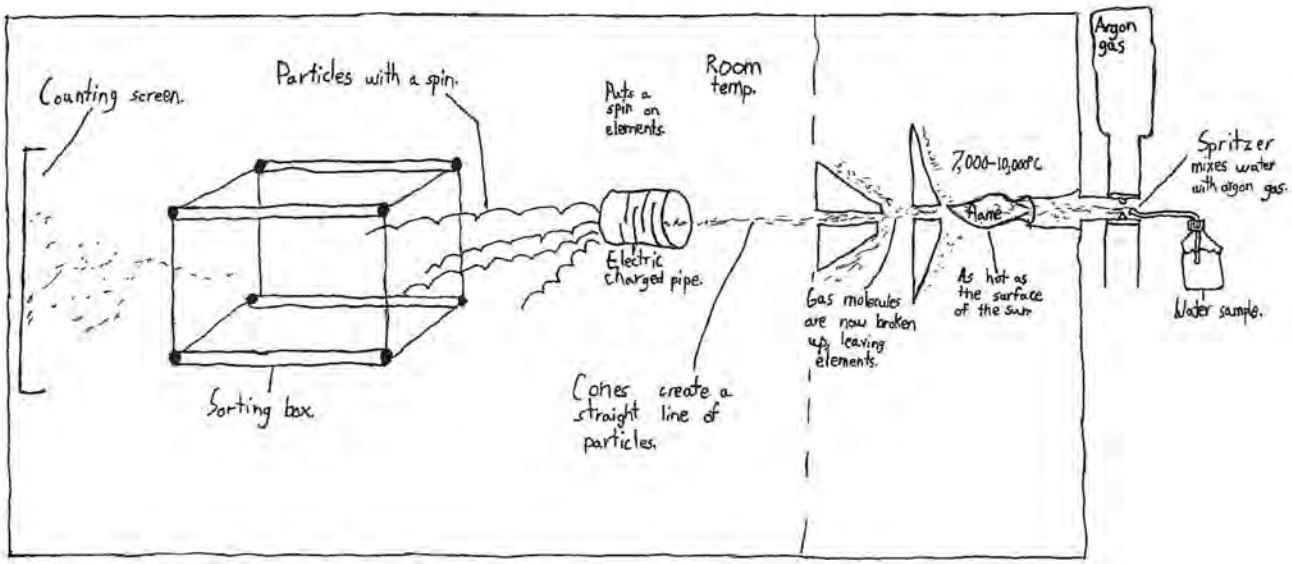
The ICP-MS: How It Works

As you know, the Inductively Coupled Plasma-Mass Spectrometer (ICP-MS) is the machine that we used to test our water samples. When you put the water sample in the machine it is spritzed together with argon gas. This mixture is passed through a chamber with ruby tips. The rubies are used because they are a very hard material and the argon gas water mixture won't wear them down as fast as it would metal. After that it is shot through a flame as hot as the surface of the sun (7,000˚C - 10,000˚C), which breaks up the water and any compounds in the water leaving just elements. The stream of elements and gas is focused and sent through two sets of cones. Only the elements shooting in a straight line go through the cones. When the minerals come out the other side of the cones, they are sent into an electrically charged spinning pipe. This gives the elements a huge spin. The spinning elements are flung into a box where they are sorted by their weight. The heavier elements settle to the bottom, while the lighter ones stay on top. The elements continue through the box and hit a screen sensor that counts all the elements in the sample. This information is then displayed on a computer screen that is hooked up to the machine.

ICP-MS Diagram



Summary of Findings

The first and most important thing that we would like to share with the town is that there were no toxic elements above EPA standards in B Samples, the samples that represented well water. We did, however, find levels of some elements which exceeded EPA secondary standards. Secondary standards are elements that make the water smell bad, taste bad, cause plumbing problems, or discolor your laundry. The elements which we found that exceeded secondary EPA standards were Iron, Manganese and Aluminum.

We have contacted a number of experts regarding the health concerns of these elements and everyone seems to agree that Iron and Manganese are not a concern. Most people feel also that Aluminum is not a concern, although there are some people who are still worried about Aluminum levels. A few years ago, there were articles which linked Aluminum to Alzheimer's disease, but most scientists feel that the research behind those articles was inaccurate and that the connection was false. The two families with high Aluminum levels remain concerned.

In all, we had four wells which exceeded EPA levels in Iron, four in Manganese, and two in Aluminum.

Sample A values were very different. A Samples were the ones that had been sitting in the pipes overnight. We had many A Sample values which were above EPA standards. The elements which were high in Sample A's were Copper, Lead, and to a lesser extent, Zinc and Nickel. This suggests that these minerals are leaching into people's water from their pipes.

The EPA standard for Copper is 1,300 ppb's. In A Samples we found certain houses that had Copper levels in the twenty thousands. In fact we had one Sample A Copper that had 42,000 ppb's but only 191 ppb's in Sample B.

Because some homes had such high levels of Copper in Sample A we wanted to look into more details of why there are such high levels of Copper in Sample A. We researched a number of questions relating to Copper levels. We looked into the pH of the water to see if Copper was leaching from pipes more in houses where the pH was lower, meaning the water was more acidic. There was a slight positive relationship, but not as much as we had expected. We think this may be because none of our water samples were very acidic – low in pH.

We also looked at Copper levels and the age of the pipes. We wondered if newer houses had more Copper leaching in. We did find a clear relationship. It only applied to houses which had very high levels of Copper (above about 5,000 ppb), but in those houses, the newer homes had higher levels, and older homes lower levels. We also had a very interesting story with an outlier. The house that had 42,075 ppb's of Copper, much higher than anyone in town, turned out to be a special case. The family told us that they took the sample from a laundry faucet that hadn't been used for about four days. This suggested to us that the longer the water sits in your pipes, the more the elements may build up. The lesson to us is that if your water has been sitting in pipes for a long time, such as coming back from vacation, you may want to run your water first to flush your pipes before drinking it.

The EPA standard for Lead is 15 ppb. The A Samples in our town were consistently higher than our towns B Samples. We had A Samples as high as 56 ppb's, but B Samples didn't go higher than 9 ppb's, and most were near 0 ppb's.

It is important to say that Lead is a very dangerous element that can cause brain damage. We were very happy that we did not find any Sample B's that were over EPA standards. However, we found 11 A Samples that were above the EPA limit of 15 ppb's. This means that 18 percent of the homes we tested in Shutesbury had over EPA standards of Lead in Sample A. It is possible that about 1 in every 5 homes in town have over EPA Lead standards in water that has been sitting in their pipes. People may want to consider running their water or filtering their water who have high Lead levels.

We were interested in where this Lead was coming from. We assumed that the older homes with Lead solder would have Lead coming from the pipes and newer homes would have none. We were surprised to find not only that newer homes had Lead, but the many homes with higher Lead were the newer homes. There was even a slight relationship that linked higher Lead to newer homes. This was one of our most surprising findings in the whole study. We don't understand where the Lead is coming from if it is not from the solder.

The EPA standard for Zinc is 5000 ppb's. Most of the samples we tested had experimental errors, so we did not include Zinc in our report. But we found a couple of A Samples that had high levels. A few samples were two times the limit.

We investigated a number of research questions, including sectors of town verses elements, to see if certain elements clustered in certain sectors of town. The group who researched that question found no strong relationships.

Another group looked for relationships between different elements, to see if high levels of one element would tend to mean that there would be high levels of another elements in the well water. This group found no strong relationships.

One group researched depth of well verses levels of different elements. They found no relationships.

In conclusion, we were very pleased to find no unacceptable levels of toxic elements in any wells we tested in town. Although we were not able to test every well in Shutesbury, we were able to test wells in every sector in which there were homes. Our research did raise some questions and concerns regarding water that has been sitting in pipes in people's homes.

A more full description of our results can be found in this report.