I obtained a large excel document with former or potential lead smelters and mining sites for another class I was working on earlier this semester. Under Missouri State law, the Department of Natural Resources, Division of Environmental Quality - Hazardous Waste Program is required to investigate all known or suspected abandoned or uncontrolled hazardous waste sites. In an audit I found from 2014 (<http://app.auditor.mo.gov/AuditReports/CitzSummary.aspx?id=295>), it stated that the DNR had not completed investigations of potential environmental concerns at 111 former lead smelters and 3,300 former mining waste sites. My story ended up focusing on former manufactured gas plants, so I never ended up analyzing the data about these lead smelters and mining site. I wanted to use this final project as an opportunity to improve my skills with Agate, so I went back and began to analyze the data using Agate and Jupyter notebook.

The initial excel document contained over 12,000 rows, so I condensed the data down to only 2,020 rows, which included data from seven counties nearby. I used Agate to find out information like which county was home to the most sites, what operators controlled the most sites and what hazardous chemicals were found at these sites the most. I also used it to count how many of the sites were past producers, potential producers or merely just occurrences. I practiced using the graphing feature in Agate to show the range of depth that the underground contaminations went into the ground. Then, I calculated the mean depth of the contaminations by using the mean statistics function. I uploaded my Jupyter Notebook to my GitHub, to show you all the steps I took using Agate:

After my analysis using Agate, I still had some information I wanted to find out, so I used SQL for those extra queries. Below are the queries I ran using mySQL and short explanations why I used those queries and what information I found out from running them.

**SELECT COUNT(\*)**

**FROM Smelters\_Mines**

**WHERE SURFACE = "Y" AND UNDERGROUN= "Y"**

204

**SELECT COUNT(\*)**

**FROM Smelters\_Mines**

**WHERE UNDERGROUND = "Y"**

509

**SELECT COUNT(\*)**

**FROM Smelters\_Mines**

**WHERE SURFACE = "Y"**

843

Thus, surface exposure of the chemicals was more common that underground exposure at these sites. Of the 2,002 record, only 204 sites had confirmed potential hazardous waste issues underground and on the surface level.

**SELECT X\_1\_2\_\_QUA, COUNT(\*)**

**FROM Smelters\_Mines**

**GROUP BY 1**

**ORDER BY 2 DESC**

Eugene had 146, Gravois Mill 132, Rocky Mount and Proctor Creek both had 109. 229 did not have anything listed.

**SELECT COMMODITY, Count(\*)**

**FROM Smelters\_Mines**

**WHERE X\_1\_2\_\_QUA = "Eugene"**

**GROUP BY 1**

**ORDER BY 2 DESC**

45 of Eugene sites have been potentially hazardous due to only lead, 32 due to only Barium and 22 due to just lead and barium.

**SELECT commodity, Count(\*)**

**FROM Smelters\_Mines**

**WHERE county= "Miller"**

**GROUP BY 1**

**ORDER BY 2 DESC**

Miller County has the most former or potential lead smelters and mining sites. This query showed that most of those sites were contaminated with only (243) and Barium (145), but there was also lead and Barium found in other sites as well, just a combination of multiple chemicals.

**SELECT Count(\*)**

**FROM Smelters\_Mines**

**WHERE commodity LIKE "%Barium%"  AND county = "Miller"**

With these two queries, I found that 279 sites in Miller county were exposed to some amount of Barium (even if that site was also exposed to other chemicals) and 449 of those sites were exposed to lead.

**SELECT count(\*)**

**FROM Smelters\_Mines**

**WHERE COMMODITY LIKE "%lead%"**

**SELECT count(\*)**

**FROM Smelters\_Mines**

**WHERE COMMODITY LIKE "%barium%"**

The list of commodities I created using Agate did not account for adding the chemicals to the lead total, when lead was present with other chemicals. This query catches that and tells me how many sites were even partly exposed to lead contamination. Of the 2,020 sites, 1,287 were contaminated by lead and 1,066 by barium.

**SELECT \***

**FROM Smelters\_Mines**

**WHERE OPERATOR = "O.S. Reavis"**

Since O.S. Reavis was the operator with the most sites in this data, I wanted to see where the sites were located and what the sites had in common. This query showed me that 15 of the 17 O.S. Reavis sites are in Morgan County, and they are all past producers besides one prospect site and one site without a status.

**SELECT COUNTY, Count(\*)**

**FROM Smelters\_Mines**

**WHERE WASTE\_ROCK = "Y"**

**GROUP BY 1**

**ORDER BY 2 DESC**

Waste Rock is much less common form of hazardous waste exposure than surface or underground contamination, so I wanted to find out where most of these waste rock sites are located. The counties with the most waste rock sites were Benton County with five sites and Moniteau County with three sites.

**SELECT PROPNAME, Count(\*)**

**FROM Smelters\_Mines**

**GROUP BY 1**

**ORDER BY 2 DESC**

This query showed me that 1173 properties don’t have names and there are a number of sites with the same names or that are listed more than once. For instance, Rocky Ford Mine (shaft) was listed five times and Rocky Ford Mine (pit) and Hayes Mine were both listed three times.

**SELECT \***

**FROM Smelters\_Mines**

**WHERE PROPNAME = "Rocky Ford Mine (shaft)"**

All of the Rocky Ford Mine (shaft) sites have different ID’s but are listed under the same coordinates. This would be something I would want to look into more to determine if these are just different areas on one site that are contaminated and the reasons why it is listed five separate times.

**SELECT \***

**FROM Smelters\_Mines**

**WHERE STATUS = "Occurrence"**

68 sites were listed on this list of former or potential mining sites or lead smelters due to an occurrence. If I wanted to find out more about these sites or what happened during the occurance, I could contact one of the owners or operators form this new list created by the query.