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Mount St. Helens Eruption

A part of the Cascade range of the Pacific Northwest, Mount St. Helens is currently active—outgassing sulfur and other volatiles into the air and bodies of water that surround it. Locally, it is known to tribes as "Loowit" or "Louwala-Clough," which means "smoking mountain," reflecting the visuals of gas casually escaping from the many vents dotting the mountain's peak and base. Mount St. Helens is a stratovolcano that formed along the Cascade Range, the result of the Juan de Fuca oceanic plate subducting below the continental North American plate.This type of boundary typically results in tall conical volcanic formations that undergo volatile and gaseous eruptions, producing large ash clouds that can become increasingly violent depending on the magnitude of the eruption. This may lead to—though not always—pyroclastic surges, lahars, debris flows, and electric storms within the ash clouds.

Stratovolcanoes develop their height more readily than their width due to the composition of their magma.They are known to form from silica-rich andesite and rhyolite, which, when melted as magma, stick together due to their high viscosity, building upward. This process can also lead to plugs or “chokes” forming in the neck of the volcano. With enough pressure and input of steam from snow melt, will lead to an even more explosive eruption than previously considered with only pressure and magma value within the chamber factored in. This massive force has been forming on

Earth for an estimated 3,000 years. Before 1980, the volcano had experienced 9 major explosions with relative periods of calm in between each. The periods of calm between explosions caused the human population around Mount St. Helens to become comfortable in its presence. However, on May 18th, 1980, that changed as humans learned just how powerful and destructive an eruption from the massive volcano could be.

Although the eruption of Mount St Helens did not take place until May of 1980 there were noticeable signs that an eruption was imminent since March of that same year. Commencing on March 15th, Mount St. Helens experienced numerous earthquakes and stream or phreatic explosions that resulted in the north side of the mountain to slowly grow over 260 feet . Until the end of April, there was continuous volcanic activity, including a relatively small explosion that produced a 6,000-foot ash cloud into the sky. From the end of April to May 7th volcanic activity seemed to stop but beginning May 7th the mountain underwent significant transformation as the north side expanded approximately 5 feet each day. The day of the eruption, at 8:32 am, a 5.1 magnitude earthquake struck one mile beneath the mountain. At this point the north side of the mountain had accumulated such a substantial volume that this seismic event triggered one of the most significant debris landslides in recent history. The landslide displaced the summit and bulge of the volcano, forcing them downward into the nearby Toutle River. The landslide eliminated a substantial portion of the mountain, relieving pressure from the magma structure. Subsequently, this led to a colossal lateral explosion, likely the image that comes to mind for most people when recalling the Mount St. Helens eruption.

Simultaneously, two different events unfolded: the landslide and the lateral explosion. The combination of these occurrences led to a cascade of events that posed a greater threat to the area surrounding Mount St. Helens. The debris landslide and mudflows swept away most of the volcano's summit, racing down to the North Fork of the nearby Toutle River. The volume of the debris was estimated to be equivalent to about one million Olympic-size swimming pools. This substantial amount of debris from the landslide alone caused the river to swell significantly compared to its usual water levels. As mentioned earlier, the lateral explosion occurred simultaneously, triggering pyroclastic flows—super-fast-moving blasts composed of a high-density mix of burning hot volcanic gas, pumice, ash, and rock debris. Pyroclastic flows are known for their speed, capable of traveling hundreds of kilometers from the vents they originate from. Predictably, the effects of these pyroclastic flows were felt as they carried their contents to the surrounding area of Mt. St. Helens. Within a 6-mile radius of the explosion's path, every tree was either demolished or at least scorched. As the debris and ash approached the aforementioned Toutle River, its impact became severe. For the Toutle River, the situation worsened by the minute as the debris and ash from the landslide and lateral explosion reached its waters. The river's hydrology was significantly impacted, with mudflows blocking the river in some areas and creating an unstable, overflowing stream. Flooding emerged as a genuine concern following the eruption, prompting the Army Corps of Engineers to devise fast, short-term responses, including a debris dam and sediment basins, which incurred approximately $327 million in costs.

Another pressing issue caused from the disaster was the fallout of ash. The explosion, lasting about 9 hours, dispersed approximately 540 million tons of ash over an expansive 22,000 square mile area. Areas closest to the blast site, especially, found themselves blanketed in a thick layer of ash, posing immediate dangers. Autopsy reports later revealed that a significant portion of the death toll was attributed to ash inhalation.The impact of the ash extended beyond the human toll. It wreaked havoc on crops, led to the clogging of electrical equipment, resulting in widespread power failures, and rendered road visibility extremely dangerous. This, in turn, forced the closure of many highways for days. Disposing of the ash after the fact proved to be a daunting but necessary chore. First-person accounts state that 'merely walking would kick up clouds of ash,' highlighting that even after the most perilous phase had passed, lingering effects continued to pose a significant risk for the locals as a result of the explosion.

Before the day of the eruption, the scenic areas surrounding Mt. St. Helens was buzzing with year-round activity. It was a popular destination for both locals and visitors, offering a plethora of recreational opportunities such as hiking, climbing, and more. Visitors of all kinds, including families, Boy Scouts, veterans, and others, were a common sight. The eruption not only impacted these visitors but also had a profound effect on the permanent residents of cabins nestled in the woods around Mt. St. Helens. These residents were particularly vulnerable to losing their cabins, but many who lost their homes comprised a financially well-off Caucasian population that viewed the cabins more like vacation homes they were okay with leaving behind. Although all listed demographics faced vulnerability to Mount St. Helens, they were primarily susceptible to secondary, unforeseen effects such as flooding or ash cloud dangers, given their locations outside the established danger zones of red and blue.

There were 57 deaths total, resulting from the eruption that took place. Much of the population most vulnerable to Mt. St. Helens included various professionals, such as volcanologists, photographers, miners, and loggers. These were working-class individuals who needed to continue working to maintain comfortable lives. Most of them did not have the privilege of staying away from Mt. St. Helens. Those particularly concerned about an impending explosion were loggers sent into the established 'blue' zone around the mountain, accessible only with a work permit. There are accounts suggesting that the loggers expressed their worries about an eruption looming overhead, but the bureaucrat responsible for handling the paperwork ultimately dismissed them.

Preparing for Mount St. Helens eruption was a challenging task due to the scientific uncertainty surrounding the potential eruption and the public's perception of risk at the time. Providing an exact date to the public or explaining the potential magnitude was difficult, given the unpredictable nature of the event. When a series of earthquakes began in March 1980, the United States Forest Service (USFS) attempted to monitor the volcano and collaborated with seismologists and scientists from the University of Washington and the USGS. Subsequently, an evacuation plan was formulated, establishing hazard zones for the area around Mt. St. Helens. The 'red zone' was designated off-limits to anyone not involved in scientific research or law enforcement. The less hazardous 'blue zone' covered an area extending five miles from the red zone, permitting entry only to workers with permits, such as loggers and miners, and property owners during daytime hours.

Due to minimal and challenging preparations, the response to the Mount St. Helens disaster was notably inefficient when it occurred. In the 1980s, there was little inter-agency cooperation, resulting in different departments and agencies essentially operating in isolation when dealing with the situation. This lack of coordination hindered the effective deployment of resources during the response. Officials and disaster experts attributed the ineffective response to the claim that there were essentially three different disasters occurring simultaneously, for which they were ill-prepared. These disasters included mud and debris flow, ash winds/clouds, and resulting floods, each creating distinct primary and secondary challenges that left officials struggling to formulate an effective response. One aspect of the response that garnered praise was the intervention of the US Army Corps in addressing the mudflow and floods in nearby rivers. They swiftly arrived on the scene and implemented a series of quick fixes to mitigate flood dangers, including the installation of costly debris dams.

Opposed to the immediate response, the long-term reaction to the disaster was considered very successful. One of the key milestones in restoring the area and the lives of the people around it was the removal of the ash. It was a lengthy task that required heavy equipment to be transported to the communities surrounding the mountain. Dump sites for the ash were designated and later entombed and developed. It was estimated that over 4 billion board feet of lumber were destroyed due to the eruption and pyroclastic blasts. To restore parts of the forest and ensure sustainability for the logging industry in the area, the USFS planted around 10 million trees in an effort to reforest thousands of acres.

Thanks to the countless volcanologists who studied the activity of Mount St. Helens before the eruption, we can analyze volcanic behavior and assess the mountain's past, present, and future to lower the chance of disaster. This particular eruption has been largely credited with the subsequent boom in the field of volcanology and the vast knowledge we received from it, spanning emergency planning to similar events and general volcano knowledge. Information and understanding are vital to the lives of millions around the world who live near these magmatic protrusions.Many scientists and emergency management specialists studying Mount St. Helens have stated that if we had the knowledge and interagency disaster cooperation we have today, the response would have been handled with greater care and efficiency. There was a key focus on new research that followed the eruption in figuring out what “normal” behavior is for a volcano and what warning signs could look like, especially compared to those given by Mount St. Helens.The newly acquired volcanic information from U.S. volcanologists helped the population found beneath Soufriere Hills, located on the Caribbean island of Montserrat. The situation was analogous to Mount Saint Helens, with strong seismic patterns and the bloating growth of the volcano. They advised the authorities to evacuate the island immediately. On the 27th of December 1997, Soufriere Hills erupted with a quake of 3.9 recorded during these swarms. A total of 8,000 people were evacuated, and there were only 19 total casualties.

Ultimately, in the grand scheme of things, we have little to no control over the natural world and the environment around us. We should be aware that we only form a minor and insignificant fraction in the geological time scale. The world that we live in is in constant movement, and it is rational that we should have a healthy fear of immense catastrophe so that we can avoid it. Ensuring that we have updated evacuation strategies and emergency shelters/food supplies is one of the most efficient ways to reduce the risk of a volcanic eruption. We cannot stop or control an eruption, but we can plan and prepare for them.

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