**Extracts from the article in Nature Chemistry July 2023 –**

**“Insights from a laboratory fire”.**

# Case study: Laboratory fire at the University of Vienna

## Introduction

A chemistry lab at the University of Vienna was recently destroyed by a fire caused by the failure of the lithium-ion battery in a laptop. Although no one was injured, the fire “led to ~€1.4-million-worth of equipment and infrastructure losses, hundreds of hours of additional labour, at least 10 months of research delays, the loss of entire projects, and immeasurable stress and pressure on many […] students and staff.”

## The Fire

The fire started in a cabinet in a laboratory. Because it contained fume cabinets at each end of the lab, which ran continuously (which appear not to have shut down when the fire occurred), hot smoke was extracted through them, “causing the air extraction system to melt and collapse”. The still-operational ventilation system resulted in massive smoke damage in neighbouring laboratories. Subsequent firefighting efforts also caused considerable water damage to everything submerged in the foam, which spread to

the adjacent laboratory. The fire was extinguished by flooding the space with foam.

## The Cause

The fire and arson investigation identified that the ignition source was “a battery inside a laptop, which was stored switched off and unplugged in a cabinet underneath a wooden laboratory bench”. Most of the cells in the laptop battery pack were destroyed and the laptop itself completely so.

The reason why the laptop had been kept in the laboratory was “because it contained software necessary to operate an analysis instrument but had not been used for at least three years.”

## The Impact

The impact of the fire included:

* Loss of equipment, much of it specialist.
* Loss of access to 5 labs, initially.
* Most furniture damaged too much to recover/repair.
* Ventilation, power, some waste infrastructure and windows destroyed.
* Total loss of a fume cupboard and 2 others only restored after specialist cleaning and repairs.
* Smoke damage to adjacent laboratories.
* Impact on research was very significant and two masters students lost almost all their thesis work.

(However, many hand tools and much of the glassware survived and only needed cleaning).

Less obvious costs incurred during the restoration of the laboratories included the human resource costs associated with putting the laboratory back together — “as a conservative estimate this represented around 1,000 working hours distributed across eleven staff, amounting to an additional €50,000 in labour not covered by insurance.”

## Lessons Learned

These included positives:

1. Things that were done well:
   * They had vented chemical storage cabinets.
   * Self-igniting chemicals were never stored in the laboratory.
   * Waste management protocols were good, meaning that minimal chemical waste was present in the laboratory at the time of the fire.
   * The laboratory fire did not become a “chemical fire or cause explosions” due to various measures in place.
   * There were no fatalities or health issues for the University’s students or staff resulting from the fire.
2. However, things that could have been better included:

* The fire alarm did not initially “rouse attention” and “poor communication between security personnel and the fire brigade exacerbated the scale of the fire damage”.
* Although the fire brigade response time was 7-minutes the fire was not put out for 25 minutes. (There was no directly interfaced with the fire brigade).
* Advice is now “not to store disused laptops or devices containing lithium-ion batteries in laboratories “— if they must be, then batteries should be removed and safely disposed of.
* Documents such as logs and laboratory books, and experimental data is digitized, and back-ups kept in other locations.
* Risk assessments are performed and experimental registration forms are completed, ensuring that laboratory work is carried out with minimal potential risk.
* The locations for emergency shut off switches for electricity, gas and water should be included in staff training in addition to “fire discovery, reporting, basic firefighting protocols and, if possible, basic firefighting training”.
* A laboratory and chemical inventory is kept up-to-date for insurance purposes “in case of a serious incident and [to] prevent unnecessary ordering and storage of excess chemicals”.

The University of Vienna “hope that our story can inspire others to start a conversation about ‘what if’ and produce resources on how to deal with and recover from major destructive incidents, which are just as important as other laboratory safety resources”.

## Acknowledgement

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Jones, M.P., Weiland, K., Mitterer, C. *et al.* Insights from a laboratory fire. *Nat. Chem.* **15**, 885–889 (2023). https://doi.org/10.1038/s41557-023-01254-6