Steam Release

Two Steam Releases in Autoclave Room Due to Lack of Backflow Preventer, Shorting of Safety Switch, and Configuration of Steam Generators

EHS was notified of two steam release incidents from an autoclave room after the second release. There are two sets of tower style autoclaves in the rooms. There are also 2 steam generators, also situated one on top of the other.

The first release was due to boiling water/steam from the top steam generator which had back-flowed into the piping which connects the DI water generator and the steam-generator. The 3/4 inch PVC pipe melted, causing steam/boiling water to leak out. Immediately afterwards Engineering installed a backflow preventer and replaced the melted pipe with a stainless steel pipe.

A week later there was a steam release from the mechanical over-pressure safety valve of the lower steam generator. Steam was released horizontally at a height of 3.5 feet. It was determined that an over pressure condition in the lower steam generator caused this release. The over pressure should have been avoided by the automatic activation of an electrical safety pressure switch which controls the amount of pressure in the steam generator’s chamber. However, the electrical switch had gotten wet during the previous week’s steam release and this had shorted it out.

Findings and Recommendations

1. Steam release/electrical hazards from stacking of the generators

There are significant safety hazards caused by having one generator stacked on top of the other. These are being immediately separated.

- Water from the top unit, can drip right onto the high voltage electrical panel of the bottom unit causing an electrical hazard.
- Water dripping from the top unit can drip onto the bottom unit’s safety switches and valves causing them to fail. As seen in this incident, this can lead to an over pressure condition.

2. Steam is directed at an unsafe location. Possibility of steam filling the room in the event of a release from the safety relief valve

When steam was released from the pressure relief valve during the second incident, the valve directed the steam to shoot out at a 3.5 foot height which could burn or people in the room during a release. There is also a possible asphyxiation hazard. The autoclave technician recommends that the pressure relief valve should be connected directly to a drain to prevent this possibility.
3. **Electrical Hazards from accessible high voltage controls**

The panel which covers high voltage electronics on each steam generator is currently unlocked on the generators. These must be securely closed and locked.

4. **Servicing Area Partitioning the front and back of the autoclaves**

There is currently no room behind the autoclaves and generators to allow access to service the units. Following the steam release from the safety relief valve, the only way that Engineering had to access the back of the autoclaves was to make holes in the wall between the autoclave room and the adjoining conference room.

The room is going to be expanded to allow for a partition wall and a servicing area behind the autoclave. To minimize the chance of injury from steam, the steam generators are being unstacked and relocated behind this partition.

5. **Back-flow Check Valve**

Engineering has recently installed a stainless steel check valve to prevent backflow of boiling water/steam into the utility line which leads from the DI water. Engineering is checking to ensure that there is a valve for the bottom generator and will install one if necessary.

6. **Overcrowding in the Room**

The autoclave area is very cramped making it infeasible to use carts effectively. There is no room to pass by if a person is working at the autoclaves or if the autoclave door is open or if someone is working at the drying oven. This condition increases the risks of burns. This situation will be alleviated by the expansion of the room.

7. **Emergency Steam Shut Off**

There are currently two switches labeled "safety switch" located on the wall opposite the autoclaves. No one knows what is the purpose of these switches or what they control. This information should be obtained. If the steam generators will remain in the autoclave room there must be an emergency switch in the room which can be activated at the far end of the room to shut off the steam source to allow personnel to exit the room in the event of an emergency. Alternatively, an emergency exit should be provided out of the far end of the room.

8. **Training**

Lab personnel will receive appropriate training in safety and ergonomic measures when autoclaving.