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Screening Assessment of Potential Off-Site Doses from Demolition of Building 4055

Technical screening assessment | 3 November 2026

Status: Illustrative inhalation-dose sensitivity analysis, not a site-specific prediction, measured exposure, regulatory compliance determination, or verified upper bound.

Executive summary

Rockwell's final radiation survey and an NRC-sponsored ORAU confirmatory survey documented generally low residual accessible alpha activity after localized cleanup. This assessment reconstructs an illustrative Building 4055 inventory from survey-group averages and estimated surface areas, then calculates potential off-site committed effective doses from inhalation of airborne Pu-239. All gross-alpha activity is provisionally attributed to Pu-239; 1% and 100% airborne release cases are examined. These are assumptions, not measurements [1–5].

Atmospheric dispersion is modeled using published Briggs open-country coefficients for neutral (D) and stable (F) atmospheric conditions [9–11]. Both cases are shown to illustrate sensitivity to atmospheric stability; neither class is established as representative of SSFL demolition weather.

1. Primary evidence and independent confirmation

Evidence	Findings / qualifications
Rockwell final survey [1,2]	Mean total alpha: unposted 2.6 dpm/100 cm² (141 readings); glovebox room 7.1 (202); other posted 5.7 (201). Mean removable alpha: 0.3, 0.5, 0.4, respectively. A 10,465 dpm/100 cm² hotspot was cleaned to nondetectable.
ORAU confirmatory survey [3]	Localized Room 127 alpha measurement initially 390 dpm/100 cm²; cleanup reduced removable activity to below a 3 dpm/100 cm² minimum detectable activity. Selected paint samples showed Pu-239/240 approximately 1–2 dpm/100 cm².
EPA/Tetra Tech (2002) [4,5]	Maximum reported accessible total alpha for T-055: 15.75 dpm/100 cm²; removable results below criteria. Paint/coatings limit inference about buried or covered activity.

The independent survey supports the overall localized-contamination pattern but does not reproduce Rockwell's numerical means, since survey designs and measurement locations differed.

2. Estimated building surface area

Sapere describes a roughly 200 × 60 × 16 ft building [6]. The 5,000 m² nominal surface area is a geometric approximation, not a measured contaminated surface area.

Surface	Estimated area	Basis
Floor	1,115 m²	Plan footprint
Roof/ceiling	1,115 m²	Plan footprint
Exterior walls, both faces	1,545 m²	Perimeter × height × 2
Interior partitions, both faces	900 m²	150 m partition length × 3 m × 2
Structural / other	325 m²	Unmeasured allowance
Total	5,000 m²	Rounded estimate

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3. Area-weighted source-term reconstruction

The measurement-count weighted Rockwell mean is (141 × 2.6 + 202 × 7.1 + 201 × 5.7)/544 = 5.42 dpm/100 cm²; this is not an area-weighted mean. For screening, assume 50% unposted/exterior-equivalent, 20% glovebox, and 30% other posted area. These allocations are not measured [1,6].

Survey category	Area	Mean alpha	Activity
Unposted / exterior-equivalent	2,500 m²	2.6 dpm/100 cm²	0.293 µCi
Glovebox	1,000 m²	7.1 dpm/100 cm²	0.320 µCi
Other posted	1,500 m²	5.7 dpm/100 cm²	0.385 µCi
Total	5,000 m²	4.43 dpm/100 cm²	0.998 µCi

Area-weighted mean = (2,500 × 2.6 + 1,000 × 7.1 + 1,500 × 5.7)/5,000 = 4.43 dpm/100 cm². Inventory = 4.43 × 500,000/60 = 36,917 Bq ≈ 0.998 µCi. The EPA maximum-everywhere comparison is 15.75 dpm/100 cm² over the entire 5,000 m², equivalent to about 3.55 µCi. Applying the unposted mean to exterior surfaces may overstate their process-related activity, but actual exterior activity was not established.

4. Source and release scenarios

Scenario	Mean gross alpha	Pu fraction	Respirable release
Area-weighted screening	4.43 dpm/100 cm²	100% assumed	1%
Maximum-everywhere screening	15.75 dpm/100 cm²	100% assumed	1%
Area-weighted extreme release	4.43 dpm/100 cm²	100% assumed	100%
Maximum-everywhere extreme release	15.75 dpm/100 cm²	100% assumed	100%

The 1% release fraction is illustrative, not a measured demolition fraction or an EPA default for Pu-contaminated painted concrete. EPA AP-42 provides general construction-dust methods but does not validate this fraction [8]. The 100% release cases are deliberately extreme source-term sensitivity tests, not verified physical upper bounds.

5. Atmospheric dispersion method and technical basis

A continuous ground-level, centerline Gaussian plume with ground reflection is used solely for screening. Each community is assumed independently to lie directly downwind for the full release. Wind speed u = 2 m/s, adult breathing rate = 0.833 m³/h (20 m³/day), Pu-239 Type M inhalation dose coefficient = 5.0 mrem/Bq, and an 8-hour uniform release are assumed. The 5.0 mrem/Bq coefficient is conditional on the specified Type M aerosol and dosimetric assumptions; other aerosol types and particle sizes can produce different coefficients.

The plume model is $C = Q/(\pi u \sigma_y \sigma_z)$, where C is air activity concentration (Bq/m³), Q is source rate (Bq/s), and σ_y and σ_z are crosswind and vertical plume standard deviations (m). For downwind distance x in meters, published Briggs open-country expressions are [9–11]:

Class D (neutral): $\sigma_y = 0.08x(1 + 0.0001x)^{-1/2}$; $\sigma_z = 0.06x(1 + 0.0015x)^{-1/2}$.

Class F (stable): $\sigma_y = 0.04x(1 + 0.0001x)^{-1/2}$; $\sigma_z = 0.016x(1 + 0.0003x)^{-1}$.

These empirical coefficients are derived from dispersion studies and are tabulated by EPA, DOE and PNNL [9–11]. The Class F vertical expression has a first-power denominator (no square root); the Class F horizontal expression has a square-root denominator. Open-country conditions are a transparent reference case, not a finding that the SSFL-to-community terrain behaves as flat rural terrain.

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6. Worked West Hills calculation (7 km)

Release duration and interpretation. Eight hours is used solely as a computational convenience to calculate a constant emission rate. Actual demolition, debris handling, ground storage, and containerization may extend over days or longer. For a fixed total airborne activity released, constant wind direction and speed, atmospheric stability, plume geometry, receptor location, and breathing rate, the integrated inhalation dose is independent of the assumed uniform release duration: doubling the duration halves the emission rate but doubles the exposure time. In reality, these conditions vary over longer periods; this simplified model does not predict the effects of such changes.

Step 1 — Inventory and emission rate. The area-weighted inventory is 0.998 µCi, or approximately 36,917 Bq (1 µCi = 37,000 Bq). At 1% respirable release, airborne activity is 369.17 Bq. For an eight-hour release:

$$Q = 369.17\ \text{Bq} / (8 \times 3{,}600\ \text{s}) = 0.01282\ \text{Bq/s}.$$

Step 2 — Plume spreading. At x = 7,000 m, substitute the distance in meters into the published Briggs Class D and Class F equations. Here x denotes distance, while × denotes multiplication.

Class D: $\sigma_y = 429.5$ m; $\sigma_z = 123.9$ m.

Step 3 — Air concentration, Class D. $C = Q/(\pi u \sigma_y \sigma_z) = 0.01282/(\pi \times 2 \times 429.5 \times 123.9) = 0.000000038$ Bq/m³.

Step 4 — Inhaled activity, Class D. $I = C \times (0.833\ \text{m}^3/\text{h}) \times (8\ \text{h}) = 0.000000256$ Bq.

Step 5 — Committed effective dose, Class D. $D = I \times (5.0\ \text{mrem/Bq}) = 0.000001278$ mrem.

Class F: $\sigma_y = 214.8$ m; $\sigma_z = 36.1$ m.

Step 3 — Air concentration, Class F. $C = Q/(\pi u \sigma_y \sigma_z) = 0.01282/(\pi \times 2 \times 214.8 \times 36.1) = 0.000000263$ Bq/m³.

Step 4 — Inhaled activity, Class F. $I = C \times (0.833\ \text{m}^3/\text{h}) \times (8\ \text{h}) = 0.000001752$ Bq.

Step 5 — Committed effective dose, Class F. $D = I \times (5.0\ \text{mrem/Bq}) = 0.000008761$ mrem.

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7. Potential off-site inhalation doses

Distances are approximate radial screening distances: West Hills 7 km, Woodland Hills 12 km, Chatsworth 11 km, Simi Valley 8 km. Values are mrem of committed effective dose, not measured exposure. Each site is independently assigned the plume centerline.

Stability class D (neutral)

Community (km)	Area 1% (mrem)	Area 100% (mrem)	Max 1% (mrem)	Max 100% (mrem)
West Hills (7)	0.0000013	0.00013	0.0000045	0.00045
Woodland Hills (12)	0.00000064	0.000064	0.0000023	0.00023
Chatsworth (11)	0.00000071	0.000071	0.0000025	0.00025
Simi Valley (8)	0.0000011	0.00011	0.0000038	0.00038

Stability class F (stable)

Community (km)	Area 1% (mrem)	Area 100% (mrem)	Max 1% (mrem)	Max 100% (mrem)
West Hills (7)	0.0000088	0.00088	0.000031	0.0031
Woodland Hills (12)	0.0000050	0.00050	0.000018	0.0018
Chatsworth (11)	0.0000055	0.00055	0.000019	0.0019
Simi Valley (8)	0.0000076	0.00076	0.000027	0.0027

All values are in mrem. “Area” denotes the 4.43 dpm/100 cm² area-weighted source; “Max” denotes 15.75 dpm/100 cm² on every surface. All columns assume 100% of gross alpha is Pu-239. At fixed meteorology, 100% release is 100 times the 1% dose. Stable F predictions exceed neutral D predictions here because modeled dispersion is narrower.

8. Repainting, embedded activity and interpretation

Alpha particles have short ranges in solids, and coatings can attenuate detectable surface alpha; swipes measure accessible removable activity. Thus accessible-surface measurements do not establish the absence of covered contamination. Conversely, pre-cleanup hotspot values should not be equated with residual activity after remediation [1–5]. The substrate and repainting history at the EPA maximum location (Room 127, grid W29) are not established by the summary evidence.

These estimates exclude site-specific meteorological frequencies, changing wind direction, topographic channeling, elevated terrain, building wakes, particle-size distributions, deposition, resuspension, rainfall, staged demolition, soil/subsurface sources, and non-inhalation pathways. The 8-hour uniform duration cancels algebraically from integrated dose only under the fixed-wind, fixed-stability, constant-centerline assumptions. Real multi-day operations require time-resolved modeling. Stable F is a sensitivity case, not a credible claim of continuous F conditions for eight hours.

Conclusion: The screening inhalation doses are small under the selected assumptions, but no value here establishes actual community exposure or a defensible maximum dose. A site-specific evaluation should use representative hourly meteorology, terrain and building inputs, and a suitable regulatory dispersion model (e.g., AERMOD), together with a defensible radionuclide inventory and emission characterization [12].

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