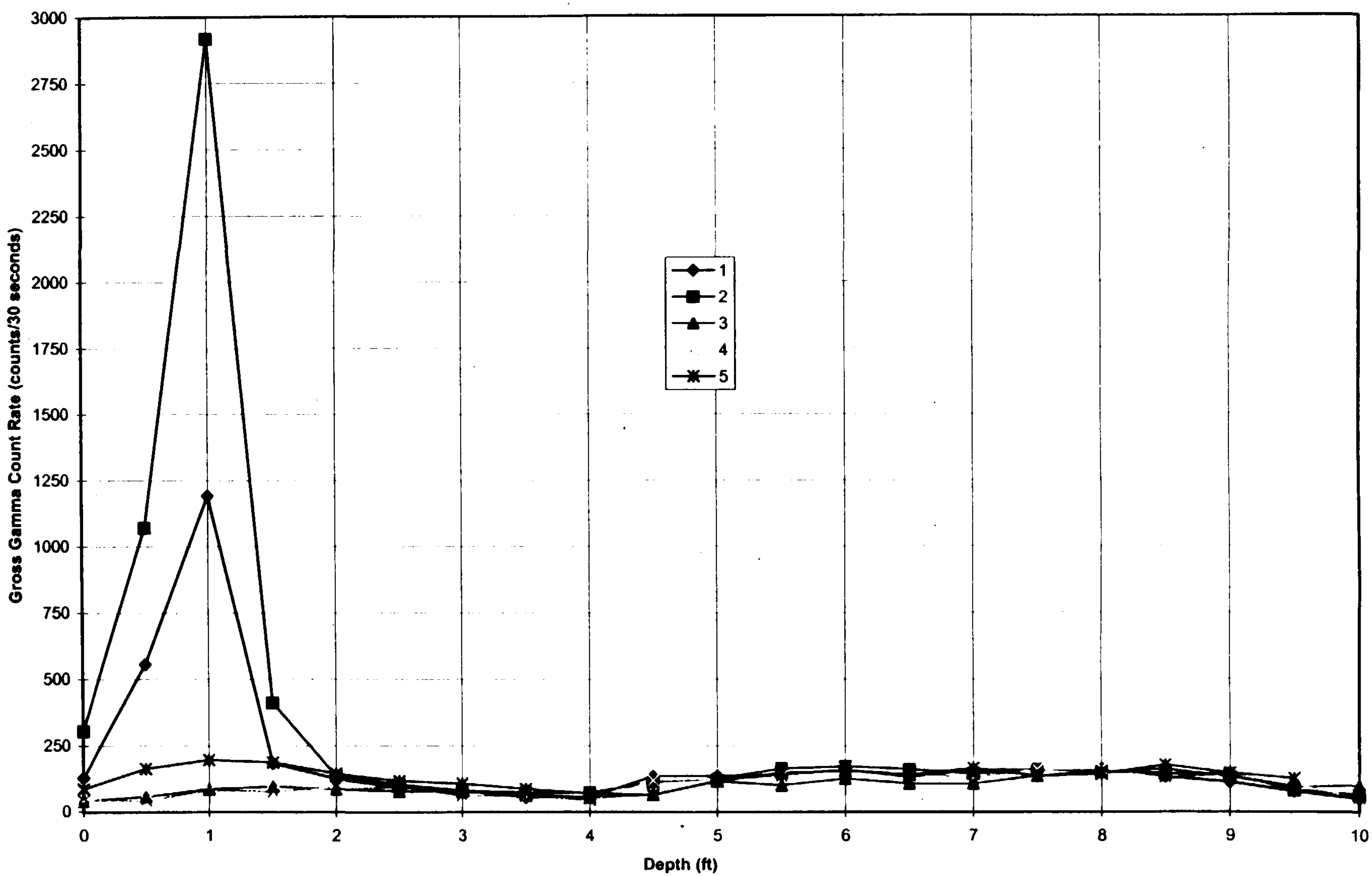

300918

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 5)
## APPENDIX D-3



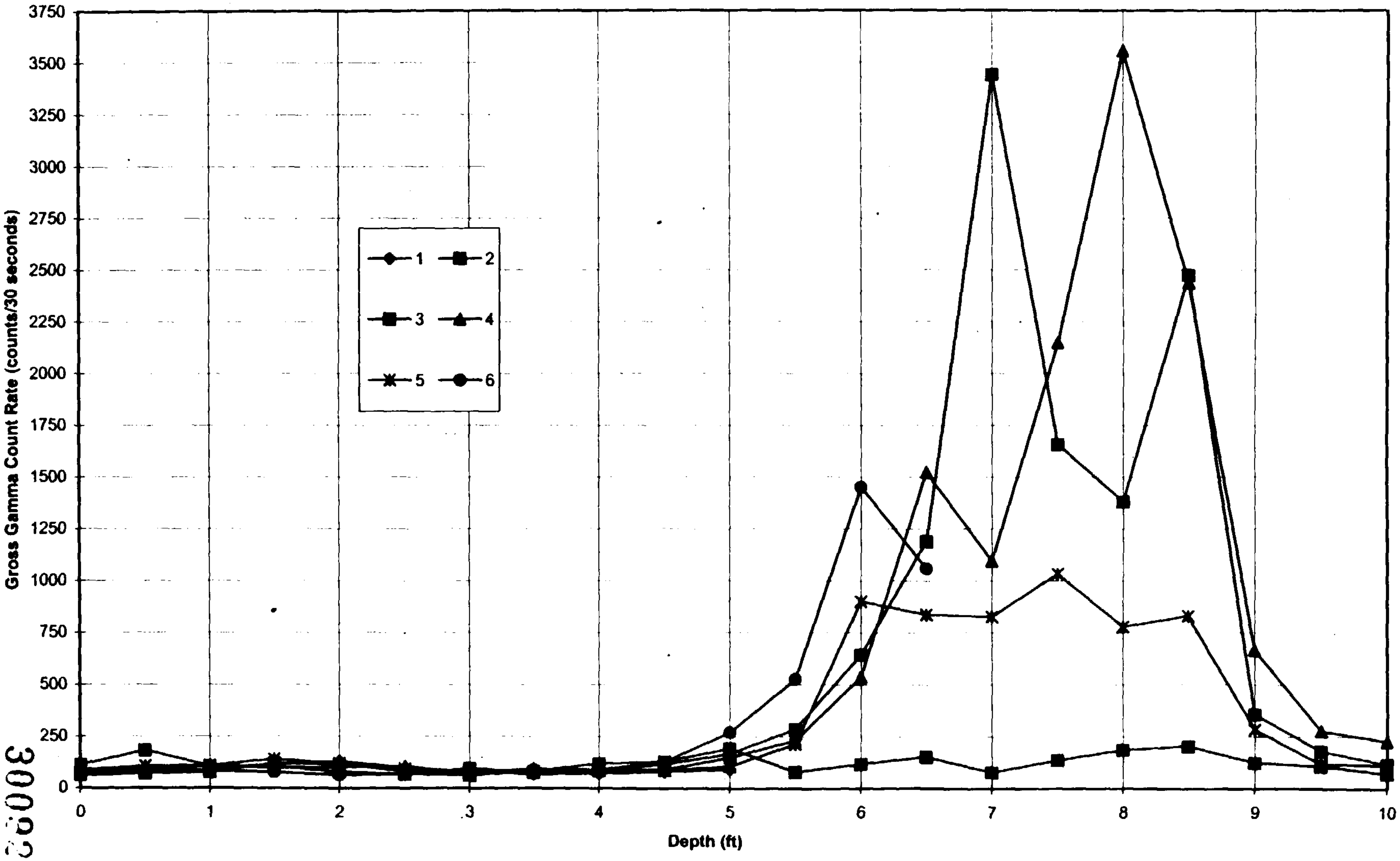

300920

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 6)
## APPENDIX D-3



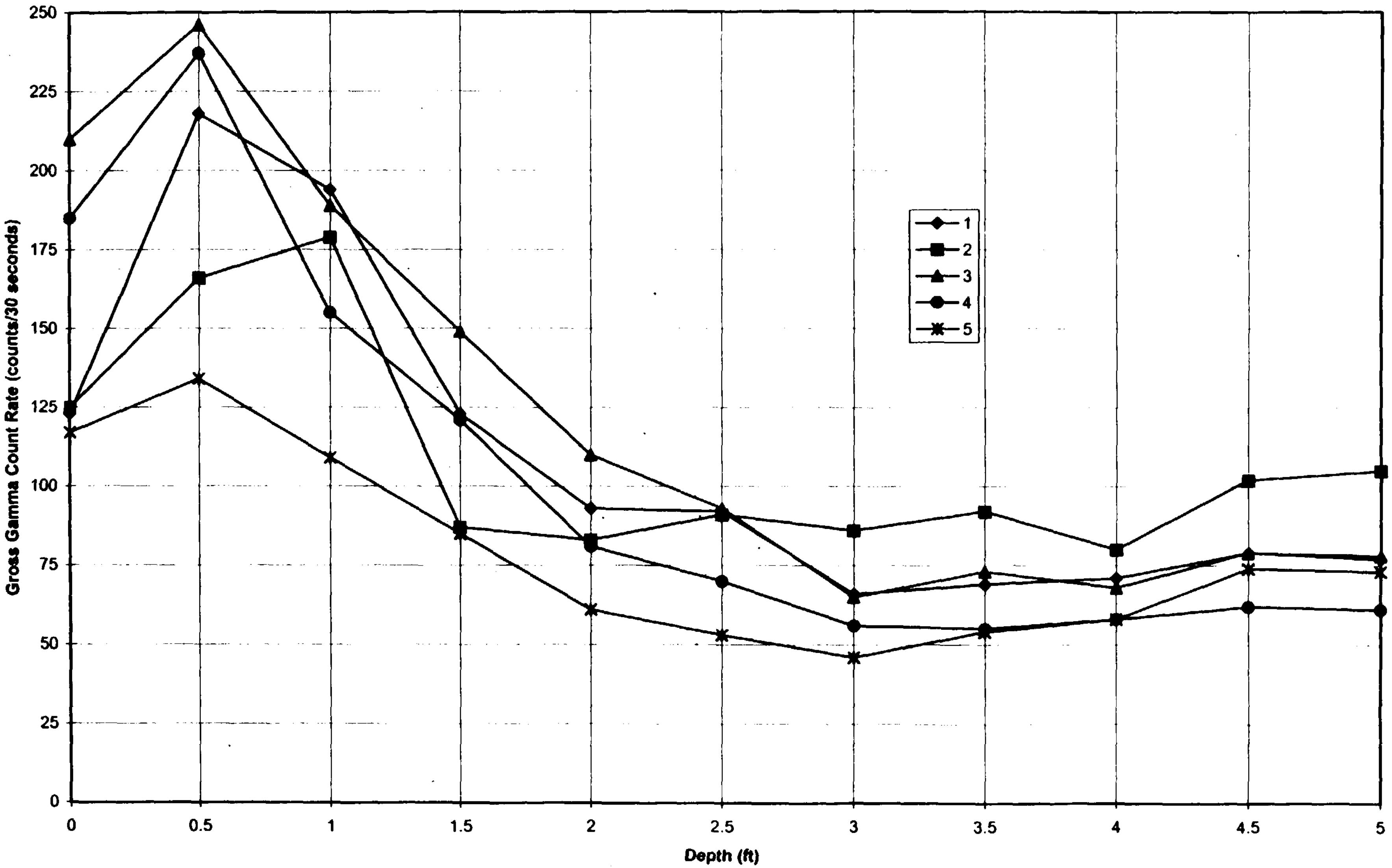

300

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 7)
## APPENDIX D-3



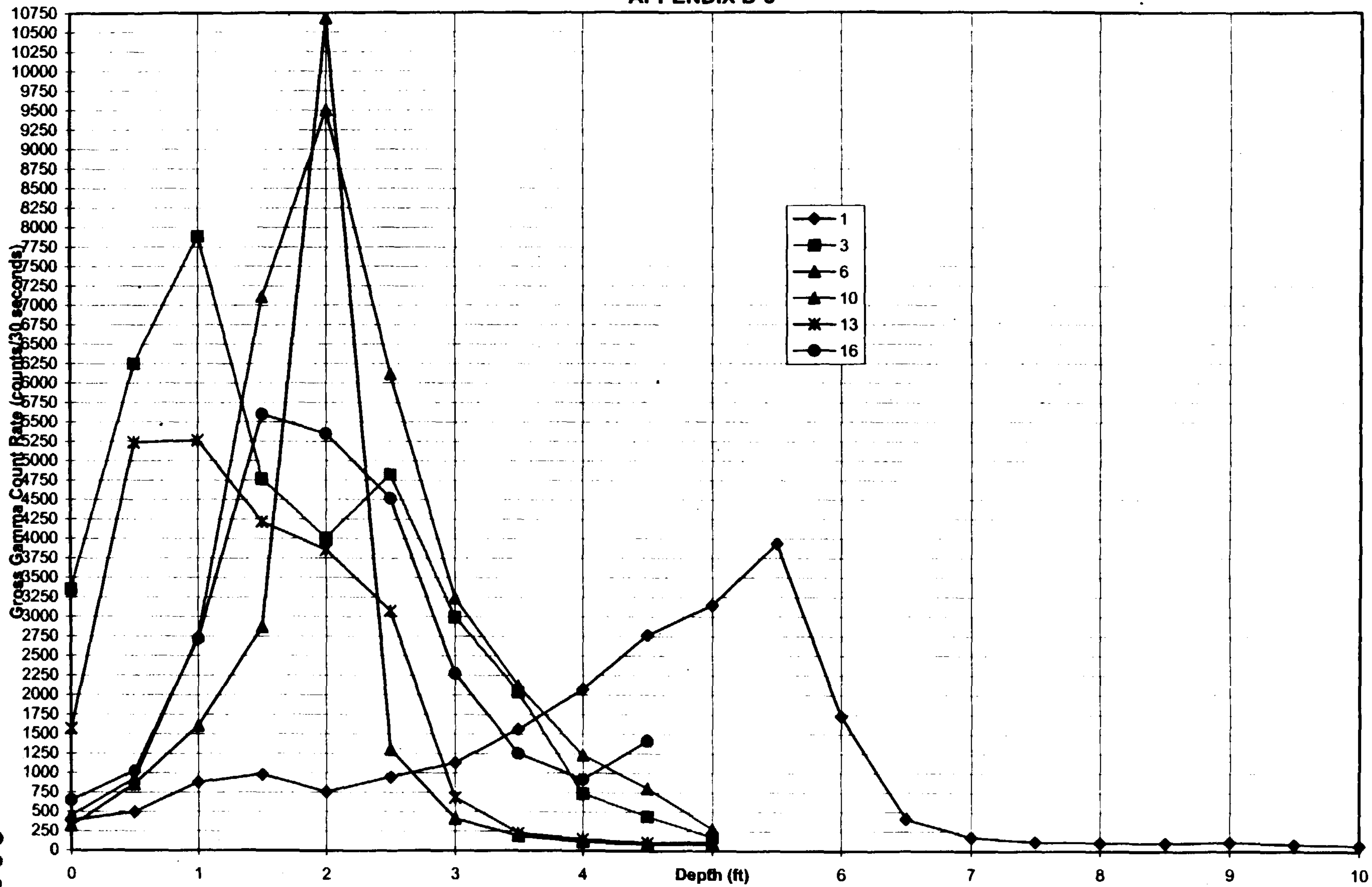

300022

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 8)
## APPENDIX D-3




300923

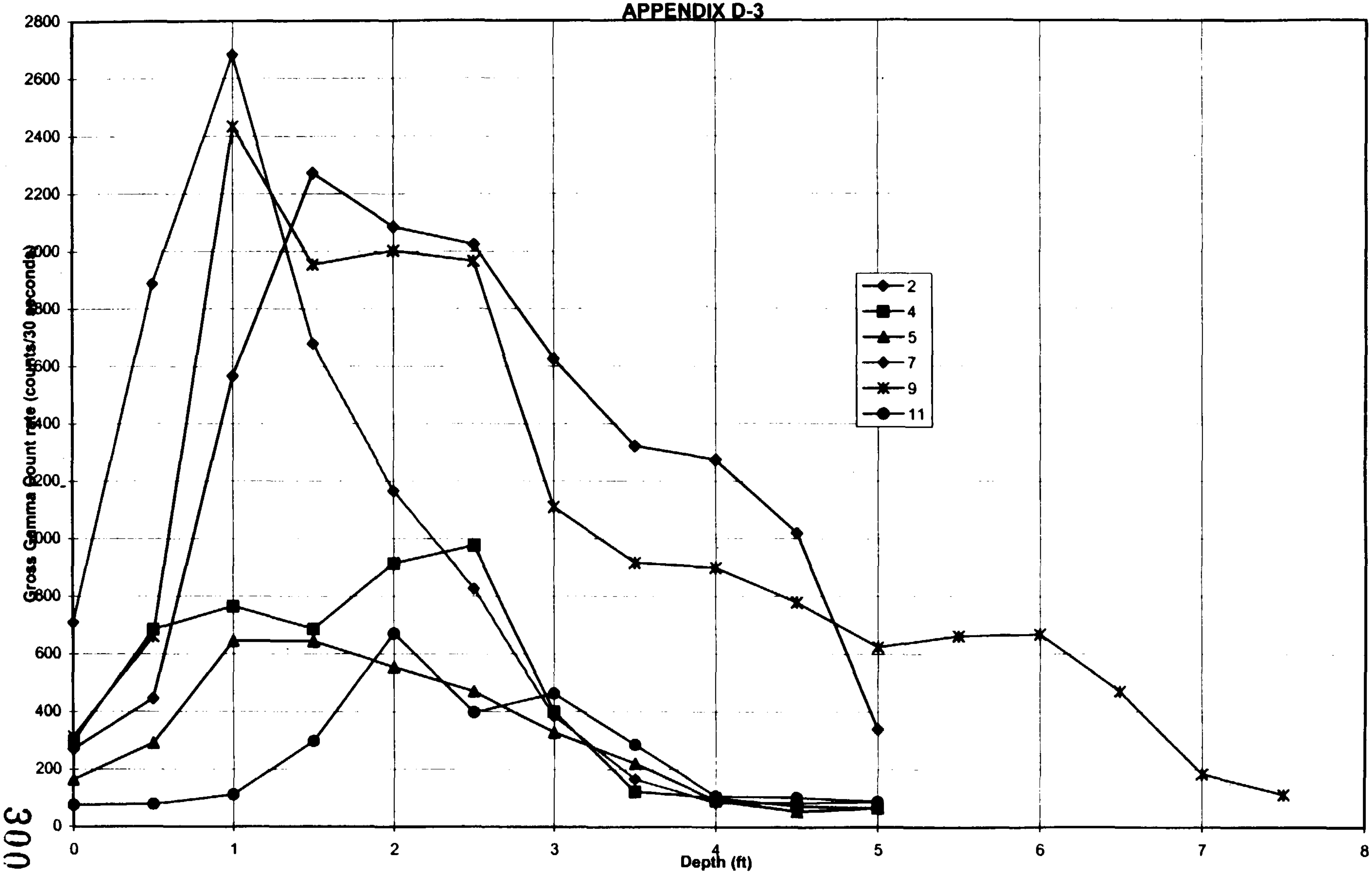
WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 14)
APPENDIX D-3



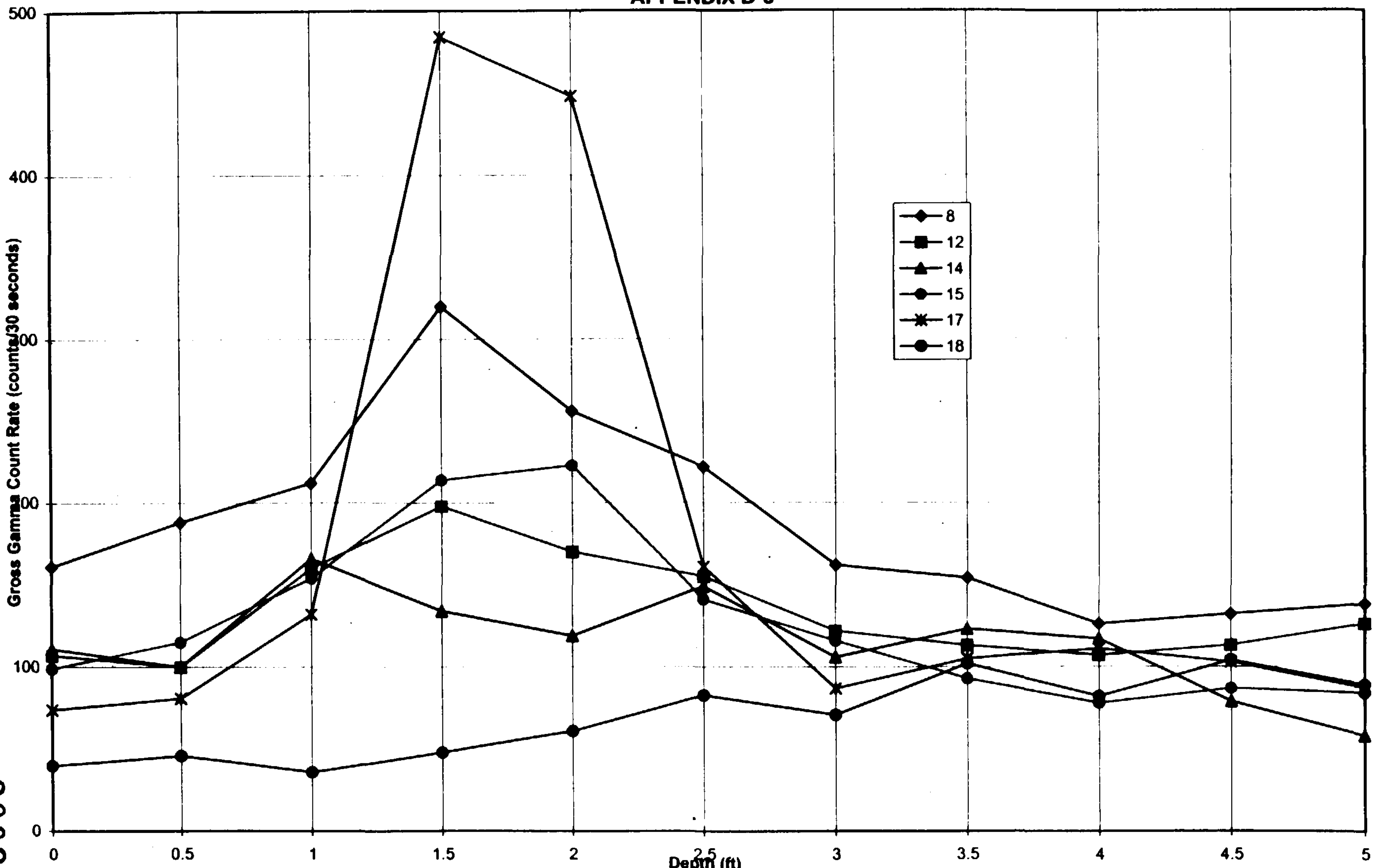



300094

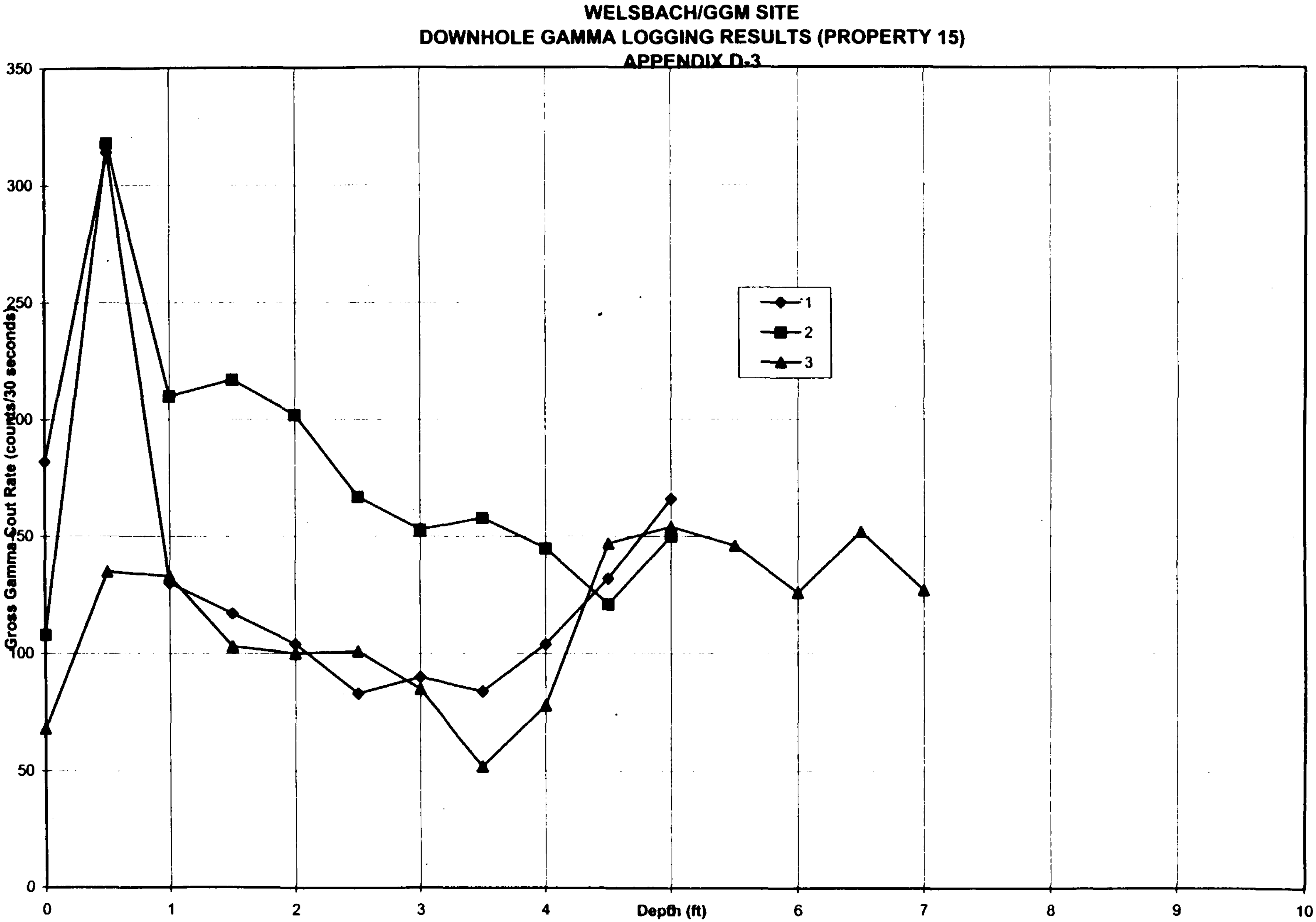
**WELSBACH/GGM SITE**
**DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 14)**
**APPENDIX D-3**



WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 14)
APPENDIX D-3



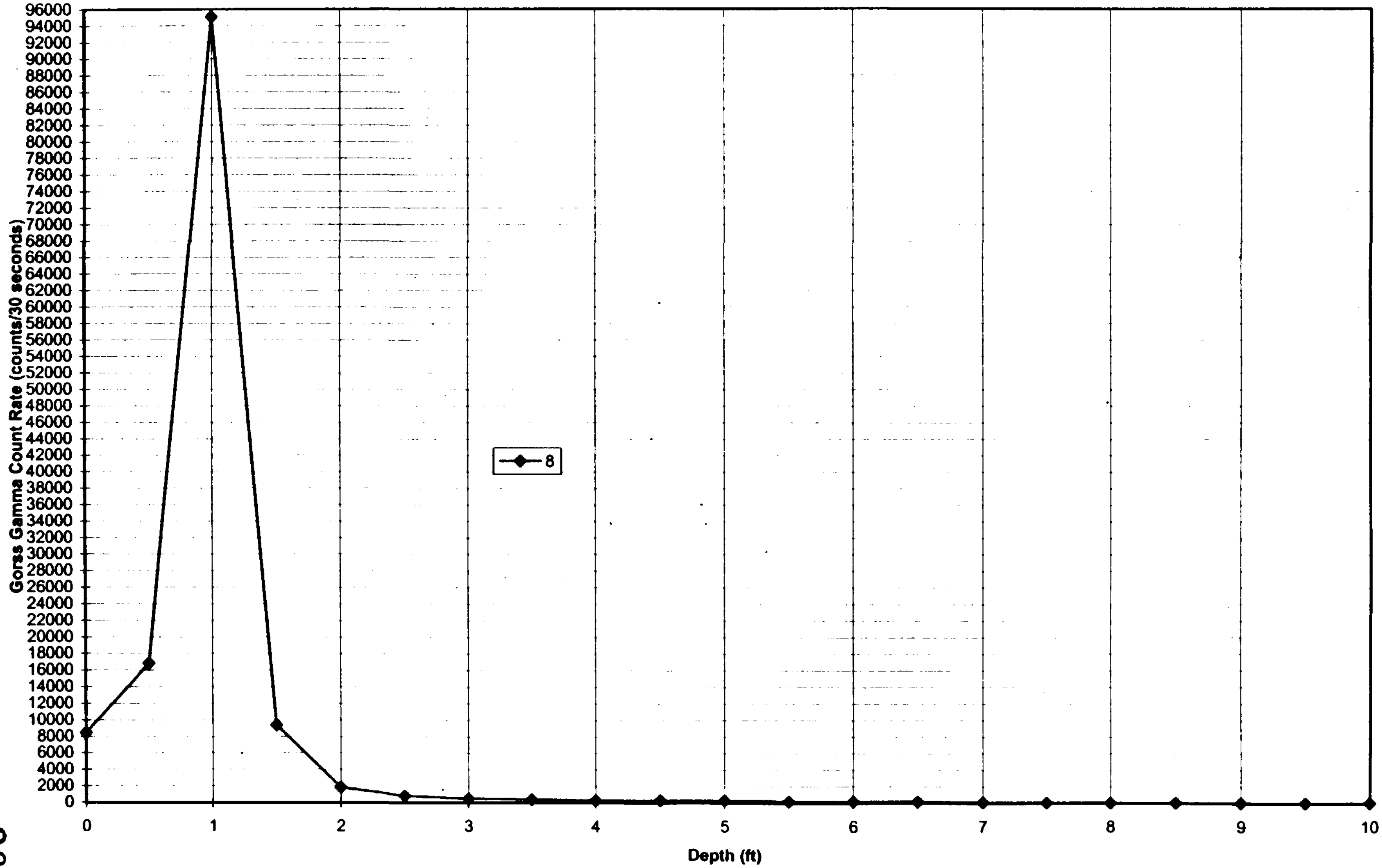

300096


WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 15)
APPENDIX D-3
Gross Gamma Cout Rate (counts/30 seconds)
Depth (ft)
1
2
3
0
50
100
150
200
250
300
350
0
1
2
3
4
5
6
7
8
9
10



300963

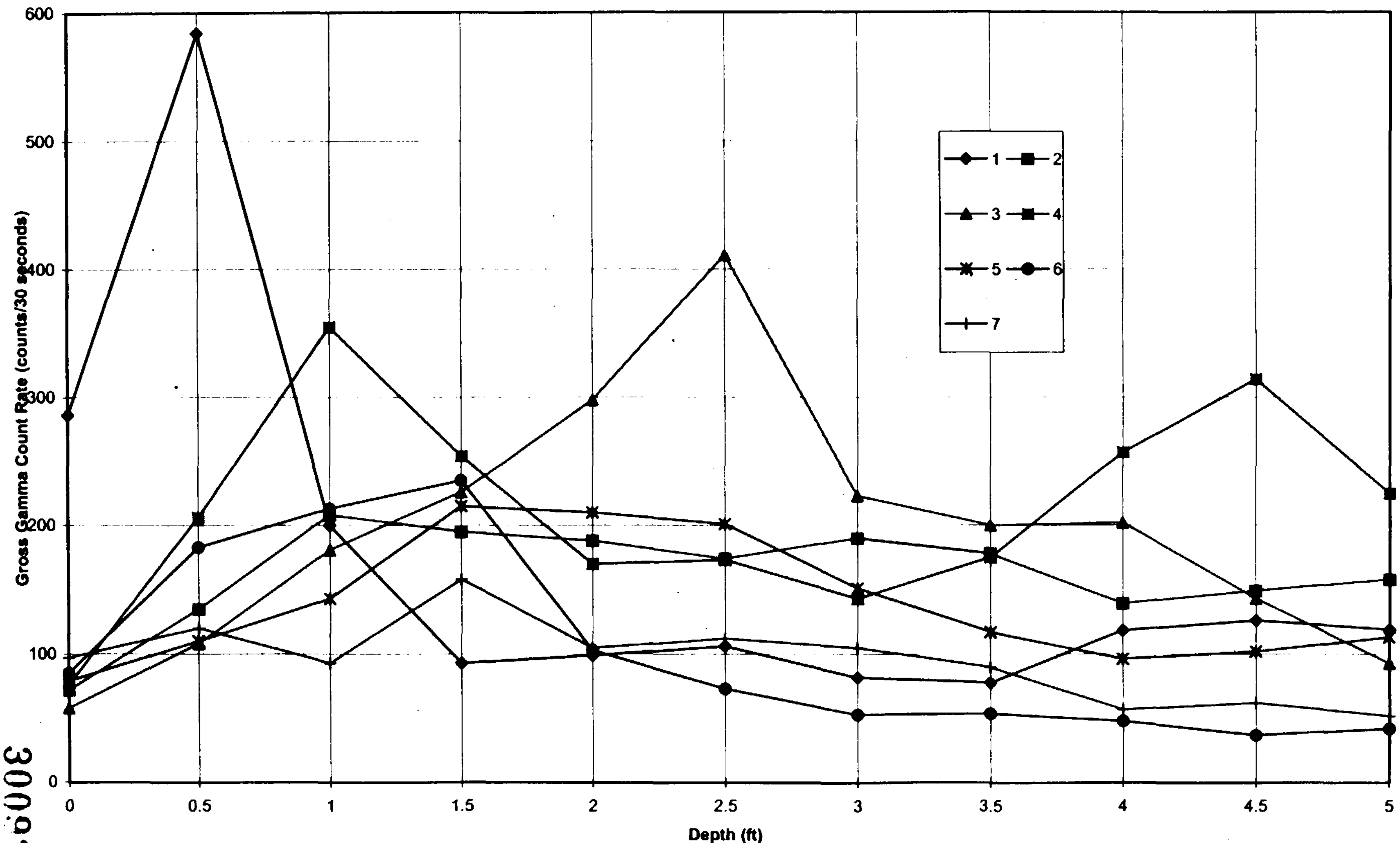
## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 16)
## APPENDIX D-3





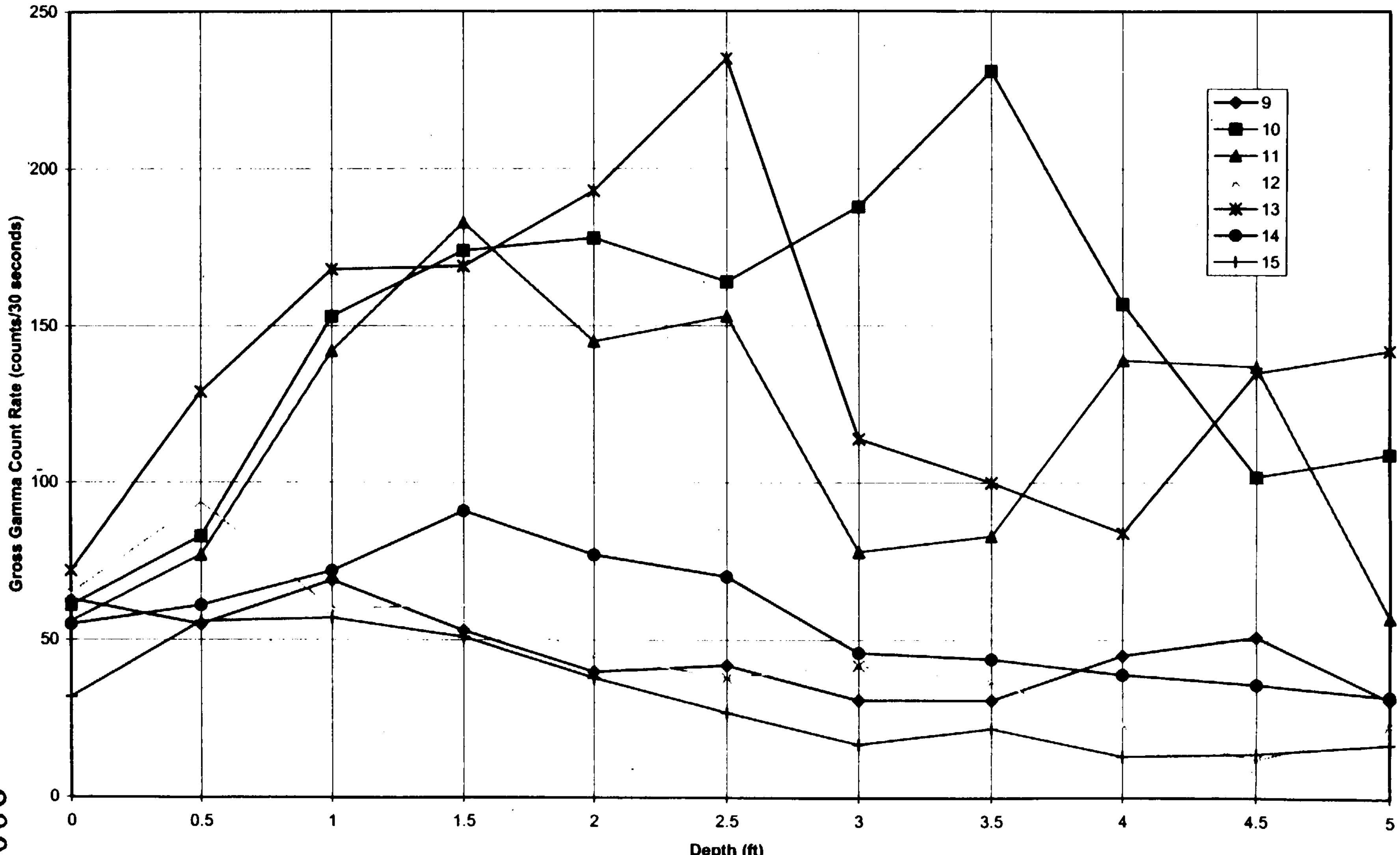

300[illegible]

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 16)
## APPENDIX D-3



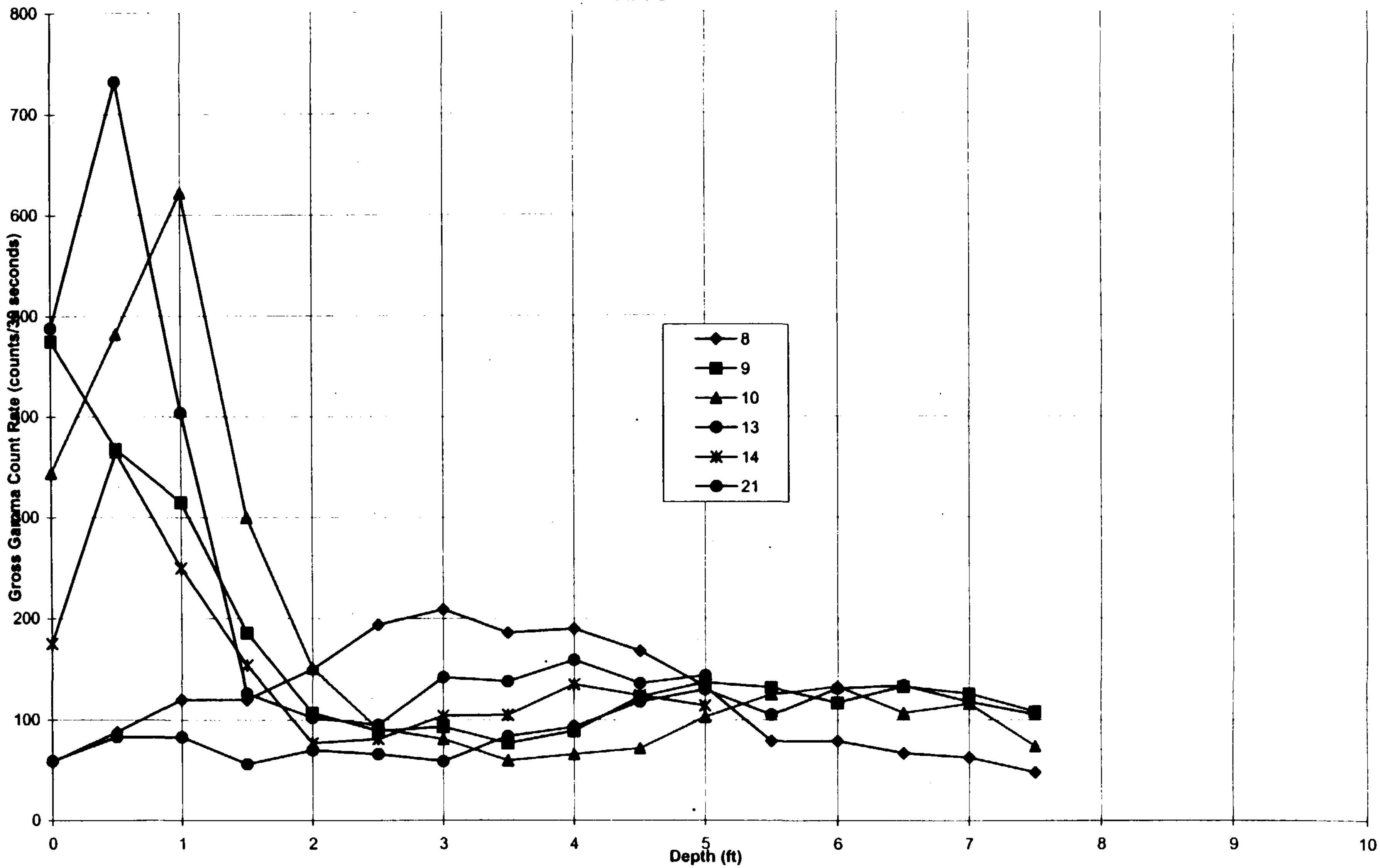

300093

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 16)
APPENDIX D-3



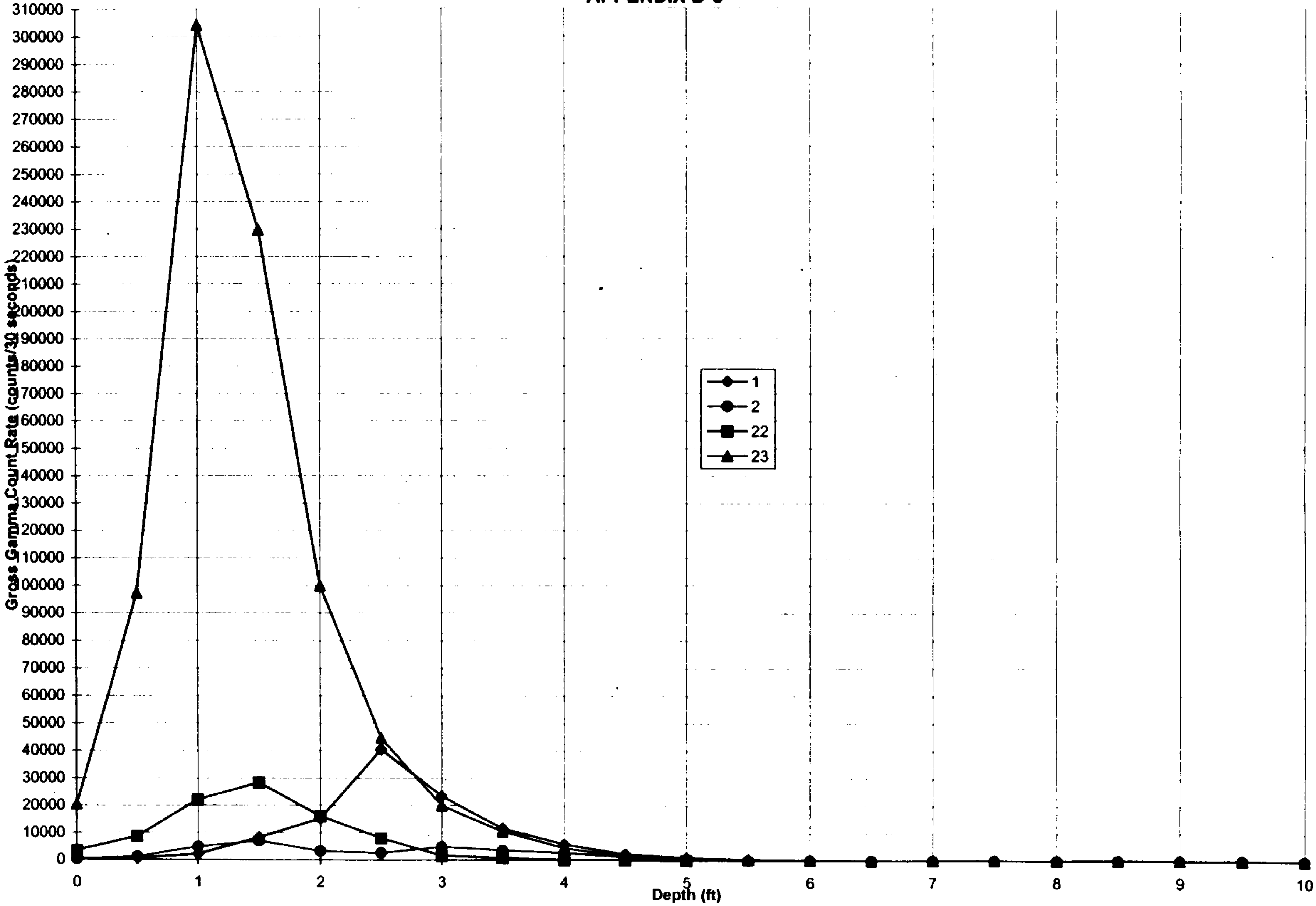

300930

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 17)
## APPENDIX D-3




3009021

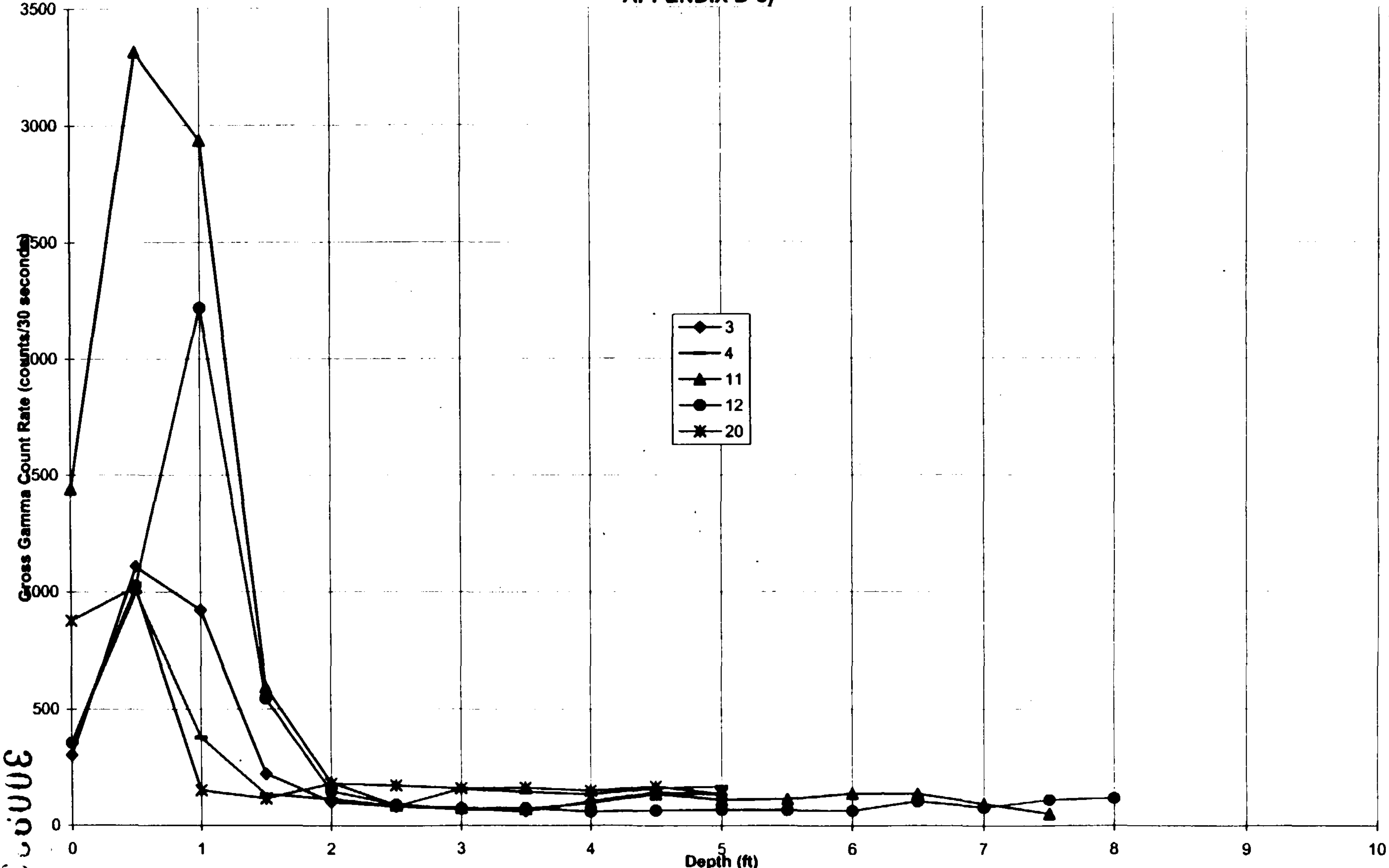
WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 17)
APPENDIX D-3





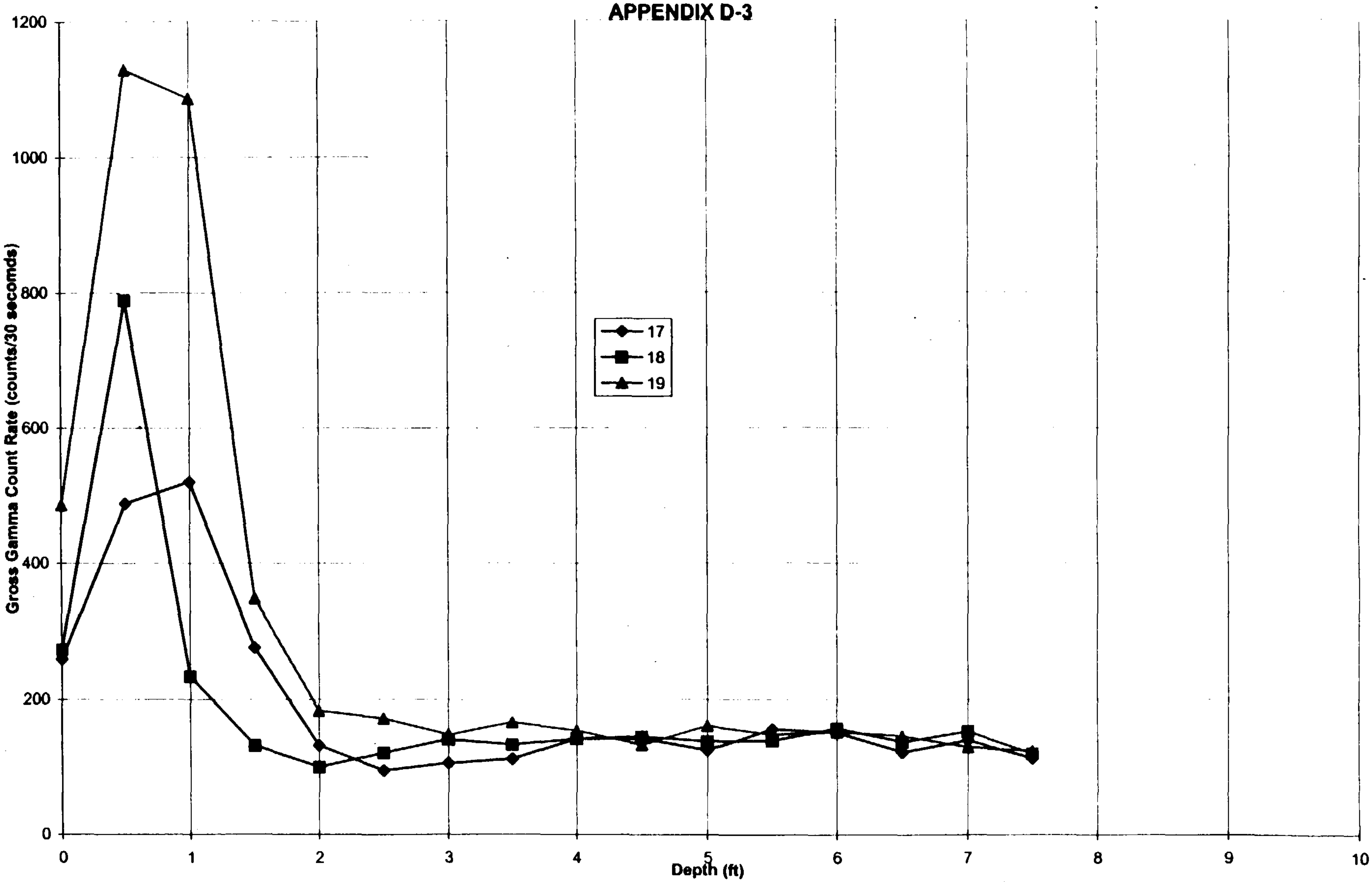

300002

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 17
APPENDIX D-3)

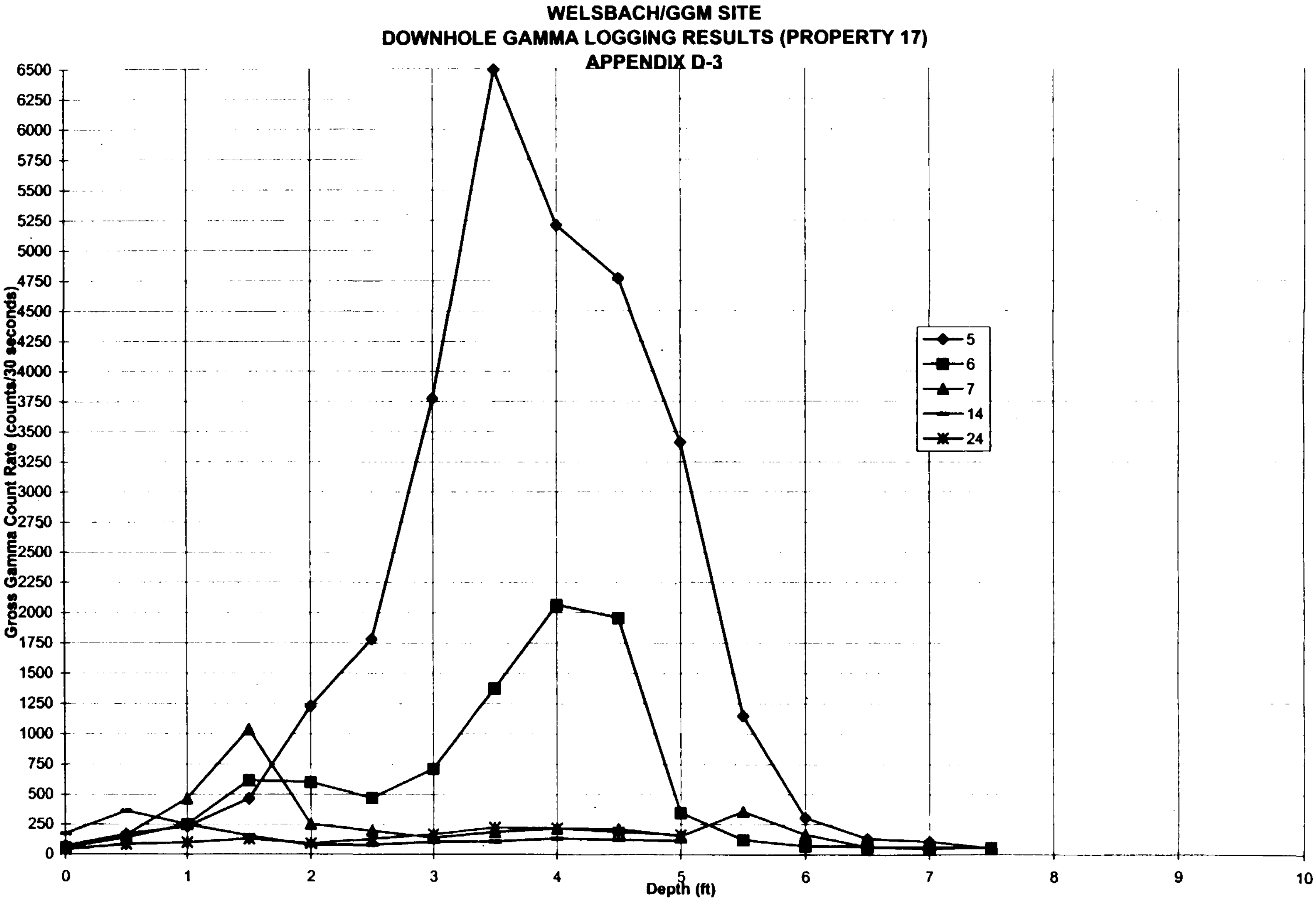



300006

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 17)
APPENDIX D-3

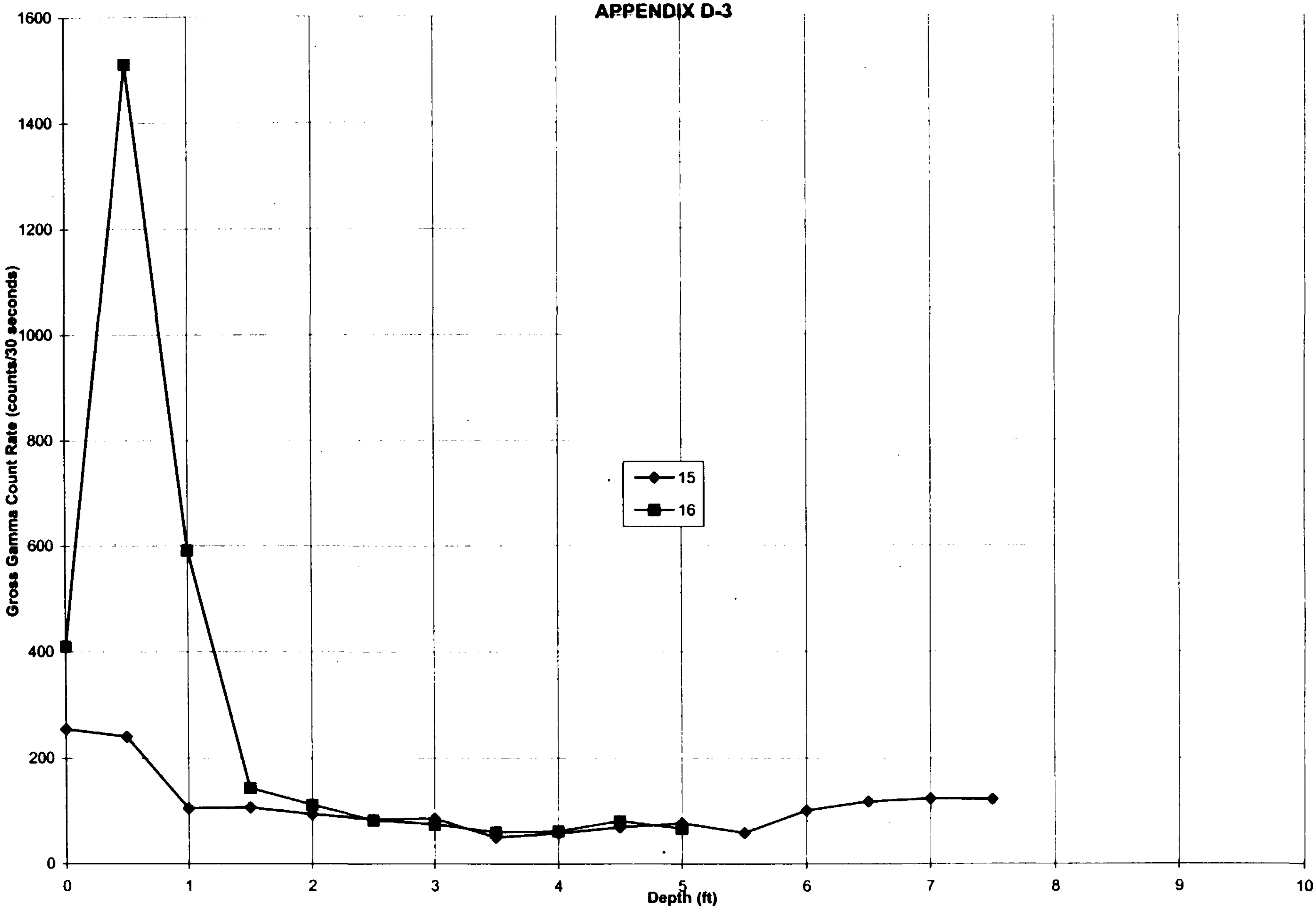



30063



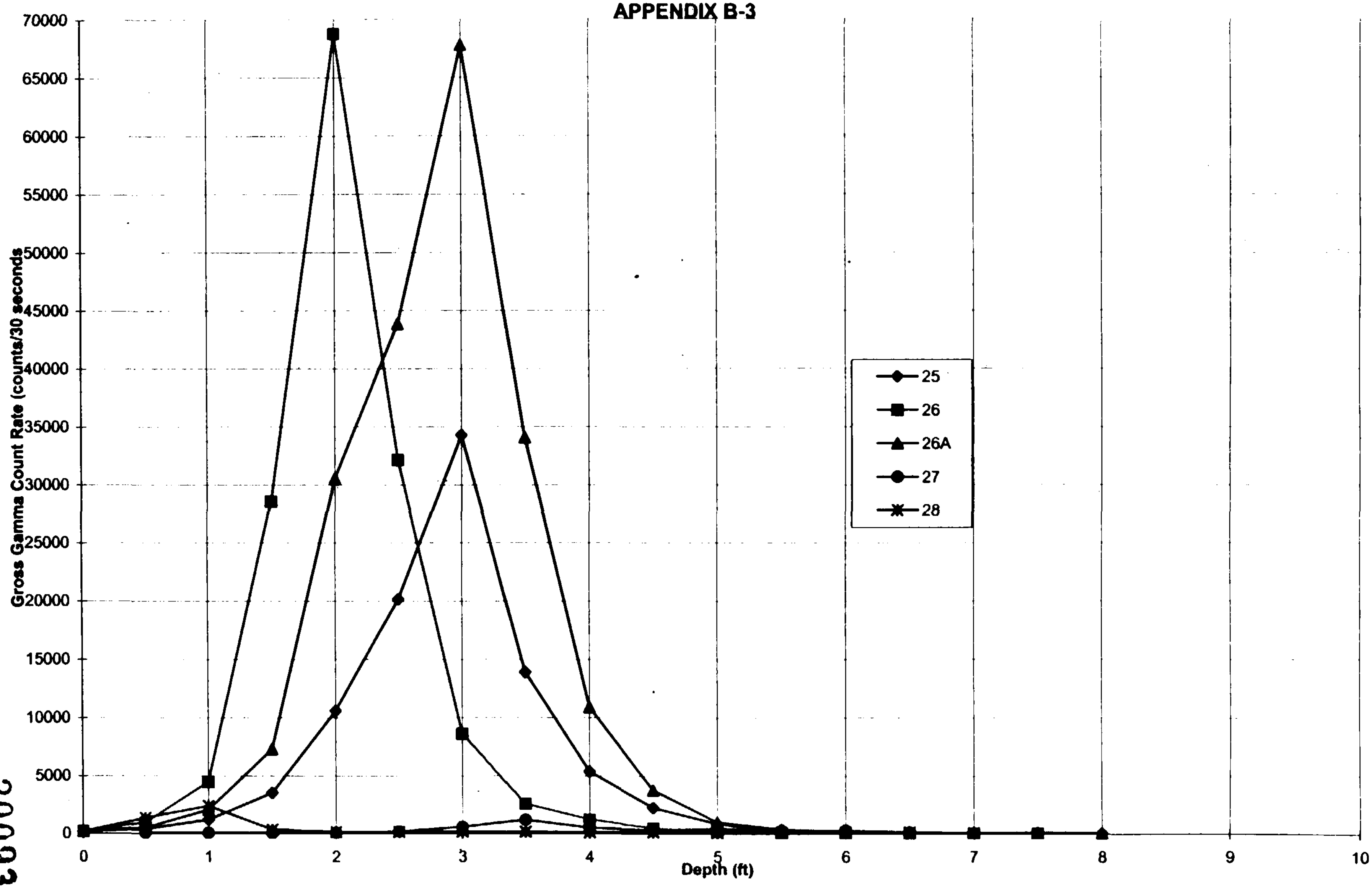
WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 17)
APPENDIX D-3
Gross Gamma Count Rate (counts/30 seconds)
6500
6250
6000
5750
5500
5250
5000
4750
4500
4250
4000
3750
3500
3250
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
0
1
2
3
4
5
6
7
8
9
10
Depth (ft)
5
6
7
14
24

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 17)
APPENDIX D-3



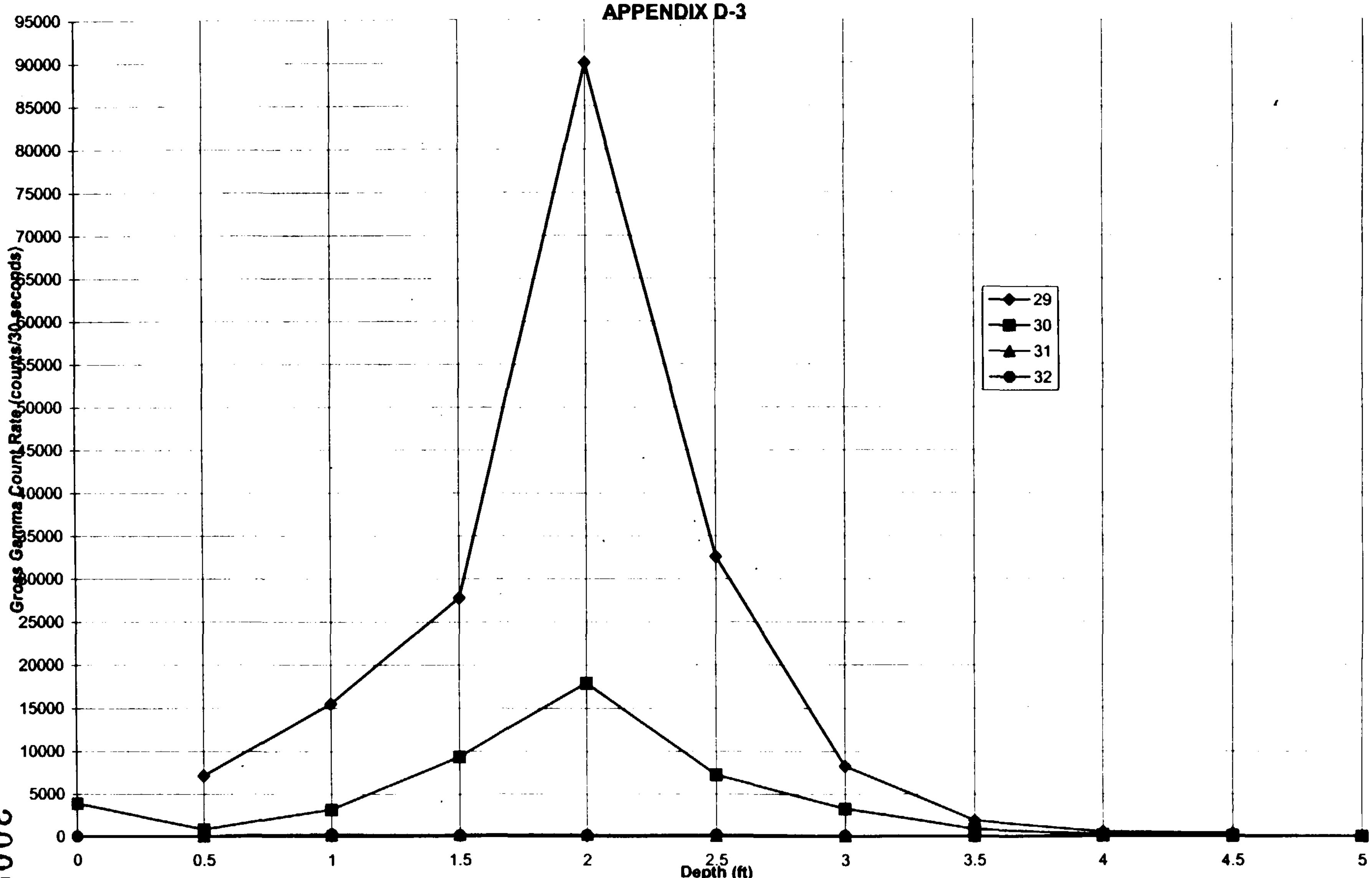

3000?6

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 17)
APPENDIX B-3



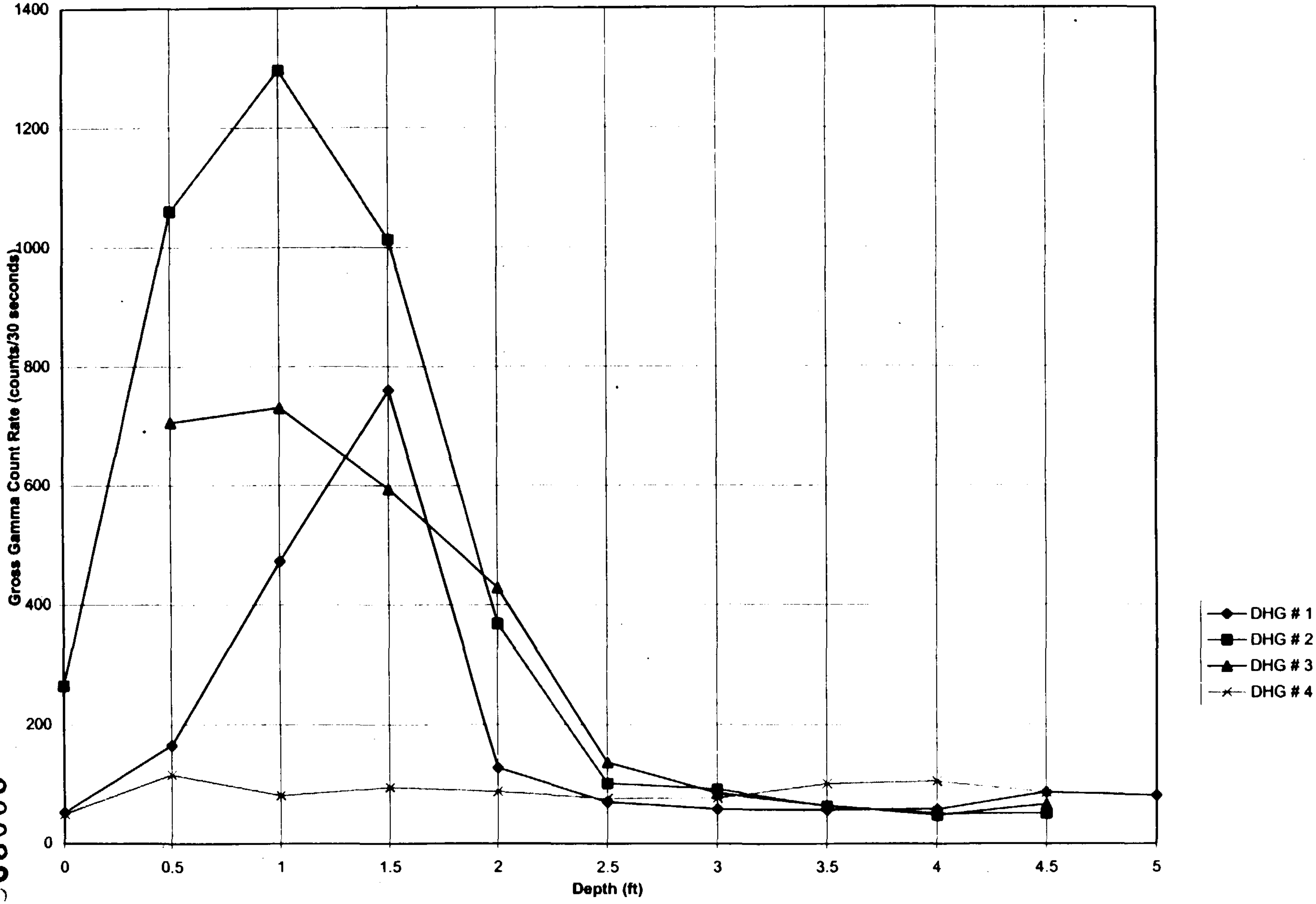

300931

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPRTY 17)
APPENDIX D-3



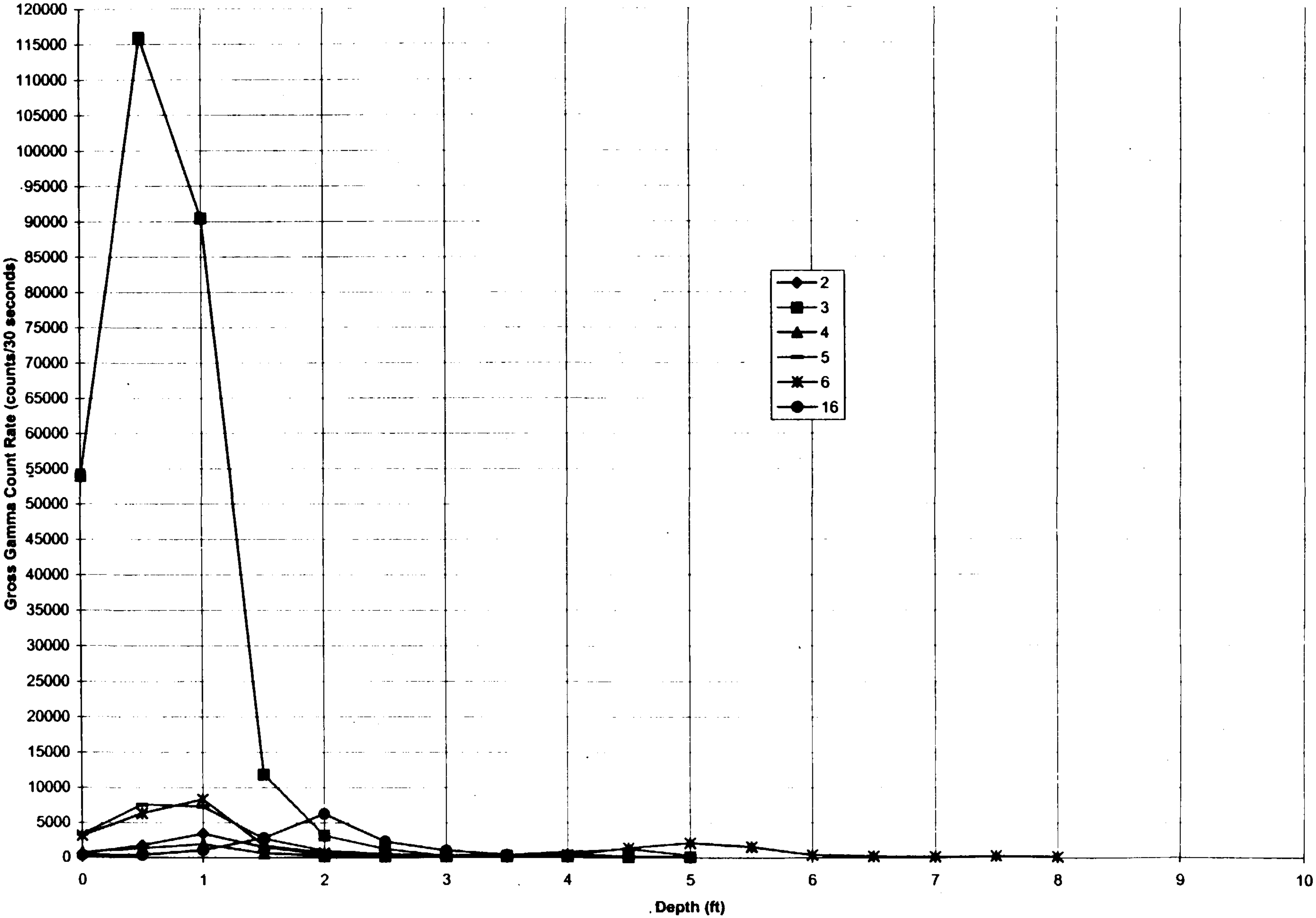

300036

WELSBACH/GGM SITE
DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 18)
APPENDIX D-3



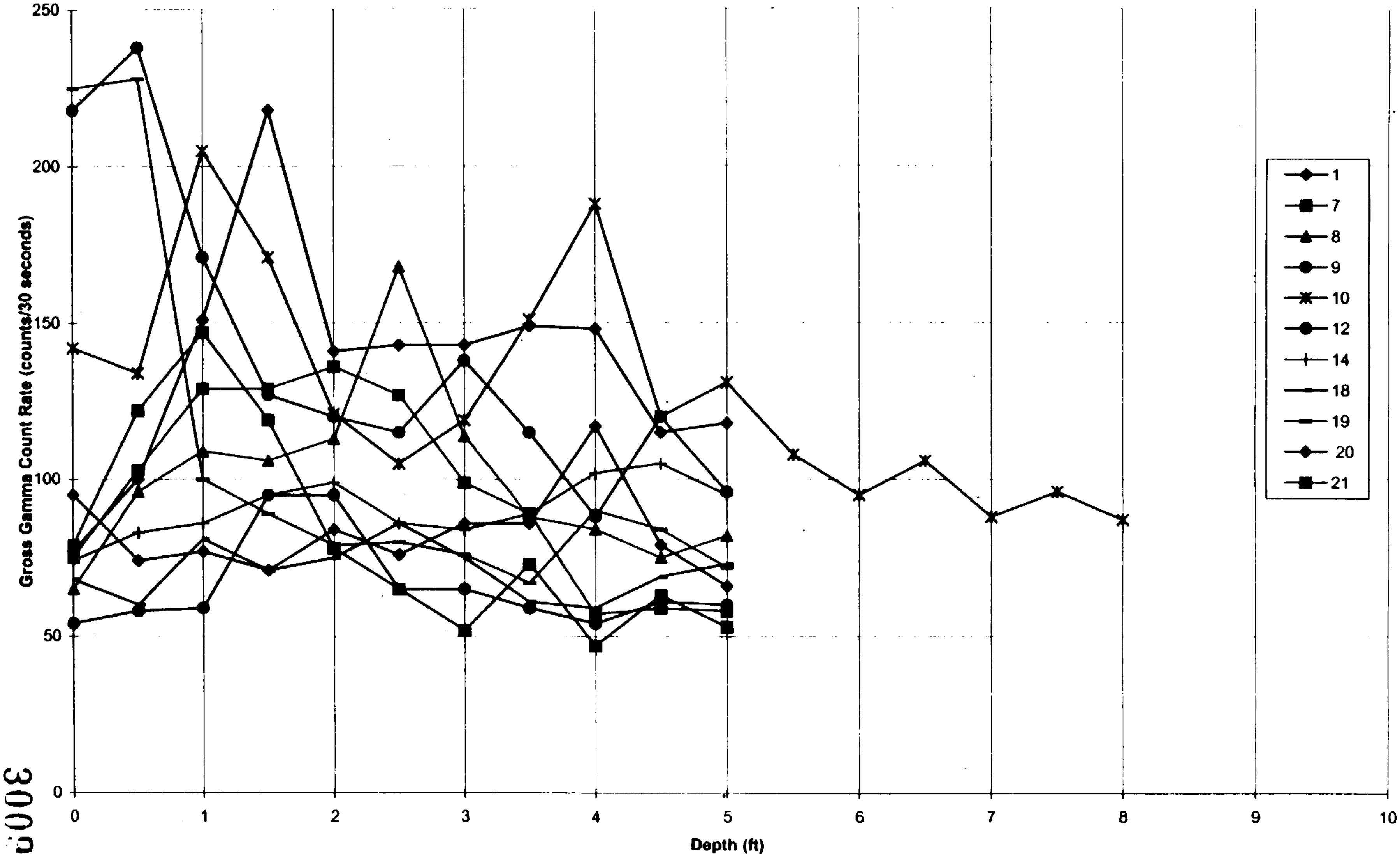

300943

**WELSBACH/GGM SITE**
**DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 20)**
**APPENDIX D-3**



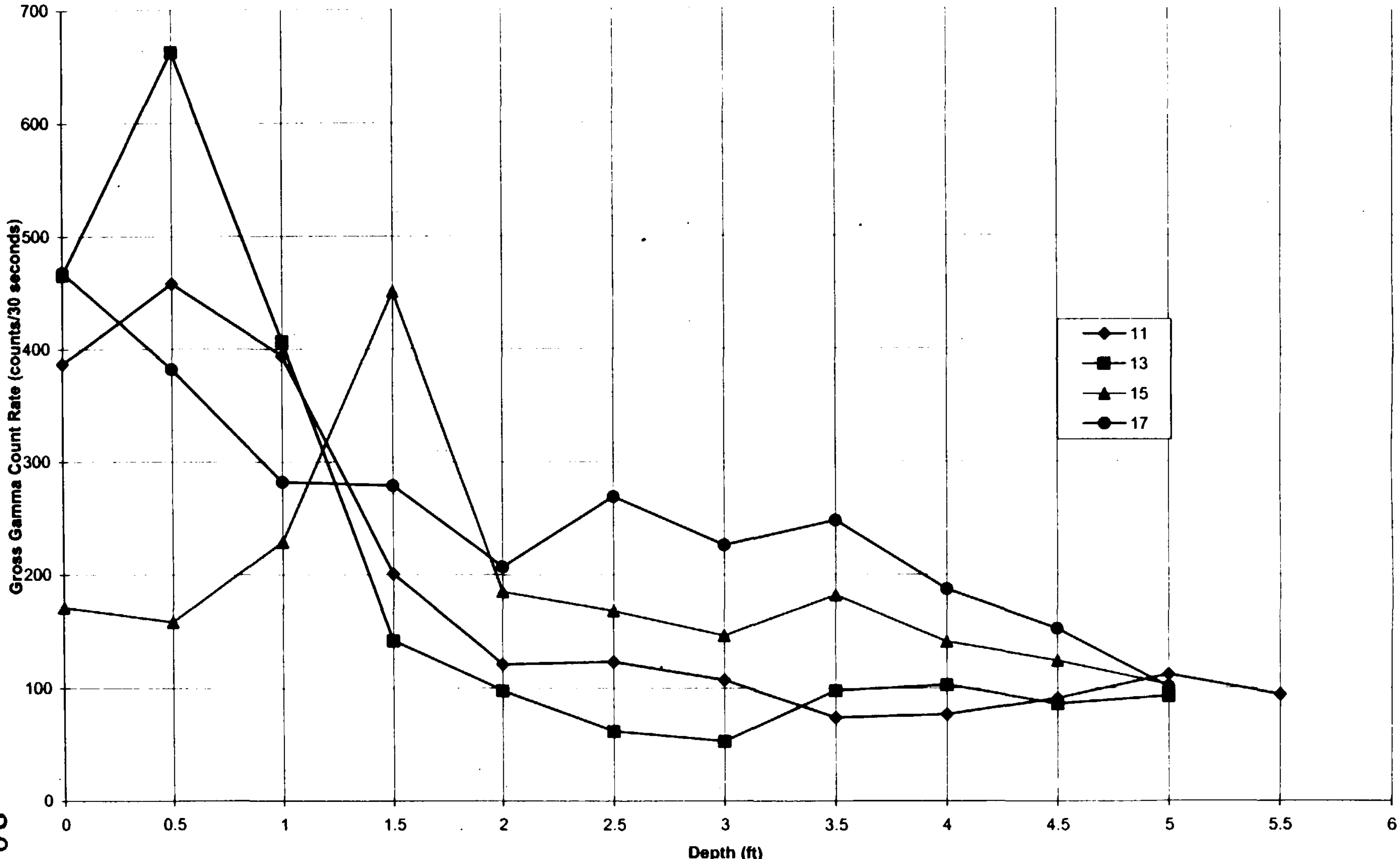

300924

# WELSBACH/GGM SITE
# DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 20)
# APPENDIX D-3




3000?41

## WELSBACH/GGM SITE
## DOWNHOLE GAMMA LOGGING RESULTS (PROPERTY 20)
## APPENDIX D-3




300042

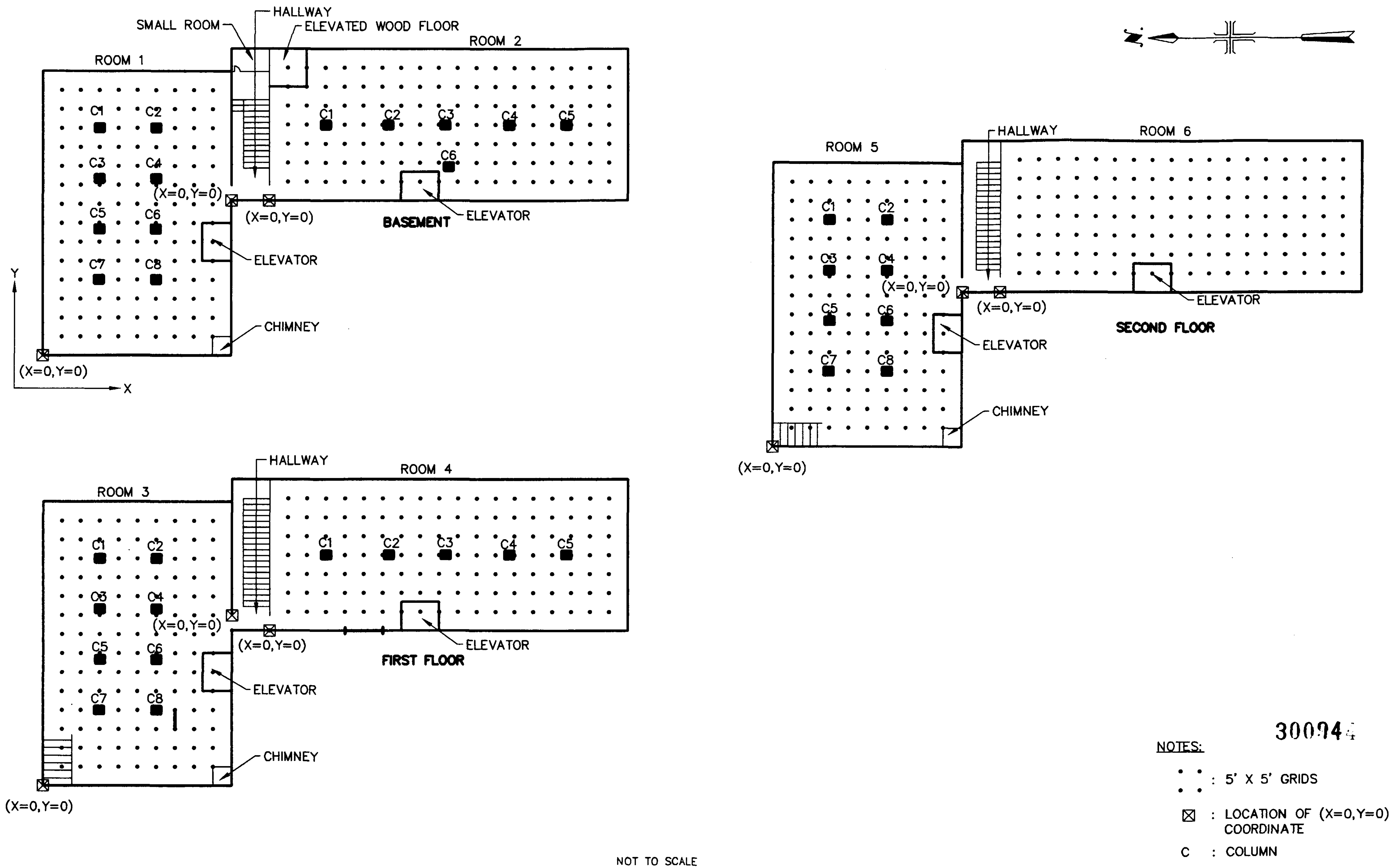
E

**APPENDIX E**

**WELSBACH/GGM SITE**

**EXPOSURE RATE DATA - GENERAL GAS MANTLE**

<u>REMEDIAL INVESTIGATION AND FEASIBILITY STUDY</u>
WELSBACH/GGM SITE
CAMDEN AND GLOUCESTER CITY
CAMDEN COUNTY, NEW JERSEY




30094

MALCOLM PIRNIE

WELSBACH/GGM SITE

FORMER GGM BUILDING
GRID POINT LOCATIONS

MALCOLM PIRNIE, INC.

APPENDIX E

## Room 1 Exposure Rate Results of the GGM Building

## Welsbach/GGM Site

## Gross Exposure Rate (μR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 47 | 39 | 5 | 35 | 56 | 68 | 10 | 70 | 43 | 47 | 20 | 25 | 68 | 96 |
| 0 | 5 | 51 | 47 | 5 | 40 | 39 | 43 | 10 | 74 | 39 | 39 | 20 | 30 | 127 | 111 |
| 0 | 10 | 64 | 56 | 5 | 45 | 27 | 31 | 15 | 0 | 39 | 31 | 20 | 35 | 39 | 39 |
| 0 | 15 | 189 | 135 | 5 | 50 | 31 | 27 | 15 | 5 | 35 | 39 | 20 | 40 | 35 | 35 |
| 0 | 20 | 135 | 111 | 5 | 55 | 27 | 27 | 15 | 10 | 39 | 43 | 20 | 45 | 35 | 31 |
| 0 | 25 | 151 | 127 | 5 | 60 | 31 | 31 | 15 | 15 | 64 | 60 | 20 | 50 | 39 | 31 |
| 0 | 30 | 127 | 119 | 5 | 65 | 31 | 31 | 15 | 20 | 43 | 56 | 20 | 55 | 43 | 39 |
| 0 | 35 | 178 | 151 | 5 | 70 | 31 | 35 | 15 | 25 | 72 | 76 | 20 | 60 | 72 | 60 |
| 0 | 40 | 39 | 43 | 5 | 74 | 23 | 27 | 15 | 30 | 88 | 84 | 20 | 65 | 96 | 80 |
| 0 | 45 | 31 | 31 | 10 | 0 | 47 | 39 | 15 | 35 | 47 | 51 | 20 | 70 | 80 | 80 |
| 0 | 50 | 43 | 31 | 10 | 5 | 39 | 39 | 15 | 40 | 35 | 31 | 20 | 74 | 72 | 72 |
| 0 | 55 | 27 | 23 | 10 | 10 | 47 | 51 | 15 | 45 | 35 | 35 | 25 | 0 | 60 | 47 |
| 0 | 60 | 23 | 23 | 10 | 15 | 80 | 72 | 15 | 50 | 39 | 31 | 25 | 5 | 39 | 39 |
| 0 | 65 | 31 | 27 | 10 | 20 | 60 | 68 | 15 | 55 | 39 | 35 | 25 | 10 | 35 | 35 |
| 0 | 70 | 31 | 27 | 10 | 25 | 92 | 80 | 15 | 60 | 72 | 64 | 25 | 15 | 64 | 88 |
| 0 | 74 | 27 | 23 | 10 | 30 | 80 | 80 | 15 | 65 | 60 | 56 | 25 | 20 | 636 | 234 |
| 5 | 0 | 127 | 56 | 10 | 35 | 60 | 56 | 15 | 70 | 60 | 56 | 25 | 25 | 76 | 88 |
| 5 | 5 | 119 | 64 | 10 | 40 | 39 | 35 | 15 | 74 | 51 | 56 | 25 | 30 | 47 | 56 |
| 5 | 10 | 68 | 64 | 10 | 45 | 31 | 31 | 20 | 0 | 72 | 43 | 25 | 35 | 35 | 39 |
| 5 | 15 | 127 | 104 | 10 | 50 | 35 | 31 | 20 | 5 | 107 | 47 | 25 | 40 | 39 | 39 |
| 5 | 20 | 119 | 104 | 10 | 55 | 31 | 31 | 20 | 10 | 31 | 39 | 25 | 45 | 39 | 31 |
| 5 | 25 | 80 | 88 | 10 | 60 | 39 | 43 | 20 | 15 | 60 | 60 | 25 | 50 | 35 | 39 |
| 5 | 30 | 80 | 96 | 10 | 65 | 39 | 39 | 20 | 20 | 47 | 56 | 25 | 55 | 47 | 43 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.

Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:

X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

** Coordinates in feet. N/A = Inaccessible.

300945

## Room 1 Exposure Rate Results of the GGM Building
## Welsbach/GGM Site
## Gross Exposure Rate (μR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 60 | 68 | 64 | 35 | 5 | 64 | 56 | 40 | 30 | 181 | 139 | 45 | 55 | 56 | 56 |
| 25 | 65 | 88 | 80 | 35 | 10 | 39 | 35 | 40 | 35 | 104 | 123 | 45 | 60 | 72 | 68 |
| 25 | 70 | 107 | 100 | 35 | 15 | 39 | 39 | 40 | 40 | 56 | 68 | 45 | 65 | 119 | 88 |
| 25 | 74 | 88 | 80 | 35 | 20 | 39 | 43 | 40 | 45 | 39 | 47 | 45 | 70 | 88 | 72 |
| 30 | 0 | 47 | 39 | 35 | 25 | 56 | 56 | 40 | 50 | 56 | 56 | 45 | 74 | 72 | 72 |
| 30 | 5 | 47 | 43 | 35 | 30 | 60 | 72 | 40 | 55 | 43 | 56 | 47 | 0 | N/A | N/A |
| 30 | 10 | 39 | 43 | 35 | 35 | 47 | 56 | 40 | 60 | 64 | 64 | 47 | 5 | N/A | N/A |
| 30 | 15 | 60 | 56 | 35 | 40 | 39 | 39 | 40 | 65 | 80 | 80 | 47 | 10 | 104 | 39 |
| 30 | 20 | 96 | 72 | 35 | 45 | 39 | 39 | 40 | 70 | 84 | 80 | 47 | 15 | N/A | N/A |
| 30 | 25 | 47 | 47 | 35 | 50 | 39 | 43 | 40 | 74 | 68 | 64 | 47 | 20 | N/A | N/A |
| 30 | 30 | 47 | 43 | 35 | 55 | 47 | 47 | 45 | 0 | N/A | N/A | 47 | 25 | 80 | 64 |
| 30 | 35 | 39 | 47 | 35 | 60 | 60 | 64 | 45 | 5 | 39 | 31 | 47 | 30 | 100 | 88 |
| 30 | 40 | 31 | 39 | 35 | 65 | 60 | 72 | 45 | 10 | 72 | 47 | 47 | 35 | 47 | 64 |
| 30 | 45 | 35 | 39 | 35 | 70 | 80 | 88 | 45 | 15 | N/A | N/A | 47 | 40 | 47 | 47 |
| 30 | 50 | 39 | 39 | 35 | 74 | 72 | 72 | 45 | 20 | N/A | N/A | 47 | 45 | 47 | 47 |
| 30 | 55 | 47 | 47 | 40 | 0 | 72 | 51 | 45 | 25 | 127 | 88 | 47 | 50 | 104 | 56 |
| 30 | 60 | 56 | 60 | 40 | 5 | 43 | 56 | 45 | 30 | 119 | 111 | 47 | 55 | 104 | 72 |
| 30 | 65 | 379 | 158 | 40 | 10 | 43 | 35 | 45 | 35 | 107 | 119 | 47 | 60 | 96 | 80 |
| 0 | 15DUP | 189 | 119 | 40 | 15 | 31 | 35 | 45 | 40 | 47 | 60 | 47 | 65 | 189 | 111 |
| 30 | 70 | 96 | 111 | 15 | 30DUP | 96 | 88 | 45 | 45 | 56 | 56 | 47 | 70 | 80 | 68 |
| 30 | 74 | 143 | 104 | 40 | 20 | 31 | 39 | 30 | 55 DUP | 47 | 47 | 47 | 74 | 96 | 80 |
| 35 | 0 | 878 | 158 | 40 | 25 | 72 | 80 | 45 | 50 | 56 | 51 | 45 | 74 DUP | 80 | 80 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.

Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:

$X=(-3.25E-9*R^2) + (4.13E-3*R) - 1.661$.

** Coordinates in feet.

N/A = Inaccessible.

# Room 2 Exposure Rate Results of the GGM Building

## Welsbach/GGM Site

## Gross Exposure Rate (μR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 19 | 15 | 10 | 25 | 19 | 19 | 25 | 5 | 19 | 23 | 35 | 30 | 27 | 23 |
| 0 | 5 | 23 | 19 | 10 | 30 | 19 | 15 | 25 | 10 | 23 | 19 | 35 | 35 | 23 | 23 |
| 0 | 10 | 19 | 15 | 10 | 35 | 19 | 19 | 25 | 15 | 23 | 23 | 35 | 39 | 15 | 15 |
| 0 | 15 | 15 | 19 | 10 | 39 | 19 | 19 | 25 | 20 | 23 | 23 | 40 | 0 | 23 | 19 |
| 0 | 20 | 23 | 19 | 15 | 0 | 23 | 23 | 25 | 25 | 23 | 23 | 40 | 5 | 23 | 19 |
| 0 | 25 | 19 | 19 | 15 | 5 | 23 | 23 | 25 | 30 | 19 | 23 | 40 | 10 | 23 | 23 |
| 0 | 30 | 23 | 19 | 15 | 10 | 23 | 19 | 25 | 35 | 19 | 15 | 40 | 15 | 27 | 31 |
| 0 | 35 | N/A | 19 | 15 | 15 | 23 | 23 | 25 | 39 | 19 | 15 | 40 | 20 | 31 | 31 |
| 0 | 39 | N/A | N/A | 15 | 20 | 19 | 23 | 30 | 0 | 27 | 23 | 40 | 25 | 31 | 27 |
| 5 | 0 | 19 | 15 | 15 | 25 | 23 | 23 | 30 | 5 | 19 | 23 | 40 | 30 | 23 | 23 |
| 5 | 5 | 27 | 23 | 15 | 30 | 23 | 23 | 30 | 10 | 23 | 27 | 40 | 35 | 15 | 15 |
| 5 | 10 | 23 | 19 | 15 | 35 | 23 | 23 | 30 | 15 | 23 | 27 | 40 | 39 | 19 | 19 |
| 5 | 15 | 19 | 23 | 15 | 39 | N/A | N/A | 30 | 20 | 27 | 27 | 45 | 0 | 19 | 15 |
| 5 | 20 | 19 | 15 | 20 | 0 | 19 | 15 | 30 | 25 | 31 | 31 | 45 | 5 | 19 | 19 |
| 5 | 25 | 23 | 19 | 20 | 5 | 23 | 19 | 30 | 30 | 23 | 23 | 45 | 10 | 23 | 23 |
| 5 | 30 | 19 | 19 | 20 | 10 | 19 | 23 | 30 | 35 | 19 | 19 | 45 | 15 | 23 | 23 |
| 5 | 35 | N/A | 19 | 20 | 15 | 23 | 23 | 30 | 39 | 15 | 15 | 45 | 20 | 23 | 23 |
| 5 | 39 | N/A | 19 | 20 | 20 | 23 | 23 | 35 | 0 | 23 | 19 | 45 | 25 | 27 | 23 |
| 10 | 0 | 19 | 19 | 20 | 25 | 23 | 23 | 35 | 5 | 23 | 23 | 45 | 30 | 23 | 23 |
| 10 | 5 | 23 | 23 | 20 | 30 | 19 | 19 | 35 | 10 | 23 | 23 | 45 | 35 | 23 | 19 |
| 10 | 10 | 19 | 19 | 20 | 35 | 23 | 19 | 35 | 15 | 31 | 31 | 45 | 39 | 19 | 15 |
| 10 | 15 | 23 | 23 | 20 | 39 | 23 | 19 | 35 | 20 | 27 | 31 | 50 | 0 | N/A | N/A |
| 10 | 20 | 23 | 23 | 25 | 0 | 19 | 19 | 35 | 25 | 31 | 31 | 50 | 5 | N/A | N/A |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.
Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:
X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

# Room 2 Exposure Rate Results of the GGM Building
## Welsbach/GGM Site
## Gross Exposure Rate (μR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 10 | N/A | N/A | 60 | 30 | 19 | 19 | 75 | 5 | 19 | 19 | 85 | 25 | 19 | 19 |
| 50 | 15 | 23 | 23 | 60 | 35 | 19 | 19 | 75 | 10 | 23 | 19 | 85 | 30 | 19 | 19 |
| 50 | 20 | 19 | 23 | 60 | 39 | 19 | 15 | 75 | 15 | 19 | 19 | 85 | 35 | 19 | 19 |
| 50 | 25 | 23 | 23 | 65 | 0 | 19 | 19 | 75 | 20 | 23 | 23 | 85 | 39 | 19 | 19 |
| 50 | 30 | 23 | 23 | 65 | 5 | 19 | 19 | 75 | 25 | 23 | 19 | 90 | 0 | 31 | 27 |
| 50 | 35 | 19 | 15 | 65 | 10 | 23 | 19 | 75 | 30 | 19 | 19 | 90 | 5 | 31 | 27 |
| 50 | 39 | 15 | 15 | 65 | 15 | 23 | 23 | 75 | 35 | 23 | 23 | 90 | 10 | 31 | 27 |
| 55 | 0 | N/A | N/A | 65 | 20 | 23 | 19 | 75 | 39 | 19 | 19 | 90 | 15 | 27 | 23 |
| 55 | 5 | N/A | N/A | 65 | 25 | 23 | 19 | 80 | 0 | 19 | 19 | 90 | 20 | 23 | 23 |
| 55 | 10 | N/A | N/A | 65 | 30 | 23 | 23 | 80 | 5 | 23 | 23 | 90 | 25 | 19 | 19 |
| 55 | 15 | 19 | 19 | 65 | 35 | 23 | 23 | 80 | 10 | 31 | 23 | 90 | 30 | 19 | 19 |
| 55 | 20 | 27 | 23 | 65 | 39 | 19 | 19 | 80 | 15 | 23 | 23 | 90 | 35 | 19 | 19 |
| 55 | 25 | 23 | 23 | 70 | 0 | 19 | 19 | 80 | 20 | 19 | 19 | 90 | 39 | 19 | 19 |
| 55 | 30 | 19 | 19 | 70 | 5 | 19 | 19 | 80 | 25 | 23 | 23 | 95 | 0 | 31 | 23 |
| 55 | 35 | 19 | 15 | 70 | 10 | 23 | 19 | 80 | 30 | 23 | 19 | 95 | 5 | 47 | 39 |
| 55 | 39 | 15 | 15 | 70 | 15 | 23 | 23 | 80 | 35 | 19 | 19 | 95 | 10 | 31 | 23 |
| 60 | 0 | 23 | 19 | 70 | 20 | 23 | 23 | 80 | 39 | 19 | 19 | 95 | 15 | 23 | 19 |
| 60 | 5 | 19 | 19 | 70 | 25 | 23 | 19 | 85 | 0 | 31 | 27 | 95 | 20 | 19 | 19 |
| 60 | 10 | 19 | 19 | 70 | 30 | 19 | 19 | 85 | 5 | 47 | 31 | 95 | 25 | 23 | 23 |
| 60 | 15 | 19 | 19 | 70 | 35 | 23 | 23 | 85 | 10 | 31 | 23 | 95 | 30 | 23 | 19 |
| 60 | 20 | 23 | 19 | 70 | 39 | 23 | 19 | 85 | 15 | 31 | 23 | 95 | 35 | 19 | 19 |
| 60 | 25 | 19 | 19 | 75 | 0 | 19 | 19 | 85 | 20 | 23 | 23 | 95 | 39 | 39 | 23 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.

Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:

$X=(-3.25E-9*R^2) + (4.13E-3*R) - 1.661$.

** Coordinates in feet.

N/A = Inaccessible.

## Room 3 Exposure Rate Results of the GGM Building
## Welsbach/GGM Site
## Gross Exposure Rate (μR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | N/A | N/A | 0 | 10 | N/A | N/A | 0 | 20 | 56 | 47 | 0 | 30 | 56 | 56 |
| 5 | 0 | 23 | 23 | 5 | 10 | 47 | 47 | 5 | 20 | 60 | 60 | 5 | 30 | 60 | 56 |
| 10 | 0 | 31 | 31 | 10 | 10 | 47 | 47 | 10 | 20 | 64 | 60 | 10 | 30 | 60 | 60 |
| 15 | 0 | 35 | 35 | 15 | 10 | 47 | 47 | 15 | 20 | 64 | 60 | 15 | 30 | 64 | 64 |
| 20 | 0 | 31 | 35 | 20 | 10 | 43 | 47 | 20 | 20 | 72 | 68 | 20 | 30 | 68 | 72 |
| 25 | 0 | 35 | 31 | 25 | 10 | 47 | 47 | 25 | 20 | 72 | 64 | 25 | 30 | 60 | 60 |
| 30 | 0 | 39 | 39 | 30 | 10 | 51 | 47 | 30 | 20 | 64 | 60 | 30 | 30 | 60 | 64 |
| 35 | 0 | 64 | 60 | 35 | 10 | 56 | 51 | 35 | 20 | 60 | 56 | 35 | 30 | 72 | 72 |
| 40 | 0 | 88 | 68 | 40 | 10 | 64 | 51 | 40 | 20 | 56 | 51 | 40 | 30 | 100 | 80 |
| 45 | 0 | 96 | 80 | 45 | 10 | 35 | 31 | 45 | 20 | N/A | N/A | 45 | 30 | 104 | 80 |
| 48 | 0 | N/A | N/A | 48 | 10 | 31 | 31 | 48 | 20 | N/A | N/A | 48 | 30 | 80 | 80 |
| 0 | 5 | N/A | N/A | 0 | 15 | N/A | N/A | 0 | 25 | 56 | 51 | 0 | 35 | 56 | 47 |
| 5 | 5 | 47 | 39 | 5 | 15 | N/A | N/A | 5 | 25 | 72 | 68 | 5 | 35 | 72 | 64 |
| 10 | 5 | 47 | 43 | 10 | 15 | 56 | 56 | 10 | 25 | 72 | 72 | 10 | 35 | 64 | 64 |
| 15 | 5 | 39 | 39 | 15 | 15 | 56 | 56 | 15 | 25 | 64 | 64 | 15 | 35 | 56 | 56 |
| 20 | 5 | 39 | 43 | 20 | 15 | 60 | 60 | 20 | 25 | 80 | 72 | 20 | 35 | 60 | 60 |
| 25 | 5 | 47 | 39 | 25 | 15 | 60 | 56 | 25 | 25 | 80 | 72 | 25 | 35 | 64 | 60 |
| 30 | 5 | 51 | 47 | 30 | 15 | 56 | 56 | 30 | 25 | 68 | 64 | 30 | 35 | 47 | 51 |
| 35 | 5 | 56 | 51 | 35 | 15 | 47 | 47 | 35 | 25 | 68 | 68 | 35 | 35 | 80 | 80 |
| 40 | 5 | 60 | 47 | 40 | 15 | 51 | 56 | 40 | 25 | 92 | 84 | 40 | 35 | 96 | 92 |
| 45 | 5 | 56 | 43 | 45 | 15 | N/A | N/A | 45 | 25 | 88 | 76 | 45 | 35 | 88 | 84 |
| 48 | 5 | N/A | N/A | 48 | 15 | N/A | N/A | 48 | 25 | 76 | 72 | 48 | 35 | 80 | 72 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.
Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:
X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

** Coordinates in feet.

N/A = Inaccessible.

**Room 3 Exposure Rate Results of the GGM Building**

**Welsbach/GGM Site**

**Gross Exposure Rate (μR/h)***

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 40 | 47 | 47 | 0 | 50 | 43 | 39 | 0 | 60 | 47 | 39 | 0 | 70 | 47 | 47 |
| 5 | 40 | 64 | 60 | 5 | 50 | 47 | 47 | 5 | 60 | 43 | 47 | 5 | 70 | 47 | 51 |
| 10 | 40 | 60 | 56 | 10 | 50 | 47 | 47 | 10 | 60 | 51 | 56 | 10 | 70 | 68 | 84 |
| 15 | 40 | 56 | 56 | 15 | 50 | 47 | 51 | 15 | 60 | 64 | 64 | 15 | 70 | 147 | 127 |
| 20 | 40 | 64 | 56 | 20 | 50 | 60 | 64 | 20 | 60 | 104 | 96 | 20 | 70 | 379 | 234 |
| 25 | 40 | 60 | 56 | 25 | 50 | 88 | 84 | 25 | 60 | 119 | 104 | 25 | 70 | 234 | 234 |
| 30 | 40 | 64 | 64 | 30 | 50 | 80 | 76 | 30 | 60 | 127 | 119 | 30 | 70 | 750 | 379 |
| 35 | 40 | 88 | 80 | 35 | 50 | 88 | 84 | 35 | 60 | 96 | 104 | 35 | 70 | 636 | 308 |
| 40 | 40 | 96 | 84 | 40 | 50 | 88 | 80 | 40 | 60 | 104 | 107 | 40 | 70 | 139 | 151 |
| 45 | 40 | 96 | 80 | 45 | 50 | 76 | 72 | 45 | 60 | 96 | 92 | 45 | 70 | 104 | 100 |
| 48 | 40 | 80 | 72 | 48 | 50 | 72 | 68 | 48 | 60 | 88 | 76 | 48 | 70 | 100 | 84 |
| 0 | 45 | 47 | 43 | 0 | 55 | 39 | 39 | 0 | 65 | 47 | 47 | 0 | 75 | 39 | 39 |
| 5 | 45 | 51 | 47 | 5 | 55 | 43 | 47 | 5 | 65 | 47 | 47 | 5 | 75 | 43 | 39 |
| 10 | 45 | 51 | 51 | 10 | 55 | 47 | 47 | 10 | 65 | 56 | 64 | 10 | 75 | 56 | 64 |
| 15 | 45 | 56 | 51 | 15 | 55 | 51 | 56 | 15 | 65 | 72 | 84 | 15 | 75 | 189 | 119 |
| 20 | 45 | 56 | 56 | 20 | 55 | 80 | 80 | 20 | 65 | 197 | 135 | 20 | 75 | 185 | 147 |
| 25 | 45 | 72 | 68 | 25 | 55 | 92 | 88 | 25 | 65 | 151 | 151 | 25 | 75 | 430 | 308 |
| 30 | 45 | 68 | 64 | 30 | 55 | 96 | 88 | 30 | 65 | 181 | 174 | 30 | 75 | 447 | 60 |
| 35 | 45 | 80 | 80 | 35 | 55 | 80 | 80 | 35 | 65 | 234 | 234 | 35 | 75 | 447 | 379 |
| 40 | 45 | 96 | 88 | 40 | 55 | 104 | 92 | 40 | 65 | 111 | 135 | 40 | 75 | 127 | 147 |
| 45 | 45 | 80 | 80 | 45 | 55 | 84 | 80 | 45 | 65 | 104 | 100 | 45 | 75 | 104 | 96 |
| 48 | 45 | 72 | 64 | 48 | 55 | 72 | 68 | 48 | 65 | 88 | 84 | 48 | 75 | 80 | 76 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.

Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:

X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

** Coordinates in feet.

N/A = Inaccessible.

**Room 4 Exposure Rate Results of the GGM Building**

**Welsbach/GGM Site**

**Gross Exposure Rate (μR/h)***

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | N/A | N/A | 10 | 25 | 47 | 39 | 25 | 5 | 43 | 39 | 35 | 30 | 47 | 47 |
| 0 | 5 | 23 | 23 | 10 | 30 | 31 | 31 | 25 | 10 | 51 | 47 | 35 | 35 | 39 | 35 |
| 0 | 10 | 39 | 31 | 10 | 35 | 23 | 27 | 25 | 15 | 56 | 51 | 35 | 40 | 31 | 31 |
| 0 | 15 | 39 | 35 | 10 | 40 | 27 | 27 | 25 | 20 | 88 | 56 | 40 | 0 | 13 | 15 |
| 0 | 20 | 56 | 39 | 15 | 0 | 60 | 39 | 25 | 25 | 68 | 56 | 40 | 5 | 16 | 27 |
| 0 | 25 | 39 | 31 | 15 | 5 | 47 | 39 | 25 | 30 | 39 | 39 | 40 | 10 | 31 | 39 |
| 0 | 30 | 47 | 31 | 15 | 10 | 56 | 39 | 25 | 35 | 43 | 2 | 40 | 15 | 51 | 56 |
| 0 | 35 | 23 | 23 | 15 | 15 | 56 | 47 | 25 | 40 | 35 | 31 | 40 | 20 | 68 | 72 |
| 0 | 40 | 23 | 23 | 15 | 20 | 56 | 43 | 30 | 0 | 43 | 39 | 40 | 25 | 56 | 56 |
| 5 | 0 | 56 | 31 | 15 | 25 | 47 | 39 | 30 | 5 | 35 | 39 | 40 | 30 | 43 | 43 |
| 5 | 5 | 43 | 35 | 15 | 30 | 31 | 35 | 30 | 10 | 47 | 47 | 40 | 35 | 39 | 35 |
| 5 | 10 | 47 | 39 | 15 | 35 | 35 | 35 | 30 | 15 | 60 | 60 | 40 | 40 | 31 | 31 |
| 5 | 15 | 43 | 39 | 15 | 40 | 31 | 23 | 30 | 20 | 88 | 68 | 45 | 0 | 23 | 23 |
| 5 | 20 | 47 | 39 | 20 | 0 | N/A | N/A | 30 | 25 | 76 | 64 | 45 | 5 | 31 | 31 |
| 5 | 25 | 43 | 31 | 20 | 5 | 47 | 39 | 30 | 30 | 47 | 43 | 45 | 10 | 39 | 35 |
| 5 | 30 | 39 | 31 | 20 | 10 | 56 | 47 | 30 | 35 | 35 | 39 | 45 | 15 | 39 | 43 |
| 5 | 35 | 23 | 23 | 20 | 15 | 60 | 47 | 30 | 40 | 39 | 31 | 45 | 20 | 47 | 43 |
| 5 | 40 | 27 | 23 | 20 | 20 | 64 | 47 | 35 | 0 | 23 | 23 | 45 | 25 | 43 | 43 |
| 10 | 0 | 60 | 39 | 20 | 25 | 51 | 47 | 35 | 5 | 27 | 31 | 45 | 30 | 39 | 39 |
| 10 | 5 | 43 | 43 | 20 | 30 | 47 | 39 | 35 | 10 | 47 | 43 | 45 | 35 | 35 | 31 |
| 10 | 10 | 47 | 43 | 20 | 35 | 39 | 35 | 35 | 15 | 72 | 80 | 45 | 40 | 31 | 31 |
| 10 | 15 | 39 | 39 | 20 | 40 | 31 | 31 | 35 | 20 | 852 | 234 | 50 | 0 | N/A | N/A |
| 10 | 20 | 35 | 35 | 25 | 0 | 47 | 39 | 35 | 25 | 80 | 80 | 50 | 5 | N/A | N/A |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.
Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:
X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

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## Room 4 Exposure Rate Results of the GGM Building
## Welsbach/GGM Site
## Gross Exposure Rate (mR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 10 | 31 | 31 | 60 | 30 | 31 | 31 | 75 | 5 | 27 | 23 | 85 | 25 | 27 | 27 |
| 50 | 15 | 31 | 35 | 60 | 35 | 27 | 27 | 75 | 10 | 23 | 27 | 85 | 30 | 23 | 23 |
| 50 | 20 | 31 | 31 | 60 | 40 | 23 | 23 | 75 | 15 | 27 | 27 | 85 | 35 | 23 | 23 |
| 50 | 25 | 31 | 35 | 65 | 0 | 23 | 23 | 75 | 20 | 27 | 27 | 85 | 40 | 19 | 19 |
| 50 | 30 | 27 | 31 | 65 | 5 | 31 | 31 | 75 | 25 | 27 | 27 | 90 | 0 | 23 | 23 |
| 50 | 35 | 27 | 27 | 65 | 10 | 31 | 31 | 75 | 30 | 23 | 31 | 90 | 5 | 23 | 23 |
| 50 | 40 | 27 | 23 | 65 | 15 | 31 | 31 | 75 | 35 | 31 | 23 | 90 | 10 | 23 | 23 |
| 55 | 0 | N/A | N/A | 65 | 20 | 31 | 27 | 75 | 40 | 23 | 23 | 90 | 15 | 23 | 23 |
| 55 | 5 | N/A | N/A | 65 | 25 | 27 | 27 | 80 | 0 | 23 | 23 | 90 | 20 | 23 | 23 |
| 55 | 10 | 31 | 35 | 65 | 30 | 31 | 27 | 80 | 5 | 23 | 27 | 90 | 25 | 23 | 23 |
| 55 | 15 | 31 | 35 | 65 | 35 | 27 | 27 | 80 | 10 | 23 | 23 | 90 | 30 | 23 | 23 |
| 55 | 20 | 27 | 31 | 65 | 40 | 23 | 27 | 80 | 15 | 27 | 27 | 90 | 35 | 23 | 23 |
| 55 | 25 | 31 | 31 | 70 | 0 | 31 | 23 | 80 | 20 | 23 | 23 | 90 | 40 | 19 | 19 |
| 55 | 30 | 27 | 31 | 70 | 5 | 23 | 27 | 80 | 25 | 23 | 23 | 95 | 0 | 19 | 15 |
| 55 | 35 | 31 | 23 | 70 | 10 | 27 | 27 | 80 | 30 | 23 | 23 | 95 | 5 | 19 | 15 |
| 55 | 40 | 23 | 23 | 70 | 15 | 27 | 31 | 80 | 35 | 23 | 23 | 95 | 10 | 23 | 25 |
| 60 | 0 | N/A | N/A | 70 | 20 | 27 | 27 | 80 | 40 | 23 | 23 | 95 | 15 | 23 | 25 |
| 60 | 5 | N/A | N/A | 70 | 25 | 27 | 27 | 85 | 0 | 23 | 23 | 95 | 20 | 23 | 15 |
| 60 | 10 | 35 | 35 | 70 | 30 | 31 | 27 | 85 | 5 | 23 | 23 | 95 | 25 | 19 | 19 |
| 60 | 15 | 35 | 31 | 70 | 35 | 31 | 23 | 85 | 10 | 31 | 23 | 95 | 30 | 19 | 19 |
| 60 | 20 | 31 | 31 | 70 | 40 | 23 | 23 | 85 | 15 | 27 | 23 | 95 | 35 | 23 | 19 |
| 60 | 25 | 27 | 31 | 75 | 0 | 23 | 23 | 85 | 20 | 23 | 23 | 95 | 40 | 31 | 15 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.

Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:

X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

** Coordinates in feet.

N/A = Inaccessible.

# Room 5 Exposure Rate Results of the GGM Building

## Welsbach/GGM Site

## Gross Exposure Rate (μR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 0 | 31 | 27 | 20 | 0 | 39 | 31 | 25 | 0 | 39 | 31 | 30 | 0 | 39 | 39 |
| 15 | 5 | 35 | 31 | 20 | 5 | 39 | 35 | 25 | 5 | 43 | 39 | 30 | 5 | 47 | 39 |
| 15 | 10 | 39 | 39 | 20 | 10 | 47 | 43 | 25 | 10 | 47 | 39 | 30 | 10 | 47 | 43 |
| 15 | 15 | 39 | 35 | 20 | 15 | 43 | 39 | 25 | 15 | 39 | 39 | 30 | 15 | 47 | 47 |
| 15 | 20 | 39 | 39 | 20 | 20 | 51 | 43 | 25 | 20 | 51 | 47 | 30 | 20 | 47 | 47 |
| 15 | 25 | 39 | 39 | 20 | 25 | 47 | 47 | 25 | 25 | 47 | 47 | 30 | 25 | 56 | 47 |
| 15 | 30 | 158 | 39 | 20 | 30 | 39 | 39 | 25 | 30 | 47 | 43 | 30 | 30 | 47 | 43 |
| 15 | 35 | 43 | 39 | 20 | 35 | 47 | 47 | 25 | 35 | 51 | 47 | 30 | 35 | 56 | 51 |
| 15 | 40 | 51 | 47 | 20 | 40 | 64 | 56 | 25 | 40 | 64 | 56 | 30 | 40 | 60 | 56 |
| 15 | 45 | 47 | 47 | 20 | 45 | 51 | 51 | 25 | 45 | 56 | 56 | 30 | 45 | 56 | 56 |
| 15 | 50 | 56 | 51 | 20 | 50 | 60 | 56 | 25 | 50 | 60 | 60 | 30 | 50 | 60 | 56 |
| 15 | 55 | 56 | 56 | 20 | 55 | 80 | 64 | 25 | 55 | 72 | 72 | 30 | 55 | 72 | 64 |
| 15 | 60 | 64 | 64 | 20 | 60 | 88 | 80 | 25 | 60 | 92 | 88 | 30 | 60 | 80 | 80 |
| 15 | 65 | 80 | 72 | 20 | 65 | 104 | 88 | 25 | 65 | 107 | 88 | 30 | 65 | 96 | 88 |
| 15 | 70 | 84 | 80 | 20 | 70 | 104 | 84 | 25 | 70 | 104 | 88 | 30 | 70 | 111 | 88 |
| 15 | 75 | 76 | 68 | 20 | 75 | 100 | 76 | 25 | 75 | 96 | 80 | 30 | 75 | 104 | 80 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.

Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:

X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

** Coordinates in feet. N/A = Inaccessible.

## Room 5 Exposure Rate Results of the GGM Building
## Welsbach/GGM Site
## Gross Exposure Rate (μR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | 0 | 43 | 39 | 40 | 0 | 39 | 35 | 45 | 0 | 39 | 31 | 47 | 0 | N/A | N/A |
| 35 | 5 | 47 | 43 | 40 | 5 | 43 | 39 | 45 | 5 | 47 | 39 | 47 | 5 | 39 | 31 |
| 35 | 10 | 47 | 47 | 40 | 10 | 47 | 47 | 45 | 10 | 47 | 43 | 47 | 10 | 39 | 39 |
| 35 | 15 | 47 | 43 | 40 | 15 | 47 | 39 | 45 | 15 | 51 | 43 | 47 | 15 | N/A | N/A |
| 35 | 20 | 47 | 47 | 40 | 20 | 31 | 39 | 45 | 20 | N/A | N/A | 47 | 20 | N/A | N/A |
| 35 | 25 | 56 | 47 | 40 | 25 | 47 | 47 | 45 | 25 | 56 | 47 | 47 | 25 | 47 | 39 |
| 35 | 30 | 51 | 47 | 40 | 30 | 47 | 47 | 45 | 30 | 51 | 39 | 47 | 30 | 47 | 43 |
| 35 | 35 | 60 | 51 | 40 | 35 | 56 | 47 | 45 | 35 | 56 | 47 | 47 | 35 | 51 | 47 |
| 35 | 40 | 64 | 56 | 40 | 40 | 60 | 56 | 45 | 40 | 56 | 51 | 47 | 40 | 47 | 43 |
| 35 | 45 | 64 | 60 | 40 | 45 | 64 | 56 | 45 | 45 | 56 | 43 | 47 | 45 | 51 | 47 |
| 35 | 50 | 72 | 60 | 40 | 50 | 72 | 60 | 45 | 50 | 51 | 51 | 47 | 50 | 47 | 47 |
| 35 | 55 | 72 | 60 | 40 | 55 | 80 | 72 | 45 | 55 | 60 | 60 | 47 | 55 | 56 | 51 |
| 35 | 60 | 80 | 72 | 40 | 60 | 80 | 76 | 45 | 60 | 68 | 39 | 47 | 60 | 56 | 56 |
| 35 | 65 | N/A | N/A | 40 | 65 | N/A | N/A | 45 | 65 | N/A | N/A | 47 | 65 | N/A | N/A |
| 35 | 70 | N/A | N/A | 40 | 70 | N/A | N/A | 45 | 70 | N/A | N/A | 47 | 70 | N/A | N/A |
| 35 | 75 | N/A | N/A | 40 | 75 | N/A | N/A | 45 | 75 | N/A | N/A | 47 | 75 | N/A | N/A |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.

Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:

X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

** Coordinates in feet.

N/A = Inaccessible.

**Room 6 Exposure Rate Results of the GGM Building**

**Welsbach/GGM Site**

**Gross Exposure Rate (μR/h)***

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | N/A | N/A | 10 | 25 | 35 | 27 | 25 | 5 | N/A | N/A | 35 | 30 | 47 | 47 |
| 0 | 5 | N/A | N/A | 10 | 30 | 35 | 31 | 25 | 10 | N/A | N/A | 35 | 35 | 56 | 39 |
| 0 | 10 | N/A | N/A | 10 | 35 | 31 | 27 | 25 | 15 | 31 | 31 | 35 | 40 | 47 | 39 |
| 0 | 15 | 39 | 27 | 10 | 40 | 23 | 23 | 25 | 20 | 35 | 31 | 40 | 0 | N/A | N/A |
| 0 | 20 | 27 | 23 | 15 | 0 | N/A | N/A | 25 | 25 | 39 | 35 | 40 | 5 | N/A | N/A |
| 0 | 25 | 31 | 23 | 15 | 5 | N/A | N/A | 25 | 30 | 39 | 39 | 40 | 10 | N/A | N/A |
| 0 | 30 | 35 | 23 | 15 | 10 | N/A | N/A | 25 | 35 | 35 | 31 | 40 | 15 | 39 | 39 |
| 0 | 35 | 23 | 23 | 15 | 15 | 31 | 27 | 25 | 40 | 39 | 31 | 40 | 20 | 39 | 39 |
| 0 | 40 | 27 | 23 | 15 | 20 | 31 | 31 | 30 | 0 | N/A | N/A | 40 | 25 | 56 | 39 |
| 5 | 0 | N/A | N/A | 15 | 25 | 35 | 31 | 30 | 5 | N/A | N/A | 40 | 30 | 47 | 43 |
| 5 | 5 | N/A | N/A | 15 | 30 | 39 | 31 | 30 | 10 | N/A | N/A | 40 | 35 | 56 | 47 |
| 5 | 10 | N/A | N/A | 15 | 35 | 39 | 31 | 30 | 15 | 35 | 31 | 40 | 40 | 51 | 43 |
| 5 | 15 | 23 | 23 | 15 | 40 | 23 | 23 | 30 | 20 | 31 | 35 | 45 | 0 | N/A | N/A |
| 5 | 20 | 31 | 31 | 20 | 0 | N/A | N/A | 30 | 25 | 39 | 39 | 45 | 5 | N/A | N/A |
| 5 | 25 | 31 | 27 | 20 | 5 | N/A | N/A | 30 | 30 | 47 | 39 | 45 | 10 | N/A | N/A |
| 5 | 30 | 27 | 23 | 20 | 10 | N/A | N/A | 30 | 35 | 39 | 35 | 45 | 15 | 35 | 31 |
| 5 | 35 | 31 | 27 | 20 | 15 | 31 | 31 | 30 | 40 | 43 | 31 | 45 | 20 | 39 | 39 |
| 5 | 40 | 23 | 23 | 20 | 20 | 31 | 31 | 35 | 0 | N/A | N/A | 45 | 25 | 47 | 39 |
| 10 | 0 | N/A | N/A | 20 | 25 | 39 | 35 | 35 | 5 | N/A | N/A | 45 | 30 | 43 | 39 |
| 10 | 5 | N/A | N/A | 20 | 30 | 35 | 35 | 35 | 10 | N/A | N/A | 45 | 35 | 47 | 39 |
| 10 | 10 | N/A | N/A | 20 | 35 | 39 | 35 | 35 | 15 | 35 | 31 | 45 | 40 | 56 | 35 |
| 10 | 15 | 31 | 27 | 20 | 40 | 35 | 31 | 35 | 20 | 39 | 39 | 50 | 0 | N/A | N/A |
| 10 | 20 | 31 | 31 | 25 | 0 | N/A | N/A | 35 | 25 | 47 | 43 | 50 | 5 | N/A | N/A |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.
Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:
X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

## Room 6 Exposure Rate Results of the GGM Building
## Welsbach/GGM Site
## Gross Exposure Rate (μR/h)*

| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 10 | N/A | N/A | 60 | 30 | 47 | 43 | 75 | 5 | N/A | N/A | 85 | 25 | 27 | 27 |
| 50 | 15 | 43 | 39 | 60 | 35 | 51 | 47 | 75 | 10 | N/A | N/A | 85 | 30 | 31 | 31 |
| 50 | 20 | 39 | 39 | 60 | 40 | 60 | 51 | 75 | 15 | 35 | 31 | 85 | 35 | 39 | 31 |
| 50 | 25 | 39 | 39 | 65 | 0 | N/A | N/A | 75 | 20 | 39 | 39 | 85 | 40 | 39 | 31 |
| 50 | 30 | 47 | 39 | 65 | 5 | N/A | N/A | 75 | 25 | 27 | 31 | 90 | 0 | N/A | N/A |
| 50 | 35 | 39 | 39 | 65 | 10 | N/A | N/A | 75 | 30 | 39 | 39 | 90 | 5 | N/A | N/A |
| 50 | 40 | 56 | 43 | 65 | 15 | 39 | 39 | 75 | 35 | 43 | 39 | 90 | 10 | N/A | N/A |
| 55 | 0 | N/A | N/A | 65 | 20 | 39 | 39 | 75 | 40 | 47 | 39 | 90 | 15 | 31 | 39 |
| 55 | 5 | N/A | N/A | 65 | 25 | 39 | 47 | 80 | 0 | N/A | N/A | 90 | 20 | 31 | 31 |
| 55 | 10 | N/A | N/A | 65 | 30 | 43 | 39 | 80 | 5 | N/A | N/A | 90 | 25 | 31 | 27 |
| 55 | 15 | 76 | 51 | 65 | 35 | 43 | 39 | 80 | 10 | N/A | N/A | 90 | 30 | 39 | 31 |
| 55 | 20 | 51 | 43 | 65 | 40 | 104 | 39 | 80 | 15 | 35 | 31 | 90 | 35 | 31 | 27 |
| 55 | 25 | 47 | 47 | 70 | 0 | N/A | N/A | 80 | 20 | 31 | 31 | 90 | 40 | 31 | 31 |
| 55 | 30 | 39 | 43 | 70 | 5 | N/A | N/A | 80 | 25 | 31 | 31 | 95 | 0 | N/A | N/A |
| 55 | 35 | 56 | 47 | 70 | 10 | N/A | N/A | 80 | 30 | 31 | 31 | 95 | 5 | N/A | N/A |
| 55 | 40 | 92 | 47 | 70 | 15 | 35 | 35 | 80 | 35 | 39 | 35 | 95 | 10 | N/A | N/A |
| 60 | 0 | N/A | N/A | 70 | 20 | 35 | 35 | 80 | 40 | 39 | 35 | 95 | 15 | 27 | 23 |
| 60 | 5 | N/A | N/A | 70 | 25 | 35 | 39 | 85 | 0 | N/A | N/A | 95 | 20 | 27 | 23 |
| 60 | 10 | N/A | N/A | 70 | 30 | 43 | 39 | 85 | 5 | N/A | N/A | 95 | 25 | 23 | 23 |
| 60 | 15 | 68 | 47 | 70 | 35 | 47 | 39 | 85 | 10 | N/A | N/A | 95 | 30 | 23 | 23 |
| 60 | 20 | 56 | 47 | 70 | 40 | 56 | 39 | 85 | 15 | 27 | 27 | 95 | 35 | 27 | 23 |
| 60 | 25 | 56 | 47 | 75 | 0 | N/A | N/A | 85 | 20 | 31 | 31 | 95 | 40 | 27 | 23 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.

Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows:

$X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661$.

** Coordinates in feet.

N/A = Inaccessible.

300956

## Hallway Exposure Rate Results at GGM Building
## Welsbach/GGM Site
## Gross Exposure Rate (μR/h)*

| BASEMENT HALLWAY | | | | SECOND FLOOR HALLWAY | | | | FIRST FLOOR HALLWAY | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| X** | Y** | Surface | 1 Meter | X | Y | Surface | 1 Meter | X | Y | Surface | 1 Meter |
| 2.5 | 0 | 23 | 23 | 1 | 0 | 27 | 23 | 0 | 0 | 31 | 35 |
| 2.5 | 5 | 27 | 23 | 1 | 5 | 27 | 27 | 6 | 0 | 31 | 31 |
| 2.5 | 10 | 19 | 19 | 1 | 10 | 27 | 23 | 0 | 5 | 27 | 23 |
| 2.5 | 15 | 19 | 19 | 1 | 15 | 27 | 27 | 6 | 5 | 31 | 31 |
| 2.5 | 20 | 19 | 19 | 1 | 20 | 23 | 23 | 0 | 10 | 31 | 31 |
| 2.5 | 25 | 19 | 19 | 1 | 25 | 19 | 19 | 6 | 10 | 35 | 31 |
| 2.5 | 30 | 19 | 19 | 1 | 30 | 23 | 23 | 0 | 15 | 39 | 31 |
| 2.5 | 35 | 19 | 19 | 1 | 35 | 19 | 19 | 6 | 15 | N/A | N/A |
| 2.5 | 39 | 19 | 19 | 1 | 39 | 23 | 19 | 0 | 20 | 35 | 31 |
| | | | | | | | | 6 | 20 | N/A | N/A |
| | | | | | | | | 0 | 25 | 35 | 31 |
| | | | | | | | | 6 | 25 | 31 | 11 |
| | | | | | | | | 0 | 30 | 31 | 23 |
| | | | | | | | | 6 | 30 | 23 | 23 |
| | | | | | | | | 0 | 35 | 23 | 19 |
| | | | | | | | | 6 | 35 | 23 | 23 |
| | | | | | | | | 0 | 38 | 23 | 19 |
| | | | | | | | | 6 | 38 | 19 | 19 |
| | | | | | | | | 3 | 0 | 23 | 23 |
| | | | | | | | | 3 | 5 | 27 | 23 |
| | | | | | | | | 3 | 10 | 19 | 19 |
| | | | | | | | | 3 | 15 | 19 | 19 |
| | | | | | | | | 3 | 20 | 19 | 19 |
| | | | | | | | | 3 | 25 | 19 | 19 |
| | | | | | | | | 3 | 30 | 19 | 19 |

*Count rate, R (cpm), measurements were made with Ludlum model 12, serial # 78689, and Ludlum model 44-2, serial # 071914.
Data were converted to exposure rate, X (uR/h), via cross calibration to Reuter-Stokes pressurized ion Chamber as follows: X=(-3.25E-9*R^2) + (4.13E-3*R) -1.661.

** Coordinates in feet. N/A = Inaccessible.



300957

F

**APPENDIX F**

**WELSBACH/GGM SITE**

**SOIL BORING LOGS**

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
WELSBACH/GGM SITE
CAMDEN AND GLOUCESTER CITY
CAMDEN COUNTY, NEW JERSEY

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-01**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/9/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shuffes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 0' | Asphalt | | Started hole at 1610 |
| | | | | | | | 3" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Black sand and slag | | 8000 CPM |
| | | | 3 | 4 | 4 | 4 | 2' | Reddish brown medium grain sand | | |
| 2 | 2-4' | | | | | | | | | |
| | | | 2 | 3 | 6 | 5 | 4' | " " | | |
| 3 | 4-6' | | | | | | 5' | Black sand and slag | | 6000 CPM |
| | | | | | | | 5'2" | Reddish brown medium grain sand | | 80 CPM |
| | | | 3 | 7 | 7 | 8 | 6' | " " | | |
| 4 | 6-8' | | | | | | | | | |
| | | | 2 | 10 | 9 | 10 | 8' | " " | | |
| 5 | 8-10' | | | | | | 8'6" | Black sand and slag | | 1000 CPM |
| | | | 4 | 15 | 17 | 20 | 10' | Reddish brown medium grain sand | | |
| 6 | 10-12' | | | | | | 10'4" | Black sand, slag, and rock fragments (Quartz) | | 160 CPM |
| | | | 3 | 10 | 16 | 20 | 12' | Reddish brown medium grain sand | | |
| 7 | 12-14' | | | | | | | | | |
| | | | | | | | 13'8" | Black sand and slag | | 900 CPM |
| | | | 3 | 6 | 12 | 18 | 14' | " " | | |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 14'9" | Reddish brown medium grain sand | | |
| | | | 4 | 6 | 4 | 7 | 16' | Reddish brown medium grain sand and weathered | | |
| | | | | | | | | Dolomite | | BOB |
| | | | | | | | | | | Completed hole at 1715 |

# MALCOLM PIRNIE, INC.

BORING: SB-02

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/9/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny 40-45 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| 1 | 0-2' | 17" | 10 | 8 | | | | (1) 4" ash fill grades into medium grain sand, | | |
| | | | 8 | 12 | | | 2' | medium brown | | |
| 2 | 2-4' | 7" | 7 | 100/2 | | | | | | |
| | | | | | | | 4' | (2) 7" moist silty medium grain sand, | | |
| | | | | | | | | medium brown to tan | | |
| | | | | | | | | @ 2'8" brick foundation, auger to 4' all | | Spoon refusal @ 2'8" |
| | | | | | | | | masoned red brick | | Auger refusal @ 4' |
| | | | | | | | | | | EOB @ 4' |



300906

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-03

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/9/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 2037 |
| | | | | | | | 3" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Black sand and slag | | 100 CPM |
| | | | 8 | 21 | 10 | 8 | 2' | Black sand and slag | | |
| 2 | 2-4' | | | | | | | | | 140 CPM |
| | | | 4 | 6 | 11 | 7 | 4' | Dark rediish brown and black sand | | |
| 3 | 4-6' | | | | | | | | | |
| | | | | | | | 5'6" | Black sand and slag with red brick fragments | | 130 CPM |
| | | | 7 | 6 | 6 | 5 | 6' | Dark rediish brown and black sand | | |
| | | | | | | | 6'2" | Black sand | | |
| 4 | 6-8' | | | | | | | | | |
| | | | | | | | 7'4" | Dark rediish brown and black sand | | |
| | | | 5 | 3 | 3 | 3 | 8' | Black sand and slag | | 100 CPM |
| 5 | 8-10' | | | | | | | | | |
| | | | 3 | 3 | 4 | 4 | 10' | " " | | 100 CPM |
| 6 | 10-12' | | | | | | | | | |
| | | | | | | | 11'6" | Very light brown medium grain sand | | 80 CPM |
| | | | 1 | 3 | 4 | 7 | 12' | " " | | |
| 7 | 12-14' | | | | | | | | | |
| | | | | | | | 13'5" | Black sand and slag | | 100 CPM |
| | | | 7 | 6 | 8 | 10 | 14' | Very light brown medium grain sand | | 80 CPM |
| 8 | 14-16' | | | | | | | | | |
| | | | 5 | 7 | 15 | 20 | 16' | " " | | BOB<br>Completed hole at 2120 |



300901

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-04

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/9/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny 40 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| 1 | 0-2' | 6" | 22 | 100/2 | | | | (1) 0-6" black ash fill with some brick chips | | |
| | | | | | | | 2' | refusal @ 8" concrete | | Spoon refusal @ 8" |
| 2 | 2-4' | 8" | 8 | 15 | | | | auger through concrete (6"-2') | | |
| | | | 12 | 24 | | | 4' | | | |
| 3 | 4-6' | 8" | 18 | 60 | | | | (2) fill sand and fill debris | | |
| | | | 100/0 | | | | 6' | red brick, concrete and ash | | |
| 4 | 6-8' | 8" | 18 | 9 | | | | | | |
| | | | 12 | 9 | | | 8' | (3) medium to fine grain sand fill | | |
| 5 | 8-10' | 10" | 8 | 5 | | | | some red brick chips and ash | | |
| | | | 4 | 4 | | | 10' | | | |
| 6 | 10-12' | 16" | 2 | 3 | | | | (4) medium grain light to medium brown sand | | |
| | | | 1 | 1 | | | 12' | | | |
| 7 | 12-14' | 8' | 1 | 2 | | | | (5) SAA | | |
| | | | 2 | 3 | | | 14' | | | |
| 8 | 14-16' | 18' | 1 | 3 | | | | (6) SAA, moist to saturated | | |
| | | | 4 | 7 | | | 16' | | | |
| | | | | | | | | (7) 2" saturated medium grain sand | | |
| | | | | | | | | (perched water) | | |
| | | | | | | | | 6" most clay, grey to brown | | |
| | | | | | | | | | | |
| | | | | | | | | (8) moist clay, grey to brown, very cohesive, | | |
| | | | | | | | | grades to a sandy clay saturated, | | |
| | | | | | | | | less cohesive | | EOB @ 16' |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-05

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/10/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1240 |
| | | | | | | | 3" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Black sand and slag with red brick fragments | | 60000 CPM |
| | | | 16 | 12 | 16 | 19 | 2' | Rediish brown medium grain sand | | |
| 2 | 2-4' | | | | | | 2'6" | Light gray to white medium grain sand | | 2000 CPM |
| | | | 7 | 19 | 33 | 28 | 4' | Rediish brown medium grain sand | | |
| 3 | 4-6' | | | | | | | | | |
| | | | 10 | 20 | 6 | 6 | 6' | Black sand and slag | | 2500 CPM |
| | | | | | | | | | | 1200 CPM |
| 4 | 6-8' | | | | | | | | | |
| | | | | | | | 7' | Light Brown medium grain sand | | |
| | | | 4 | 8 | 11 | 12 | 8' | | | |
| 5 | 8-10' | | | | | | 9' | Black sand and slag | | 1900 CPM |
| | | | | | | | 9'4" | Rediish brown to light green medium grain sand | | |
| | | | 3 | 5 | 6 | 15 | 10' | Rediish brown and black medium grain sand | | 3200 CPM |
| 6 | 10-12' | | | | | | 11'5" | Weathered brick | | |
| | | | 3 | 6 | 12 | 9 | 12' | Reddish brown and white sand | | 900 CPM |
| 7 | 12-14' | | | | | | 12'6" | Gray clay (dense with low plasticity) | | |
| | | | 6 | 8 | 9 | 8 | 14' | " " | | 1000 CPM |
| 8 | 14-16' | | | | | | | | | |
| | | | 4 | 5 | 8 | 22 | 16' | " " | | BOB<br>Completed hole at 1400 |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-06

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/9/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Clear 30 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| 1 | 0-2' | 16" | 28 | 28 | | | | (1) medium grain brown sand with some | | |
| | | | 19 | 17 | | | 2' | fill ash and red brick chips | | |
| 2 | 2-4' | 20" | 7 | 10 | | | | | | |
| | | | 7 | 7 | | | 4' | (2) medium to fine grain silty sand with fill | | |
| 3 | 4-6' | 18" | 2 | 9 | | | | material, ash, brick and qtz pebbles | | |
| | | | 5 | 5 | | | 6' | | | |
| 4 | 6-8' | 24" | 27 | 26 | | | | (3) SAA (fill) | | |
| | | | 10 | 9 | | | 8' | | | |
| 5 | 8-10' | 24" | 3 | 3 | | | | (4) SAA to 7'2" abruptly changes to fine grain | | (4) 3" spoon |
| | | | 3 | 3 | | | 10' | sand, light tan to brown | | |
| 6 | 10-12' | 20" | 4 | 3 | | | | | | |
| | | | 3 | 7 | | | 12' | (5) fine grain sand light tan to brown | | |
| 7 | 12-14' | 20" | 14 | 13 | | | | | | |
| | | | 22 | 24 | | | 14' | (6) SAA | | |
| 8 | 14-16' | 18" | 12 | 22 | | | | | | |
| | | | 19 | 33 | | | 16' | (7) SAA some modling iron stain bands | | |
| | | | | | | | | | | |
| | | | | | | | | (8) SAA moist, saturated @ 15'9" | | EOB @ 16' |

# MALCOLM PIRNIE, INC.

BORING: SB-07

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/10/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1500 |
| | | | | | | | 3" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Red Brick | | 900 CPM |
| | | | | | | | | | | |
| | | | | | 36 | 35 | 2' | Auger Refusal (Bldg. Foundation) | | BOB |
| | | | | | | | | | | Hole completed at 1507 |



300985

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-08**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/10/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny 50-55 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | |
| 1 | 0-2' | 18" | 16 | 15 | | | | |
| | | | 16 | 11 | | | 2' | |
| 2 | 2-4' | 16" | 7 | 9 | | | | |
| | | | 6 | 5 | | | 4' | |
| 3 | 4-6' | 14" | 6 | 9 | | | | |
| | | | 11 | 15 | | | 6' | |
| 4 | 6-8' | 18" | 22 | 17 | | | | |
| | | | 17 | 15 | | | 8' | |
| 5 | 8-10' | 14" | 4 | 6 | | | | |
| | | | 10 | 17 | | | 10' | |
| 6 | 10-12' | 16" | 14 | 12 | | | | |
| | | | 17 | 18 | | | 12' | |
| 7 | 12-14' | 18" | 17 | 27 | | | | |
| | | | 29 | 29 | | | 14' | |
| 8 | 14-16' | 20" | 13 | 36 | | | | |
| | | | 25 | 26 | | | 16' | |

| SOIL DESCRIPTION | WELL CONS | REMARKS |
|---|---|---|
| (1) 0-6" yellow brown silty sand<br>6-10" light tan to white sand and ash<br>black ash, brown red sand last 4" | | |
| (2) red brown sand grades to a sandy silt,<br>cohesive | | |
| (3) red brown medium grain silty sand<br>some evidence of fill (red brick chips) | | |
| (4) medium grain red to tan sand grades to fine<br>grain red brown silty sand<br>*iron staining throughout* | | |
| (5) medium grain red to tan sand<br>heavy iron stained modling | | |
| (6) tan sand grades to medium grey silty sand<br>grades to sandy grey silt, cohesive | | |
| (7) tan to grey silty sand grades to grey silty<br>cohesive medium grain sand to grey<br>medium grain sand | | (7) 3" spoon |
| (8) tan to grey medium grey sand grades to<br>sandy silt, dense and cohesive<br>*some trace dark grey clay grades back to*<br>silty grey sand, some small qtz pebbles | | (8) 3" spoon<br><br>EOB @ 16' |



3009[illegible]3

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-09**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/10/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1520 |
| | | | | | | | 3" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Black sand and slag with red brick fragments | | 120 CPM |
| | | | 27 | 19 | 18 | 13 | 2' | Reddish brown medium grain sand | | |
| 2 | 2-4' | | | | | | | | | |
| | | | 5 | 8 | 8 | 14 | 4' | Auger refusal (Bldg. foundation, metal, and Brick) | | BOB |
| | | | | | | | | | | Completed hole at 1545 |
| | | | | | | | | ...Lost two auger teeth in the hole | | |

# MALCOLM PIRNIE, INC.

BORING: SB-10

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/10/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| 1 | 0-2' | 8" | 24 | 46 | | | | (1) ash fill and red brick, some concrete | | (1) 3" spoon |
| | | | 100/2 | | | | 2' | refusal @ 14" | | Spoon refusal @ 14" |
| 2 | 2-4' | 16" | 10 | 8 | | | | | | Auger to 2' through red |
| | | | 14 | 19 | | | 4' | (2) medium to fine grain tan brown silty sand | | brick and concrete |
| 3 | 4-6' | 14" | 2 | 8 | | | | grades to a light tan to white fine grain sand | | |
| | | | 15 | 29 | | | 6' | | | |
| 4 | 6-8' | 12" | 34 | 56 | | | | (3) light tan to white fine grain silty sand | | |
| | | | 52 | 100/2 | | | 8' | slightly cohesive | | |
| 5 | 8-10' | 16" | 18 | 47 | | | | | | |
| | | | 42 | 17 | | | 10' | (4) light tan fine to medium grain sand, | | |
| 6 | 10-12' | 16" | 6 | 8 | | | | iron stained modling | | |
| | | | 12 | 12 | | | 12' | | | |
| 7 | 12-14' | 18" | 2 | 7 | | | | (5) coarse to fine grain silty sand light brown | | |
| | | | 10 | 10 | | | 14' | to tan, some modling | | |
| 8 | 14-16' | 12" | 2 | 2 | | | | | | |
| | | | 6 | 8 | | | 16' | (6) coarse to fine grain silty sand grades to | | |
| | | | | | | | | a very cohesive grey clay | | |
| | | | | | | | | (7) very cohesive grey clay grades to a | | |
| | | | | | | | | softer brown to tan clay | | |
| | | | | | | | | (8) soft brown clay grades to a medium to fine | | |
| | | | | | | | | grain silty red to brown sand | | |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-11

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/10/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1700 |
| | | | | | | | 3" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Red Brick | | |
| | | | 3 | 6 | 16 | 28 | 2' | Black sand and slag | | 40 CPM |
| 2 | 2-4' | | | | | | | | | |
| | | | 5 | 28 | 17 | 18 | 4' | " " | | 40 CPM |
| 3 | 4-6' | | | | | | | | | |
| | | | 15 | 14 | 14 | 15 | 6' | " " | | 70 CPM |
| 4 | 6-8' | | | | | | | | | |
| | | | 18 | 19 | 13 | 9 | 8' | " " | | 65 CPM |
| 5 | 8-10' | | | | | | | | | |
| | | | 14 | 5 | 3 | 4 | 10' | " " | | 50 CPM |
| 6 | 10-12' | | | | | | | | | |
| | | | 5 | 9 | 14 | 12 | 12' | " " | | 80 CPM |
| 7 | 12-14' | | | | | | | | | |
| | | | 3 | 4 | 9 | 4 | 14' | " " | | 40 CPM |
| 8 | 14-16' | | | | | | | | | |
| | | | 1 | 2 | 7 | 0 | 16' | " " | | 60 CPM |
| | | | | | | | | | | BOB |
| | | | | | | | | | | Completed hole at 1800 |

# MALCOLM PIRNIE, INC.

**BORING: SB-12**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/11/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny to P-cloudy 35 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| 1 | 0-2' | 16" | 38 | 43 | | | | (1) dark ash/fill to coarse/fine grain silty sand | | (1) 3" spoon |
| | | | 47 | 36 | | | 2' | with debris brick chips and qtz pebbles | | |
| 2 | 2-4' | 14' | 12 | 16 | | | | | | |
| | | | 12 | 11 | | | 4' | (2) red brown to tan medium silty sand with | | |
| 3 | 4-6' | 10" | 6 | 4 | | | | crystaline quartz pebbles | | |
| | | | 4 | 2 | | | 6' | | | |
| 4 | 6-8' | 2" | 1 | 3 | | | | (3) medium grain silty sand with quartz pebbles, | | |
| | | | 18 | 9 | | | 8' | brown to grey, moist | | DTW @ approx. 7' |
| | | | | | | | | (4) wood debris and consolidated unsorted | | EOB @ 8' |
| | | | | | | | | sand, medium to coarse grain with | | |
| | | | | | | | | qtz pebbles | | |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-13**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/10/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1900 |
| | | | | | | | 3" | Black sand and slag with pebbles and cobbles | | 20 CPM |
| 1 | 0-2' | | | | | | | | | |
| | | | | 11 | 14 | 23 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | |
| | | | | | | | | | | 40 CPM |
| | | | 8 | 20 | 31 | 21 | 4' | " " | | |
| 3 | 4-6' | | | | | | 5'4" | " " and wood | | 20 CPM |
| | | | 7 | 7 | 11 | 5 | 6' | Black sand and slag | | 50 CPM |
| 4 | 6-8' | | | | | | | | | |
| | | | 5 | 8 | 21 | 11 | 8' | Black sand and slag | | 40 CPM |
| 5 | 8-10' | | | | | | | | | |
| | | | 6 | 14 | 20 | 8 | 10' | Black sand and slag | | 20 CPM |
| 6 | 10-12' | | | | | | | | | |
| | | | 6 | 14 | 10 | 13 | 12' | Black sand and slag | | 30 CPM |
| 7 | 12-13' | | | | | | | | | |
| | | | | | | | 13' | Auger refusal | | BOB<br>Completed hole at 1940 |



300971

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-14

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/11/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Forner Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | mostly cloudy 35 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| 1 | 0-2' | 10" | 4 | 3 | | | | (1) weathered red brick (8") grades to medium | | |
| | | | 3 | 6 | | | 2' | grain brown to tan silty sand (2") | | |
| 2 | 2-4' | 14" | 7 | 16 | | | | | | |
| | | | 17 | 26 | | | 4' | (2) coarse to medium grain brown to red sand | | |
| 3 | 4-6' | 16" | 7 | 14 | | | | grades to siltysand, more cohesive and | | |
| | | | 20 | 21 | | | 6' | back to all sand then to a silty cohesive | | |
| 4 | 6-8' | NR | 14 | 16 | | | | sand | | |
| | | | 18 | 28 | | | 8' | | | |
| 5 | 8-10' | 18" | 10 | 31 | | | | (3) medium grain silty sand, cohesive, | | |
| | | | 29 | 38 | | | 10' | grades to grey white clay with sand | | |
| 6 | 10-12' | 14" | 8 | 28 | | | | | | |
| | | | 50 | 59 | | | 12' | (4) No Recovery | | (4) lost spoon basket tip |
| 7 | 12-14' | 20" | 11 | 31 | | | | | | |
| | | | 42 | 56 | | | 14' | (5) Medium to coarse grain silty sand red to | | |
| 8 | 14-16' | 18" | 8 | 8 | | | | brown, cohesive, grades to a fine grain | | |
| | | | 8 | 13 | | | 16' | 'white to tan sand | | |
| | | | | | | | | (6) fine grain white sand | | |
| | | | | | | | | (7) grey to white medium to fine grain silty sand, cohesive, grades to yellow tan iron stained fine sand, grades to fine grain white sand | | |
| | | | | | | | | (8) tan to white fine grain sand, grades to silty sand, grades to grey dense clay, very cohesive | | |



300972

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-15**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/11/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1000 |
| | | | | | | | 3" | Black sand and slag with pebbles and cobbles | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Light brown to white silty sand | | |
| | | | 22 | 12 | 9 | 7 | 2' | " " | | 350 CPM |
| 2 | 2-4' | | | | | | | | | |
| | | | 7 | 16 | 2 | 4 | 4' | " " | | 140 CPM |
| 3 | 4-6' | | | | | | | | | |
| | | | 6 | 6 | 8 | 10 | 6' | " " | | 150 CPM |
| 4 | 6-8' | | | | | | | | | |
| | | | | | | | 7' | " " showing clayey features | | |
| | | | | | | | | Becoming more plastic | | |
| | | | 3 | 8 | 10 | 17 | 8' | Gray clay (dense and very plastic) | | 170 CPM |
| 5 | 8-10' | | | | | | 9' | Reddish brown sand | | |
| | | | 13 | 17 | 16 | 20 | 10' | " " | | 100 CPM |
| 6 | 10-12' | | | | | | | | | |
| | | | 2 | 6 | 14 | 14 | 12' | " " | | 140 CPM |
| 7 | 12-14' | | | | | | | | | |
| | | | | | | | 12'8" | Gray clay (dense and very plastic) | | |
| | | | 7 | 13 | 9 | 11 | 14' | | | 220 CPM |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 15'6" | Light gray to white clay | | |
| | | | 2 | 5 | 10 | 18 | 16' | " " | | 100 CPM |
| | | | | | | | | | | BOB |
| | | | | | | | | | | Completed hole at 1100 |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-16**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/13/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | P-cloudy breezy 35-40 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| 1 | 0-2' | 16" | 32 | 48 | | | | (1) dark brown to black ash and medium grain sand fill material, brick chips, grades to yellow brown poorly sorted sand with silt grades to white poorly sorted sand (carbonate?) | | |
| | | | 40 | 32 | | | 2' | | | |
| 2 | 2-4' | 16" | 19 | 21 | | | | | | |
| | | | 20 | 17 | | | 4' | | | |
| 3 | 4-6' | 4" | 4 | 5 | | | | | | |
| | | | 7 | 8 | | | 6' | | | |
| 4 | 6-8' | 14" | 2 | 3 | | | | (2) dolomite pepples mixed with fill ash, red brick chips, grades to dark brown medium to fine grain sand, silty | | |
| | | | 3 | 4 | | | 8' | | | |
| 5 | 8-10' | 12" | 1 | 1 | | | | | | |
| | | | 1 | 1 | | | 10' | | | |
| | | | | | | | | (3) dark brown medium to fine grain sand, silty | | (3) 3" spoon, no basket little recovery |
| | | | | | | | | (4) SAA moist to saturated | | |
| | | | | | | | | (5) SAA saturated | | DTW @ approx. 8' EOB @ 10' |



3009?

# MALCOLM PIRNIE, INC.

**BORING: SB-17**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/11/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1230 |
| | | | | | | | 3" | Brick | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 6" | Reddish brown sand | | |
| | | | 31 | 14 | 15 | 16 | 2' | Light brown to gray silty clay | | 900 CPM |
| 2 | 2-4' | | | | | | | | | |
| | | | 5 | 4 | 5 | 6 | 4' | " " | | 600 CPM |
| 3 | 4-6' | | | | | | | | | |
| | | | 3 | 5 | 4 | 7 | 6' | Light brown to white sand | | 400 CPM |
| 4 | 6-8' | | | | | | | | | |
| | | | 17 | 20 | 25 | 32 | 8' | " " | | 1000 CPM |
| 5 | 8-10' | | | | | | | | | |
| | | | 4 | 9 | 16 | 25 | 10' | " " | | 300 CPM |
| 6 | 10-12' | | | | | | | | | |
| | | | 5 | 11 | 17 | 24 | 12' | " " | | 200 CPM |
| 7 | 12-14' | | | | | | | | | |
| | | | | | | | 13'2" | Light gray to white clay (very dense) | | |
| | | | 13 | 17 | 10 | 11 | 14' | " " | | 220 CPM |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 15' | White weathered rock (dolomite) | | |
| | | | 14 | 17 | 30 | 49 | 16' | " " | | 220 CPM |
| | | | | | | | | | | BOB |
| | | | | | | | | | | Completed hole at 1300 |



3009[illegible]

# MALCOLM PIRNIE, INC.

BORING: SB-18

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/13/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | P-cloudy 35 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | WELL CONS |
| 1 | 0-2' | 2" | 100/2 | | | | | |
| | | | | | | | 2' | |
| 2 | 2-4' | 14" | 34 | 60 | | | | |
| | | | 31 | 70 | | | 4' | |
| 3 | 4-6' | 22" | 12 | 22 | | | | |
| | | | 25 | 100/3 | | | 6' | |
| 4 | 6-8' | 10" | 2 | 15 | | | | |
| | | | 18 | 14 | | | 8' | |
| 5 | 8-10' | 3" | 6 | 13 | | | | |
| | | | 100/3 | 3 | | | 10' | |
| 6 | 10-12' | 3" | 9 | 100/3 | | | | |
| | | | | | | | 12' | |
| 7 | 12-14' | 3" | 38 | 32 | | | | |
| | | | 13 | 11 | | | 14' | |
| 8 | 14-16' | 10" | 18 | 8 | | | | |
| | | | 10 | 6 | | | 16' | |

**SOIL DESCRIPTION**

(1) ash and sand fill, some pebbles

(2) dolomite pebbles (fill) ash and debris, white to tan medium to fine grain sand grades to poorly sorted sand stone type conglomerate

(3) brown medium to fine grain silty sand sone orcanic lenses (dark) some fill material brick chips and pebbles

(4) brown medium to fine grain silty sand fill, red brick and slag grades to sandy fill mix with slag and brick chips

(5) dense sand fill conglomerate, wood

(6) brown medium to fine grain silty sand (fill)

(7) SAA

(8) SAA, fill, wood

**REMARKS**

(1) spoon refusal @ 2"
auger to 2'

(3) 3" spoon
spoon refusal @ 5'9"
auger to 6'

(5) Volatile oder from spoon
2 units above bkg on H-nu
wood blocked spoon

(6) spoon refusal @ 10'9"
Volatile oder
auger to 12'

(7) Volatile oder

(8) Volatile oder
5 units above bkg on H-nu



300[illegible]

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-19**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/11/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1430 |
| | | | | | | | 3" | Black sand and slag | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 6" | Rock | | |
| | | | 100 | 20 | 17 | 11 | 2' | Reddish brown silty clay | | 20 CPM |
| 2 | 2-4' | | | | | | | | | |
| | | | 5 | 5 | 5 | 5 | 4' | " " | | 40 CPM |
| 3 | 4-6' | | | | | | | | | |
| | | | 2 | 4 | 8 | 9 | 6' | " " | | 70 CPM |
| 4 | 6-8' | | | | | | 6'5" | Reddish brown silty sand | | |
| | | | 44 | 66 | 74 | 0 | 8' | " " | | 30 CPM |
| 5 | 8-10' | | | | | | | | | |
| | | | | | | | 9' | White sand | | |
| | | | 13 | 15 | 19 | 24 | 10' | " " | | 20 CPM |
| 6 | 10-12' | | | | | | | | | |
| | | | 4 | 10 | 12 | 9 | 12' | " " | | 50 CPM |
| 7 | 12-14' | | | | | | | | | |
| | | | 8 | 10 | 12 | 40 | 14' | " " | | 20 CPM |
| 8 | 14-16' | | | | | | | | | |
| | | | 7 | 18 | 31 | 36 | 16' | " " | | 10 CPM |
| | | | | | | | | | | BOB |
| | | | | | | | | | | Completed hole at 1520 |

# MALCOLM PIRNIE, INC.

BORING: SB-20

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/13/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | P-cloudy 25-30 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Frank Steffen | DATUM: | |
| HELPER: | Emilio Zeolo | HYDROGEOLOGIST: | John Ifkovits |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| 1 | 0-2' | 8" | 5 | 4 | | | | (1) black organic sand/fill red brick chips, grades to medium to fine tan silty sand some fill debris | | |
| | | | 6 | 10 | | | 2' | | | |
| 2 | 2-4' | 22" | 18 | 22 | | | | | | |
| | | | 21 | 43 | | | 4' | | | |
| 3 | 4-6' | 24" | 4 | 20 | | | | (2) tan to brown silty medium grain sand red bricks to sand to bricks | | |
| | | | 27 | 62 | | | 6' | | | |
| 4 | 6-8' | 22" | 37 | 17 | | | | | | |
| | | | 19 | 25 | | | 8' | (3) fill caried down from above (10") red brick graded with medium to fine grain silty sand, waxy clay like substance @ 5'6" | | (3) 3" spoon waxy clay- 2400 cpm |
| 5 | 8-10' | 14" | 5 | 10 | | | | | | |
| | | | 17 | 21 | | | 10' | | | |
| 6 | 10-12' | 20" | 10 | 6 | | | | | | |
| | | | 11 | 14 | | | 12' | (4) tan to white fine grain sand, large qtz pebble @ 7'8" | | |
| 7 | 12-14' | 16" | 15 | 20 | | | | | | |
| | | | 19 | 23 | | | 14' | | | |
| 8 | 14-16' | 22" | 13 | 13 | | | | (5) medium grain white to tan sand grades to red brown coarse grain silty sand | | |
| | | | 18 | 29 | | | 16' | | | |
| | | | | | | | | (6) fill caried down from above (8") red brown coarse grain silty sand, some modling | | |
| | | | | | | | | (7) red brown coarse grain sand with qtz pebbles, grades to fine grain white to tan sand with inon stained modling | | |
| | | | | | | | | (8) coarse grained ged brown sand with qtz pebbles, grades to dedse silty red brown sand, grades to dense grey brown clay back to sandy clay | | |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-21**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/13/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1245 |
| | | | | | | | 3" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Dark gray to black sand | | |
| | | | 100 | 20 | 17 | 11 | 2' | " " with brick fragments | | 30 CPM |
| 2 | 2-4' | | | | | | | | | |
| | | | 5 | 5 | 5 | 5 | 4' | Dark gray to black sand | | 40 CPM |
| 3 | 4-6' | | | | | | | | | |
| | | | 2 | 4 | 8 | 9 | 6' | " " | | 30 CPM |
| 4 | 6-8' | | | | | | | | | |
| | | | 44 | 66 | 74 | 0 | 8' | " " soil is much more cohesive and slightly wet | | 40 CPM |
| 5 | 8-10' | | | | | | 8'10" | " " (loose and very wet) | | |
| | | | | | | | 9' | ***GROUNDWATER*** | | |
| | | | 13 | 15 | 19 | 24 | 10' | | | 60 CPM<br>BOB<br>Completed hole at 1315 |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-22

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 4/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~65 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Donimic | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | | | | |
| | | | 21 | 12 | 13 | 11 | 0' | Black fill matenal | | Started hole at 1000 |
| | | | | | | | | | | 400 cpm |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Coarse grained reddish brown sand | | |
| | | | 12 | 13 | 12 | 11 | 2' | " " | | 40 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | 8 | 10 | 12 | 9 | 4' | " " | | 40 cpm |
| 3 | 4-6' | | | | | | 5' | Light brown/tan coarse grained sand | | |
| | | | 22 | 5 | 6 | 9 | 6' | Fine grained white sand. Very compact layer | | 50 cpm |
| 4 | 6-8' | | | | | | | | | |
| | | | 4 | 4 | 3 | 3 | 8' | Fine grained white sand | | 40 cpm |
| 5 | 8-10' | | | | | | | | | |
| | | | 5 | 3 | 3 | 7 | 10' | Medium grained white sand | | 40 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 7 | 11 | 19 | 42 | 12' | " " | | 50 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 23 | Refusal | | | 14' | " " | | 50 cpm |
| 8 | 14-14.5' | | | | | | | | | |
| | | | | | | | 14.5' | Auger Refusal - BOB | | |

# MALCOLM PIRNIE, INC.

**BORING: SB-23**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| **PROJECT NAME:** | **Welsbach/GGM Site** | **DATE:** | **2/13/98** |
| **JOB NUMBER:** | **8001230** | **LOCATION:** | **Former Welsback Fac.** |
| **DRILLING FIRM:** | **AC Shultes** | **WEATHER:** | **~50, sunny skies** |
| **DRILLING METHOD:** | **Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons** | **ELEVATION:** | |
| **DRILLER:** | **Eli** | **DATUM:** | |
| **HELPER:** | **Chris** | **HYDROGEOLOGIST:** | **Patrick Rabideau** |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| **No.** | **Depth** | **Rec** | **Blows per 6"** | | | | **Depth** | **SOIL DESCRIPTION** | **CONS** | **REMARKS** |
| | | | | | | | 0' | Asphalt | | **Started hole at 1345** |
| | | | | | | | 3" | Concrete and rock fragments (dolomite and quartz) | | |
| 1 | 0-2' | | | | | | | | | |
| | | | Auger | | | | 2' | No recovery - Rock fragments (dolomite and quartz) | | NONE |
| 2 | 2-4' | | | | | | | | | |
| | | | 40 | 66 | 32 | 27 | 4' | Rock fragments - (Dolomite and quartz) with some black sand | | 20 cpm |
| 3 | 4-6' | | | | | | | | | |
| | | | 6 | 19 | 20 | 12 | 6' | " " | | 20 cpm |
| 4 | 6-8' | | | | | | | | | |
| | | | | | | | 7' | Black sand and red brick fragments | | |
| | | | 34 | 50 | 21 | 24 | 8' | " " | | 20 cpm |
| 5 | 8-10' | | | | | | | | | |
| | | | 30 | 12 | 10 | 16 | 10' | " " - slight odor of oil | | 40 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 44 | 36 | 32 | 16 | 12' | Rock Fragments (dolomite) | | 30 cpm |
| 7 | 12-14' | | | | | | 13'4" | " " - slight odor of oil | | |
| | | | | | | | 14' | ***GROUNDWATER*** | | 20 cpm<br>**BOB**<br>**Completed hole at 1500** |

# MALCOLM PIRNIE, INC.

**BORING: SB-24**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 4/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~65 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Donimic | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | 25 | 10 | 5 | 4 | 0' | Asphalt | | Started hole at 1130 |
| | | | | | | | 0.5' | Medium grained red sand | | White layer is 2400 cpm. The rest is 1500 cpm. |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | White fill layer | | |
| | | | | | | | 1' 2" | Medium grained red sand | | |
| | | | 5 | 4 | 3 | 3 | 2' | No recovery (asphalt) | | 600 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | 3 blows total | | | | 4' | Void underground - no recovery. Could be the result of construction for tunnel | | N/A |
| 3 | 4-6' | | | | | | | | | |
| | | | 5 | 10 | 19 | 27 | 6' | Fine to medium grained light reddish brown sand Not much recovery. There were rotten wood fragments in sand. | | 300 cpm |
| 4 | 6-8' | | | | | | | | | |
| | | | 7 | 7 | 10 | 15 | 8' | Fine grained white sand | | 100-120 cpm |
| 5 | 8-10' | | | | | | | | | |
| | | | | | | | 9.5' | Coarse grained red (rust colored) sand | | |
| | | | 11 | 15 | 21 | 27 | 10' | Coarse grained reddish brown (rust colored, almost orange) sand | | 100-140 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 8 | 13 | 14 | 12 | 12' | Coarse grained reddish brown sand | | 800 cpm - High reading could be due to drawdown in the spoon. |
| | | | | | | | 12.5' | Medium grained gray to black sand | | |
| 7 | 12-14' | | | | | | 13' | Coarse grained white sand | | |
| | | | 8 | 10 | 12 | 6 | 14' | Coarse grained gray grading to black sand | | 150 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |



300982

# MALCOLM PIRNIE, INC.

**BORING: SB-25**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/13/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1630 |
| | | | | | | | 3" | Dark brown sand with red brick fragments | | |
| 1 | 0-2' | | | | | | | | | |
| | | | Auger | 14 | 7 | 4 | 2' | No recovery | | 20 CPM |
| 2 | 2-4' | | | | | | | | | |
| | | | 14 | 13 | 9 | 4 | 4' | Red Brick Fragments | | NONE |
| | | | | | | | 5'2" | Black sand with rock and red brick fragments | | |
| 3 | 4-6' | | | | | | | | | |
| | | | 12 | 16 | 6 | 6 | 6' | | | 30 cpm |
| | | | | | | | 6'4" | Light brown to white sand | | |
| 4 | 6-8' | | | | | | | | | |
| | | | 6 | 6 | 5 | 7 | 8' | " " | | 30 cpm |
| 5 | 8-10' | | | | | | | | | |
| | | | 49 | 44 | 15 | 24 | 10' | " " | | 20 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 13 | 5 | 12 | 7 | 12' | " " | | 20 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 13 | 40 | 41 | | 14' | " " | | 20 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | 13 | 12 | 28 | 41 | 16' | " " | | 20 CPM<br>BOB<br>Completed hole at 1730 |

# MALCOLM PIRNIE, INC.

**BORING: SB-26**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

*NOTE: This boring log was lost. Information below was copied out of log book.*

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 4/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~65 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Donimic | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | | | | | 0' | | | Started hole at 1300 |
| | | | | | | | | | | 80-100 cpm |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 2' | Crushed red brick | | 140 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | | | | | 4' | Medium grained light reddish brown sand | | 40-60 cpm |
| 3 | 4-6' | | | | | | | | | |
| | | | | | | | 6' | | | 60 cpm |
| 4 | 6-8' | | | | | | | | | |
| | | | | | | | 8' | Fine grained light brown sand | | 80-100 cpm |
| 5 | 8-10' | | | | | | | | | |
| | | | | | | | 10' | | | 60 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | | | | | 12' | | | 60 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | | | | | 14' | Fine grained white sand | | 60 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |

# MALCOLM PIRNIE, INC.

BORING: SB-27

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 2/13/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsback Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | ~50, sunny skies |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli | DATUM: | |
| HELPER: | Chris | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | | | | | 0' | Asphalt | | Started hole at 1940 |
| | | | | | | | 3" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | Auger | | 12 | 8 | 2' | Reddish brown and black sand with red brick fragments | | 300 CPM |
| 2 | 2-4' | | | | | | | | | |
| | | | 12 | 9 | 9 | 10 | 4' | " " | | 80 CPM |
| 3 | 4-6' | | | | | | 4'8" | Light brown sand | | |
| | | | 2 | 10 | 4 | 5 | 6' | Dark brown to black silty sand (very cohesive) | | 200 CPM |
| 4 | 6-8' | | | | | | | | | |
| | | | 14 | 30 | 33 | 45 | 8' | Light gray silty clay (dense and very plastic) | | 20 CPM |
| 5 | 8-10' | | | | | | 8'6" | Reddish brown sand | | |
| | | | 8 | 62 | 34 | 47 | 10' | " " with red brickk fragments | | 500 CPM |
| 6 | 10-12' | | | | | | | | | |
| | | | 8 | 20 | 10 | 7 | 12' | Reddish brown silty sand (more cohesive) | | 80 CPM |
| 7 | 12-14' | | | | | | | | | |
| | | | | | | | 13'8" | Light brown sand (very wet) | | |
| | | | 7 | 9 | 13 | 9 | 14' | <u>*GROUNDWATER*</u> | | 80 CPM<br>BOB<br>Completed hole at 2015 |



300[illegible]5

# MALCOLM PIRNIE, INC.

**BORING: SB-28**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

NOTE: This boring log was lost. Information below was copied out of log book.

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 4/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~65 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Donimic | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | 48 | 18 | 8 | 6 | 0' | No recovery (asphalt) | | Started hole at 1500 |
| | | | | | | | | | | 120 cpm |
| 1 | 0-2' | | | | | | | | | |
| | | | 6 | 6 | 5 | 9 | 2' | Medium grained brown sand | | 200-250 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | 3 blows total | | | | 4' | " " | | 80 cpm |
| 3 | 4-6' | | | | | | | | | |
| | | | 17 | 4 | 3 | 4 | 6' | " " | | 40-60 cpm |
| 4 | 6-8' | | | | | | 7' | Coarse grained tan/ gray brown sand | | |
| | | | 1 | 2 | 1 | 2 | 8' | Fine grained gray brown sand | | 60-80 cpm |
| 5 | 8-10' | | | | | | 9' | Fine grained brown sand | | |
| | | | 8 | 7 | 9 | 10 | 10' | Fine grained brown sand, grading to medium grained around 11' | | 60-80 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | | | | | 11.5' | Medium grained white sand | | |
| | | | 8 | 10 | 12 | 8 | 12' | Coarse grained white sand | | 60 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 4 | 6 | 3 | 2 | 14' | " " | | 80 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-29

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 4/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~65 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Donimic | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | 46 | 23 | 12 | 11 | 0' | Asphalt | | Started hole at 1545<br>140 cpm |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Red brick | | |
| | | | 11 | 9 | 8 | 6 | 2' | Red brick. Cuttings showed dark brown medium to coarse grained sand as well. | | 250 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | 12 | 15 | 13 | 11 | 4' | Red brick | | 200 cpm |
| 3 | 4-6' | | | | | | 5' | Coarse grained light reddish brown sand | | |
| | | | 5 | 5 | 7 | 12 | 6' | Tan colored clay and sand holding together gravel and pieces of metal debris - very cohesive | | 60 cpm |
| 4 | 6-8' | | | | | | | | | |
| | | | 12 | 15 | 17 | 10 | 8' | " " | | 150 cpm |
| 5 | 8-10' | | | | | | 9' | Reddish brown gravelly sand. Not as cohesive as overlying layer | | |
| | | | 5 | 6 | 7 | 12 | 10' | " " | | 120 cpm |
| | | | | | | | 10.5' | Gray clayey sand - very compact and cohesive/solid. | | |
| 6 | 10-12' | | | | | | | | | |
| | | | | | | | 11.5' | Fine grained white sand | | |
| | | | 6 | 8 | 7 | 6 | 12' | Fine grained white sand with bands or streaks of orange/rust color | | 60 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 12 | 17 | 15 | 19 | 14' | " " | | 40 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |

# MALCOLM PIRNIE, INC.

BORING: SB-30

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 4/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Rainy, cool ~55 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Donimic | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 58 | 47 | 42 | 39 | 0' | Asphalt | | Started hole at 0815 |
| | | | | | | | | | | 80 cpm |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Fill material - red brick and stones stuck together | | |
| | | | | | | | | with brown clayey sand | | |
| | | | | | | | | | | |
| | | | Spoon refusal | | | | 2' | No recovery - augured through cement | | Augured down to 5' thru cement. |
| | | | | | | | | | | Stopped at 5'. |
| | | | | | | | | | | |
| 2 | 2-4' | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | Augured through | | | | 4' | Augured through cement | | |
| 3 | 4-5' | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | 5' | BOB | | |

# MALCOLM PIRNIE, INC.

BORING: SB-31

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

*NOTE: Background RAD by pancake detector for this hole is 250 cpm.*

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 4/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Rainy, cool ~55 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Donimic | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 24 | 14 | 12 | 11 | 0' | Asphalt | | Started hole at 0845 |
| | | | | | | | | | | 700 cpm |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Fill material - white chalky fill material, red brick, | | |
| | | | | | | | | and black material | | |
| | | | 12 | 10 | 12 | 14 | 2' | Red brick | | 440 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | | | | | 3.5' | Brown clayey sand with black gravel - soil with fill | | |
| | | | 10 | 8 | 6 | 5 | 4' | Reddish brown fine grained sand | | 600 cpm |
| 3 | 4-6' | | | | | | | | | |
| | | | 24 | 22 | 19 | 17 | 6' | Fine grained tan sand | | 250 cpm |
| 4 | 6-8' | | | | | | | | | |
| | | | | | | | 7.5' | Tan and rust colored gravelly sand with some clay. | | |
| | | | | | | | | Gravel is of varying type. | | |
| | | | 24 | 22 | 18 | 19 | 8' | " " | | 250 cpm |
| 5 | 8-10' | | | | | | 9' | Grading into a grayish brown clay. | | |
| | | | | | | | 9.5' | Gray sandy clay - very compact and hard to break | | |
| | | | | | | | | apart. | | |
| | | | 13 | 8 | 9 | 11 | 10' | Gray clay. | | 250 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | | | | | 11.5' | Medium grained white sand. | | |
| | | | 8 | 7 | 10 | 9 | 12' | " " | | 250 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | | | | | 13.5' | White sand grading into light reddish brown sand | | |
| | | | 10 | 13 | 15 | 10 | 14' | Medium to coarse grained white sand. | | 250 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |

# MALCOLM PIRNIE, INC.

**BORING: SB-32**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

*NOTE: Background RAD by pancake detector for this hole is 250 cpm.*

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 4/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former Welsbach Fac. |
| DRILLING FIRM: | AC Shultes | WEATHER: | Rainy, cool ~55 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Donimic | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 45 | 42 | 18 | 16 | 0' | Asphalt | | Started hole at 0945 2000 cpm |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Red brick, brown sand and gravel - fill material. | | |
| | | | 12 | 10 | 8 | 10 | 2' | Fine grained reddish brown sand grading into fine grained tan sand | | 80 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | 5 | 4 | 3 | 3 | 4' | Fine grained tan sand with some reddish colored streaks | | 80 cpm |
| 3 | 4-6' | | | | | | | | | |
| | | | 10 | 12 | 8 | 10 | 6' | " " | | 60 cpm |
| | | | | | | | 6.5' | Medium grained white sand | | |
| 4 | 6-8' | | | | | | | | | |
| | | | 5 | 7 | 6 | 9 | 8' | " " | | 100 cpm |
| 5 | 8-10' | | | | | | | | | |
| | | | 7 | 9 | 6 | 8 | 10' | " " | | 60 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 3 | 4 | 4 | 3 | 12' | " " | | 30 cpm |
| | | | | | | | 12.5' | Gray clay | | |
| 7 | 12-14' | | | | | | | | | |
| | | | 5 | 3 | 7 | 5 | 14' | " " | | 30 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |



300996

## MALCOLM PIRNIE, INC.

**BORING: SB-33**

ONE INTERNATIONAL BOULEVARD MAHWAH. NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/24/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Cloudy ~53 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Chuck Lind | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 9 | 8 | 5 | 7 | 0' | Asphalt (no recovery) | | Started hole at 1317 |
| | | | | | | | 4" | Concrete | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Reddish brown nedium sand | | 0 cpm |
| | | | 7 | 8 | 7 | 10 | 2' | No recovery | | |
| 2 | 2-4' | | | | | | | | | 0 cpm |
| | | | 67 | 19 | 17 | 9 | 4' | No recovery | | |
| 3 | 4-6' | | | | | | | | | 0 cpm |
| | | | 6 | 21 | 22 | 27 | 6' | No recovery | | |
| 4 | 6-8' | | | | | | | | | 0 cpm |
| | | | 8 | 20 | 24 | 24 | 8' | No recovery | | |
| 5 | 8-10' | | | | | | | | | 0 cpm |
| | | | 3 | 5 | 6 | 5 | 10' | No recovery | | |
| | | | | | | | | Lost tip of fpoon in the hole | | |
| | | | | | | | | | | 0 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 6 | 4 | 4 | 2 | 12' | Reddish brown medium sand | | |
| | | | | | | | | | | 60 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 8 | 6 | 2 | 4 | 14' | " " | | |
| | | | | | | | | | | 60 cpm |
| 8 | 14-16' | | | | | | 14'6" | Gray fine sand | | |
| | | | | | | | 15" | Groundwater | | |
| | | | | | | | 16' | BOB | | Hole completed at 1430 |



300991

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-34

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~50 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Chuck Lind | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | AUGER | | | | 0' | Granite cobbles (no recovery) | | Started hole at 0900 |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Reddish brown medium sand | | 0 cpm |
| | | | 12 | 2 | 3 | 13 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | 240 cpm |
| | | | 13 | 9 | 8 | 10 | 4' | " " | | |
| 3 | 4-6' | | | | | | 5' | Light brown and gray fine sand | | 500 cpm |
| | | | 29 | 15 | 17 | 23 | 6' | " " | | |
| 4 | 6-8' | | | | | | | | | 80 cpm |
| | | | 13 | 15 | 11 | 13 | 8' | " " | | |
| 5 | 8-10' | | | | | | | | | 80 cpm |
| | | | | | | | 9'8" | Gray silt (odor of fuel oil) | | |
| | | | 8 | 8 | 9 | 5 | 10' | Gray silt | | |
| | | | | | | | | | | 100 cpm |
| 6 | 10-12' | | | | | | 10'9" | Light brown fine sand | | |
| | | | 5 | 6 | 8 | 4 | 12' | " " | | |
| | | | | | | | | | | 100 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 7 | 6 | 6 | 8 | 14' | " " | | |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | Hole completed at 1000 |

# MALCOLM PIRNIE, INC.

**BORING: SB-35**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~50 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Chuck Lind | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | AUGE | 4 | 5 | 8 | 0' | Asphalt | | Started hole at 1030 |
| | | | | | | | 2" | Concrete | | |
| 1 | 0-2' | | | | | | 8" | Black Fill | | |
| | | | | | | | 1' | Reddish brown medium sand | | 220 cpm |
| | | | 2 | 5 | 5 | 12 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | 90 cpm |
| | | | 10 | 17 | 12 | 14 | 4' | " " | | |
| 3 | 4-6' | | | | | | 5' | Light brown and gray fine sand | | 100 cpm |
| | | | 10 | 13 | 17 | 15 | 6' | " " | | |
| 4 | 6-8' | | | | | | | | | 100 cpm |
| | | | 7 | 10 | 9 | 8 | 8' | " " | | |
| 5 | 8-10' | | | | | | | | | 90 cpm |
| | | | 10 | 19 | 8 | 7 | 10' | " " | | |
| | | | | | | | | | | 120 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 11 | 10 | 9 | 9 | 12' | " " | | |
| | | | | | | | | | | 90 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 8 | 10 | 8 | 10 | 14' | " " | | |
| 8 | 14-16' | | | | | | | | | 60 cpm |
| | | | | | | | 15'8" | Gray medium sand (slightly wet) | | |
| | | | | | | | 16' | BOB | | Hole completed at 1100 |

300?? Page 1 of 1

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-36**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~50 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Chuck Lind | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | AUGE | 3 | 5 | 7 | 0' | Asphalt | | Started hole at 1130 |
| | | | | | | | 2" | Concrete | | |
| 1 | 0-2' | | | | | | 8" | Black Fill | | |
| | | | | | | | 1' | Reddish brown medium sand | | 2000 cpm |
| | | | 18 | 15 | 10 | 12 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | 150 cpm |
| | | | 11 | 21 | 16 | 16 | 4' | " " | | |
| 3 | 4-6' | | | | | | | | | 150 cpm |
| | | | 5 | 9 | 20 | 20 | 6' | " " | | |
| 4 | 6-8' | | | | | | 7' | Gray fine sand | | 150 cpm |
| | | | 7 | 14 | 3 | 9 | 8' | " " | | |
| 5 | 8-10' | | | | | | | | | 100 cpm |
| | | | 9 | 10 | 9 | 3 | 10' | " " | | |
| | | | | | | | | | | 100 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 12 | 11 | 11 | 11 | 12' | " " | | |
| | | | | | | | | | | 80 cpm |
| 7 | 12-14' | | | | | | 13' | Light brown and gray medium sand | | |
| | | | 8 | 6 | 6 | 7 | 14' | " " | | |
| 8 | 14-16' | | | | | | | | | 60 cpm |
| | | | | | | | 15'8" | Gray medium sand (slightly wet) | | |
| | | | | | | | 16' | BOB | | Hole completed at 1215 |

300[illegible]4

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-37**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/25/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~50 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Chuck Lind | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 12 | 8 | 9 | 13 | 0' | Asphalt | | Started hole at 1330 |
| | | | | | | | 2" | Black fill | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Reddish brown medium sand | | 1200 cpm |
| | | | 7 | 9 | 9 | 7 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | 140 cpm |
| | | | 4 | 8 | 6 | 4 | 4' | " " | | |
| 3 | 4-6' | | | | | | 5'6" | Light brown fine sand | | 100 cpm |
| | | | 22 | 12 | 12 | 17 | 6' | " " | | |
| 4 | 6-8' | | | | | | 7' | Gray fine sand | | 150 cpm |
| | | | 3 | 4 | 8 | 1 | 8' | " " | | |
| 5 | 8-10' | | | | | | | | | 100 cpm |
| | | | 6 | 7 | 7 | 6 | 10' | " " | | |
| | | | | | | | | | | 180 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 4 | 6 | 9 | 7 | 12' | Reddish brown medium sand | | |
| | | | | | | | | | | 100 cpm |
| 7 | 12-14' | | | | | | 13' | Gray fine sand | | |
| | | | 5 | 8 | 7 | 8 | 14' | " " | | |
| 8 | 14-16' | | | | | | | | | 120 cpm |
| | | | | | | | 15'8" | Gray medium sand (slightly wet) | | |
| | | | | | | | 16' | BOB | | Hole completed at 1420 |

# MALCOLM PIRNIE, INC.

BORING: SB-38

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~55 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Mark | DATUM: | |
| HELPER: | Vince | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 6 | 9 | 7 | 11 | 0' | Dark brown to black soil | | Started hole at 0905 |
| 1 | 0-2' | | | | | | 0.5' | Black fill | | 120 com |
| | | | 4 | 3 | 1 | 3 | 2' | Reddish brown medium to fine sand | | 80 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | 3 | 2 | 1 | 1 | 4' | No recovery | | The spoon came back empty. Drillers tried to take another sample, but second spoon returned nothing as well. Void. |
| 3 | 4-6' | | | | | | | | | |
| | | | 6 | 9 | 10 | 9 | 6' | Reddish brown medium sand | | 70 cpm |
| 4 | 6-8' | | | | | | | | | |
| | | | 9 | 12 | 12 | 14 | 8' | " " | | 60 cpm |
| 5 | 8-10' | | | | | | 9' | Gray brown medium sand | | |
| | | | 8 | 7 | 6 | 5 | 10' | " " | | 60 cpm |
| | | | | | | | 10.5' | Gray fine sand | | |
| 6 | 10-12' | | | | | | | | | |
| | | | 5 | 9 | 8 | 10 | 12' | Gray silty sand | | 60 cpm |
| 7 | 12-14' | | | | | | 13' | Gray medium sand | | |
| | | | 11 | 9 | 10 | 11 | 14' | Gray medium to fine sand | | 60 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-39**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Overcast ~50 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Chuck Lind | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 16 | 11 | 8 | 12 | 0' | Asphalt | | Started hole at 0900 |
| | | | | | | | 2" | Black fill | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Reddish brown medium sand | | 80 cpm |
| | | | 7 | 5 | 5 | 6 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | 60 cpm |
| | | | 9 | 8 | 6 | 5 | 4' | " " | | |
| 3 | 4-6' | | | | | | | | | 80 cpm |
| | | | 24 | 11 | 10 | 10 | 6' | " " | | |
| 4 | 6-8' | | | | | | 7' | Light brown fine sand | | 80 cpm |
| | | | | | | | 7'4" | Reddish brown medium sand | | |
| | | | 4 | 4 | 3 | 4 | 8' | " " | | |
| | | | | | | | 8'4" | Gray fine sand | | |
| 5 | 8-10' | | | | | | | | | 60 cpm |
| | | | 5 | 7 | 7 | 6 | 10' | " " | | |
| | | | | | | | | | | 60 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 35 | 20 | 14 | 12 | 12' | " " | | |
| | | | | | | | | | | 50 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 18 | 14 | 10 | 12 | 14' | " " | | |
| 8 | 14-16' | | | | | | | | | 80 cpm |
| | | | | | | | 16' | BOB | | Hole completed at 0945 |

300907

# MALCOLM PIRNIE, INC.

BORING: SB-40

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~55 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Mark | DATUM: | |
| HELPER: | Vince | HYDROGEOLOGIST: | Bryn Wolf |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | 5 | 11 | 12 | 11 | 0' | Soil | | Started hole at 1045 |
| 1 | 0-2' | | | | | | 0.5' | Black fill | | 120 com |
| | | | 6 | 4 | 3 | 2 | 2' | Reddish brown medium to fine sand | | 100 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | 3 | 4 | 4 | 5 | 4' | Reddish brown medium sand | | 80 cpm |
| 3 | 4-6' | | | | | | | | | |
| | | | 4 | 6 | 7 | 15 | 6' | Reddish brown fine sand | | 100 cpm |
| 4 | 6-8' | | | | | | 7' | Reddish brown medium sand | | |
| | | | 11 | 12 | 6 | 6 | 8' | " " | | 80 cpm |
| 5 | 8-10' | | | | | | 9' | Gray fine sand | | |
| | | | 3 | 4 | 6 | 6 | 10' | Gray medium sand | | 80 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 6 | 7 | 8 | 7 | 12' | " " | | 60 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 5 | 3 | 4 | 4 | 14' | " " | | 60 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-41**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Overcast ~50 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Chuck Lind | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | 3 | 5 | 5 | 8 | 0' | Black soil (organic) | | Started hole at 1030 |
| | | | | | | | 4" | Black fill | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | | | | 100 cpm |
| | | | 5 | 5 | 5 | 4 | 2' | " " | | |
| | | | | | | | 2'3" | Reddish brown medium sand | | |
| 2 | 2-4' | | | | | | | | | 50 cpm |
| | | | 3 | 4 | 4 | 5 | 4' | " " | | |
| 3 | 4-6' | | | | | | | | | 60 cpm |
| | | | 5 | 9 | 10 | 7 | 6' | " " | | |
| | | | | | | | 6'10" | Light brown and gray fine sand | | |
| 4 | 6-8' | | | | | | | | | 50 cpm |
| | | | 3 | 7 | 9 | 5 | 8' | " " | | |
| | | | | | | | 8'4" | Gray fine sand | | |
| 5 | 8-10' | | | | | | | | | 60 cpm |
| | | | 6 | 10 | 8 | 11 | 10' | " " | | |
| | | | | | | | | | | 60 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 8 | 5 | 6 | 6 | 12' | " " | | |
| | | | | | | | | | | 80 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 9 | 7 | 3 | 3 | 14' | " " | | |
| 8 | 14-16' | | | | | | | | | 60 cpm |
| | | | | | | | 16' | BOB | | Hole completed at 1115 |

300999

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-42**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny, clear ~55 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Mark | DATUM: | |
| HELPER: | Vince | HYDROGEOLOGIST: | Bryn Woll |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | AUGER | | | | 0' | Asphault | | Started hole at 1305 |
| 1 | 0-2' | | 4 | 6 | 11 | 11 | 0.5' | Reddish brown coarse sand | | 2200 cpm |
| | | | | | | | 1.5' | Black fill | | |
| | | | 11 | 11 | 11 | 11 | 2' | Reddish brown medium sand | | 150 cpm |
| 2 | 2-4' | | | | | | | | | |
| | | | 5 | 9 | 12 | 15 | 4' | " " | | 100cpm |
| 3 | 4-6' | | | | | | | | | |
| | | | 15 | 17 | 17 | 20 | 6' | Gray sandy silt | | 100 cpm |
| 4 | 6-8' | | | | | | | | | |
| | | | 13 | 15 | 13 | 15 | 8' | " " | | 80 cpm |
| 5 | 8-10' | | | | | | 9' | Gray fine sand | | |
| | | | 12 | 9 | 10 | 9 | 10' | " " | | 80 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 8 | 10 | 11 | 13 | 12' | " " | | 80 cpm |
| 7 | 12-14' | | | | | | 13' | Reddish brown medium sand | | |
| | | | 10 | 11 | 11 | 12 | 14' | Gray fine sand | | 60 cpm |
| 8 | 14-16' | | | | | | | | | |
| | | | | | | | 16' | BOB | | |

3010000

# MALCOLM PIRNIE, INC.

**BORING: SB-43**

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Overcast ~50 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Eli Gonzales | DATUM: | |
| HELPER: | Chuck Lind | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | 3 | 3 | 4 | 5 | 0' | Black soil (organic) | | Started hole at 1130 |
| | | | | | | | 4" | Black fill | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1'5" | Reddish brown medium sand | | 60 cpm |
| | | | 13 | 20 | 6 | 5 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | 60 cpm |
| | | | 3 | 3 | 2 | 4 | 4' | " " and quartz cobbles | | |
| 3 | 4-6' | | | | | | | | | 60 cpm |
| | | | 3 | 9 | 10 | 10 | 6' | " " | | |
| | | | | | | | 6'4" | Light brown silty sand | | |
| 4 | 6-8' | | | | | | 6'10" | Reddish brown medium sand | | 30 cpm |
| | | | 3 | 7 | 7 | 10 | 8' | " " | | |
| | | | | | | | 8'6" | Gray fine sand | | |
| 5 | 8-10' | | | | | | | | | 30 cpm |
| | | | 7 | 47 | 23 | 9 | 10' | " " | | |
| | | | | | | | | | | 20 cpm |
| 6 | 10-12' | | | | | | | | | |
| | | | 3 | 6 | 5 | 6 | 12' | " " | | |
| | | | | | | | | | | 20 cpm |
| 7 | 12-14' | | | | | | | | | |
| | | | 4 | 2 | 2 | 1 | 14' | " " | | |
| 8 | 14-16' | | | | | | | | | 30 cpm |
| | | | | | | | 16' | BOB | | Hole completed at 1220 |

301001

## MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-44**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/27/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny ~70 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Mark | DATUM: | |
| HELPER: | Vince | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 18 | 20 | 11 | 6 | 0' | Asphalt | | Started hole at 0830 |
| | | | | | | | 4" | Black fill | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | | | | 140 cpm |
| | | | 13 | 10 | 8 | 8 | 2' | " " | | |
| | | | | | | | 2'2" | Reddish brown coarse sand | | |
| 2 | 2-4' | | | | | | | | | 60 cpm |
| | | | 10 | 16 | 18 | 18 | 4' | " " | | |
| 3 | 4-6' | | | | | | | | | 60 cpm |
| | | | 14 | 12 | 11 | 18 | 6' | " " | | |
| | | | | | | | 6'6" | Gray silty clay | | Hole completed at 0845 |
| 4 | 6-8' | | | | | | | Groundwater | | |
| | | | | | | | | BOB | | |

301002

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-45**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/26/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Overcast ~50 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Mark | DATUM: | |
| HELPER: | Vince | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | Auger | | 3 | 3 | 0' | Concrete | | Started hole at 1230 |
| | | | | | | | 6" | Black fill | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | | | | 60 cpm |
| | | | 8 | 4 | 3 | 2 | 2' | " " | | |
| 2 | 2-4' | | | | | | 3'10" | Light brown fine sand | | 40 cpm |
| | | | 3 | 4 | 2 | 2 | 4' | " " | | |
| | | | | | | | 4'4" | Reddish brown silty sand | | |
| 3 | 4-6' | | | | | | | | | 20 cpm |
| | | | | | | | 5'4" | Reddish brown medium sand (slightly wet) | | |
| | | | 11 | 17 | 11 | 13 | 6' | " " | | |
| | | | | | | | | | | 20 cpm |
| 4 | 6-8' | | | | | | | | | |
| 5 | 8-10' | | 10 | 8 | 6 | 8 | 8' | | | |
| | | | | | | | 9'2" | Gray silt (wet) | | 20 cpm |
| 6 | 10-12' | | 8 | 29 | 5 | 6 | 10' | | | |
| | | | | | | | 10'4" | Gray medium sand | | |
| | | | | | | | | | | 40 cpm |
| 7 | 12-14' | | 3 | 3 | 5 | 8 | 12' | | | |
| | | | | | | | | | | 20 cpm |
| 8 | 14-16' | | 5 | 5 | 4 | 5 | 14' | | | |
| | | | | | | | | | | 20 cpm |
| | | | | | | | 16' | BOB | | Hole completed at 1300 |



301003

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-46

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/27/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny ~70 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Mark | DATUM: | |
| HELPER: | Vince | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | WELL | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | CONS | REMARKS |
| | | | 2 | 3 | 3 | 3 | 0' | Granite cobbles | | Started hole at 0945 |
| | | | | | | | 10" | Reddish brown medium sand | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | | | | 160 cpm |
| | | | 22 | 22 | 21 | 12 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | 60 cpm |
| | | | 22 | 18 | 23 | 21 | 4' | " " | | |
| 3 | 4-6' | | | | | | 5' | Light brown and gray fine sand (dense) | | 120 cpm |
| | | | 19 | 27 | 28 | 23 | 6' | " " | | |
| 4 | 6-8' | | | | | | | | | |
| | | | 24 | 13 | 13 | 14 | 8' | " " | | 60 cpm |
| 5 | 8-10' | | | | | | | | | |
| | | | | | | | 10' | Groundwater | | 60 cpm |
| | | | | | | | | BOB | | Hole completed at 1015 |

301004

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

**BORING: SB-47**

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/27/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny ~70 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Mark | DATUM: | |
| HELPER: | Vince | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | Auger | | 6 | 3 | 0' | Concrete | | Started hole at 1100 |
| | | | | | | | 4" | Black fill | | |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Reddish brown coarse sand | | 150 cpm |
| | | | 4 | 7 | 7 | 21 | 2' | " " | | |
| 2 | 2-4' | | | | | | | | | 100 cpm |
| | | | 12 | 16 | 17 | 10 | 4' | " " | | |
| 3 | 4-6' | | | | | | 5' | Gray fine sand | | 60 cpm |
| | | | 12 | 14 | 14 | 12 | 6' | " " | | |
| 4 | 6-8' | | | | | | | | | 60 cpm |
| | | | | | | | 8' | " " | | |
| 5 | 8-9' | | | | | | | | | |
| | | | | | | | 9' | Groundwater | | Hole completed at 1130 |
| | | | | | | | | BOB | | |
| | | | | | | | 10' | | | |



301005

# MALCOLM PIRNIE, INC.

ONE INTERNATIONAL BOULEVARD MAHWAH, NEW JERSEY 07495-0018

BORING: SB-48

| | | | |
|---|---|---|---|
| PROJECT NAME: | Welsbach/GGM Site | DATE: | 3/27/98 |
| JOB NUMBER: | 8001230 | LOCATION: | Former GGM Facility |
| DRILLING FIRM: | AC Shultes | WEATHER: | Sunny ~70 |
| DRILLING METHOD: | Hollow Stem Auger 4 1/2 I.D. Continuous 2" Splitspoons | ELEVATION: | |
| DRILLER: | Mark | DATUM: | |
| HELPER: | Vince | HYDROGEOLOGIST: | Patrick Rabideau |

| SAMPLE INFORMATION | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. | Depth | Rec | Blows per 6" | | | | Depth | SOIL DESCRIPTION | WELL CONS | REMARKS |
| | | | 6 | 6 | 4 | 3 | 0' | Black fill | | Started hole at 1145 |
| 1 | 0-2' | | | | | | | | | |
| | | | | | | | 1' | Reddish brown coarse sand | | 100 cpm |
| | | | 10 | 12 | 12 | 11 | 2' | " " | | |
| | | | | | | | 2'6" | Light brown medium sand | | |
| 2 | 2-4' | | | | | | 3' | Gray coarse sand | | 60 cpm |
| | | | 9 | 9 | 11 | 8 | 4' | " " | | |
| 3 | 4-6' | | | | | | | | | 60 cpm |
| | | | 6 | 5 | 5 | 8 | 6' | " " | | |
| 4 | 6-8' | | | | | | 7'10" | Gray silty clay | | 40 cpm |
| | | | | | | | 8' | " " | | |
| 5 | 8-9' | | | | | | | | | |
| | | | | | | | 9' | Groundwater | | Hole completed at 1215 |
| | | | | | | | | BOB | | |

301006

**APPENDIX G**

**WELSBACH/GGM SITE**

**COST ESTIMATE - BACKUP**

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
WELSBACH/GGM SITE
CAMDEN AND GLOUCESTER CITY
CAMDEN COUNTY, NEW JERSEY

G

## APPENDIX G - COST ESTIMATE BACKUP

### Cost Analysis

Cost estimates were developed for the Welsbach/GGM remedial alternatives described in Section 10.1. These estimates present both capital and annual operation and maintenance (O/M) costs. The present value of the remedial action alternatives for the soil of Welsbach/GGM ranged from $0 (the three no-action alternatives) to approximately $17.75 million (excavation and off-site disposal for the former Welsbach). Present value was calculated utilizing a 8.0% interest rate for a 30 year period of remediation. The cost estimates are presented in Tables G-3 to G-9

The cost estimates were produced utilizing the following references: 1995 R.S. Means Building Construction Cost Data, telephone conversations with manufacturers and vendors, and experience with similar projects. Capital costs include construction costs and include labor, overhead, profit, raw materials and equipment. O/M costs include those costs associated with daily operations and implementation of a specific alternative presented on an annual basis. Costs that are not included in the estimate consist of engineering fees and administrative costs.

Several assumptions were used in the development of the cost estimates. Assumptions that were common to all of the alternatives include an addition of a 30% contingency to the capital costs, a 10% increase in unit costs for work activities involving hazardous waste, and a 7% increase in unit costs to account for elevated regional pricing. O/M costs consist of follow-up visits, investigations, site/risk assessments, and maintenance. Additional assumptions that significantly affect the estimate are presented in the following sections, specific to each alternative.

### Alternatives W-1, V-1, G-1 - No Action

These alternatives serve as a basis for the comparison of the other alternatives. Accordingly, the no action alternatives involve leaving the contaminated material on the site in the state at which it exists. No further action would be conducted, and as a result no costs would be incurred.

**Alternative W-2 - Engineering Controls**

It was assumed that steel would provide the primary gamma shielding. A three inch layer of concrete would cover the steel to provide a layer to which the asphalt could adhere

**Alternative V-2 -Engineering Controls**

Indoor Radon Mitigation

The installation of a trench around the perimeter of the lowest floor of a structure will require the removal of approximately 6" of concrete and 12" of soils underneath the slab. It is assumed that this material will be transported to and disposed of at an appropriate offsite facility. Additionally, it is assumed that active ventilation by fans is incorporated into the remedial action to remove radon from the collection system. It is assumed that the radon concentration is low enough that it can be vented directly to the atmosphere. If the concentration of radon is elevated enough to produce substantial emissions, carbon canisters can be used at the discharge to prevent significant mass loadings to the ambient environment. The costs would be affected; however, the degree of the effect on the cost analysis cannot be determined without additional information.

**Alternatives W-2 V-2 G-2- Engineering Controls**

Indoor and Outdoor Gamma Shielding

A radiological shielding code, Microshield Version 5.03, was utilized to determine the shielding thickness to reduce the external gamma dose rate at the surface of each contaminated area to less than or equal to twice the background level. Several assumptions were made in determining the shielding thickness (i.e., type of contaminated material, the depth of contamination, etc.), and consequently the shielding volume.

Three types of shielding material were selected (i.e., soil, concrete, and steel) to encompass indoor and outdoor area as appropriate. The shielding thickness was determined from the computer code runs by calculating Dose Reduction Factors (DRFs) for each thickness of shielding material, and then by calculating the ratio of the measured exposure rate to that due to natural background.

If shielding is chosen as an alternative, a more comprehensive analysis, further radiological site activities, and a more elaborate shielding analysis would be required.

**Alternatives W-3, V-3, G-3 - Excavation and Off-Site Disposal**

Excavation/Transportation/Disposal of Contaminated Soils

The excavation of the soils was assumed to proceed to the outer edge of the contamination in the horizontal direction. In the vertical direction, excavation was assumed to proceed to the depth of contamination, however; no excavation would occur below the groundwater table.

# BACKUP COSTS - OUTDOOR GAMMA SHIELDING

# TABLE G-1
# VICINITY PROPERTIES: SOIL OUTDOOR GAMMA SHIELDING
# WELSBACH/GGM SITE

| Property Number | | Geotextile Mat (SY) | Select Fill/ Grade/Compact (CY) | Topsoil (CY) | Seeding (SY) | Total Cost Shield |
|---|---|---|---|---|---|---|
| 1 | # of Units[1] | 50.00 | 16.67 | 8.33 | 50.00 | |
| | Unit Cost ($)[2] | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($)[3] | 112.50 | 416.67 | 250.00 | 550.00 | $1,330 |
| 2 | # of Units | 530.56 | 176.39 | 88.43 | 530.56 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 1193.76 | 4409.75 | 2652.90 | 5836.16 | $14,090 |
| 3 | # of Units | 44.44 | 14.82 | 7.41 | 44.44 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 99.99 | 370.50 | 222.30 | 488.84 | $1,180 |
| 4 | # of Units | 32.22 | 7.96 | 5.37 | 32.22 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 72.50 | 199.00 | 161.10 | 354.42 | $790 |
| 5 | # of Units | 25.00 | 8.33 | 4.17 | 25.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 56.25 | 208.25 | 125.10 | 275.00 | $660 |
| 6 | # of Units | 8.33 | 2.78 | 1.39 | 8.33 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 18.74 | 69.50 | 41.70 | 91.63 | $220 |
| 7 | # of Units | 2.78 | 0.46 | 0.46 | 2.78 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 6.26 | 11.50 | 13.80 | 30.58 | $60 |
| 8 | # of Units | 2.78 | 0.46 | 0.46 | 2.78 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 6.26 | 11.50 | 13.80 | 30.58 | $60 |
| 9 | # of Units | 8.33 | 1.39 | 1.39 | 8.33 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 18.74 | 34.75 | 41.70 | 91.63 | $190 |
| 14 | # of Units | 2555.56 | 953.70 | 425.93 | 2555.56 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 5750.01 | 23842.50 | 12777.90 | 28111.16 | $70,480 |
| 16 | # of Units | 627.78 | 640.28 | 104.63 | 627.78 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 1412.51 | 16007.00 | 3138.90 | 6905.58 | $27,460 |
| 17 | # of Units | 636.11 | 229.76 | 106.02 | 636.11 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 1431.25 | 5744.00 | 3180.60 | 6997.21 | $17,350 |
| 18 | # of Units | 44.44 | 14.82 | 7.41 | 44.44 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 99.99 | 370.50 | 222.30 | 488.84 | $1,180 |
| 20 | # of Units | 1313.90 | 490.65 | 219.00 | 1313.90 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 2956.28 | 12266.25 | 6570.00 | 14452.90 | $36,250 |

(1) Based on a variable depth of select fill and 6 inches of topsoil

(2) Costs from 1995 R.S. Means and vendor quotes

(3) Includes only the cost of the shield. Does not include mobilization and permitting costs

# TABLE G-1(Continued)
# VICINITY PROPERTIES: SOIL OUTDOOR GAMMA SHIELDING
# WELSBACH/GGM SITE

| Property Number | | Geotextile Mat (SY) | Select Fill/ Grade/Compact (CY) | Topsoil (CY) | Seeding (SY) | Total Cost Shield |
|---|---|---|---|---|---|---|
| 21 | # of Units[1] | 33.33 | 11.11 | 5.56 | 33.33 | |
| | Unit Cost ($)[2] | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($)[3] | 74.99 | 277.75 | 166.80 | 366.63 | $890 |
| 22 | # of Units | 13.89 | 4.63 | 2.31 | 13.89 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 31.25 | 115.75 | 69.30 | 152.79 | $370 |
| 23 | # of Units | 5.56 | 0.93 | 0.93 | 5.56 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 12.51 | 23.25 | 27.90 | 61.16 | $120 |
| 24 | # of Units | 22.22 | 7.41 | 3.70 | 22.22 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 50.00 | 185.25 | 111.00 | 244.42 | $590 |
| 25 | # of Units | 11.11 | 1.85 | 1.85 | 11.11 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 25.00 | 46.25 | 55.50 | 122.21 | $250 |
| 26 | # of Units | 3.00 | 1.00 | 0.50 | 3.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 6.75 | 25.00 | 15.00 | 33.00 | $80 |
| 27 | # of Units | 6.00 | 1.00 | 1.00 | 6.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 13.50 | 25.00 | 30.00 | 66.00 | $130 |
| 28 | # of Units | 3.00 | 1.00 | 0.50 | 3.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 6.75 | 25.00 | 15.00 | 33.00 | $80 |
| 29 | # of Units | 6.00 | 2.00 | 1.00 | 6.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 13.50 | 50.00 | 30.00 | 66.00 | $160 |
| 30 | # of Units | 3.00 | 0.50 | 0.50 | 3.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 6.75 | 12.50 | 15.00 | 33.00 | $70 |
| 31 | # of Units | 22.22 | 7.41 | 3.70 | 22.22 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 50.00 | 185.25 | 111.00 | 244.42 | $590 |
| 32 | # of Units | 3.00 | 0.50 | 0.50 | 3.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 6.75 | 12.50 | 15.00 | 33.00 | $70 |
| 33 | # of Units | 30.00 | 5.00 | 5.00 | 30.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 67.50 | 125.00 | 150.00 | 330.00 | $670 |
| 34 | # of Units | 1.00 | 0.33 | 0.17 | 1.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 2.25 | 8.25 | 5.10 | 11.00 | $30 |

(1) Based on a variable depth of select fill and 6 inches of topsoil

(2) Costs from 1995 R.S. Means and vendor quotes

(3) Includes only the cost of the shield. Does not include mobilization and permitting costs

# TABLE G-1(Continued)
## VICINITY PROPERTIES: SOIL OUTDOOR GAMMA SHIELDING
## WELSBACH/GGM SITE

| Property Number | | Geotextile Mat (SY) | Select Fill/ Grade/Compact (CY) | Topsoil (CY) | Seeding (SY) | Total Cost Shield |
|---|---|---|---|---|---|---|
| 35 | # of Units[1] | 45.00 | 7.50 | 7.50 | 45.00 | |
| | Unit Cost ($)[2] | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($)[3] | 101.25 | 187.50 | 225.00 | 495.00 | $1,010 |
| 36 | # of Units | 51.00 | 17.00 | 8.50 | 51.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 114.75 | 425.00 | 255.00 | 561.00 | $1,360 |
| 37 | # of Units | 1.00 | 0.33 | 0.17 | 3.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 2.25 | 8.25 | 5.10 | 33.00 | $50 |
| 38 | # of Units | 1.00 | 0.33 | 0.17 | 3.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 2.25 | 8.25 | 5.10 | 33.00 | $50 |
| 39 | # of Units | 23.33 | 7.78 | 3.89 | 23.33 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 52.49 | 194.50 | 116.70 | 256.63 | $620 |
| 40 | # of Units | 1.00 | 0.33 | 0.17 | 1.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 2.25 | 8.25 | 5.10 | 11.00 | $30 |
| 41 | # of Units | 16.67 | 5.56 | 2.78 | 16.67 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 37.51 | 139.00 | 83.40 | 183.37 | $440 |
| 42 | # of Units | 444.44 | 296.30 | 74.10 | 444.44 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 999.99 | 7407.50 | 2223.00 | 4888.84 | $15,520 |
| 43 | # of Units | 333.33 | 111.11 | 55.56 | 333.33 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 749.99 | 2777.75 | 1666.80 | 3666.63 | $8,860 |
| 44 | # of Units | 3.00 | 1.00 | 0.50 | 3.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 6.75 | 25.00 | 15.00 | 33.00 | $80 |
| 45 | # of Units | 1111.11 | 370.40 | 185.20 | 1111.11 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 2500.00 | 9260.00 | 5556.00 | 12222.21 | $29,540 |
| 46 | # of Units | 12.00 | 4.00 | 2.00 | 12.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 27.00 | 100.00 | 60.00 | 132.00 | $320 |
| 47 | # of Units | 25.00 | 8.33 | 4.17 | 25.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 56.25 | 208.25 | 125.10 | 275.00 | $660 |
| 48 | # of Units | 6.00 | 3.00 | 1.00 | 6.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 13.50 | 75.00 | 30.00 | 66.00 | $180 |

(1) Based on a variable depth of select fill and 6 inches of topsoil
(2) Costs from 1995 R.S. Means and vendor quotes
(3) Includes only the cost of the shield. Does not include mobilization and permitting costs

# TABLE G-1(Continued)
# VICINITY PROPERTIES: SOIL OUTDOOR GAMMA SHIELDING
# WELSBACH/GGM SITE

| Property Number | | Geotextile Mat (SY) | Select Fill/ Grade/Compact (CY) | Topsoil (CY) | Seeding (SY) | Total Cost Shield |
|---|---|---|---|---|---|---|
| 49 | # of Units[1] | 56.00 | 18.67 | 9.33 | 56.00 | |
| | Unit Cost ($)[2] | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($)[3] | 126.00 | 466.75 | 279.90 | 616.00 | $1,490 |
| 50 | # of Units | 15.00 | 2.50 | 2.50 | 15.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 33.75 | 62.50 | 75.00 | 165.00 | $340 |
| 51 | # of Units | 10.00 | 3.33 | 1.67 | 10.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 22.50 | 83.25 | 50.10 | 110.00 | $270 |
| 52 | # of Units | 8.00 | 2.67 | 1.33 | 8.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 126.00 | 466.75 | 279.90 | 616.00 | $1,490 |
| 53 | # of Units | 7.00 | 2.33 | 1.17 | 7.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 15.75 | 58.25 | 35.22 | 77.00 | $190 |
| 54 | # of Units | 14.00 | 2.33 | 2.33 | 14.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 31.50 | 58.25 | 69.90 | 154.00 | $310 |
| 55 | # of Units | 7.00 | 1.17 | 1.17 | 7.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 15.75 | 29.25 | 35.10 | 77.00 | $160 |
| 56 | # of Units | 8.00 | 1.33 | 1.33 | 8.00 | |
| | Unit Cost ($) | 2.25 | 25.00 | 30.00 | 11.00 | |
| | Cost ($) | 18.00 | 33.25 | 39.90 | 88.00 | $180 |

(1) Based on a variable depth of select fill and 6 inches of topsoil
(2) Costs from 1995 R.S. Means and vendor quotes
(3) Includes only the cost of the shield. Does not include mobilization and permitting costs

# BACKUP COSTS - INDOOR GAMMA SHIELDING

TABLE G-2
VICINITY PROPERTIES: INDOOR GAMMA SHIELDING
WELSBACH/GGM SITE

| Property Number | | Concrete Shield (CY) | Steel Shield (CF) | Total Cost Shields |
|---|---|---|---|---|
| 1 | # of Units | 1.50 | 0.00 | |
| | Unit Cost ($)[1] | 800.00 | 520.00 | |
| | Cost ($)[2] | 1200.00 | 0.00 | $1,200 |
| 2 | # of Units | 0.28 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 224.00 | 0.00 | $220 |
| 3 | # of Units | 0.56 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 448.00 | 0.00 | $450 |
| 4 | # of Units | 1.50 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 1200.00 | 0.00 | $1,200 |
| 7 | # of Units | 1.40 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 1120.00 | 0.00 | $1,120 |
| 11 | # of Units | 0.20 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 160.00 | 0.00 | $160 |
| 12 | # of Units | 0.60 | 8.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 480.00 | 4160.00 | $4,640 |
| 13 | # of Units | 1.85 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 1480.00 | 0.00 | $1,480 |
| 19 | # of Units | 40.10 | 40.50 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 32080.00 | 21060.00 | $53,140 |
| 21 | # of Units | 1.50 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 1200.00 | 0.00 | $1,200 |
| 23 | # of Units | 1.50 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 1200.00 | 0.00 | $1,200 |
| 24 | # of Units | 2.22 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 1776.00 | 0.00 | $1,780 |
| 25 | # of Units | 1.30 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 1040.00 | 0.00 | $1,040 |
| 28 | # of Units[1] | 0.20 | 0.00 | |
| | Unit Cost ($)[2] | 800.00 | 520.00 | |
| | Cost ($)[3] | 160.00 | 0.00 | $160 |

(1) Costs from 1995 R.S. Means and previous Malcolm Pirnie Project experience
(2) Does not include mobilization and permitting costs

TABLE G-2 (Continued)
VICINITY PROPERTIES: INDOOR GAMMA SHIELDING
WELSBACH/GGM SITE

| Property Number | | Concrete Shield (CY) | Steel Shield (CF) | Total Cost Shields |
|---|---|---|---|---|
| 29 | # of Units | 2.80 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 2240.00 | 0.00 | $2,240 |
| 36 | # of Units | 6.00 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 4800.00 | 0.00 | $4,800 |
| 39 | # of Units | 3.70 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 2960.00 | 0.00 | $2,960 |
| 57 | # of Units | 0.55 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 440.00 | 0.00 | $440 |
| 58 | # of Units | 0.46 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 368.00 | 0.00 | $370 |
| 59 | # of Units | 3.25 | 0.00 | |
| | Unit Cost ($) | 800.00 | 520.00 | |
| | Cost ($) | 2600.00 | 0.00 | $2,600 |



(1) Costs from 1995 R.S. Means and previous Malcolm Pirnie Project experience
(2) Does not include mobilization and permitting costs

**BACKUP COSTS - EXCAVATION AND DISPOSAL**

MALCOLM PIRNIE

MALCOLM PIRNIE, INC.
BY S/B DATE 8-4-98 SHEET NO. 1 OF 2
CHKD. BY RE DATE 8-4-98 JOB NO. 0001-230-09A
SUBJECT Welsbach T&D Costing

Per Rick Robinson, 1998 actuals for Montclair project:

Disposal $167/cy inplace volume

Transportation $144/ton

Convert tons to cy:

sandy soil, dry $\left(\frac{90\ lb}{cf}\right)\left(\frac{ton}{2200\ lb}\right)\left(\frac{27\ cf}{cy}\right) = 1.1\ \frac{ton}{cy}$

clayey soil, wet $\left(\frac{129\ lb}{cf}\right)\left(\frac{ton}{2200\ lb}\right)\left(\frac{27\ cf}{cy}\right) = 1.6\ \frac{ton}{cy}$

source of soil densities:
"Civil Engineering Reference Manual", Lindeburg, 1992, p. 9-6

→ use $1.5\ \frac{ton}{cy}$ to be conservative

transp. $\left(\frac{\$144}{ton}\right)\left(\frac{1.5\ ton}{cy}\right) = \$216/cy$

T&D (1998): $167/cy + $216/cy = $383/cy,

say $400/cy

301020

per Rick Robinson: 1998 actuals for Montclair Project

Building Materials

Disposal = \$414/cy

Transportation · \$ 144/ton

Convert tons to cy

assume all concrete - conservative

density of concrete = 150 lb/cf

$$\left(\frac{150\ \text{lb}}{\text{cf}}\right)\left(\frac{1\ \text{ton}}{2000\ \text{lb}}\right)\left(\frac{27\ \text{cf}}{\text{cy}}\right) = 1.85\ \text{ton/cy}$$

$$\text{Transportation} = \left(\frac{\$144}{\text{ton}}\right)\left(\frac{1.85\ \text{ton}}{\text{cy}}\right) = \frac{\$266}{\text{cy}}$$

$$\text{T + D (1998)}: \frac{\$266}{\text{cy}} + \frac{\$414}{\text{cy}} = \frac{\$680}{\text{cy}} \Rightarrow \frac{\$700}{\text{cy}}$$

# COST ESTIMATE

# TABLE G-3
## ALTERNATIVE W-2: WELSBACH/HOLT CARGO: ENGINEERING CONTROLS
## WELSBACH/GGM SITE

| Capital Costs | Quantity | Unit | Cost per Unit | Total |
|---|---|---|---|---|
| Mobilization | 1 | l.s. | $50,000 | $50,000 |
| Outdoor Gamma Shielding (steel) | 7,520 | c.f. | $520 | $3,910,000 |
| Concrete (3 inches) over steel | 500 | c.y | $600 | $300,000 |
| Asphalt over Shielding (4") | 53,400 | s.f. | $1.20 | $64,000 |
| Air Monitoring During Construction | 1 | l.s. | $50,000 | $50,000 |
| Subtotal | | | | $4,374,000 |
| Contingency (30%) | | | | $1,312,000 |
| **TOTAL Capital Costs** | | | | **$5,686,000** |

| Operation and Maintenance Costs | Cost per Unit | Frequency | Annual Total | Present Worth<br>Term (yrs) 30<br>Interest 8.0% |
|---|---|---|---|---|
| Site Inspection | $6,000 | Annually | $6,000 | $68,000 |
| Outdoor Shield Maintenance | $30,000 | Annually | $30,000 | $338,000 |
| Site Maintenance (Includes Fencing Upkeep) | $5,000 | Annually | $5,000 | $56,000 |
| Site Risk Assessment | $15,000 | Every 5 Years | $3,000 | $34,000 |
| **Present Worth of Operation and Maintenance Costs** | | | | **$496,000** |

**Total Present Worth (Capital and O/M) of Alternative W-2** **$6,180,000**

**TABLE G-4**
**ALTERNATIVE V-2: VICINITY PROPERTIES: ENGINEERING CONTROLS**
**WELSBACH/GGM SITE**

| Capital Costs | Quantity | Unit | Cost per Unit | Total |
|---|---|---|---|---|
| Mobilization | 1 | l.s. | $150,000 | $150,000 |
| Indoor Radon Mitigation | - | - | - | |
| Clearing/Ceaning/Preparation | 3,600 | s.f. | $0.30 | $1,100 |
| Sub Slab Ventilation | - | - | - | |
| Demolition of Concrete Flooring (6") | 1,150 | s.f. | $36 | $41,400 |
| Excavation of Soils Underneath Slab (12" deep) | 45 | c.y. | $55 | $2,500 |
| Installation of Collection System | - | - | - | |
| Trench Lining (Geomembrane on Geotextile) | 2,300 | s.f. | $5 | $10,400 |
| Piping | 540 | l.f. | $4 | $2,200 |
| Pipe Fittings | 16 | ea. | $60 | $1,000 |
| Pea Gravel | 40 | c.y. | $60 | $2,400 |
| Ventillation Equipment | 8 | ea. | $480 | $3,800 |
| Concrete Replacement (6" thick) | 21 | c.y. | $800 | $16,800 |
| Handling and Loading of Contaminated Soil and Concrete | 66 | c.y. | $30 | $2,000 |
| Transportation and Disposal of Soil | 45 | c.y. | $400 | $18,000 |
| Transportation and Disposal of Concrete | 21 | c.y. | $700 | $14,700 |
| Indoor Gamma Shielding (Concrete 6") | 72 | c.y. | $600 | $42,900 |
| Indoor Gamma Shielding (Steel) | 48 | c.f. | $520 | $24,700 |
| Outdoor Gamma Shielding | - | - | - | |
| Geotextile Mat | 8,700 | s.y. | $2.25 | $19,600 |
| Select Fill | 3,050 | c.y. | $25 | $76,300 |
| Topsoil (6") | 1,450 | c.y. | $30 | $43,500 |
| Seeding | 8,700 | s.y. | $11 | $95,700 |
| Air Monitoring During Construction | 1 | l.s. | $125,000 | $125,000 |
| Subtotal | | | | $694,000 |
| Contingency (30%) | | | | $208,000 |
| **TOTAL Capital Costs** | | | | **$902,000** |

## TABLE G-4 (Continued)
## ALTERNATIVE V-2: VICINITY PROPERTIES: ENGINEERING CONTROLS
## WELSBACH/GGM SITE

| Operation and Maintenance Costs | | | Total (1) | Term (yrs) 30<br>Interest 8.0% |
|---|---|---|---|---|
| Site Inspection | $5,000 | Annually | $5,000 | $56,000 |
| Radon Testing/Air Monitoring | | | | |
| First Year | $5,000 | Quarterly | $20,000 | $20,000 |
| After First Year | $5,000 | Annually | $5,000 | $56,000 |
| Radon Mitigation System Maintenance | $5,000 | Annually | $5,000 | $56,000 |
| Electrical Equipment Maintenance | $2,000 | Annually | $1,000 | $11,000 |
| Outdoor Shield Maintenance | $50,000 | Annually | $50,000 | $563,000 |
| Site Maintenance (Includes Fencing Upkeep) | $10,000 | Annually | $10,000 | $113,000 |
| Site Risk Assessment | $15,000 | Every 5 Years | $3,000 | $34,000 |
| **Present Worth of Operation and Maintenance Costs** | | | | **$909,000** |

**Total Present Worth (Capital and O/M) of Alternative V-2** **$1,810,000**

# TABLE G-5
# ALTERNATIVE G-2: GENERAL GAS MANTLE: ENGINNERING CONTROLS
# WELSBACH/GGM SITE

| Capital Costs | Quantity | Unit | Cost per Unit | Total |
|---|---|---|---|---|
| Mobilization | 1 | l.s. | $50,000 | $50,000 |
| Outdoor Gamma Shielding (Concrete 6" or Greater) | 41.00 | c.y. | $600 | $24,600 |
| Outdoor Gamma Shielding (Soil) | - | - | - | - |
| Soil Cover | 31 | c.y. | $25 | $800 |
| Topsoil (6") | 20 | c.y. | $30 | $600 |
| Geotextile Mat | 120 | s.y. | $2.25 | $300 |
| Seeding | 120 | s.y. | $11 | $1,300 |
| Air Monitoring During Construction | 1 | l.s. | $20,000 | $20,000 |
| Subtotal | | | | $97,600 |
| Contingency (30%) | | | | $24,000 |
| **TOTAL Capital Costs** | | | | **$121,600** |

| Operation and Maintenance Costs | Cost per Unit | Frequency | Annual Total | Present Worth<br>Term (yrs) 30<br>Interest 8.0% |
|---|---|---|---|---|
| Site Inspection | $5,000 | Annually | $5,000 | $56,000 |
| Outdoor Shield Maintenance | $10,000 | Annually | $10,000 | $113,000 |
| Site Maintenance (Includes Fencing Upkeep) | $5,000 | Annually | $5,000 | $56,000 |
| Site Risk Assessment | $15,000 | Every 5 Years | $3,000 | $34,000 |
| **Present Worth of Operation and Maintenance Costs** | | | | **$259,000** |

**Total Present Worth (Capital and O/M) Of Alternative G-2** **$380,000**

# TABLE G-6
## ALTERNATIVE W-3: WELSBACH/HOLT CARGO: EXCAVATION AND DISPOSAL
## WELSBACH/GGM SITE

| Capital Costs | Quantity | Unit | Cost per Unit | Total |
|---|---|---|---|---|
| Mobilization | 1 | l.s. | $50,000 | $50,000 |
| Excavation/Transportation/Disposal of Soils and Buried Building Debris | - | - | - | - |
| Permitting | 1 | l.s. | $5,000.00 | $5,000 |
| Excavation/Handling/Stockpiling of Soils and Buried Building Debris | 23,300 | c.y. | $20.00 | $466,000 |
| Hand Excavation/Handling/Stockpiling of Soils and Buried Building Debris | 3,900 | c.y. | $80.00 | $312,000 |
| Transportation and Disposal of Soils | 22,200 | c.y. | $400.00 | $8,880,000 |
| Transportation and Disposal of Buried Building Debris | 5,000 | c.y. | $700.00 | $3,500,000 |
| Backfill (clean fill)/Compaction/Grading | 27,200 | c.y. | $25.00 | $680,000 |
| Sheeting for Excavation Support | - | - | - | |
| Wood sheeting (to be pulled upon finishing) | 12,000 | s.f. | $9 | $108,000 |
| Transportation and Disposal of pulled sheeting | 75 | c.y. | $650 | $49,000 |
| Erosion Control | - | - | - | |
| Silt Fencing | 2,000 | l.f. | $1.10 | $2,000 |
| Place and Remove Hay Bales | 1 | l.s. | $460 | $460 |
| Cover Storm Drains | 1 | l..s. | $100 | $100 |
| Stabilized Construction Entrance (3/4" Crushed Stone) | 280 | s.y. | $9 | $2,000 |
| Restoration | 58,850 | s.f. | $1.25 | $74,000 |
| Survey | 1 | l.s. | $5,000.00 | $5,000 |
| Air Monitoring During Construction | 1 | l.s. | $100,000 | $100,000 |
| Subtotal | | | | $14,233,560 |
| Contingency (30%) | | | | $4,270,000 |
| **TOTAL Capital Costs** | | | | **$18,503,560** |

# TABLE G-6 (Continued)
## ALTERNATIVE W-3: WELSBACH/HOLT CARGO: EXCAVATION AND DISPOSAL
## WELSBACH/GGM SITE

| Operation and Maintenance Costs | Cost per Unit | Frequency | Annual Total (1) | Present Worth Term (yrs) 30 Interest 8.0% |
|---|---|---|---|---|
| NONE | $0 | | $0 | $0 |
| Present Worth of Operation and Maintenance Costs | | | | $0 |

Total Present Worth (Capital and O/M) of Alternative W-3 $18,500,000

# TABLE G-7
# ALTERNATIVE V-3: VICINITY PROPERTIES: EXCAVATION AND DISPOSAL
# WELSBACH/GGM SITE

| Capital Costs | Quantity | Unit | Cost per Unit | Total |
|---|---|---|---|---|
| Mobilization | 1 | l.s. | $150,000 | $150,000 |
| Excavation/Transportation/Disposal of Soils and Buried Building Debris | - | - | - | - |
| Permitting | 1 | l.s. | $5,000 | $5,000 |
| Excavation of Soils and Buried Building Debris | 9,300 | c.y. | $20 | $186,000 |
| Excavation of Soils and Buried Building Debris (Hand Excavate) | 1,350 | c.y. | $80 | $108,000 |
| Transportation and Disposal of Soils | 9,200 | c.y. | $400 | $3,680,000 |
| Transportation and Disposal of Buried Building Debris | 1,450 | c.y. | $700 | $1,015,000 |
| Backfill of Excavated Areas (clean fill)/Compaction/Grading | 10,650 | c.y. | $25 | $266,000 |
| Top Soil (6") | 478 | c.y. | $30 | $14,000 |
| Seeding of Excavated Areas | 2,870 | s.y. | $11 | $32,000 |
| Sheeting for Excavation Support | - | - | - | - |
| Wood sheeting | 5,280 | s.f. | $9 | $48,000 |
| Transportation and Disposal of sheeting | 33 | c.y. | $700 | $23,000 |
| Excavations inside Residences | - | - | - | - |
| Breakup Concrete Slab | 1,450 | s.f. | $36 | $52,000 |
| Excavate Soil under Concrete slab (12") | 60 | c.y. | $80 | $5,000 |
| Handling and Loading of Contaminated Soils and Concrete | 90 | c.y. | $30 | $3,000 |
| Transportation and Disposal of Soil | 60 | c.y. | $400 | $24,000 |
| Transportation and Disposal of Concrete | 30 | c.y. | $700 | $21,000 |
| Backfill of Excavated Areas (clean fill)/Compaction/Grading | 60 | c,y | $25 | $2,000 |
| Place Concrete Slab (6") | 30 | c.y. | $800 | $24,000 |

# TABLE G-7 (Continued)
# ALTERNATIVE V-3: VICINITY PROPERTIES: EXCAVATION AND DISPOSAL
# WELSBACH/GGM SITE



| Capital Costs | Quantity | Unit | Cost per Unit | Total |
|---|---|---|---|---|
| Property 14 - Removal, Transportation and Disposal of Concrete Slab | - | - | - | - |
| Removal of Concrete Slab | 400 | c.y. | $275 | $110,000 |
| Cut Concrete Slab in Half | 200 | l.f. | $37 | $7,000 |
| Transportation and Disposal of Contaminated Concrete Slab | 200 | c.y. | $700 | $140,000 |
| Transportation and Disposal of Non-Contaminated Concrete Slab | 200 | c.y. | $13.75 | $3,000 |
| Property 19 Building Activities | - | - | - | - |
| Underpinning Building (excavation of soil underneath) | 1,750 | c.y. | $1,475 | $2,581,000 |
| Remove Concrete Slab | 1,150 | c.y. | $275 | $316,000 |
| Cut Concrete Slab in Half | 200 | l.f. | $37 | $7,000 |
| Transportation and Disposal of Soil | 1,750 | c.y. | $400 | $700,000 |
| Transportation and Disposal of Contaminated Concrete Slab | 575 | c.y. | $700 | $403,000 |
| Transportation and Disposal of Non-Contaminated Concrete Slab | 575 | c.y. | $13.75 | $8,000 |
| Backfill (clean fill)/Compaction/Grading | 1,750 | c.y. | $25.00 | $44,000 |
| Place Concrete Slab (6") | 290 | c.y. | $600.00 | $174,000 |
| Erosion Control | - | - | - | - |
| Silt Fencing | 3,800 | l.f. | $1.10 | $4,000 |
| Place and Remove Hay Bales | 1 | l.s. | $460 | $460 |
| Cover Storm Drains | 1 | l.s. | $100 | $100 |
| Stabilized Construction Entrance (3/4" Crushed Stone) | 980 | s.y. | $9 | $9,000 |
| Air Monitoring During Construction | 1 | l.s. | $150,000 | $150,000 |
| Subtotal | | | | $10,314,560 |
| Contingency (30%) | | | | $3,094,000 |
| **TOTAL Capital Costs** | | | | **$13,408,560** |

# TABLE G-7 (Continued)
## ALTERNATIVE V-3: VICINITY PROPERTIES: EXCAVATION AND DISPOSAL
## WELSBACH/GGM SITE

| Operation and Maintenance Costs | Cost per Unit | Frequency | Annual Total | Present Worth | |
|---|---|---|---|---|---|
| | | | | Term (yrs) | 30 |
| | | | | Interest | 8.0% |
| NONE | $0 | | $0 | | $0 |
| **Present Worth of Operation and Maintenance Costs** | | | | | **$0** |

**Total Present Worth (Capital and O/M) of Alternative V-3** **$13,410,000**

# TABLE G-8

## ALTERNATIVE G-3 OPTION A: GGM EXCAVATION AND DISPOSAL AND DEMOLITION OF BUILDING WELSBACH/GGM SITE

| Capital Costs | Quantity | Unit | Cost per Unit | Total | |
|---|---|---|---|---|---|
| Mobilization | 1 | l.s. | $50,000 | | $50,000 |
| Permitting | 1 | ea. | $5,000 | | $5,000 |
| Removal of Contaminated Building Materials | - | - | - | | - |
| Demolition | 950 | c.y. | $10.80 | | $10,000 |
| Remove Concrete Basement (Floors and Walls) | 450 | c.y. | $275 | | $124,000 |
| Transportation and Disposal | 1,400 | c.y. | $700 | | $980,000 |
| Excavation/Transportation/Disposal of Soils and Buried Building Debris | - | - | - | | - |
| Excavation of Soils and Buried Building Debris | 800 | c.y. | $20 | | $16,000 |
| Excavation of Soils and Buried Building Debris (Hand Excavate) | 145 | c.y. | $80 | | $12,000 |
| Transportation and Disposal of Soils | 885 | c.y. | $400 | | $354,000 |
| Transportation and Disposal of Building Debris | 60 | c,y, | $700 | | $42,000 |
| Backfill (clean fill)/Compaction/Grading | 2,500 | c.y. | $25 | | $63,000 |
| Top Soil (6") | 83 | c.y. | $30 | | $3,000 |
| Seeding of Excavated Areas | 500 | s.y. | $11.00 | | $6,000 |
| Erosion Control | - | - | - | | - |
| Silt Fencing | 1,150 | l.f. | $1.10 | | $1,000 |
| Place and Remove Hay Bales | 1 | l.s. | $460 | | $460 |
| Cover Storm Drains | 1 | l.s. | $100 | | $100 |
| Stabilized Construction Entrance (3/4" Crushed Stone) | 280 | s.y. | $9 | | $2,000 |
| Traffic Control | 1 | l.s. | $2,000 | | $2,000 |
| Repave Street | 3,750 | s.f. | $1.50 | | $6,000 |
| Air Monitoring During Construction | 1 | l.s. | $100,000 | | $100,000 |
| Subtotal | | | | | $1,776,560 |
| Contingency (30%) | | | | | $533,000 |
| **TOTAL Capital Costs** | | | | | **$2,309,560** |

## TABLE G-8 (Continued)
## ALTERNATIVE G-3 OPTION A: GGM EXCAVATION AND DISPOSAL AND DEMOLITION OF BUILDING
## WELSBACH/GGM SITE

301

| Operation and Maintenance Costs | Cost per Unit | Frequency | Annual Total | Present Worth | |
|---|---|---|---|---|---|
| | | | | Term (yrs) | 30 |
| | | | | Interest | 8.0% |
| NONE | $0 | | $0 | | $0 |
| **Present Worth of Operation and Maintenance Costs** | | | | | **$0** |

**Total Present Worth (Capital and O/M) of Alternative G-3** **$2,310,000**

301034

# TABLE G-9
## Alternative G-3 Option B: GGM: Excavation and Disposal and Decon. and Demolition of Building
## WELSBACH/GGM SITE

| Capital Costs | Quantity | Unit | Cost per Unit | Total | |
|---|---|---|---|---|---|
| Mobilization | 1 | l.s. | $50,000 | | $50,000 |
| Removal of Wood Structural Material and Roof Material | - | - | - | | - |
| Removal of Wood Floor | 12,900 | s.f. | $1.20 | | $15,000 |
| Removal of Ceiling | 6,600 | sf | $0.60 | | $4,000 |
| Chimney Removal | 50 | v.f. | $118 | | $6,000 |
| Transportation and Disposal | 500 | c.y. | $700 | | $350,000 |
| Decontamination of Remaining Shell (Pressure Washing) | 25,100 | sf | $2.00 | | $50,000 |
| Removal of Non-Contaminated Building Materials | - | - | - | | - |
| Demolition | 24,800 | c.f. | $0.40 | | $10,000 |
| Remove Concrete Basement (Floors and Walls) | 450 | c.y. | $275 | | $124,000 |
| Crush and Place Non-Contaminated Building Materials | 900 | c.y. | $50 | | $45,000 |
| Compact and Grade Crushed Building Materials | 900 | c.y. | $3.25 | | $3,000 |
| Excavation/Transportation/Disposal of Soils and Buried Building Debris | - | - | - | | - |
| Permitting | 1 | ea. | $20,000 | | $20,000 |
| Package treatment unit | 1 | ea. | $75,000 | | $75,000 |
| Excavation of Soils and Buried Building Debris | 800 | c.y. | $20 | | $16,000 |
| Excavation of Soils and Buried Building Debris (Hand Excavate) | 145 | c.y. | $80 | | $12,000 |
| Transportation and Disposal of Soils | 885 | c.y. | $400 | | $354,000 |
| Transportation and Disposal of Buried Building Debris | 60 | c.y. | $700 | | $42,000 |
| Backfill (clean fill)/Compaction/Grading | 1,600 | c.y. | $25 | | $40,000 |
| Top Soil (6") | 83 | c.y. | $30 | | $2,000 |
| Seeding of Excavated Areas | 500 | s.y. | $11 | | $6,000 |

301035

# TABLE G-9 (Continued)
## Alternative G-3 Option B: GGM: Excavation and Disposal and Decon. and Demolition of Building
## WELSBACH/GGM SITE

| Capital Costs | Quantity | Unit | Cost per Unit | Total | |
|---|---|---|---|---|---|
| Erosion Control | - | - | - | | - |
| Silt Fencing | 1,150 | l.f. | $1.10 | | $1,000 |
| Place and Remove Hay Bales | 1 | l.s. | $460 | | $460 |
| Cover Storm Drains | 1 | l..s. | $100 | | $100 |
| Stabilized Construction Entrance (3/4" Crushed Stone) | 280 | s.y. | $9 | | $2,000 |
| Traffic Control | 1 | l.s. | $2,000 | | $2,000 |
| Repave Street | 3,750 | s.f. | $1.50 | | $6,000 |
| Air Monitoring During Construction | 1 | l.s. | $100,000 | | $100,000 |
| Subtotal | | | | | $1,335,560 |
| Contingency (30%) | | | | | $401,000 |
| **TOTAL Capital Costs** | | | | | **$1,736,560** |

| Operation and Maintenance Costs | Cost per Unit | Frequency | Annual Total | Present Worth | |
|---|---|---|---|---|---|
| | | | | Term (yrs) | 30 |
| | | | | Interest | 8.0% |
| NONE | $0 | | $0 | | $0 |
| **Present Worth of Operation and Maintenance Costs** | | | | | **$0** |

**Total Present Worth (Capital and O/M) of Alternative** **$1,740,000**