January 6th-January 11th 2023 Winter *Stagnation* Event

The following passages are from MPCA's EnviroFlash Alerts from the corresponding days of the Stagnation Event that occurred primarily over northwest and central Minnesota in January 0f 2023. This event was likely the worst air stagnation event in Minnesota since 2005.

I thought they did a quick & succinct job of laying out what was happening during the event and illustrated some discrepancies in forecasting such an event.

If you wish to receive air quality alerts via email, you can subscribe to EnviroFlash at this link: https://www.enviroflash.info/signup.cfm

For more information on where you can find Air Quality Alerts, please keep an eye out on the FDL Air Program Website for the "Accessing Air Quality Alerts" document that lays out some great resources!

Thank you for your time!

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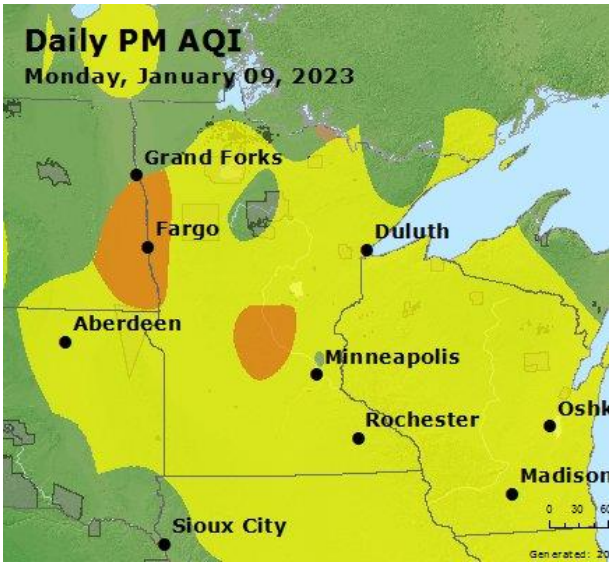
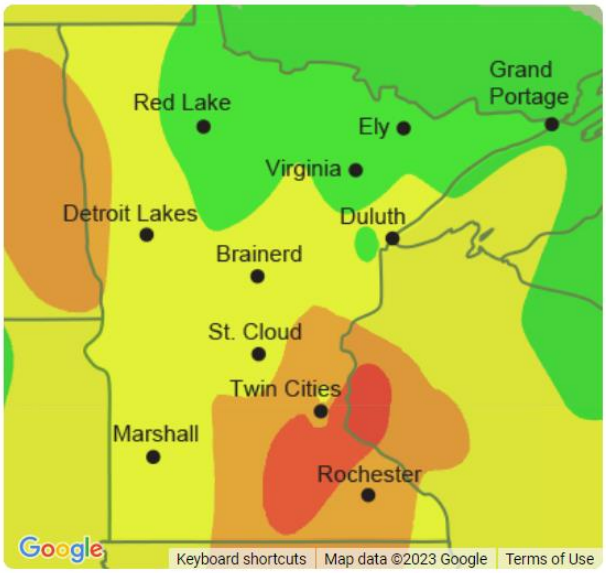
Fri, January 6, 2022: High pressure has built over the Upper Midwest. Light winds are making the atmosphere stagnate and fine particulate has crept up into **Yellow (Moderate)** in much of the state. The high pressure will remain camped over the area on Saturday and into Sunday morning before shifting east of the area late Sunday and Monday. Winds will be very light throughout the weekend and air quality **will be Yellow in the majority of Minnesota**. Better air quality will be found in northeast Minnesota where AQIs have **the best chance at remaining Green**. Winds will increase slightly later Sunday with the high shifting east and for Monday as a weak front passes through the area. Air quality *should improve* for Sunday afternoon and Monday and Tuesday, but with only a modest increase in winds AQIs may hang onto **Yellow in much of the area.**

Sat, January 7, 2022: High pressure centered over the Upper Midwest has *brought light winds and stagnation to the area.* Fine particulate has crept up into **Yellow (Moderate)** in much of the state, and has even reached **Orange (Unhealthy for Sensitive Groups) at times** around the Twin Cities Metro down to Rochester. The high pressure will remain camped over the area tonight and into Sunday morning before shifting east of the area late Sunday and Monday. Winds will continue to be very light throughout tonight and Sunday. **Air quality will be Yellow in the majority** of Minnesota with periods **Orange AQIs continuing tonight and Sunday morning** in the Metro and Rochester. **Better air quality will be found in northeast Minnesota where AQIs have the best chance at remaining Green**. Winds will increase slightly later Sunday with the high shifting east and for Monday as a weak front passes through the area. Air quality *should improve for Sunday afternoon and Monday and Tuesday*, but with only a modest increase in winds AQIs may **hang onto Yellow in much of the area.**

Mon, January 9, 2023: This morning **upgraded the forecast** to **Orange (Unhealthy for Sensitive Groups)** across central and northwestern MN. **This prompted the issuance of the first air quality alert in MN in 18 months**. The airmass over the state today has been very good at creating **PM25** The reasons are a **strong inversion, light winds, and temperatures near freezing**. With a strong inversion noted about 1km up in the atmosphere. This has trapped NOx near the surface. With surface wind speeds around 5mph the NOx are not dispersing. Even as winds gradually pick up tonight, the expected recirculation of these materials back over areas like the Twin Cities will take a while to bring relief. With temperatures around freezing the chemical transformation from NOx into PM25 is more efficient as extra water vapor is released into the boundary layer from the melting snowpack. The end result is that **have Orange AQI conditions over central and northwestern MN**. Conditions will gradually improve beginning Tuesday afternoon. The air quality alert will expire at noon, though **Orange may linger** a bit beyond that. By Wednesday flow will increase that should help limit the stagnation issues. **As such Yellow (Moderate) AQI is forecasted Wednesday** followed by **Green (Good) AQI on Thursday.**

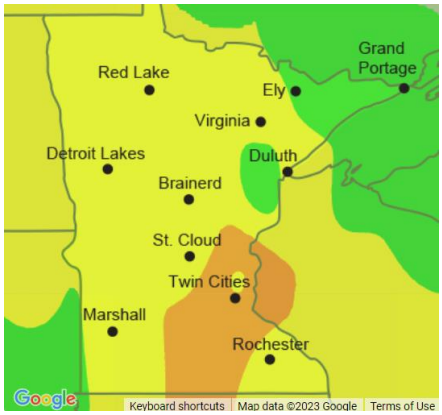


Tue, January 10, 2023: ***Extended the air quality alert until 6pm Wednesday this morning*.** Also upgraded the Twin Cities Metro and Moorhead into **the Red AQI (Unhealthy for All) Category**. A remarkable stagnation event is unfolding across MN. **This appears to be the worst stagnation event since 2005**. In large part this **is due to the combination of the warm temperature and extremely deep and water loaded snowpack**. That extra slug of moisture from the wet snow much of MN has seen has allowed for very efficient production of PM25. Conditions will largely stay as they are now through Wednesday afternoon. The feature to watch for will be the cold front. The previous alert expiration was based on the possibility of precip helping to settle some of the PM. That may still occur but weather models have been struggling with that system and regardless of the solution the surface manifestation is lackluster. This storm system is unlikely to



break the inversion and with the scant amount of precip expected it may even boost PM formation some with the extra moisture. Instead watching the surface cold front which clears the state around 6pm Wednesday. Weather model soundings show the inversion breaking with a fairly uniform 10mph wind. This will help dispersal. However on the AQI model side, CMAQ still **shows a blob of red over the Twin Cities at 6pm**. Decided to follow the meteorology on this one and timed the alert expiration for the frontal passage. Conditions will closely be monitored tomorrow and an extension of the alert will be possible across the Twin Cities if it looks like the front will take extra time to full scour out the inversion and fine particulates. Beyond Thursday the colder airmass will bring with it some more consistent flow and that will help dispersion. **Kept Yellow (Moderate) Thursday** as there may be some lingering **but Green (Good) should prevail starting Thursday evening.**

<u>Wed Jan 11, 2023 :</u> The air quality alert has been extended for the Twin Cities Metro until Midnight tonight. Another tricky forecast today. Yesterday **Apple Valley and St. Paul set a new record for winter stagnation events with readings in the upper-levels of the Red AQI Category**. Since then conditions have been slowly improving. As of this afternoon a cold front is about halfway across Minnesota. That feature will be the one to finally break this stagnation pattern. Observations upstream into North Dakota have shown that it has taken 3-4 hours for mixing to really start to disperse the fine particle pollution. With that in mind went back and used weather model data to get an idea of what an ideal sounding for atmospheric dispersion looks like. The HRRR and Euro have type of profile arrives on the MN/WI border by about 11pm so extended the alert until Midnight. As that front moves through there will likely be a spike due to surface convergence. Purple Air sensors area already showing that west of the Twin Cities. It should also be noted that these sensors can struggle with a lot of moisture in the air, so these observations are likely a little high. Regardless **orange will continue** in the current alert area until 6pm and then until Midnight across the Twin Cities Metro and surrounding counties. Beyond that conditions will improve tomorrow. The forecast is for **Yellow (Moderate) across the southern half of the state** with **Green (Good) across the northern**. Friday into Saturday **will be Green (Good) statewide**.

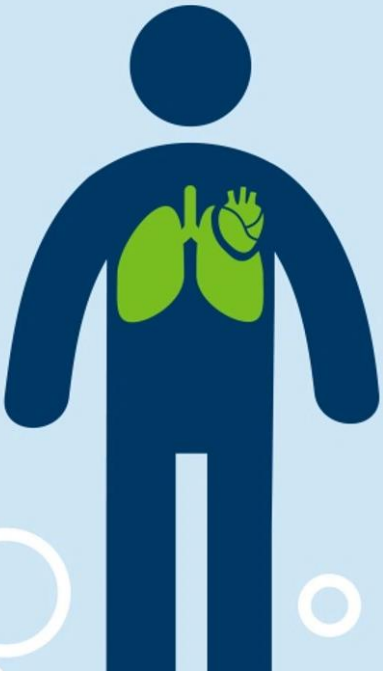


Fine particles
pollution can cause:

- Shortness of breath
- Wheezing, coughing
- Chest pain
- Fatigue

Fine particles can make these conditions **worse**:

- Cardiovascular and heart disease
- Asthma and COPD



Ground-level ozone
pollution can cause:

- Difficulty breathing deeply
- Shortness of breath
- Sore throat
- Wheezing, coughing
- Fatigue

Ozone can make these conditions **worse**:

- Asthma and COPD
- Emphysema