

# Exploring information issues in education for environmental health and safety data literacy

Robert Belford, UALR;  
Ralph Stuart, Keene State College

Collecting and working with technical data requires both  
1) an understanding of the scientific models being used to collect and interpret the data to form decision-making information and  
2) an understanding of the sources and limits of those data.

For this reason, working with raw data requires information literature skills which are often underdeveloped as part of a chemistry education. This poster illustrates this concept using two use cases – 1 teaching and 1 resaerch.

## Models

### Lab Safety

Question: What are the risks of this lab procedure?



## Data Sources

### Legacy and Emerging Sources

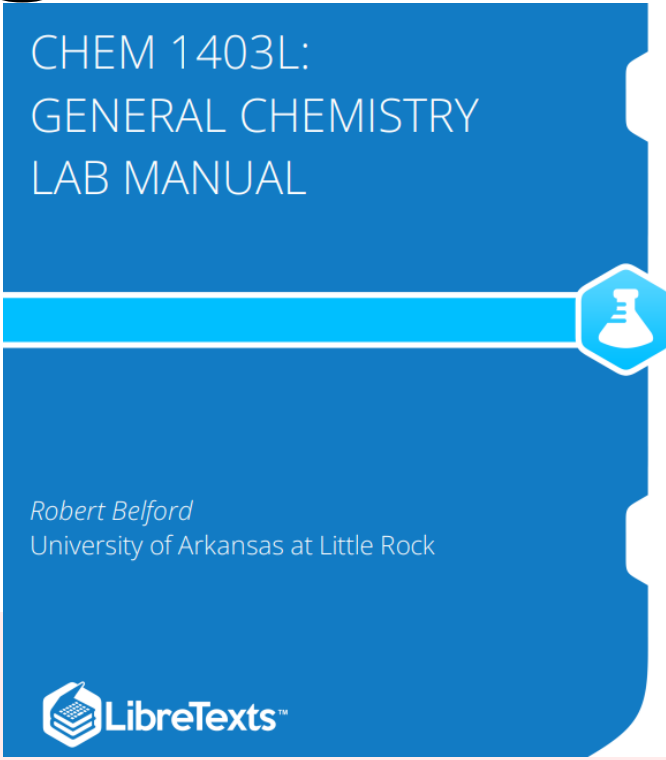


## Information Literacy Tools

### FAIR data

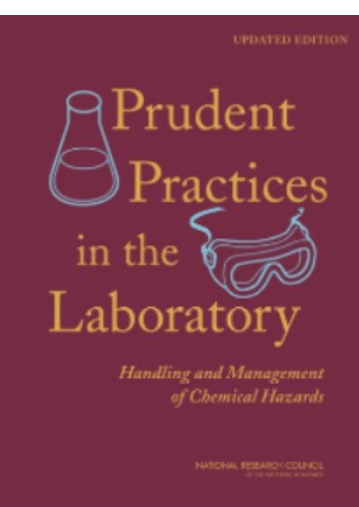


# Safety Literacy in the Freshmen Lab: Incorporating Information Literacy Issues in Academic Labs



### Safety

- Emergency Preparedness
  - Eye protection is mandatory in this lab, and you should not wear shorts or open toed shoes.
  - Ferrous sulfate PubChem LCSS
  - 1,10 Phenanthroline PubChem LCSS
- Minimize Risk
  - label all containers
- Recognize Hazards
  - All solutions should be considered harmful and care should be taken to avoid contact with your skin or other body tissues.
  - In event of contact with reagents you should flush contacted area with water and notify instructor immediately.
  - All waste is placed in the labeled container in the hood and will be recycled when the lab is over. Contact your instructor if the waste container is full, or about full.



**Chemical Hygiene Plan**  
Every university has a CHP (Chemical Hygiene Plan) as required by OSHA standard 29 CFR 1910.1450 and a CHO (Chemical Hygiene Officer) who is responsible for its implementation, and UALR's CHP can be found at the [Facilities Management Web Page](#). Within the CHP are a set of standard SOPs (Safe Operating Procedures) that represent the minimum safe practices for the handling of hazardous chemicals and the operation of equipment (like how to secure a compressed gas tank).

### Chemical Safety Resources

#### Prudent Practices

The National Research Council of the National Academies of Sciences has published a book "Prudent Practices in the Laboratory" that can be downloaded for free and has a wealth of information on chemical safety, including a copy of OSHA's Laboratory Standard (29 CFR 1910.1450). There is also an accompanying zip file of

#### UN GHS

OSHA's laboratory standard is actually integrated into the United States implementation of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS) and the 8th edition can be [downloaded as a PDF](#). Within the GHS are the requirements for Safety Data Sheets (SDS) which have superseded the MSDS (Material Safety Data Sheets) that are required for any chemical transported or sold within the US. SDS as actually developed by the manufacturers of chemicals and will have a legal disclaimer, and the regulations state what kind of material must be provided, but they do not validate that the information is correct. Likewise, the GHS labeling system does not define what labels should be on a chemical, that is up to the laws and regulations of a country the chemical is in, but it says the same label means the same thing in all countries. Before the

#### PubChem LCSS

The National Institute of Health's (NIH) National Library of Medicine's (NLM) PubChem have developed LCSS that model the LCSS of the NRC, but extract data from multiple chemical compound databases. This is a very valuable resource for finding safety information on chemicals. One of the greatest values of PubChem LCSS is that they maintain the data provenance for all the information, that is, you can find the source of the information. This means you can often find contradicting information as different sources may have posted different information. PubChem LCSS makes it very easy to survey information on a specific chemical from multiple resources and having this skill is very important.

InChI Trust Open Education Resource (InChI-OER)

Supported by IUPAC Project 2018-012-3-024  
<https://www.inchi-trust.org/oer/>

Content Type: OER  
Uploaded By: Bob Belford, built by Jordi Cuadros  
Content Link: [https://docs.google.com/spreadsheets/d/1Oc3PhvZvt0a2G2GR0107Cub4\\_Q\\_vY8a2\\_Z\\_Za7v7copy](https://docs.google.com/spreadsheets/d/1Oc3PhvZvt0a2G2GR0107Cub4_Q_vY8a2_Z_Za7v7copy)  
License: CC BY-NC-SA

Molecule2PubChemLCSS by Jordi Cuadros  
This Google spreadsheet will allow anyone to connect a list of up to 1,000 chemical names to safety chemical information available in PubChem LCSS. To obtain the spreadsheet you

Content Types: DER Post, Non DER  
InChI Tags: News, Events, Classroom Material, Organic, Cheminformatics, Safety, InChI Overview, Scientific Applications, Amino, InChI Development, Drug Design, Drug Discovery, InChI Applications

1 benzene  
2 toluene  
3 alanine  
4 L-alanine  
5 D-alanine  
6 cyclohexatriene  
7 50 ml Erlenmeyer flask  
8 2-aminopropanoic acid  
9 p-xylene  
10 alanine

1 71080 (2R)-2-aminopropanoic acid  
2 5950 (2S)-2-aminopropanoic acid  
3 7809 1,4-xylene  
4 602 2-aminopropanoic acid  
5 241 benzene  
6 1140 toluene

InputChemicalsList OrderedBookroom

PubChem

PubChem Compound 1140  
Toluene

# Research into Real Time Environmental Monitoring Data Issues

What is the role of citizen science (i.e. "big", Low Cost sensor-based ) in decision-making?

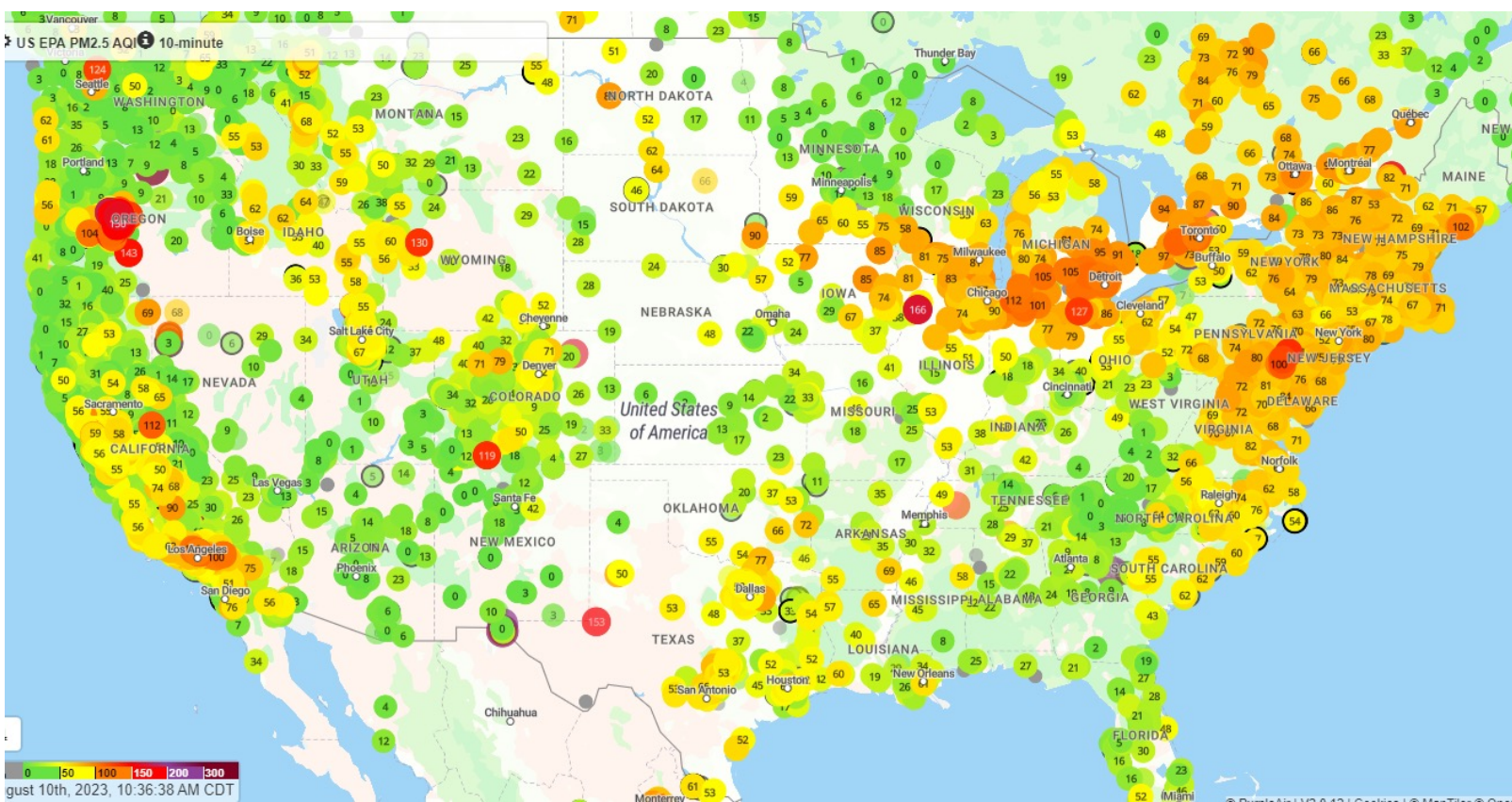
## A Real World Use Case: Comparing two PM maps

EPA PM map



<https://www.airnow.gov/>

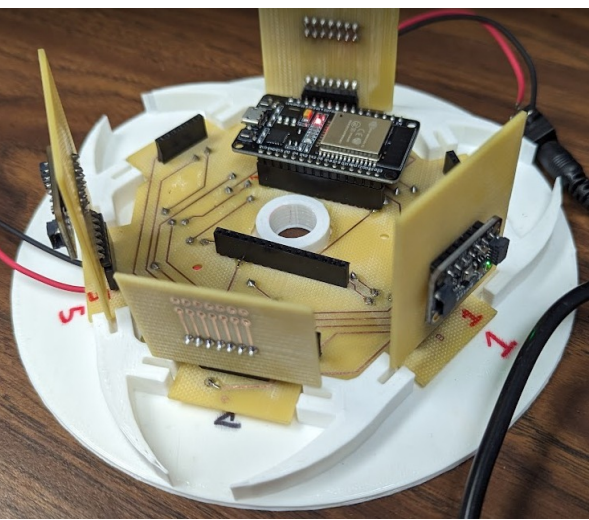
"Citizen Science" PM map



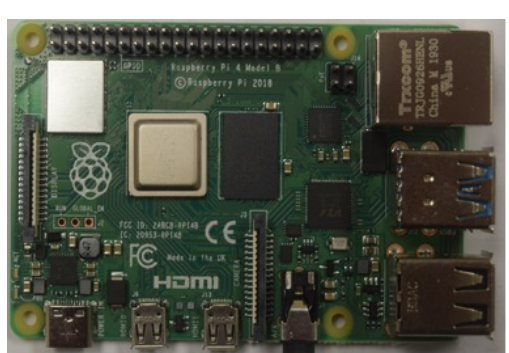
<https://map.purpleair.com/>

The EPA network of Federal Reference Monitors (FRM) has holes where no data is obtained. FRM monitors are only required to measure EPA Criteria Pollutants and so there are many states where other Hazardous Air Pollutants are simply not measured.

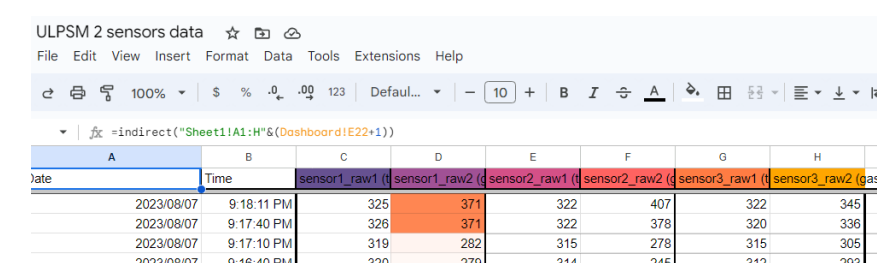
## Configuration Vector is an artifact of sensor locations in a POD. This enables New Features for AI/ML.



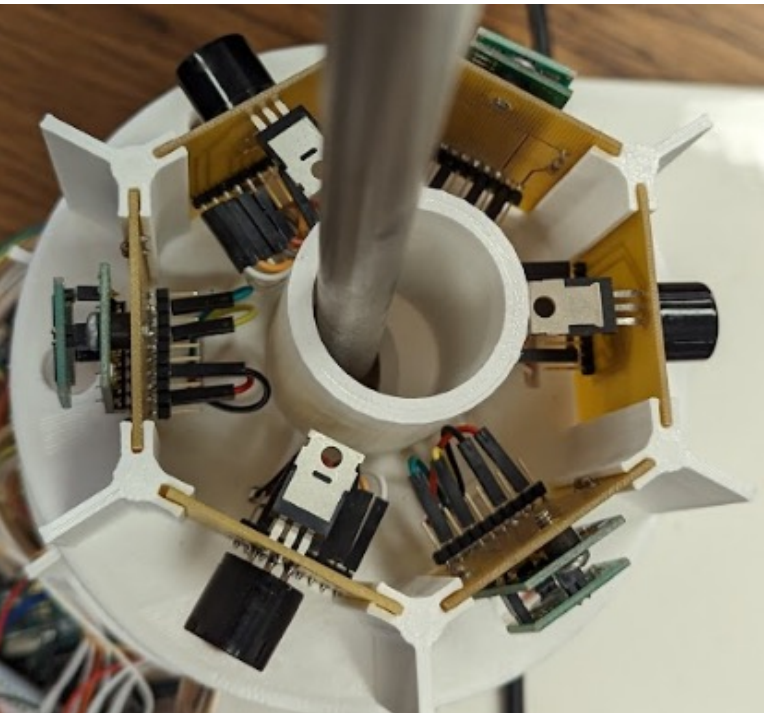
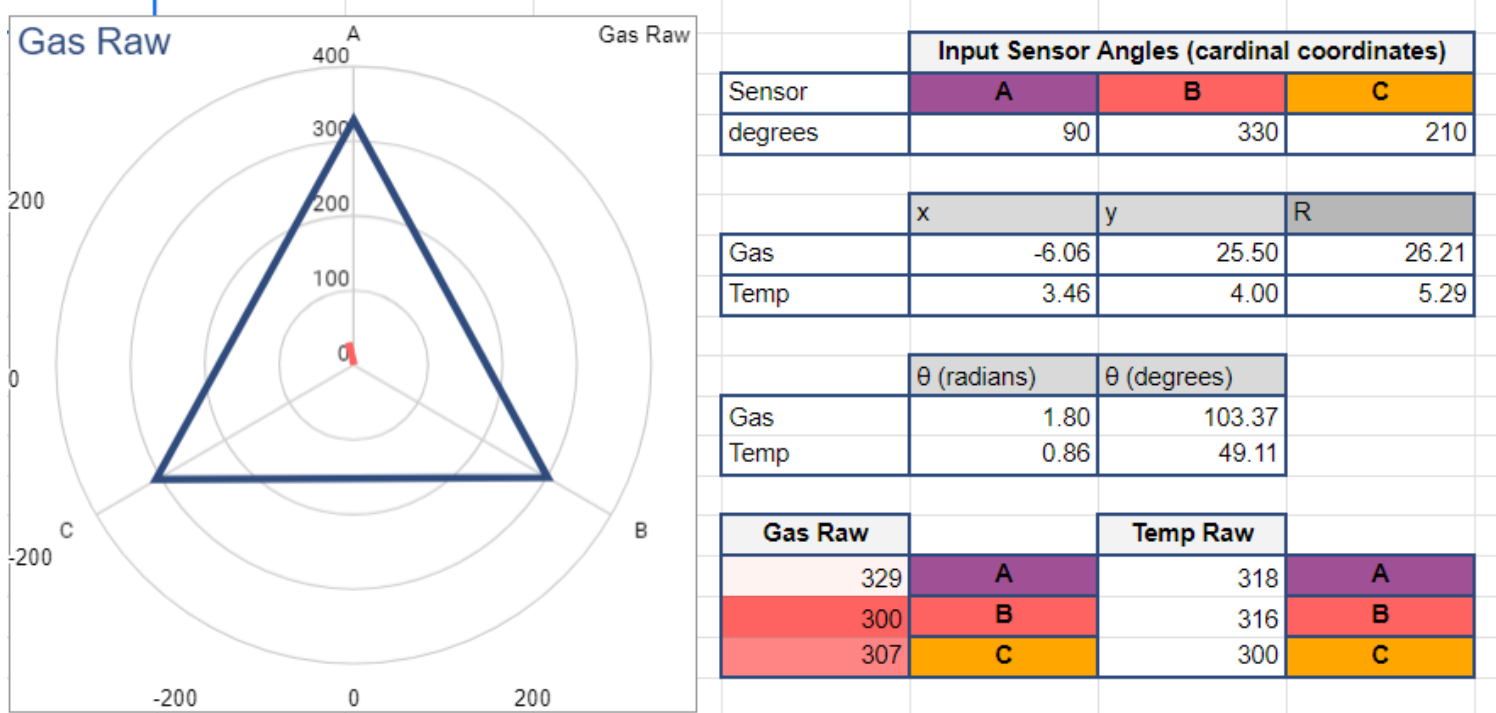
ESP32 microcontroller generate IP address displaying data from three trigonal planar sensors



Raspberry Pi Python Scripts pull data from IP address, assign values to variables and uploads them to Google Sheet on Cron



Google Sheet converts scalar signals to a vector and displays it on a dashboard



Work in progress for collocation studies with FRM units run by ADEQ in North Little Rock. This work is supported by Arkansas INBRE NIH grant P20 GM103429