

# Where Should COVID-19 Vaccinations Be Sent First in Pennsylvania to Prevent Chronic Conditions & Death?

By Peyton Schwarzman



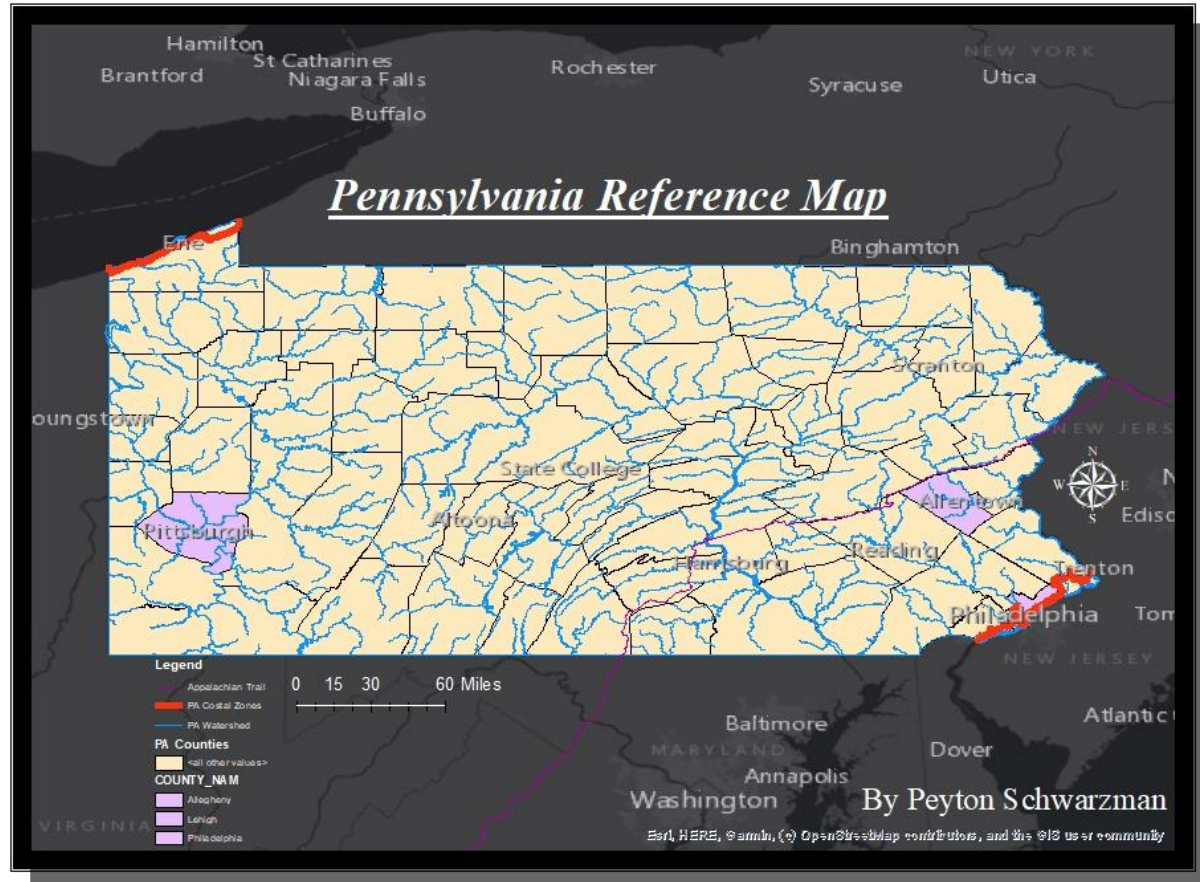
# Background:

Due to a criminally negligent lack of leadership, the COVID-19 Virus has been allowed to ravage the entire United States for the past year. While Pennsylvania was largely spared from the initial massive spread of infection, the continuation of the pandemic eventually began to lead to increased infections in PA. The dangers of becoming infected with COVID-19 have been well-documented as the pandemic has continued, with a slow death being the result everyone is terrified of. However, data has begun to emerge showing that in many age groups that don't succumb to the virus, long-term complications can develop (Williamson, 2020). The most worrisome of these complications compound on the lungs. Examples of these long term-complications manifest as newly developed asthma, COPD, shortness of breath, and extreme fatigue due to decreased oxygenation (Chudasama et al., 2020). These chronic respiratory conditions can then be dangerously exacerbated by air particulates in the environment, which led to one of the factors being evaluated in the following maps.



## Background Cont:

For many U.S. citizens, the recent news about potential COVID-19 Vaccinations has been seen as a God-send. As a result of Operation Warp Speed, multiple COVID-19 Vaccinations have been sent through a rapid fire clinical trial phase with many expecting to be shipped out to the United States by early December (Sullivan, 2020). In total, 1 Billion doses are expected to be shipped to the United States from the first batch of vaccines. The following maps were created out of the goal to determine where these vaccines should be sent first in regards to Pennsylvania counties, in order to minimize the mortality rate in the older population and the potential complications in younger populations.



# PA Low Air Quality Sites

- Legend**
- Air Emission Plants
    - SUB\_FAC1\_2
      - COMBUSTION UNIT
      - PORT OF AIR EMISSION
  - PA Counties
    - Allegheny
    - Delaware
    - Philadelphia

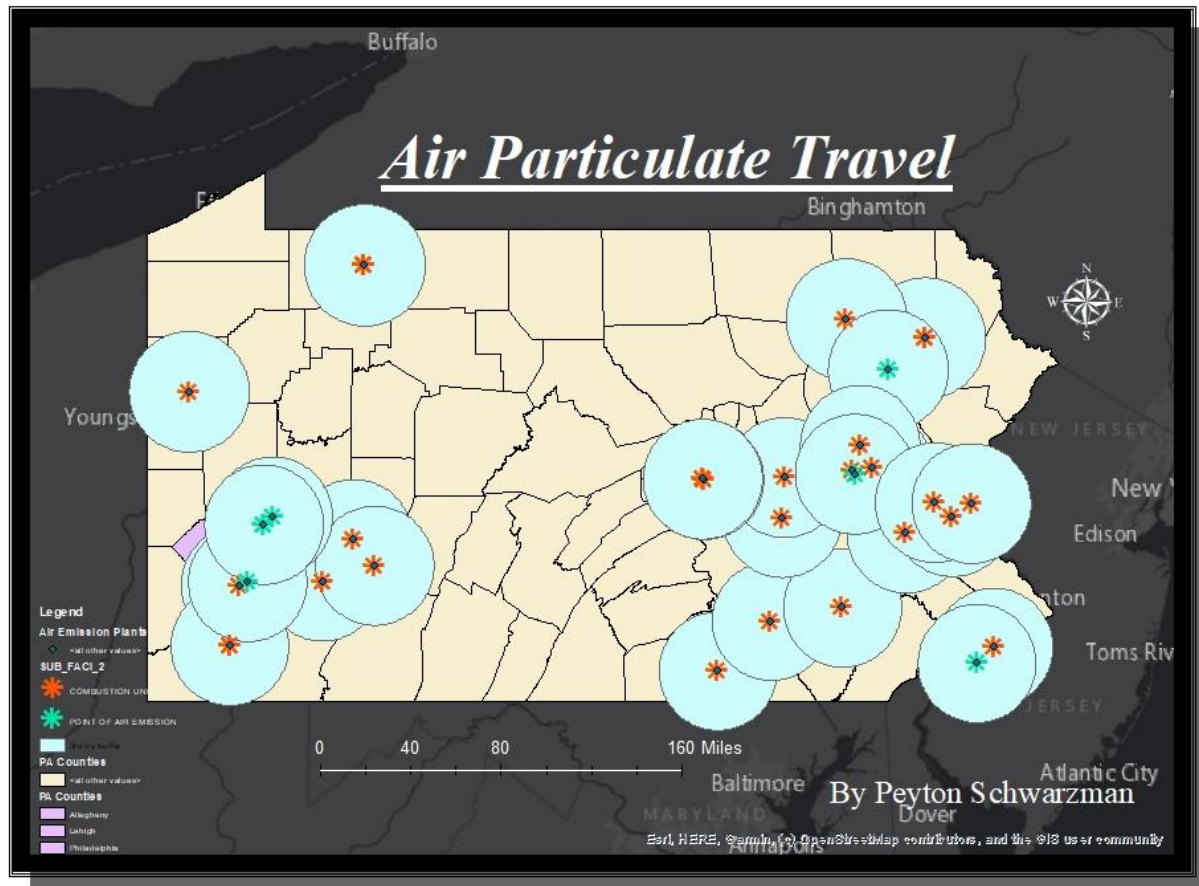
0 40 80 160 Miles

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Esri, HERE, Garmin, OpenStreetMap contributors, and the GIS user community



FID	Shape *	ORGANIZATI	CLIENT_NAM	PRIMARY_2	PRIMARY_3	OTHER_FACI	SUB_FACI_2	SITE_STATU	PRIMARY__4	SUB_FACI_3	COMPLIANCE
0	Point	PIXELLE SPECIALTY SOLUTIONS LLC	PIXELLE SPECIALTY SOLUTIONS LLC	AIR EMISSION PLANT	Unavailable	83-1623694-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
1	Point	WENGER FEEDS LLC	WENGER FEEDS LLC	AIR EMISSION PLANT	Unavailable	23-1374081-2	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
2	Point	VALLEY PROTEINS INC	VALLEY PROTEINS INC	AIR EMISSION PLANT	Unavailable	54-0606187-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
3	Point	PEI POWER CORP	PEI POWER CORP	AIR EMISSION PLANT	Unavailable	23-2933578-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
4	Point	PEI POWER CORP	PEI POWER CORP	AIR EMISSION PLANT	Unavailable	23-2933578-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
5	Point	RAUSCH CREEK GENERATION LLC	RAUSCH CREEK GENERATION LLC	AIR EMISSION PLANT	Unavailable	39-2000742-2	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
6	Point	VAN HOEKELN GREENHOUSES INC	VAN HOEKELN GREENHOUSES INC	AIR EMISSION PLANT	Unavailable	23-2523765-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
7	Point	UNITED REF CO OF PA	UNITED REF CO OF PA	AIR EMISSION PLANT	Unavailable	25-1411751-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
8	Point	MT CARMEL COGEN INC	MT CARMEL COGEN INC	AIR EMISSION PLANT	Unavailable	22-2763306-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
9	Point	TYK AMER INC	TYK AMER INC	AIR EMISSION PLANT	Unavailable	25-1415004-2	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
10	Point	PHILA CITY NORTHEAST WATER POLL PHILA C	PHILA CITY NORTHEAST WATER POLL PHILA C	AIR EMISSION PLANT	Unavailable	09513-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
11	Point	HOMER CITY GENERATION LP	HOMER CITY GENERATION LP	AIR EMISSION PLANT	Unavailable	80-0833693-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
12	Point	HAMILTON 9999 ASSOC LP	HAMILTON 9999 ASSOC LP	AIR EMISSION PLANT	Unavailable	45-4455452-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
13	Point	PANTHER CREEK POWER OPR LLC	PANTHER CREEK POWER OPR LLC	AIR EMISSION PLANT	Unavailable	45-5062056-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
14	Point	FAYETTE THERMAL LLC	FAYETTE THERMAL LLC	AIR EMISSION PLANT	Unavailable	25-1872205-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
15	Point	PROCTER & GAMBLE PAPER PROD CO	PROCTER & GAMBLE PAPER PROD CO	AIR EMISSION PLANT	Unavailable	31-0590862-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
16	Point	UNITED REF CO OF PA	UNITED REF CO OF PA	AIR EMISSION PLANT	Unavailable	25-1411751-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
17	Point	KAPPA GRAPHICS LP	KAPPA GRAPHICS LP	AIR EMISSION PLANT	Unavailable	23-2776254-1	POINT OF AIR EMISSION	ACTIVE	ACTIVE	ACTIVE	NO
18	Point	GUTCHESS HARDWOODS INC	GUTCHESS HARDWOODS INC	AIR EMISSION PLANT	Unavailable	25-1622436-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
19	Point	UNITED REF CO OF PA	UNITED REF CO OF PA	AIR EMISSION PLANT	Unavailable	25-1411751-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
20	Point	UNITED REF CO OF PA	UNITED REF CO OF PA	AIR EMISSION PLANT	Unavailable	25-1411751-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
21	Point	DWMP ASSOC LLC	DWMP ASSOC LLC	AIR EMISSION PLANT	Unavailable	27-2471302-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
22	Point	FAYETTE THERMAL LLC	FAYETTE THERMAL LLC	AIR EMISSION PLANT	Unavailable	25-1872205-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
23	Point	MERCER AREA SCH DIST	MERCER AREA SCH DIST	AIR EMISSION PLANT	Unavailable	25-1158489-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
24	Point	BINGAMAN & SON LUMBER INC	BINGAMAN & SON LUMBER INC	AIR EMISSION PLANT	Unavailable	23-1694390-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
25	Point	220 INGRAHAM OPR CORP	220 INGRAHAM OPR CORP	AIR EMISSION PLANT	Unavailable	11-3187074-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
26	Point	SILBERLINE MFG CO INC	SILBERLINE MFG CO INC	AIR EMISSION PLANT	Unavailable	35-1273539-1	POINT OF AIR EMISSION	ACTIVE	ACTIVE	ACTIVE	NO
27	Point	NORTHAMPTON GENERATING CO LP	NORTHAMPTON GENERATING CO LP	AIR EMISSION PLANT	Unavailable	23-2683633-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
28	Point	EASTON HOSP	EASTON HOSP	AIR EMISSION PLANT	Unavailable	24-0798689-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
29	Point	US STEEL DIV OF USS CORP	US STEEL DIV OF USS CORP	AIR EMISSION PLANT	Unavailable	25-0996816-35	POINT OF AIR EMISSION	ACTIVE	ACTIVE	ACTIVE	NO
30	Point	KEYSTONE CONEMAUGH PROJ LLC	KEYSTONE CONEMAUGH PROJ LLC	AIR EMISSION PLANT	Unavailable	83-3299524-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO
31	Point	PHILA ENERGY SOLUTIONS REFINING & MARKE	PHILA ENERGY SOLUTIONS REFINING & MARKE	AIR EMISSION PLANT	Unavailable	749286	POINT OF AIR EMISSION	ACTIVE	ACTIVE	ACTIVE	NO
32	Point	HARSCO METALS AMER DIV OF HARSCO CORP	HARSCO METALS AMER DIV OF HARSCO CORP	AIR EMISSION PLANT	Unavailable	23-1483991-26	POINT OF AIR EMISSION	ACTIVE	ACTIVE	ACTIVE	NO
33	Point	SMITHFIELD PACKAGED MEATS CORP	SMITHFIELD PACKAGED MEATS CORP	AIR EMISSION PLANT	Unavailable	36-2332471-1	POINT OF AIR EMISSION	ACTIVE	ACTIVE	ACTIVE	NO
34	Point	SMITHFIELD PACKAGED MEATS CORP	SMITHFIELD PACKAGED MEATS CORP	AIR EMISSION PLANT	Unavailable	36-2332471-1	POINT OF AIR EMISSION	ACTIVE	ACTIVE	ACTIVE	NO
35	Point	WOOD MODE LLC	WOOD MODE LLC	AIR EMISSION PLANT	Unavailable	84-2232763-1	COMBUSTION UNIT	ACTIVE	ACTIVE	ACTIVE	NO



## Spread of Active COVID-19 Cases in PA

### Legend

#### Air Emission Plants

○ <all other values>

#### SUB\_FACI\_2

✱ COMBUSTION UNIT

✱ POINT OF AIR EMISSION

● COVID-19 Cases > 5,000

#### PA Counties

○ <all other values>

#### COUNTY\_NAM

ALLEGHENY

LANCASTER

LEHIGH

LUZERNE

NORTHAMPTON

PHILADELPHIA

WESTMORELAND

YORK

0 45 90 180 Miles

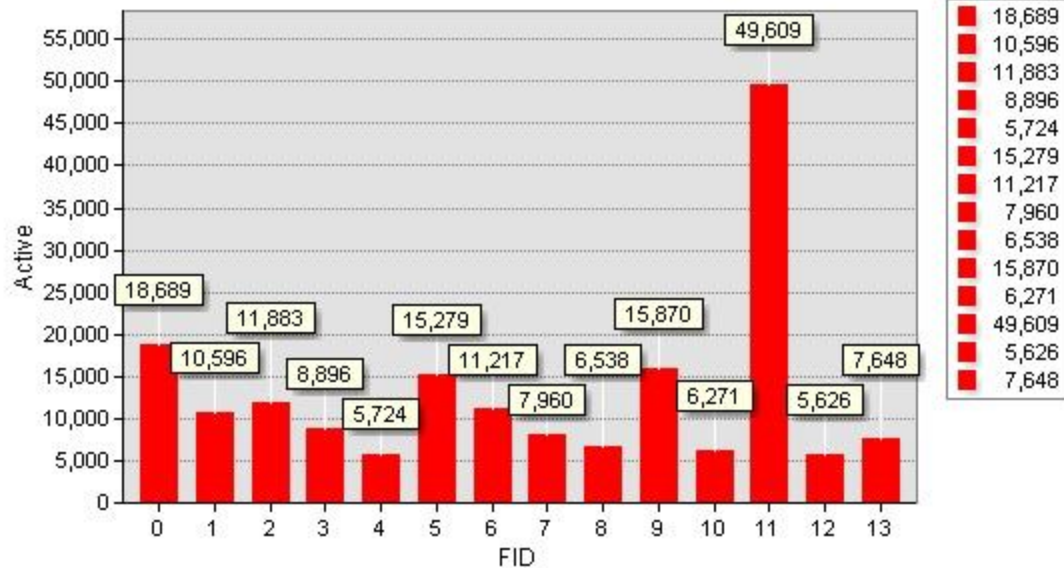
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FID	Shape *	OBJECTID	Province_S	Country_Re	Last_Updated	Lat	Long_	Confirmed	Recovered	Deaths	Active	Admin2	FIPS	Combined_K	Incident_R
0	Point	2294	Pennsylvania	US	11/13/2020	40.468099	-79.981677	19129	0	440	18689	Allegheny	42003	Allegheny, Pennsylvania, US	1573.050339
1	Point	2298	Pennsylvania	US	11/13/2020	40.415705	-75.924578	11036	0	440	10596	Berks	42011	Berks, Pennsylvania, US	2620.356916
2	Point	2301	Pennsylvania	US	11/13/2020	40.336821	-75.108366	12519	0	636	11883	Bucks	42017	Bucks, Pennsylvania, US	1992.61464
3	Point	2307	Pennsylvania	US	11/13/2020	39.972918	-75.747684	9279	0	383	8896	Chester	42029	Chester, Pennsylvania, US	1767.465604
4	Point	2314	Pennsylvania	US	11/13/2020	40.413771	-76.779932	5924	0	200	5724	Dauphin	42043	Dauphin, Pennsylvania, US	2128.645809
5	Point	2315	Pennsylvania	US	11/13/2020	39.916802	-75.402437	16056	0	777	15279	Delaware	42045	Delaware, Pennsylvania, US	2833.010144
6	Point	2328	Pennsylvania	US	11/13/2020	40.039046	-76.247701	11712	0	495	11217	Lancaster	42071	Lancaster, Pennsylvania, US	2146.139807
7	Point	2331	Pennsylvania	US	11/13/2020	40.615482	-75.594352	8332	0	372	7960	Lehigh	42077	Lehigh, Pennsylvania, US	2256.050341
8	Point	2332	Pennsylvania	US	11/13/2020	41.17823	-75.984476	6760	0	222	6538	Luzerne	42079	Luzerne, Pennsylvania, US	2129.690596
9	Point	2338	Pennsylvania	US	11/13/2020	40.210537	-75.366523	16773	0	903	15870	Montgomery	42091	Montgomery, Pennsylvania, US	2018.61803
10	Point	2340	Pennsylvania	US	11/13/2020	40.751827	-75.304718	6593	0	322	6271	Northampton	42095	Northampton, Pennsylvania, US	2159.621337
11	Point	2343	Pennsylvania	US	11/13/2020	40.003385	-75.137927	51513	0	1904	49609	Philadelphia	42101	Philadelphia, Pennsylvania, US	3251.951941
12	Point	2358	Pennsylvania	US	11/13/2020	40.31378	-79.466155	5757	0	131	5626	Westmoreland	42129	Westmoreland, Pennsylvania, US	1650.047722
13	Point	2360	Pennsylvania	US	11/13/2020	39.921009	-76.730401	7869	0	221	7648	York	42133	York, Pennsylvania, US	1752.334888

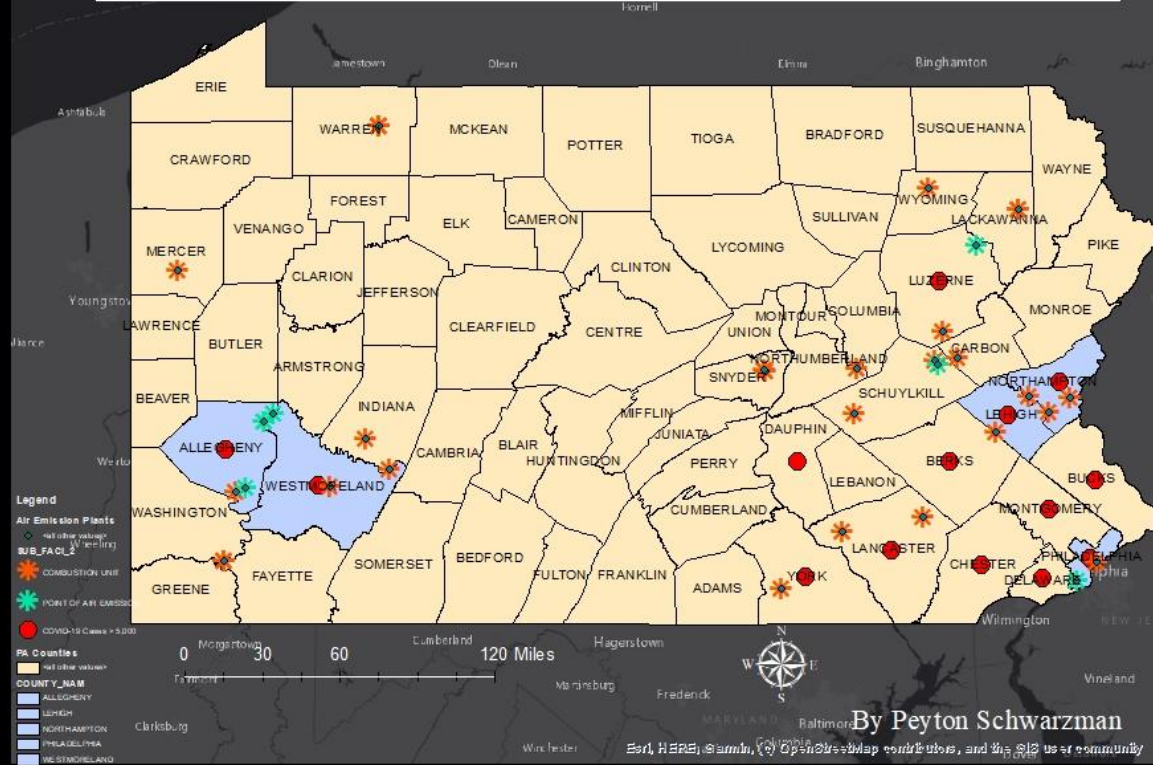
Graph of COVID-19 Cases > 5,000



FID Legend

- 0= Allegheny
- 1= Berks
- 2= Bucks
- 3= Chester
- 4= Dauphin
- 5= Delaware
- 6= Lancaster
- 7= Lehigh
- 8= Luzerne
- 9= Montgomery
- 10= Northampton
- 11= Philadelphia
- 12= Westmoreland
- 13= York

## PA Counties That Should Recieve COVID-19 Vaccinations First





# Conclusion

In relation to the Final Map taking into account overall population by county, COVID-19 cases by county, and the level of air pollution, the initial shipment of COVID-19 Vaccinations sent to Pennsylvania should be distributed between: Philadelphia County, Allegheny County, Westmoreland County, Lehigh County, & Northampton County. The total population of these counties would add up to 3,792,441, with the required vaccinations doubling that figure to 7,584,882. After every eligible individual in those populations have been inoculated, there would still be a little over 12,000,000 vaccines available from the first shipment that could be delivered to the next “at-risk” areas.



# Bibliography

Chudasama, Y., Gillies, C., Zaccardi, F., Coles, B., Davies, M., Seidu, S., & Khunti, K. (2020, June 23). Impact of COVID-19 on routine care for chronic diseases: A global survey of views from healthcare professionals. Retrieved November 26, 2020, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7308780/>

Sullivan, H. (2020, November 23). US, Germany and UK could start Covid vaccinations as early as December. Retrieved November 26, 2020, from <https://www.theguardian.com/world/2020/nov/23/us-germany-and-uk-could-start-covid-vaccinations-as-early-as-december>

Williamson, L. (2020, July 6). Months after infection, many COVID-19 patients can't shake illness. Retrieved November 26, 2020, from <https://www.heart.org/en/news/2020/07/06/months-after-infection-many-covid-19-patients-cant-shake-illness>