## Basic Principles of Safety – Chemicals — Steam

Your Objectives:

At the end of this lesson, you should be able to describe inherent dangers of steam and to reference the (M)SDS as and when appropriate.

Exposure to pollutants, especially if inhaled may cause serious _____ to the respiratory _____ and to the entire organism, even. If hazardous substances, such as fine dust, gases and _____, entered the bloodstream via the lungs, they would have the potential to trigger _____, resulting in such things as asbestosis, asthma or cancer. Needless to say, this should be avoided at all cost **at the** _____.

As you may well know, being burned on some hot surface, or being scalded by steam, can be excruciatingly painful. This is because even a small _____ of steam will propagate large amounts of _____ and energy. Steam is a gaseous form of water and behaves like a gas when it is hot. (Steam for sterilisation is typically at 121°C and 1bar.) As such, manoeuvering equipment like steam _____ and pipelines always comes with a potential danger.

In the past, an explosion from improperly maintained or designed steam boiler was a common occurrence, something which could also even have led to an entire plant's demise. Nowadays, although the _____ has substantially improved, strict protective measures must be taken to prevent vapours from begin released. Hence, the MSDS must be

read before carrying out any activity, not only because it is also informative, since it describes what kind of protection against burns there are, but because it will explain what to do in the event that one should accidentally inhale a [ ] substance of any kind.

For instance, we learn that steam temperature and [ ] are related in that the higher the pressure, the [ ] the steam will be. Some safety considerations when working with steam include the following:

Since steam will burn you instantly, always wear [ ], stand to the side when opening valves or releasing steam. As steam generates explosive pressure, always open steam [ ] *slowly*. Last but not least, always check gauges and isolation valves before disconnecting steam lines or hoses.

Plant steam is Biogen's thermal energy source. The plant's [ ] is also the heat source for bioreactors, WFI distillation systems, and the HVAC system (Heating, Ventilation and Air Conditioning). Plant steam is, however, too impure for product contact. Clean steam, therefore, is generated using [ ] water and is intended for direct product contact applications. It is distributed through stainless steel piping and used throughout Biogen's manufacturing processes for such things as [ ] large tanks and pipes, sterilising liquid media used to grow cells, and providing steam power for our autoclaves.

**Aufgabe Lückentext:**

**Folgende Wörter bitte in den Lückentext einfüllen.**
**Jedes Wort kommt einmal vor.**
**Bitte Gross- und Kleinbuchstaben beachten.**

amount, damage, gloves, generators, hotter, heat, hazardous, illness, organs, purified, pressure, steam, sterilising, technology, valves, vapours, workplace