Wet Vacuum-Based Sampling of *Bacillus* spores on Selected Indoor and Outdoor Surfaces

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**Introduction**

A release of hazardous biological material in an urban area would require sampling for characterization and post decontamination using various methods depending on the surface types. Individual methods are material dependent for application and limited for sampling area (1 – 4 ft² per sample). This study evaluated commercial wet vacuums as a sampling tool and this method is widely available, applicable on various surfaces, and easy to operate.

**Technical Approach**

**Phase I: Evaluation of Wet Vacuum Cleaner Operational Parameters**

The tested parameters are:

- **Sampling Liquid Type**
  - deionized (DI) water
  - phosphate-buffered saline with Tween® 20 (PBST)
  - DI water with Tween® 20 at 0.05% concentration

- **Contact Time**
  - 1 sec where the liquid was pulled immediately following spraying
  - 30, 100, and 300 sec.

- **Liquid Volume**
  - Effect of liquid volume applied for sampling on spore recovery at a constant elapsed time.

**Phase II: Commercially-Available Wet Vacuum Cleaner Evaluation**

As part of Phase II tests, various commercial wet vacuums were evaluated for their effectiveness on spore surface sampling on realistic conditions using the results of Phase I.

**Testing and Sampling Approach**

For both Phase I and Phase II tests, aerosol deposited *Bacillus* spores (10⁶–10⁷) were used on surface coupons. The sampling efficiencies of the selected wet vacuums were compared to the recoveries obtained by currently-used surface sampling methods.

**Test Results**

**Phase I Summary**

1. DI water-Tween liquid solution achieved the highest recovery among the tested liquid types. (Figure 7).
2. Concrete surface tests showed a marked effect of elapsed time on the spore recovery effectiveness. Concrete surfaces need to be vacuumed as soon as the liquid is applied.

**Phase II Summary**

Recoveries (%) for the wet vacuums (independent of material type and surrogate type), varied between 32 ± 20% for the portable, 25 ± 26% for Shop-Vac, 33 ± 17% for the residential, and 55 ± 52% for the commercial vacuum.

The overall results show that sampling via wet vacuum is a viable sampling methods. All wet vacuum cleaner spore recoveries were within an order of magnitude of the material-specific sampling methods (PRB wipe, vacuum sock, and 37 mm cassette).