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**RADIOLOGICAL SCOPING SURVEY OF  
FORMER MONSANTO FACILITIES  
(Unit III and Warehouse)  
DAYTON, OHIO**

**Report Date: 4 September 1997**

**Survey Date: 27 August 1997**

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Radiation Safety Branch**

**Sponsored by: Miamisburg Environmental Management Project Office  
Ohio Field Office  
U.S. Department of Energy**



**Conducted by: Radiation Safety Branch  
Office of Environmental Management  
88<sup>th</sup> Air Base Wing  
U.S. Department of the Air Force**



**In Cooperation With:**

**Southwest District Office  
Ohio Environmental Protection Agency**

**OhioEPA Ohio Environmental  
Protection Agency**

**Bureau of Radiological Health  
Ohio Department of Health**



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## RADIOLOGICAL SCOPING SURVEY OF FORMER MONSANTO FACILITIES (Unit III and Warehouse)

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### 1.0 Purpose

The scoping survey was to confirm/validate previous radiological surveys and to assess the facilities and grounds to determine whether or not indicators exist to warrant a full characterization radiological survey. The Miamisburg Environmental Management Project Office, Ohio Field Office, U.S. Department of Energy requested the scoping survey.

### 2.0 Background Information

Monsanto Chemical Company (Central Research Department in Dayton) accepted responsibility for the production of polonium in support of the development of an atomic weapon in 1943. As the work progressed, various facilities were acquired. One such facility is located at 1601 West First Street and designated as Unit III. Another facility was known as "The Warehouse" and located at Third and Sears Street. Both facilities are in Dayton, Ohio.

#### 2.1. Unit III

Unit III was rented from the Dayton School Board in 1943 and initially consisted of one structure that was converted to a laboratory. Additional structures were constructed on the property between the period of 1944-1946. The facilities were used for general research, development research, and production of polonium. Operations ceased in 1948 and the facilities returned to the Dayton Board of Education after radiological surveys and decontamination were performed.

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#### 2.2 The Warehouse

The Warehouse operations began in 1946 and were limited to trace quantities of polonium for the analysis of environmental monitoring samples, bioassay samples, and preliminary biological studies on the effects of polonium on laboratory animals. This facility was used due to the low background of polonium thus preventing contamination of the samples. The activities were transferred to Mound Laboratory, Miamisburg, in 1948-1949. The facility was returned to the building manager.

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**3.0 Site Description**

**3.1 Unit III**

Unit III is a piece of property sided by West First Street, Euclid Avenue, Edison Street and an alley. A chain link fence encloses the property. When the facility was first rented one building was on the property. Guard houses, chemical storage shed, warehouses, offices, cafeteria, physics laboratory, locker rooms, laundry, glass blowing shop, machine shop and power plant were later constructed. Refer to Unit III site plot plan October 1947 at attachment 1. Several structures were dismantled prior to returning the property to the Dayton Board of Education. Refer to Unit III site plot plan October 1949 at attachment 2. Subsequently, the primary building, designated "M", has been demolished and an additional building has been constructed on a portion of the concrete pad remaining where Building "L" stood. The revised Unit III site plot plan at attachment 3 reflects these two changes.

The current designations of the buildings have changed since Monsanto's occupancy. The following compares the designations of the existing structures.

Monsanto's Designation	Dayton Board of Education Designation
A	6
B	5
C	4
D	3
E	2
G	1

**3.2 The Warehouse**

The Warehouse located at Third and Sears Streets is a 5 to 6 story warehouse that is connected to another structure. Only the dark red brick building is considered the warehouse. Details of the

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interior were not researched as a component of this scoping survey. Only a walk-around was within the scope of this radiological survey.

### 4.0 Results of Previous Surveys

#### 4.1 Unit III

A final survey of Unit III was conducted in September and October 1949 by Monsanto personnel. The objectives of the cleaning process was to leave all areas with no detectable wipe and direct reading of less than 5000 disintegration per minute (dpm) per 100 cm<sup>2</sup>. The wipes taken represented the rubbing of about 40 in<sup>2</sup> of surface with filter paper. The final survey was conducted at two different times since not all decontamination work had been completed at the time the initial final survey began. The majority of the final survey was completed between 13 September 1949 and 30 September 1949. The results of this survey consisted of Buildings B, C, D, E, and grounds. The report recorded a preliminary reading for direct and wipe, before cleaning, and final readings for direct and wipe, after cleaning, at several locations within each structure and the grounds. A review of the results indicates that the direct final readings within the structures were less than 5000 dpm with exceptions in Building M (this building does not currently exist). All results of the wipe testing were recorded as N.D. (non-detectable). Measurements that exceeded the objective were on roofs or drains of Building D, E, M, and the sidewalk and gutter to and around number 3 gate. The high spots on the roof were not cleaned because it appeared impractical. Previous readings taken indicated that the activity was eroding away faster than could have been from decay alone. The roof drains were not cleaned because they represented an accumulation point of activity as it eroded from the roof.

The second component of the final survey was recorded as the supplement to the final survey and was conducted 13 October 1949 to 28 October 1949. The results of the wipe tests were N.D. The results of the direct readings were recorded less than 5000 dpm/100 cm<sup>2</sup> with four exceptions, not including the Quonset concrete slab. The four exceptions were warehouse no. 3 (one spot), southeast corner (one spot), brace supporting no. 2 step, and concrete slab for drum storage (2 spots). The Quonset slab survey indicated 214 readings above the objective level. It was felt

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decontamination could not proceed further. The recommendation was to paint the slab rather than break up and remove the slab due to considerable amounts of contamination that may be spread by concrete dust.

### 4.2 The Warehouse

Specific information of a final release survey was not located. A reference is made in a summary that the area was scrubbed down.

### 5.0 Final Survey Procedures

Representatives of Department of Energy, Ohio Environmental Protection Agency, Ohio Department of Health, and Radiation Safety Office, Wright-Patterson Air Force Base met 19 August 1997 to discuss the type, methods, and detail of the radiological survey necessary. The direction of the radiological survey should be one of a scoping and confirmatory survey. The radiological survey should provide information to assess whether a potential situation exists which would warrant a detailed characterization radiological survey. In addition, the radiological survey should perform a certain level of confirmation for the previous final release survey. Attachment 4 is the basis for the survey performed.

### 5.1 Unit III

The parameters for the radiological survey at Unit III were as follow:

1. Investigatory surface scanning was performed
2. Limited direct measurement of exposure rate and surface activity levels were performed at selected locations
3. Smears were performed at selected locations
4. Environmental measurements at selected locations were conducted.

The above parameters were achieved by using instrumentation listed in Attachment 5. Sodium iodide scintillation, compared to pressurized ion chambers, was used for direct measurements of exposure rates. Zinc sulfide scintillation was used for direct measurements of surface alpha

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activity. A Tennelec model 5100 was used for gross alpha/beta analysis for removable contamination. The instrumentation selected was based on the past history of the facility.

A background measurement was taken at one meter in the interior center of each structure using the NaI scintillation devices. A scan was made along all walls and floor juncture within the structure. The criterion used during the survey for locations to perform direct measurements was based on the locations that contamination would most likely exist. Examples of locations of interest were corners, floor seams, cracks, drains, and floor openings. At the selected locations, an exposure rate measurement, alpha measurement (one tenth of a minute), and a smear was taken. The smear consisted of wiping 100 cm<sup>2</sup>. Two limitations did exist. First, water, oil and/or grease on the floor of some structures did not allow for smears and would most likely attenuate any alpha emissions. Secondly, inaccessibility of some areas due to storage of miscellaneous items prevented full scanning.

Travelling parallel lines at 10-foot intervals, a walkover the property was conducted for exterior measurements. The survey consisted of observations of deflection at approximately one meter from the ground. Time was taken allowing for stabilization of the instrumentation.

### 5.2 Warehouse

The parameters of the radiological survey of the Warehouse changed at the time of the survey. At the direction of Department of Energy representatives, the radiological survey consisted of a scan of the building exterior only using NaI scintillation meters. A walk-around with parallel lines at 5-foot intervals was conducted. In addition, a background measurement across the street was taken.

## 6.0 Survey Findings

### 6.1 Unit III

The background exposure rate measurements in each of the structures ranged from 5 to 8 microrentgen per hour ( $\mu\text{R/hr}$ ). The scans of each structure did not reveal any measurement that exceeded this range with one exception, a shower stall with ceramic tile. The tenth of minute alpha background measurements ranged from 0-3 counts. The selected locations (refer to

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attachment 6) were within this range. The analysis of smears taken at selected locations (refer to attachment 6) did not indicate radioactive contamination.

The background measurements of the exterior ranged from 10-12  $\mu\text{R/hr}$  at one meter. The highest contact reading obtained was 14  $\mu\text{R/hr}$  at two locations. One location was the west down spout of Building 4. Ohio Environmental Protection Agency will perform soil analysis at this point. The second location was approximately 5 feet north of the walk path that enters from Euclid Avenue and 5 feet west of the exterior fence.

Exposure rate measurements were taken at each Ohio Environmental Protection Agency soil sampling point. The following are the results:

OEPA Sample Number	1 meter ( $\mu\text{R/hr}$ )	Contact ( $\mu\text{R/hr}$ )
32201	9	10
32202	9	9
32203	8	8
32204	11	11
32205	12	12
32206	12	12

**6.2 Warehouse**

Exposure rate measurements were taken at parallel lines 5 feet apart around the exterior of the building. Measurements ranged from 5 to 10  $\mu\text{R/hr}$ . The measurement across the street was 10  $\mu\text{R/hr}$ . The red brick driveway behind the Warehouse did exhibit a reading of 14  $\mu\text{R/hr}$ .

**7.0 Conclusion**

The results of the scoping survey, consisting of exposure rates, direct alpha measurements, and smears, were at background levels. Based on the survey, there are no indications that a more detailed radiological survey or further health assessment is needed at Unit III. This conclusion is contingent on the results of radioanalysis of soils collected by Ohio Environmental Protection Agency.

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The exposure rates exterior to the Warehouse were at background levels.

**ATTACHMENTS**

1. Diagram of Unit III facilities in 1947
2. Diagram of Unit III facilities in 1949
3. Diagram of Unit III facilities in 1997
4. Radiation Instrumentation
5. Swipe Test Results by Building

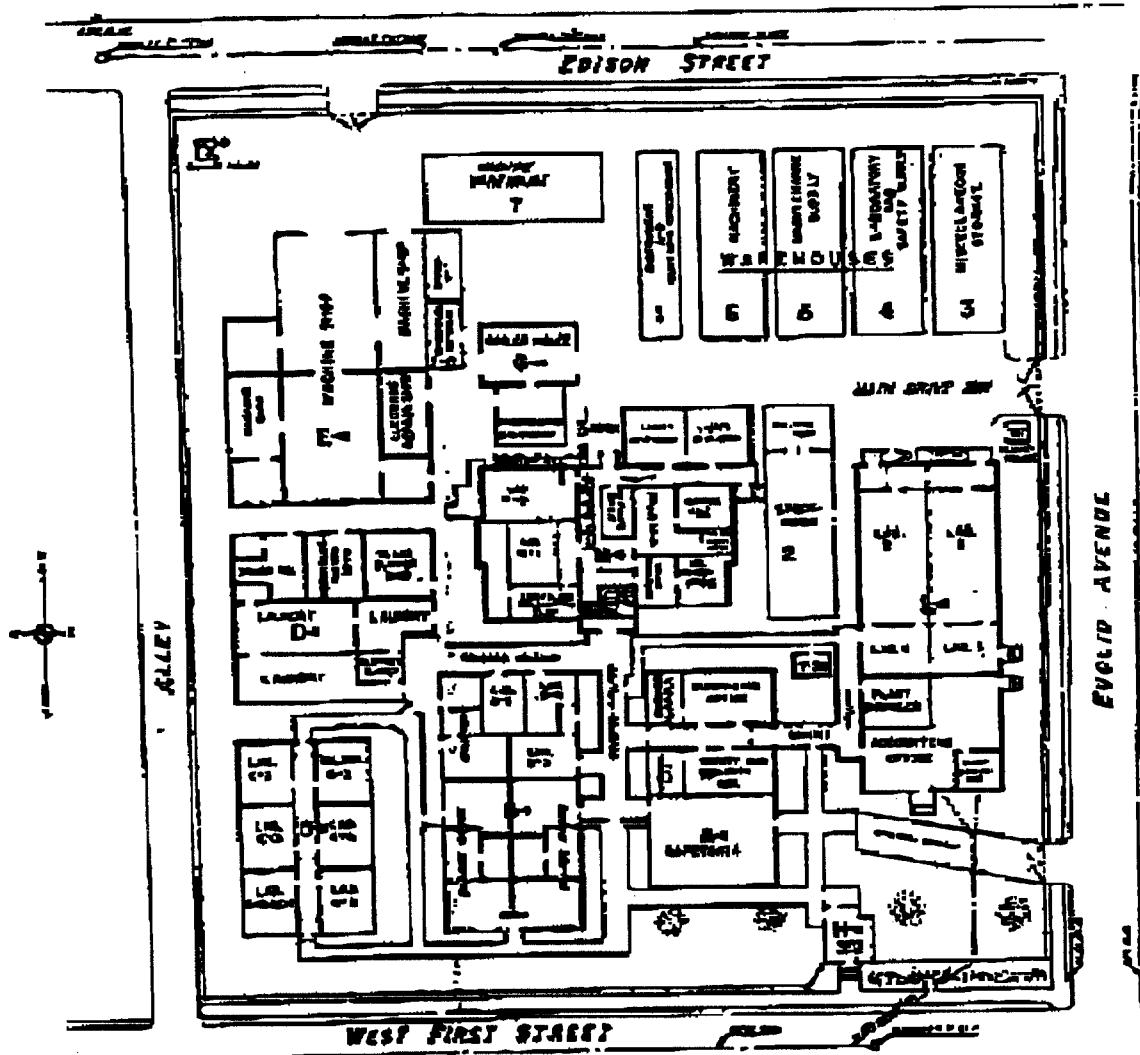




# RADIOLOGICAL SCOPING SURVEY OF FORMER MONSANTO FACILITIES (Unit III and Warehouse)

## ATTACHMENT I

### UNIT III SITE PLOT PLAN (October 1947)

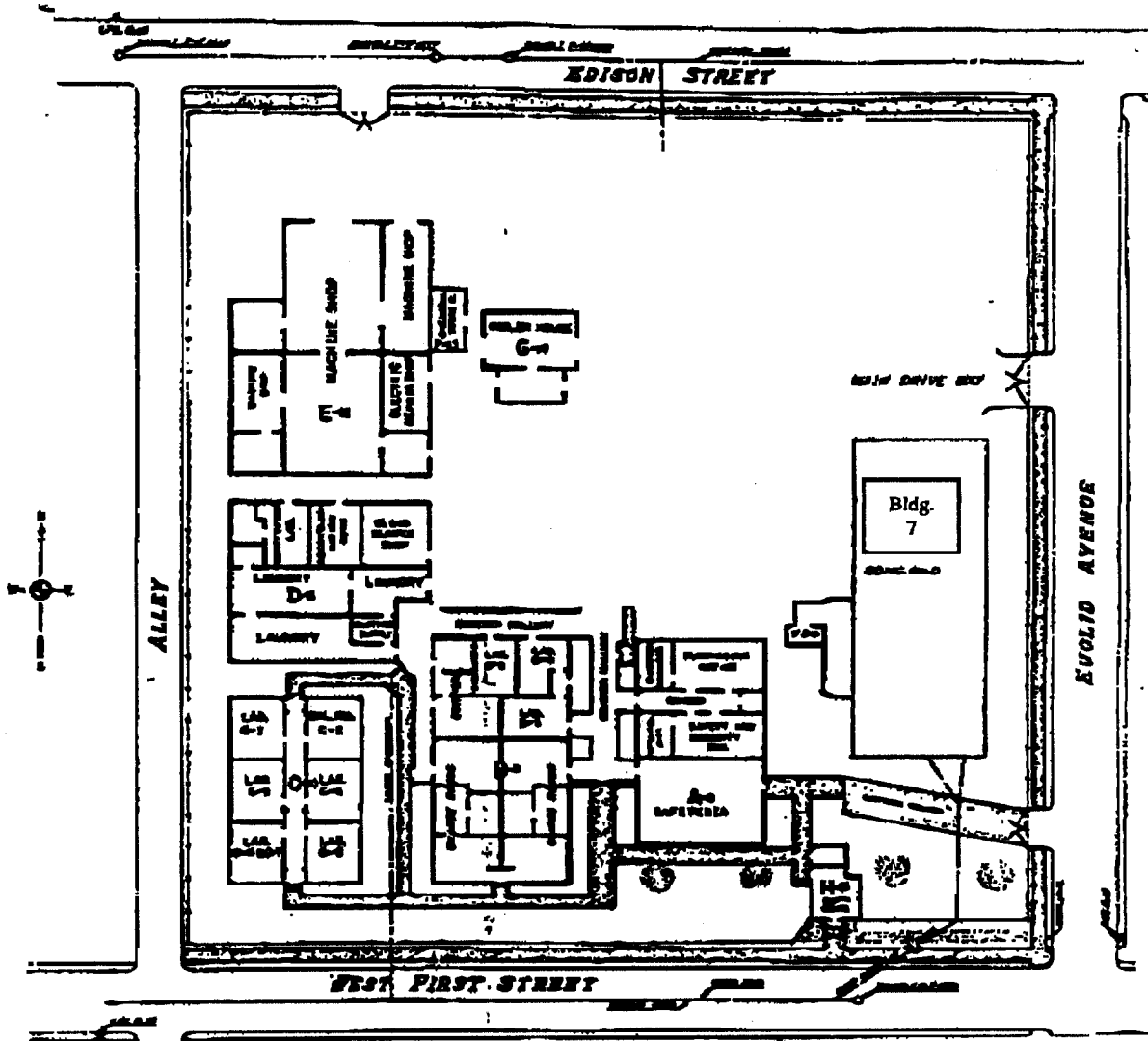




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**ATTACHMENT 3**

**UNIT III SITE PLOT PLAN  
(August 1997)**



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**ATTACHMENT 4**

**SCOPE of VALDATION/CONFIRMATION  
RADIOLOGICAL SURVEY AT FORMER MONSANTO FACILITES  
(UNIT III and WAREHOUSE)  
August 1997**

Monsanto Chemical Company used facilities in Dayton, Ohio that were designated as Unit III and the Warehouse. Operations at these facilities ceased in 1948 and 1949, respectively. The facilities were decommissioned and returned to their respective owners.

The Department of Energy, Ohio Department of Health, Ohio Environmental Protection Agency, Dayton Board of Education, and the City of Dayton requests a scoping survey for validation/confirmation that a radiological condition does not exist which would require a detailed follow-up investigation. To accomplish this, the Radiation Safety Branch, Office of Environmental Management, 88<sup>th</sup> Air Base Wing, of the Department of the Air Force has been asked to perform the scoping radiological survey in conjunction with State of Ohio officials.

The scoping radiological survey will be conducted with the following parameters:

1. Investigatory surface scanning will be performed
2. Limited direct measurements at selected locations (exposure rate and surface activity levels)
3. Smears at selected locations
4. Environmental measurements performed at selected locations

The direct measurements will consist of contact measurements for alpha emissions using a zinc sulfide or air proportional counter and gamma emission using sodium iodide detectors. Sodium iodide detectors may be compared to a pressurized ion chamber. The environmental measurements (over soil) will be performed at one meter from the surface. Smears will consist of 100 cm<sup>2</sup> area swiped and analysis with a gross alpha/beta gas flow proportional counter.

Locations to be considered for monitoring are the most likely to contain residual activity and places that have been identified from previous radiological surveys (Mound Plant Potential Release Site Package (May 1997)) to have elevated residual activity levels after decontamination events.

The following activities will be performed as stated:

1. The Ohio Environmental Protection Agency shall conduct the soil sample collection and shall direct the radioanalysis.
2. The Department of Energy (Mound) shall perform and direct public affair activities.

Concurrence:

Department of Energy (Mound) :  
Ohio Department of Health:  
Ohio Environmental Protection Agency:  
Radiation Safety Branch:

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**ATTACHMENT 5**

**RADIOLOGICAL SURVEY INSTRUMENTATION USED**

**PURPOSE: Exposure Rate Scanning**

Manufacturer	Model Number	Serial Number	Detection Methodology	Calibration Date
Ludlum	19	62564	Nal(TL) scintillation	7/2/97
Ludlum	19	80397	Nal(TL) scintillation	12/31/96
Ludlum	19	62551	Nal(TL) scintillation	12/31/96
Ludlum	19	80379	Nal(TL) scintillation	8/20/96
Ludlum	19	62582	Nal(TL) scintillation	8/20/96
Victoreen	450P	1504	Pressurized Ion Chamber	10/29/96
Victoreen	450P	1509	Pressurized Ion Chamber	12/18/96

The Ludlum model 19 were compared to readings the Victoreen model 450P for accuracy.

**PURPOSE: Surface Measurements**

Manufacturer	Model Number	Serial Number	Probe Model Number	Serial Number	Detection Methodology	Calibration Date
Ludlum	2220	58301	43-S	PR053901	ZnS scintillation	6/10/97
Ludlum	2220	58315	43-S	PR052900	ZnS scintillation	6/10/97

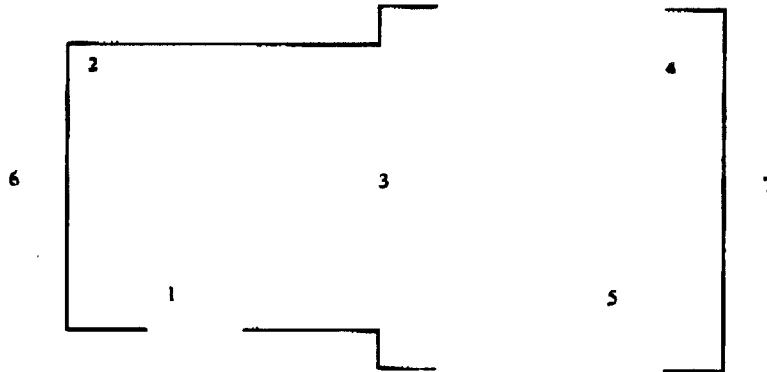
**PURPOSE: Smear Analysis**

Manufacturer	Model Number	Serial Number	Detection Methodology	Calibration Date
Tennelec	LB5100-W-UPGIII	30870	Gross alpha/beta gas flow proportional	6/30/97

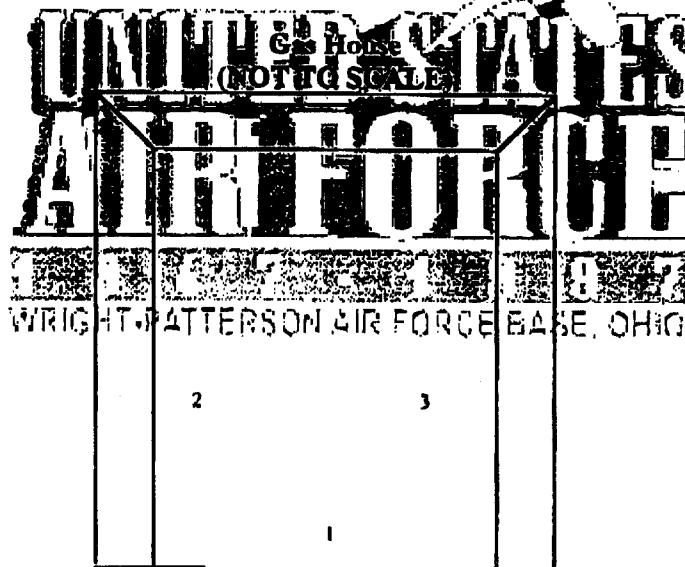
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**ATTACHMENT 6  
RESULTS OF SMEAR SURVEYS**

**Building 1  
(NOT TO SCALE)**



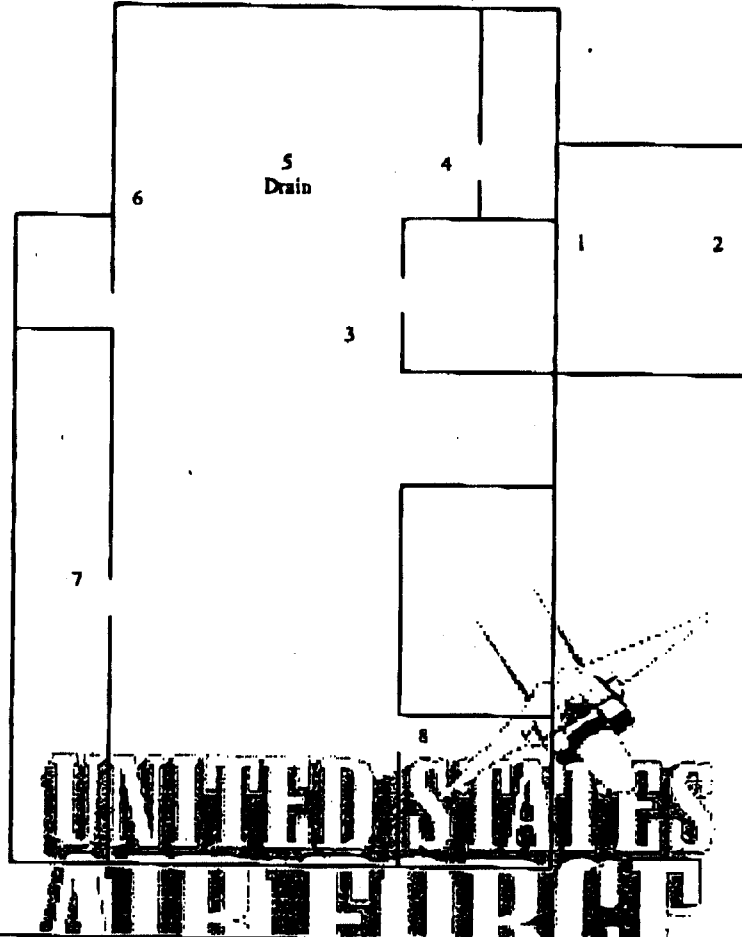
Location	1	2	3	4	5	6	7
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14
Beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91



Location	1	2	3
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14
Beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91

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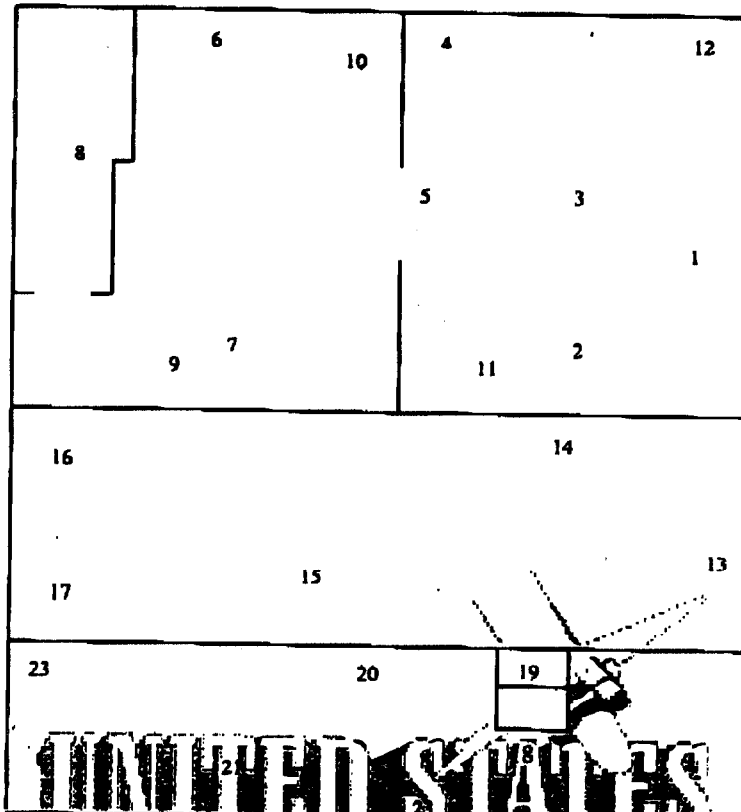
**Building 2  
(NOT TO SCALE)**



Location	1	2	3	4	5	6	7	8
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14
Beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91

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**Building 3  
(NOT TO SCALE)**



Location	1	2	3	4	5	6	7	8	9	10
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14
Beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91

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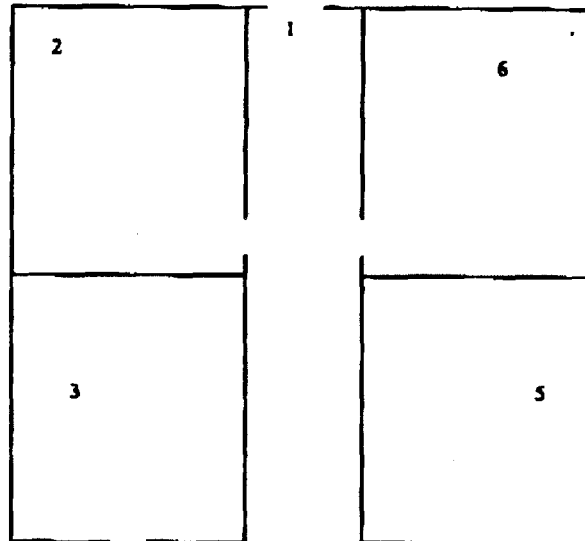
Location	11	12	13	14	15	16	17	18	19	20
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14
Beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91

Location	21	22	23
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14
Beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91



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**Building 4  
(NOT TO SCALE)**

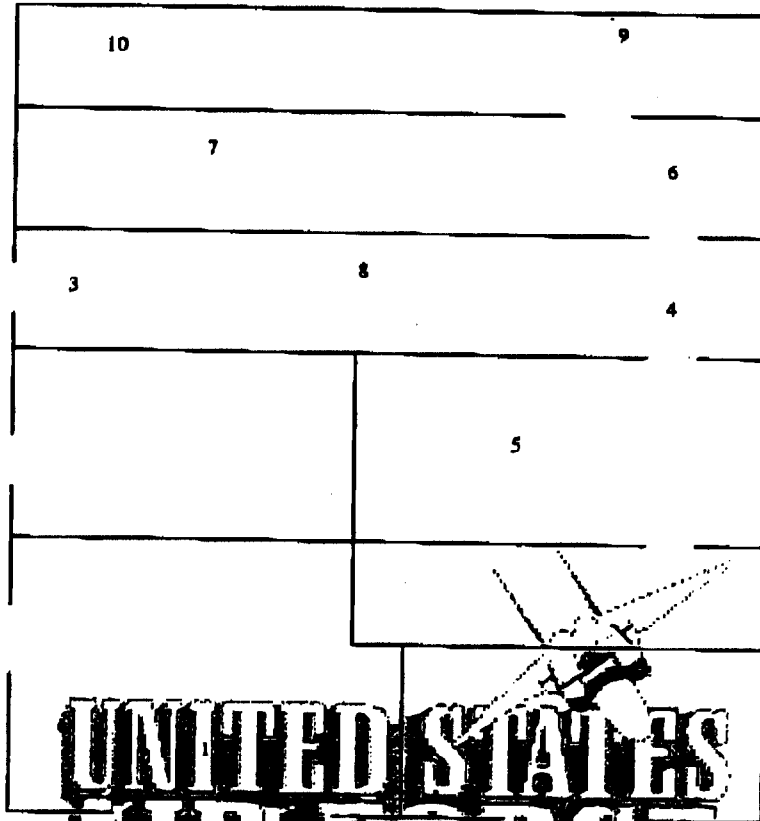


Location	1	2	3	4	5	6
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14
beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91

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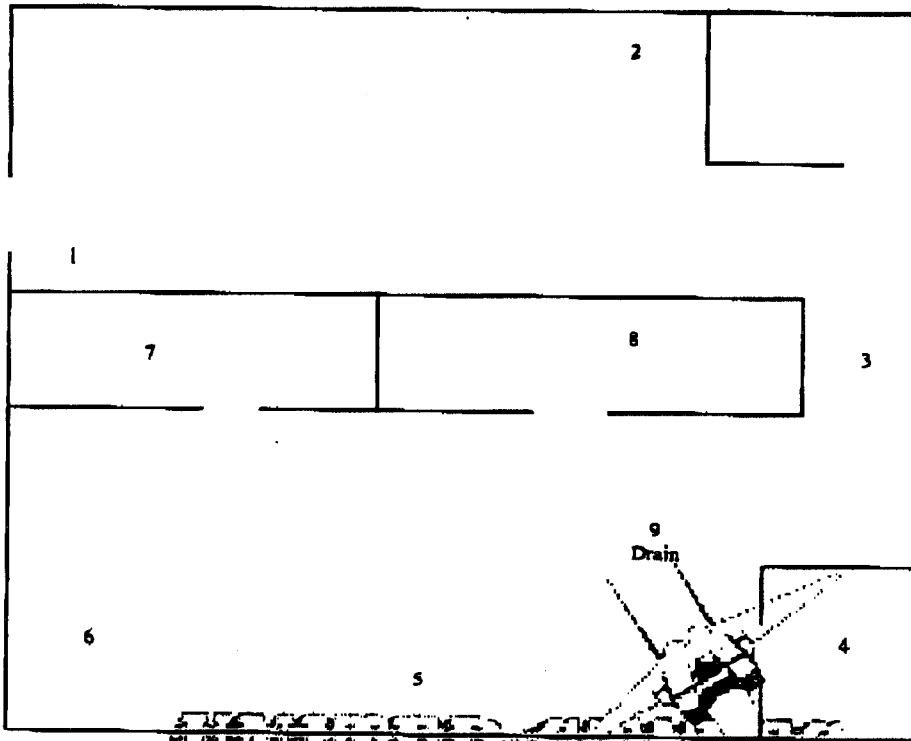
**Building 5  
(NOT TO SCALE)**



Location	1	2	3	4	5	6	7	8	9	10
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14
Beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91

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**Building 6  
(NOT TO SCALE)**



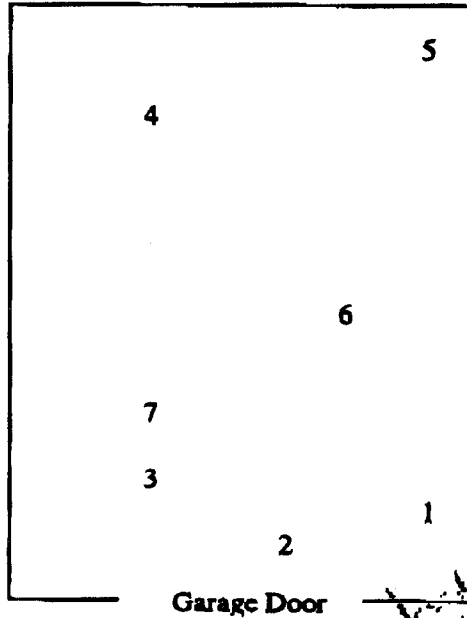
**UNITED STATES**

Location	1	2	3	4	5	6	7	8	9
alpha dpm/100 cm <sup>2</sup>	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14
Beta dpm/100 cm <sup>2</sup>	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91

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**Building 7  
(NOT TO SCALE)**



Location	1	2	3	4	5	6	7
alpha dpm/100 cm	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14	<4.14
beta dpm/100 cm	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91	<6.91

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**WRIGHT-PATTERSON AIR FORCE BASE, OHIO**