# How high will the emissions from an aluminum recycling plant go up into the atmosphere out of the disbursement stack if it is 100 ft tall and the climate is dry and warm

The height to which emissions from an aluminum recycling plant's stack will rise into the atmosphere depends on several factors, including the physical stack height, exit gas temperature, exit velocity, stack diameter, ambient wind speed, and atmospheric conditions such as temperature and stability.

For a 100-foot tall stack in a dry, warm climate, plume rise can significantly increase the effective height at which emissions are released. This effective height is the combination of the physical stack height plus the plume rise due to buoyancy and momentum of the hot exhaust gases.

Plume rise formulas, such as those developed by G.A. Briggs (1969), are commonly used to estimate this additional height. Key parameters include:

- Exit gas velocity and temperature (typically hotter than ambient air in a warm climate, causing buoyancy)
- Wind speed at stack height (typically moderate in warm climates)
- Stack diameter and exit conditions

In general, warm and dry conditions can enhance plume rise compared to cooler, more humid conditions because the buoyant hot gases rise more readily in warmer ambient air.

For a 100 ft (≈30 m) stack, typical plume rise from industrial stacks with moderate to high exit temperatures and velocities can add on the order of tens to over a hundred feet (meters) in effective stack height. For example, plume rise could add around 50 to 150 feet (15 to 45 meters) or more, depending on the exhaust heat and air velocity through the stack.

This means the emissions could be effectively dispersed at heights around 150 to 250 feet (45 to 75 meters) or higher above ground level in such a climate, promoting better dilution and dispersion of pollutants before they reach ground level.

Factors specific to aluminum recycling plants—such as large heat releases from scrap melting processes and dry scrubber stacks—may create plume merging and enhanced lift effects, contributing to higher plume rise beyond the physical stack height.

Overall, while the exact plume rise depends on specific operational parameters and local meteorology, a 100-foot stack in a dry, warm climate can be expected to have an effective emission release height on the order of 150 to 250 feet or more due to plume rise.

For precise assessment, detailed measurements or simulations using plume rise models including exhaust temperature, velocity, wind speed, and atmospheric stability are recommended. These models consider stack parameters and environmental conditions to calculate plume rise accurately for regulatory and environmental compliance purposes.

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# How high will the emissions from an aluminum recycling plant go up into the atmosphere out of the disbursement stack if it is 100 ft tall and the climate is cool and dry

In a cool and dry climate, the emissions from an aluminum recycling plant's 100-foot tall stack will have a different plume rise effect compared to a warm climate. Cooler ambient temperatures generally reduce the buoyancy of the hot exhaust gases, resulting in a smaller plume rise.

Plume rise depends on stack parameters such as exit gas temperature and velocity, wind speed, and atmospheric stability. In cool, dry climates:

- The temperature difference between stack gases and ambient air is larger, but the surrounding cooler air is denser, which tends to suppress the vertical rise somewhat.
- The dry atmosphere has little moisture to influence plume buoyancy through humidity effects.

Typically, the effective stack height (stack height + plume rise) in such climates may increase by a moderate amount, potentially on the order of 30 to 80 feet above the physical stack height for a 100 ft stack, depending on the exact parameters (gas exit velocity, temperature, and wind conditions).

Therefore, emissions would likely be dispersed effectively at heights around 130 to 180 feet or so above ground level.

To summarize:

- Physical stack height: 100 ft
- Approximate additional plume rise in cool, dry climate: 30 to 80 ft
- Effective emission release height: about 130 to 180 ft above ground

This smaller plume rise compared to warm climates is due to reduced buoyancy effects in cooler ambient air. Accurate determination requires specific operational and meteorological data and detailed plume rise modeling.

If you need more precise data or modeling advice, I can guide you on how to perform that calculation.

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