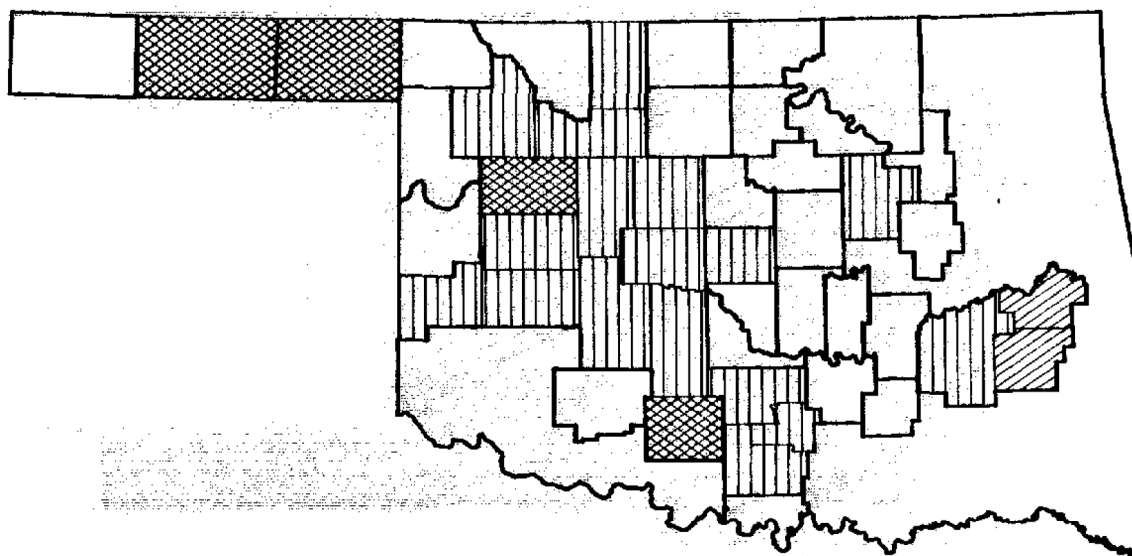


## FIGURE 2 - DIFFERENCE OVER BACKGROUND

OKLAHOMA

GAS PROCESSING FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

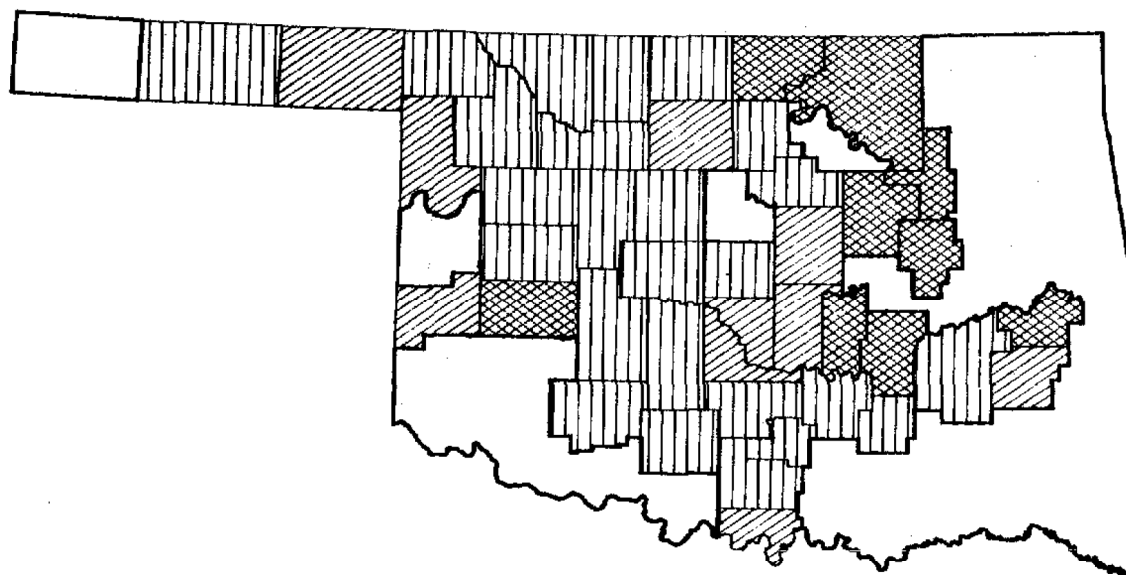
.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 3 – DIFFERENCE OVER BACKGROUND

OKLAHOMA

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Oklahoma

## FACILITY: Gas Processing

Obsns	Equipment	Median Difference	75 <sup>th</sup> Percentile
99	COMPRESSOR	0.0	2.0
2	CRYO UNIT	0.0	0.0
27	DEHYDRATOR	0.0	0.0
20	FRAC TOWER	0.0	0.0
35	INLET SCRUBBER	0.0	0.0
8	METER	0.0	0.0
32	OTANK	0.0	0.0
17	OTHER	0.0	4.6
8	PRODUCT LINE	0.0	12.8
12	REFRIGERATION	0.0	0.0
13	SWEETENER	0.0	0.0
9	PTANK	0.5	8.3
9	OPUMP	10.5	47.0
2	BOTTOMS PUMP	12.7	25.0
4	PPUMP	17.5	409.0
7	REFLUX PUMP	20.9	46.4
304			

Median of Difference Over Background

## FACILITY: Production

59	FLINE	0.0	30.0
111	MANIFOLD	0.0	3.0
135	METER	0.0	1.0
195	OTHER	0.0	4.0
271	PUMP	0.0	1.0
626	SEP	0.0	4.0
1,012	STANK	0.0	1.0
3	VRU	0.0	0.0
347	WPROD	0.0	2.0
350	H/T	1.0	6.0
42	SUMP	1.0	10.3
585	WTANK	2.0	13.5
9	WINJ	6.0	40.0
79	WLINE	14.0	89.0
3,824			

Median of Difference Over Background

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

**FACILITY:** Gas Processing

Obsns County		Median	75th Difference Percentile
3	ALFALFA	0.00	1.0
17	BECKHAM	0.00	0.0
63	BLAINE	0.00	0.0
1	CADDO	0.00	0.0
10	CANADIAN	0.00	0.5
1	CARTER	0.00	0.0
1	CREEK	0.00	0.0
3	CUSTER	0.00	0.0
2	GARVIN	0.00	0.0
11	GRADY	0.00	1.0
30	KINGFISHER	0.00	0.0
1	MAJOR	0.00	0.0
16	MURRAY	0.00	0.0
4	OKLAHOMA	0.00	0.0
10	PITTSBURG	0.00	0.0
1	WASHITA	0.00	0.0
44	WOODWARD	0.00	0.0
44	HASKELL	1.50	3.0
2	LATIMER	1.50	2.0
8	BEAVER	2.00	2.0
9	TEXAS	10.50	13.8
20	DEWEY	13.35	44.0
3	STEPHENS	15.20	44.2

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Table 2 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Oklahoma

FACILITY: Production

Obsns County		Median Difference	75 <sup>th</sup> Percentile
118	ALFALFA	0.00	0.0
140	BLAINE	0.00	2.0
136	CANADIAN	0.00	2.0
390	CARTER	0.00	3.0
12	COMANCHE	0.00	0.0
83	CUSTER	0.00	0.0
59	DEWEY	0.00	1.0
156	GARVIN	0.00	2.0
127	GRADY	0.00	2.0
2	GRANT	0.00	0.0
15	HARPER	0.00	0.0
526	KINGFISHER	0.00	2.0
101	MAJOR	0.00	3.0
68	MURRAY	0.00	0.0
9	NOBLE	0.00	1.0
44	OKLAHOMA	0.00	0.0
18	PAYNE	0.00	95.8
40	PITTSBURG	0.00	0.0
31	PONTOTOC	0.00	4.0
368	STEPHENS	0.00	4.0
18	TEXAS	0.00	0.3
4	WOODS	0.00	0.0
7	WOODWARD	0.00	0.0
14	CADDO	0.50	3.0
74	COAL	0.50	4.0
8	BEAVER	1.00	66.8
173	BECKHAM	1.00	2.0
103	CLEVELAND	1.00	3.0
13	ELLIS	1.00	5.0
22	GARFIELD	1.00	4.0
25	LATIMER	1.00	2.0
5	LINCOLN	1.00	10.5
8	LOVE	1.00	9.3
37	MCCLAIN	1.00	60.0

2 4 6 8 10 12 14 16 18

Median of Difference Over Background

Table 2 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Oklahoma

FACILITY: Production

Obsns County			Median Difference	75 <sup>th</sup> Percentile
50	POTTAWATOMIE	***	1.00	12.0
1	UNREPORTED	**	1.00	1.0
149	HASKELL	****	2.00	3.0
74	KAY	****	2.00	114.3
12	TULSA	****	2.00	85.8
23	WASHITA	****	2.00	2.0
285	CREEK	*****	3.00	46.5
31	OKMULGEE	*****	3.00	137.0
115	OSAGE	*****	4.00	32.0
126	SEMINOLE	*****	4.00	45.5
4	HUGHES	*****	5.50	15.8
-----			-----+-----+-----+-----+-----+-----+-----+-----+-----+-----	
3,824			2 4 6 8 10 12 14 16 18 20	
			Median of Difference Over Background	

Table 3  
Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Oklahoma

Obs	County		Median	75 <sup>th</sup> Percentile
4	HUGHES	*****	5.0	5.0
1	UNREPORTED	*****	5.0	5.0
24	WASHITA	*****	5.0	5.0
8	LOVE	*****	5.5	6.8
31	BECKHAM	*****	6.0	7.0
391	CARTER	*****	6.0	9.0
86	CUSTER	*****	6.0	6.0
13	ELLIS	*****	6.0	8.0
5	LINCOLN	*****	6.0	6.0
102	MAJOR	*****	6.0	9.0
27	TEXAS	*****	6.5	6.8
75	CADDO	*****	7.0	9.0
146	CANADIAN	*****	7.0	8.0
8	COAL	*****	7.0	7.0
138	GRADY	*****	7.0	10.0
84	MURRAY	*****	7.0	7.0
31	PONTOTOC	*****	7.0	10.0
121	ALFALFA	*****	8.0	8.0
203	BLAINE	*****	8.0	10.5
103	CLEVELAND	*****	8.0	9.0
158	GARVIN	*****	8.0	9.0
9	NOBLE	*****	8.0	8.0
31	OKMULGEE	*****	8.0	13.0
115	OSAGE	*****	8.0	9.0
50	POTTAWATOMIE	*****	8.0	8.0
126	SEMINOLE	*****	8.0	9.0
12	COMANCHE	*****	9.0	9.0
286	CREEK	*****	9.0	11.0
15	HARPER	*****	9.0	10.0
27	LATIMER	*****	9.0	10.0
371	STEPHENS	*****	9.0	15.0

-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+  
2 4 6 8 10 12 14 16 18 20  
Median of Background Readings

Table 3 (Continued)

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Oklahoma

Obs	County		Median	75 <sup>th</sup> Percentile
2	GRANT	*****	10.0	10.0
193	HASKELL	*****	10.0	10.0
556	KINGFISHER	*****	10.0	10.0
37	MCCLAIN	*****	10.0	10.0
50	PITTSBURG	*****	10.0	10.0
181	BEAVER	*****	11.0	11.0
79	DEWEY	*****	11.0	11.0
48	OKLAHOMA	*****	11.0	11.0
12	TULSA	*****	11.0	14.0
4	WOODS	*****	11.0	11.8
22	GARFIELD	*****	11.5	13.3
51	WOODWARD	*****	12.5	12.5
74	KAY	*****	15.0	15.3
18	PAYNE	*****	15.0	15.0
		-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+		
		2 4 6 8 10 12 14 16 18 20		

Median of Background Readings

# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Oklahoma

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
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#### Gas Processing Facilities

COMPRESSOR	99	0.970	5.0	0.0	0.00	0.00	2.00
CRYO UNIT	2	0.000	0.0	0.0	0.00	0.00	0.00
DEHYDRATOR	27	0.333	4.0	0.0	0.00	0.00	0.00
FRAC TOWER	20	1.225	15.0	0.0	0.00	0.00	0.00
INLET SCRUBBER	35	0.206	2.0	0.0	0.00	0.00	0.00
METER	8	0.687	4.5	0.0	0.00	0.00	0.75
OTANK	32	7.403	89.0	0.0	0.00	0.00	0.50
OTHER	17	4.180	44.0	0.0	0.00	0.00	4.60
PRODUCT LINE	8	5.187	24.5	0.0	0.00	0.00	12.75
REFRIGERATION	12	0.000	0.0	0.0	0.00	0.00	0.00
SWEETENER	13	0.000	0.0	0.0	0.00	0.00	0.00
PTANK	9	4.811	20.0	0.0	0.00	0.50	8.30
OPUMP	9	33.333	176.0	0.0	0.00	10.50	47.00
BOTTOMS PUMP	2	12.750	25.0	0.5	0.50	12.75	25.00
PPUMP	4	143.475	539.0	0.0	3.97	17.45	409.00
REFLUX PUMP	7	26.114	51.3	0.0	4.80	20.90	46.40

#### Production Facilities

FLINE	59	47.610	888	0	0	0	30.00
MANIFOLD	111	40.027	1196	0	0	0	3.00
METER	135	0.652	7	0	0	0	1.00
OTHER	195	44.492	994	0	0	0	4.00
PUMP	271	13.139	986	0	0	0	1.00
SEP	626	38.785	3391	0	0	0	4.00
STANK	1012	8.253	986	0	0	0	1.75
VRU	3	0.000	0	0	0	0	0.00
WPROD	347	9.140	790	0	0	0	2.00
H/T	350	19.700	1205	0	0	1	6.00
SUMP	42	31.048	685	0	0	1	10.25
WTANK	585	45.335	3786	0	0	2	13.50
WINJ	9	109.111	886	0	0	6	40.00
WLINE	79	184.934	2790	0	0	14	89.00

# Appendix 2

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Oklahoma

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	ALFALFA	3	0.333	1.0	0	0.00	0.00	1.00
GP	BECKHAM	22	0.136	1.0	0	0.00	0.00	0.00
GP	BLAINE	63	2.129	74.5	0	0.00	0.00	0.00
GP	CADDO	1	0.000	0.0	0	0.00	0.00	0.00
GP	CANADIAN	10	0.500	3.0	0	0.00	0.00	0.50
GP	CARTER	1	0.000	0.0	0	0.00	0.00	0.00
GP	CREEK	1	0.000	0.0	0	0.00	0.00	0.00
GP	CUSTER	3	0.000	0.0	0	0.00	0.00	0.00
GP	GARVIN	2	0.000	0.0	0	0.00	0.00	0.00
GP	GRADY	11	1.718	15.9	0	0.00	0.00	1.00
GP	KINGFISHER	30	6.900	176.0	0	0.00	0.00	0.00
GP	MAJOR	1	0.000	0.0	0	0.00	0.00	0.00
GP	MURRAY	14	0.286	4.0	0	0.00	0.00	0.00
GP	OKLAHOMA	4	0.000	0.0	0	0.00	0.00	0.00
GP	PITTSBURG	10	0.100	1.0	0	0.00	0.00	0.00
GP	WASHITA	1	0.000	0.0	0	0.00	0.00	0.00
GP	WOODWARD	44	1.602	25.0	0	0.00	0.00	0.00
GP	HASKELL	44	1.750	5.0	0	0.00	1.50	3.00
GP	LATIMER	2	1.500	2.0	1	1.00	1.50	2.00
GP	BEAVER	8	1.375	2.0	0	0.25	2.00	2.00
GP	TEXAS	9	8.978	23.4	0	0.00	10.50	13.75
GP	DEWEY	20	47.130	539.0	0	0.00	13.35	44.00
GP	STEPHENS	3	19.800	44.2	0	0.00	15.20	44.20
PROD	ALFALFA	118	1.102	83.0	0	0.00	0.00	0.00
PROD	BLAINE	140	5.929	120.0	0	0.00	0.00	2.00
PROD	CANADIAN	136	14.096	887.0	0	0.00	0.00	2.00
PROD	CARTER	390	7.983	268.0	0	0.00	0.00	3.00
PROD	COMANCHE	12	1.583	19.0	0	0.00	0.00	0.00
PROD	CUSTER	83	0.012	1.0	0	0.00	0.00	0.00
PROD	DEWEY	59	0.322	2.0	0	0.00	0.00	1.00
PROD	GARVIN	156	32.006	986.0	0	0.00	0.00	2.00
PROD	GRADY	127	29.315	990.0	0	0.00	0.00	2.00
PROD	GRANT	2	0.000	0.0	0	0.00	0.00	0.00
PROD	HARPER	15	0.900	12.5	0	0.00	0.00	0.00
PROD	KINGFISHER	526	14.530	789.0	0	0.00	0.00	2.00
PROD	MAJOR	101	19.772	986.0	0	0.00	0.00	3.00
PROD	MURRAY	70	0.000	0.0	0	0.00	0.00	0.00
PROD	NOBLE	9	0.556	2.0	0	0.00	0.00	1.00
PROD	OKLAHOMA	44	10.886	460.0	0	0.00	0.00	0.00
PROD	PAYNE	18	123.222	1585.0	0	0.00	0.00	95.75

# Appendix 2 (Continued)

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Oklahoma

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
PROD	PITTSBURG	40	0.125	1.0	0	0.00	0.00	0.00
PROD	PONTOTOC	31	9.032	135.0	0	0.00	0.00	4.00
PROD	STEPHENS	368	17.457	744.0	0	0.00	0.00	4.00
PROD	TEXAS	18	0.572	4.5	0	0.00	0.00	0.25
PROD	WOODS	4	0.000	0.0	0	0.00	0.00	0.00
PROD	WOODWARD	7	0.286	2.0	0	0.00	0.00	0.00
PROD	CADDO	74	7.659	189.0	0	0.00	0.50	4.00
PROD	COAL	8	28.125	103.0	0	0.00	0.50	66.75
PROD	BEAVER	173	0.942	5.0	0	0.00	1.00	2.00
PROD	BECKHAM	9	40.444	313.0	0	0.00	1.00	23.00
PROD	CLEVELAND	103	8.553	143.0	0	0.00	1.00	3.00
PROD	ELLIS	13	2.231	8.0	0	0.00	1.00	5.00
PROD	GARFIELD	22	3.455	20.0	0	0.00	1.00	4.00
PROD	LATIMER	25	0.800	2.0	0	0.00	1.00	2.00
PROD	LINCOLN	5	4.400	20.0	0	0.00	1.00	10.50
PROD	LOVE	8	5.000	23.0	0	0.00	1.00	9.25
PROD	MCCLAIN	37	119.784	2140.0	0	0.00	1.00	60.00
PROD	POTTAWATOMIE	50	45.300	1190.0	0	0.00	1.00	12.00
PROD	UNREPORTED	1	1.000	1.0	1	1.00	1.00	1.00
PROD	HASKELL	149	2.020	16.0	0	1.00	2.00	3.00
PROD	KAY	74	85.365	685.0	0	0.00	2.00	114.25
PROD	TULSA	12	179.583	986.0	0	0.00	2.00	85.75
PROD	WASHITA	23	1.783	9.0	0	0.00	2.00	2.00
PROD	CREEK	285	100.926	2790.0	0	0.00	3.00	46.50
PROD	OKMULGEE	31	228.774	3786.0	0	0.00	3.00	137.00
PROD	OSAGE	115	87.113	3391.0	0	1.00	4.00	32.00
PROD	SEMINOLE	126	63.944	888.0	0	1.00	4.00	45.45
PROD	HUGHES	4	8.750	19.0	5	5.00	5.50	15.75

# Appendix 3

## Statistical Data on Background by County (Micro-Rems/Hr) Oklahoma

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
HUGHES	4	5.0000	5.0	5.0	5.0	5.0	5.00
UNREPORTED	1	5.0000	5.0	5.0	5.0	5.0	5.00
WASHITA	24	5.0000	5.0	5.0	5.0	5.0	5.00
LOVE	8	5.7500	7.0	5.0	5.0	5.5	6.75
BECKHAM	31	6.2903	7.0	6.0	6.0	6.0	7.00
CARTER	391	7.0066	15.0	3.2	5.0	6.0	9.00
CUSTER	86	5.2605	10.0	1.4	5.0	6.0	6.00
ELLIS	13	6.8462	9.0	6.0	6.0	6.0	8.00
LINCOLN	5	6.0000	6.0	6.0	6.0	6.0	6.00
MAJOR	102	7.1520	14.0	4.0	5.0	6.0	9.00
TEXAS	27	7.3556	14.0	5.6	5.6	6.5	6.80
CADDO	75	7.5600	13.0	4.0	6.0	7.0	9.00
CANADIAN	146	7.2329	14.0	3.0	6.0	7.0	8.00
COAL	8	7.0000	7.0	7.0	7.0	7.0	7.00
GRADY	138	7.2971	10.0	2.9	5.0	7.0	10.00
MURRAY	84	6.5000	10.0	5.0	6.0	7.0	7.00
PONTOTOC	31	6.7419	13.0	4.0	4.0	7.0	10.00
ALFALFA	121	7.5455	11.0	5.0	7.0	8.0	8.00
BLAINE	203	8.2246	14.0	2.4	6.0	8.0	10.50
CLEVELAND	103	7.5534	11.0	2.0	7.0	8.0	9.00
GARVIN	158	7.8241	15.0	3.0	6.0	8.0	9.00
NOBLE	9	8.0000	10.0	7.0	7.5	8.0	8.00
OKMULGEE	31	8.8387	14.0	4.0	5.0	8.0	13.00
OSAGE	115	7.6522	15.0	5.0	6.0	8.0	9.00
POTTAWATOMIE	50	7.6800	12.0	5.0	7.0	8.0	8.00
SEMINOLE	126	7.9190	16.0	4.0	5.0	8.0	9.00
COMANCHE	12	9.0000	9.0	9.0	9.0	9.0	9.00
CREEK	206	9.6853	17.0	4.0	8.0	9.0	11.00
HARPER	15	9.3333	12.5	7.5	7.5	9.0	10.00
LATIMER	27	9.0296	14.0	4.4	9.0	9.0	10.00
STEPHENS	371	9.2550	25.0	3.0	5.0	9.0	15.00
GRANT	2	10.0000	10.0	10.0	10.0	10.0	10.00
HASKELL	193	9.8549	12.0	9.0	9.0	10.0	10.00
KINGFISHER	556	9.3201	13.0	5.0	8.0	10.0	10.00
MCCLAIN	37	9.4324	10.0	6.0	9.0	10.0	10.00
PITTSBURG	50	8.6800	10.0	5.0	7.0	10.0	10.00
BEAVER	181	10.5856	12.0	8.0	10.0	11.0	11.00
DEWEY	79	9.7595	13.0	5.2	9.0	11.0	11.00
OKLAHOMA	48	10.5625	12.0	9.0	9.0	11.0	11.00
TULSA	12	10.8333	14.0	5.0	7.5	11.0	14.00
WOODS	4	11.2500	12.0	11.0	11.0	11.0	11.75
GARFIELD	22	11.7727	14.0	10.0	10.0	11.5	13.25
WOODWARD	51	11.8627	12.5	8.0	12.5	12.5	12.50
KAY	74	13.2162	18.0	1.0	10.0	15.0	15.25
PAYNE	18	15.0000	15.0	15.0	15.0	15.0	15.00



# SUMMARY

(Texas)

## I. All significant differences were equipment specific.

The equipment with the most pronounced differences over background based on Median ranking are listed below in descending order. The difference is the excess of the reading over background:

Equipment	Median Difference	75 <sup>th</sup> Percentile
1. Reflux Pumps (GP)	65 $\mu$ R/hr	295.0 $\mu$ R/hr
2. Propane Pumps (GP)	31	89.5

II. The 123 counties in the survey had background levels ranging from very low (0.3) in Brazoria county to high (13) in Jack county. The detailed listing is given in Table 3 and Appendix 3.

## III. Overall Summary

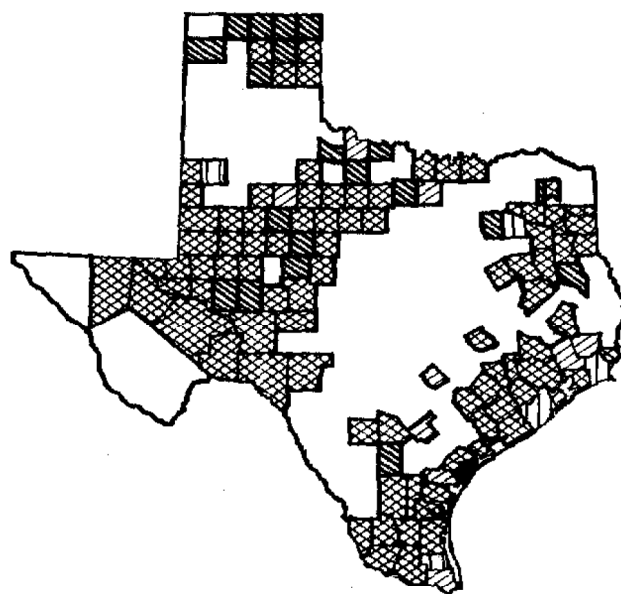
ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
1. Statewide					
a. Background	15,138	6.0	8.0	10.0	60
b. Max Reading	15,138	8.0	12.0	32.0	4,130
c. Difference	15,138	0.0	4.0	25.0	4,120
2. Facility					
a. Background					
Gas Processing	1496	5.0	7.0	10.0	15
Production	13642	7.0	8.0	10.0	60
b. Max Reading					
Gas Processing	1496	7.0	15.0	70.0	3,000
Production	13642	8.0	12.0	30.0	4,130
c. Difference					
Gas Processing	1496	0.0	6.0	65.0	2,985
Production	13642	0.0	3.0	22.0	4,120

NOTES: 1) All data are measured in micro-rem/hr

2) The apparent differences between facilities are due to the specific items of equipment listed in Section I above.

# FIGURE 1 — MEDIAN BACKGROUND LEVELS

TEXAS



MICRO-REMS/HR

NO DATA  
5.0 - 9.0

0 - 2.33  
9.01 - 14.0

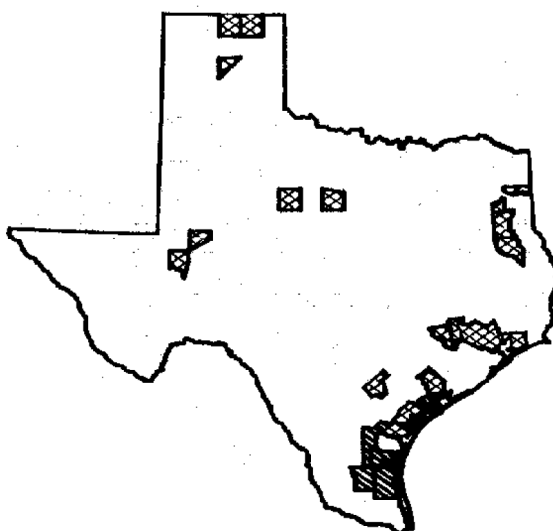
2.34 - 4.99  
OVER 14.0

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

## FIGURE 2 - DIFFERENCE OVER BACKGROUND

### TEXAS

**GAS PROCESSING FACILITIES  
(COUNTIES WITH 2 MICRO-REMS/HR OR MORE)**



MICRO-REMS/HR



NO DATA  
2 - 33



BELOW .8  
33.01 - 245



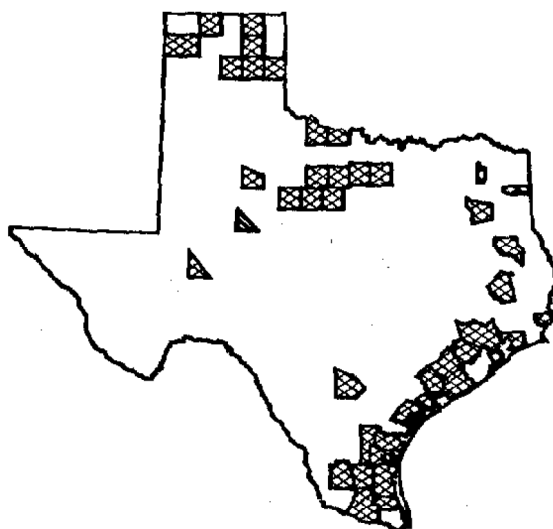
.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 3 - DIFFERENCE OVER BACKGROUND

## TEXAS

PRODUCTION FACILITIES  
(COUNTIES WITH 2 MICRO-REMS/HR OR MORE)



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

.8 - 1.99

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas

FACILITY: Gas Processing

Obsns	Equipment		Median Difference	75 <sup>th</sup> Percentile
176	COMPRESSOR		0.0	0.0
33	CRYO UNIT		0.0	2.0
104	DEHYDRATOR		0.0	2.0
128	FRAC TOWER		0.0	3.8
220	INLET SCRUBBER		0.0	1.0
37	METER		0.0	4.3
112	OTANK		0.0	13.2
79	REFRIGERATION		0.0	3.0
128	SWEETENER		0.0	0.0
185	OTHER	*	1.0	10.5
102	OPUMP	****	7.8	70.8
14	BOTTOMS PUMP	*****	10.5	23.0
26	PTANK	*****	11.5	26.5
52	PRODUCT LINE	*****	12.5	58.8
42	PPUMP	*****	31.0	89.5
67	REFLUX PUMP	*****	65.0	295.0
-----+-----+-----+-----+-----+-----				
1496			10 20 30 40 50 60	
			Median of Difference Over Background	

FACILITY: Production

1109	FLINE		0.0	0.0
1137	MANIFOLD		0.0	1.0
55	METER		0.0	3.0
800	OTHER		0.0	2.0
646	PUMP		0.0	1.0
3513	SEP		0.0	6.0
2890	STANK		0.0	2.0
132	SUMP		0.0	2.0
58	VRU		0.0	0.0
44	WINJ		0.0	10.0
2	WOTHER		0.0	0.0
651	WPROD		0.0	1.0
994	H/T	*	1.0	6.0
81	WLINE	*	2.0	50.0
1530	WTANK	**	3.0	12.0
-----+-----+-----+-----+-----+-----				
13642			10 20 30 40 50 60	
			Median of Difference Over Background	

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

**FACILITY:** Gas Processing

-----+-----+-----+-----+-----+-----+-----+-----+-----+  
 20 40 60 80 100 120 140  
 Median of Difference Over Background

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

**FACILITY:** Gas Processing.

Median of Difference Over Background

Table 2 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas

FACILITY: Production

Obsns County	Median Difference	75 <sup>th</sup> Percentile
34 ANDERSON	0.0	1.0
1101 ANDREWS	0.0	1.0
45 AUSTIN	0.0	3.0
63 BORDEN	0.0	0.0
73 BRAZORIA	0.0	0.0
36 BURLESON	0.0	1.8
173 CALDWELL	0.0	0.4
88 COCHRAN	0.0	0.0
176 COKE	0.0	5.0
45 COLORADO	0.0	0.0
56 COOKE	0.0	4.8
265 CRANE	0.0	3.0
278 CROCKETT	0.0	1.3
111 CULBERSON	0.0	0.0
118 DAWSON	0.0	0.0
18 DUVAL	0.0	13.0
502 ECTOR	0.0	3.6
13 EDWARDS	0.0	0.0
181 FISHER	0.0	1.0
53 FOARD	0.0	0.0
31 FRIO	0.0	0.0
297 GAINES	0.0	4.5
19 GARZA	0.0	0.0
342 GLASSCOCK	0.0	0.0
195 GRAYSON	0.0	21.0
937 GREGG	0.0	2.0
101 HARDIN	0.0	3.2
25 HARRISON	0.0	2.0
24 HASKELL	0.0	0.8

20 40 60 80 100 120 140 160 180 200

Median of Difference Over Background



Table 2 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas

FACILITY: Production

Obsns	County	Median Difference	75 <sup>th</sup> Percentile
22	HEMPHILL	0.0	0.0
107	HOCKLEY	0.0	0.0
413	HOWARD	0.0	2.0
40	IRION	0.0	11.0
79	JEFFERSON	0.0	2.2
62	KING	0.0	0.0
211	LAVACA	0.0	0.0
40	LIBERTY	0.0	0.0
28	LIPSCOMB	0.0	1.0
99	LOVING	0.0	1.0
44	MARTIN	0.0	0.0
45	MCMULLEN	0.0	0.0
149	MIDLAND	0.0	11.0
204	MONTAGUE	0.0	3.0
14	NOLAN	0.0	10.0
309	PECOS	0.0	13.0
3	RAINS	0.0	0.0
88	REAGAN	0.0	7.0
98	REEVES	0.0	2.0
21	RUNNELS	0.0	0.0
291	RUSK	0.0	0.0
13	SAN PATRICIO	0.0	0.4
21	SCHLEICHER	0.0	0.0
52	SCURRY	0.0	0.0
17	STARR	0.0	18.5
121	STONEWALL	0.0	1.0
13	TAYLOR	0.0	3.0
3	TERRELL	0.0	0.0
61	TITUS	0.0	0.0
14	TOM GREEN	0.0	9.3
300	UNREPORTED	0.0	3.0
12	UPSHUR	0.0	0.0
15	VAL VERDE	0.0	0.0
11	VAN ZANDT	0.0	1.0
44	WALLER	0.0	5.0
243	WARD	0.0	6.0

20 40 60 80 100 120 140 160 180  
Median of Difference Over Background

Table 2 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

- Texas

FACILITY: Production

Obsns County		Median Difference	75 <sup>th</sup> Percentile
126 WINKLER		0.0	6.0
245 WOOD		0.0	3.0
1201 YOAKUM		0.0	0.0
14 ZAPATA		0.0	0.0
24 HOUSTON		0.5	1.0
34 BAYLOR		1.0	26.0
63 CHEROKEE		1.0	2.0
51 FREESTONE		1.0	4.0
238 HANSFORD		1.0	3.0
101 HUTCHINSON		1.0	9.0
11 KARNES		1.0	16.6
163 MONTGOMERY		1.0	6.6
130 PANOLA		1.0	5.0
197 FRANKLIN		2.0	10.0
87 HARRIS		2.0	8.0
23 HARTLEY		2.0	2.0
33 MARION		2.0	18.5
94 OCHILTREE		2.0	3.0
46 SHACKLEFORD		2.0	7.3
2 SHERMAN		2.0	2.0
31 WICHITA		2.0	67.0
39 WISE		2.0	4.0
45 JACKSON	*	3.0	5.0
223 ROBERTS	*	3.0	26.0
314 GRAY	*	4.0	14.0
3 ORANGE	*	4.0	7.0
25 SMITH	*	4.0	43.0
149 UPTON	*	4.0	28.5
35 WHEELER	*	4.0	8.0
102 WILLACY	*	4.1	25.2
32 CARSON	*	4.5	9.8
32 GALVESTON	*	5.0	31.6
97 JACK	*	5.0	56.0
39 NACOGDOCHES	*	6.0	50.0
5 WHARTON	*	6.0	17.5
170 CHAMBERS	*	6.1	25.3

20 40 60 80 100 120 140 160 180 200  
Median of Difference Over Background

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

**FACILITY:** Production

-186-

Table 3  
Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas

Obs	County		75th	
			Median	Percentile
93	BRAZORIA	*	0.30	5.0
147	HOCKLEY	*	0.40	5.0
79	JEFFERSON	*	0.70	0.8
102	WILLACY	**	0.90	6.0
77	VAN ZANDT	****	2.00	2.0
10	CAMERON	*****	2.90	2.9
173	CALDWELL	*****	3.90	4.2
14	KARNES	*****	3.95	5.0
33	GALVESTON	*****	4.00	6.0
104	HARDIN	*****	4.00	4.9
39	WISE	*****	4.00	5.0
47	LIBERTY	*****	4.50	5.5
15	SAN PATRICIO	*****	4.50	4.5
5	KENT	*****	4.80	5.8
3	WILBARGER	*****	4.80	4.8
95	BROOKS	*****	5.00	5.0
182	CHAMBERS	*****	5.00	6.0
13	EDWARDS	*****	5.00	5.0
114	HARRIS	*****	5.00	6.0
40	IRION	*****	5.00	5.0
63	JACKSON	*****	5.00	6.0
89	KENEDY	*****	5.00	5.0
95	KLEBERG	*****	5.00	7.0
183	MONTGOMERY	*****	5.00	5.0
33	NUECES	*****	5.00	5.0
9	POLK	*****	5.00	6.0
14	TOM GREEN	*****	5.00	5.3
159	WINKLER	*****	5.00	6.0
1330	YOAKUM	*****	5.00	5.0
26	ZAPATA	*****	5.00	5.0
61	TITUS	*****	5.20	5.2
32	JIM WELLS	*****	5.50	6.0
1204	ANDREWS	*****	6.00	7.0
36	BURLESON	*****	6.00	6.5
195	COLORADO	*****	6.00	6.0
292	CRANE	*****	6.00	8.0

-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+  
2    4    6    8    10    12    14    16    18    20  
Median of Background Level

Table 3 (Continued)

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

## Texas

Obs	County		Median	75 <sup>th</sup> Percentile
391	CROCKETT	*****	6.00	7.0
119	DAWSON	*****	6.00	7.0
568	ECTOR	*****	6.00	7.0
58	FREESTONE	*****	6.00	7.0
31	FRIO	*****	6.00	6.0
297	GAINES	*****	6.00	6.0
134	HIDALGO	*****	6.00	6.0
12	JONES	*****	6.00	6.0
190	LOVING	*****	6.00	7.0
17	STARR	*****	6.00	6.0
3	TERRELL	*****	6.00	6.0
65	THROCKMORTON	*****	6.00	7.0
366	UNREPORTED	*****	6.00	7.0
15	VAL VERDE	*****	6.00	7.0
75	WALLER	*****	6.00	9.0
5	WHARTON	*****	6.00	6.5
35	WHEELER	*****	6.00	6.0
72	FORT BEND	*****	6.50	8.0
245	LAVACA	*****	6.50	6.5
344	RUSK	*****	6.80	8.0
13	ATASCOSA	*****	7.00	8.0
89	COCHRAN	*****	7.00	8.0
116	CULBERSON	*****	7.00	8.0
18	DUVAL	*****	7.00	7.0
24	HASKELL	*****	7.00	7.8
424	HOWARD	*****	7.00	8.0
56	MARTIN	*****	7.00	8.8
19	MATAGORDA	*****	7.00	8.0
103	REEVES	*****	7.00	8.0
6	REFUGIO	*****	7.00	7.0
84	SHACKLEFORD	*****	7.00	8.0
57	STEPHENS	*****	7.00	10.0
12	UPSHUR	*****	7.00	8.0
262	WARD	*****	7.00	8.0
340	WOOD	*****	7.00	8.0
76	YOUNG	*****	7.00	7.0
68	BORDEN	*****	8.00	9.0

-----+-----+-----+-----+-----+-----+-----+-----+-----+  
 2 4 6 8 10 12 14 16 18 20  
 Median of Background Level

Table 3 (Continued)

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

## Texas

Obs	County		Median	75 <sup>th</sup> Percentile
80	CHEROKEE	*****	8.00	9.0
56	COOKE	*****	8.00	8.8
181	FISHER	*****	8.00	9.0
19	GARZA	*****	8.00	8.0
327	GRAY	*****	8.00	9.0
947	GREGG	*****	8.00	9.0
22	HEMPHILL	*****	8.00	9.0
24	HOUSTON	*****	8.00	8.0
1	JIM HOGG	*****	8.00	8.0
62	KING	*****	8.00	8.3
35	MARION	*****	8.00	10.0
150	MIDLAND	*****	8.00	9.0
4	MITCHELL	*****	8.00	12.5
209	MONTAGUE	*****	8.00	10.0
9	ORANGE	*****	8.00	8.0
318	PECOS	*****	8.00	9.0
3	RAINS	*****	8.00	9.0
21	RUNNELS	*****	8.00	8.0
21	SCHLEICHER	*****	8.00	10.0
121	STONEWALL	*****	8.00	9.0
13	TAYLOR	*****	8.00	8.0
46	AUSTIN	*****	8.50	9.0
38	ANDERSON	*****	9.00	9.0
9	CALHOUN	*****	9.00	9.0
342	GLASSCOCK	*****	9.00	10.0
223	GRAYSON	*****	9.00	10.0
35	HARRISON	*****	9.00	14.0
101	HUTCHINSON	*****	9.00	9.0
132	PANOLA	*****	9.00	10.0
33	SMITH	*****	9.00	9.0
34	BAYLOR	*****	10.00	14.0
177	COKE	*****	10.00	10.0
53	FOARD	*****	10.00	10.0
197	FRANKLIN	*****	10.00	10.0
13	KAUFMAN	*****	10.00	10.0
45	MCMULLEN	*****	10.00	10.0
44	NACOGDOCHES	*****	10.00	13.0

2 4 6 8 10 12 14 16 18  
Median of Background Level

Table 3 (Continued)

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas

Obs	County		Median	75 <sup>th</sup> Percentile
14	NOLAN	*****	10.00	10.0
91	REAGAN	*****	10.00	10.0
223	ROBERTS	*****	10.00	13.0
52	SCURRY	*****	10.00	10.0
150	UPTON	*****	10.00	11.0
32	WICHITA	*****	10.00	13.8
61	CARSON	*****	11.00	15.0
278	HANSFORD	*****	11.00	12.0
23	HARTLEY	*****	11.00	11.0
28	LIPSCOMB	*****	12.00	14.3
104	OCHILTREE	*****	12.00	12.0
5	SHERMAN	*****	12.00	12.5
97	JACK	*****	13.00	16.0
-----+-----+-----+-----+-----+-----+-----+-----+-----				
		2 4 6 8 10 12 14 16 18		
		Median of Background Level		

## SUMMARY

(Texas Regional Break-out)

### I. Regional Breakouts

The counties surveyed in Texas were grouped into three regions based upon their tendency to have similar radiation properties and their geographical proximity. These regions are the coastal crescent, the northern crescent and the central/western areas. Figure 1 shows the groupings and Figures 2-7 show the county details by facility. Background data and maps can be found in the Texas report on the combined counties.

### II. Equipment Readings By Region.

The equipment with the most pronounced differences over background based on Median ranking are listed below in descending order. The difference is the excess of the reading over background:

Equipment		Median Difference	75 <sup>th</sup> Percentile
Coastal Region			
1. Reflux Pumps	(GP)	145 $\mu$ R/hr	295.0 $\mu$ R/hr
2. Bottoms Pump	(GP)	77	125.5
3. Other Pumps	(GP)	45.0	145.0
4. Flow Line	(PROD)	45.5	114.8
Northern Region			
1. Water Line	(PROD)	40.0	160.0
2. Reflux Pumps	(GP)	30.5	154.3
Western Region			
1. Product Line	(GP)	80.0	180.0
2. Propane Pump	(GP)	61.0	79.5

### III. Overall Summary By Region

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
1. Background					
a. Coastal Region	2567	5.0	6.0	7.0	25.8
b. Northern Region	4927	8.0	10.0	12.0	25.0
c. Western Region	7278	6.0	8.0	9.0	23.0



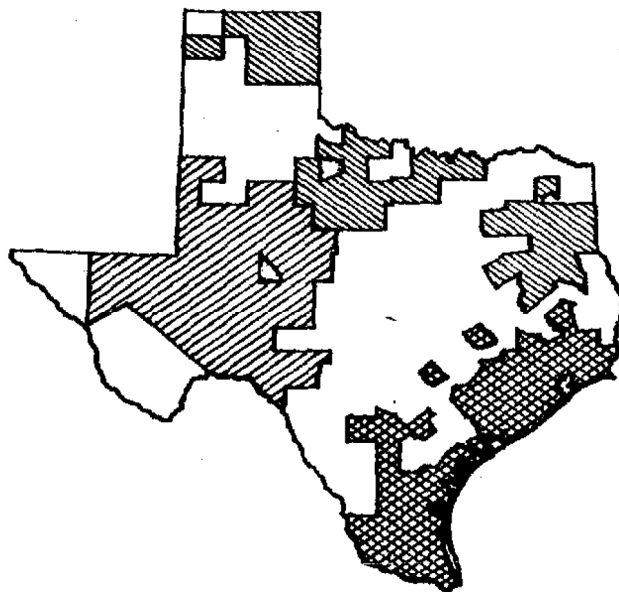
SUMMARY (Continued)  
(Texas Regional Break-out)

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
2. Difference Over Background - Gas Processing Facilities					
a. Coastal Region	449	0.0	42.0	145.0	2495.0
b. Northern Region	492	1.0	4.0	32.4	2985.0
c. Western Region	497	0.0	1.0	16.0	820.0
3. Difference Over Background - Production Facilities					
a. Coastal Region	2118	1.0	16.0	74.2	3496.0
b. Northern Region	4435	1.0	4.0	25.0	3785.0
c. Western Region	6781	0.0	1.0	10.0	4120.0
c. Difference					

NOTES: All data are measured in micro-rem/hr

# FIGURE 1 — REGIONAL GROUPING OF DATA

TEXAS



REGIONS



NO DATA  
COASTAL



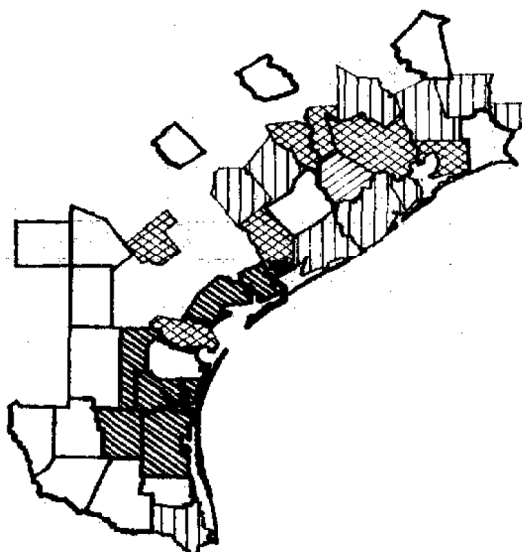
CENTRAL/WESTERN  
NORTHERN

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## FIGURE 2 — DIFFERENCE OVER BACKGROUND

### TEXAS COASTAL CRESCENT

#### GAS PROCESSING FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

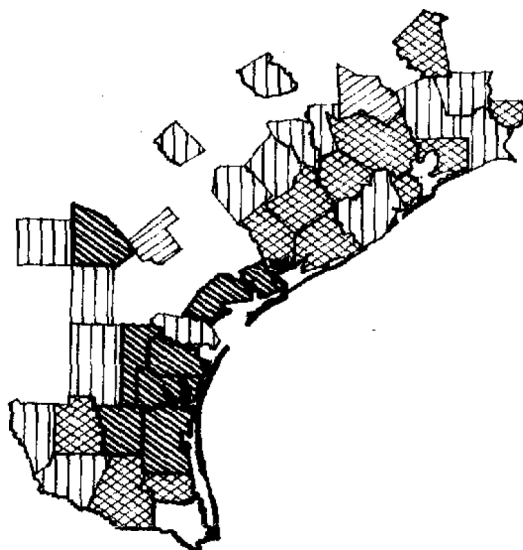
.8 - 1.99  
OVER 245

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# FIGURE 3 — DIFFERENCE OVER BACKGROUND

TEXAS COASTAL CRESCENT

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

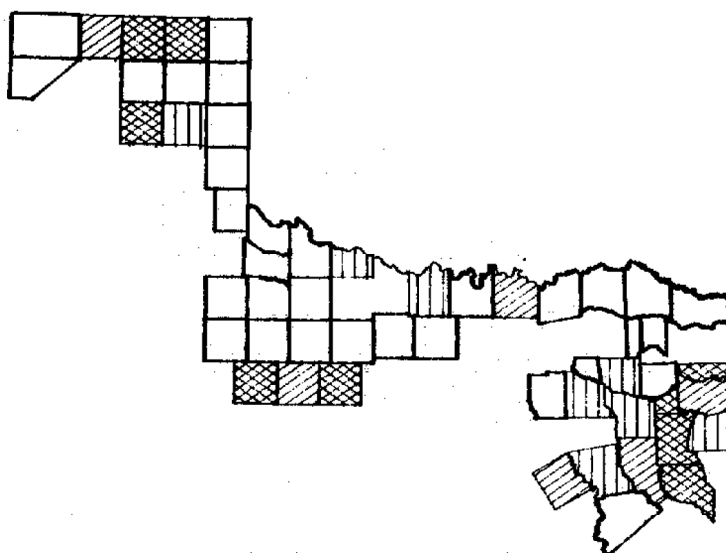
.8 - 1.99  
OVER 245

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 4 — DIFFERENCE OVER BACKGROUND

TEXAS NORTHERN CRESCENT

GAS PROCESSING FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

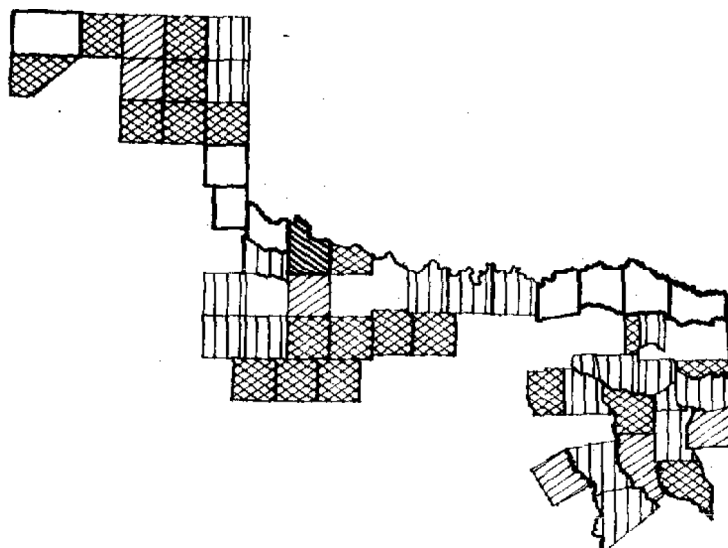
.8 - 1.99  
OVER 245

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 5 – DIFFERENCE OVER BACKGROUND

TEXAS NORTHERN CRESCENT

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

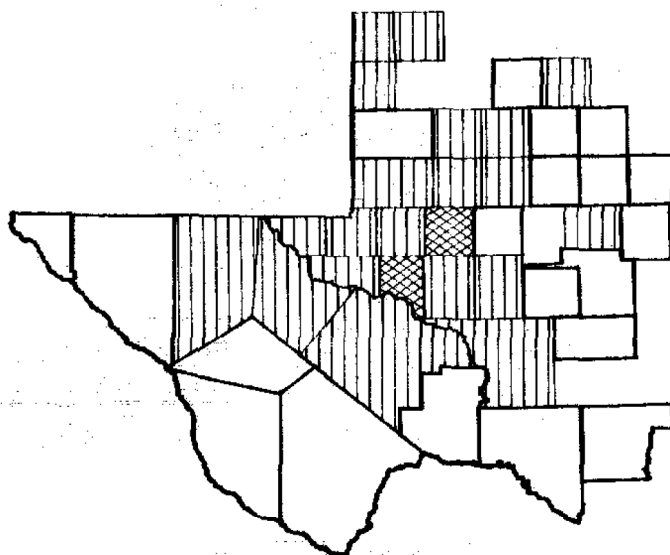
.8 - 1.99  
OVER 245

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 6 — DIFFERENCE OVER BACKGROUND

TEXAS CENTRAL AND WESTERN REGION

GAS PROCESSING FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

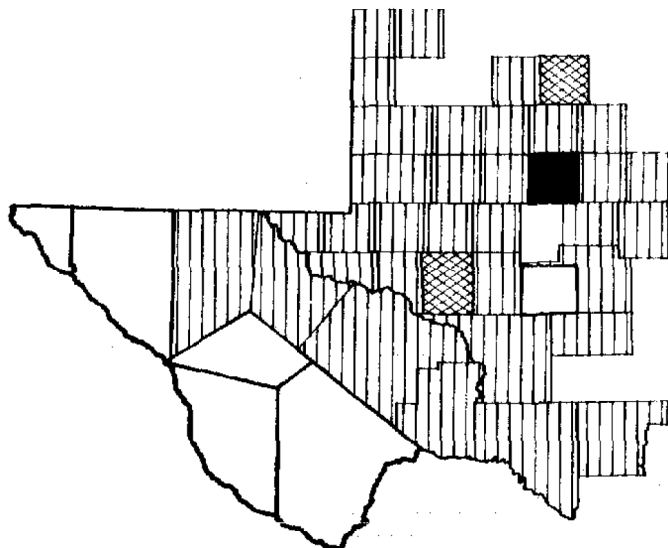
.8 - 1.99  
OVER 245

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 7 — DIFFERENCE OVER BACKGROUND

TEXAS CENTRAL AND WESTERN REGION

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

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NATURALLY OCCURRING RADIOACTIVITY SURVEY



Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

FACILITY: Gas Processing

**FACILITY:** Production

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Table 5

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas Northern Crescent

FACILITY: Gas Processing

Obsns	Equipment	Median Difference	75 <sup>th</sup> Percentile
60	COMPRESSOR	0.0	2.0
41	FRAC TOWER	0.0	0.2
108	INLET SCRUBBER	0.0	1.0
7	METER	0.0	90.0
18	REFRIGERATION	0.0	3.0
28	SWEETENER	0.0	0.0
15	CRYO UNIT	1.0	2.0
45	DEHYDRATOR	2.0	3.0
24	OTANK	2.0	16.8
58	OTHER	3.0	7.5
10	BOTTOMS PUMP	3.5	18.8
34	OPUMP	4.5	41.3
7	PPUMP	5.0	48.0
11	PTANK	9.0	31.0
10	PRODUCT LINE	12.0	35.0
16	REFLUX PUMP	38.5	154.3
492			
		10 20 30 40 50	
	Median of Difference over Background		

FACILITY: Production

310	MANIFOLD	0.0	1.0
2	METER	0.0	0.0
199	OTHER	0.0	2.0
321	PUMP	0.0	2.0
922	STANK	0.0	2.0
17	SUMP	0.0	1.5
3	VRU	0.0	0.0
313	WPROD	0.0	2.0
1072	SEP	1.0	4.0
379	H/T	2.0	10.0
20	FLINE	3.0	59.0
836	WTANK	4.0	14.0
13	WINJ	5.0	50.0
28	WLINE	40.0	168.0
4435			
		10 20 30 40 50	
	Median of Difference over Background		

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

FACILITY: Gas Processing

MEDIAN OF DIFF

Device	Median of Difference over Background	Standard Deviation	Mean
886 FLINE	0.0	0.0	0.0
503 H/T	0.0	5.0	0.0
609 MANIFOLD	0.0	0.0	0.0
14 METER	0.0	0.0	0.0
483 OTHER	0.0	1.0	0.0
233 PUMP	0.0	0.0	0.0
1711 SEP	0.0	5.0	0.0
1544 STANK	0.0	1.7	0.0
92 SUMP	0.0	0.8	0.0
51 VRU	0.0	0.0	0.0
21 WINJ	0.0	8.9	0.0
20 WLINE	0.0	1.7	0.0
179 WPROD	0.0	0.0	0.0
435 WTANK	1.0	9.0	0.0
6781	0.0	0.0	0.0

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

FACILITY: Gas Processing

Median of Difference over Background

Table 7 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas Coastal Crescent

FACILITY: Production

Obsns County		Median Difference	75 <sup>th</sup> Percentile
45	AUSTIN	0.0	3.0
72	BRAZORIA	0.0	0.0
36	BURLESON	0.0	1.8
173	CALDWELL	0.0	0.4
45	COLORADO	0.0	0.0
18	DUVAL	0.0	13.0
31	FRIO	0.0	0.0
101	HARDIN	0.0	3.2
79	JEFFERSON	0.0	2.2
211	LAVACA	0.0	0.0
40	LIBERTY	0.0	0.8
45	MCMULLEN	0.0	0.0
13	SAN PATRICIO	0.0	0.4
17	STARR	0.0	18.5
44	WALLER	0.0	5.0
14	ZAPATA	0.0	0.0
11	KARNES	1.0	16.5
163	MONTGOMERY	1.0	6.0
87	HARRIS	2.0	8.0
45	JACKSON	3.0	5.0
3	ORANGE	4.0	7.0
102	WILLACY	4.1	25.2
32	GALVESTON	5.0	31.6
5	WHARTON	6.0	17.5
170	CHAMBERS	6.1	25.3
17	MATAGORDA	7.0	50.0
9	POLK	7.0	15.0
65	FORT BEND	12.0	67.0
134	HIDALGO	12.5	54.0
1	JIM HOGG	15.0	15.0
2	REFUGIO	44.5	46.0
86	BROOKS	47.0	86.0
33	NUECES	55.0	85.0
26	JIM WELLS	60.0	106.5
86	KENEDY	65.0	173.8
39	KLEBERG	76.0	142.0
13	ATASCOSA	78.0	107.5
5	CALHOUN	91.0	266.0

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Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

FACILITY: Gas Processing

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Table 8 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas Northern Crescent

FACILITY: Production

Obsns	County	Median Difference	75 <sup>th</sup> Percentile
34	ANDERSON	0.00	1.0
56	COOKE	0.00	4.8
53	FOARD	0.00	0.0
195	GRAYSON	0.00	21.0
937	GREGG	0.00	2.0
25	HARRISON	0.00	2.0
24	HASKELL	0.00	0.8
22	HEMPHILL	0.00	0.0
62	KING	0.00	0.0
28	LIPSCOMB	0.00	1.0
204	MONTAGUE	0.00	3.0
3	RAINS	0.00	0.0
291	RUSK	0.00	0.0
121	STONEWALL	0.00	1.0
61	TITUS	0.00	0.0
12	UPSHUR	0.00	0.0
11	VAN ZANDT	0.00	1.0
245	WOOD	0.00	3.0
24	HOUSTON	0.50	1.0
34	BAYLOR	1.00	26.0
63	CHEROKEE	1.00	2.0
51	FREESTONE	1.00	4.0
238	HANSFORD	1.00	3.0
101	HUTCHINSON	1.00	9.0
130	PANOLA	1.00	5.0
197	FRANKLIN	2.00	10.0
23	HARTLEY	2.00	2.0
33	MARION	2.00	18.5
94	OCHILTREE	2.00	3.0
46	SHACKLEFORD	2.00	7.3
2	SHERMAN	2.00	2.0
31	WICHITA	2.00	67.0
39	WISE	2.00	4.0

-----+-----+-----+-----+-----+-----+-----  
10 20 30 40 50 60  
Median of Difference over Background

Table 8 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas Northern Crescent

FACILITY: Production

Obsns County			Median Difference	75 <sup>th</sup> Percentile
223	ROBERTS	**	3.00	26.0
314	GRAY	**	4.00	14.0
25	SMITH	**	4.00	43.0
35	WHEELER	**	4.00	8.0
32	CARSON	**	4.50	9.8
97	JACK	***	5.00	56.0
39	NACOGDOCHES	***	6.00	50.0
65	THROCKMORTON	****	8.00	29.5
76	YOUNG	****	8.00	43.3
11	JONES	*****	9.00	94.0
13	KAUFMAN	*****	33.00	45.0
12	STEPHENS	*****	35.00	82.5
3	WILBARGER	***** / *****	92.00	253.3
-----+-----+-----+-----+-----+ / +-----+-----				
10 20 30 40 50 60 70 80 90				

Median of Difference over Background



Table 9

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas Central/Western Region

FACILITY: Gas Processing

Obsns	County	Median Difference	75 <sup>th</sup> Percentile
103	ANDREWS	0.0	0.0
5	BORDEN	0.0	0.0
1	COCHRAN	0.0	0.0
1	COKE	0.0	0.0
23	CROCKETT	0.0	14.0
5	CULBERSON	0.0	0.5
1	DAWSON	0.0	0.0
66	ECTOR	0.0	2.5
40	HOCKLEY	0.0	0.2
11	HOWARD	0.0	0.0
1	KENT	0.0	0.0
1	LOVING	0.0	0.0
12	MARTIN	0.0	0.0
9	PECOS	0.0	0.0
3	REAGAN	0.0	0.0
5	REEVES	0.0	2.5
1	UPTON	0.0	0.0
19	WARD	0.0	73.0
33	WINKLER	0.0	0.0
129	YOAKUM	0.0	9.0
27	CRANE	3.0	69.0
1	MIDLAND	8.7	8.7

-----+-----+-----+-----+-----+-----+-----+-----+-----+  
2 4 6 8 10 12 14 16 18 20  
Median of Difference over Background

Table 9 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas Central/Western Region

FACILITY: Production

Obsns County	Median Difference	75 <sup>th</sup> Percentile
1101 ANDREWS	0.0	1.0
63 BORDEN	0.0	0.0
88 COCHRAN	0.0	0.0
176 COKE	0.0	5.0
265 CRANE	0.0	3.0
278 CROCKETT	0.0	1.3
111 CULBERSON	0.0	0.0
118 DAWSON	0.0	0.0
502 ECTOR	0.0	3.6
13 EDWARDS	0.0	0.0
181 FISHER	0.0	1.0
297 GAINES	0.0	4.5
19 GARZA	0.0	0.0
342 GLASSCOCK	0.0	0.0
107 HOCKLEY	0.0	0.0
413 HOWARD	0.0	2.0
40 IRION	0.0	11.0
99 LOVING	0.0	1.0
44 MARTIN	0.0	0.0
149 MIDLAND	0.0	11.0
14 NOLAN	0.0	10.0
309 PECOS	0.0	13.0
88 REAGAN	0.0	7.0
98 REEVES	0.0	0.0
21 RUNNELS	0.0	0.0
21 SCHLEICHER	0.0	0.0
52 SCURRY	0.0	0.0
13 TAYLOR	0.0	3.0
3 TERRELL	0.0	0.0
14 TOM GREEN	0.0	9.3
15 VAL VERDE	0.0	0.0
243 WARD	0.0	6.0
126 WINKLER	0.0	6.0
1201 YOAKUM	0.0	0.0
149 UPTON	4.0	28.5
4 KENT	6.5	21.4
4 MITCHELL	252.0	267.0

Median of Difference over Background

Table 10

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

## Texas Coastal Crescent

Obs	County		75 <sup>th</sup>	
			Median	Percentile
93	BRAZORIA	*	0.30	5.0
79	JEFFERSON	*	0.70	0.8
102	WILLACY	**	0.90	6.0
10	CAMERON	*****	2.90	2.9
173	CALDWELL	*****	3.90	4.2
14	KARNES	*****	3.95	5.0
33	GALVESTON	*****	4.00	6.0
104	HARDIN	*****	4.00	4.9
47	LIBERTY	*****	4.50	5.5
15	SAN PATRICIO	*****	4.50	4.5
95	BROOKS	*****	5.00	5.0
182	CHAMBERS	*****	5.00	6.0
114	HARRIS	*****	5.00	6.0
63	JACKSON	*****	5.00	6.0
89	KENEDY	*****	5.00	5.0
95	KLEBERG	*****	5.00	7.0
183	MONTGOMERY	*****	5.00	5.0
33	NUECES	*****	5.00	5.0
9	POLK	*****	5.00	6.0
26	ZAPATA	*****	5.00	5.0
32	JIM WELLS	*****	5.50	6.0
36	BURLESON	*****	6.00	6.5
195	COLORADO	*****	6.00	6.0
31	FRIO	*****	6.00	6.0
134	HIDALGO	*****	6.00	6.0
17	STARR	*****	6.00	6.0
75	WALLER	*****	6.00	9.0
5	WHARTON	*****	6.00	6.5
72	FORT BEND	*****	6.50	8.0
245	LAVACA	*****	6.50	6.5
13	ATASCOSA	*****	7.00	8.0
18	DUVAL	*****	7.00	7.0
19	MATAGORDA	*****	7.00	8.0
6	REFUGIO	*****	7.00	7.0
1	JIM HOGG	*****	8.00	8.0
9	ORANGE	*****	8.00	8.0
46	AUSTIN	*****	8.50	9.0
9	CALHOUN	*****	9.00	9.0
45	MCMULLEN	*****	10.00	10.0

2 4 6 8 10 12 14 16

Median of Background Reading

Table 11

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Texas Northern Crescent

Obs	County		Median	75 <sup>th</sup> Percentile
77	VAN ZANDT	****	2.00	2.0
39	WISE	*****	4.00	5.0
3	WILBARGER	*****	4.80	4.8
61	TITUS	*****	5.20	5.5
58	FREESTONE	*****	6.00	7.0
12	JONES	*****	6.00	6.0
65	THROCKMORTON	*****	6.00	7.0
35	WHEELER	*****	6.00	6.0
344	RUSK	*****	6.80	8.0
24	HASKELL	*****	7.00	7.8
84	SHACKLEFORD	*****	7.00	8.0
57	STEPHENS	*****	7.00	10.0
12	UPSHUR	*****	7.00	8.0
340	WOOD	*****	7.00	8.0
76	YOUNG	*****	7.00	7.0
80	CHEROKEE	*****	8.00	9.0
56	COOKE	*****	8.00	8.8
327	GRAY	*****	8.00	9.0
947	GREGG	*****	8.00	9.0
22	HEMPHILL	*****	8.00	9.0
24	HOUSTON	*****	8.00	8.0
62	KING	*****	8.00	8.3
35	MARION	*****	8.00	10.0
209	MONTAGUE	*****	8.00	10.0
3	RAINS	*****	8.00	9.0
121	STONEWALL	*****	8.00	9.0
38	ANDERSON	*****	9.00	9.0
223	GRAYSON	*****	9.00	10.0
35	HARRISON	*****	9.00	14.0
101	HUTCHINSON	*****	9.00	9.0
132	PANOLA	*****	9.00	10.0
33	SMITH	*****	9.00	9.0

-----+-----+-----+-----+-----+-----+-----+-----+-----+  
2 4 6 8 10 12 14 16 18

Median of Background Readings

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Obs	County	75th Median Percentile
34	BAYLOR	10.00 14.0
53	FOARD	10.00 10.0
197	FRANKLIN	10.00 10.0
13	KAUFMAN	10.00 10.0
44	NACOGDOCHES	10.00 13.0
223	ROBERTS	10.00 13.0
32	WICHITA	10.00 13.8
61	CARSON	11.00 15.0
278	HANSFORD	11.00 12.0
23	HARTLEY	11.00 11.0
28	LIPSCOMB	12.00 14.3
104	OCHILTREE	12.00 12.0
5	SHERMAN	12.00 12.5
97	JACK	13.00 16.0

Median of Background Readings

Table 12

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

## Texas Central/Western Region

Obs	County		Median	75 <sup>th</sup> Percentile
147	HOCKLEY	*	0.4	5.0
5	KENT	*****	4.8	5.8
13	EDWARDS	*****	5.0	5.0
40	IRION	*****	5.0	5.0
14	TOM GREEN	*****	5.0	5.3
159	WINKLER	*****	5.0	6.0
1330	YOAKUM	*****	5.0	5.0
1204	ANDREWS	*****	6.0	7.0
292	CRANE	*****	6.0	8.0
301	CROCKETT	*****	6.0	7.0
119	DAWSON	*****	6.0	7.0
568	ECTOR	*****	6.0	7.0
297	GAINES	*****	6.0	6.0
100	LOVING	*****	6.0	7.0
3	TERRELL	*****	6.0	6.0
15	VAL VERDE	*****	6.0	7.0
89	COCHRAN	*****	7.0	8.0
116	CULBERSON	*****	7.0	8.0
424	HOWARD	*****	7.0	8.0
15	MARTIN	*****	7.0	8.8
103	REEVES	*****	7.0	8.0
262	WARD	*****	7.0	8.0
68	BORDEN	*****	8.0	9.0
181	FISHER	*****	8.0	9.0
19	GARZA	*****	8.0	8.0
150	MIDLAND	*****	8.0	9.0
4	MITCHELL	*****	8.0	12.5
318	PECOS	*****	8.0	9.0
21	RUNNELS	*****	8.0	8.0
21	SCHLEICHER	*****	8.0	10.0
13	TAYLOR	*****	8.0	8.0
342	GLASSCOCK	*****	9.0	10.0
177	COKE	*****	10.0	10.0
14	NOLAN	*****	10.0	10.0
91	REAGAN	*****	10.0	10.0
52	SCURRY	*****	10.0	10.0
150	UPTON	*****	10.0	10.0

2 4 6 8 10 12 14 16 18  
Median of Background Readings

# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Texas

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
<u>Gas Processing Facilities</u>							
COMPRESSOR	167	3.538	498.0	0	0.0	0.00	0.000
CRYO UNIT	33	96.400	2985.0	0	0.0	0.00	2.000
DEHYDRATOR	104	2.538	80.0	0	0.0	0.00	2.000
FRAC TOWER	128	18.035	395.0	0	0.0	0.00	3.750
INLET SCRUBBER	220	4.185	387.0	0	0.0	0.00	0.975
METER	37	18.678	243.0	0	0.0	0.00	4.250
OTANK	112	16.875	193.0	0	0.0	0.00	13.200
REFRIGERATION	79	13.816	153.0	0	0.0	0.00	3.000
SWEETENER	120	2.170	105.0	0	0.0	0.00	0.000
OTHER	185	19.336	995.0	0	0.0	1.00	10.500
OPUMP	102	93.677	1391.0	0	0.0	7.75	70.750
BOTTOMS PUMP	14	22.393	125.5	0	0.0	10.50	23.000
PTANK	26	29.131	241.0	0	1.0	11.50	26.500
PRODUCT LINE	52	44.610	580.0	0	0.0	12.50	50.750
PPUMP	42	119.052	1041.0	0	3.0	31.00	89.500
REFLUX PUMP	67	287.987	2985.0	0	0.4	65.00	295.000

### Production Facilities

FLINE	1109	14.3909	620	0	0	0	0.00
MANIFOLD	1137	10.1551	1180	0	0	0	0.95
METER	55	6.2364	92	0	0	0	3.00
OTHER	800	22.0115	3785	0	0	0	2.00
PUMP	646	8.4807	985	0	0	0	1.00
SEP	3513	23.9209	4120	0	0	0	6.00
STANK	2890	6.1435	983	0	0	0	2.00
SUMP	132	17.3864	740	0	0	0	2.00
VRU	50	0.0897	3	0	0	0	0.00
WINJ	44	27.1591	285	0	0	0	10.50
WOTHER	2	0.0000	0	0	0	0	0.00
WPROD	651	6.0214	737	0	0	0	1.00
H/T	994	20.4407	3391	0	0	1	6.00
WLINE	81	57.4099	793	0	0	2	50.00
WTANK	1530	28.7806	2490	0	0	3	12.00

# Appendix 2

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Texas

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	ANDREWS	103	0.168	5.5	0	0.00	0.00	0.00
GP	BORDEN	5	0.000	0.0	0	0.00	0.00	0.00
GP	BRAZORIA	21	0.181	2.2	0	0.00	0.00	0.00
GP	CAMERON	10	1.320	13.2	0	0.00	0.00	0.00
GP	COCHRAN	1	0.000	0.0	0	0.00	0.00	0.00
GP	COKE	1	0.000	0.0	0	0.00	0.00	0.00
GP	COLORADO	150	10.600	194.0	0	0.00	0.00	2.00
GP	CROCKETT	23	8.783	62.0	0	0.00	0.00	14.00
GP	CULBERSON	5	0.200	1.0	0	0.00	0.00	0.50
GP	DAWSON	1	0.000	0.0	0	0.00	0.00	0.00
GP	ECTOR	66	47.753	820.0	0	0.00	0.00	2.50
GP	GALVESTON	1	0.000	0.0	0	0.00	0.00	0.00
GP	GRAY	13	0.000	0.0	0	0.00	0.00	0.00
GP	HARDIN	3	0.000	0.0	0	0.00	0.00	0.00
GP	HOCKLEY	40	0.187	2.6	0	0.00	0.00	0.15
GP	HOWARD	11	0.000	0.0	0	0.00	0.00	0.00
GP	KENT	1	0.000	0.0	0	0.00	0.00	0.00
GP	LAVACA	34	2.282	25.5	0	0.00	0.00	0.00
GP	LIBERTY	7	0.471	1.3	0	0.00	0.00	1.30
GP	LOVING	1	0.000	0.0	0	0.00	0.00	0.00
GP	MARTIN	12	5.167	43.0	0	0.00	0.00	0.00
GP	MATAGORDA	2	0.000	0.0	0	0.00	0.00	0.00
GP	MONTAGUE	5	0.000	0.0	0	0.00	0.00	0.00
GP	MONTGOMERY	20	15.550	145.0	0	0.00	0.00	0.00
GP	ORANGE	6	2.167	12.0	0	0.00	0.00	3.75
GP	PANOLA	2	0.000	0.0	0	0.00	0.00	0.00
GP	PECOS	9	5.733	51.6	0	0.00	0.00	0.00
GP	REAGAN	3	0.000	0.0	0	0.00	0.00	0.00
GP	REEVES	5	1.000	4.0	0	0.00	0.00	2.50
GP	SMITH	8	3.250	19.0	0	0.00	0.00	4.75
GP	UNREPORTED	50	6.224	96.0	0	0.00	0.00	5.25
GP	UPTON	1	0.000	0.0	0	0.00	0.00	0.00
GP	VAN ZANDT	66	0.432	23.0	0	0.00	0.00	0.00
GP	WARD	19	37.053	193.0	0	0.00	0.00	73.00
GP	WICHITA	1	0.000	0.0	0	0.00	0.00	0.00
GP	WINKLER	33	0.409	4.5	0	0.00	0.00	0.00
GP	WOOD	95	3.376	98.0	0	0.00	0.00	0.40
GP	YOAKUM	129	16.620	771.0	0	0.00	0.00	9.00
GP	ZAPATA	12	0.000	0.0	0	0.00	0.00	0.00
GP	ANDERSON	4	0.750	2.0	0	0.00	0.50	1.75
GP	CHEROKEE	17	1.529	4.0	1	1.00	1.00	1.00



# Appendix 2 (Continued)

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Texas

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	FORT BEND	7	10.286	55.0	0	0.00	1.00	14.00
GP	FREESTONE	7	2.143	4.0	0	1.00	1.00	4.00
GP	GRAYSON	28	3.893	31.0	0	0.00	1.00	2.00
GP	SHACKLEFORD	38	60.079	886.0	0	0.00	1.00	45.00
GP	SHERMAN	3	1.000	2.0	0	0.00	1.00	2.00
GP	HARRISON	10	1.650	7.0	0	0.00	1.75	2.00
GP	GREGG	10	1.800	4.0	0	0.75	2.00	3.00
GP	WALLER	31	187.161	1391.0	0	0.00	2.00	241.00
GP	CRANE	27	31.259	144.0	0	0.00	3.00	69.00
GP	HANSFORD	40	117.000	2985.0	0	0.00	3.00	52.75
GP	MARION	2	3.000	3.0	3	3.00	3.00	3.00
GP	OCHILTREE	10	2.600	4.0	1	1.75	3.00	3.25
GP	RUSK	53	4.679	54.0	0	0.00	3.00	4.00
GP	AUSTIN	1	4.000	4.0	4	4.00	4.00	4.00
GP	HARRIS	27	242.852	2495.0	0	0.00	4.00	100.000
GP	SAM PATRICIO	2	4.200	8.4	0	0.00	4.20	8.400
GP	CHAMBERS	12	114.000	490.0	0	1.25	6.00	267.750
GP	NACOGDOCHES	5	82.000	387.0	0	2.00	7.00	199.500
GP	STEPHENS	45	17.178	168.0	0	1.00	7.00	16.000
GP	MIDLAND	1	8.700	8.7	8.7	8.70	8.70	8.700
GP	CARSON	29	140.483	2985.0	0.0	0.00	10.00	43.500
GP	KARNES	3	13.200	13.2	13.2	13.20	13.20	13.200
GP	JONES	1	18.000	18.0	18.0	18.00	18.00	18.000
GP	JACKSON	18	50.172	254.6	1.3	11.80	30.40	61.800
GP	JIM WELLS	6	122.300	319.1	9.4	16.67	49.70	294.875
GP	BROOKS	9	121.111	495.0	23.0	27.00	65.00	165.000
GP	REFUGIO	4	201.750	593.0	63.0	64.25	75.50	465.500
GP	KENEDY	3	117.667	191.0	81.0	81.00	81.00	191.000
GP	KLEBERG	56	196.786	1145.0	25.0	65.00	110.00	195.000
GP	CALHOUN	4	151.750	243.0	78.0	88.00	143.00	224.250
PROD	ANDERSON	34	0.529	2.0	0.0	0.00	0.00	1.000
PROD	ANDREWS	1101	3.389	494.0	0.0	0.00	0.00	1.000
PROD	AUSTIN	45	1.578	12.0	0.0	0.00	0.00	3.000
PROD	BORDEN	63	2.016	81.0	0.0	0.00	0.00	0.000
PROD	BRAZORIA	72	1.350	18.0	0.0	0.00	0.00	0.000
PROD	BURLESON	36	0.833	4.0	0.0	0.00	0.00	1.750
PROD	CALDWELL	173	0.534	33.5	0.0	0.00	0.00	0.350
PROD	COCHRAN	88	0.375	8.0	0.0	0.00	0.00	0.000
PROD	COKE	176	14.290	490.0	0.0	0.00	0.00	5.000
PROD	COLORADO	45	1.178	20.0	0.0	0.00	0.00	0.000
PROD	COOKE	56	8.232	172.0	0.0	0.00	0.00	4.750

Appendix 2 (Continued)

Statistical Data on Median Difference over Background  
By Facility and County  
(Micro-Rems/Hr)

Texas

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
PROD	CRANE	265	4.150	143.0	0.0	0.000	0.0	3.000
PROD	CROCKETT	278	7.335	342.0	0.0	0.000	0.0	1.250
PROD	CULBERSON	111	1.180	52.0	0.0	0.000	0.0	0.000
PROD	DAWSON	118	0.703	25.0	0.0	0.000	0.0	0.000
PROD	DUVAL	18	5.278	24.0	0.0	0.000	0.0	13.000
PROD	ECTOR	502	3.956	115.0	0.0	0.000	0.0	3.625
PROD	EDWARDS	13	0.077	1.0	0.0	0.000	0.0	0.000
PROD	FISHER	181	2.465	37.0	0.0	0.000	0.0	1.000
PROD	FOARD	53	2.604	50.0	0.0	0.000	0.0	0.000
PROD	FRIIO	31	1.968	34.0	0.0	0.000	0.0	0.000
PROD	GAINES	297	4.785	92.0	0.0	0.000	0.0	4.500
PROD	GARZA	19	1.053	17.0	0.0	0.000	0.0	0.000
PROD	GLASSCOCK	342	6.132	898.0	0.0	0.000	0.0	0.000
PROD	GRAYSON	195	28.318	989.0	0.0	0.000	0.0	21.000
PROD	GREGG	937	1.984	87.0	0.0	0.000	0.0	2.000
PROD	HARDIN	101	3.076	38.7	0.0	0.000	0.0	3.150
PROD	HARRISON	25	5.540	106.0	0.0	0.000	0.0	2.000
PROD	HASKELL	24	3.625	39.0	0.0	0.000	0.0	0.750
PROD	HEMPHILL	22	36.591	392.0	0.0	0.000	0.0	0.000
PROD	HOCKLEY	107	1.274	27.0	0.0	0.000	0.0	0.000
PROD	HOWARD	413	4.778	392.0	0.0	0.000	0.0	2.000
PROD	IRION	40	20.800	744.0	0.0	0.000	0.0	11.000
PROD	JEFFERSON	79	2.320	54.3	0.0	0.000	0.0	2.200
PROD	KING	62	0.677	12.0	0.0	0.000	0.0	0.000
PROD	LAVACA	211	0.400	18.7	0.0	0.000	0.0	0.000
PROD	LIBERTY	40	1.622	24.9	0.0	0.000	0.0	0.825
PROD	LIPSCOMB	28	8.000	138.0	0.0	0.000	0.0	1.000
PROD	LOVING	99	11.586	241.0	0.0	0.000	0.0	1.000
PROD	MARTIN	44	1.045	17.0	0.0	0.000	0.0	0.00
PROD	MCMULLEN	45	1.556	42.0	0.0	0.000	0.0	0.00
PROD	MIDLAND	149	46.423	740.0	0.0	0.000	0.0	11.00
PROD	MONTAGUE	204	34.480	1186.0	0.0	0.000	0.0	3.00
PROD	NOLAN	14	9.286	60.0	0.0	0.000	0.0	10.00
PROD	PECOS	309	40.345	4120.0	0.0	0.000	0.0	13.00
PROD	RAINS	3	0.000	0.0	0.0	0.000	0.0	0.00
PROD	REAGAN	88	59.375	2490.0	0.0	0.000	0.0	7.00
PROD	REEVES	98	10.969	362.0	0.0	0.000	0.0	2.00

Appendix 2 (Continued)

Statistical Data on Median Difference over Background  
By Facility and County  
(Micro-Rems/Hr)

Texas

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
PROD	RUNNELS	21	0.095	2.0	0	0.00	0.0	0.00
PROD	RUSK	291	1.637	104.8	0	0.00	0.0	0.00
PROD	SAN PATRICIO	13	0.331	2.3	0	0.00	0.0	0.35
PROD	SCHLEICHER	21	0.095	2.0	0	0.00	0.0	0.00
PROD	SCURRY	52	0.673	15.0	0	0.00	0.0	0.00
PROD	STARR	17	10.941	59.0	0	0.00	0.0	18.50
PROD	STONEWALL	121	5.174	172.0	0	0.00	0.0	1.00
PROD	TAYLOR	13	1.462	5.0	0	0.00	0.0	3.00
PROD	TERRELL	3	0.000	0.0	0	0.00	0.0	0.00
PROD	TITUS	61	2.092	48.3	0	0.00	0.0	0.00
PROD	TOM GREEN	14	4.429	20.0	0	0.00	0.0	9.25
PROD	UNREPORTED	308	14.060	451.0	0	0.00	0.0	3.00
PROD	UPSHUR	12	0.000	0.0	0	0.00	0.0	0.00
PROD	VAL VERDE	15	0.000	0.0	0	0.00	0.0	0.00
PROD	VAN ZANDT	11	0.364	1.0	0	0.00	0.0	1.00
PROD	WALLER	44	30.318	541.0	0	0.00	0.0	5.00
PROD	WARD	243	35.412	2992.0	0	0.00	0.0	6.00
PROD	WINKLER	126	10.097	244.0	0	0.00	0.0	6.00
PROD	WOOD	245	15.437	793.0	0	0.00	0.0	3.00
PROD	YOAKUM	1201	0.752	95.0	0	0.00	0.0	0.00
PROD	ZAPATA	14	1.071	10.0	0	0.00	0.0	0.00
PROD	HOUSTON	24	0.583	3.0	0	0.00	0.5	1.00
PROD	BAYLOR	34	111.735	2386.0	0	0.00	1.0	26.00
PROD	CHEROKEE	63	3.635	60.0	0	0.00	1.0	2.00
PROD	FREESTONE	51	4.902	64.0	0	0.00	1.0	4.00
PROD	HANSFORD	238	4.050	240.0	0	1.00	1.0	3.00
PROD	HUTCHINSON	101	6.040	67.0	0	0.00	1.0	9.00
PROD	KARNES	11	7.691	29.4	0	1.00	1.0	16.50
PROD	MONTGOMERY	163	9.963	394.0	0	0.00	1.0	6.00
PROD	PANOLA	130	9.323	266.0	0	0.00	1.0	5.00
PROD	FRANKLIN	197	29.838	2189.0	0	0.00	2.0	10.00
PROD	HARRIS	87	5.345	75.0	0	0.00	2.0	8.00
PROD	HARTLEY	23	2.565	14.0	0	1.00	2.0	2.00
PROD	MARION	33	46.939	990.0	0	0.00	2.0	18.50
PROD	OCHILTREE	94	2.234	5.0	0	1.75	2.0	3.00
PROD	SHACKLEFORD	46	19.478	213.0	0	0.75	2.0	7.25
PROD	SHERMAN	2	2.000	2.0	2	2.00	2.0	2.00
PROD	WICHITA	31	47.781	387.0	0	0.00	2.0	67.00
PROD	WISE	39	5.385	105.0	0	0.00	2.0	4.00
PROD	JACKSON	45	6.396	74.0	0	1.80	3.0	5.00
PROD	ROBERTS	223	79.377	1984.0	0	0.00	3.0	26.00

Appendix 2 (Continued)

Statistical Data on Median Difference over Background  
By Facility and County  
(Micro-Rems/Hr)

Texas

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
PROD	GRAY	314	42.911	3391.0	0.0	0.00	4.0	14.00
PROD	ORANGE	3	4.000	7.0	0.0	1.00	4.0	7.00
PROD	SMITH	25	23.320	101.0	0.0	0.00	4.0	43.00
PROD	UPTON	149	84.360	2288.0	0.0	0.00	4.0	28.50
PROD	WHEELER	35	4.343	14.0	0.0	0.00	4.0	8.00
PROD	WILLACY	102	32.563	581.0	0.0	1.750	4.10	25.175
PROD	CARSON	32	9.812	59.0	0.0	0.000	4.50	9.750
PROD	GALVESTON	32	25.953	194.0	0.0	0.850	5.00	31.625
PROD	JACK	97	220.910	3785.0	0.0	0.000	5.00	56.000
PROD	NACOGDOCHES	39	49.564	401.0	0.0	2.000	6.00	50.000
PROD	WHARTON	5	10.200	22.0	5.0	5.000	6.00	17.500
PROD	CHAMBERS	170	63.801	3496.0	0.0	0.000	6.10	25.250
PROD	KENT	4	9.275	24.2	0.0	0.000	6.45	21.375
PROD	MATAGORDA	17	30.294	113.0	0.0	1.500	7.00	50.000
PROD	POLK	9	9.333	24.0	2.0	4.000	7.00	15.000
PROD	THROCKMORTON	65	33.169	415.0	0.0	2.000	8.00	29.500
PROD	YOUNG	76	46.763	350.0	0.0	2.000	8.00	43.250
PROD	JONES	11	69.364	294.0	1.0	1.000	9.00	94.000
PROD	FORT BEND	65	72.508	592.0	0.0	5.000	12.00	67.000
PROD	HIDALGO	134	41.726	374.0	0.0	0.000	12.50	54.000
PROD	JIM HOGG	1	15.000	15.0	15.0	15.000	15.00	15.000
PROD	KAUFMAN	13	76.462	640.0	0.0	5.500	33.00	45.000
PROD	STEPHENS	12	60.917	250.0	0.0	20.725	35.00	82.500
PROD	REFUGIO	2	44.500	46.0	43.0	43.000	44.50	46.000
PROD	BROOKS	86	70.884	396.0	11.0	29.500	47.00	86.000
PROD	NUECES	33	90.788	445.0	15.0	30.000	55.00	85.000
PROD	JIM WELLS	26	94.846	494.0	24.0	34.750	60.00	106.500
PROD	KENEDY	86	116.267	620.0	4.0	34.500	65.00	173.750
PROD	KLEBERG	39	123.308	493.0	20.0	50.000	76.00	142.000
PROD	ATASCOSA	13	78.469	341.0	0.0	0.900	78.00	107.500
PROD	CALHOUN	5	141.000	391.0	41.0	41.000	91.00	266.000
PROD	WILBARGER	3	129.633	253.3	43.6	43.600	92.00	253.300
PROD	MITCHELL	4	250.500	272.0	226.0	232.500	252.00	267.000

# Appendix 3

## Statistical Data on Background by County (Micro-Rems/Hr)

### Texas

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
BRAZORIA	93	2.32151	8.0	0.3	0.30	0.30	5.000
HOCKLEY	147	2.17415	6.0	0.3	0.40	0.40	5.000
JEFFERSON	79	1.17848	10.0	0.4	0.60	0.70	0.800
WILLACY	102	2.38627	9.0	0.3	0.50	0.90	6.000
VAN ZANDT	77	2.90909	9.0	2.0	2.00	2.00	2.000
CAMERON	10	2.90000	2.9	2.9	2.90	2.90	2.900
CALDWELL	173	3.68844	5.6	1.3	3.10	3.90	4.200
KARNES	14	3.95000	5.0	2.9	2.90	3.95	5.000
GALVESTON	33	3.65152	10.0	0.5	0.50	4.00	6.000
HARDIN	104	7.60000	25.8	0.0	3.50	4.00	4.875
WISE	39	4.40718	6.0	3.0	4.00	4.00	5.000
LIBERTY	47	4.80851	7.4	3.5	3.50	4.50	5.500
SAN PATRICIO	15	4.51333	5.2	3.9	4.50	4.50	4.500
KENT	5	5.20000	5.0	4.0	4.80	4.80	5.800
WILBARGER	3	4.80000	4.8	4.8	4.80	4.80	4.800
BROOKS	95	5.06316	6.0	4.0	5.00	5.00	5.000
CHAMBERS	182	4.18846	13.0	0.3	2.00	5.00	6.000
EDWARDS	13	5.00000	5.0	5.0	5.00	5.00	5.000
HARRIS	114	5.43860	7.0	4.0	5.00	5.00	6.000
IRION	40	5.22500	6.0	5.0	5.00	5.00	5.000
JACKSON	63	4.66667	6.0	2.6	3.50	5.00	6.000
KENEDY	89	5.44944	9.0	4.0	5.00	5.00	5.000
KLEBERG	95	5.83150	9.0	5.0	5.00	5.00	7.000
MONTGOMERY	183	4.88361	7.0	3.0	4.00	5.00	5.000
NUECES	33	4.96970	5.0	4.0	5.00	5.00	5.000
POLK	9	5.33333	6.0	5.0	5.00	5.00	6.000
TOM GREEN	14	5.21429	6.0	5.0	5.00	5.00	5.250
WINKLER	159	4.23899	7.0	1.5	1.50	5.00	6.000
YOAKUM	1330	4.74504	9.0	0.3	4.00	5.00	5.000
ZAPATA	26	5.00000	5.0	5.0	5.00	5.00	5.000
TITUS	61	5.13443	6.5	4.4	4.65	5.20	5.500
JIM WELLS	32	5.15625	6.0	3.5	4.25	5.50	6.000
ANDREWS	1204	5.67193	15.0	1.5	5.00	6.00	7.000
BURLESON	36	5.95833	6.5	5.0	5.25	6.00	6.500
COLORADO	195	6.22564	15.0	5.0	5.00	6.00	6.000
CRANE	292	6.54418	23.0	2.9	5.00	6.00	8.000
CROCKETT	301	6.13621	11.0	4.0	5.00	6.00	7.000
DAWSON	119	6.73950	10.0	5.0	6.00	6.00	7.000

Appendix 3 (Continued)

Statistical Data on Background by County  
(Micro-Rems/Hr)

Texas

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
ECTOR	568	5.38380	15.0	1.8	2.50	6.00	7.000
FREESTONE	58	6.25862	7.0	6.0	6.00	6.00	7.000
FRIO	31	6.00000	6.0	6.0	6.00	6.00	6.000
GAINES	297	5.56566	7.0	3.0	5.00	6.00	6.000
HIDALGO	134	5.64403	6.0	3.9	6.00	6.00	6.000
JONES	12	6.00000	6.0	6.0	6.00	6.00	6.000
LOVING	100	6.66000	9.0	5.0	6.00	6.00	7.000
STARR	17	6.05882	7.0	6.0	6.00	6.00	6.000
TERRELL	3	6.00000	6.0	6.0	6.00	6.00	6.000
THROCKMORTON	65	6.23077	8.0	4.0	5.00	6.00	7.000
UNREPORTED	366	8.40464	60.0	4.0	5.00	6.00	7.000
VAL VERDE	15	6.20000	7.0	5.0	6.00	6.00	7.000
WALLER	75	6.22667	9.0	4.0	5.00	6.00	9.000
WHARTON	5	5.80000	7.0	5.0	5.00	6.00	6.500
WHEELER	35	6.17143	8.0	6.0	6.00	6.00	6.000
FORT BEND	72	7.11111	12.0	4.0	5.00	6.50	8.000
LAVACA	245	5.33388	6.5	3.2	3.50	6.50	6.500
RUSK	344	6.2727	15.0	1.5	5.20	6.8	8.00
ATASCOSA	13	6.4846	9.0	3.9	4.35	7.0	8.00
COCHRAN	89	7.0674	8.0	6.0	7.00	7.0	8.00
CULBERSON	116	6.9655	8.0	4.0	7.00	7.0	8.00
DUVAL	18	6.8889	7.0	6.0	7.00	7.0	7.00
HASKELL	24	7.6667	10.0	7.0	7.00	7.0	7.75
HOWARD	424	6.4958	13.0	1.3	6.00	7.0	8.00
MARTIN	56	7.5179	15.0	5.0	6.00	7.0	8.75
MATAGORDA	19	7.0000	8.0	5.0	7.00	7.0	8.00
REEVES	103	7.3010	12.0	4.0	6.00	7.0	8.00
REFUGIO	6	7.0000	7.0	7.0	7.00	7.0	7.00
SHACKLEFORD	84	7.0595	15.0	0.0	6.00	7.0	8.00
STEPHENS	57	8.0088	15.0	5.0	6.00	7.0	10.00
UPSHUR	12	7.0000	8.0	6.0	6.00	7.0	8.00
WARD	262	7.1336	15.0	5.0	6.00	7.0	8.00
WOOD	340	7.1300	15.0	1.6	7.00	7.0	8.00
YOUNG	76	7.3553	12.0	5.0	6.00	7.0	7.00
BORDEN	68	8.0441	9.0	7.0	7.00	8.0	9.00
CHEROKEE	80	8.2000	10.0	6.0	7.00	8.0	9.00

Appendix 3 (Continued)

Statistical Data on Background by County  
(Micro-Rems/Hr)

Texas

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
COOKE	56	7.9286	9.0	5.0	7.25	8.0	8.75
FISHER	181	7.7994	11.0	3.9	7.00	8.0	9.00
GARZA	19	8.0000	8.0	8.0	8.00	8.0	8.00
GRAY	327	8.3211	18.0	0.0	7.00	8.0	9.00
GREGG	947	8.1227	15.0	4.5	8.00	8.0	9.00
HEMPHILL	22	8.1818	9.0	7.0	7.00	8.0	9.00
HOUSTON	24	7.8750	8.0	7.0	8.00	8.0	8.00
JIM HOGG	1	8.0000	8.0	8.0	8.00	8.0	8.00
KING	62	8.2742	10.0	5.0	8.00	8.0	8.25
MARION	35	8.9143	11.0	6.0	8.00	8.0	10.00
MIDLAND	150	7.4607	15.0	1.0	6.00	8.0	9.00
MITCHELL	4	9.5000	14.0	8.0	8.00	8.0	12.50
MONTAGUE	209	8.9330	15.0	5.0	8.00	8.0	10.00
ORANGE	9	7.5556	8.0	4.0	8.00	8.0	8.00
PECOS	318	8.1836	16.1	3.5	6.00	8.0	9.00
RAINS	3	7.6667	9.0	6.0	6.00	8.0	9.00
RUNNELS	21	6.6667	10.0	5.0	5.00	8.0	8.00
SCHLEICHER	21	8.4762	10.0	6.0	8.00	8.0	10.00
STONEWALL	121	7.6529	11.0	6.0	6.00	8.0	9.00
TAYLOR	13	7.6154	10.0	5.0	7.00	8.0	8.00
AUSTIN	46	7.9783	10.0	5.0	7.00	8.5	9.00
ANDERSON	38	9.6842	15.0	8.0	8.00	9.0	9.00
CALHOUN	9	8.1111	9.0	7.0	7.00	9.0	9.00
GLASSCOCK	342	8.8860	11.0	7.0	8.00	9.0	10.00
GRAYSON	223	9.3229	13.0	5.0	9.00	9.0	10.00
HARRISON	35	7.5143	15.0	2.0	2.00	9.0	14.00
HUTCHINSON	101	8.6337	12.0	7.0	8.00	9.0	9.00
PANOLA	132	9.2576	11.0	8.0	9.00	9.0	10.00
SMITH	33	9.1515	10.0	8.0	9.00	9.0	9.00
BAYLOR	34	10.9706	15.0	8.0	9.00	10.0	14.00
COKE	177	9.3051	12.0	6.0	8.00	10.0	10.00
FOARD	53	10.1509	11.0	10.0	10.00	10.0	10.00
FRANKLIN	197	9.5787	12.0	6.0	9.00	10.0	10.00
KAUFMAN	13	9.8462	10.0	9.0	10.00	10.0	10.00
MCMULLEN	45	9.8444	10.0	6.0	10.00	10.0	10.00
NACOGDOCHES	44	10.9318	13.0	9.0	9.00	10.0	13.00
NOLAN	14	10.0000	10.0	10.0	10.0	10.0	10.00
REAGAN	91	9.3846	10.0	8.0	9.0	10.0	10.00
ROBERTS	223	10.9327	20.0	6.0	9.0	10.0	13.00
SCURRY	52	9.5000	10.0	8.0	9.0	10.0	10.00
UPTON	150	8.9500	15.0	1.0	6.0	10.0	11.00
WICHITA	32	9.8125	14.0	4.8	4.8	10.0	13.75
CARSON	61	11.6393	15.0	7.0	8.0	11.0	15.00

# Appendix 3 (Continued)

## Statistical Data on Background by County (Micro-Rems/Hr)

### Texas

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
HANSFORD	278	11.5612	15.0	9.0	11.0	11	12.00
HARTLEY	23	11.2174	12.0	11.0	11.0	11	11.00
LIPSCOMB	28	13.0357	25.0	8.0	11.0	12	14.25
OCHILTREE	104	11.6538	17.5	9.0	11.0	12	12.00
SHERMAN	5	12.0000	13.0	11.0	11.5	12	12.50
JACK	97	11.3299	20.0	3.0	5.0	13	16.00



# Appendix 4

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Texas Coastal Crescent

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
<u>Gas Processing Facilities</u>							
COMPRESSOR	34	14.500	490.0	0	0.0	0.00	0.00
CRYO UNIT	9	0.778	7.0	0	0.0	0.00	0.00
DEHYDRATOR	25	5.080	80.0	0	0.0	0.00	1.50
INLET SCRUBBER	43	2.165	55.0	0	0.0	0.00	0.00
METER	9	44.333	243.0	0	0.0	0.00	76.00
OTANK	50	18.418	191.0	0	0.0	0.00	23.50
SWEETENER	34	4.471	105.0	0	0.0	0.00	0.00
FRAC TOWER	28	49.139	395.0	0	0.0	1.00	88.75
REFRIGERATION	20	28.550	145.0	0	0.0	1.50	42.50
PRODUCT LINE	34	29.785	145.0	0	0.0	2.50	36.25
OTHER	46	57.439	995.0	0	0.0	3.50	65.00
PTANK	7	46.486	241.0	0	1.3	14.00	48.10
PPUMP	21	151.724	1041.0	0	5.2	30.00	124.50
OPUMP	48	147.975	1391.0	0	0.0	45.00	145.00
BOTTOMS PUMP	2	77.250	125.5	29	29.0	77.25	125.50
REFLUX PUMP	39	328.567	2495.0	0	19.1	145.00	295.00

### Production Facilities

H/T	94	7.7181	143.0	0	0	0.0	3.40
METER	39	8.7692	92.0	0	0	0.0	4.00
PUMP	73	4.4247	101.0	0	0	0.0	3.55
STANK	389	7.3710	246.0	0	0	0.0	5.00
WINJ	3	0.7667	2.3	0	0	0.0	2.30
WOTHER	2	0.0000	0.0	0	0	0.0	0.00
WPROD	109	2.2963	74.0	0	0	0.0	0.00
MANIFOLD	191	39.0508	592.0	0	0	1.0	28.00
OTHER	117	43.4769	3496.0	0	0	1.0	9.00
WTANK	233	17.0489	441.0	0	0	1.0	10.00
WLINE	22	40.8636	245.0	0	0	3.0	57.50
SEP	659	34.6165	617.0	0	0	3.0	25.70
SUMP	17	13.8235	91.0	0	5	6.0	15.00
FLINE	170	84.6971	620.0	0	11	45.5	114.75

# Appendix 5

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Texas Northern Crescent

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
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#### Gas Processing Facilities

COMPRESSOR	60	1.267	10	0	0.0	0.0	2.00
FRAC TOWER	41	10.910	360	0	0.0	0.0	0.20
INLET SCRUBBER	108	5.689	387	0	0.0	0.0	1.00
METER	7	37.000	168	0	0.0	0.0	90.00
REFRIGERATION	18	2.278	23	0	0.0	0.0	3.00
SWEETENER	28	3.536	60	0	0.0	0.0	0.00
CRYO UNIT	15	210.533	2985	0	0.0	1.0	2.00
DEHYDRATOR	45	2.933	56	0	0.0	2.0	3.00
OTANK	24	16.250	92	0	0.0	2.0	16.75
OTHER	58	7.534	52	0	1.0	3.0	7.50
BOTTOMS PUMP	10	14.300	81	0	0.0	3.5	18.75
OPUMP	34	66.353	886	0	0.0	4.5	41.25
PPUMP	7	66.000	360	0	3.0	5.0	48.00
PTANK	11	30.273	173	0	1.0	9.0	31.00
PRODUCT LINE	10	20.500	81	0	4.5	12.0	35.00
REFLUX PUMP	16	251.937	2985	0	1.5	38.5	154.25

#### Production Facilities

MANIFOLD	310	8.527	1180	0	0.000	0	1.0
METER	2	0.000	0	0	0.000	0	0.0
OTHER	199	53.560	3785	0	0.000	0	2.0
PUMP	321	14.486	985	0	0.000	0	2.0
STANK	922	7.832	983	0	0.000	0	2.0
SUMP	17	1.647	15	0	0.000	0	1.5
VRU	3	0.000	0	0	0.000	0	0.0
WPROD	313	2.111	61	0	0.000	0	2.0
SEP	1072	20.293	2189	0	0.000	1	4.0
H/T	379	52.660	3391	0	0.000	2	10.0
FLINE	20	71.900	586	0	0.000	3	59.0
WTANK	836	36.041	1584	0	0.675	4	14.0
WINJ	13	22.385	90	0	0.000	5	50.0
WLINE	28	123.196	793	0	4.625	40	168.0

# Appendix 6

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Texas Central/Western Region

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
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#### Gas Processing Facilities

COMPRESSOR	68	0.247	4.0	0	0.0	0.0	0.00
DEHYDRATOR	30	0.100	2.0	0	0.0	0.0	0.00
FRAC TOWER	58	8.316	134.0	0	0.0	0.0	4.50
INLET SCRUBBER	65	1.557	43.0	0	0.0	0.0	0.00
METER	20	1.655	16.0	0	0.0	0.0	1.05
OTANK	25	22.804	193.0	0	0.0	0.0	16.50
OTHER	73	4.904	62.0	0	0.0	0.0	6.00
REFRIGERATION	39	12.269	153.0	0	0.0	0.0	0.00
SWEETENER	55	0.033	1.3	0	0.0	0.0	0.00
OPUMP	19	10.332	73.0	0	0.0	1.3	17.50
CRYO UNIT	7	2.314	6.0	0	0.0	1.6	6.00
PTANK	3	11.667	31.0	0	0.0	4.0	31.00
BOTTOMS PUMP	2	8.000	16.0	0	0.0	8.0	16.00
REFLUX PUMP	12	204.167	820.0	0	6.0	19.5	468.25
PPUMP	13	104.000	771.0	0	31.0	61.0	79.50
PRODUCT LINE	8	137.750	580.0	0	12.5	88.0	180.00

#### Production Facilities

FLINE	886	0.0001	65.0	0	0	0	0.000
H/T	503	14.8316	890.0	0	0	0	5.000
MANIFOLD	609	0.8739	225.0	0	0	0	0.000
METER	14	0.0714	1.0	0	0	0	0.000
OTHER	483	3.8114	125.0	0	0	0	1.000
PUMP	233	2.1609	290.0	0	0	0	0.000
SEP	1711	21.7599	4120.0	0	0	0	5.000
STANK	1544	4.8926	638.7	0	0	0	1.700
SUMP	92	21.6630	740.0	0	0	0	0.750
VRU	51	0.1020	3.0	0	0	0	0.000
WINJ	21	42.3667	285.0	0	0	0	8.850
WLINE	20	14.2850	213.0	0	0	0	1.725
WPROD	179	13.9626	737.0	0	0	0	0.000
WTANK	435	22.1644	2490.0	0	0	1	9.000

# Appendix 7

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Texas Coastal Crescent

FACILITY	COUNTY	NO	AVG	LARGEST	LOWEST	PCT25	MED	PCT75
GP	BRAZORIA	21	0.181	2.2	0.0	0.000	0.0	0.000
GP	CAMERON	10	1.320	13.2	0.0	0.000	0.0	0.000
GP	COLORADO	150	10.600	194.0	0.0	0.000	0.0	2.000
GP	GALVESTON	1	0.000	0.0	0.0	0.000	0.0	0.000
GP	HARDIN	3	0.000	0.0	0.0	0.000	0.0	0.000
GP	LAVACA	34	2.282	25.5	0.0	0.000	0.0	0.000
GP	LIBERTY	7	0.471	1.3	0.0	0.000	0.0	1.300
GP	MATAGORDA	2	0.000	0.0	0.0	0.000	0.0	0.000
GP	MONTGOMERY	20	15.550	145.0	0.0	0.000	0.0	0.000
GP	ORANGE	6	2.167	12.0	0.0	0.000	0.0	3.750
GP	ZAPATA	12	0.000	0.0	0.0	0.000	0.0	0.000
GP	FORT BEND	7	10.286	55.0	0.0	0.000	1.0	14.000
GP	WALLER	31	187.161	1391.0	0.0	0.000	2.0	241.000
GP	AUSTIN	1	4.000	4.0	4.0	4.000	4.0	4.000
GP	HARRIS	27	242.852	2495.0	0.0	0.000	4.0	100.000
GP	SAN PATRICIO	2	4.200	8.4	0.0	0.000	4.2	8.400
GP	CHAMBERS	12	114.000	490.0	0.0	1.250	6.0	267.750
GP	KARNES	3	13.200	13.2	13.2	13.200	13.2	13.200
GP	JACKSON	18	50.172	254.6	1.3	11.800	30.4	61.800
GP	JIM WELLS	6	122.300	319.1	9.4	16.675	49.7	294.875
GP	BROOKS	9	121.111	495.0	23.0	27.000	65.0	165.000
GP	REFUGIO	4	201.750	593.0	63.0	64.250	75.5	465.500
GP	KENEDY	3	117.667	191.0	81.0	81.000	81.0	191.000
GP	KLEBERG	56	196.786	1145.0	25.0	65.000	110.0	195.000
GP	CALHOUN	4	151.750	243.0	78.0	88.000	143.0	224.250
PROD	AUSTIN	45	1.578	12.0	0.0	0.000	0.0	3.000
PROD	BRAZORIA	72	1.350	18.0	0.0	0.000	0.0	0.000
PROD	BURLESON	36	0.833	4.0	0.0	0.000	0.0	1.750
PROD	CALDWELL	173	0.534	33.5	0.0	0.000	0.0	0.350
PROD	COLORADO	45	1.178	20.0	0.0	0.000	0.0	0.000
PROD	DUVAL	18	5.278	24.0	0.0	0.000	0.0	13.000
PROD	FRIO	31	1.968	34.0	0.0	0.000	0.0	0.000
PROD	HARDIN	101	3.076	38.7	0.0	0.000	0.0	3.150
PROD	JEFFERSON	79	2.320	54.3	0.0	0.000	0.0	2.200
PROD	LAVACA	211	0.400	18.7	0.0	0.000	0.0	0.000
PROD	LIBERTY	40	1.622	24.9	0.0	0.000	0.0	0.825
PROD	MCMULLEN	45	1.556	42.0	0.0	0.000	0.0	0.000
PROD	SAN PATRICIO	13	0.331	2.3	0.0	0.000	0.0	0.350
PROD	STARR	17	10.941	59.0	0.0	0.000	0.0	18.500

# Appendix 7 (Continued)

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Texas Coastal Crescent

FACILITY	COUNTY	NO	AVG	LARGEST	LOWEST	PCT25	MED	PCT75
PROD	WALLER	44	30.318	541.0	0.0	0.000	0.0	5.000
PROD	ZAPATA	14	1.071	10.0	0.0	0.000	0.0	0.000
PROD	KARNES	11	7.691	29.4	0.0	1.000	1.0	16.500
PROD	MONTGOMERY	163	9.963	394.0	0.0	0.000	1.0	6.000
PROD	HARRIS	87	5.345	75.0	0.0	0.000	2.0	8.000
PROD	JACKSON	45	6.396	74.0	0.0	1.800	3.0	5.000
PROD	ORANGE	3	4.000	7.0	1.0	1.000	4.0	7.000
PROD	WILLACY	102	32.563	581.0	0.0	1.750	4.1	25.175
PROD	GALVESTON	32	25.953	194.0	0.0	0.850	5.0	31.625
PROD	WHARTON	5	10.200	22.0	5.0	5.000	6.0	17.500
PROD	CHAMBERS	170	63.801	3496.0	0.0	0.000	6.1	25.250
PROD	MATAGORDA	17	30.294	113.0	0.0	1.500	7.0	50.000
PROD	POLK	9	9.333	24.0	2.0	4.000	7.0	15.000
PROD	FORT BEND	65	72.508	592.0	0.0	5.000	12.0	67.000
PROD	HIDALGO	134	41.726	374.0	0.0	0.000	12.5	54.000
PROD	JIM HOGG	1	15.000	15.0	15.0	15.000	15.0	15.000
PROD	REFUGIO	2	44.500	46.0	43.0	43.000	44.5	46.000
PROD	BROOKS	86	70.884	396.0	11.0	29.500	47.0	86.000
PROD	NUECES	33	90.788	445.0	15.0	30.000	55.0	85.000
PROD	JIM WELLS	26	94.846	494.0	24.0	34.750	60.0	106.500
PROD	KENEDY	86	116.267	620.0	4.0	34.500	65.0	173.750
PROD	KLEBERG	39	123.308	493.0	20.0	50.000	76.0	142.000
PROD	ATASCOSA	13	78.469	341.0	0.0	0.900	78.0	107.500
PROD	CALHOUN	5	141.000	391.0	41.0	41.000	91.0	266.000

# Appendix 8

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Texas Northern Crescent

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	GRAY	13	0.000	0.0	0	0.00	0.00	0.00
GP	MONTAGUE	5	0.000	0.0	0	0.00	0.00	0.00
GP	PANOLA	2	0.000	0.0	0	0.00	0.00	0.00
GP	SMITH	8	3.250	19.0	0	0.00	0.00	4.75
GP	VAN ZANDT	66	0.432	23.0	0	0.00	0.00	0.00
GP	WICHITA	1	0.000	0.0	0	0.00	0.00	0.00
GP	WOOD	95	3.376	98.0	0	0.00	0.00	0.40
GP	ANDERSON	4	0.750	2.0	0	0.00	0.50	1.75
GP	CHEROKEE	17	1.529	4.0	1	1.00	1.00	1.00
GP	FREESTONE	7	2.143	4.0	0	1.00	1.00	4.00
GP	GRAYSON	28	3.893	31.0	0	0.00	1.00	2.00
GP	SHACKLEFORD	38	60.079	886.0	0	0.00	1.00	45.00
GP	SHERMAN	3	1.000	2.0	0	0.00	1.00	2.00
GP	HARRISON	10	1.650	7.0	0	0.00	1.75	2.00
GP	GREGG	10	1.800	4.0	0	0.75	2.00	3.00
GP	HANSFORD	40	117.000	2985.0	0	0.00	3.00	52.75
GP	MARION	2	3.000	3.0	3	3.00	3.00	3.00
GP	OCHILTREE	10	2.600	4.0	1	1.75	3.00	3.25
GP	RUSK	53	4.679	54.0	0	0.00	3.00	4.00
GP	NACOGDOCHES	5	82.000	387.0	0	2.00	7.00	199.50
GP	STEPHENS	45	17.178	168.0	0	1.00	7.00	16.00
GP	CARSON	29	140.483	2985.0	0	0.00	10.00	43.50
GP	JONES	1	18.000	18.0	18	18.00	18.00	18.00
PROD	ANDERSON	34	0.529	2.0	0	0.00	0.00	1.00
PROD	COOKE	56	8.232	172.0	0	0.00	0.00	4.75
PROD	FOARD	53	2.604	50.0	0	0.00	0.00	0.00
PROD	GRAYSON	195	28.318	989.0	0	0.00	0.00	21.00
PROD	GREGG	937	1.984	87.0	0	0.00	0.00	2.00
PROD	HARRISON	25	5.540	106.0	0	0.00	0.00	2.00
PROD	HASKELL	24	3.625	39.0	0	0.00	0.00	0.75
PROD	HEMPHILL	22	36.591	392.0	0	0.00	0.00	0.00
PROD	KING	62	0.677	12.0	0	0.00	0.00	0.00
PROD	LIPSCOMB	28	8.000	138.0	0	0.00	0.00	1.00
PROD	MONTAGUE	204	34.480	1186.0	0	0.00	0.00	3.00
PROD	RAINS	3	0.000	0.0	0	0.00	0.00	0.00
PROD	RUSK	291	1.637	104.8	0	0.00	0.00	0.00
PROD	STONEWALL	121	5.174	172.0	0	0.00	0.00	1.00
PROD	TITUS	61	2.092	48.3	0	0.00	0.00	0.00
PROD	UPSHUR	12	0.000	0.0	0	0.00	0.00	0.00

Appendix 8 (Continued)

Statistical Data on Median Difference over Background  
By Facility and County  
(Micro-Rems/Hr)

Texas Northern Crescent

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
PROD	VAN ZANDT	11	0.364	1.0	0	0.00	0.00	1.00
PROD	WOOD	245	15.437	793.0	0	0.00	0.00	3.00
PROD	HOUSTON	24	0.583	3.0	0	0.00	0.50	1.00
PROD	BAYLOR	34	111.735	2386.0	0	0.00	1.00	26.00
PROD	CHEROKEE	63	3.635	60.0	0	0.00	1.00	2.00
PROD	FREESTONE	51	4.902	64.0	0	0.00	1.00	4.00
PROD	HANSFORD	238	4.050	240.0	0	1.00	1.00	3.00
PROD	HUTCHINSON	101	6.040	67.0	0	0.00	1.00	9.00
PROD	PANOLA	130	9.323	266.0	0	0.00	1.00	5.00
PROD	FRANKLIN	197	29.838	2189.0	0	0.00	2.00	10.00
PROD	HARTLEY	23	2.565	14.0	0	1.00	2.00	2.00
PROD	MARION	33	46.939	990.0	0	0.00	2.00	18.50
PROD	OCHILTREE	94	2.234	5.0	0	1.75	2.00	3.00
PROD	SHACKLEFORD	46	19.478	213.0	0	0.75	2.00	7.25
PROD	SHERMAN	2	2.000	2.0	2	2.00	2.00	2.00
PROD	WICHITA	31	47.781	387.0	0	0.00	2.00	67.00
PROD	WISE	39	5.385	105.0	0.0	0.000	2.00	4.00
PROD	ROBERTS	223	79.377	1984.0	0.0	0.000	3.00	26.00
PROD	GRAY	314	42.911	3391.0	0.0	0.000	4.00	14.00
PROD	SMITH	25	23.320	101.0	0.0	0.000	4.00	43.00
PROD	WHEELER	35	4.343	14.0	0.0	0.000	4.00	8.00
PROD	CARSON	32	9.812	59.0	0.0	0.000	4.50	9.75
PROD	JACK	97	220.918	3785.0	0.0	0.000	5.00	56.00
PROD	NACOGDOCHES	39	49.564	401.0	0.0	2.000	6.00	50.00
PROD	THROCKMORTON	65	33.169	415.0	0.0	2.000	8.00	29.50
PROD	YOUNG	76	46.763	350.0	0.0	2.000	8.00	43.25
PROD	JONES	11	69.364	294.0	1.0	1.000	9.00	94.00
PROD	KAUFMAN	13	76.462	640.0	0.0	5.500	33.00	45.00
PROD	STEPHENS	12	60.917	250.0	0.0	20.725	35.00	82.50
PROD	WILBARGER	3	129.633	253.3	43.6	43.600	92.00	253.30

# Appendix 9

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Texas Central/Western Region

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	ANDREWS	103	0.1600	5.5	0.0	0.0	0.0	0.000
GP	BORDEN	5	0.0000	0.0	0.0	0.0	0.0	0.000
GP	COCHRAN	1	0.0000	0.0	0.0	0.0	0.0	0.000
GP	COKE	1	0.0000	0.0	0.0	0.0	0.0	0.000
GP	CROCKETT	23	0.7826	62.0	0.0	0.0	0.0	14.000
GP	CULBERSON	5	0.2000	1.0	0.0	0.0	0.0	0.500
GP	DAWSON	1	0.0000	0.0	0.0	0.0	0.0	0.000
GP	ECTOR	66	47.7530	820.0	0.0	0.0	0.0	2.500
GP	HOCKLEY	40	0.1875	2.6	0.0	0.0	0.0	0.150
GP	HOWARD	11	0.0000	0.0	0.0	0.0	0.0	0.000
GP	KENT	1	0.0000	0.0	0.0	0.0	0.0	0.000
GP	LOVING	1	0.0000	0.0	0.0	0.0	0.0	0.000
GP	MARTIN	12	5.1667	43.0	0.0	0.0	0.0	0.000
GP	PECOS	9	5.7333	51.6	0.0	0.0	0.0	0.000
GP	REAGAN	3	0.0000	0.0	0.0	0.0	0.0	0.000
GP	REEVES	5	1.0000	4.0	0.0	0.0	0.0	2.500
GP	UPTON	1	0.0000	0.0	0.0	0.0	0.0	0.000
GP	WARD	19	37.0526	193.0	0.0	0.0	0.0	73.000
GP	WINKLER	33	0.4091	4.5	0.0	0.0	0.0	0.000
GP	YOAKUM	129	16.6202	771.0	0.0	0.0	0.0	9.000
GP	CRANE	27	31.2593	144.0	0.0	0.0	3.0	69.000
GP	MIDLAND	1	8.7000	8.7	8.7	8.7	8.7	8.700
PROD	ANDREWS	1101	3.3894	494.0	0.0	0.0	0.0	1.000
PROD	BORDEN	63	2.0159	81.0	0.0	0.0	0.0	0.000
PROD	COCHRAN	88	0.3750	8.0	0.0	0.0	0.0	0.000
PROD	COKE	176	14.2898	490.0	0.0	0.0	0.0	5.000
PROD	CRANE	265	4.1502	143.0	0.0	0.0	0.0	3.000
PROD	CROCKETT	278	7.3345	342.0	0.0	0.0	0.0	1.250
PROD	CULBERSON	111	1.1802	52.0	0.0	0.0	0.0	0.000
PROD	DAWSON	118	0.7034	25.0	0.0	0.0	0.0	0.000
PROD	ECTOR	502	3.9564	115.0	0.0	0.0	0.0	3.625
PROD	EDWARDS	13	0.0769	1.0	0.0	0.0	0.0	0.000
PROD	FISHER	181	2.4646	37.0	0.0	0.0	0.0	1.000
PROD	GAINES	297	4.7852	92.0	0.0	0.0	0.0	4.500
PROD	GARZA	19	1.0526	17.0	0.0	0.0	0.0	0.000
PROD	GLASSCOCK	342	6.1316	890.0	0.0	0.0	0.0	0.000
PROD	HOCKLEY	107	1.2738	27.0	0.0	0.0	0.0	0.000
PROD	HOWARD	413	4.7777	392.0	0.0	0.0	0.0	2.000
PROD	IRION	40	28.8000	744.0	0.0	0.0	0.0	11.000
PROD	LOVING	99	11.5859	241.0	0.0	0.0	0.0	1.000
PROD	MARTIN	44	1.0455	17.0	0.0	0.0	0.0	0.000
PROD	MIDLAND	149	46.4235	740.0	0.0	0.0	0.0	11.000



# Appendix 9 (Continued)

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Texas Central/Western Region

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
PROD	NOLAN	14	9.2857	60.0	0.0	0.0	0.0	10.000
PROD	PECOS	309	40.3453	4120.0	0.0	0.0	0.0	13.000
PROD	REAGAN	88	59.3750	2490.0	0.0	0.0	0.0	7.000
PROD	REEVES	98	10.9694	362.0	0.0	0.0	0.0	2.000
PROD	RUNNELS	21	0.0952	2.0	0.0	0.0	0.0	0.000
PROD	SCHLEICHER	21	0.0952	2.0	0.0	0.0	0.0	0.000
PROD	SCURRY	52	0.6731	15.0	0.0	0.0	0.0	0.000
PROD	TAYLOR	13	1.4615	5.0	0.0	0.0	0.0	3.000
PROD	TERRELL	3	0.0000	0.0	0.0	0.0	0.0	0.000
PROD	TOM GREEN	14	4.4286	20.0	0.0	0.0	0.0	9.250
PROD	VAL VERDE	15	0.0000	0.0	0.0	0.0	0.0	0.000
PROD	WARD	243	35.4115	2992.0	0.0	0.0	0.0	6.000
PROD	WINKLER	126	10.0968	244.0	0.0	0.0	0.0	6.000
PROD	YOAKUM	1201	0.752	95.0	0	0.0	0.0	0.000
PROD	UPTON	149	84.360	2288.0	0	0.0	4.0	28.500
PROD	KENT	4	9.275	24.2	0	0.0	6.4	21.375
PROD	MITCHELL	4	250.500	272.0	226	232.5	252.0	267.000

# Appendix 10

## Statistical Data on Background by County (Micro-Rems/Hr)

### Texas Coastal Crescent

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
BRAZORIA	93	2.32151	8.0	0.3	0.30	0.30	5.000
JEFFERSON	79	1.17848	10.0	0.4	0.60	0.70	0.800
WILLACY	102	2.38627	9.0	0.3	0.50	0.90	6.000
CAMERON	10	2.90000	2.9	2.9	2.90	2.90	2.900
CALDWELL	173	3.60844	5.6	1.3	3.10	3.90	4.200
KARNES	14	3.95000	5.0	2.9	2.90	3.95	5.000
GALVESTON	33	3.65152	10.0	0.5	0.50	4.00	6.000
HARDIN	104	7.60000	25.8	0.8	3.50	4.00	4.875
LIBERTY	47	4.80851	7.4	3.5	3.50	4.50	5.500
SAN PATRICIO	15	4.51333	5.2	3.9	4.50	4.50	4.500
BROOKS	95	5.06316	6.0	4.0	5.00	5.00	5.000
CHAMBERS	182	4.18846	13.0	0.3	2.00	5.00	6.000
HARRIS	114	5.43860	7.0	4.0	5.00	5.00	6.000
JACKSON	63	4.66667	6.0	2.6	3.50	5.00	6.000
KENEDY	89	5.44944	9.0	4.0	5.00	5.00	5.000
KLEBERG	95	5.83158	9.0	5.0	5.00	5.00	7.000
MONTGOMERY	183	4.88361	7.0	3.0	4.00	5.00	5.000
NUECES	33	4.96970	5.0	4.0	5.00	5.00	5.000
POLK	9	5.33333	6.0	5.0	5.00	5.00	6.000
ZAPATA	26	5.00000	5.0	5.0	5.00	5.00	5.000
JIM WELLS	32	5.15625	6.0	3.5	4.25	5.50	6.000
BURLESON	36	5.95833	6.5	5.0	5.25	6.00	6.500
COLORADO	195	6.22564	15.0	5.0	5.00	6.00	6.000
FRIO	31	6.00000	6.0	6.0	6.00	6.00	6.000
HIDALGO	134	5.64403	6.0	3.9	6.00	6.00	6.000
STARR	17	6.05882	7.0	6.0	6.00	6.00	6.000
WALLER	75	6.22667	9.0	4.0	5.00	6.00	9.000
WHARTON	5	5.80000	7.0	5.0	5.00	6.00	6.500
FORT BEND	72	7.11111	12.0	4.0	5.00	6.50	8.000
LAVACA	245	5.33388	6.5	3.2	3.50	6.50	6.500
ATASCOSA	13	6.48462	9.0	3.9	4.35	7.00	6.000
DUVAL	18	6.80889	7.0	6.0	7.00	7.00	7.000
MATAGORDA	19	7.00000	8.0	5.0	7.00	7.00	8.000
REFUGIO	6	7.00000	7.0	7.0	7.00	7.00	7.000
JIM HOGG	1	8.00000	8.0	8.0	8.00	8.00	8.000
ORANGE	9	7.55556	8.0	4.0	8.00	8.00	8.000
AUSTIN	46	7.97826	10.0	5.0	7.00	8.50	9.000
CALHOUN	9	8.11111	9.0	7.0	7.00	9.00	9.000
MCMULLEN	45	9.84444	10.0	6.0	10.00	10.00	10.000

Appendix 11  
Statistical Data on Background by County  
(Micro-Rems/Hr)

Texas Northern Crescent

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
VAN ZANDT	77	2.9091	9.0	2.0	2.00	2.0	2.00
WISE	39	4.4872	6.0	3.0	4.00	4.0	5.00
WILBARGER	3	4.8000	4.8	4.8	4.80	4.8	4.80
TITUS	61	5.1344	6.5	4.4	4.65	5.2	5.50
FREESTONE	58	6.2586	7.0	6.0	6.00	6.0	7.00
JONES	12	6.0000	6.0	6.0	6.00	6.0	6.00
THROCKMORTON	65	6.2308	8.0	4.0	5.00	6.0	7.00
WHEELER	35	6.1714	8.0	6.0	6.00	6.0	6.00
RUSK	344	6.2727	15.0	1.5	5.20	6.8	8.00
HASKELL	24	7.6667	10.0	7.0	7.00	7.0	7.75
SHACKLEFORD	84	7.0595	15.0	0.0	6.00	7.0	8.00
STEPHENS	57	8.0088	15.0	5.0	6.00	7.0	10.00
UPSHUR	12	7.0000	8.0	6.0	6.00	7.0	8.00
WOOD	340	7.1270	15.0	1.6	7.00	7.0	8.00
YOUNG	76	7.3553	12.0	5.0	6.00	7.0	7.00
CHEROKEE	80	8.2000	10.0	6.0	7.00	8.0	9.00
COOKE	56	7.9286	9.0	5.0	7.25	8.0	8.75
GRAY	327	8.3211	18.0	0.0	7.00	8.0	9.00
GREGG	947	8.1227	15.0	4.5	8.00	8.0	9.00
HEMPHILL	22	8.1818	9.0	7.0	7.00	8.0	9.00
HOUSTON	24	7.8750	8.0	7.0	8.00	8.0	8.00
KING	62	8.2742	10.0	5.0	8.00	8.0	8.25
MARION	35	8.9143	11.0	6.0	8.00	8.0	10.00
MONTAGUE	209	8.9330	15.0	5.0	8.00	8.0	10.00
RAINS	3	7.6667	9.0	6.0	6.00	8.0	9.00
STONEWALL	121	7.6529	11.0	6.0	6.00	8.0	9.00
ANDERSON	38	9.6842	15.0	8.0	8.00	9.0	9.00
GRAYSON	223	9.3229	13.0	5.0	9.00	9.0	10.00
HARRISON	35	7.5143	15.0	2.0	2.00	9.0	14.00
HUTCHINSON	101	8.6337	12.0	7.0	8.00	9.0	9.00
PANOLA	132	9.2576	11.0	8.0	9.00	9.0	10.00
SMITH	33	9.1515	10.0	8.0	9.00	9.0	9.00
BAYLOR	34	10.9706	15.0	8.0	9.00	10.0	14.00
FOARD	53	10.1509	11.0	10.0	10.00	10.0	10.00
FRANKLIN	197	9.5787	12.0	6.0	9.00	10.0	10.00
KAUFMAN	13	9.8462	10.0	9.0	10.00	10.0	10.00
NACOGDOCHES	44	10.9318	13.0	9.0	9.00	10.0	13.00
ROBERTS	223	10.9327	20.0	6.0	9.00	10.0	13.00
WICHITA	32	9.8125	14.0	4.8	4.80	10.0	13.75
CARSON	61	11.6393	15.0	7.0	8.00	11.0	15.00
HANSFORD	278	11.5612	15.0	9.0	11.00	11.0	12.00
HARTLEY	23	11.2174	12.0	11.0	11.00	11.0	11.00
LIPSCOMB	28	13.0357	25.0	8.0	11.00	12.0	14.25
OCHILTREE	104	11.6538	17.5	9.0	11.00	12.0	12.00
SHERMAN	5	12.0000	13.0	11.0	11.50	12.0	12.50
JACK	97	11.3299	20.0	3.0	5.00	13.0	16.00

# Appendix 12

## Statistical Data on Background by County (Micro-Rems/Hr)

### Texas Central/Western Region

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
HOCKLEY	147	2.1741	6.0	0.3	0.4	0.4	5.00
KENT	5	5.2000	5.8	4.8	4.8	4.8	5.80
EDWARDS	13	5.0000	5.0	5.0	5.0	5.0	5.00
IRION	40	5.2250	6.0	5.0	5.0	5.0	5.00
TOM GREEN	14	5.2143	6.0	5.0	5.0	5.0	5.25
WINKLER	159	4.2390	7.0	1.5	1.5	5.0	6.00
YOAKUM	1330	4.7450	9.0	3.3	4.0	5.0	5.00
ANDREWS	1204	5.6719	15.0	1.5	5.0	6.0	7.00
CRANE	292	6.5442	23.0	2.9	5.0	6.0	8.00
CROCKETT	301	6.1362	11.0	4.0	5.0	6.0	7.00
DAWSON	119	6.7395	10.0	5.0	6.0	6.0	7.00
ECTOR	568	5.3838	15.0	1.8	2.5	6.0	7.00
GAINES	297	5.5657	7.0	3.0	5.0	6.0	6.00
LOVING	100	6.6600	9.0	5.0	6.0	6.0	7.00
TERRELL	3	6.0000	6.0	6.0	6.0	6.0	6.00
VAL VERDE	15	6.2000	7.0	5.0	6.0	6.0	7.00
COCHRAN	89	7.0674	8.0	6.0	7.0	7.0	8.00
CULBERSON	116	6.9655	8.0	4.0	7.0	7.0	8.00
HOWARD	424	6.4958	13.0	1.3	6.0	7.0	8.00
MARTIN	56	7.5179	15.0	5.0	6.0	7.0	8.75
REEVES	103	7.3010	12.0	4.0	6.0	7.0	8.00
WARD	262	7.1336	15.0	5.0	6.0	7.0	8.00
BORDEN	68	8.0441	9.0	7.0	7.0	8.0	9.00
FISHER	181	7.7994	11.0	3.9	7.0	8.0	9.00
GARZA	19	8.0000	8.0	8.0	8.0	8.0	8.00
MIDLAND	150	7.4607	15.0	1.0	6.0	8.0	9.00
MITCHELL	4	9.5000	14.0	8.0	8.0	8.0	12.50
PECOS	318	8.1836	16.1	3.5	6.0	8.0	9.00
RUNNELS	21	6.6667	10.0	5.0	5.0	8.0	8.00
SCHLEICHER	21	8.4762	10.0	6.0	8.0	8.0	10.00
TAYLOR	13	7.6154	10.0	5.0	7.0	8.0	8.00
GLASSCOCK	342	8.8860	11.0	7.0	8.0	9.0	10.00
COKE	177	9.3051	12.0	6.0	8.0	10.0	10.00
NOLAN	14	10.0000	10.0	10.0	10.0	10.0	10.00
REAGAN	91	9.3846	10.0	8.0	9.0	10.0	10.00
SCURRY	52	9.5000	10.0	8.0	9.0	10.0	10.00
UPTON	150	8.9500	15.0	1.0	6.0	10.0	11.00

## SUMMARY

(Utah)

- I. The vast majority of readings (80.5 %) did not exceed background levels. As a result, there were no significant differences among the items of equipment or between facility types.
- II. San Juan county in the four corners area had a low background level and Uintah county to it's north had a high background level.

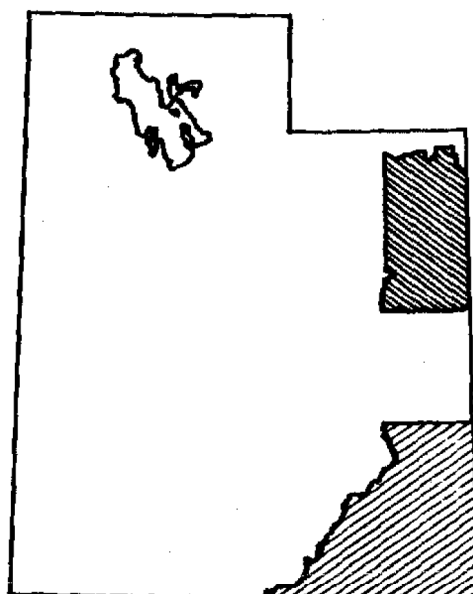
### III. Overall Summary

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
1. Statewide					
a. Background	364	10.0	11.0	12.0	14
b. Max Reading	364	10.0	11.0	14.0	600
c. Difference	364	0.0	0.0	4.0	588
2. Facility					
a. Background					
Gas Processing	9	9.0	10.0	10.0	10
Production	355	10.0	11.0	12.0	14
b. Max Reading					
Gas Processing	9	9.0	10.0	10.0	10
Production	355	10.0	11.0	14.0	600
c. Difference					
Gas Processing	9	0.0	0.0	0.0	0
Production	355	0.0	0.0	5.0	588

NOTE: All data are measured in micro-rems/hr

# FIGURE 1 — MEDIAN BACKGROUND LEVELS

UTAH



MICRO-REMS/HR



NO DATA



5.0 - 9.0



0 - 2.33



9.01 - 14.0



2.34 - 4.99



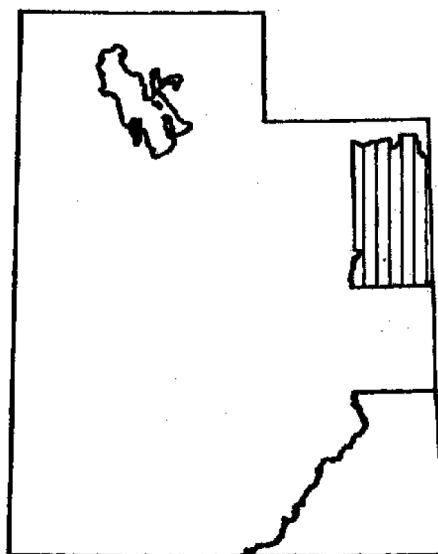
OVER 14.0

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

## FIGURE 2 - DIFFERENCE OVER BACKGROUND

UTAH

GAS PROCESSING FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

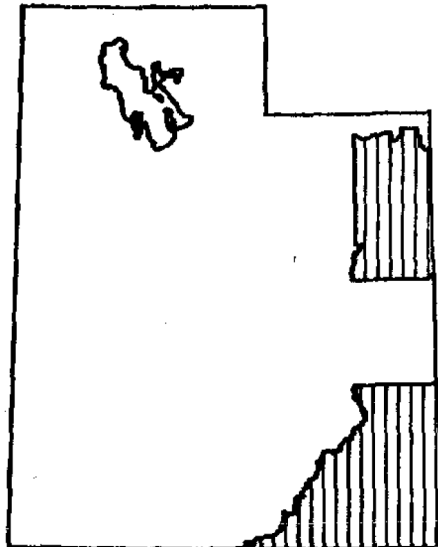
.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 3 - DIFFERENCE OVER BACKGROUND

UTAH

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY



Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Utah

FACILITY: Gas Processing

Obsns	Equipment	Median Difference	75th Percentile
3	COMPRESSOR	0.0	0.0
5	DEHYDRATOR	0.0	0.0
1	INLET SCRUBBER	0.0	0.0
9			

Median of Difference Over Background

FACILITY: Production

5	FLINE	0.0	0.9
78	H/T	0.0	0.0
31	MANIFOLD	0.0	0.0
12	OTHER	0.0	0.0
22	PUMP	0.0	1.1
55	SEP	0.0	5.0
56	STANK	0.0	0.0
3	WINJ	0.0	0.0
6	WLINE	0.0	1.7
61	WPROD	0.0	0.0
26	WTANK	0.0	8.8
355			

Median of Difference Over Background

Table 2

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Utah

FACILITY: Gas Processing

Obsns	County		Median Difference	75 <sup>th</sup> Percentile
9	UINTAH		0.0	0.0
		-----+-----+-----+-----+-----+-----+-----		
		10 20 30 40 50 60		

Median of Difference Over Background

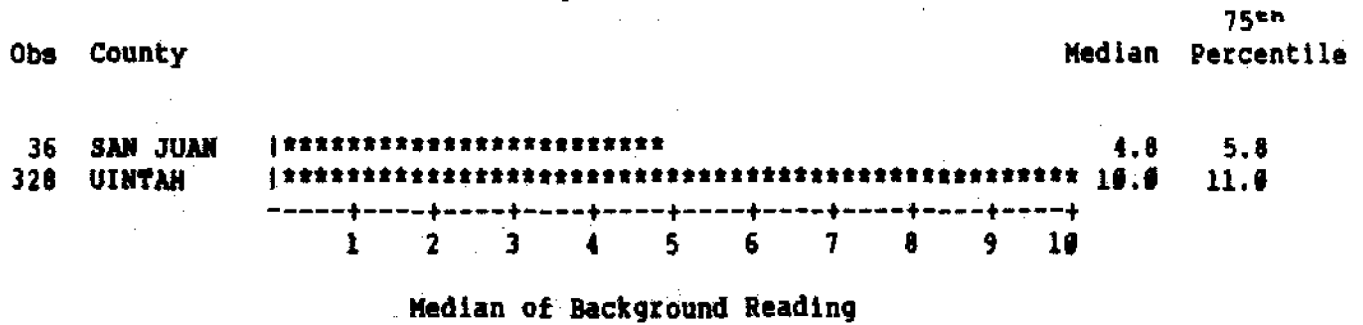
FACILITY: Production

36	SAN JUAN		0.0	1.0
319	UINTAH		0.0	0.0
---		-----+-----+-----+-----+-----+-----+-----		
355		10 20 30 40 50 60		

Median of Difference Over Background

Table 3  
 Median Background by County  
 Sequenced by Increasing Median Difference  
 (Micro-Rems/Hr)

Utah



# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Utah

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
-----------	----	---------	---------	---------	------	--------	------

#### Gas Processing Facilities

COMPRESSOR	3	0	0	0	0	0	0
DEHYDRATOR	5	0	0	0	0	0	0
INLET SCRUBBER	1	0	0	0	0	0	0

#### Production Facilities

FLINE	5	0.3400	1.0	0	0	0	0.850
H/T	70	4.2192	190.0	0	0	0	0.000
MANIFOLD	31	2.6452	47.0	0	0	0	0.000
OTHER	12	0.5000	5.0	0	0	0	0.000
PUMP	22	0.7409	8.0	0	0	0	1.075
SEP	55	22.1945	588.0	0	0	0	5.000
STANK	56	0.4464	5.0	0	0	0	0.000
WINJ	3	0.0000	0.0	0	0	0	0.000
WLINE	6	0.7000	2.9	0	0	0	1.700
WPROD	61	3.9500	236.0	0	0	0	0.000
WTANK	26	23.5385	496.0	0	0	0	0.750

## Appendix 2

### Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

Utah

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	UINTAH	9	0.00000	0.0	0	0	0	0
PROD	SAN JUAN	36	0.58333	2.9	0	0	0	1
PROD	UINTAH	319	7.89028	580.0	0	0	0	0

### Appendix 3

#### Statistical Data on Background by County (Micro-Rems/Hr)

##### Utah

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
SAN JUAN	36	5.07778	5.8	4.8	4.8	4.8	5.8
UINTAH	328	9.60366	14.0	5.0	8.0	10.0	11.0

# SUMMARY

(Wyoming)

I. There were no significant differences in readings among the items of equipment, facilities, or counties.

II. Utah had a wide range of background levels. Carbon, Uinta, Washakie, and Park counties were low; Fremont, Sublette, Sweetwater, and Lincoln were mid-range; Converse, Crook, Hot Springs, Niobrara, Johnson and Laramie were high; and Big Horn and Campbell were very high.

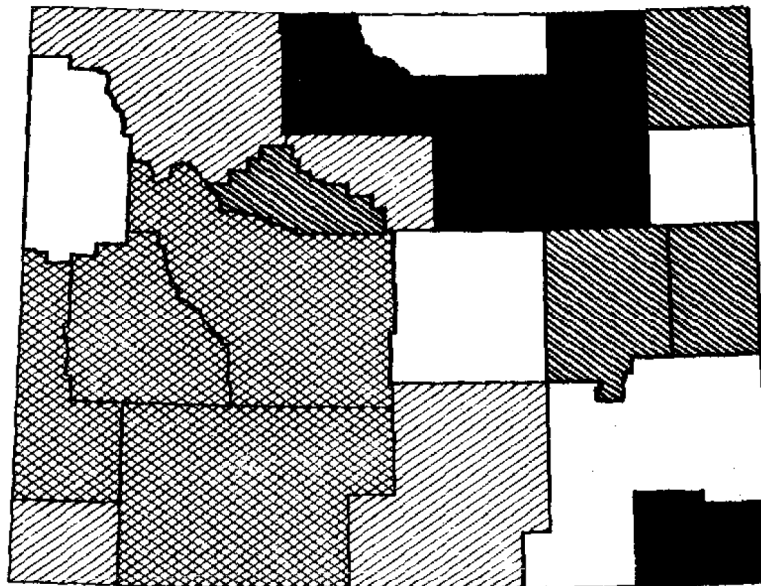
## III. Overall Summary

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
1. Statewide					
a. Background	1,687	9.0	12.0	15.0	17.0
b. Max Reading	1,687	10.0	14.0	15.0	850.0
c. Difference	1,687	0.0	0.0	2.0	836.0
2. Facility					
a. Background					
Gas Processing	378	4.6	6.0	7.0	12.5
Production	1,309	10.0	14.0	15.0	17.0
b. Max Reading					
Gas Processing	378	5.8	6.0	12.0	69.0
Production	1,309	11.0	14.0	15.0	850.0
c. Difference					
Gas Processing	378	0.0	0.0	1.0	56.5
Production	1,309	0.0	0.0	2.0	836.0

NOTE: All data are measured in micro-rem/hr

# FIGURE 1 - MEDIAN BACKGROUND LEVELS

WYOMING



MICRO-REMS/HR



NO DATA  
5.0 - 9.0



0 - 2.33  
9.01 - 14.0



2.34 - 4.99  
OVER 14.0

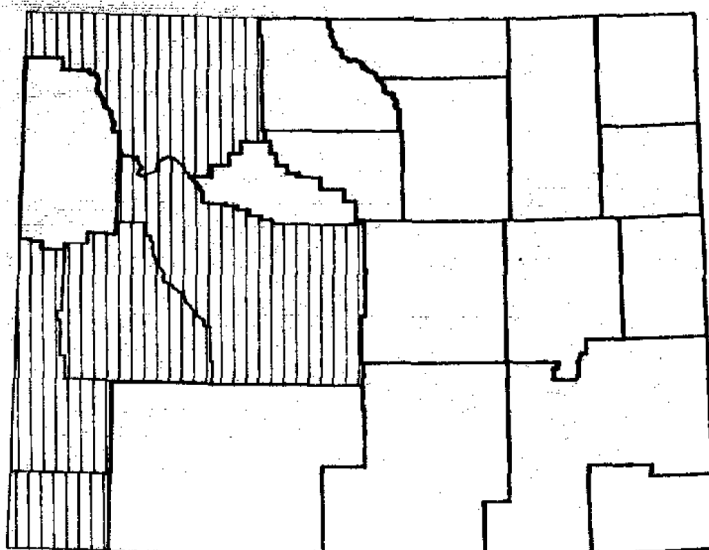
AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY



## FIGURE 2 — DIFFERENCE OVER BACKGROUND

WYOMING

GAS PROCESSING FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

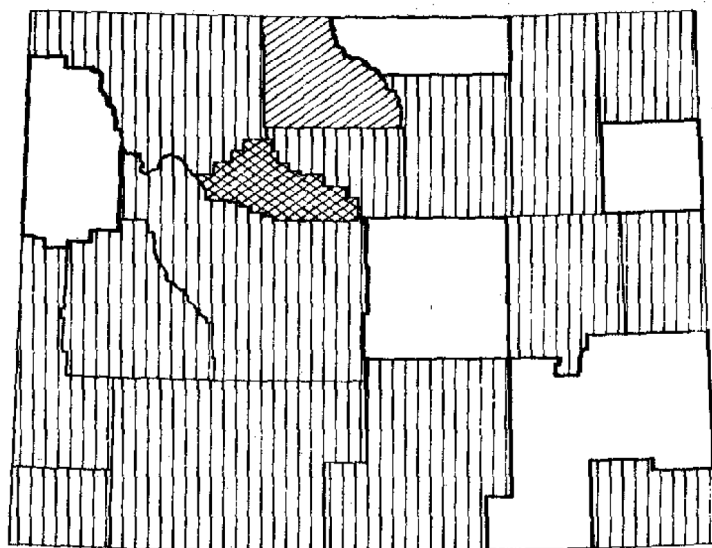
.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 3 - DIFFERENCE OVER BACKGROUND

WYOMING

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Wyoming

## FACILITY: Gas Processing

Obsns	Equipment	Median Difference	75 <sup>th</sup> Percentile
1	BOTTOMS PUMP	0.00	0.0
43	COMPRESSOR	0.00	0.0
26	DEHYDRATOR	0.00	0.0
31	FRAC TOWER	0.00	4.0
70	INLET SCRUBBER	0.00	0.0
3	METER	0.00	3.5
18	OPUMP	0.00	0.0
48	OTANK	0.00	0.0
80	OTHER	0.00	0.0
1	PPUMP	0.00	0.0
7	PRODUCT LINE	0.00	0.0
1	REFRIGERATION	0.00	0.0
43	SWEETENER	0.00	0.0
6	PTANK	5.50	0.0
-----			
378			

-----+-----+-----+-----+-----+-----+  
 1 2 3 4 5 6  
 Median of Difference Over Background

## FACILITY: Production

11	FLINE	0.00	0.0
245	H/T	0.00	0.0
65	MANIFOLD	0.00	0.0
44	METER	0.00	0.0
94	OTHER	0.00	0.0
30	PUMP	0.00	0.0
191	SEP	0.00	0.0
457	STANK	0.00	0.0
15	WLINE	0.00	0.0
1	WINJ	0.00	0.0
77	WPROD	0.00	0.0
66	WTANK	0.00	0.13
13	SUMP	3.80	16.50
-----			
1309			

-----+-----+-----+-----+-----+-----+  
 1 2 3 4 5 6  
 Median of Difference Over Background

Table 2

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Wyoming

## FACILITY: Gas Processing

Obsns	County		Median Difference	75 <sup>th</sup> Percentile
40	FREMONT		0.0	0.3
100	LINCOLN		0.0	0.0
55	PARK		0.0	5.0
42	SUBLETTE		0.0	0.0
135	UINTA		0.0	0.0
6	UNREPORTED	*****	5.5	26.5
		-----+-----+-----+-----+-----+-----+-----		
		1 2 3 4 5 6 7		

Median of Difference Over Background

## FACILITY: Production

82	CAMPBELL		0.0	0.0
35	CARBON		0.0	0.2
36	CONVERSE		0.0	0.0
24	CROOK		0.0	0.0
148	FREMONT		0.0	0.5
412	JOHNSON		0.0	0.0
18	LARAMIE		0.0	0.0
38	LINCOLN		0.0	0.0
20	NIOBRARA		0.0	0.0
213	PARK		0.0	0.0
61	SUBLETTE		0.0	0.0
8	SWEETWATER		0.0	0.0
64	UINTA		0.0	0.0
30	WASHAKIE		0.0	0.0
5	BIG HORN	****	1.0	2.5
84	UNREPORTED	****	1.0	3.8
31	HOT SPRINGS	*****	2.0	9.0
		-----+-----+-----+-----+-----+-----+-----		
		1 2 3 4 5 6 7		

Median of Difference Over Background

Table 3  
Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Wyoming

Obs	County		Median	75th Percentile
35	CARBON	*****	3.0	11.0
199	UINTA	*****	4.0	8.0
30	WASHAKIE	*****	4.3	4.5
268	PARK	*****	4.8	10.0
188	FREMONT	*****	5.8	12.0
103	SUBLETTE	*****	6.0	6.0
8	SWEETWATER	*****	6.3	6.9
138	LINCOLN	*****	7.0	8.0
90	UNREPORTED	*****	9.5	10.0
36	CONVERSE	*****	11.0	12.0
24	CROOK	*****	11.0	11.0
31	HOT SPRINGS	*****	12.0	12.0
20	NIOBRARA	*****	12.0	13.0
412	JOHNSON	*****	14.0	15.0
18	LARAMIE	*****	14.0	14.0
5	BIG HORN	*****	15.0	15.0
82	CAMPBELL	*****	15.0	15.0
		-----+-----+-----+-----+-----+-----+-----+		
		2 4 6 8 10 12 14 16		
Median of Background Readings				

# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Wyoming

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
-----------	----	---------	---------	---------	------	--------	------

#### Gas Processing Facilities

BOTTOMS PUMP	1	0.0000	0.0	0	0	0.0	0.0
COMPRESSOR	43	0.0070	0.3	0	0	0.0	0.0
DEHYDRATOR	26	0.0000	0.0	0	0	0.0	0.0
FRAC TOWER	31	4.6161	42.0	0	0	0.0	4.0
INLET SCRUBBER	70	0.0714	5.0	0	0	0.0	0.0
METER	3	1.1667	3.5	0	0	0.0	3.5
OPUMP	18	0.0000	0.0	0	0	0.0	0.0
OTANK	48	1.9729	56.0	0	0	0.0	0.0
OTHER	80	2.0375	56.5	0	0	0.0	0.0
PPUMP	1	0.0000	0.0	0	0	0.0	0.0
PRODUCT LINE	7	0.0000	0.0	0	0	0.0	0.0
REFRIGERATION	1	0.0000	0.0	0	0	0.0	0.0
SWEETENER	43	0.0000	0.0	0	0	0.0	0.0
PTANK	6	11.8333	37.0	0	0	5.5	26.5

#### Production Facilities

FLINE	11	24.6364	271	0	0	0.0	0.000
H/T	245	5.7710	836	0	0	0.0	0.000
MANIFOLD	65	6.9462	451	0	0	0.0	0.000
METER	44	0.0000	0	0	0	0.0	0.000
OTHER	94	0.4181	7	0	0	0.0	0.000
PUMP	30	0.2333	5	0	0	0.0	0.000
SEP	191	2.8901	181	0	0	0.0	1.000
STANK	457	0.6046	41	0	0	0.0	0.000
WINJ	1	0.0000	0	0	0	0.0	0.000
WLINE	15	0.0000	0	0	0	0.0	0.000
WPROD	77	0.0000	0	0	0	0.0	0.000
WTANK	66	0.7879	8	0	0	0.0	0.125
SUMP	13	15.4462	117	0	0	3.8	16.500

# Appendix 2

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Wyoming

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	FREMONT	40	3.4150	56.5	0	0.0	0.0	0.225
GP	LINCOLN	100	0.0000	0.0	0	0.0	0.0	0.000
GP	PARK	55	4.4473	56.0	0	0.0	0.0	5.000
GP	SUBLETTE	42	0.0000	0.0	0	0.0	0.0	0.000
GP	UINTA	135	0.2104	5.5	0	0.0	0.0	0.000
GP	UNREPORTED	6	11.8333	37.0	0	0.0	5.5	26.500
PROD	CAMPBELL	82	0.0000	0.0	0	0.0	0.0	0.000
PROD	CARBON	35	0.2543	3.0	0	0.0	0.0	0.200
PROD	CONVERSE	36	24.3611	836.0	0	0.0	0.0	0.000
PROD	CROOK	24	0.0417	1.0	0	0.0	0.0	0.000
PROD	FREMONT	148	6.3439	451.0	0	0.0	0.0	0.450
PROD	JOHNSON	412	0.3714	9.0	0	0.0	0.0	0.000
PROD	LARAMIE	18	0.0000	0.0	0	0.0	0.0	0.000
PROD	LINCOLN	38	0.0000	0.0	0	0.0	0.0	0.000
PROD	NIOBRARA	20	0.1000	2.0	0	0.0	0.0	0.000
PROD	PARK	213	0.4695	6.0	0	0.0	0.0	0.000
PROD	SUBLETTE	61	0.0000	0.0	0	0.0	0.0	0.000
PROD	SWEETWATER	8	0.0000	0.0	0	0.0	0.0	0.000
PROD	UINTA	64	4.8750	271.0	0	0.0	0.0	0.000
PROD	WASHAKIE	30	0.0000	0.0	0	0.0	0.0	0.000
PROD	BIG HORN	5	1.4000	4.0	0	0.5	1.0	2.500
PROD	UNREPORTED	84	0.0095	192.0	0	0.0	1.0	3.750
PROD	HOT SPRINGS	31	4.0000	12.0	0	0.8	2.0	9.000

# Appendix 3

## Statistical Data on Background by County (Micro-Rems/Hr)

### Wyoming

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
CARBON	35	6.5286	14.0	1.8	2.5	3.0	11.0
UINTA	199	5.3327	10.0	0.0	4.0	4.0	8.0
WASHAKIE	30	4.2633	4.8	3.9	4.0	4.3	4.5
PARK	268	6.4179	15.0	1.0	3.5	4.8	10.0
FREMONT	188	7.4862	15.0	2.3	3.5	5.0	12.0
SUBLETTE	103	6.1748	7.0	6.0	6.0	6.0	6.0
SWEETWATER	8	6.5250	6.9	6.3	6.3	6.3	6.9
LINCOLN	130	7.5290	12.0	4.5	6.0	7.0	8.0
UNREPORTED	90	9.1778	12.0	7.0	8.0	9.5	10.0
CONVERSE	36	11.6944	14.0	11.0	11.0	11.0	12.0
CROOK	24	11.0000	11.0	11.0	11.0	11.0	11.0
HOT SPRINGS	31	9.8839	14.0	2.0	3.0	12.0	12.0
NIOBRARA	20	12.1000	14.0	8.0	12.0	12.0	13.0
JOHNSON	412	12.0252	17.0	8.0	11.0	14.0	15.0
LARAMIE	18	14.0000	14.0	14.0	14.0	14.0	14.0
BIG HORN	5	14.6000	15.0	14.0	14.0	15.0	15.0
CAMPBELL	82	14.0244	16.0	10.0	14.0	15.0	15.0



## VIII. Measurement Collection Protocols

American Petroleum Institute  
211 N. Ervey, Suite 1700  
Dallas, TX 75201-3668  
214-220-2034



B. R. Hall  
Production Director

August 2, 1988

To: API OPERATING COMMITTEE MEMBERS

API NORM DATA COMPILATION EFFORT

Gentlemen:

In follow-up to our request for release of your company's external survey measurements to API for analysis, your data on Naturally Occurring Radioactive Material should be transmitted to API, Attn: J. M. Spanhel, 211 N. Ervey, Suite 1700, Dallas, Texas 75201, by September 15, 1988. The data for each company will be grouped so that the measurements will not be attributable to any specific company.

The data required for analysis as described on the attachment should be limited to:


- State
- County
- Facility Type
- Equipment Type
- Maximum External Measurement
- Background Measurement

The data should be provided on 5 1/4" floppy diskettes on a LOTUS 123 spreadsheet with each state prepared as a separate worksheet, entitled "ST.WK1" (eg., TX.WK1, LA.WK1, etc.). Field widths shall be as follows: State - 2; County - 20; Facility Type - 4; Equipment Type - 20; Maximum Reading - 6; and Background Reading - 6.

Each measurement provided should be the maximum external radiation dose reading in mR/hr for the specific piece of equipment surveyed. Measurements should be provided for in service equipment only. Surveys conducted on soil, junk/salvage vessels and tubing pipeyards and drum storage areas are not appropriate for this study.

Please advise me at 214/220-2034 if there is any problem in providing this information by September 15 and providing it in the requested format.

Very truly yours,

  
B. R. Hall

BRH:GC  
Attachment

API NORM  
DATA COMPILATION  
WORKSHEET

State	County	Facility Type	Equipment Type	Maximum Reading	Background Reading
1-2	3-22	23-26	27-46	47-52	52-58

State: TX - Texas; LA - Louisiana; also use OS for Offshore O.C.S. Properties

County: Self-explanatory

Facility Type: Prod - Production  
 GP - Gas Processing  
 Anything not considered Gas Processing should be classified as Production.

Equipment Type:

Production Facilities

- WPROD - Production wellhead
- WINJ - Injection wellhead
- WOTHER - Other wellheads
- MANIFOLD - Manifold/Header piping, valves and chokes, etc.
- SEP - Separators to include production separators, fwko, gunbarrels, etc.
- H/T - Heater treater
- STANK - Stock tanks
- WTANK - Water tanks
- PUMP - All pumps
- SUMP - Sumps to include pits, pigtraps, ponds, etc.
- FLINE - Flowlines to include all valves and elbows
- WLINE - Water lines to include all valves and elbows
- VRU - Vapor Recovery Units
- OTHER - All other measurements of in service equipment

Gas Processing

- INLET SCRUBBER - Inlet scrubbers, separators, fwko, etc.
- SWEETENER - All gas sweetening equipment to include amine systems, etc.
- DEHYDRATOR - Dehydration equipment to include Glycol, EG and TEG systems, etc.
- FRAC TOWER - All process towers/columns
- CRYO UNIT - All equipment associated with cryogenic process
- REFLEX PUMP - All reflex pumps
- BOTTOMS PUMP - Pumps transferring liquids off the bottoms of towers
- METER - All metering equipment to include meters, meter runs, screens, strainers, filters, etc.
- PPUMP - Propane pump
- OPUMP - All other pumps
- PTANK - Propane tanks
- OTANK - All other tanks
- PRODUCT LINE - All product pipelines
- COMPRESSOR - Compressors and associated equipment
- REFRIGERATION - All equipment associated with the Propane Refrigeration System
- OTHER - All other gas processing equipment to include pig launcher/receiver, etc.

## MEASUREMENT PROTOCOL FOR THE OCCURRENCE OF LSA MATERIAL (Phase I Survey Procedures)

### Objective

To provide uniform measurement criteria to assess the occurrence of low specific activity (LSA) scale and solids (material) and associated potential exposures.

### Introduction

Naturally occurring radioactive materials (NORM) may be produced with some petroleum fluids. These radioactive materials may accumulate in scale or solids in vessels, pipes, tubing, or other production equipment. In this protocol, we will refer to these radioactive materials as LSA material.

Daughter products of natural uranium and thorium are expected to be the major radioactive components of LSA material. These daughter products emit alpha, beta, and gamma radiations. The alpha and beta radiations do not normally penetrate through the vessel or pipe wall. However, the gamma radiation can be measured outside the vessel or pipe and can be used to determine the occurrence of LSA material in this equipment. This gamma radiation can also lead to direct radiation exposure, and this exposure should be assessed.

Measurements along the external surface of the production train can be made to determine where LSA material has accumulated inside equipment and piping. Where accumulations are detected, exposure rate measurements should also be made to determine potential employee exposure to gamma radiation that penetrates through the equipment or pipe.

For a more complete discussion on naturally occurring radioactive materials and the occurrence of LSA material, the reader is referred to the following publications:

- o Manuscript of presentation by A. L. Smith at the March 1985 Offshore Technology Conference in Houston, Texas
- o National Council on Radiation Protection and Measurements Report Numbers 50, 77, and 78
- o Exploration and Production Forum of February 12, 1987

### Equipment

**SAFETY NOTE:** These instruments are not intrinsically safe. There is some potential for sparking when detector cables are connected or disconnected, or when switches are turned on or off. Where explosive atmospheres may be encountered, explosive gas measurements should be made prior to the radiation survey.

- o A pulse rate meter with a sodium iodide (NaI) scintillation detector with a 1" x 1" crystal is recommended to determine where LSA material exists.
- o A pulse rate meter with an energy-compensated Geiger-Muller (GM) detector is recommended to measure exposure rates.

NOTE: The same pulse rate meter can be calibrated for use with either detector. However, care should be taken to ensure that field adjustments to the pulse rate meter are not necessary when the detectors are changed.

- o Brief descriptions of these instruments are contained in Attachment I to this procedure.

#### Equipment Calibration

- o Regulatory agencies require that radiation survey equipment be calibrated periodically. It is recommended that radiation survey equipment be calibrated at least annually.
- o A National Bureau of Standards (NBS) traceable cesium-137 (Cs-137) source is recommended for the calibration of the pulse rate meter with both detectors.

#### Training

Employees who perform LSA material surveys should receive, as a minimum, the following training to ensure consistent and accurate results:

- o Overview of LSA material occurrence
- o Need for proper instrument calibration (by manufacturer or calibration lab)
- o Use of measurement instruments
- o Measurement techniques
- o Use and purpose of check sources
- o Survey strategy (where to survey)
- o Interpretation of results
- o LSA material handling procedures and safety precautions

NOTE: Since survey personnel will probably be asked a broad range of questions by field employees on LSA material and related employee health concerns, they should be briefed on how to respond to these types of questions.

### Where To Survey

- o No firm correlations have been drawn to date that allow us to predict which formations, wells, or production trains may be associated with LSA material accumulation. It appears that the only way to find out if LSA material is present at a particular location is to survey it.
- o Common areas where LSA material accumulation has been found are:
  - In field production facilities:

Heater treaters, water knockouts, liquid product tanks, separators, tubing and piping (particularly at points where flow direction or velocity changes), water transfer pumps, and produced water handling equipment.
  - In gas plants:

Propane/ethane reflux pumps, liquid product pumps and storage tanks, and points of flow velocity or directional changes (particularly in piping in propane, ethane, and product service).
- o Where practical, it is recommended that all accessible parts of the production train be surveyed.
- o At some locations where LSA material has come in contact with or fallen to the ground, soil measurements may be needed.

### Survey Techniques/Procedures

- o Review and follow manufacturer's operating instructions for the instrument(s) to be used.
- o Complete the top half of the survey data sheet up to "background readings."
- o Check instruments using a check source to determine that they are operating properly. (Coleman lantern mantles have been found to be useful and inexpensive check sources.)
- o Measure background radiation levels with the NaI detector. These background measurements should be made at a minimum distance of 20 feet from production equipment. Report the background measurement results in counts per minute (cpm) on the attached survey data sheets.

NOTE: A good location to make background measurements onshore is at the entrance to the lease site, and offshore is on the heliport.
- o Where practical, survey all accessible parts of the production train. Hold the NaI detector as close to the equipment surface as possible. Scan the equipment by moving the NaI detector slowly along the production train. Record the NaI detector readings in cpm on the attached survey data sheet. Record a reading for each separate piece of equipment/piping surveyed, even if at background.

Where levels vary for a given piece of equipment or pipe, the highest reading should be recorded unless different parts or components of the equipment or pipe can be identified (on the survey data sheet) and surveyed individually.

- o Using the energy-compensated GM detector, survey locations where levels measured with the NaI detector exceeded 4000 cpm above background. Hold the GM detector 1 foot away from the equipment being surveyed. Where soil measurements are made, the GM detector readings should be taken at the height of the reproductive organs (about 1 meter (3.3 feet) from the ground). Record the GM detector results in millirems per hour (mR/hr) on the attached survey data sheet.

NOTE: In areas where background readings exceed 2000 cpm, it is recommended that energy-compensated GM detector measurements be made at all locations where NaI detector readings exceed 6000 cpm.

- o When the GM detector has been used at a given location, measure background radiation with the GM detector. Make these measurements at the location where the NaI detector background readings were made. Record the GM detector background readings in mR/hr on the attached data sheet.

NOTE: It may be more convenient to take both the NaI and GM detector background readings prior to the survey.

### Records

Where practical, all of the information on the attached sample data sheet should be completed for each location surveyed.







## ATTACHMENT I

### Theory of Operation:

#### A. Scintillation Detectors

Some materials emit light or "scintillate" when exposed to radiation. For example, the sodium iodide (NaI) detectors we are using to determine where LSA scale or solids have accumulated emit light when exposed to gamma radiation. This emitted light is then detected by a photomultiplier tube in the detector, which produces a pulsed electric current that is roughly proportional to the amount of gamma radiation present. This electric pulse is then fed into the pulse rate meter where it is converted to a meter reading in counts per minute (cpm). From this meter reading we are able to locate LSA material that has accumulated in equipment and get a rough idea of how much of this LSA material is present.

We are not able to accurately determine exposure rates from these scintillation detector readings because these detectors are markedly energy dependent and tend to overrespond (read too high) when exposed to low energy gamma radiation (Reference: NCRP 50<sup>1</sup>). To measure exposure rates, a detector that is energy independent is needed.

#### B. Energy-Compensated Geiger Muller Detectors

Energy-compensated Geiger Muller (GM) tube detectors are for all practical purposes energy independent and can be used to measure exposure rates. Gamma radiation that enters an energy-compensated GM tube causes the gas (e.g. air) in the tube to break down into positively and negatively charged materials called ions. These charged ions cause a pulsed current to flow in the GM tube. This pulse is fed to the pulse rate meter, where it is converted to a meter reading and read in millirems per hour. Each gamma radiation (photon) that enters the energy-compensated GM detector produces a single pulse of current.

An energy-independent response is achieved in these energy-compensated GM detectors by using detector shields (NCRP 50<sup>1</sup>).

<sup>1</sup>National Council on Radiation Protection and Measurements Report No. 50, pages 75-77.



Appendix 2 (Continued)

Statistical Data on Median Difference over Background  
By Facility and County  
(Micro-Rems/Hr)

Oklahoma

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
PROD	PITTSBURG	40	0.125	1.0	0	0.00	0.00	0.00
PROD	PONTOTOC	31	9.032	135.0	0	0.00	0.00	4.00
PROD	STEPHENS	368	17.457	744.0	0	0.00	0.00	4.00
PROD	TEXAS	18	0.572	4.5	0	0.00	0.00	0.25
PROD	WOODS	4	0.000	0.0	0	0.00	0.00	0.00
PROD	WOODWARD	7	0.286	2.0	0	0.00	0.00	0.00
PROD	CADDO	74	7.659	189.0	0	0.00	0.50	4.00
PROD	COAL	8	28.125	103.0	0	0.00	0.50	66.75
PROD	BEAVER	173	0.942	5.0	0	0.00	1.00	2.00
PROD	BECKHAM	9	40.444	313.0	0	0.00	1.00	23.00
PROD	CLEVELAND	103	8.553	143.0	0	0.00	1.00	3.00
PROD	ELLIS	13	2.231	8.0	0	0.00	1.00	5.00
PROD	GARFIELD	22	3.455	20.0	0	0.00	1.00	4.00
PROD	LATIMER	25	0.800	2.0	0	0.00	1.00	2.00
PROD	LINCOLN	5	4.400	20.0	0	0.00	1.00	10.50
PROD	LOVE	8	5.000	23.0	0	0.00	1.00	9.25
PROD	MCCLAIN	37	119.784	2140.0	0	0.00	1.00	60.00
PROD	POTTAWATOMIE	50	45.380	1190.0	0	0.00	1.00	12.00
PROD	UNREPORTED	1	1.000	1.0	1	1.00	1.00	1.00
PROD	HASKELL	149	2.020	16.0	0	1.00	2.00	3.00
PROD	KAY	74	85.365	685.0	0	0.00	2.00	114.25
PROD	TULSA	12	179.583	986.0	0	0.00	2.00	85.75
PROD	WASHITA	23	1.783	9.0	0	0.00	2.00	2.00
PROD	CREEK	285	100.926	2790.0	0	0.00	3.00	46.50
PROD	OKMULGEE	31	228.774	3786.0	0	0.00	3.00	137.00
PROD	OSAGE	115	87.113	3391.0	0	1.00	4.00	32.00
PROD	SEMINOLE	126	63.944	888.0	0	1.00	4.00	45.45
PROD	HUGHES	4	8.750	19.0	5	5.00	5.50	15.75

# Appendix 2

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### Oklahoma

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	ALFALFA	3	0.333	1.0	0	0.00	0.00	1.00
GP	BECKHAM	22	0.136	1.0	0	0.00	0.00	0.00
GP	BLAINE	63	2.129	74.5	0	0.00	0.00	0.00
GP	CADDO	1	0.000	0.0	0	0.00	0.00	0.00
GP	CANADIAN	10	0.500	3.0	0	0.00	0.00	0.50
GP	CARTER	1	0.000	0.0	0	0.00	0.00	0.00
GP	CREEK	1	0.000	0.0	0	0.00	0.00	0.00
GP	CUSTER	3	0.000	0.0	0	0.00	0.00	0.00
GP	GARVIN	2	0.000	0.0	0	0.00	0.00	0.00
GP	GRADY	11	1.718	15.9	0	0.00	0.00	1.00
GP	KINGFISHER	30	6.900	176.0	0	0.00	0.00	0.00
GP	MAJOR	1	0.000	0.0	0	0.00	0.00	0.00
GP	MURRAY	14	0.286	4.0	0	0.00	0.00	0.00
GP	OKLAHOMA	4	0.000	0.0	0	0.00	0.00	0.00
GP	PITTSBURG	10	0.100	1.0	0	0.00	0.00	0.00
GP	WASHITA	1	0.000	0.0	0	0.00	0.00	0.00
GP	WOODWARD	44	1.602	25.0	0	0.00	0.00	0.00
GP	HASKELL	44	1.750	5.0	0	0.00	1.50	3.00
GP	LATIMER	2	1.500	2.0	1	1.00	1.50	2.00
GP	BEAVER	8	1.375	2.0	0	0.25	2.00	2.00
GP	TEXAS	9	8.978	23.4	0	0.00	10.50	13.75
GP	DEWEY	20	47.130	539.0	0	0.00	13.35	44.00
GP	STEPHENS	3	19.000	44.2	0	0.00	15.20	44.20
PROD	ALFALFA	118	1.102	83.0	0	0.00	0.00	0.00
PROD	BLAINE	140	5.929	120.0	0	0.00	0.00	2.00
PROD	CANADIAN	136	14.096	887.0	0	0.00	0.00	2.00
PROD	CARTER	390	7.983	268.0	0	0.00	0.00	3.00
PROD	COMANCHE	12	1.583	19.0	0	0.00	0.00	0.00
PROD	CUSTER	83	0.012	1.0	0	0.00	0.00	0.00
PROD	DEWEY	59	0.322	2.0	0	0.00	0.00	1.00
PROD	GARVIN	156	32.006	986.0	0	0.00	0.00	2.00
PROD	GRADY	127	29.315	990.0	0	0.00	0.00	2.00
PROD	GRANT	2	0.000	0.0	0	0.00	0.00	0.00
PROD	HARPER	15	0.900	12.5	0	0.00	0.00	0.00
PROD	KINGFISHER	526	14.530	789.0	0	0.00	0.00	2.00
PROD	MAJOR	101	19.772	986.0	0	0.00	0.00	3.00
PROD	MURRAY	70	0.000	0.0	0	0.00	0.00	0.00
PROD	NOBLE	9	0.556	2.0	0	0.00	0.00	1.00
PROD	OKLAHOMA	44	10.886	460.0	0	0.00	0.00	0.00
PROD	PAYNE	18	123.222	1585.0	0	0.00	0.00	95.75

# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Oklahoma

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
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#### Gas Processing Facilities

COMPRESSOR	99	0.970	5.0	0.0	0.00	0.00	2.00
CRYO UNIT	2	0.000	0.0	0.0	0.00	0.00	0.00
DEHYDRATOR	27	0.333	4.0	0.0	0.00	0.00	0.00
FRAC TOWER	20	1.225	15.0	0.0	0.00	0.00	0.00
INLET SCRUBBER	35	0.206	2.0	0.0	0.00	0.00	0.00
METER	8	0.687	4.5	0.0	0.00	0.00	0.75
OTANK	32	7.403	89.0	0.0	0.00	0.00	0.50
OTHER	17	4.188	44.0	0.0	0.00	0.00	4.60
PRODUCT LINE	8	5.187	24.5	0.0	0.00	0.00	12.75
REFRIGERATION	12	0.000	0.0	0.0	0.00	0.00	0.00
SWEETENER	13	0.000	0.0	0.0	0.00	0.00	0.00
PTANK	9	4.811	20.0	0.0	0.00	0.50	8.30
OPUMP	9	33.333	176.0	0.0	0.00	10.50	47.00
BOTTOMS PUMP	2	12.750	25.0	0.5	0.50	12.75	25.00
PPUMP	4	143.475	539.0	0.0	3.97	17.45	409.00
REFLUX PUMP	7	26.114	51.3	0.0	4.80	20.90	46.40

#### Production Facilities

FLINE	59	47.610	888	0	0	0	30.00
MANIFOLD	111	40.027	1196	0	0	0	3.00
METER	135	0.652	7	0	0	0	1.00
OTHER	195	44.492	994	0	0	0	4.00
PUMP	271	13.139	986	0	0	0	1.00
SEP	626	30.785	3391	0	0	0	4.00
STANK	1012	8.253	986	0	0	0	1.75
VRU	3	0.000	0	0	0	0	0.00
WPROD	347	9.140	790	0	0	0	2.00
H/T	350	19.700	1205	0	0	1	6.00
SUMP	42	31.048	685	0	0	1	10.25
WTANK	505	45.335	3786	0	0	2	13.50
WINJ	9	109.111	886	0	0	6	40.00
WLINE	79	184.934	2790	0	0	14	89.00

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Obs	County	Median	75 <sup>th</sup> Percentile
2	GRANT	10.0	10.0
193	HASKELL	10.0	10.0
556	KINGFISHER	10.0	10.0
37	MCCLAIN	10.0	10.0
50	PITTSBURG	10.0	10.0
181	BEAVER	11.0	11.0
79	DEWEY	11.0	11.0
48	OKLAHOMA	11.0	11.0
12	TULSA	11.0	14.0
4	WOODS	11.0	11.8
22	GARFIELD	11.5	13.3
51	WOODWARD	12.5	12.5
74	KAY	15.0	15.3
18	PAYNE	15.0	15.0

### Median of Background Readings

Table 3

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

			75 <sup>th</sup>
Obs	County		Percentile
4	HUGHES	*****	5.0 5.0
1	UNREPORTED	*****	5.0 5.0
24	WASHITA	*****	5.0 5.0
8	LOVE	*****	5.5 6.8
31	BECKHAM	*****	6.0 7.0
391	CARTER	*****	6.0 9.0
86	CUSTER	*****	6.0 6.0
13	ELLIS	*****	6.0 8.0
5	LINCOLN	*****	6.0 6.0
102	MAJOR	*****	6.0 9.0
27	TEXAS	*****	6.5 6.8
75	CADDO	*****	7.0 9.0
146	CANADIAN	*****	7.0 8.0
8	COAL	*****	7.0 7.0
138	GRADY	*****	7.0 10.0
84	MURRAY	*****	7.0 7.0
31	PONTOTOC	*****	7.0 10.0
121	ALFALFA	*****	8.0 8.0
203	BLAINE	*****	8.0 10.5
103	CLEVELAND	*****	8.0 9.0
158	GARVIN	*****	8.0 9.0
9	NOBLE	*****	8.0 8.0
31	OKMULGEE	*****	8.0 13.0
115	OSAGE	*****	8.0 9.0
50	POTTAWATOMIE	*****	8.0 8.0
126	SEMINOLE	*****	8.0 9.0
12	COMANCHE	*****	9.0 9.0
286	CREEK	*****	9.0 11.0
15	HARPER	*****	9.0 10.0
27	LATIMER	*****	9.0 10.0
371	STEPHENS	*****	9.0 15.0

-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+

2    4    6    8    10    12    14    16    18    20

Median of Background Readings



Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

FACILITY: Production

-169-

Table 2 (Continued)

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Oklahoma

FACILITY: Production

Obsns	County		Median Difference	75 <sup>th</sup> Percentile
118	ALFALFA		0.00	0.0
140	BLAINE		0.00	2.0
136	CANADIAN		0.00	2.0
390	CARTER		0.00	3.0
12	COMANCHE		0.00	0.0
83	CUSTER		0.00	0.0
59	DEWEY		0.00	1.0
156	GARVIN		0.00	2.0
127	GRADY		0.00	2.0
2	GRANT		0.00	0.0
15	HARPER		0.00	0.0
526	KINGFISHER		0.00	2.0
101	MAJOR		0.00	3.0
68	MURRAY		0.00	0.0
9	NOBLE		0.00	1.0
44	OKLAHOMA		0.00	0.0
18	PAYNE		0.00	95.8
40	PITTSBURG		0.00	0.0
31	PONTOTOC		0.00	4.0
368	STEPHENS		0.00	4.0
18	TEXAS		0.00	0.3
4	WOODS		0.00	0.0
7	WOODWARD		0.00	0.0
14	CADDO	*	0.50	3.0
74	COAL	*	0.50	4.0
8	BEAVER	**	1.00	66.8
173	BECKHAM	**	1.00	2.0
103	CLEVELAND	**	1.00	3.0
13	ELLIS	**	1.00	5.0
22	GARFIELD	**	1.00	4.0
25	LATIMER	**	1.00	2.0
5	LINCOLN	**	1.00	10.5
8	LOVE	**	1.00	9.3
37	MCCLAIN	**	1.00	60.0

-----+-----+-----+-----+-----+-----+-----+-----+-----+  
2 4 6 8 10 12 14 16 18  
Median of Difference Over Background

Table 2

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Oklahoma

FACILITY: Gas Processing

Obsns County		Median Difference	75 <sup>th</sup> Percentile
3	ALFALFA	0.00	1.0
17	BECKHAM	0.00	0.0
63	BLAINE	0.00	0.0
1	CADDO	0.00	0.0
10	CANADIAN	0.00	0.5
1	CARTER	0.00	0.0
1	CREEK	0.00	0.0
3	CUSTER	0.00	0.0
2	GARVIN	0.00	0.0
11	GRADY	0.00	1.0
30	KINGFISHER	0.00	0.0
1	MAJOR	0.00	0.0
16	MURRAY	0.00	0.0
4	OKLAHOMA	0.00	0.0
10	PITTSBURG	0.00	0.0
1	WASHITA	0.00	0.0
44	WOODWARD	0.00	0.0
44	HASKELL	1.50	3.0
2	LATIMER	1.50	2.0
8	BEAVER	2.00	2.0
9	TEXAS	10.50	13.8
20	DEWEY	13.35	44.0
3	STEPHENS	15.20	44.2
304			

Median of Difference Over Background

Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Oklahoma

## FACILITY: Gas Processing

Obsns	Equipment		Median Difference	75 <sup>th</sup> Percentile
99	COMPRESSOR		0.0	2.0
2	CRYO UNIT		0.0	0.0
27	DEHYDRATOR		0.0	0.0
20	FRAC TOWER		0.0	0.0
35	INLET SCRUBBER		0.0	0.0
8	METER		0.0	0.0
32	OTANK		0.0	0.0
17	OTHER		0.0	4.6
8	PRODUCT LINE		0.0	12.0
12	REFRIGERATION		0.0	0.0
13	SWEETENER		0.0	0.0
9	PTANK		0.5	8.3
9	OPUMP	*****	10.5	47.0
2	BOTTOMS PUMP	*****	12.7	25.0
4	PPUMP	*****	17.5	409.0
7	REFLUX PUMP	*****	20.9	46.4
304		-----+-----+-----+-----+-----+-----+-----		
		10 20 30 40 50 60		

Median of Difference Over Background

## FACILITY: Production

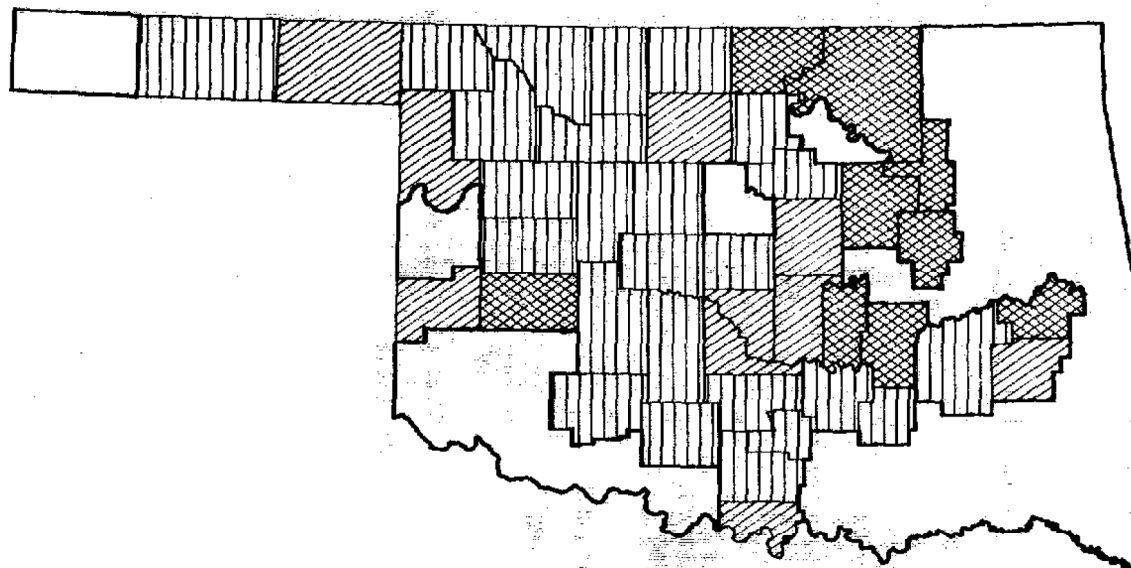
59	FLINE		0.0	30.0
111	MANIFOLD		0.0	3.0
135	METER		0.0	1.0
195	OTHER		0.0	4.0
271	PUMP		0.0	1.0
626	SEP		0.0	4.0
1,012	STANK		0.0	1.0
3	VRU		0.0	0.0
347	WPROD		0.0	2.0
350	H/T	*	1.0	6.0
42	SUMP	*	1.0	10.3
585	WTANK	*	2.0	13.5
9	WINJ	***	6.0	40.0
79	WLINE	*****	14.0	89.0
3,824		-----+-----+-----+-----+-----+-----+-----		
		10 20 30 40 50 60		

Median of Difference Over Background

# FIGURE 3 — DIFFERENCE OVER BACKGROUND

OKLAHOMA

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

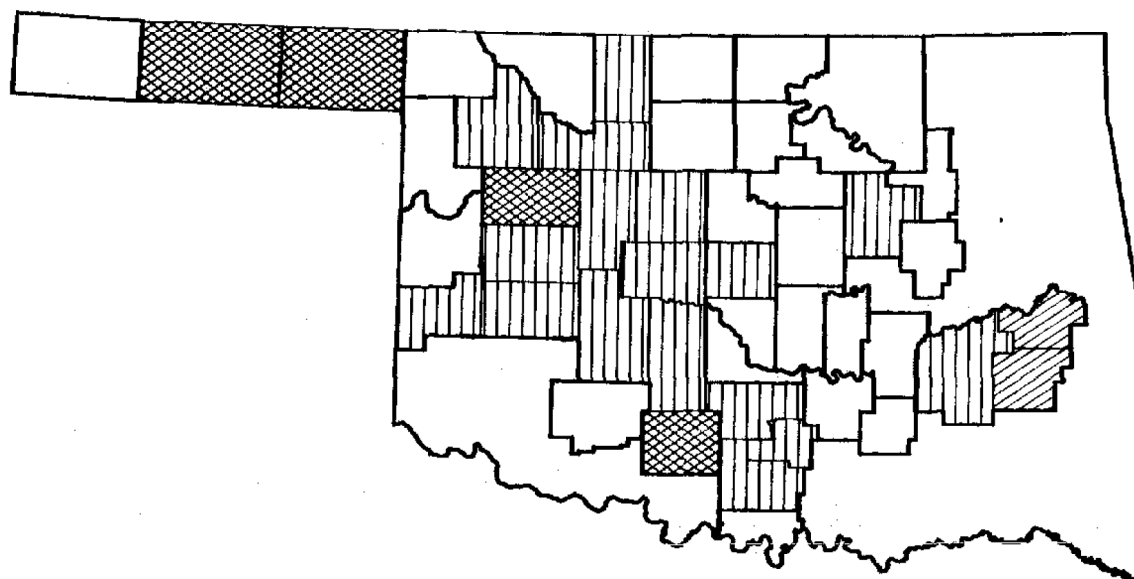
.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

## FIGURE 2 — DIFFERENCE OVER BACKGROUND

OKLAHOMA

GAS PROCESSING FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

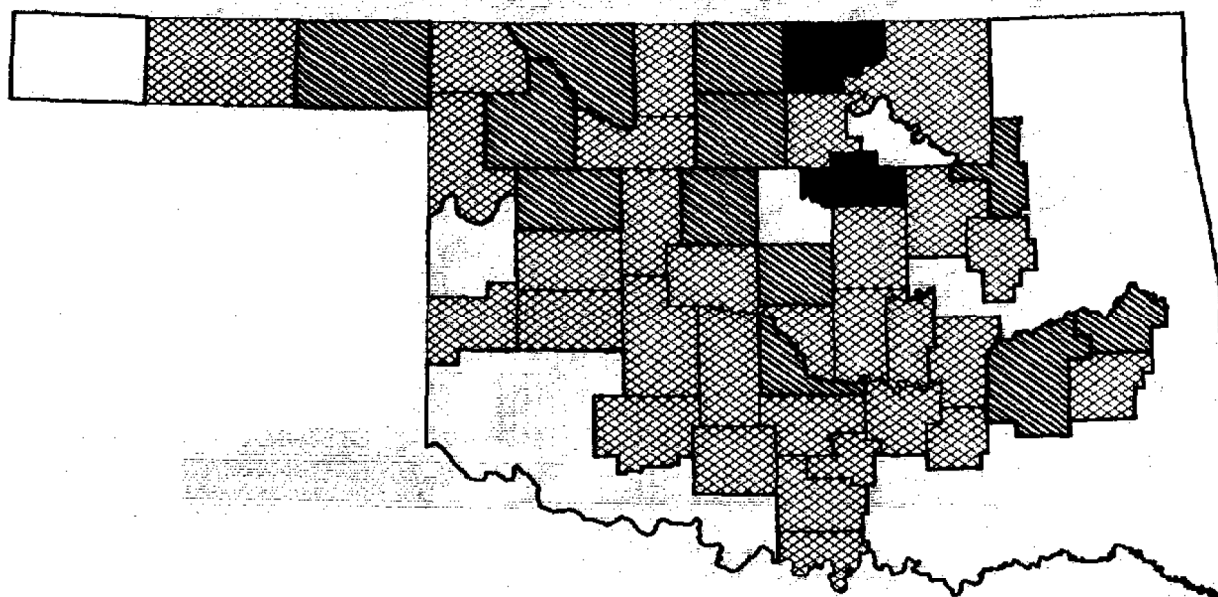
BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 1 — MEDIAN BACKGROUND LEVELS

OKLAHOMA



MICRO-REMS/HR

NO DATA  
5.0 - 9.0

0 - 2.33  
9.01 - 14.0

2.34 - 4.99  
OVER 14.0

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

# SUMMARY

(Oklahoma)

- I. There were no significant differences among the different items of equipment.
- II. Background levels were mid-range in all counties except Grant, Haskell, Kingfisher, McClain, Pittsburg, Beaver, Dewey, Oklahoma, Tulsa, Woods, Garfield, and Woodward which were high, and Kay and Payne which were very high.

## III. Overall Summary

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
1. Statewide					
a. Background	4,128	9.0	10.0	12.0	25
b. Max Reading	4,128	10.0	13.0	42.0	3,800
c. Difference	4,128	0.0	3.0	33.1	3,786
2. Facility					
a. Background					
Gas Processing	304	10.0	11.0	12.5	14
Production	3,824	9.0	10.0	12.0	25
b. Max Reading					
Gas Processing	304	10.0	12.5	15.0	550
Production	3,824	10.0	13.0	40.0	3,800
c. Difference					
Gas Processing	304	0.0	1.0	8.3	539
Production	3,824	0.0	3.0	38.0	3,786

NOTE: All data are measured in micro-rem/hr



## Appendix 2

### Statistical Data on Median Difference over Background By Facility and Area (Micro-Rems/Hr)

#### Offshore

FACILITY	AREA	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	CALIFORNIA	28	0.1429	1	0	0	0.0	0
GP	GULF	30	16.5000	68	0	5	13.0	20
PROD	CALIFORNIA	86	3.5000	48	0	0	0.0	3
PROD	GULF	2776	20.4281	995	0	0	0.5	7

## Appendix 3

### Statistical Data on Background by Area (Micro-Rems/Hr)

#### Offshore

AREA	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GULF	2806	1.2721	10	0	0.7	1	1.3
CALIFORNIA	114	2.0000	2	2	2.0	2	2.0

# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Offshore

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
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#### Gas Processing Facilities

COMPRESSOR	12	0.5833	7	0	0	0.0	0.00
INLET SCRUBBER	35	9.8000	68	0	0	1.0	14.00
DEHYDRATOR	4	4.7500	14	0	0	2.5	11.75
METER	1	5.0000	5	5	5	5.0	5.00
OTANK	1	10.0000	10	10	10	10.0	10.00
OPUMP	3	28.3333	55	15	15	15.0	55.00
OTHER	2	15.0000	20	10	10	15.0	20.00

#### Production

WPROD	513	3.7164	495.0	0.0	0.00	0.0	0.300
MANIFOLD	591	24.5440	598.0	0.0	0.00	0.3	8.200
PUMP	93	7.0183	88.0	0.0	0.00	0.3	8.350
OTHER	368	19.2701	995.0	0.0	0.00	0.3	2.875
WOTHER	6	1.4500	5.5	0.0	0.00	0.6	2.875
VRU	1	0.8000	0.8	0.8	0.80	0.8	0.800
H/T	90	29.4578	595.0	0.0	0.00	1.0	10.250
SEP	725	21.5276	748.0	0.0	0.00	1.0	8.000
WLINE	17	32.9765	397.0	0.0	0.05	2.1	6.150
FLINE	131	27.8000	473.0	0.0	0.00	3.0	22.000
STANK	168	29.8440	748.0	0.0	0.43	3.2	19.000
WTANK	76	13.1013	128.2	0.0	1.80	6.1	18.725
SUMP	73	54.1192	793.0	0.0	0.75	8.0	50.000
METER	8	23.5000	44.0	4.0	9.25	21.0	38.750
WINJ	2	95.0000	97.0	93.0	93.00	95.0	97.000

Table 2

Median Difference Over Background by Area  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

## Offshore

FACILITY: Gas Processing

Obsns	Area		Median Difference	75 <sup>th</sup> Percentile
28	CALIFORNIA		0.0	0.0
30	GULF	*****	12.5	21.0
		-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+		
		2 4 6 8 10 12 14 16 18 20		
Median of Difference Over Background				

FACILITY: Production

86	CALIFORNIA		0.0	0.0
2776	GULF	*	0.5	7.0
		-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+		
		2 4 6 8 10 12 14 16 18 20		
Median of Difference Over Background				

Table 3

Median Background by Area  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

## Offshore

Obs	Area		Median	75 <sup>th</sup> Percentile
2806	GULF	**	1.0	1.3
114	CALIFORNIA	****	2.0	2.0
		-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+		
		2 4 6 8 10 12 14 16 18		
Median of Background Readings				

Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

## Offshore

## FACILITY: Gas Processing

Obsns	Equipment		Median Difference	75 <sup>th</sup> Percentile
12	COMPRESSOR		0.00	0.0
35	INLET SCRUBBER		1.00	14.0
4	DEHYDRATOR	*	2.50	11.8
1	METER	***	5.00	5.0
1	OTANK	*****	10.00	10.0
3	OPUMP	*****	15.00	55.0
2	OTHER	*****	15.00	20.0
<hr/>				
58		10 20 30 40 50 60 70 80 90		

Median of Difference Over Background

## FACILITY: Production

513	WPROD		0.00	0.3
519	MANIFOLD		0.30	8.2
93	PUMP		0.30	8.4
368	OTHER		0.35	2.9
6	WOTHER		0.60	2.9
1	VRU		0.80	0.8
90	H/T		1.00	10.3
725	SEP	*	1.00	8.0
17	WLINE	*	2.10	10.6
131	FLINE	*	3.00	22.0
168	STANK	*	3.20	19.0
76	WTANK	***	6.10	18.7
73	SUMP	****	8.00	50.0
8	METER	*****	21.00	38.8
2	WINJ	*****	95.00	97.0
<hr/>				
2860		10 20 30 40 50 60 70 80 90		

Median of Difference Over Background

## SUMMARY

(Offshore)

### I. All significant differences were equipment specific.

The equipment with the most pronounced differences over background based on Median ranking is listed below. The difference is the excess of the reading over background:

Equipment	Median Difference	75 <sup>th</sup> Percentile
Injection Well (Prod)	95 $\mu$ R/hr	97.0 $\mu$ R/hr

### II. There were no significant differences in background readings between the Gulf of Mexico (1 $\mu$ R/Hr) and California (2 $\mu$ R/Hr). The Alaska offshore data (4 $\mu$ R/Hr) were reported with the rest of Alaska since there were few observations and there was no difference between onshore and offshore in that state.

### III. Overall Summary

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
1. Overall					
a. Background	2920	1.0	2.0	2.0	10
b. Max Reading	2920	2.0	8.9	40.0	1,000
c. Difference	2920	0.5	7.0	39.0	995
2. Facility					
a. Background					
Gas Processing	58	2.0	2.0	5.0	5
Production	2,862	1.0	2.0	2.0	10
b. Max Reading					
Gas Processing	58	3.0	15.0	25.5	70
Production	2,862	2.0	8.1	42.7	1,000
c. Difference					
Gas Processing	58	1.0	13.3	24.4	60
Production	2,862	0.5	7.0	41.3	995

NOTE: All data are measured in micro-rems/hr

### Appendix 3

#### Statistical Data on Background by County (Micro-Rems/Hr)

##### North Dakota

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
WILLIAMS	19	7.3684	10	5	5	5	10.0
BOTTINEAU	57	8.4035	9	8	8	8	9.0
DIVIDE	134	8.6269	13	2	7	9	9.5
RICHLAND	39	9.2051	11	9	9	9	9.0
BILLINGS	218	10.7156	14	9	10	10	10.0
BURKE	27	9.8148	10	9	10	10	10.0
RENVILLE	8	10.0000	10	10	10	10	10.0
GOLDEN VALLEY	14	11.0000	11	11	11	11	11.0
MCKENZIE	259	10.9228	13	8	10	11	12.0
SHERIDAN	11	11.2727	12	11	11	11	12.0
STARK	70	12.5000	15	9	12	13	13.0

# Appendix 2

## Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

### North Dakota

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
PROD	BILLINGS	218	0.6835	36	0	0	0	0.00
PROD	BOTTINEAU	57	2.3860	68	0	0	0	0.00
PROD	BURKE	27	3.1852	20	0	0	0	5.00
PROD	DIVIDE	134	15.3881	311	0	0	0	2.00
PROD	GOLDEN VALLEY	14	4.2857	31	0	0	0	4.25
PROD	MCKENZIE	259	5.5676	389	0	0	0	0.00
PROD	RENVILLE	8	0.0000	0	0	0	0	0.00
PROD	SHERIDAN	11	1.0000	6	0	0	0	2.00
PROD	STARK	70	3.6143	52	0	0	0	0.00
PROD	WILLIAMS	19	4.7368	25	0	0	1	7.00
PROD	RICHLAND	39	31.6923	221	0	0	4	21.00

## Appendix 1

### Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

#### North Dakota

Equipment	No	AVG	Maximum	Minimum	PCT25	Median	PCT75
<u>Production Facilities</u>							
FLINE	2	0.0000	0	0	0.0	0	0.0
H/T	108	17.2685	389	0	0.0	0	1.0
MANIFOLD	21	0.0952	2	0	0.0	0	0.0
METER	5	0.0000	0	0	0.0	0	0.0
OTHER	24	4.4583	56	0	0.0	0	0.0
PUMP	32	2.0312	36	0	0.0	0	0.0
SEP	108	0.2593	15	0	0.0	0	0.0
STANK	327	1.4954	161	0	0.0	0	0.0
WINJ	1	0.0000	0	0	0.0	0	0.0
WPROD	62	1.3226	68	0	0.0	0	0.0
WTANK	156	17.7564	229	0	0.0	1	18.5
WLINE	5	14.2000	52	0	3.0	6	29.5
SUMP	5	9.2000	16	0	1.5	13	15.0

#### Gas Processing

None



Table 3

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

North Dakota

Obs	County	Facility: Production	75 <sup>th</sup>	
			Median	Percentile
19	WILLIAMS	*****	5.0	10.0
57	BOTTINEAU	*****	8.0	9.0
134	DIVIDE	*****	9.0	9.5
39	RICHLAND	*****	9.0	9.0
218	BILLINGS	*****	10.0	10.0
27	BURKE	*****	10.0	10.0
8	RENVILLE	*****	10.0	10.0
14	GOLDEN VALLEY	*****	11.0	11.0
259	MCKENZIE	*****	11.0	12.0
11	SHERIDAN	*****	11.0	12.0
70	STARK	*****	13.0	13.0
-----+-----+-----+-----+-----+-----+-----+				
2 4 6 8 10 12 14 16				
Median of Background				

856

Table 2

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

North Dakota

FACILITY: Production

Obsns County		Median Difference	75 <sup>th</sup> Percentile
218	BILLINGS		0.0 0.0
57	BOTTINEAU		0.0 0.0
27	BURKE		0.0 5.0
134	DIVIDE		0.0 2.0
14	GOLDEN VALLEY		0.0 4.3
259	MCKENZIE		0.0 0.0
8	RENVILLE		0.0 0.0
11	SHERIDAN		0.0 2.0
70	STARK		0.0 0.0
19	WILLIAMS	*****	1.0 7.0
39	RICHLAND	*****	4.0 21.0
856		-----+-----+-----+-----+-----+-----+-----	
		1 2 3 4 5 6 7	
		Median of Difference	

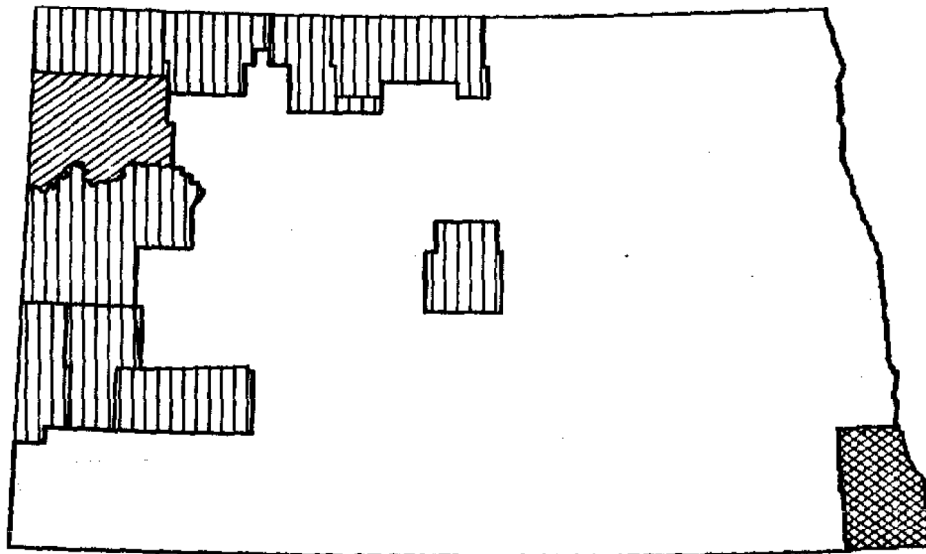
Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

**FACILITY:** Production

-151-

# FIGURE 2 – MEDIAN DIFFERENCE OVER BACKGROUND

NORTH DAKOTA  
PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

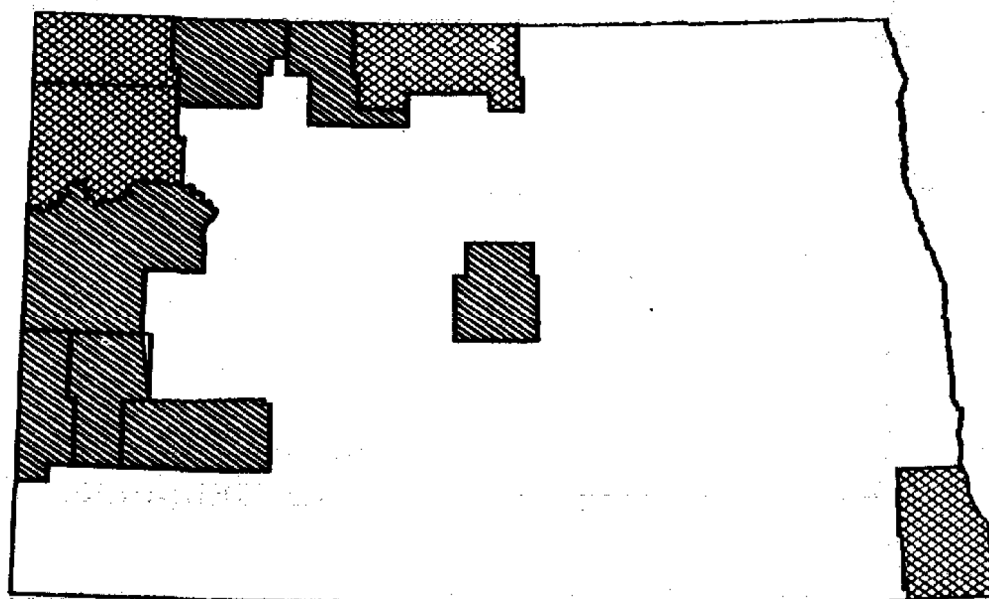
BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 1 - MEDIAN BACKGROUND LEVELS

NORTH DAKOTA



MICRO-REMS/HR

NO DATA

5.0 - 9.0

0 - 2.33

9.01 - 14.0

2.34 - 4.99

OVER 14.0

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

## SUMMARY

(North Dakota)

- I. North Dakota reported no Gas Processing equipment. There are no significant differences between types of equipment.
- II. Williams, Bottineau, Divide, and Richland counties had mid-range background levels while the remainder were high.
- III. Overall Summary (Production Facilities)

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
Statewide					
a. Background	856	10.0	12.0	13.0	15
b. Max Reading	856	10.0	12.0	19.3	400
c. Difference	856	0.0	0.0	8.3	389

NOTE: All data are measured in micro-rem/hr

### Appendix 3

#### Statistical Data on Background by County (Micro-Rems/Hr)

##### New Mexico

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
UNION	148	1.3587	1.8	1.0	1.000	1.5	1.5
LEA	1946	5.6028	18.0	2.0	5.000	5.0	6.0
UNREPORTED	76	5.8158	8.0	5.0	5.000	5.0	7.0
CHAVES	30	6.8667	13.0	5.0	6.000	6.0	7.0
BODY	262	5.0153	10.0	1.5	1.500	6.0	8.0
SAN JUAN	204	8.1382	14.0	3.3	4.575	10.0	10.0
RIO ARriba	246	12.2435	27.0	3.0	11.000	13.0	13.0

## Appendix 2

### Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

#### New Mexico

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	EDDY	100	2.1750	98.5	0	0	0.0	0.0
GP	LEA	190	34.4474	743.0	0	0	0.0	7.0
GP	UNION	142	0.0444	1.5	0	0	0.0	0.0
GP	UNREPORTED	23	40.6522	383.0	0	0	0.0	10.0
PROD	CHAVES	30	22.2667	370.0	0	0	0.0	4.5
PROD	EDDY	162	12.4938	444.0	0	0	0.0	0.0
PROD	RIO ARriba	246	0.1098	3.0	0	0	0.0	0.0
PROD	SAN JUAN	204	10.0049	790.0	0	0	0.0	0.0
PROD	UNION	6	0.0000	0.0	0	0	0.0	0.0
PROD	LEA	1756	11.6379	843.0	0	0	1.0	4.0
PROD	UNREPORTED	53	39.8679	545.0	0	0	3.0	12.5



# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### New Mexico

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
<u>Gas Processing Facilities</u>							
COMPRESSOR	221	0.025	1.5	0	0	0	0.00
DEHYDRATOR	7	0.043	0.3	0	0	0	0.00
FRAC TOWER	39	6.782	115.0	0	0	0	1.00
INLET SCRUBBER	24	5.167	63.5	0	0	0	4.50
OTANK	31	23.355	383.0	0	0	0	2.00
OTHER	22	11.773	153.0	0	0	0	3.25
PPUMP	11	25.136	135.0	0	0	0	38.00
SWEETENER	19	3.158	50.0	0	0	0	0.00
CRYO UNIT	7	41.857	195.0	0	0	2	85.00
PUMP	3	25.333	73.0	0	0	3	73.00
REFRIGERATION	18	66.250	595.0	0	0	4	75.00
PTANK	17	22.735	215.0	0	0	5	23.50
OPUMP	15	115.933	743.0	0	0	5	53.00
METER	9	119.444	695.0	0	0	7	174.00
BOTTOMS PUMP	11	48.636	220.0	1	3	21	65.00
PRODUCT LINE	1	693.000	693.0	693	693	693	693.00
<u>Production Facilities</u>							
FLINE	256	1.0742	239	0	0	0.0	0.00
MANIFOLD	88	2.7727	95	0	0	0.0	1.00
METER	13	0.0000	0	0	0	0.0	0.00
OTHER	58	11.4828	210	0	0	0.0	1.00
PUMP	15	7.8667	95	0	0	0.0	5.00
SEP	577	12.9726	582	0	0	0.0	4.00
STANK	691	8.2438	790	0	0	0.0	3.00
SUMP	36	65.3894	593	0	0	0.0	88.25
VRU	5	0.6000	3	0	0	0.0	1.50
WLINE	63	4.4921	78	0	0	0.0	0.00
WPROD	155	0.7613	20	0	0	0.0	0.00
WINJ	2	1.5000	3	0	0	1.5	3.00
H/T	290	21.1238	843	0	0	2.0	9.25
WTANK	208	18.9308	792	0	0	2.0	13.00

Table 3

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rms/Hr)

New Mexico

Obs	County		Median	Percentile
148	UNION	***	1.5	1.5
1,946	LEA	*****	5.0	6.0
76	UNREPORTED	*****	5.0	7.0
30	CHAVES	*****	6.0	7.0
262	EDDY	*****	6.0	8.0
204	SAN JUAN	*****	10.0	10.0
246	RIO ARRIBA	*****	13.0	13.0
		-----+-----+-----+-----+-----+-----+-----+-----+-----		
		2 4 6 8 10 12 14		
Median of Background Reading				

Table 2

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

## New Mexico

Obsns	County		Median Difference	75 <sup>th</sup> Percentile	
FACILITY: Gas Processing					
100	EDDY		0.0	0.0	
190	LEA		0.0	7.0	
142	UNION		0.0	0.0	
23	UNREPORTED		0.0	10.0	
<hr/>					
		1	2	3	4
Median of Difference Over Background					

FACILITY: Production				
30	CHAVES		0.0	4.5
162	EDDY		0.0	0.0
246	RIO ARRIBA		0.0	0.0
204	SAN JUAN		0.0	0.0
6	UNION		0.0	0.0
1,756	LEA	*****	1.0	4.0
53	UNREPORTED	*****	3.0	12.5
		-----+-----+-----+		
		1                  2                  3                  4		
Median of Difference Over Background				

Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

New Mexico

FACILITY: Gas Processing

Obsns	Equipment	Median Difference	75 <sup>th</sup> Percentile
221	COMPRESSOR	0.0	0.0
7	DEHYDRATOR	0.0	0.0
39	FRAC TOWER	0.0	1.0
24	INLET SCRUBBER	0.0	4.5
31	OTANK	0.0	2.0
22	OTHER	0.0	3.5
11	PPUMP	0.0	38.0
19	SWEETENER	0.0	0.0
7	CRYO UNIT	2.0	85.0
3	PUMP	3.0	73.0
18	REFRIGERATION	4.0	75.0
17	PTANK	5.0	23.5
15	OPUMP	5.0	53.0
9	METER	7.0	174.0
11	BOTTOMS PUMP	21.0	65.0
1	PRODUCT LINE	693.0	693.0
455		100 200 300 400 500 600 700	

Median of Difference Over Background

Facility: Production

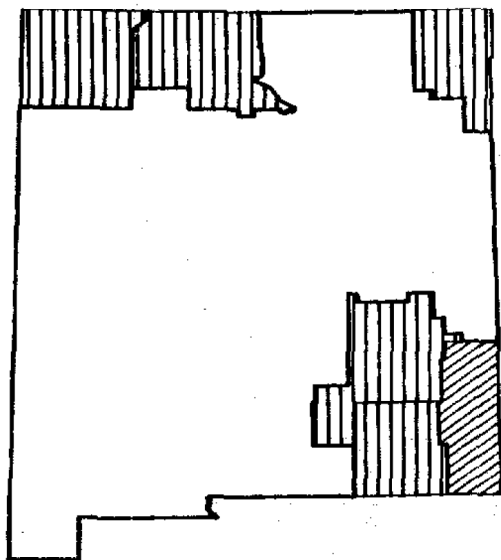
256	PLINE	0.0	0.0
88	MANIFOLD	0.0	1.0
13	METER	0.0	0.0
58	OTHER	0.0	1.0
15	PUMP	0.0	5.0
577	SEP	0.0	4.0
691	STANK	0.0	3.0
5	VRU	0.0	1.5
63	WLINE	0.0	0.0
155	WPROD	0.0	0.0
2	WINJ	1.5	3.0
290	H/T	2.0	9.3
36	SUMP	2.0	88.3
208	WTANK	2.0	13.0
2457		100 200 300 400 500 600 700	

Median of Difference Over Background

# FIGURE 3 - DIFFERENCE OVER BACKGROUND

NEW MEXICO

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

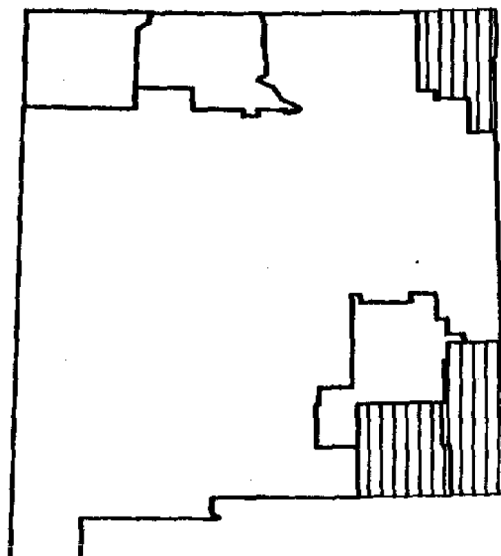
.8 - 1.99  
OVER 245

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## FIGURE 2 - DIFFERENCE OVER BACKGROUND

NEW MEXICO

GAS PROCESSING FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

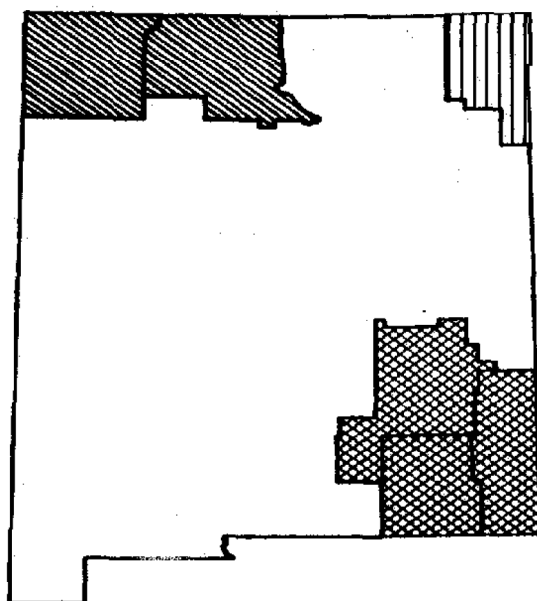
BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 1 — MEDIAN BACKGROUND LEVELS

NEW MEXICO



MICRO-REMS/HR



NO DATA



5.0 - 9.0



0 - 2.33



9.01 - 14.0



2.34 - 4.99



OVER 14.0

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

## SUMMARY

(New Mexico)

### I. All significant differences were equipment specific.

The equipment with the most pronounced differences over background based on Median ranking are listed below in descending order. The difference is the excess of the reading over background:

Equipment	Median Difference	75 <sup>th</sup> Percentile
Product line (1) (GP)	693 $\mu$ R/hr	693 $\mu$ R/hr

### II. Union county had a very low background level, Lea, Chaves and Eddy were mid-range, and San Juan and Rio Arriba were high.

### III. Overall Summary

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
1. Statewide					
a. Background	2,912	5.0	7.0	10.0	27
b. Max Reading	2,912	7.0	11.0	21.0	850
c. Difference	2,912	0.0	3.0	15.0	843
2. Facility					
a. Background					
Gas Processing	455	1.5	7.0	7.0	7
Production	2,457	5.0	8.0	11.0	27
b. Max Reading					
Gas Processing	455	3.5	7.0	30.0	750
Production	2,457	7.0	12.0	20.0	850
c. Difference					
Gas Processing	455	0.0	0.3	25.0	743
Production	2,457	0.0	3.0	15.0	843

NOTES: 1) All data are measured in micro-rem/hr



# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Nebraska

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
<u>Production Facilities</u>							
MANIFOLD	3	0.00000	0.0	0	0	0	0.0
OTHER	1	0.00000	0.0	0	0	0	0.0
PUMP	6	0.00000	0.0	0	0	0	0.0
SEP	13	2.98462	13.5	0	0	0	5.4
STANK	2	0.00000	0.0	0	0	0	0.0
WLINE	2	0.00000	0.0	0	0	0	0.0
WTANK	3	0.00000	0.0	0	0	0	0.0

Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Nebraska

FACILITY: Production

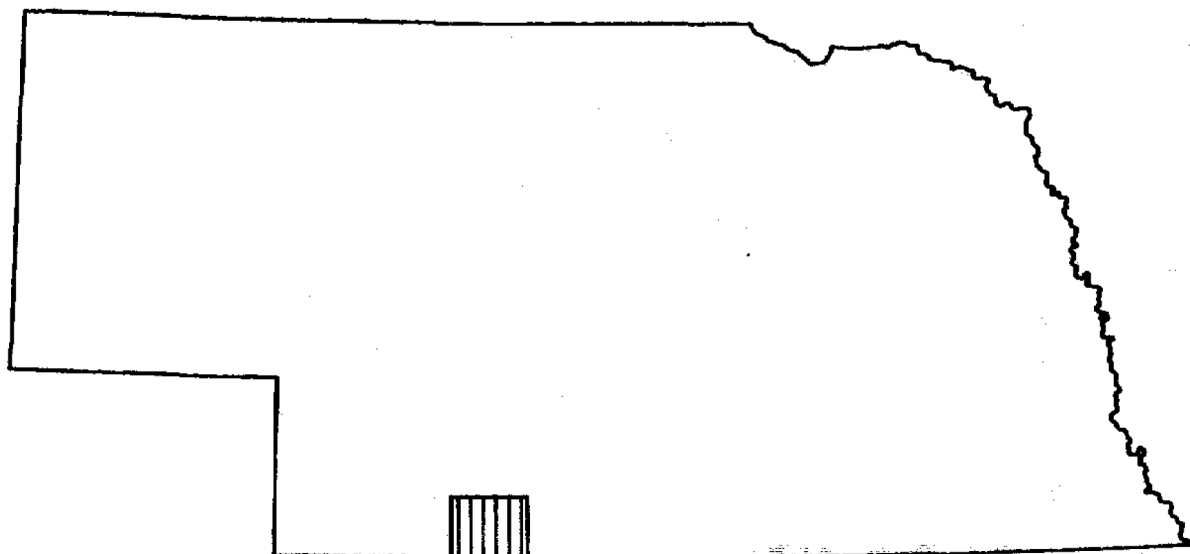
Obsns	Equipment	Median Difference	75 <sup>th</sup> Percentile
3	MANIFOLD	0.0	0.0
1	OTHER	0.0	0.0
6	PUMP	0.0	0.0
13	SEP	0.0	5.4
2	STANK	0.0	0.0
2	WLINE	0.0	0.0
3	WTANK	0.0	0.0
30		10 20 30 40 50 60	

Median of Difference Over Background

## FIGURE 2 – MEDIAN DIFFERENCE OVER BACKGROUND

NEBRASKA

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

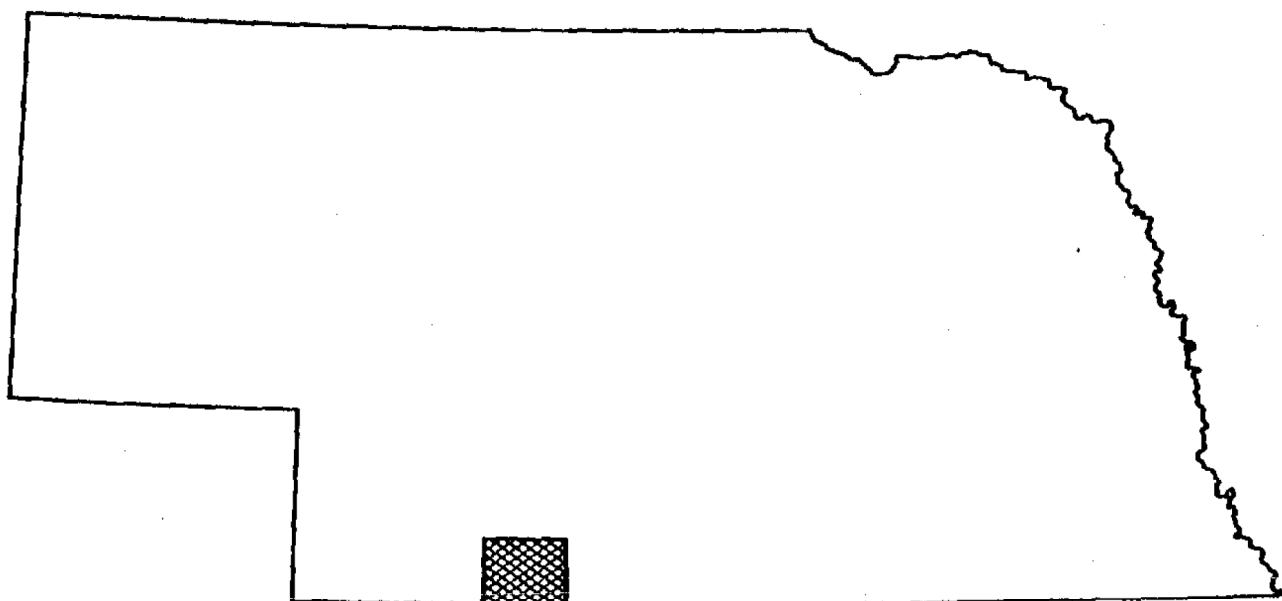
BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 1 - MEDIAN BACKGROUND LEVELS

NEBRASKA



MICRO-REMS/HR



NO DATA

5.0 - 9.0



0 - 2.33

9.01 - 14.0



2.34 - 4.98

OVER 14.0

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

## SUMMARY

(Nebraska)

- I. There were no significant differences between items of equipment. All readings were quite low.
- II. All data came from Red Willow county which had a mid-range background level.
- III. Overall Summary (There were no Gas Processing data)

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
Statewide (Red Willow County)					
a. Background	30	6.3	6.5	6.5	6.5
b. Max Reading	30	6.3	6.5	12.2	20.0
c. Difference	30	0.0	0.0	5.7	13.5

NOTE: All data are measured in micro-rams/hr

### Appendix 3

#### Statistical Data on Background by County (Micro-Rems/Hr)

##### Montana

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
DAWSON	53	7.5894	9	7	7	7	8
FALLON	348	7.3247	12	7	7	7	8
PRAIRIE	57	7.8351	9	7	7	7	7
SHERIDAN	89	8.4944	10	7	8	8	10
GLACIER	10	9.8888	9	9	9	9	9
ROSEBUD	30	9.1888	10	9	9	9	9
VALLEY	103	8.7767	10	8	8	9	9
ROOSEVELT	10	11.8888	12	10	10	11	12

## Appendix 2

### Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

#### Montana

FACILITY	COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MBD	PCT75
PROD	DAWSON	53	0.2453	10	0	0.00	0	0.00
PROD	FALLOW	348	0.0000	0	0	0.00	0	0.00
PROD	GLACIER	10	0.0000	0	0	0.00	0	0.00
PROD	PRAIRIE	57	0.0351	1	0	0.00	0	0.00
PROD	ROSEBUD	30	0.0333	1	0	0.00	0	0.00
PROD	VALLEY	103	0.0777	5	0	0.00	0	0.00
PROD	ROOSEVELT	10	72.9000	228	0	1.75	21	164.25
PROD	SHERIDAN	89	96.7303	615	0	2.00	30	127.50

# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Montana

Equipment	No	Average	Maximum	Minimum	PCT25	Median	PCT75
H/T	71	47.761	615	0	0.00	0.0	0.0
MANIFOLD	5	0.000	0	0	0.00	0.0	0.0
METER	1	0.000	0	0	0.00	0.0	0.0
OTHER	5	22.400	112	0	0.00	0.0	56.0
SEP	481	0.031	10	0	0.00	0.0	0.0
STANK	53	5.189	35	0	0.00	0.0	6.0
WPROD	17	1.000	10	0	0.00	0.0	0.0
SUMP	0	27.125	92	0	1.25	3.0	75.0
PUMP	11	24.091	92	0	0.00	12.0	42.0
WINJ	2	10.000	36	0	0.00	10.0	36.0
WLINE	3	40.667	92	2	2.00	20.0	92.0
FLINE	4	53.750	152	6	11.25	20.5	121.5
WTANK	39	120.436	370	0	0.00	92.0	212.0



Table 3

**Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)**

**Montana**

Obsns	County		75 <sup>th</sup>	
			Median	Percentile
53	DAWSON	*****	7.0	8.0
348	FALLON	*****	7.0	8.0
57	PRAIRIE	*****	7.0	7.0
89	SHERIDAN	*****	8.0	10.0
18	GLACIER	*****	9.0	9.0
38	ROSEBUD	*****	9.0	9.0
183	VALLEY	*****	9.0	9.0
18	ROOSEVELT	*****	11.0	12.0
-----+-----+-----+-----+-----+-----+-----+-----+				
2 4 6 8 10 12 14 16 18				
Median of Background Reading				

**Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rms/Hr)**

**FACILITY:** Production

### Median of Difference Over Background

**Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)**

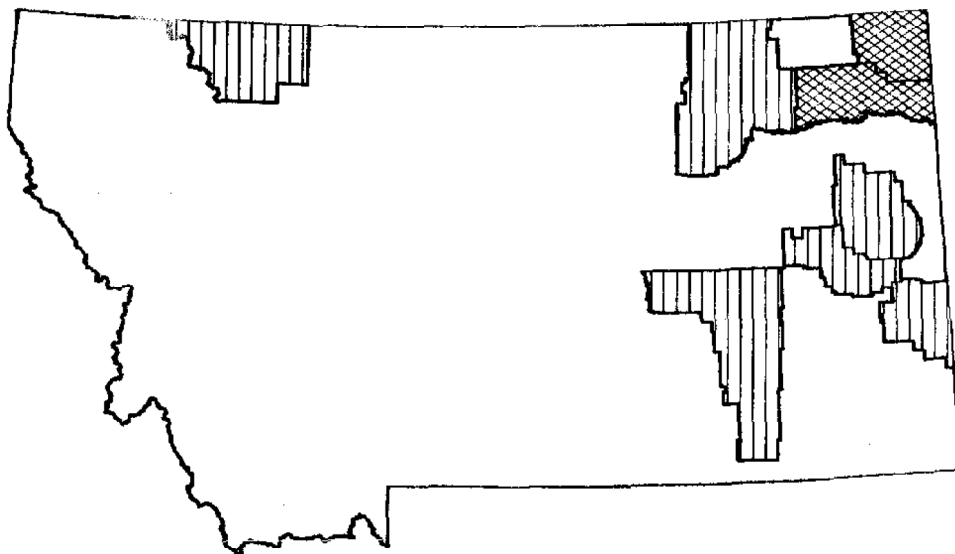
**FACILITY:** Production

-127-

# FIGURE 2 – MEDIAN DIFFERENCE OVER BACKGROUND

MONTANA

PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

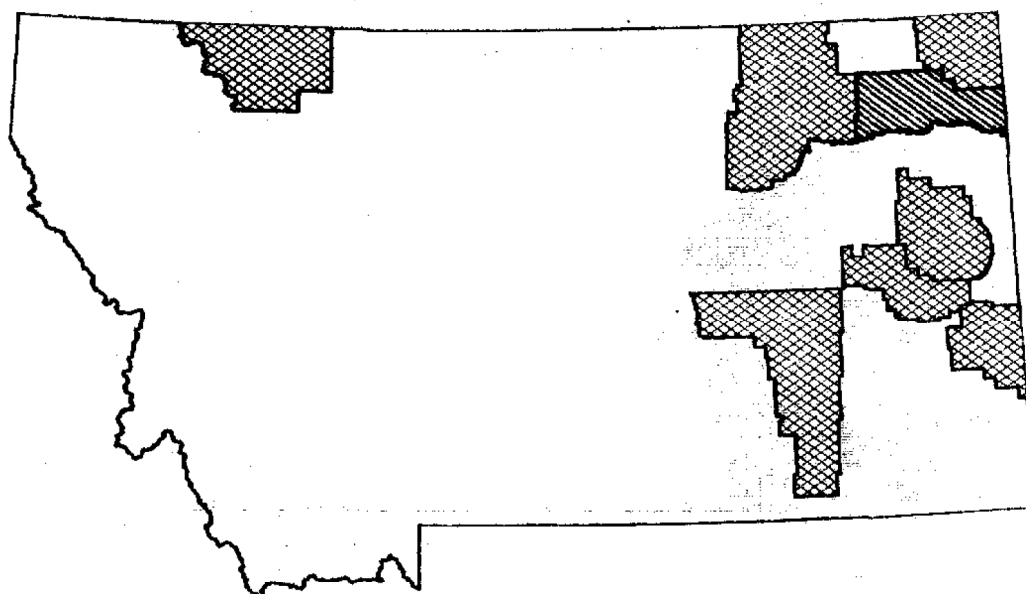
BELOW .8  
33.01 - 245

.8 - 1.99  
OVER 245

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

# FIGURE 1 — MEDIAN BACKGROUND LEVELS

MONTANA



MICRO-REMS/HR



NO DATA



5.0 - 9.0



0 - 2.33



9.01 - 14.0



2.34 - 4.99



OVER 14.0

AMERICAN PETROLEUM INSTITUTE  
NATURALLY OCCURRING RADIOACTIVITY SURVEY

## SUMMARY

(Montana)

- I. All of the reported readings in Montana were from Production Facilities. All significant differences were due to Water Tank readings in Sheridan county. This item of equipment is noted below:

Equipment	Median Difference	75 <sup>th</sup> Percentile
Water Tank (Prodn)	92 $\mu$ R/hr	212 $\mu$ R/hr

- II. All counties had mid-range background levels except Roosevelt which was high.

### III. Overall Summary (Production Facilities)

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
Statewide					
a. Background	700	7.0	8.0	10.0	12
b. Max Reading	700	8.0	9.0	15.0	625
c. Difference	700	0.0	0.0	5.9	615

NOTE: All data are measured in micro-rem/hr

### Appendix 3

#### Statistical Data on Background by County (Micro-Rems/Hr)

#### Mississippi

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
JEFFERSON	23	9.0652	17.9	3.5	3.5	3.5	17.9
JEFFERSON DAVIS	11	7.1818	11.0	4.0	4.0	4.0	11.0
SMITH	94	4.3617	5.0	4.0	4.0	4.0	5.0
LINCOLN	12	4.5000	5.0	4.0	4.0	4.5	5.0
CLARKE	100	6.9500	15.0	3.0	3.0	5.0	9.0
HINDS	45	4.6889	5.0	4.0	4.0	5.0	5.0
JASPER	83	6.9759	15.0	4.0	5.0	5.0	8.0
JONES	232	5.1250	15.0	4.0	4.0	5.0	5.0
MARION	152	6.9737	15.0	4.0	5.0	5.0	9.0
PEARL RIVER	4	5.0000	5.0	5.0	5.0	5.0	5.0
PIKE	1	5.0000	5.0	5.0	5.0	5.0	5.0
RANKIN	14	4.5714	5.0	4.0	4.0	5.0	5.0
FRANKLIN	23	5.5000	5.5	5.5	5.5	5.5	5.5
AMITE	3	7.0000	7.0	7.0	7.0	7.0	7.0
ADAMS	10	8.4167	8.5	7.0	8.5	8.5	8.5
WAYNE	64	11.7141	22.2	3.5	3.5	11.0	15.0
LAMAR	16	11.2500	13.0	6.0	10.0	11.5	13.0
PERRY	5	15.0000	15.0	15.0	15.0	15.0	15.0
WALTHALL	11	15.0000	15.0	15.0	15.0	15.0	15.0

## Appendix 2

### Statistical Data on Median Difference over Background By Facility and County (Micro-Rems/Hr)

#### Mississippi

FACILITY COUNTY		NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
GP	CLARKE	3	0.000	0.0	0	0.00	0.0	0.00
GP	AMITE	1	38.000	38.0	38	38.00	38.0	38.00
PROD	ADAMS	18	1.250	10.5	0	0.00	0.0	0.25
PROD	CLARKE	97	0.809	21.0	0	0.00	0.0	0.00
PROD	FRANKLIN	23	0.357	2.8	0	0.00	0.0	0.50
PROD	JEFFERSON	23	10.013	125.5	0	0.00	0.0	9.40
PROD	WAYNE	64	85.102	1590.0	0	0.00	0.0	28.87
PROD	JASPER	83	35.663	585.0	0	0.00	1.0	16.00
PROD	PIKE	1	10.000	10.0	10	10.00	10.0	10.00
PROD	AMITE	2	23.000	28.0	18	18.00	23.0	28.00
PROD	JONES	232	140.267	2292.0	0	7.00	29.0	135.75
PROD	PERRY	5	35.000	85.0	0	0.00	35.0	70.00
PROD	MARION	152	175.309	4491.0	0	9.00	45.0	141.00
PROD	JEFFERSON DAVIS	11	60.182	116.0	10	26.00	56.0	106.00
PROD	PEARL RIVER	4	158.250	495.0	25	27.00	56.5	391.25
PROD	LINCOLN	12	602.833	2996.0	14	20.25	60.0	970.00
PROD	SMITH	94	188.968	1995.0	1	25.50	95.0	195.00
PROD	WALTHALL	11	245.000	1385.0	45	95.00	115.0	185.00
PROD	LAMAR	16	363.125	1887.0	15	55.25	140.5	624.50
PROD	RANKIN	14	819.000	3396.0	25	88.50	201.0	1095.00
PROD	HINDS	45	645.400	2995.0	15	95.00	345.0	995.00



# Appendix 1

## Statistical Data by Facility and Equipment Difference Over Background (Micro-Rems/Hr)

### Mississippi

Equipment	No	Average	Maximum	Minimum	25 %	Median	75 %
-----------	----	---------	---------	---------	------	--------	------

#### Gas Processing Facilities

COMPRESSOR	3	0	0	0	0	0	0
INLET SCRUBBER	1	38	38	38	38	38	38

#### Production Facilities

PUMP	13	35.385	235	0.0	0.000	0.0	42.50
STANK	101	37.671	585	0.0	0.000	0.0	20.10
SUMP	1	0.000	0	0.0	0.000	0.0	0.00
OTHER	92	47.449	595	0.0	0.000	5.0	33.75
WPROD	124	83.242	1196	0.0	3.000	12.5	76.00
WTANK	143	140.731	1995	0.0	0.000	23.0	145.00
MANIFOLD	72	177.833	2995	0.0	14.000	33.0	96.00
SEP	168	229.172	4491	0.0	9.250	36.0	136.00
WINJ	10	69.000	245	0.0	20.000	45.0	90.00
H/T	150	312.908	2995	0.0	1.875	74.0	387.50
WLINE	12	102.325	245	1.7	47.500	105.0	135.00
FLINE	13	140.077	843	0.0	12.500	106.0	133.00

Median Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

			75 <sup>th</sup>
Obs	County		Percentile
23	JEFFERSON	*****	3.5 17.9
11	JEFFERSON DAVIS	*****	4.0 11.0
94	SMITH	*****	4.0 5.0
12	LINCOLN	*****	4.5 5.0
100	CLARKE	*****	5.0 9.0
45	HINDS	*****	5.0 5.0
83	JASPER	*****	5.0 8.0
232	JONES	*****	5.0 5.0
152	MARION	*****	5.0 9.0
4	PEARL RIVER	*****	5.0 5.0
1	PIKE	*****	5.0 5.0
14	RANKIN	*****	5.0 5.0
23	FRANKLIN	*****	5.5 5.5
3	AMITE	*****	7.0 7.0
18	ADAMS	*****	8.5 8.5
64	WAYNE	*****	11.0 15.0
16	LAMAR	*****	11.5 13.0
5	PERRY	*****	15.0 15.0
11	WALTHALL	*****	15.0 15.0

-----+-----+-----+-----+-----+-----+-----+-----+-----+

2    4    6    8    10    12    14    16    18

**MEDIAN OF BKGRND**

Median Difference Over Background by County  
Sequenced by Increasing Median Difference  
(Micro-Rms/Hr)

**FACILITY:** Gas Processing

Obsns County		Median Difference	75 <sup>th</sup> Percentile
3	CLARKE	0.0	0
1	AMITE	38.0	38

### Median of Difference Over Background

**FACILITY:** Production

18	ADAMS		0	0.3
97	CLARKE		0	0.0
23	FRANKLIN		0	0.5
23	JEFFERSON		0	9.4
64	WAYNE		0	28.9
83	JASPER		1	16.0
1	PIKE	*	10	10.0
2	AMITE	***	23	28.0
232	JONES	****	29	135.8
5	PERRY	*****	35	70.0
152	MARION	*****	45	141.0
11	JEFFERSON DAVIS	*****	56	106.0
4	PEARL RIVER	*****	56	391.3
12	LINCOLN	*****	60	970.0
94	SMITH	*****	95	195.0
11	WALTHALL	*****	115	185.0
16	LAMAR	*****	140	624.5
14	RANKIN	*****	201	1095.0
45	HINDS	*****	345	995.0
-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+-----				
30 60 90 120 150 180 210 240 270 300 330				

### Median of Difference Over Background

Table 1

Difference of Maximum Reading over Background by Equipment  
Sequenced by Increasing Median Difference  
(Micro-Rems/Hr)

Mississippi

FACILITY: Gas Processing

Obsns	Equipment		Median Difference	75 <sup>th</sup> Percentile
3	COMPRESSOR		0.0	0.0
1	INLET SCRUBBER	*****	38.0	38.0
4		-----+-----+-----+-----+-----+-----+-----+-----+-----+-----		
		10 20 30 40 50 60 70		
Median of Difference Over Background				

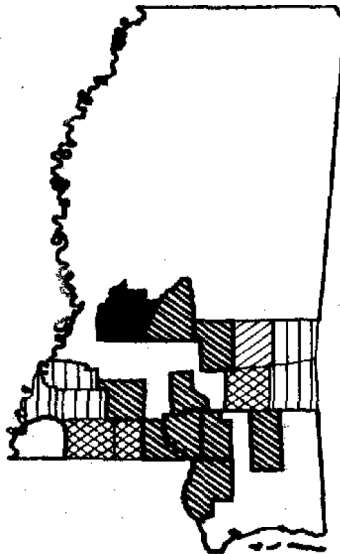
FACILITY: Production

13	PUMP		0.0	42.5
101	STANK		0.0	20.1
1	SUMP		0.0	0.0
92	OTHER	***	5.0	33.8
124	WPROD	*****	12.5	76.0
143	WTANK	*****	23.0	145.0
72	MANIFOLD	*****	33.0	96.0
168	SEP	*****	36.0	136.0
10	WINJ	*****	45.0	98.0
158	H/T	*****	74.0	387.5
12	WLINE	*****	105.0	135.0
13	FLINE	*****	106.0	133.0
		-----+-----+-----+-----+-----+-----+-----+-----+-----+-----		
		10 20 30 40 50 60 70 80 90 100		
Median of Difference Over Background				

# FIGURE 3 — DIFFERENCE OVER BACKGROUND

## MISSISSIPPI

### PRODUCTION FACILITIES



MICRO-REMS/HR

NO DATA  
2 - 33

BELOW .8  
33.01 - 245

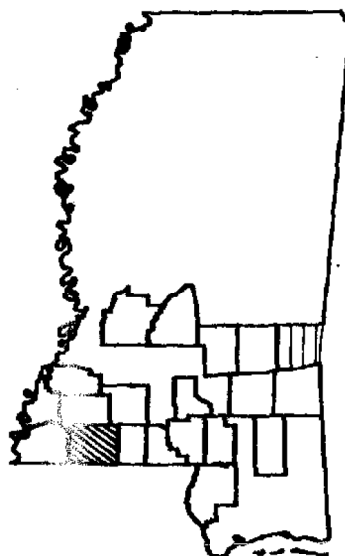
.8 - 1.99  
OVER 245

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## FIGURE 2 - DIFFERENCE OVER BACKGROUND

MISSISSIPPI

GAS PROCESSING FACILITIES



MICRO-REMS/HR



NO DATA  
2 - 33



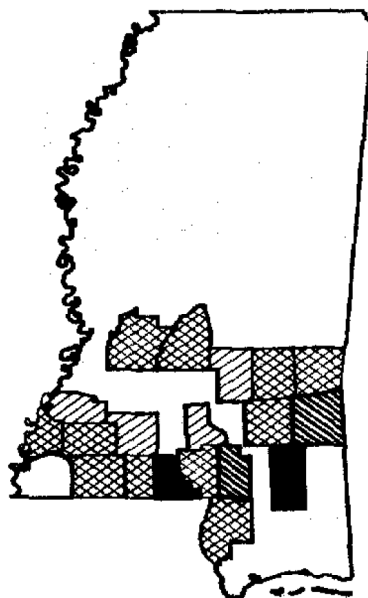
BELOW .8  
33.01 - 245



.8 - 1.99  
OVER 245

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NATURALLY OCCURRING RADIOACTIVITY SURVEY

**FIGURE 1 - MEDIAN BACKGROUND LEVELS**  
**MISSISSIPPI**



**MICRO-REMS/HR**



**NO DATA**



**5.0 - 9.0**



**0 - 2.93**



**9.01 - 14.0**



**2.34 - 4.99**



**OVER 14.0**

**AMERICAN PETROLEUM INSTITUTE**  
**NATURALLY OCCURRING RADIOACTIVITY SURVEY**

## SUMMARY

(Mississippi)

### I. All significant differences were equipment specific.

The equipment with the most pronounced differences over background based on Median ranking are listed below in descending order. The difference is the excess of the reading over background:

Equipment		Median Difference	75 <sup>th</sup> Percentile
1. Flow Line	(Prod)	106 $\mu$ R/hr	133.0 $\mu$ R/hr
2. Water Line	(Prod)	105	135.0
3. Heater Treater	(Prod)	74	387.5
4. Injection Well	(Prod)	45	90.0
5. Inlet Scrubber	(GP)	38	38.0
6. Separator	(Prod)	36	136.0
7. Manifold	(Prod)	33	96.0

### II. Jefferson, Jefferson Davis, Smith, and Lincoln counties had low background levels. The remaining ones were mid-range except for Wayne, Lamar, Perry, and Waltham which were high.

### III. Overall Summary

ITEM	No	Median	75 <sup>th</sup> Pct.	90 <sup>th</sup> Pct.	Max Value
1. Statewide					
a. Background	911	5.0	8.0	15.0	22
b. Max Reading	911	25.0	120.0	400.0	4,500
c. Difference	911	20.0	115.0	395.0	4,491
2. Facility					
a. Background					
Gas Processing	4	6.0	7.0	7.0	7
Production	907	5.0	8.0	15.0	22
b. Max Reading					
Gas Processing	4	6.0	35.5	45.0	45
Production	907	25.0	120.0	402.0	4,500
c. Difference					
Gas Processing	4	0.0	28.5	38.0	38
Production	911	20.0	115.0	398.0	4,491

NOTES: 1) All data are measured in micro-rams/hr

2) The apparent differences between facilities are due to the specific items of equipment listed in Section I above.



# Appendix 3

## Statistical Data on Background by County (Micro-Rems/Hr)

### Michigan

COUNTY	NO	AVERAGE	MAXIMUM	MINIMUM	PCT25	MED	PCT75
ANTRIM	18	0.30000	0.3	0.3	0.3	0.3	0.3
CRAWFORD	19	0.40000	0.4	0.4	0.4	0.4	0.4
GRAND TRAVERSE	26	0.36154	0.4	0.3	0.3	0.4	0.4
KALKASKA	82	0.35488	0.4	0.3	0.3	0.4	0.4
OTSEGO	18	0.80000	0.8	0.8	0.8	0.8	0.8
UNREPORTED	49	3.64286	4.0	1.5	4.0	4.0	4.0
CALHOUN	226	5.68496	10.0	3.0	5.0	5.0	6.0
EATON	48	6.02083	9.0	4.0	5.0	6.0	7.0
INGHAM	225	6.11422	10.0	3.0	5.0	6.0	7.0