Just how small is a spore?

A visualization of spacecraft contamination
An endospore (spore) is a resting state some bacteria enter when conditions get tough.
Planetary protection requirements limit microbial contamination to less than 300 spores per square meter on a spacecraft surface.

That’s an incredibly small number, and almost impossible to visualize.
Spores are tiny – barely 1 micron across. That’s one millionth of a meter: $10^{-6}$ m.

For comparison, a poppy seed is 1mm across, a thousand times bigger!

What if we scale a spore up to the size of a poppyseed?
300 spores per square meter. Here’s a square meter.

If a spore is magnified to the size of a poppyseed, we need to magnify the area – one square meter - $1m^2$ by the same amount.

A poppy seed is 1000x the diameter of a spore, but in cross-section, that’s $(1000)^2 = 10^6 \times$ the area.

That’s a million square meters, or 1 square kilometer!
So 300 spores/m² scales to 300 poppy seeds/10⁶ m²

Central Park is 4km x 0.8km
Let’s change the area into something more familiar (unless you live in Manhattan): a soccer field.

The MLS San Jose Quake’s field size of 105m x 68m = 7140 m\(^2\) in area. How many soccer fields in 1 km\(^2\)?

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\frac{1,000,000}{7140} = 140 \text{ soccer fields} \quad \frac{300 \text{ poppyseeds}}{140 \text{ fields}} = 2.1 \text{ per field}
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So 300 poppyseeds spread over 140 football fields means two seeds per field!
Perseverance rover depositing sample cannisters for their eventual return to Earth. A maximum contamination of 300 spores/m², or $3 \times 10^5$ spores over the entire rover, ensures that the samples contain markers for life from Mars, and not from Percy’s planet of origin.