If you’ve ever seen movies about World War I, you know that the soldiers in the trenches often wore bulbous gas masks that made them look like human insects. The masks were necessary to protect them from chemical weapons such as chlorine gas, a noxious substance that could almost instantly suffocate unprotected victims.

**Pool Pests**

If chlorine is so dangerous, why the do we dump it in swimming pools?

As you probably already know, chlorine is used to [disinfect swimming pools](http://indianapublicmedia.org/amomentofscience/swimming-with-germs/). It also gives most pools their distinctive odor. Chlorine comes in pellet, liquid, and gas forms, and when it reacts with pool water it immediately breaks down into different chemicals, including hypochlorous acid and hypochlorite ion. Both chemicals attack microorganisms in the water by breaking through their cell walls and scrambling the inner workings of the cells, rendering them harmless.

**Parts Per Million**

So why don’t these killer chemicals destroy human cells as well? They would, if not for the very small amounts of chlorine needed to cleanse the typical pool. For example, the concentration of chlorine used to sanitize an Olympic-size pool is three parts per million, meaning that for every three molecules of chlorine there are one million water molecules. Such low concentrations may cause slight irritation to the eyes and skin, but there’s not enough chlorine to cause any real harm to swimmers.

Chlorine is not the only chemical used to keep pools clean—bromine and ozone are becoming increasingly popular in pool maintenance facilities. But chlorine is still the pool cleaner’s mainstay.

如果你曾经看过关于第一次世界大战的电影，你就知道战壕里的士兵经常戴着球状的防毒面具，使它们看起来像人类的昆虫。面具是保护他们免受氯气这样的化学武器所必需的，氯气是一种几乎可以立即窒息未受保护的受害者的有毒物质。

### 池害虫

如果氯是如此危险，为什么我们将它倾倒在游泳池？

您可能已经知道，氯被用来[消毒游泳池](http://indianapublicmedia.org/amomentofscience/swimming-with-germs/)。它还为大多数泳池提供了独特的气味。氯以颗粒，液体和气体形式存在，当它与池水反应时，它会立即分解成不同的化学物质，包括次氯酸和次氯酸根离子。这两种化学物质通过破坏细胞壁并扰乱细胞的内部运作来攻击水中的微生物，使它们无害。

### 百万分之一

那么为什么这些杀手化学物质也不会破坏人体细胞呢？如果不是为了清洗典型的水池所需的极少量的氯，他们会。例如，用于消毒奥林匹克规模池的氯浓度为百万分之三，这意味着每三个氯分子就有一百万个水分子。如此低的浓度可能会对眼睛和皮肤造成轻微的刺激，但是没有足够的氯气对游泳者造成任何真正的伤害。

氯不是唯一用于保持游泳池清洁的化学品 - 溴和臭氧在游泳池维护设施中越来越受欢迎。但氯仍然是游泳池清洁剂的主要支柱。