

### **5.2.3 Soil Monitoring**

The permit application must address sampling of surface and subsurface soils in, and around, the Subpart X unit, specifically OB/OD unit(s). The soil sampling program must, at a minimum, address sampling frequency, location, quantity, and the

elements identified in 40 CFR §§ 264.601(a)(1), 264.601(a)(7), 264.601(b)(2), 264.601(b)(8), 270.23 (b) and 270.23 (e). Sampling frequency must be sufficient to determine whether the OB/OD operation is having an impact on the surrounding soils. The sample(s) must be collected from the area impacted by the operation; the number of samples must be statistically significant for the area of impact. Surface soil sampling locations should include coverage of the following areas based on the potential for contamination:

1. Treatment source zone (e.g., pit/crater areas for OD, ground-based burn area for OB, as applicable, or within 1-3 m of burn pans)
2. Ejecta zone (to be determined on a site-specific basis)
3. Remainder of OB/OD unit, including any drainage pathways
4. Prevailing downwind location areas associated with maximum predicted gravitational settling/deposition potential (as practical)
5. Natural background

For open burning treatment, the area of impact (distance from center of treatment) may extend as far as 1,800 feet, based on the burning of 10,000 pounds of reactive wastes. In situations where the facility treats explosive hazardous waste, by open burning, in volumes greater than 10,000 pounds, the applicant will be required to present a minimum safe setback distance in the application. The applicant must provide justification for the proposed safe setback distance. For open detonation treatment, the area of impact may extend as far as, but not farther than, the minimum safe distance specified in Section 5.2.2.4 (page 35) of [Approaches for the Remediation of Federal Facility Sites Contaminated with Explosive or Radioactive Wastes](#), (EPA, 1993a). For non-fragmenting explosive material, the minimum distance is either 1,250 feet or the explosive's actual maximum debris and fragment range. For fragment-producing materials, the

minimum distance is 2,500 feet. For bombs and projectiles with a caliber greater than 5 inches, the minimum distance is 4,000 feet. The minimum distance can be calculated using the empirical formula:

$$D=300 \times (NEW)^{1/2}$$

Where D is the minimum distance and NEW is the net explosive weight of the munitions in pounds. If the facility believes that its area of impact is different, justification must be provided in the permit application.

The sample collection procedure, number of samples within each of these areas, and statistical analysis approach should be based on standard EPA guidance (e.g., SW-846). The heterogeneity of explosives in soils is frequently observed in duplicate sample analytical results which differ by more than an order of magnitude. Based on surface soil sampling tests for energetics conducted by the U.S. Army at several OB/OD units and military ranges, the following recommendations were made to improve site characterization of soils.

- Increase the number of samples
- Collecting composite samples
- Use of a stratified sampling design
- Reduce within-sample heterogeneity by either homogenization and extraction or analysis of a larger sample.

Discrete surface soil samples for energetics (even those used to obtain a composite sample) should be collected from a small area (i.e., within a 4-ft diameter). In general, the number of subsurface soil sampling locations can be limited to those needed to characterize natural background and those surface soil sampling locations that exceed screening or risk-based criteria. However, a minimum of two to three soil borings within the OB/OD unit (at least one

within the source treatment zone) should be obtained. Subsurface soils sampling depths should include the following (at a minimum):

- Every 1 ft from the surface to a depth of 4 ft
- Every 4 ft from a depth of 4 ft to 16 ft
- Every 8 ft beyond 16 ft

The maximum subsurface soil sampling depth required is the depth of the uppermost aquifer or bedrock (whichever occurs first).