How Long Do Bacteria Survive in Indoor Sewage Spills?

emlab.com/resources/education/ask-dr-burge/how-long-do-bacteria-survive-in-indoor-sewage-spills

By Dr. Harriet Burge

This is a good question that, currently, does not have an answer. Virtually all of the research on the survival of these bacteria has focused on water, soil, manure, and sewage sludge. On the other hand, the indoor environmental investigator needs to know how long the bacteria survive as a sewage spill or flood dries, and how to document that the environment has been sufficiently cleaned.

Bacterial decay (death) rates are generally measured in log reductions in culturable organisms. Note that there may be viable organisms remaining that are not culturable but could indicate a continuing risk of exposure. A logarithmic decline in a bacterial population means that a large percentage of the bacteria die quickly, and the rate of death slows as time passes.

A quick survey of the literature revealed the following estimates of survival time for some important bacteria:

Organism	Substrate	Survival Time
E. coli	Water	> 100 days
Enterococcus	Dry Surfaces	> 24 hours
Staphylococcus aureus	Hospital dry surface	> 9-11 days
E. coli	Lettuce	> 25 days
E. coli	Soil	> 60 days
E. coli H37	Soil	> 15 weeks

The fact that all of these times are indicated with "greater than" means that residual organisms were present at the end of each of these experiments. To clarify what logarithmic decay means, let's assume you have a sewage spill with 1,000,000 bacteria/100ml and a decay rate of 1 log/day. (This is an artificially high rate for convenience). After one day you will have 100,000 bacteria/100ml, and it will take 5 additional days to reach 1 bacterium/100ml. For a small spill (e.g., 30 liters), you will have a total of 30,000,000 total bacteria after one day, and 3,000 at day five.

This assumes, of course, that the rate of decay remains constant over the time of measurement and you don't do anything to artificially reduce the population. In the case of indoor sewage spills, the natural decay rate would tend to increase because of the reduction in the amount of liquid remaining (as it evaporates), and because the air and surface temperature to which the spilled sewage is exposed is likely to be higher than that in the original source. Both increasing temperature and drying tend to increase the decay rate.

Let's say that the decay rate in the spilled sewage increases gradually over 24 hours to 2 logs/day. Thus, by the end of the second day in the example above you will have 1000 bacteria/100ml, and by day 3 you may be down to less than 10 bacteria/100ml. Of course these changes are dependent in part on ambient relative humidity and both ambient and surface temperatures.

Now, let's assume you are on-site within 1 hour after the spill. You are faced with slightly less than 300,000,000 bacteria. You get right to work removing the water and the solids and are able to effect a 99.9% reduction by the end of the day. You have removed 3 logs of bacteria and are now down to about 30,000 bacteria assuming natural decay continued.

The good news is, if you used detergent and bleach (1/2 c/gallon of water), you have killed at least 3 logs more, bring you down to 30 bacteria, which in my opinion is an acceptable number. Unfortunately, these 30 bacteria will not be grouped in one little spot so that you can collect them and "prove" that only 30 are left. Depending on the size of the area affected, you would have to take many samples to document efficacy. I don't think the effort and cost is worth it.

Documentation on how to clean sewage spills indoors is available in many places. The procedure explained at KingCounty.gov is good, although I would use a more concentrated bleach solution. Another good procedure can be found at Washington State Department of Health's "Cleaning up a sewage spill."

An important thing to remember is that once the spill has happened, the bacteria are not confined to the actual wet places. They could also be on higher surfaces. It is important to clean all surfaces that might be touched by the occupants in the near future.

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