

**INCIDENT DATE:** August 23, 2020

**SUBJECT:** Chemical Explosion

### BACKGROUND:

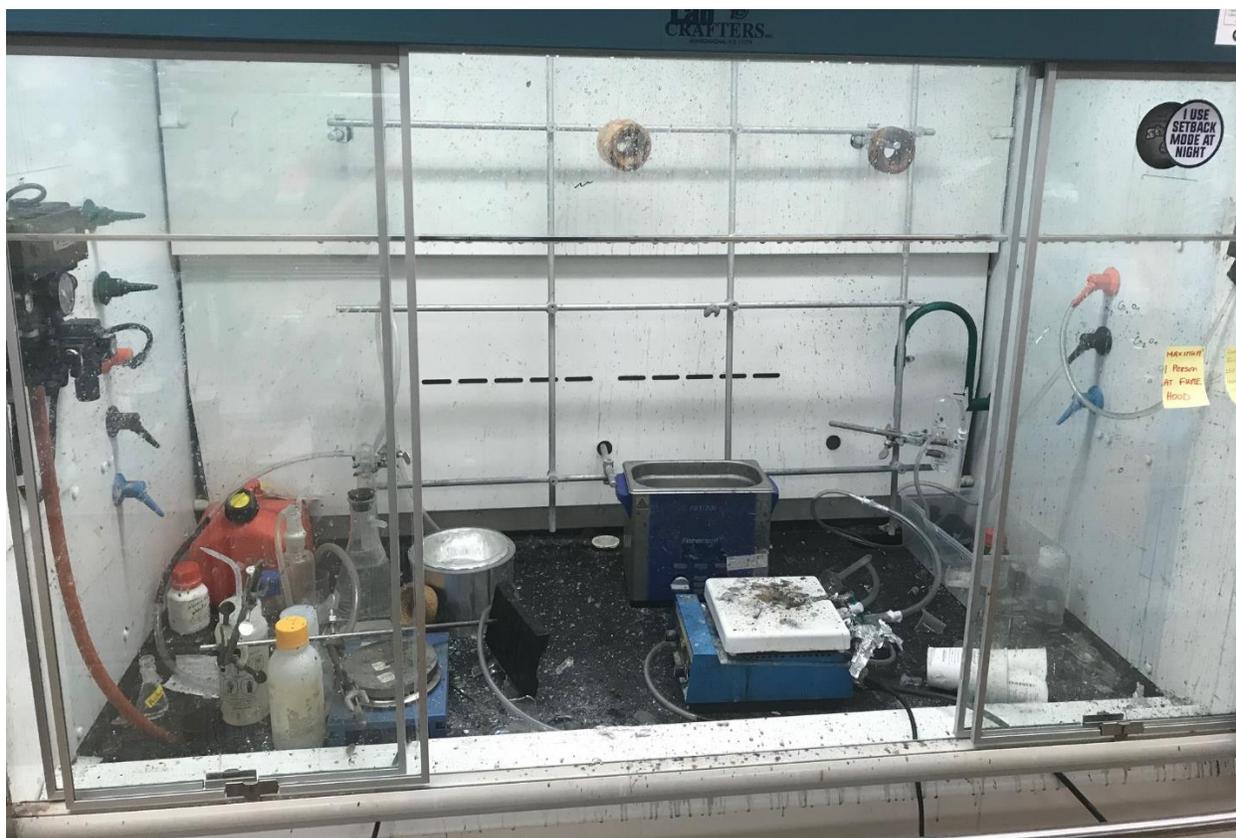
On Sunday August 23 2020 at 6 pm, a researcher was setting up a chemical reaction in a dual sash fume hood. They were conducting a variation of the reaction they previously performed using different oxidizing agents. They had dry loaded the solid chemicals (graphite and potassium chlorate) into a flask and were adding a concentrated acid mixture (sulfuric acid and nitric acid) dropwise by gravity using a dropping funnel. They noticed the stir bar having difficulty in stirring; they opened the horizontal sliding sash to close the dropping funnel to adjust the stirring. At that point they saw a small flash inside the reaction mixture and then the reaction immediately exploded.

### INJURIES

The researcher was standing in front of the chemical explosion suffered a laceration from a projectile glass shard. They were bleeding profusely and required immediate medical attention. Paramedics were summoned and took the injured researcher to the hospital.

### EQUIPMENT DAMAGE

The glassware used in the reaction set up was destroyed and most of the glass shards were scattered within the fume hood





### IMMEDIATE CAUSE

The chemical explosion occurred because the synthesis conducted uses strong oxidizing agents. Potassium chlorate in particular has a high risk of explosion when mixed with various chemicals such as all reducing agents, any substance that can burn and sulfuric acid. In this incident, sulfuric acid was added dropwise and the reaction between potassium chlorate and sulfuric acid produces a highly unstable and explosive gas, chlorine dioxide.

### LEARNING OUTCOMES

Although the researcher was not working alone, they were working outside of normal hours on a dangerous reaction. The injured researcher was not aware of the explosive nature of the reaction. They had done a similar reaction before with potassium permanganate as the oxidizing agent and no explosion occurred. There was no explosion warning in the literature paper they referenced that used potassium chlorate and the SDS of the chemicals were not reviewed. Other literature papers discovered after the incident did indicate the reaction with potassium chlorate has an explosion risk and order of the addition of solid dry chemicals to acid mixture reduced the risk of an explosion – the opposite order was performed in this incident. The injured researcher was not trained on the use of dual sash fume hoods such that the horizontal sliding sash was opened from the middle and fully exposed the researcher to the explosion. If the researcher adjusted the horizontal sliding sash from the left or right side, they would have had the sash protect them from the blast.

### RECOMMENDATIONS TO PREVENT RECURRENCE

- Review all SDS documents before proceeding with experiments
- Conduct hazard evaluation and risk assessment before attempting new reactions
- Develop a safe work procedure when handling explosive chemicals or reactions
- Use blast shields when handling explosive chemicals or reactions
- Train lab personnel on how to safely use a fume hood sash, in particular dual sash hoods
- Orient lab personnel to the lab space and equipment which they are working in
- Conduct dangerous experiments during normal working hours and never alone

For more information on best practices for working alone or after hours:

<https://www.uvic.ca/ohse/health/Working%20alone/index.php>

For more information on WHMIS

<https://www.uvic.ca/ohse/research/laboratory/whmis/index.php>

For more information on fume hoods:

<https://www.uvic.ca/ohse/research/laboratory/fumehoods/index.php>

For more information on special hazards:

<https://www.uvic.ca/ohse/research/laboratory/special/index.php>