How large is a peta of table salt grains?

You have to make assumptions to do this calculation. Here are mine.

1. Morton salt says that there are 16,000,000 grains of salt in a 26 oz can.
2. I assume that the salt fills the whole can completely and the walls of can are negligibly thin--meaning I treat the can like it is 100% salt ignoring that fact the cardboard of the walls takes up some of that space.
3. I assume that an Olympic swimming pool has 2500 cubic meters of volume.

Scientists from different research groups try to reproduce each other's results, but they do so by trying to find any error in the published work and correct it with better methods in a new publication. What assumptions may I have made that contribute to error here? How could you make them better? I invite you to publish your better assumptions and methods via email paretekoonst@ornl.gov !

Here are the calculations I did for the slide.

How many cans of salt to get 1e15 grains?

1 peta = 1,000,000,000,000,000 or 1e15 which is a short way to say 1 followed by 15 zeros.

16E6 grains /can (16 followed by 6 zeros)

Number of cans = 1e15/16e6 grains per can =62,500,000 cans or 62.5E6 cans.

What about my statement that you could fit that much salt in 20 Olympic swimming pools?

Remember that I assume that the volume of an Olympic swimming pool is 2500 cubic meters.

What is the volume of a can of salt? I measured the outside of the can and used geometry. The volume of a cylinder is $\mathbf{\Pi \times r^2 \times h}$ (pi times the radius of the circle of the top of the can squared, times the height of the can.)

The diameter of the circle that makes the top of the can is 8.5 cm, so the radius is 4.25 cm.

The height of the can is 14 cm.
I will use 3.14159 for pi.

The volume of the salt can is 3.14159 ×4.25 cm×4.25cm×14cm =794.4 cubic cm.

But wait! I need cubic meters to compare this with a pool! So I will divide by 100 cm/meter 3 times (one for each dimension).

794.4 cm^3 /$(100cm)^3$ =0.00079 cubic meters.

How many cans per pool?

2500 m^3 per pool/0.00079 m^3 =3132155.2 cans

How much salt is that?

3132155.2 cans per pool * 16E6 grains per can = 5.011E13 grains per pool.

So how many pools of salt to get a peta?

1e15 per peta/5.011E13 grains per pool. = 19.95 pools.

What assumptions have I made that could cause error? Could this have been done a different way? What information on the can label would allow me to do this calculation without finding the volume of the can?

Note: In real science we quantify our error, which means that I would give you the number of pools with a calculated measure of the probable error. For example, 20 swimming pools ± 0.5 pools. I have not done that for this calculation. How would you estimate the error in each part of this calculation?