by the industry is the precipitation with ferric chloride but in some plants also the precipitation as calcium arsenate is used.

It involves the formation of an insoluble ferric arsenate ("jarosite type") compound which is allowed to sediment at the bottom of tailings or residue ponds. It appears to be stable for many years in the proper environment which includes slightly acidic and oxidizing conditions. So it can be deposited in certain areas and is safe for a lot years. The earlier method by precipitation with limestone has shown evidence that calcium arsenate compounds decompose very slowly in contact with atmospheric carbon dioxide, but may be used also if stored under closed conditions.

In most of the smelters also slags have to be disposed, if there is no usage for the iron silicate material or if the slag is ground after a flotation process. But as the leachability of the slag is slow, there is - in normal iron silicate slags - no direct danger for the environment by the disposal of these slags. Even if all the slags have to be deposited, the smelting process typically produces less than three tons of solid waste per ton of copper produced. If the slag is used as product because of its quality and a market next to the smelter the waste is much lower. E.G. 2009 in Hamburg in total 17,000 t of waste has to be disposed, from which about 12,800 t have been classified - mainly because of the arsenic content - as hazardous and are safely stored in old salt mines. That means a very low waste formation of only 30 to 40 kg/ ton of copper.

5.3.11 Energy consumption of Smelting and Refining

Smelting and refining facilities require large amounts of energy, notably the fuel energy used for drying, heating, smelting, fuming, melting and transportation, and the electrical energy used in electrolysis, for the production of oxygen and for powering utilities and equipment. One big step in reducing the energy consumption of smelting and refining of copper was made with the Outotec ™ flash furnace technology because it is possible to operate the process autogenous, that is smelting only by the use of the reaction heat. As the gases are capsuled in the waste heat boiler the energy which is in the off gas can be recovered to produce high pressure steam and electrical power.

Nevertheless, even the flash furnace technology uses fuels for heating the settling furnace. In the converter process the reaction heat is used to melt reverbs or scrap without using additional fuel. These are examples in which the industry has optimized energy consumption. Nevertheless, some processes have got in the meantime the physical limits where additional substantial energy savings are possible. The reduction of energy is in nearly all smelters a focus of optimization - as energy and labor cost are the main cost positions with