

## Altitude

I have a lot of experience with altitude. I spent three years working at approximately 7,775 feet followed by five years at 13,796 feet and three more years at 6,875 feet. Altitude sickness is very real and the effects that it can have on people are diverse. Feeling faint is a common symptom and I have seen people actually faint at altitude.

When I worked in La Palma in the Canary Islands at 7,775 feet, the observatory was significantly above the tree line. The tree line is located at a very definite altitude. Above it, the vegetation significantly changes to low bushy growth of only a couple of feet tall. The trees at the tree line tend to be disfigured and showing stress. This indicates that the biological environment has changed and is biologically harmful to trees. It is likely a solar radiation effect.

The Hawaii observatory was significantly higher at 13,796 feet. It was a barren place with almost no visible life where the observatory was located. Just lots of rocks and cinder! It was far above the tree line. Our blood oxygen levels would be running at 80% of normal up there.

The Arizona observatory at 6,875 feet was below the tree line. However, it appeared to be high enough to cause growth defects in the trees. I remember the trees up there being twisted and disfigured. You could definitely feel the altitude sickness even at this lower elevation.

**Altitude sickness is known to occur in most people above 4,900 feet. Aircraft commonly pressurize their cabins to the air pressure found at 6,900 feet to try and prevent these symptoms from occurring. However, some people still report altitude sickness symptoms at this pressure. They are probably the ones that you see holding the sick bags! Nausea is a feature of altitude sickness.**

There are very definite symptoms that are associated with the different levels of altitude and Wikipedia states:

- *High altitude 1,500 to 3,500 metres (4,900 to 11,500 ft) - The onset of physiological effects of diminished inspiratory oxygen pressure ( $PiO_2$ ) includes decreased exercise performance and increased ventilation (lower arterial  $PCO_2$ ). Minor impairment exists in arterial oxygen transport (arterial oxygen saturation ( $SaO_2$ ) at least 90%), but arterial  $PO_2$  is significantly diminished. Because of the large number of people who ascend rapidly to altitudes between 2,400 and 4,000 m, high-altitude illness is common in this range.*
- *Very high altitude 3,500 to 5,500 metres (11,500 to 18,000 ft) - Maximum  $SaO_2$  falls below 90% as the arterial  $PO_2$  falls below 60mmHg. Extreme hypoxemia may occur during exercise, during sleep, and in the presence of high altitude pulmonary edema or other acute lung conditions. Severe altitude illness occurs most commonly in this range.*
- *Extreme altitude above 5,500 metres (18,000 ft) - Marked hypoxemia, hypocapnia, and alkalosis are characteristic of extreme altitudes. Progressive deterioration of physiologic function eventually outstrips acclimatization. As a result, no permanent human habitation occurs above 6,000m. A period of acclimatization is necessary when ascending to extreme altitude; abrupt ascent without supplemental oxygen for other than brief exposures invites severe altitude sickness.*

The Hawaii observatory was so high that we used to stop and acclimatize at 9,200 feet, before heading to the peak.

I was lucky enough to have two positions in Hawaii. The first position had me commuting from sea level to 13,796 feet on a daily basis. I would feel lethargic, have a headache, and show stomach problems during the day. In the evening, I just wanted to lay down and recover. I changed my position to the night shift and found that it was much more agreeable to

human health. Indeed, it was one of my motivations to move onto the night shift. On nights I would stay on the mountain at 9,200 feet for five nights and commute up to 13,796 feet to work.

**One of the things that I do remember that was distinct about working nights at 13,796 feet were the hallucinations. I saw some strange things on top of that mountain! I knew I was hallucinating and it was manageable feature of my job. I found it absolutely fascinating to see the tricks that the human mind could play on me. It was not often that I would have hallucinations, but it generally would occur on my first night on the mountain where my environmental conditions had been greatly changed. Many people report feeling a “presence” when at high altitudes and I frequently experienced this sensation.**

Common to all three observatories where I worked was that the long term staff appeared to get leg problems. Some of them would have very strange walks. Indeed, it was like being in the Monty Python's sketch of “The Ministry of Silly Walks”! It was as if their joints had gone stiff. They also did not appear to be very healthy. I suspect that it was caused by daily high altitude commuting and the strange environmental conditions that they were working in. This appears to be called “Delayed Radiation Myelopathy” and is well documented in the medical field of nuclear medicine.

I did see two of the long term full time mountain employees die of disease. These disease conditions that they had were preceded by many years of poor health and both had the strange walks that I was observing. I imagine that high altitude commuting increases the risks of illness, disease and premature death.

**This leads me into the purpose of this chapter and that is as you increase in altitude, your environmental conditions significantly change. The higher you go, the greater the change is. There are a wide variety of changes that occur and we will look into these.**

Temperature is the most obvious change. The higher you go, the cooler it gets. In Hawaii, you could be sunbathing in shorts on the beach in the morning and by the afternoon you would be in your winter clothes making snowmen on top of the mountain! The temperature change between sea level and 13,796 feet can be extreme.

Less noticeable is the change in solar radiation levels. The sunlight is stronger and has frequencies of radiation in it that you will never find at sea level. As such, the solar radiation conditions are unnatural to the human. We see the effects of this at the tree line in the stressed trees. The ultraviolet levels increase by approximately 10% to 12% with every increase of 3,281 feet in altitude.

**If you were to take a Geiger counter to altitude, you would notice that there are far more counts per minute (CPM) on it. This is because the closer you get to Space, the higher the radioactivity from Space becomes! The difference between being below 4,900 feet and above 4,900 feet is significant. Cosmic radiation exposures approximately double with every four thousand feet increase in altitude. This is most certainly an issue for frequent air travelers. At 35 degrees north latitude we find the radiation levels at altitude are:**

- **0 Feet = 0.04 micro Sieverts per hour.**
- **10,000 Feet = 0.19 micro Sieverts per hour.**
- **20,000 Feet = 0.99 micro Sieverts per hour.**
- **30,000 Feet = 3.25 micro Sieverts per hour.**
- **40,000 Feet = 6.68 micro Sieverts per hour.**

Nighttime radiation levels are different also. Less atmospheric filtering is taking place and the radiation levels from Space are much higher. You actually see less stars up there, due to the eyes being starved of oxygen. They lose some of their nighttime sensitivity.

Radiation from artificial satellites is greatly increased due to the thinner atmosphere absorbing less artificial radiation. You will be exposed to much higher radio frequencies from the global positioning system (GPS), communication satellites and RADAR mapping satellites. LASER mapping satellites will expose you to higher levels of their radiation. I was a little surprised to find that my cell phone would work at 13,796 feet and it indicates that ground based transmitters are extensively radiating out to Space.

The electrical conductivity of the air is very different. The air at altitude is in a partial vacuum and the density is far less. Nikola Tesla had noted during his research into wireless energy transmission that it was preferable to transmit at altitude due to the better conductivity of air to high electrical frequencies. He states that the conductivity was “*better than copper wire*”. This electrical conductivity of the air increases approximately exponentially with altitude.

The air is also electrically charged, as Wikipedia states: *Atmospheric electricity abounds in the environment; some traces of it are found less than four feet from the surface of the earth, but on attaining greater height it becomes more apparent. The main concept is that the air above the surface of the earth is usually, during fine weather, positively electrified, or at least that it is positive with respect to the Earth's surface, the Earth's surface being relatively negative.*

*The measurements of atmospheric electricity can be seen as measurements of difference of potential between a point of the Earth's surface, and a point somewhere in the air above it. The atmosphere in different regions is often found to be at different local potentials, which differ from that of the ground sometimes even by as much as 3000 Volts within 100 feet (30 m).*

Pressure is less and your body has to work harder to extract oxygen from the thinner air. The body will create extra blood cells and the blood will thicken. Everything in your body will start to expand as the pressure reduces. Your body is constantly working to address these expansion issues. You will need to be drinking plenty of water and electrolytes to enable the body to adapt. The opposite effects occur as you descend to

lower elevations. Pressure changes are well known for their ability to make bones ache.

The humidity can either be extremely low if it is clear or extremely high if you are in the clouds.

**As you can see, the environment at altitude is very different to what it is at sea level. For the purpose of human health, it appears that it is wise to work and live below 4,900 feet. Living and working above this altitude is likely to lead to altitude related health problems occurring. If you do work at altitude then daily commuting to altitude is undesirable and it is far better to stay there until your work is completed. You should probably not stay in a high altitude job for a long period of time and be aware that you are increasing your risks of illness, disease, cancer, and mental health problems in such jobs. Living or working near or above the tree line is not advisable.**

You should only be living and working at altitude if you can trace your genetics to it. People in high cities such as La Paz, Bolivia, at an elevation of 11,942 ft will be genetically adapted to that area. For them, they would be wise to stay at that elevation.

Living at sea level may also be an issue today, particularly in or near to large coastal cities. Much of the pollution that is created by these will stay at sea level. The majority of pollutants are heavier than air and may stay near to the ground as they cool. This can be seen in large cities like Los Angeles as a cloud of pollution hanging over the city. It can also be seen near to erupting volcanoes.

If you live in locations such as these, it is advisable to live at an altitude that puts you above the pollution cloud. The ideal location for human health is not to live in such a polluted area.

***“Because of the high altitude, you get drunk really fast. So everyone's drunk all the time.”***

***Clea Duvall***