



**Innovative Techniques to Process
and Display Large Environmental
Datasets**

Zak Schmidt



Project Overview

- Client: Large O&G company
- Initial Scope: Air monitoring
- Primary driver: Landowner complaints
- Data altered to maintain confidentiality



Project Goals

- Process data
- Simplify / compile data
- Create reasonable data summaries



Project Data (Air Monitoring)

Data Type	Time Frame	Frequency	Number of Data Points
On-site Air Quality Data	1/1/2021 – 9/30/2022	Every 15 minutes	180,000+
Off-site Air Quality Data	7/18/2020 – 10/10/2022	About every 2 minutes	9.9MM +
Meteorological Data (Wind)	1/14/2021 – 10/1/2022	Every 5 minutes	176,000+

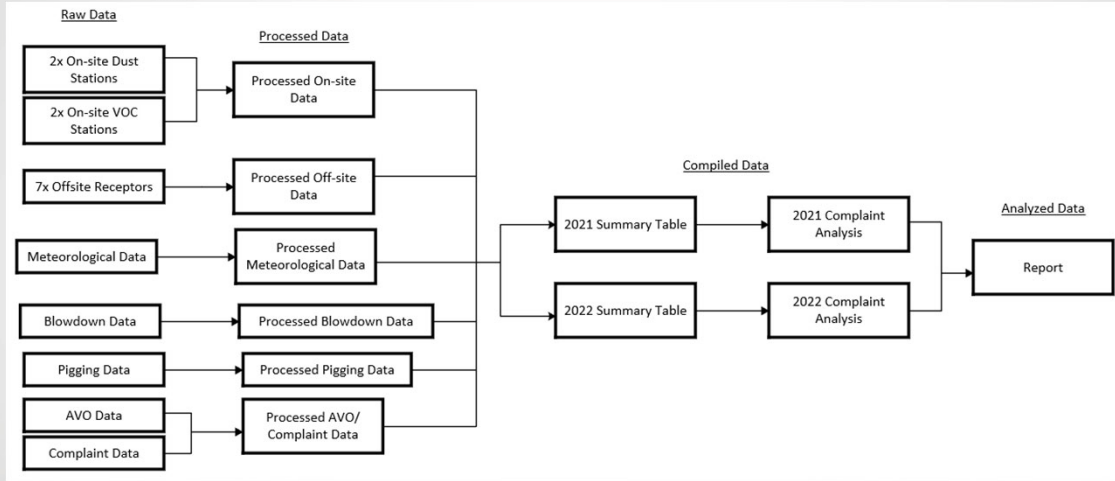


Project Data (Events)

Data Type	Time Frame	Frequency	Number of Data Points
Blowdown Events	6/3/2020 – 9/27/2022	As occurred	409 Events
Pigging Events	11/1/2021 – 9/30/2022	As occurred	45 Events
AVO Events	11/1/2021 – 9/30/2022	As occurred	77 Events
Landowner Complaints	11/1/2021 – 9/25/2022	As occurred	51 Events



Data Flow / Automation



Initial Data Processing

Iso9401Time	Date	Time	Date and Time	internal_0	VOC (ppm)
2022-02-25T17:46:44	19.5556				
2022-02-25T17:46:45	429329-05	134.7			
2022-02-25T17:47:14	18.4				
2022-02-25T17:47:15	456162-05	133.9333			
2022-02-25T17:47:44	20.867				
2022-02-25T17:47:45	480608-05	133			
2022-02-25T17:48:14	19.05555				
2022-02-25T17:48:15	003996-05	134.6897			
2022-02-25T17:48:44	717567-05	133.5517			
2022-02-25T17:48:44	15.7				
2022-02-25T17:49:14	637558-05	133.6207			
2022-02-25T17:49:14	17.6777				
2022-02-25T17:49:44	575828-05	128.9333			
2022-02-25T17:49:44	15				
2022-02-25T17:49:52	082176-05	128.2667			

Iso8601Time	Date	Time	Date and Time	internal_0	VOC (ppm)
2022-01-01T00:00:14	509794-05:00	1/1/2022 12:00:15 AM	01/01/2022 00:00:15	806.4137931	0.80641379
2022-01-01T00:00:44	589882-05:00	1/1/2022 12:00:45 AM	01/01/2022 00:00:45	854.9333333	0.85493333
2022-01-01T00:01:14	613888-05:00	1/1/2022 12:01:15 AM	01/01/2022 00:01:15	849.8666667	0.84986667
2022-01-01T00:01:44	636828-05:00	1/1/2022 12:01:45 AM	01/01/2022 00:01:45	818.9333333	0.81893333
2022-01-01T00:02:14	660953-05:00	1/1/2022 12:02:15 AM	01/01/2022 00:02:15	884.5666667	0.88456667
2022-01-01T00:02:44	684406-05:00	1/1/2022 12:02:45 AM	01/01/2022 00:02:45	885.7333333	0.88573333
2022-01-01T00:03:14	706489-05:00	1/1/2022 12:03:15 AM	01/01/2022 00:03:15	932.2666667	0.93226667
2022-01-01T00:03:44	729263-05:00	1/1/2022 12:03:45 AM	01/01/2022 00:03:45	878.3666667	0.87836667
2022-01-01T00:04:14	250283-05:00	1/1/2022 12:04:14 AM	01/01/2022 00:04:14	915.0344828	0.91503448
2022-01-01T00:04:44	963903-05:00	1/1/2022 12:04:45 AM	01/01/2022 00:04:45	970.7931034	0.9707931
2022-01-01T00:05:14	799541-05:00	1/1/2022 12:05:15 AM	01/01/2022 00:05:15	919.1666667	0.91916667
2022-01-01T00:05:44	499146-05:00	1/1/2022 12:05:44 AM	01/01/2022 00:05:44	941.6206897	0.94162069
2022-01-01T00:06:14	849146-05:00	1/1/2022 12:06:15 AM	01/01/2022 00:06:15	901.5	0.9015
2022-01-01T00:06:44	872536-05:00	1/1/2022 12:06:45 AM	01/01/2022 00:06:45	875.0666667	0.87506667
2022-01-01T00:07:14	895908-05:00	1/1/2022 12:07:15 AM	01/01/2022 00:07:15	962.8333333	0.96283333
2022-01-01T00:07:44	918035-05:00	1/1/2022 12:07:45 AM	01/01/2022 00:07:45	1011.2666667	1.01126667
2022-01-01T00:08:14	940432-05:00	1/1/2022 12:08:15 AM	01/01/2022 00:08:15	889.4666667	0.88946667
2022-01-01T00:08:45	462798-05:00	1/1/2022 12:08:45 AM	01/01/2022 00:08:45	865.8965517	0.86589655



Data Compilation

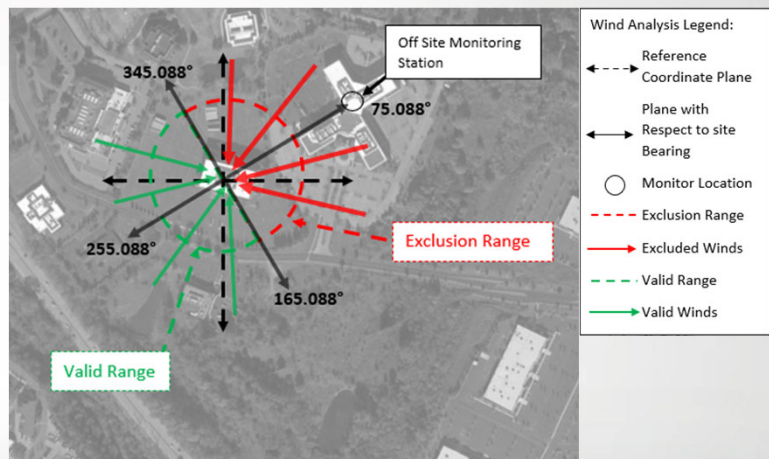
- Daily min, max, average
- MINIFS, AVERAGEIFS, MAXIFS
- Event records
- Wind analysis

Offsite Monitoring Station			
Date	YOC Min (ppm)	YOC Average (ppm)	YOC Max (ppm)
3/1/2022	0.03	0.12	0.23
3/2/2022	0.02	0.13	0.31
3/3/2022	0.02	0.14	0.56
3/4/2022	0.02	0.18	0.26
3/5/2022	0.02	0.15	0.21
3/6/2022	0.04	0.08	0.11
3/7/2022	0.05	0.09	0.11
3/8/2022	0.05	0.09	0.20
3/9/2022	0.02	0.14	0.42
3/10/2022	0.02	0.12	0.53
3/11/2022	0.02	0.08	0.26
3/12/2022	0.03	0.12	0.23
3/13/2022	0.02	0.13	0.24
3/14/2022	0.06	0.16	0.39
3/15/2022	0.02	0.11	0.45
3/16/2022	0.02	0.26	0.46
3/17/2022	0.09	0.30	0.51
3/18/2022	0.11	0.25	0.38
3/19/2022	0.12	0.23	0.58
3/20/2022	0.08	0.23	6.02
3/21/2022	0.06	0.22	0.32
3/22/2022	0.11	0.17	0.23
3/23/2022	0.02	0.15	0.36
3/24/2022	0.05	0.13	0.48
3/25/2022	0.12	0.16	0.34
3/26/2022	0.09	0.14	0.21
3/27/2022	0.08	0.11	0.18
3/28/2022	0.03	0.08	0.26
3/29/2022	0.02	0.11	0.26
3/30/2022	0.02	0.15	0.56



Exclusion Criteria - Wind

- Calculated bearings
- Exclusion range
- Within 90° of site



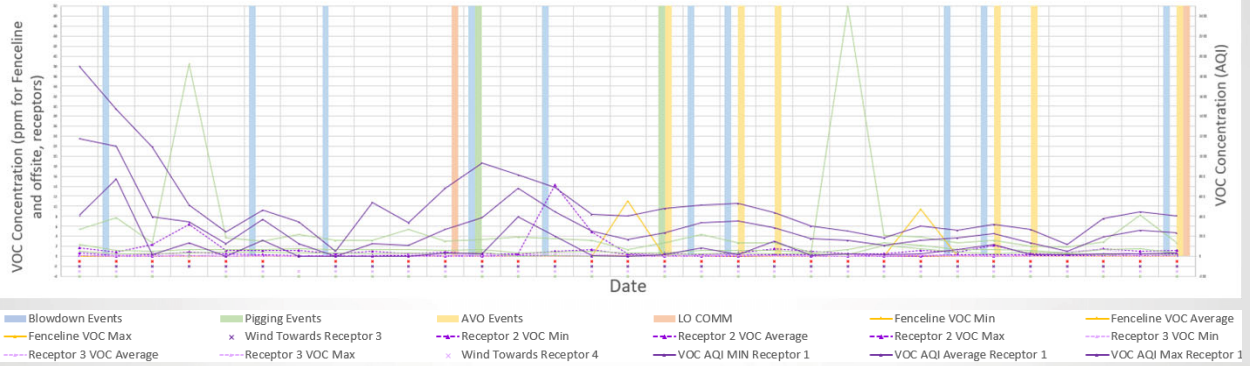
Wind Analysis Legend:

- Reference Coordinate Plane
- Plane with Respect to site Bearing
- Monitor Location
- - - Exclusion Range
- Excluded Winds
- - - Valid Range
- Valid Winds



Compiled Database - Graphs

VOC Comparison



Compiled Database - Yearly

2022 Event Summary							2022 Event Summary							2022 Event Summary						
Date	Blowdown Events					Date	Pigging Events					Date	AVO Events							
	Blowdown Event Time	Winds Toward Offsite Receptor 1	Winds Toward Offsite Receptor 2	Winds Towards Offsite Receptor 3	Wind Towards Offsite Receptor 4		Wind Towards Offsite Receptor 5	Pigging Event Time	Winds Toward Offsite Receptor 1	Winds Toward Offsite Receptor 2	Winds Towards Offsite Receptor 3		Winds Towards Offsite Receptor 4	Winds Towards Offsite Receptor 5	AVO Deviation Time	Winds Toward Offsite Receptor 1	Winds Toward Offsite Receptor 2	Winds Towards Offsite Receptor 3	Wind Towards Offsite Receptor 4	Wind Towards Offsite Receptor 5
16/2/2022	N/A	N/A	N/A	N/A	N/A	16/2/2022	N/A	N/A	N/A	N/A	16/2/2022	8:00:00 AM	Yes	Yes	Yes	Yes	Yes			
16/2/2022	N/A	N/A	N/A	N/A	N/A	16/2/2022	N/A	N/A	N/A	N/A	16/2/2022	3:40:00 PM	Yes	Yes	Yes	Yes	Yes			
17/2/2022	10:00:00 AM	Yes	Yes	Yes	Yes	17/2/2022	N/A	N/A	N/A	N/A	17/2/2022	3:10:00 PM	Yes	Yes	Yes	Yes	Yes			
16/2/2022	8:40:00 AM	Yes	Yes	Yes	Yes	16/2/2022	N/A	N/A	N/A	N/A	16/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
16/2/2022	05:55:00 PM	Yes	Yes	Yes	Yes	16/2/2022	N/A	N/A	N/A	N/A	16/2/2022	3:00:00 PM	Yes	Yes	Yes	Yes	Yes			
11/3/2022	N/A	N/A	N/A	N/A	N/A	11/3/2022	N/A	N/A	N/A	N/A	11/3/2022	3:50:00 PM	Yes	Yes	Yes	Yes	Yes			
19/2/2022	8:40:00 AM	Yes	Yes	No	No	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
19/2/2022	02:53:00 PM	Yes	Yes	No	No	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
19/2/2022	02:10:00 PM	No	No	No	No	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
19/2/2022	10:03:00 PM	No	No	No	No	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
19/2/2022	08:25:00 AM	Yes	Yes	Yes	No	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
19/2/2022	8:42:00 AM	Yes	Yes	Yes	Yes	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	10:00:00 AM	Yes	Yes	Yes	Yes	Yes			
19/2/2022	10:23:00 AM	Yes	Yes	Yes	Yes	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
19/2/2022	03:32:00 PM	Yes	Yes	Yes	Yes	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
19/2/2022	2:40:00 PM	Yes	Yes	Yes	Yes	19/2/2022	N/A	N/A	N/A	N/A	19/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
12/2/2022	N/A	N/A	N/A	N/A	N/A	12/2/2022	N/A	N/A	N/A	N/A	12/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
12/2/2022	01:03:00 AM	No	No	No	No	12/2/2022	N/A	N/A	N/A	N/A	12/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
12/2/2022	05:57:00 AM	Yes	Yes	Yes	Yes	12/2/2022	N/A	N/A	N/A	N/A	12/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			
12/2/2022	11:46:00 AM	Yes	Yes	Yes	Yes	12/2/2022	N/A	N/A	N/A	N/A	12/2/2022	N/A	N/A	N/A	N/A	N/A	N/A			



Compiled Database - Yearly

2022 Event Summary						
Date	Complaint Time	Landowner Complaints				
		Winds Toward Offsite Receptor 1	Winds Toward Offsite Receptor 2	Winds Towards Offsite Receptor 3	Wind Towards Offsite Receptor4	Wind Towards Offsite Receptor 5
1/6/2022	6:50:00 PM	Yes	Yes	Yes	Yes	Yes
1/6/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/7/2022	10:00:00 AM	Yes	Yes	Yes	Yes	Yes
1/8/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/8/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/13/2022	8:00:00 AM	Yes	Yes	Yes	Yes	Yes
1/15/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/15/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/16/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/17/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/18/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/19/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/19/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/19/2022	7:53:00 AM	Yes	Yes	Yes	Yes	Yes
1/19/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/20/2022	10:53:00 AM	Yes	Yes	Yes	Yes	Yes
1/22/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/23/2022	N/A	N/A	N/A	N/A	N/A	N/A
1/23/2022	N/A	N/A	N/A	N/A	N/A	N/A

2022 Event Summary		
Date	Air Quality Rating	
	Receptor 1 PM Air Quality Rating	Receptor 2 VOC Air Quality Rating
1/6/2022	Good	Extremely Polluted
1/6/2022	Good	Extremely Polluted
1/7/2022	Moderate	Extremely Polluted
1/8/2022	Moderate	Extremely Polluted
1/8/2022	Moderate	Extremely Polluted
1/13/2022	Moderate	Severely Polluted
1/15/2022	Moderate	Extremely Polluted
1/15/2022	Moderate	Extremely Polluted
1/16/2022	Good	Moderately Polluted
1/17/2022	Good	Extremely Polluted
1/18/2022	Moderate	Severely Polluted
1/19/2022	Moderate	Lightly Polluted
1/19/2022	Moderate	Lightly Polluted
1/19/2022	Moderate	Lightly Polluted
1/19/2022	Moderate	Lightly Polluted
1/20/2022	Moderate	Extremely Polluted
1/22/2022	Moderate	Severely Polluted
1/23/2022	Moderate	Extremely Polluted
1/23/2022	Moderate	Extremely Polluted



Importance of Automation

- Ease of changes / additions
- Save time
- Reduce errors
- Simplify QA process
- Use in similar projects
- “Text only” files to client



Events vs. Complaints

2022 Complaint Analysis							
Complaint Date	Complaint Time	Number of Events	Event Type	Event Times ^{1,2,3}			Comments
				Blowdowns	AVO	Pigging	
1/5/2022	6:53 PM	2	AVO	N/A	10 AM - Burn Exhaust 3:47 PM - Burn Exhaust	N/A	
1/8/2022	10:04 AM	2	Blowdown, AVO	BDS: 11:05 AM - 11:22 AM	3:22 PM - Int. Exhaust	N/A	Both of the on-site events on this date took place after the complaint was recorded. AVO event recorded more than 3 hours after the complaint was made.

Color Coding Key
N/A - This type of event did not occur on the date of the complaint
Event(s) could possibly contribute to complaint ⁴
Event(s) not likely to contribute to complaint ⁴
Not clear whether the event had the potential to contribute to the complaint.

- Display every complaint
- Determine facility influence on complaints



Largest Challenges

- Scale of data
- Wind analysis limitations
- Uncertainty surrounding offsite receptors

Greatest Takeaways

- Importance of planning
- Benefits of automation
- Exclusion criteria



Presenter

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QUESTIONS?

