

Snow can spread and worsen the effects of pollutants in the environment

October 18 2022, by Ubong Eduok



Credit: AI-generated image ([disclaimer](#))

By October, autumn's arrival brings with it the promise of winter—and snow.

And with it comes a quieter world, thanks to [snow](#)'s ability to absorb noise. This is because the spaces between [snow crystals](#) limit sound

waves from bouncing around, creating a soundproofing effect.

Snow also adsorbs other matters it comes into contact with. Adsorption is when substances adhere on surfaces of materials (usually liquids or solids). The adsorptive properties of snow are the reason for some of its unique features, including its loosely bound crystalline porous structure with finely divided individually shaped flakes with large surface areas.

Its [dynamic changes](#) between ice and liquid states facilitate the absorption and release of pollutants, depending on prevailing surface and atmospheric conditions.

As an analytical material chemist with a research background in adsorption, I am interested in understanding how various materials—like snow—adsorb certain substances, like persistent organic and vehicular exhaust pollutants.

Snow and pollution

In the winter, snow becomes a superabsorbent for a wide range of [pollutants](#), including vehicular exhaust particulate matters, [persistent organic pollutants](#) (POPs), trace metals and [chlorides from road salts](#).

As snow subsequently moves around or melts, most of these pollutants find their way into underground pipes and aquifers.

POPs are some of the most dangerous pollutants because they remain active, lasting for several years within their environments before [finally degrading into other chemical forms](#). POPs, such as polychlorinated biphenyls, [organochlorine pesticides](#) and perflouroalkylated substances, have [severe environmental impacts](#).



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They are classified under the [Toxic Substances Management Policy as Track 1 substances in Canada](#), and are usually targeted for [environmental removal](#).

Just like POPs, very little is also known about how chemical pollutants from the exhausts of gasoline-powered vehicles interact with snow.

In Canadian cities, snow is moved around through various means, including [snow melts](#), during plowing, on tires of vehicles or even soles of pedestrian shoes. During transportation, changes in ground surface pressure and [ambient temperature](#) can also affect the adsorption rates of chemical pollutants on snow.

Research conducted in Québec has shown that snow adsorbs significant

amounts of organic pollutants and aerosol particles from exhaust pipes [within 30 minutes of exposure](#). These researchers also observed the adsorption of aerosol particles with larger particulate sizes (approximately 50-400 nm) relative to smaller nanoparticles (less than 50 nm).

Health effects

POPs are introduced into the environment through agricultural and industrial practices. Most of them may have come from other anthropogenic sources but are unintentionally released from simple events like [burning household waste](#).

Burning industrial, municipal or medical wastes can also release dioxins and furans. [Toxaphene](#) and [hexachlorobenzene](#) could originate from uncontrolled insecticide and pesticide waste disposal. Upon exposure during winter, these chemical pollutants find their way into the snow, then into surface water and up the food chain. They can adversely affect [aquatic life](#) when subsequently introduced into the aquatic ecosystems.

POPs and exhaust particulate matters can [affect human health](#). They can cause allergies, hypersensitivity, birth defects and neurological disorders. Most POPs are carcinogens. Some of them may alter the nervous systems, leading to chronic health conditions. POPs can also affect reproductive health and disrupt the immune system. Some particulate matters cause lung inflammation and increase the risk of blood clotting.

These severe impacts on [human health](#) and environment sustainability are why POPs are [currently regulated under the Stockholm Convention, as adopted by Canada in 2001](#).

Between applicable industries and environmental monitoring agencies, federal and provincial governments and us, everyone has a part to play.

All hands must be on deck in providing sustainable regulations for these pollutants. And as we approach winter, measures should be developed to reduce the amount of pollutants that can accumulate and persist in snow.

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