Technical Basis for the Release of T (Technical) Building at the Miamisburg Closure Project, Miamisburg, Ohio

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ACRONYM LIST

ALARA – As Low As Reasonably Achievable
ANL – Argonne National Laboratories
CERCLA – Comprehensive Environmental Response, Compensation and Liability Act
CLER – Clerk
COC – Contaminant of Concern
COOR – Coordinator
cu/ft – Cubic Feet
DMC – Demolition Construction Craft
DTEC – Demolition Technician
DOE – Department of Energy
HEAV – Heavy Duty Operator
IC – Institutional Control
LLW – Low Level Waste
LSA – Low Specific Activity
MCP-Miamisburg Closure Project
MGMT – Management
MMCIC – Miamisburg Mound Community Improvement Corporation
mr – Milli-REM
MRC – Mound Reuse Committee
NAC – National Association of Comptrollers
NFPA – National Fire Protection Agency
NORM – Naturally Occurring Radioactive Materials
NUREG – Nuclear Regulatory
OEPA – Ohio Environmental Protection Agency
ODH – Ohio Department of Health
OTP – Overtime Premium
OU – Operable Unit
PMAN – Project Manager
PRS – Potential Release Site
RADD – Radiological Control Technician
SU – Survey Unit
SUPV – Supervision
TECG – Technician
TEDE – Total Effective Dose Equivalent
TERF – Tritium Emission Reduction Facility
USEPA – United States Environmental Protection Agency
VSAP – Verification Sampling and Analysis Plan
yr - Year

1. EXECUTIVE SUMMARY

This report summarizes the measurements and dose modeling performed in the evaluation of residual contamination left in specific areas of the Technical (T) Building with volumetric contamination on the Mound Site in Miamisburg, Ohio. The evaluations follow the Department of Energy (DOE) guidance on property release described in DOE Order 5400.5 (Ref 1) and DOE G 441.1-XX (Ref 2). It demonstrates that the potential dose to likely individual receptors (either a renovation worker or a building occupancy worker) would be less than 15 mrem/year, excluding NORM in building material as required by site Mound 2000 (Ref 3) acceptance criteria. The range of estimated dose for the areas in question is conservatively estimated at 0.90 to 11.10 mrem/yr. This estimate is based on compliance with the intended end use of the building and the associated institutional controls spelled out in the Record of Decision for Parcels 6, 7, and 8 of the Mound Site. For the worst-case scenario that could occur should the institutional controls placed on the building be violated, the potential dose is conservatively estimated for an individual receptor as 106 mrem/yr.

This report also provides an As Low As Reasonably Achievable (ALARA) analysis that evaluates the cost and risk of further reducing the residual contamination left in the building. The ALARA evaluation demonstrates that the building's present configuration is an appropriate final condition from a radiological standpoint. Further reduction in radiological dose is achievable but with a great financial cost. Using specific assumptions, the cost of removing the residual contamination (achieving a dose below 3 mrem/yr) was estimated to be in excess of $8.27M.

Based on the analysis and the conservatively estimated low dose to a future worker, the building is deemed to be protective of human health in its present condition. Institutional controls have been placed on the building to assure the low dose is maintained.

The RESRAD-BUILD computer code (Ref. 5) was used to estimate potential radiation doses resulting from residual radioactivities remained in the building. Argonne National Laboratory provided assistance to Mound in reviewing the RESRAD-BUILD dose results and in performing an independent verification of the dose modeling, including determining the input source values based on available radiological survey data, selection of appropriate exposure parameters associated with considered exposure scenarios, and interpretation of the calculation results.

2. INTRODUCTION

T Building was originally built in 1948 to process radioactive polonium and minor amounts of other radionuclides. The Building is a heavily reinforced subterranean concrete structure located almost entirely under ground. T Building contains more than 200 rooms and 20 corridors. The building was constructed by excavating the side of a hill, assembling the basic reinforced concrete building shell, and then backfilling the excavated area to the original slope and grade. The interior dimensions of the basic building shell are 345 feet long by 150 feet wide. The roof is fifteen feet thick reinforced concrete.

T Building was a category II nuclear facility for much of its operational history. From 1949 to 1973, the building supported polonium programs included processing and separation programs, fuels research and development programs, a neutron source program, and other research, development and production programs using polonium. In the early 1970s a substantial decontamination effort was performed and in the early 1980s modifications were made to accommodate tritium-processing operations, nondestructive testing, environmental testing, gamma and mass spectroscopy, calorimetry, neutron activation analysis, and safeguards research and development (R&D). Since the decision to decommission T Building, the facilities and equipment have undergone shutdown and removal operations. Because of the formidable construction, demolition of the building was not a viable option; therefore the building was decontaminated and verified protective of human health in preparation for transfer to the local community reuse organization.

The release criteria for T Building and the Mound Site on which it is located is defined by the Mound 2000 process (Ref 3). This criteria and the process was agreed upon and signed by representatives of the DOE, the United States Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA) as part of the CERCLA clean up of the site. The plan defines surface release criteria similar to that used in DOE 5400.5 (Ref 1), In addition, where volumetric contamination is present, the plan allows for the use of the RESRAD-Build computer modeling code to estimate the potential dose. The plan establishes conservative release criteria of 15mrem/year for the industrial use scenario. The original intent of the decontamination effort as defined in T Building Removal Action (Ref 4) was to release the building based on surface release criteria only. After extensive remediation efforts, it was determined that approximately 5.5% of the total floor space had some volumetric residual contamination. Therefore the use of the RESRAD-Build method was implemented.

Once the decision was made to use the RESRAD-Build code to model, several actions were taken to ensure stakeholder involvement. Meetings were held with the USEPA, OEPA, and Ohio Department of Health (ODH) representatives to formalize the assumptions used in the code and to solidify the approach. In

addition, representatives from Argonne National Laboratories responsible for the development and application of the computer code were contacted to provide oversight. To solicit public involvement, a public fact sheet was generated and numerous meetings and tours were held with local stakeholder organizations to discuss the use of the RESRAD-Build code and the application of institutional controls.

This document is organized so that it summarizes the DOE requirements for releasing T Building and the Mound 2000 process (Ref 3). It describes radiological surveys and final results of these surveys in section 4. It describes sampling and quality assurance methods and provides conservative dose modeling for two industrial use scenarios in sections 8 and 5. In addition, this document evaluates the worst-case scenario should institutional controls be violated in section 6. It also analyzes the cost to reduce the volumetric contamination to achieve a background dose given specific assumptions in section 6. A summary of stakeholder involvement is provided as well as a summary of critical documentation in sections 7 and 10.

3. REQUIREMENTS FOR RELEASING T BUILDING

3.1 DOE Requirements & Guidance

The Draft DOE Guidance 441.1-XX (Ref 4), indicates a primary dose limit of 100 mrem/yr from all sources other than background and that authorized limits for release of property should be as far below 25 mrem/yr as practicable. DOE Order 5400.5 (Ref 1) specifies a dose limit of 100 mrem/yr from all sources other than background .

3.2 Site Specific Requirements and Guidance

The Mound site will be transferred to the Miamisburg Mound Community Improvement Corporation (MMCIC) based on the site sales agreement signed in 1997. This contract states that the Mound Site will be cleaned to an "Industrial Use" standard prior to transfer. This standard is set forth in the Mound 2000 (Ref 3) and agreed upon by the USEPA and OEPA. Using this process, the DOE Miamisburg Closure Project (MCP) office and its contractors have remediated buildings and land and evaluated the potential risk to the public prior to transfer to the MMCIC. This evaluation is documented in the Record of Decision (ROD) for each parcel as well as specific restrictions placed on the property in order to ensure the property is protective of human health under the "industrial use" scenario. These restrictions are passed on in the deed prior to transfer. T Building is located in the center of the Mound Site and will be transferred with the parcel of land designated as Parcel 8. Reuse restrictions associated for Parcel 8 as well as T Building are as follows:

Site Restrictions - As with previous transferred parcels, land reuse restrictions will be placed in the Record of Decision and subsequently the deed. These restrictions are as follows:

- Maintenance of industrial/commercial land use
- Prohibition against residential, day care, schools, or educational facilities, community centers, playgrounds, or other religious facilities for children under 18 years of age
- Prohibition against the use of groundwater
- Site access for federal and state agencies for the purpose of sampling and monitoring
- Prohibition against removal of soils from the Mound property (as owned in 1998) boundary without approval from ODH, OEPA, and USEPA.

Room Restrictions (all rooms cleared using RESRAD Build) – In order to assure that concrete flooring from these rooms is not removed and placed in a landfill or other uncontrolled location, the ROD will contain Institutional Controls (IC) specific to these rooms in T Building:

- Prohibition against removal of concrete in specific T Building floors (Figure 1) from the Mound property (as owned in 1998) boundary without approval from ODH, OEPA and USEPA.
- Prohibition against remediation of concrete floors in specific T Building floors (Figure 1) without approval from ODH, OEPA, and USEPA.

Dose limits for Buildings with volumetric contamination are specified in the Mound 2000 Approach (Ref 3). This limit is "15 mrem/yr excluding NORM in building materials and soil." Mound 2000 (Ref 3) also states "The computer code RESRAD-BUILD may be used to assess dose for reuse of buildings/structures at the Mound Site." Therefore, the final end state dose limits in T Building are established at 15 mrem/yr.

4. RADIOLOGICAL SURVEYS AND SAMPLING

4.1 Survey Unit Location

There are five rooms/areas in T-Building with residual contamination. All other areas including the walls and ceilings of the rooms with residual volumetric contamination meet the surface release criteria of the Mound 2000 (Ref 3). The locations of the areas below are shown in Figure 1.

- (SU 1S-10)
- (SU 1C-15 and 16)
- (SU 1C-11, 12 and 21)
- (SU 1C-07, 08, 09 and 10)
- (SYS-02A, B, and C)

Surveys in these areas have resulted in the identification of contamination at levels exceeding the surface release guidelines established in Mound 2000 (Ref 3).

4.2 Sampling locations

A composite sample was produced by blending the samples selected from two sampling groups. The first group of samples was generated from randomly placed core boring locations. The random locations were selected throughout the survey unit using Visual Sampling Plan. The number of samples varied depending on the size of the survey unit. The second group was selected by using floor scan data. Typically a total of 10 bias core samples were selected in the locations that presented the highest surface contamination readings. The samples from all locations were then homogenized into one sample.

4.3 Sample Depth

Samples were drilled from three depths in most cases (1", 6", and 15"). The 1" and 6" samples were taken from locations with no previous penetrations as identified above. The composite samples (one from each depth) were analyzed for isotopic concentration. The sample concentrations were then used in the RESRAD-BUILD computer model. Sample concentrations from the 6" core were used to represent the average surface contamination in the occupational worker scenario providing additional conservatism. Samples from the 1" core were used in calculating the renovation scenario as an average volumetric contamination also providing additional conservatism. In the case of SYS-02A, only a 6" core was taken. This sample was used for both calculations. Although this sampling method varies from the other survey units, this survey unit has other built in conservative assumptions that will overshadow the lack of a 1" sample. Samples (15") were also taken as verification that contamination was captured in both the 1" and 6" samples. These 15" core borings were taken in the same core location as the 6" samples. An undersized bit was used and a core was made from 6" to 15". The samples were then homogenized and processed in the same manner as the other samples. Data were evaluated to verify that the radiological concentrations were similar to background.

4.4 Sample Processing

Each sample was labeled with date, time, room #, survey unit #, and sample ID#. The samples were recorded on Radiological Survey Data Sheets. Chain of custody was maintained for all samples. Samples were processed for gamma spectroscopy analysis in accordance with laboratory procedures. Contaminants of Concern (COC) for each area were based on previous investigation and are shown in Appendix A.

5. DOSE MODELING AND CALCULATIONS

The RESRAD-BUILD computer code has been used to bound the potential dose to likely future building occupants in these 5 areas. The computer code estimates the potential dose for an occupancy scenario and a renovation

scenario based on input parameters (Appendix B). These two scenarios mimic a stationary individual receiving a long-term external dose and a renovation worker receiving a dose over a shorter period of time from other pathways such as inhalation.

In each case, the input parameters are best estimates or conservative estimates of specific parameters used by the code. The result is an extremely conservative dose estimate that bounds likely future use of the building. Some examples of conservative assumptions are:

- Volumetric contamination is assumed to be on the surface providing maximum dose to the occupancy worker and discounting any shielding from the concrete
- Receptors are assumed to spend 100% of their time at the receptor location
- The source geometry used in the model is a disc source with an area equal to the floor providing the greatest dose
- Volumetric contamination is biased high during sampling and then again by using the greatest concentration of either 1" or 6" samples.

Calculations in each area were done independently at first, without any consideration for additive dose contributions from the other areas. Then additive dose contributions from all five areas to receptors in each area were considered. This is necessary to ensure that the maximum dose to future building occupants is less than 15 mrem/year from all building sources combined.

Another dose consideration is the potential dose from walls, ceilings and other surfaces that meet the surface release criteria. Any potential dose contributions from these areas are assumed to contribute insignificantly to the dose of future building occupants. This is based on the Mound 2000, Appendix A, Surface and Volumetric Release Criteria for Building Disposition (Ref 3), which states "If there is no surface contamination above the surface contamination criteria (Table 1), it is reasonable to assume that there is no significant exposure due to existence of residual volumetric contamination." This assumption was validated through the use of the RESRAD-BUILD computer model. A sample room was modeled and the likely contribution from this source was found to be less than 10%.

The following table summarizes the results of the independent dose calculations for each area.

TABLE 1 SUMMARY OF DOSE BY AREA

Area Description	Occupancy Scenario Dose (mrem/yr)			Renovation Scenario Dose (mrem/yr)		
	External	Internal	Total	External	Internal	Total
1S-10	10.5	0.02	**10.5**	3.05	0.05	**3.1**
1C-15	0.12	0.76	**0.9**	0.03	1.62	**1.7**
1C-16	0.13	0.74	**0.9**	0.03	1.60	**1.6**
T-Cap*	8.87	0.02	**8.9**	1.83	0.04	**1.9**
SYS-02A** (West Head House)	0.2	5.2	**5.4**	0.0	11.1	**11.1**

* T Cap includes SU#s 1C-07, 1C-08, 1C-09, 1C-10, 1C-11, 1C-12, 1C-21

** SYS-02A includes SU #s SYS-02A, SYS-02B, and SYS-02C

In this analysis, it is important to point out that T-Building is divided into 3 bays (Figure 1), each bay separated by a 3-feet thick concrete wall. Of the 5 areas listed in the above table, only 1C-15, 1C-16, and T-Cap share the same bay. Although it is possible for airborne contamination to pass freely between bays, the 3-feet thick concrete walls effectively shield the external dose between bays, i.e., reducing the dose rate by more than a factor of 1000. For simplification in this analysis, computed doses from 1C-15, 1C-16, and T-Cap will simply be combined, leaving only 3 areas to consider.

TABLE 2 SUMMARY OF COMBINED DOSE

Area Description	Occupancy Scenario Dose (mrem/yr)			Renovation Scenario Dose (mrem/yr)		
	External	Internal	Total	External	Internal	Total
1S-10	10.5	0.02	**10.5**	3.05	0.05	**3.1**
1C-15, 1C-16, and T-Cap combined for simplicity	9.12	1.52	**10.6**	1.89	3.26	**5.2**
SYS-02A	0.2	5.2	**5.4**	0.05	11.02	**11.1**

Since these 3 areas are isolated from each other with regard to external dose due to the 3-feet thick concrete wall that separates them, external dose components between the different areas may be ignored. Although some small component of the computed internal doses are from direct ingestion, for the purpose of this analysis, it is assumed that internal dose is all due to airborne contamination that may pass freely throughout the building. Therefore, the internal dose component to the building as a whole from each of the affected areas can be estimated using a ratio of the air volume of the affected area to the total building air volume. The total building air volume is approximately 42,000 m^3.

TABLE 3 AIR VOLUME RATIOS BY AREA

Area Description	Modeled room air volume (m^3)	Ratio (modeled room air volume/building air volume)
1S-10	155	0.0037
1C-15, 1C-16, and T-Cap (combined for simplicity)	2480	0.059
West Head House	500	0.012

The computed internal dose from each area can then be multiplied by this ratio to estimate the internal dose component that could affect other areas. Internal dose contributions from each area to other parts of the building are given in the table below.

TABLE 4 INTERNAL DOSE CONTRIBUTIONS BY AREA

	Occupancy Scenario Dose	Renovation Scenario Dose
Area Description	(mrem/yr)	(mrem/yr)
1S-10	0.00008	0.0002
1C-15, 1C-16, and T-Cap (combined for simplicity)	0.09	0.192
West Head House	0.06	0.131
Total	0.15	0.32

As can be seen in the table, the total internal dose component to other parts of the building from all of the affected areas combined, including both occupancy and renovation scenarios at the same time, is less than 0.5 mrem. Therefore, since the maximum dose computed for any area independently was 10.6 mrem (1C-10, 1C-16, and T-Cap combined) and the addition of 0.5 mrem is still less than 15 mrem, it may be concluded that the maximum dose to any future building occupant will be less than 15 mrem when considering the combined dose from all 5 affected areas in T-Building.

6. ALARA ANALYSIS

For ALARA analysis, the cost associated with further reducing the residual radioactivity to meet the DOE 5400.5 surface release criteria (action alternative) was analyzed. It is assumed that further remediation work would be conducted by radiation workers whose radiation dose would be monitored and kept under the DOE limit for workers; therefore, the radiation exposure was not estimated in this report.

This ALARA analysis also evaluates the collective dose to future occupants working in the affected rooms if no further remedial actions are taken (no action alternative). Then the cost/benefit of completing additional dose reduction actions was evaluated.

6.1 Likely Use Scenario

The likely use scenario was considered previously under 'Dose Modeling and Calculation'; therefore, they are not repeated here. Individual radiation dose under the no action alternative was also presented in Section 5. However some consideration should be given to the end-state of the building. At the conclusion of the T Building's useful life, the most likely scenario is that the facility will be abandoned in place and managed pursuant to restrictions imposed on the remainder of the Mound property as part of the Mound site-monitoring program. Access to the building will be barred by constructing barriers at the tunnel openings and by dismantling the elevators and stairways at the existing portals. Onsite fill material (i.e., soil) will be placed in the tunnel and portal areas, contoured to allow for re-vegetation and seeded with grasses and herbaceous plants to prevent erosion. Because of the formidable construction of T Building, D&D after completion of its useful life is not a likely scenario. As stated in the Hazardous Waste Remedial Actions Program (Ref 6), The contribution of the T Building to the total site's source term is negligible when compared with the overall levels of contamination represented by the Mound site.

6.2 Action Alternative

Under this alternative, concrete floors containing residual contamination would be remediated to surface release criteria. Floor construction (concrete, concrete and rebar, or concrete and fill material) varies between survey units but the remediation effort would involve the removal of all concrete, rebar, and fill material until the surface meets surface release criteria. Based on previous experience in T Building, this effort would require the assistance of a small excavator(s), fork trucks, and a front end loader. The work would be performed by trained radiological workers using proper personal protective equipment (respiratory protection) and under the control of an acceptable radiological protection program. Debris would be removed from the building and disposed of as low-level waste.

The result of the cost analysis for the remedial scenario is presented below. The No Action Alternative (i.e., without further remediation) is used as the baseline. In order to proceed with further remediation, the added costs to remediate must be commensurate with the degree of additional protection associated with the reduced dose exposure levels.

It is estimated that demolition activities associated with floor removal require 15 months to complete at a cost of $8.3 M. Two work crews are utilized to work the Survey Units. One crew is assigned to the T-Cap area and works there for the duration of the 15-month project. A second crew remediates the remaining areas. These areas are considerably smaller than T-Cap and lack the extensive rebar reinforcing present in the T-Cap floor. Each of the remaining areas takes approximately 4 months to complete floor removal. These areas are completed in series. A breakout of costs for the three work areas is summarized in

Appendix C. The additional dose to the radiation workers to accomplish this additional remediation is considered negligible, based on the remediation work already completed.

6.3 Worst Case Scenario

Under the worst case scenario, it is assumed that the institutional controls in place are violated and the concrete cap covering survey units 1C-10 and 1C-21 is removed exposing future workers to greater than 15mrem/yr. The greatest dose is expected to be under the occupational scenario once the cap is removed. Other scenarios were considered but were determined to be highly unlikely or of significantly less potential dose.

TABLE 5 WORST CASE SCENARIO

Area Description	Occupancy Scenario Dose (mrem/yr)		
	External	Internal	Total
1C-10 and 1C-21	106	.047	106

6.4 Collective Dose Estimation

The collective dose is estimated as the dose rate multiplied by the occupancy over the life of the building. These input parameters were conservatively estimated as follows:

6.4.1 Dose Rate

The occupancy scenario dose rate calculated in section 5 was used for calculating the long-term dose to a population over the life of the building. This dose was selected from Table 4 for each specific area and applied to the occupancy for that area.

TABLE 6 OCCUPANCY DOSE FOR SPECIFIC AREAS

Area Description	Occupancy Scenario Dose (mrem/yr)
1S-10	10.52
1C-15, 1C-16, and T-Cap (combined for simplicity)	10.64
West Head House	5.40

6.4.2 Occupancy

The most likely use for T building is light manufacturing. The occupancy rate for a light manufacturing building is conservatively estimated at 100 ft^2/person based on estimates referenced in the NFPA 101 (Ref 7) Extrapolating this value to the size of the five rooms with volumetric contamination, the number of people working in the rooms is conservatively estimated at 92 total with the likely occupancy for each area also shown below in Table 7.

TABLE 7 FLOOR SPACE DIMENSIONS FOR AFFECTED ROOMS

Room	Subtotal Areas (ft^2)	Occupancy
1S-10	2,491	25
1C-15, 1C-16, and T-Cap (combined for simplicity)	6,744	67
SYS-02A	* N/A	* N/A
Grand Total	9,235	92

* It is not reasonable to assume that this area will be populated.
The space has limited access and is designed for maintenance use only.

6.4.3 Life of the Building

An estimate of the useful life of a commercial building is 45 years based on the National Association of Comptrollers (NAC. 2002) (Ref 8). This is the projected useful life of the interior and utilities. It's assumed that the interior and utilities will undergo major reconstruction by the MMCIC in order to make the building habitable. The reconstruction should be extensive enough that the building utilities could be considered new.

The useful life of the exterior of T Building is considered significantly greater than 45 years based on the unique construction of the building. The structure has already served a useful life of 58 years with little or no visible deterioration. A realistic estimate cannot be determined due to the unique design and construction of the building. For purposes of cumulative dose calculations, a useful life of 45 years is assumed.

TABLE 8 CUMULATIVE DOSE CALCULATIONS

Room	Occupancy	Occupancy Dose mrem/yr	Collective dose Person-mrem	Cumulative dose over 45 years person-mrem
1S-10	25	10.52	263	11835
1C-15, 1C-16, and T-Cap (combined for simplicity)	67	10.64	712.9	32080
SYS-02A	* N/A	5.40	*NA	* N/A
TOTAL			976	43915

* It is not reasonable to assume that this area will be populated.
The space has limited access and is designed for maintenance use only.

6.5 Cost Analysis

The result of the cost analysis for the remedial scenario is presented below. The No Action Alternative (i.e., without further remediation) is used as the baseline. In order to proceed with further remediation, the added costs to remediate must be commensurate with the degree of additional protection associated with the reduced dose exposure levels.

It is estimated that demolition activities associated with floor removal require 15 months to complete at a cost of $8.3 M. Two work crews are utilized to work the Survey Units. One crew is assigned to the T-Cap area and works there for the duration of the 15-month project. A second crew remediates the remaining areas. These areas are considerably smaller than T-Cap and lack the extensive rebar reinforcing present in the T-Cap floor. Each of the remaining areas takes approximately 4 months to complete floor removal. These areas are completed in series. A breakout of costs for the three work areas are summarized in Appendix C. The additional dose to the radiation workers to accomplish this additional remediation is considered negligible, based on the remediation work already completed.

6.6 Conclusions

The DOE Order 5400.5 supplemental standards application process requires an analysis to determine if the proposed action is within regulatory limits and is as low as reasonably achievable (ALARA). In other words, is further reduction in dose worth the incremental cost to achieve the dose reduction? The cost/benefit analysis is normally reduced to units of dollars per person-rem (derived from lifetime cancer fatality risk estimates), and then compared with a reference value as the basis for a decision. Often the reference value is set in the range of $1,000 to $10,000 per person-rem, and may vary as much as a factor of 10 above or below the range (Argonne National Laboratory, 1993). Based on the cost estimate in Section 6.5 and the collective dose estimate in Section 6.4, the cost for person-rem avoided for taking the action alternative is $1.8M per person-rem.

7.0 STAKEHOLDER INVOLVEMENT

Stakeholder involvement has been extensive in the reuse of T Building and the use of RESRAD Build to release specific areas of the building. Below is a summary of specific dates in which significant stakeholder interaction took place. In general, this interaction has been in two forums; the first is public review of regulatory documents such as the Action Memorandum and Fact Sheet and the second is in the form of presentations and tours provided to stakeholder organizations. Public review of regulatory documents provides a formal documentation and response to stakeholder concerns. These comments and responses become a part of the document in the public reading room. Presentations and tours allow the public a more informal forum to ask questions and gain better understanding of the nature of the remediation and the final end state of the building. A summary of the T Building stakeholder meetings, tours, and solicitation of comments is presented below:

- T Building Action Memorandum
    - Public Review Period January 2003
- Meeting with the Miamisburg Mound Community Improvement Corporation

    - 1/16/06 Meeting to discuss RESRAD-BUILD
    - 4/18/06 Meeting to discuss Status prior to Tour
    - 4/20/06 Tour MMCIC Board of Directors
- Federal Facilities Agreement Monthly Meetings
    - 11/14/05 Discussion of RESRAD-BUILD
    - 12/12/05 Discussion of RESRAD-BUILD
    - 1/23/06 Discussion of RESRAD-BUILD
    - 2/22/06 Discussion of RESRAD-BUILD
    - 4/25/06 Discussion of RESRAD-BUILD
- Mound Re-use Committee Monthly Meeting
    - 2/13/06 Presentation of RESRAD-BUILD
    - 3/10/06 Discussion of RESRAD-BUILD
    - 4/21/06 Tour T Building and RESRAD-BUILD Rooms
- T Building Fact Sheet
    - Public Review Period 2/27/06 – 3/29/06

In cases where formal stakeholder comments were solicited in the T Building Fact Sheet, the majority of the comments focused on:

- Concerns about the structural integrity of the building
- Concerns that the DOE is in compliance with the "Sales Agreement" in that the seller has cleaned or will clean the Premises to an "industrial use" standard
- Concerns that restrictions such as institutional controls may limit the buildings usefulness and demand in the market place
- Concerns as to the end state/ condition at the completion of the remediation activities

Responses to these concerns were documented in a formal response to comments and included in the T Building Fact Sheet. The issues were then addressed in subsequent presentations and tours so an open discussion of the concern could be conducted.

8. VERIFICATION AND QUALITY ASSURANCE

Verification – Verification of T Building was performed in accordance with the T Building Verification Sampling and Analysis Plan. This plan divides T Building into 170+ survey units based on location, history and pathways. The plan was developed with the assistance of Argonne National Laboratories and reviewed and approved by the Department of Energy Miamisburg Closure Project, the Ohio Environmental Protection Agency, the Ohio Department of Health and the United States Environmental Protection Agency (Region 5). For all survey units surface release criteria were applied to measurements taken at statistically determined locations. All survey units passed and are considered free released under the surface release criteria with the exception of the survey units with volumetric contamination. For areas where the RESRAD-BUILD model was

applied, core samples were taken at statistically determined locations. In addition, bias samples were taken in the areas where surface activity was greatest. These samples were taken at 1-inch, 6-inch, and 15-inch depths to verify that the core sample captured the extent of the volumetric contamination.

Replicate Measurements – Sixteen replicate measurements were randomly selected from a population of approximately 100 data points. The population was composed of survey units that were surveyed under the same survey plan and methodology. Survey units with volumetric contamination were included in the sample population and a total of three replicate samples fell in these areas. Replicate measurements were taken at these locations and performed in the same manner as the original survey.

Table 9 Fixed Replicate Point Variance Analysis

QC ID#	Initial Sample ID#	Room #	alpha initial (dpm/100cm2)	alpha replicate (dpm/100cm2)	Beta initial (dpm/100cm2)	Beta replicate (dpm/100cm2)
T01QC01	1S100229S	Rm 16 (1S10)	22	8	147	984
T01QC02	1C090110S	T-cap (1C21)	656	859	25079	34521
T01QC03	2S130118S	Rm 214	0	23	1229	1324
T01QC04	2S130120S	Rm 214	0	8	968	1022
T01QC05	1C100101S	T-cap (1C12)	38	43	1811	1714
T01QC06	1N02A0214S	Rm 78a	4	27	953	1081
T01QC07	1N02C0102S	Rm 78	20	15	1780	1519
T01QC08	1N03A0115S	Rm 89	23	15	1585	1334
T01QC09	1n080111S	Rm 99	14	43	887	1509
T01QC10	2C040122S	Rm 254	4	27	1587	1626
T01QC11	2C040116S	Rm 252	15	15	921	1149
T01QC12	2C080201S	Corr 24	25	19	992	1003
T01QC13	2S02D0102S	Tunnel	23	31	1412	1587
T01QC14	5N060216S	E Tower 4th flr	23	19	1113	1928
T01QC15	5N060115S	E Tower 4th flr	15	4	1587	1948
T01QC16	5N070201S	W Tower 3rd flr	19	8	1278	1431
	Variance (S2)		25668	44097	35765988	68614494
	Ratio				0.58	0.52

The fixed replicate initial data set should generally be within a factor of 2 of the variance of the replicate data set. The data sets meet these criteria; therefore, the data are acceptable.

Replicate Scans - Replicate Scans were conducted for Class 1 areas per the T-01 survey plan. 2.5% of the scanned area was replicated on both the first and second floor of T Building. On the first floor 17,4871 ft^2. of area were scanned. Replicate scans were performed on survey units 1S-10, 1S-12, 1C-18, and 1N-02B. These units were randomly selected from a list of all first floor survey units. The selected survey units cover 4,580 ft^2. On the second floor survey units

2C07, 2N05A, 5N06 were rescanned. These units comprise 5626 sq. ft. while the total area surveyed on the second floor was 190,276 ft^2. Records indicate that the instrument calibration was verified.

These results are in agreement with the original findings. It should be noted that in the case of survey unit 1S-10 was selected for rescan. The original scan of 1S-10 noted five potentially elevated readings. Follow-up fixed point surveys of the suspected elevated areas did not detect levels above surface release criteria.

9. HISTORICAL KNOWLEDGE OF PROPERTY

T Building construction was completed in 1948. Since that time, the building has had a long documented history of radiological operations. A summary of the building history is included in Appendix A. Also included is a brief history of the specific areas with residual contamination as well as the results of previous investigations.

10. FINAL DOCUMENTATION AND AVAILABILITY

There are specific documents related to the release of T Building that are available to the public in the Mound Site Public Reading Room. These documents are as follows:

- Action Memorandum T Building Removal Action, Final CH2M Hill Mound, June 2003.
- Public Fact Sheet, T Building - Use of Dose Modeling and Institutional Controls, March 2005
- T Building Verification Sampling and Analysis Plan, October 2004.
- T Building Structure Removal Action OSC Report, July 2006
- Miamisburg Closure Project, T Building Data Quality Report, July 2006
- Record of Decision, Parcel 6, 7, and 8, July 2006

11. RECORDS MAINTENANCE AND REPORTING

The DOE retention schedule for CERCLA documents is 75 years after completion. These documents are administered by the Department of Energy Legacy Management and stored at the Federal Records Center.

APPENDIX A

HISTORICAL OVER VIEW OF T BUILDING

APPENDIX A
HISTORICAL OVER VIEW OF T BUILDING

AREA HISTORY AND REMEDIATION

T Building is a heavily reinforced subterranean concrete structure located almost entirely under ground. The south-end section of the building tunnel area is exposed aboveground and abuts the multi-story Central Operations Support (COS) Building. T Building and COS Building are separated by an approximate 6-inch thick expansion joint. Construction was completed in 1948 on T Building and associated structures (described below). Each of the two floors is compartmentalized into three general areas (bays) by two 30-inch thick reinforced concrete firewalls. T Building contains more than 200 rooms and 20 corridors. Associated building structures include two exhaust airshafts that fed two brick and mortar exhaust stack. The stacks have been demolished leaving the stack head houses for ventilation. The building has three towers along the north wall, one at each end and one at the center. The end towers contain stairways, passenger elevators, airshafts for intake ventilation air, and pedestrian entrances at grade level. The middle tower was used for providing intake ventilation air. The air required for the ventilation of the main body of the building enters at the penthouse level of each individual tower. The eastern-most tower is designated the East Tower (or Tower 1) and the western-most tower is designated the West Tower (or Tower 1A). The East Tower also provides space for various utility lines coming into the building. The East and West Towers also contain airshafts that are part of the intake air ventilation system. Large doors permit vehicles and personnel to enter the building at either end of the second floor. The vehicular tunnel extends the length of the south side of the building. The building was constructed by excavating the side of a hill, assembling the basic reinforced concrete building shell, and then back filling the excavated area to the original slope and grade. The interior dimensions of the basic building shell are 345 feet long by 150 feet wide. The roof is fifteen feet thick reinforced concrete. The building heating and cooling is achieved through single pass supply and exhaust ventilation units located on the first floor. These units were supplied with steam and chilled water / glycol from a central powerhouse which has since been demolished. The building has potable and non-potable water and sanitary services provided by the Miamisburg Closure Project (MCP). Electric service is 12,000 volts.

PAST USES

T Building was originally built to process radioactive polonium and minor amounts of other radionuclides. From 1949 to 1973, polonium programs included a processing and separation program, fuels research and development program, neutron source program, and a variety of other research, development and production programs with polonium. T Building underwent a significant decontamination in the early 1970s and a substantial modification during the early 1980s in order to accommodate tritium-processing operations. A variety of other activities have been done in T Building such as nondestructive testing,

environmental testing, gamma and mass spectroscopy, calorimetry, neutron activation analysis, and safeguards research and development (R&D). Building operations have included offices and administrative areas, laboratories, and material storage. Materials stored have included chemical products, office supplies, and waste storage containers. The building has a vault that was used to store secured nuclear materials.

MOST RECENT USES

T Building contained laboratories used for radioactive and non-radioactive work, offices, and service rooms. The Tritium Emissions Recovery Facility (TERF) processes tritiated gases to recover waste tritium for disposal. TERF operated until approximately second quarter CY2004. Since the late 1990's T Building work included pre-characterization, work planning for decontamination and decommissioning, safe shutdown, and post-characterization remedial activities. The work scope consisted of preliminary work that was required to execute building disposition activities in accordance with Environmental Safety & Health requirements, DOE Orders, and best management practices. Safe shutdown included building surveillance (weekly and monthly contamination surveys), and the accumulation, decontamination, characterization, and disposition of radioactive, non-radioactive and mixed waste. The building was vacated in February 2005, at which time only remediation and verification activities continued in preparation for transfer to MMCIC. Specific uses for the rooms in T Building impacted by volumetric contamination are as follows:

Room 16 (SU 1S-10)

Prior to 1979 this room was used for drum storage in support of T Building waste operations, In 1979 the room was upgraded with house vacuum in anticipation of the installation of new glove boxes From 1984 through the 2000, this room was used for the storage of LSA waste.

Rooms 61, 62, and 63 (SU 1C-15 and 16)

From 1960 through 1963 these rooms contained a neutron source calibration system and a test system for encapsulated thrusters. Beginning in 1973 these rooms contained the Tritium Recovery Columns and a Tritium Aqueous Water Recovery System. These systems were dismantled and removed from 2000 through 2004.

Rooms 57, 58 and 59 (SU 1C-11, 12 and 21)

From 1949 through the early 1970's these rooms were the polonium processing "concentration" cells and control room. In the mid 1970's the rooms were stripped of process equipment and decontaminated. Beginning in the late 1970's and through 2004, the areas contained tritium processing and purification systems and a mass spectrometer.

Rooms 43, 44, Corridor 51, and a portion of 48, 49 and 50 (SU 1C-09 and 10)

From 1949 through the early 1970's these rooms were part of the polonium processing support areas. In the mid 1970's the rooms were stripped of process equipment and decontaminated. Beginning in the late 1970's and through 2004, the areas contained tritium processing and purification systems and a mass spectrometer.

Area between room 99 and the West Head House

This area of the building has always been the access for exhaust ductwork to leave the main fan room (T99) and exit to the West Head House. It has also been a collection area for groundwater. Surface water entering the West Head House was captured in a weir and fed to a sump within T Building. When the weir was plugged or when water infiltration was greater than the weir could handle, the water collected in this area of the building. This groundwater was runoff from the site known as the R/SW Building Complex. This facility was a category II nuclear facility with contaminated structures, foundations, drainage, and soil. It is reasonable to assume that residual contamination in the area of T Building was the result of years of contaminated water runoff collecting and evaporation in the area.

RESULTS OF PREVIOUS INVESTIGATIONS

T Building was identified as a clean-up effort due to radiological contamination based on contaminants associated with various missions and projects that were associated with the building and that may be present at unacceptable levels. Based on the clean-up effort the Core Team recommended a removal action for T Building. Mound's Core Team consists of representatives from US DOE, US EPA Region 5, and Ohio EPA. The COC list is in agreement with the analytes reported in the Action Memorandum for T Building (Ref 4) and includes uranium-235/238 (U-235/238), cobalt-60 (Co-60), silver 108m (Ag-108m), plutonium-238/239 (Pu-238/239), americium-241 (Am-241), radium-226 (Ra-226), radon (Ra-222), bismuth-207/210m (Bi-207/210m), cesium-137 (Cs-137), strontium-90 (Sr/Y-90), and tritium (H-3). Previous measurements have confirmed presence of Bi-207, Bi-210m, Cs-137, Ag-108m, Am-241, Pu-238, Pu-239, Po-209 and Co-60 as COCs. Contaminants of concern in the specific areas with residual contamination are shown below:

AREA	COCs
1S-10	Bi-207, Bi-210, Co-60, Bi-207, Ag-108, and Cs-137
!C07,08,09,10,11,12, and 21	Bi-207, Bi-210, Co-60, Bi-207, Ag-108, Sr/Y-90, and Cs-137
1C-15 and 16	Am-241, Pu-238, Pu-239, and Cs-137
SYS02A, B, and C	Am-241, Pu-238, and Th-230

APPENDIX B

RESRAD BUILD MODEL INPUT PARAMETERS

Parameters Used in the Building Occupancy Scenario

Parameter	Value used	Remarks
Number of rooms	1	Future airflow between T Building rooms is unknown.
Air exchange rate	0.8 hr^{-1}	RESRAD-BUILD default value based on studies of various residential and commercial buildings (Yu et al. 2003) (Ref 9).
Exposure duration	365.25 days	To match occupancy period in NUREG/CR-5512 building occupancy scenario (Beyeler et al. 1999) (Ref 10).
Indoor fraction	0.267	To match 97.5 d/yr time in building in NUREG/CR-5512 (Beyeler et al. 1999)(Ref 10).
Receptor location	X, Y, 1 (meters)	The X and Y values are such that the receptor is located in the center of room/source at a height of 1 meter above floor.
Receptor inhalation rate	33.6 m^3/d	To match the 1.4 m^3/h breathing rate in NUREG/CR-5512 (Beyeler et al. 1999)(Ref 11).
Receptor indirect ingestion rate	1.12E-4 m^2/h	Mean value from the parameter distribution (Yu et al. 2003)(Ref 9).
Source type	Area	It is assumed that contamination is only on the surface (Yu et al. 2003)(Ref 9).
Direct ingestion rate	0	Direct ingestion of the floor is highly unlikely. Ingestion may occur indirectly as the floor erodes and small particles become available to contaminate an occupant's hands and subsequently be ingested. (Indirect ingestion is a separate parameter.)
Air release fraction	0.07	Most likely value from the parameter distribution (Yu et al. 2003)(Ref 9).
Removable fraction	0.1	Assumes 10% of the contamination is removable (NUREG/CR-5512 default)(Ref 11).
Time for source removal or source lifetime	10,000 days	Most likely value from parameter distribution (Yu et al. 2003)(Ref 9).
Deposition velocity	0.01 m/s	RESRAD-BUILD default (Yu et al. 2003)(Ref 9).
Resuspension rate	5E-7 s-1	RESRAD-BUILD default (Yu et al. 2003)(Ref 9).
Time fraction	1	Exposed individual spends 100% of their time at the receptor location.
Radon release fraction	0.1	RESRAD-BUILD default (Yu et al. 2003)(Ref 9).
Source geometry	------	Disc source with area equal to room floor area. Receptor positioned 1 meter above center of source.

Parameters Used in the Building Renovation Scenario

Parameter	Value used	Remarks
Number of rooms	1	Future airflow between T Building rooms is unknown.
Air exchange rate	0.8 h^{-1}	RESRAD-BUILD default value based on studies of various residential and commercial buildings (Yu et al. 2003)(Ref 9).
Exposure duration	179 days	To match renovation period in NUREG/CR-5512 building renovation scenario (Beyeler et al. 1999)(Ref 11).
Indoor fraction	0.351	To match the 62.83 days spent in the building during renovation period in NUREG/CR-5512 building renovation scenario (Wernig et al. 1999)(Ref 11).
Receptor location	X, Y, 1 (meters)	The X and Y values are such that the receptor is located in the center of room/source at a height of 1 meter above floor.
Receptor inhalation rate	38.4 m^3/d	To match building renovation scenario with 1.6 m^3/ breathing rate of moderate activity given in the EPA Exposure Factor Handbook (US EPA 1997)(Ref 12).
Receptor indirect ingestion rate	0	It is assumed that the ingestion is only from the direct contact with the source (Yu et al. 2003)(Ref 9).
Source type	Volume	Contamination is assumed to be volumetric.
Direct ingestion rate	0.052 g/h	The effective transfer rate from NUREG/CR-5512 building renovation scenario for ingestion of loose dust to the hands and mouth during building renovation (Wernig et al. 1999)(Ref 11).
Air release fraction	0.07	Most likely value from the parameter distribution (Yu et al. 2003)(Ref 9).
Source erosion rate	4.1E-4 cm/d	It is assumed that the total source thickness of 15 cm can be removed in 100 years of building life (Yu et al. 2003) (Ref 9).
Deposition velocity	0.01 m/s	RESRAD-BUILD default (Yu et al. 2003) (Ref 9).
Resuspension rate	5E-7 s-1	RESRAD-BUILD default (Yu et al. 2003) (Ref 9).
Time fraction	1	Exposed individual spends 100% of their time at the receptor location.
Source geometry	------	Volumetric disc source, 15 cm thick, with area equal to room floor area. Receptor positioned 1 meter above center of source.

APPENDIX C

BASIS FOR COST ESTIMATE

APPENDIX C
BASIS OF ESTIMATE
COST ANALYSIS OF ADDITIONAL REMEDIATION
FOR ALARA EVALUATION

Scope Expansion:

Scope of Work:
The scope of this WBS element is to perform the remediation of volumetric contamination in T Building survey units 1S10,1C07, 1C08, 1C09, 1C10, 1C11, 1C12, 21,1C15 and SYS02A, B, and C. The specific work tasks to be performed resulting in further decontamination and radiological source removal includes:

- Project and Cost Management including cost and schedule reporting, accounting, payroll, procurement, and financial management.
- Work Planning – This consists of the development of a work scope document using ISM principles outlining the contamination, the safety hazards or personal protective equipment (PPE) requirements, and the necessary work permits required for completing the work scope.
- Provide Work Package Over Sight and Support – This consists of reviewing existing characterization data, performing safety over sight, performing work supervision, performing supplemental characterization to support the removal of the contaminated items or if minimal contamination is present support leaving the item in place and demolishing with the building and performing final characterization after the contamination is removed from the area.
- Work Execution – This consists of the removal of volumetric contamination in the specified rooms. In some areas this could be as simple as acid etching the surface. In other areas such as the rooms 1C07, 1C08, 1C09, 1C10, 1C11, 1C12, 21,1C15, it is anticipated that mini excavators will be required to mechanically break up and remove the concrete. Debris will be characterized, placed in hoppers and brought to the sea land waste container for shipment.
- Waste characterization, packaging in sea land containers and shipment to Envirocare.
- Project Closeout – This consists of preparing a brief report for the file, confirming the project scope was performed and achieving safe shutdown for the work package.

Estimate Assumptions

- Contamination levels are not grossly under or over estimated.
- Total Project duration is 15 months based on rate critical path to remove concrete.
- Infrastructure costs: Rent, Utilities, Taxes, Rent and Insurance costs are based on prior estimates.
- Equipment Rental includes two mini excavators, one fork truck, and one front loader w/ scale.

- Materials are respirators, coveralls, gloves, shoe covers, tape, floor covering, hoppers, hand tools, similar to T Building Project costs during 2005 for CH2MHill Project Material cost under WBS1040F.
- Waste Containers are sea-land containers shipped via truck as LLW to Envirocare at 2/week
- Lab Fees are for isotopic analysis, waste characterization, and verification sampling.
- Total waste volume: 20,300 cu.ft.
- Disposal Rate is $14.00 per cu. ft.
- Average sea-land can be loaded to an average volume of 800 cu. ft.
- Estimate 20 core samples for verification in each remediation area.

Cost/Schedule assumptions for the Basis of Estimate:

- There will be no changes to the receiver site waste acceptance criteria.
- Stakeholders will meet scheduled commitments for review and comment cycles.

Basis of Estimate

- Estimates for remediation are based on previous experience at Mound. In some cases, the cost estimate for similar IDIQ work (OU-1) at Mound was used to estimate overhead costs. Where practical, historical information from prior remediation in T Building remediation was applied.
- Work crew sizes and support crews were based on previous experience in T Building floor remediation.
- For project materials, rental equipment, waste containers, and shipping and disposal costs data from previous work performed in FY2005 was utilized.
- Significant metrics used in the baseline cost estimate are as follows:
    - Sea Land Containers – Cubic Feet
    - Concrete – Cubic Feet

Transportation and disposal costs for waste are based on actual MCP costs.

STAFFING PROFILE AND LABOR COST

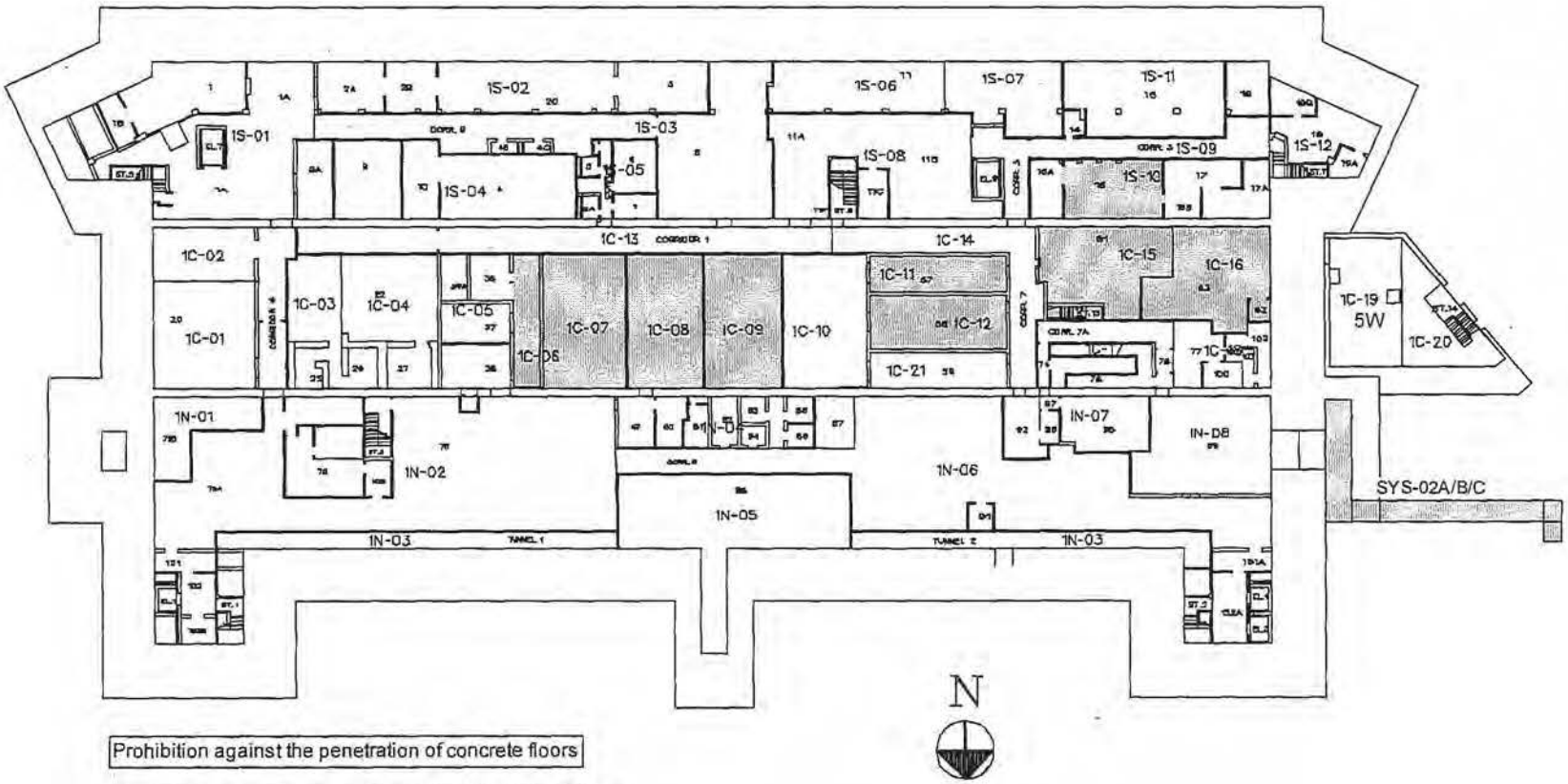
			MONTH														
	Job Type	Project	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Administration	CLER	AD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	CLER	AD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	CLER	AD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	COOR	AD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MGMT	AD	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Total AD	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
T48-57 Work Area	RADD	T	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	DMC1	T	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	DTEC	T	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
T61-63 Work Area	RADD	T			2	2	2	2									
	DMC1	T			2	2	2	2									
	DTEC	T			2	2	2	2									
T16 Work Area	RADD	T							2	2	2	2					
	DMC1	T							2	2	2	2					
	DTEC	T							2	2	2	2					
T99-HDHouse Work Area	RADD	T											2	2	2	2	
	DMC1	T											2	2	2	2	
	DTEC	T											2	2	2	2	
All Areas	HEAV	T	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	SUPR	ES	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MGMT	T	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	PMAN	T	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Total T	15	15	21	21	21	21	21	21	21	21	21	21	21	21	15
Waste Management	TECG	WM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	TECG	WM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	RADD	WM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	COOR	WM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Total WM	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total by Job Class	RADD	total	3	3	5	5	5	5	5	5	5	5	5	5	5	5	3
	DMC1	total	4	4	6	6	6	6	6	6	6	6	6	6	6	6	4
	DTEC	total	4	4	6	6	6	6	6	6	6	6	6	6	6	6	4
	HEAV	total	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	SUPR	total	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MGMT	total	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	PMAN	total	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	TECG	total	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	COOR	total	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	CLER	total	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		TOTAL	24	24	30	30	30	30	30	30	30	30	30	30	30	30	24

COST ESTIMATE FOR T BUILDING REMEDIATION

	MONTH															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL
Labor, Fringe, OTP[RG11]	$244,086	$244,086	$194,675	$244,086	$244,086	$194,675	$244,086	$244,086	$194,675	$244,086	$244,086	$194,675	$244,086	$244,086	$194,675	$3,414,239
Taxes and Insurance	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$375,000
Utilities	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$75,000
Infrastructure Costs	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$375,000
Subtotal Fixed Cost																$0
																$0
Supplies and Project Materials	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$52,000	$780,000
Rent	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$120,500	$1,807,500
Equipment Rental	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500	$112,500
Travel Training and Freight																$0
Sampling and Lab Fees	$22,000	$22,000	$22,000	$22,000	$22,000	$22,000	$22,000	$22,000	$22,000	$22,000	$22,000	$22,000	$66,000	$66,000	$22,000	$418,000
Waste Transportation & Disposal (Envirocare)	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$44,800	$672,000
Waste Containers	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$16,000	$240,000
Subtotal Variable Cost																
Total	$561,886	$561,886	$512,475	$561,886	$561,886	$512,475	$561,886	$561,886	$512,475	$561,886	$561,886	$512,475	$605,886	$605,886	$512,475	**$8,269,239**

FIGURE 1

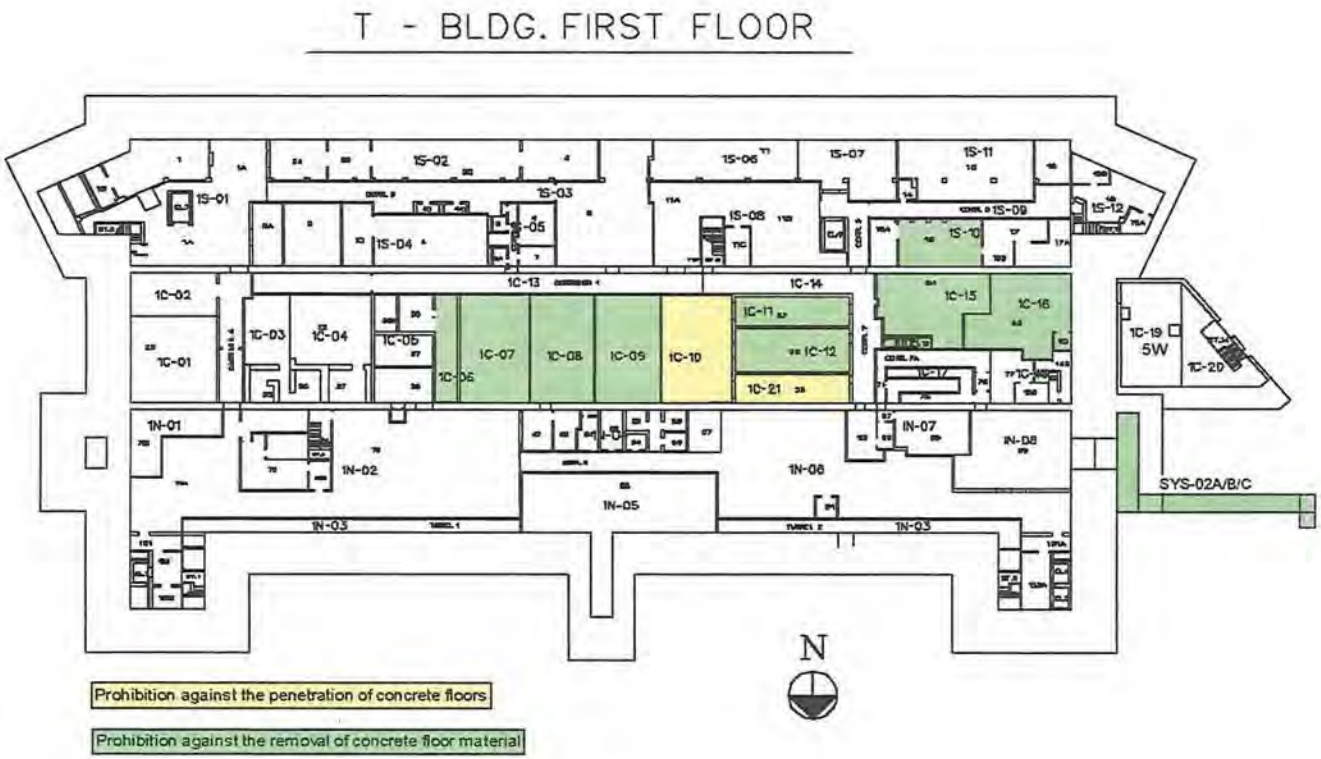
T - BLDG. FIRST FLOOR



Prohibition against the penetration of concrete floors

Prohibition against the removal of concrete floor material

This colored version of the 'T Building Restricted Areas' was added to this document to illuminate which areas in T Building are prohibited against penetration, and which areas are prohibited against removal of the concrete floor.



~~Figure 6~~ - T Building Restricted Areas

Figure 1

References

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7: NFPA 101 – Life Safety Code, 2000 http://web.jjay.cuny.edu/~tflan/documents/101docs/FIS101OccupancytypesandExits.pdf

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10: Beyeler, W.E., et al., 1999, *Residual Radioactive Contamination from Decommissioning Parameter Analysis*, NUREG/CR-5512, Vol. 3, Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Washington, D.C., October 1999

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