6.2C: Specialized Atomization Methods

There are a few elements where the atomization efficiencies with other sources are diminished to the point that trace analysis sometimes requires specialized procedures. The most common element where this is done is mercury. Mercury is important because of its high toxicity. The procedure is referred to as a **cold vapor method**. One design of a cold vapor system consists of a closed loop where there is a pump to circulate air flow, a reaction vessel, and a gas cell. The sample is placed in the reaction vessel and all of the mercury is first oxidized to the +2 state through the addition of strong acids. When the oxidation is complete, tin(II)chloride is added as a reducing agent to reduce the mercury to neutral mercury atoms. Mercury has sufficient vapor pressure at room temperature that enough atoms enter the gas phase and distribute throughout the system including the gas cell. A mercury hollow cathode lamp shines radiation through the gas cell and absorbance by atomic mercury is measured.

Two other toxic elements that are sometimes measured using specialized techniques are arsenic and selenium. In this process, sodium borohydride is added to generate arsine (AsH_3) and selenium hydride (SeH_2). These compounds are volatile and are introduced into the flame. The volatile nature of the complexes leads to a much higher atomization efficiency.

Commercial vendors sell special devices that have been developed for the cold vapor or hydride generation processes.