

TerranearPMC Safety Share

Week of September 19, 2016 – Pliny the Elder

Those of us that enter into the field of Occupational Safety and Health will inevitably learn about Pliny the Elder. Although his actual birth date was never recorded, it has been calculated, through his death, that he was born in the year 23 AD. Gaius Plinius Secundus (Latin name), was a Roman author, naturalist, and natural philosopher, as well as naval and army commander of the early Roman Empire. His life spanned the reign of five Roman Emperors: Tiberius, Caligula, Claudius, Nero and Vespasian, of whom he was a personal friend.

Pliny the Elder was a scholar spending most of his spare time studying, writing or investigating natural and geographic phenomena in the field. He is credited with writing an encyclopedic work, *Naturalis Historia* (*Natural History*), which became a model for all other encyclopedias.

From an Occupational S&H perspective, Pliny the Elder is credited with creating the concept of a respirator as he described using animal bladder skins to protect workers in Roman mines from red lead oxide dust. As it turns out, the tissue from an animal bladder is porous enough to allow a person to breathe while filtering unwanted particles from entering into the respiratory tract.

While his birth date was not given much importance, his death is marked with the infamous and historical event that occurred on August 24, 79 AD. For that was when Mount Vesuvius erupted, prompting Pliny to get a closer look at the tons of molten ash, pumice and the sulfuric gases of sulfur dioxide (SO₂) and hydrogen sulfide (H₂S) spewing into the Bay of Naples. These same materials engulfed the surrounding landscape, suffocating all the people (residents and visitors alike) that were in the Roman resort cities of Pompeii, Herculaneum and Stabiae. Tons of falling debris filled the streets until nothing remained to be seen of the once thriving communities.

Pompeii remained mostly untouched until 1748, when a group of explorers looking for ancient artifacts arrived in Campania and began to dig. They found that the ashes had acted as a very effective preservative, as underneath all the debris, Pompeii was almost exactly as it had been 2,000 years before. Its buildings were intact. Skeletons were frozen right where people had fallen. Everyday objects and household goods littered the streets. Later archaeologists even uncovered jars of preserved fruit and loaves of bread. These excavations continue today and provide insight into life during the Roman Empire.

Pliny the Elder's death was recorded by his nephew, Pliny the Younger, who, in a letter to a friend described the event.

My uncle's scholarly acumen saw at once that it was important enough for a closer inspection, and he ordered a boat to be made ready, telling me I could come with him if I wished. I replied that I preferred to go on with my studies, and as it happened he had himself given me some writing to do.

Pliny the Younger concludes his narrative:

When daylight returned on the 26th - two days after the last day he had been seen - his body was found intact and uninjured, still fully clothed and looking more like sleep than death.



TerranearPMC Safety Share

Would have Pliny's (the Elder) respirator saved his life from the poisonous gases he faced that day in Pompeii? Today, we understand that certain respirators are good for specific scenarios and therefore, a particulate filtering face piece; even one with the very best fit test factor and cartridges of the greatest efficiency, would not have helped the inquisitive master. As a rule-of-thumb, dust particles range in diameter from 1 – 100 micrometers (aka microns). Such particles include mists, mold, smoke, fumes and bacteria (such as tuberculosis). Therefore, it is quite conceivable that such materials would be filtered, and therefore, a respirator made from animal bladder placed over the mouth (assuming this bladder would remain securely on the wearer's face) could conceivably be effective: that is, to a point. However, eyes would still be unprotected (face shields, safety glasses and goggles still had a long way to go!). When we consider gases, we are referring to materials with an aerodynamic diameter of less than 0.001 microns. As such, a simple filter that removes material via mechanical processes would not offer the necessary protection for which Pliny needed. In the case of SO₂, a material such as sodium carbonate (or other agent that neutralizes or "scrubs" SO₂) would be more suitable. These are the materials used in today's "acid-gas" cartridges. However, even this type of respirator would not be appropriate for Pliny's situation. Since the gas concentrations were very high (definitely "Immediately Dangerous to Life or Health" – IDLH), no filtering respirator would offer the correct protection. Meanwhile, in the same breath (pun intended!) H₂S, due to its lack of warning properties (i.e. odor), again, no filtering face piece would be considered appropriate. Therefore, only a self-contained breathing apparatus (or a supplied air respirator with an escape bottle) would have offered poor Pliny the protection he needed. But alas, living in the first century, there were still many, many generations of scientific achievement necessary for even the concept, let alone the fabrication of a SCBA, to be realized. Nevertheless, Pliny the Elder's creative thinking came up with this original concept of the respirator. And for that, he takes his place among the founders of Occupational Safety and Health.

We can see a number of lessons to be learned from the death of Pliny the Elder. Today, we have the saying, "Curiosity killed the cat." During Pliny's time, the dangers to toxic gases that evolve from volcanos were not well understood, while *Emergency Preparedness*, was not even a concept. The fact is, about 17 years earlier, an earthquake shook the same area (documented by the philosopher Seneca, advisor to the emperor Nero). The Romans were quite interested in predicting the future, and they had many ways to detect what they saw as the approaching wrath of the gods. They were adept, for example, at observing omens and warning signs in the shape of strange sights and sounds, or unusual births. Yet, rather than relocating or establishing evacuation routes, they believed, that because Pompeii withstood the earlier earthquake, Pompeii was favored by the gods as a safe place.

The bottom line to take from the story of Pliny's death and the demise of Pompeii, is that one person alone cannot know all the hazards associated with a particular event or process. Having others review and comment is most important. No matter how much of a subject-matter expert one may be, having another set of eyes check your work can help catch a mistake while recognizing a missed hazard during an initial assessment.

The depth of darkness to which you can descend and still live is an exact measure of the height to which you can aspire to reach.

Pliny the Elder

