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## NEW MEXICO ENVIRONMENT DEPARTMENT

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### **Direct Penetrating Radiation Monitoring at the Waste Isolation Pilot Plant Conducted by NMED/DOE OB for the CY 2011 Q-1**

The New Mexico Environment Department (NMED) DOE Oversight Bureau has compiled and assessed direct penetrating radiation (DPR) data collected during CY 2011 Q-1. The accompanying table shows DPR dose levels at various locations surrounding the Waste Isolation Pilot Plant, at the Oversight Bureau Office in Carlsbad, at the Malaga Volunteer Fire Department, and at the weigh station between Carlsbad and Loving. The data were obtained using Rad Elec gamma radiation monitoring electrets. The electrets are housed in aluminum canisters designed to block gamma radiation from radon. The gamma ionizing dose, which is calculated from a voltage drop in the Rad Elec unit, is presented in the units of millirads (mrad) or thousandths of a Rad, and a Rad is Radiation Absorbed Dose or one Roentgen, regardless of its source. The REM (Roentgen Equivalent Man) is a commonly used term of ionizing radiation dose that uses a quality factor based on the source of radiation as it interacts with human body tissue. In the case of gamma radiation the quality factor is one, and thus one Rad is equal to one REM.

The DPR results ranged from a minimum average quarterly dose of 22.6 mrad at WIPP 7 (on the east side of the exclusive use fence line) to a maximum average quarterly dose of 30.8 mrad at WIPP 16 (the weigh station on US 285 between Carlsbad and Loving). The WIPP 16 is located along the southern transportation route. Currently, WIPP 15 serves as a control for quality assurance and is located at the Bureau office in Carlsbad. The average quarterly dose for WIPP 15 was 27.3 mrad.

Table 1 shows the individual results from each electret and the average quarterly dose in mrad at each location.

Graph 1 shows the average dose calculations of electrets located in the WIPP Exclusive Use Area by quarter.

These calculated doses from DPR are comparable with past results and do not show a trend of increased gamma radiation exposure above background due to WIPP operations. It is interesting to note that the slight rise in quarterly dose beginning in CY 2009 Q-3 and continuing through CY 2011 Q-1 correlates with the construction of the new salt pile evaporation pond and the rebuilding of the South Access Road, both of which were massive earth moving projects. Unfortunately, historical gamma background levels at WIPP were either determined through the

use of TLDs by the Environmental Evaluation Group, or through the use of a High Pressure Ionization Chamber (HPIC) designed to monitor low levels of gamma radiation in the environment, reported in *Statistical Summary of the Radiological Baseline Program for the WIPP* (DOE/WIPP-92-037). Neither is directly comparable to data obtained by the Bureau using electrets. Comparison studies by the Bureau have shown that electrets produce higher readings than TLDs.

#### Response

Questions and/or comments may be addressed to Barry S. Birch by phone at (505) 845-5933, or by email at [barry.birch@state.nm.us](mailto:barry.birch@state.nm.us)

Enclosures:    1. Table 1: Direct Penetrating Radiation as Measured by Electrets CY 2011 Q-1  
                     2. Graph 1: Average DPR Results in the WIPP Exclusive Use Area by Quarter  
                     3. Map 1: Location of DPR monitors maintained by the Bureau

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**Table 1: Direct Penetrating Radiation as Measured by Electrets CY 2011 Q-1****WIPP 1**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SX 3751	12/29/10 3:03 PM	3/31/11 3:16 PM	92.01	45	24.4
SFB 973	12/29/10 3:03 PM	3/31/11 3:16 PM	92.01	45	22.5
SFC 207	12/29/10 3:03 PM	3/31/11 3:16 PM	92.01	49	23.7
Average Quarterly Dose in mrad:					<b>23.5</b>

**WIPP 2**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 065	12/29/10 3:14 PM	4/1/11 8:03 AM	92.70	51	24.4
SFC 082	12/29/10 3:14 PM	4/1/11 8:03 AM	92.70	51	24.7
SFC 057	12/29/10 3:14 PM	4/1/11 8:03 AM	92.70	53	25.4
Average Quarterly Dose in mrad:					<b>24.8</b>

**WIPP 3**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFB 974	1/3/11 2:36 PM	3/31/11 2:17 PM	86.99	40	22.3
SFB 983	1/3/11 2:36 PM	3/31/11 2:17 PM	86.99	43	24.0
SFC 025	1/3/11 2:36 PM	3/31/11 2:17 PM	86.99	41	22.6
Average Quarterly Dose in mrad:					<b>23.0</b>

**WIPP 4**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFB 969	1/3/11 2:46 PM	4/1/11 8:16 AM	87.73	51	28.5
SFB 999	1/3/11 2:46 PM	4/1/11 8:16 AM	87.73	49	27.2
SFC 131	1/3/11 2:46 PM	4/1/11 8:16 AM	87.73	48	27.5
Average Quarterly Dose in mrad:					<b>27.9</b>

**WIPP 5**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 061	1/3/11 3:11 PM	4/1/11 8:31 AM	87.72	47	26.2
SFC 159	1/3/11 3:11 PM	4/1/11 8:31 AM	87.72	54	28.8
SFC 087	1/3/11 3:11 PM	4/1/11 8:31 AM	87.72	49	26.2
Average Quarterly Dose in mrad:					<b>27.1</b>

**Table 1: Direct Penetrating Radiation as Measured by Electrets CY 2011 Q-1****WIPP 6**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 099	1/3/11 2:58 PM	3/31/11 9:10 AM	86.76	43	24.6
SFC 126	1/3/11 2:58 PM	3/31/11 9:10 AM	86.76	44	25.0
SFC 171	1/3/11 2:58 PM	3/31/11 9:10 AM	86.76	44	25.3
Average Quarterly Dose in mrad:					<b>25.0</b>

**WIPP 7**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 210	12/30/10 8:20 AM	3/31/11 9:00 AM	91.03	45	22.3
SFB 985	12/30/10 8:20 AM	3/31/11 9:00 AM	91.03	43	21.8
SFB 987	12/30/10 8:20 AM	3/31/11 9:00 AM	91.03	46	23.6
Average Quarterly Dose in mrad:					<b>22.6</b>

**WIPP 8**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFB 966	12/30/10 8:51 AM	3/31/11 8:32 AM	90.99	49	25.9
SFB 988	12/30/10 8:51 AM	3/31/11 8:32 AM	90.99	50	26.1
SFC 095	12/30/10 8:51 AM	3/31/11 8:32 AM	90.99	48	25.7
Average Quarterly Dose in mrad:					<b>25.9</b>

**WIPP 9**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFB 995	12/30/10 9:35 AM	3/31/11 8:35 AM	90.96	50	25.8
SFC 018	12/30/10 9:35 AM	3/31/11 8:35 AM	90.96	50	26.0
SFB 961	12/30/10 9:35 AM	3/31/11 8:35 AM	90.96	54	28.0
Average Quarterly Dose in mrad:					<b>26.6</b>

**WIPP 10**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 010	12/29/10 9:35 AM	3/31/11 8:22 AM	91.95	54	27.2
SFB 962	12/29/10 9:35 AM	3/31/11 8:22 AM	91.95	54	27.5
SFB 963	12/29/10 9:35 AM	3/31/11 8:22 AM	91.95	54	27.4
Average Quarterly Dose in mrad:					<b>27.3</b>

**Table-1: Direct Penetrating Radiation as Measured by Electrets CY 2011 Q-1****WIPP 11**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 002	12/29/10 2:52 PM	3/31/11 9:25 AM	91.77	50	24.8
SFC 022	12/29/10 2:52 PM	3/31/11 9:25 AM	91.77	51	24.9
SFC 054	12/29/10 2:52 PM	3/31/11 9:25 AM	91.77	51	25.1
<b>Average Quarterly Dose in mrad:</b>					<b>24.9</b>

**WIPP 12**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 013	1/3/11 3:21 PM	4/1/11 8:44 AM	87.72	45	25.4
SFC 185	Result is disregarded due to anomalous high reading				
SFC 108	1/3/11 3:21 PM	4/3/11 8:44 AM	89.72	48	25.8
<b>Average Quarterly Dose in mrad:</b>					<b>25.6</b>

**WIPP 13**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 039	1/3/11 3:30 PM	4/1/11 8:50 AM	87.72	50	26.8
SFC 053	1/3/11 3:30 PM	4/1/11 8:50 AM	87.72	50	26.9
SFC 062	1/3/11 3:30 PM	4/1/11 8:50 AM	87.72	51	27.3
<b>Average Quarterly Dose in mrad:</b>					<b>27.0</b>

**WIPP 14**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 094	1/3/11 3:37 PM	4/1/11 9:01 AM	87.73	51	27.1
SFC 077	1/3/11 3:37 PM	4/1/11 9:01 AM	87.73	45	25.6
SFC 152	1/3/11 3:37 PM	4/1/11 9:01 AM	87.73	45	25.2
<b>Average Quarterly Dose in mrad:</b>					<b>25.4</b>

**WIPP 15  
Carlsbad**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 114	12/30/10 1:47 PM	4/5/11 1:59 PM	96.01	60	26.6
SFC 145	12/30/10 1:47 PM	4/5/11 1:59 PM	96.01	61	27.1
SFC 063	12/30/10 1:47 PM	4/5/11 1:59 PM	96.01	62	28.2
<b>Average Quarterly Dose in mrad:</b>					<b>27.3</b>

**Table 1: Direct Penetrating Radiation as Measured by Electrets CY 2011 Q-1****WIPP 16**

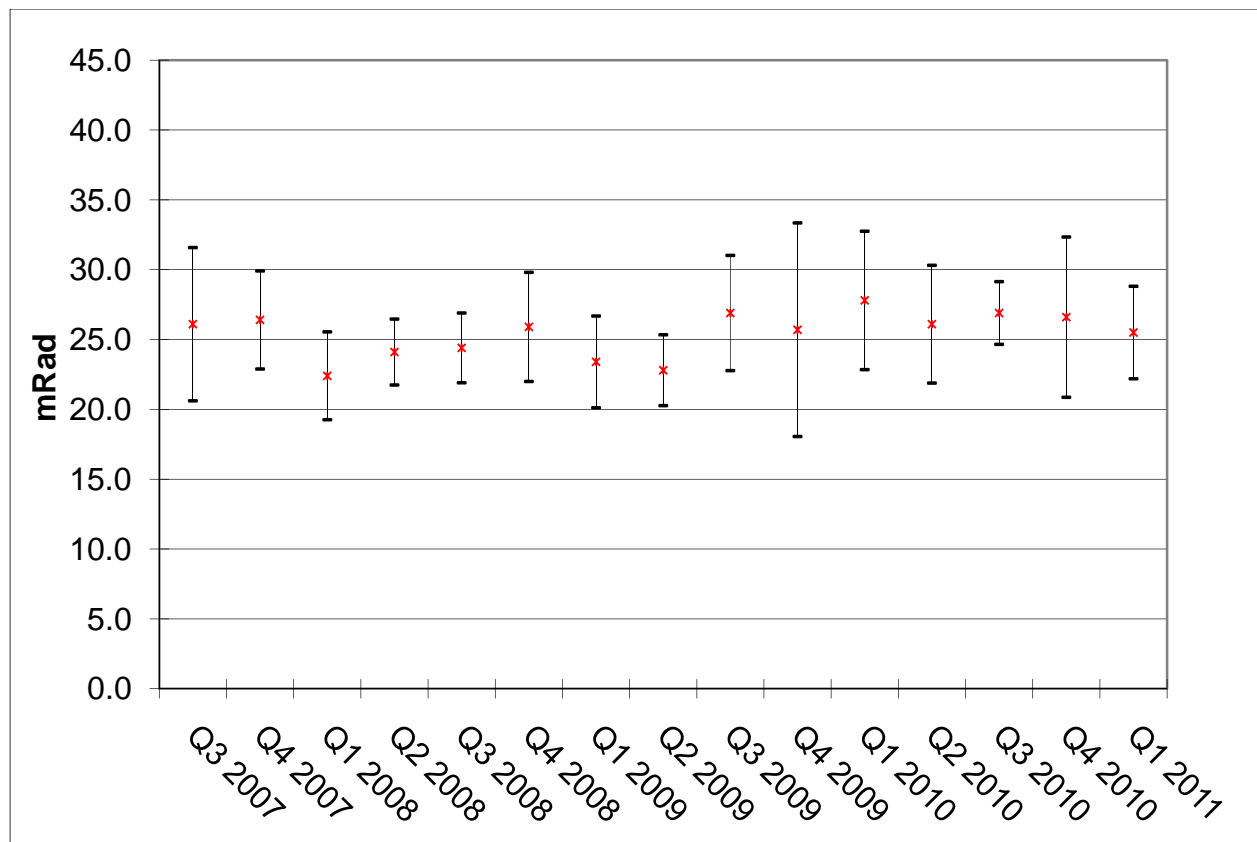
Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 060	12/29/10 12:53 PM	3/31/11 12:27 PM	91.98	60	31.9
SFC 132	12/29/10 12:53 PM	3/31/11 12:27 PM	91.98	56	29.6
SFC 173	12/29/10 12:53 PM	3/31/11 12:27 PM	91.98	59	30.8
Average Quarterly Dose in mrad:					<b>30.8</b>

**WIPP 17**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 012	12/29/10 1:18 PM	3/31/11 12:44 PM	91.98	54	27.3
SFC 021	12/29/10 1:18 PM	3/31/11 12:44 PM	91.98	54	27.1
SFC 044	12/29/10 1:18 PM	3/31/11 12:44 PM	91.98	54	27.1
Average Quarterly Dose in mrad:					<b>27.1</b>

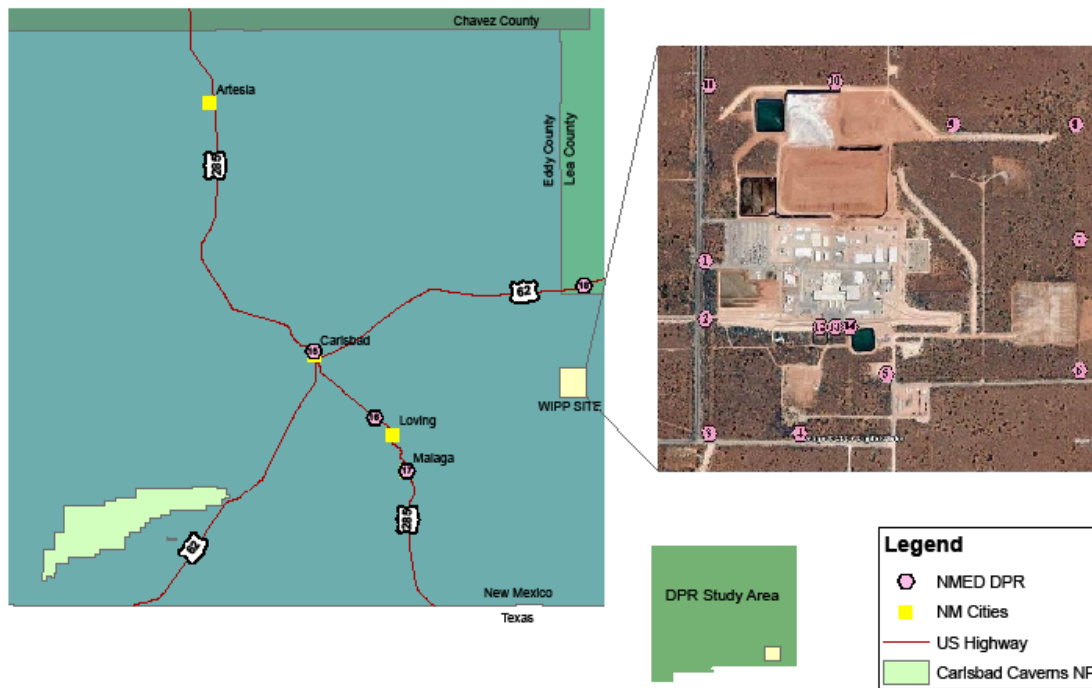
**WIPP 18**

Electret Number	Start Date and Time	Finish Date and Time	# of Days:	Voltage Drop	Quarterly Dose
SFC 092	12/29/10 2:14 PM	3/31/11 9:45 AM	91.81	59	29.2
SFC 182	12/29/10 2:14 PM	3/31/11 9:45 AM	91.81	58	28.5
SFC 183	12/29/10 2:14 PM	3/31/11 9:45 AM	91.81	60	29.6
Average Quarterly Dose in mrad:					<b>29.1</b>



Graph 1: Average DPR results in the WIPP Exclusive Use Area by quarter (±2sd)

# WIPP DOE OB Direct Penetrating Radiation



Map 1: Location of DPR monitors maintained by the Bureau