From broadcaster to receiver

In 2008 the medium-wave national radio station Beromünster, famed way beyond Switzerland's borders, finally called time on its service and the 217-meter-high Blosenbergturm was granted landmark status. The broadcasting tower now has a new role: it will aid research by serving as an air monitoring station in the National Air Pollution Monitoring Network (NABEL). Thanks to its prime location, Empa experts can keep an eye on pollutant emissions across the entire Swiss Central Plateau, from Lake Constance to Lake Geneva.

TEXT: Martina Peter / PICTURES: Empa

The broadcasting tower is in a spectacular spot: at 800 meters above sea level, it offers an unobstructed, 360-degree view, which carries many advantages. From the 1930s, not only could radio programs be broadcast throughout the Swiss Central Plateau, but also directly across Switzerland's borders. During the Second World War, this made national radio station Beromünster a key independent source of information in neighboring countries, which were swamped with propaganda.

Although the transmitter's giant copper coil still sits in a Faraday cage in a small cabin at the foot of the tower, it no longer transmits these days. Instead, pumps hum, sucking in the outside air and conducting it into the measuring station, where two air experts from Empa, Christoph Hüglin and Stefan Bugmann, are busy beavering away. While Bugmann checks the devices and changes filters, Hüglin explains how research came to be conducted here: "After the radio service ceased broadcasting, a new use was sought for the tower – just the opportunity we'd been waiting for. The location is just the ticket as the site is not just ideal for transmitting radio waves, but also gathering information on the composition of the air." The broadcasting tower allows "air to flow freely", he continues. In other words: there are no obstacles or forests to prevent the air currents from spreading pollutants throughout entire atmosphere here.

Beromünster and Jungfraujoch

The Beromünster location boasts similar conditions to the site on the Jungfraujoch, which can also rely on a "free flow of air". The Alpine research station is able to record air pol lutants from half of Europe while the Beromünster station takes readings on the entire Swiss Central Plateau – from Lake Constance to Geneva and even across the border into neigh boring regions of Germany and France; both are key elements in national and international programs, which keep an eye on air pollution.

Empa runs the National Air Pollution Monitoring Network (NABEL), which has in cluded the Beromünster station since the summer of 2016, on behalf of the Federal Office for the Environment (FOEN). In conjunction with the University of Bern and ETH Zurich, the Empa team has already measured carbon dioxide (CO_2), carbon monoxide (CO) and methane (CH_4) on five different levels of the tower in the last few years. The station has now been expanded to other pollutants.

The 217-meter Blosenbergturm of the former National Radio Station Beromünster has been listed since 2008. It is painted grey-green up to a height of 40 meters. The round engineering cabin is located at a height of 150 meters.

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In terms of equipment, the Jungfraujoch station serves as a model for the new NABEL station. At both stations, Empa installed highly sensitive analytical instruments, which can continuously detect the tiniest of traces, such as nitrous oxides (NO_x) and ozone (O_3). These studies require powerful analytical measuring technology that is available online around the clock – such as the quantum cascade laser spectrometer developed by researchers from Empa's Laboratory of Air Pollution/Environmental Technology together with its partners. It is also expected to detect and quantify laughing gas isotopes (N_2O) as of the end of the year. The instruments even gage whether N_2O molecules stem from combustion processes in power stations or were produced "biologically", such as in sewage plants.

As Stefan Bugmann turns his attention to calibrating the measuring equipment inside the former transformer box, Christoph Hüglin demonstrates the so-called impactors on the roof, which suck the air upwards with pumps and the fine particulates in the air land in a filter at the bottom. But not all of them: thanks to special flow technology, only gaseous substances and fine particulates smaller than ten micrometers are conducted inside the station. The filters are brought to Empa every two weeks, where they are evaluated in the lab on top of the data transmitted online.

As the tower's new operator, Empa will increasingly focus on air pollutants that break down rapidly, e.g. nitrous oxides and greenhouse gases, Hüglin explains. Apart from long-term measurements, shorter research campaigns are also planned to measure certain sub stances more comprehensively over a certain period. //

The fine particulate matter is collected in so-called impactors on the roof of the former control center at the foot of the tower. Christoph Hüglin (left) and Stefan Bugmann not only analyze the reading transmitted online, but also the contents of the filters.

Air Pollution Monitoring

Switzerlands National Air Pollution Monitoring Network (NABEL) monitors the air pollution at 16 locations across Switzerland. Additional stations are scattered around the country and gage the pollution at typical locations, such as inner-city roads, highways and residential areas. Inaugurated on 26 October, the Beromünster station represents rural areas below 1,000 meters above sea level.

Video
Panoramic drone flight around the Beromünsterturm at an altitude of 150 meters.
https://youtu.be/Q8IowoSVdJA