

Chemical Factsheet

Piperonyl butoxide (PBO)

General Information

- Fact Sheet: [Piperonyl Butoxide.pdf](#)
- Product Names:
 - Terro insect killer** (Senoret) formulated with [Pyrethrins](#), and [Permethrin](#)
 - Ortho Tomato & Vegetable Insect Killer** (Scotts) formulated with [Pyrethrins](#)
 - Repel-XP Emulsifiable Fly Spray** (Farnam) formulated with [Pyrethrins](#)
 - Wasp, Hornet, and Yellow Jacket Killer** (FMC) formulated with [Tetramethrin](#), and [Permethrin](#)
 - Purge** (FMC) formulated with [Pyrethrins](#)
 - Intruder Residual** (FMC) formulated with [Pyrethrins](#), and [Cyfluthrin](#)
 - Scourge** (Bayer) formulated with [Resmethrin](#)
 - Aquapy** (Bayer) formulated with [Pyrethrins](#)
 - Butacide** (Bayer)
 - Gordon's Wasp & Hornet Spray** (PBI/Gordon) formulated with [Tetramethrin](#), and [Permethrin](#)
 - Raid Flea Killer** (S.C. Johnson) formulated with [Pyrethrins](#), [Tetramethrin](#) and N-Octyl bicycloheptene dicarboximide
 - PT 565 Plus XLO** (BASF)
 - ExciteR** (Central Garden & Pet Company)
- Chemical Class: Pesticide synergist
- Uses: Preharvest and postharvest uses on crops, direct and indirect treatments of livestock animals and premises, treatments of commercial and industrial facilities and storage areas where raw and processed food/feed commodities are stored or processed, and mosquito abatement areas; targets ants, worms, beetles, mites, flies, gnats, spiders, weevils, caterpillars, grubs, moths, ticks, lice, wasps, aphids, midges, and fish.
- Alternatives: [Organic agriculture](#), [Least-toxic mosquito control](#)
- Beyond Pesticides rating: [Toxic](#)

Health and Environmental Effects

See citations at end of document.

- Cancer: Possible (1)
- Endocrine Disruption: Yes (2)
- Reproductive Effects: Yes (3)
- Neurotoxicity: Yes (3)
- Kidney/Liver Damage: Yes (4)
- Sensitizer/Irritant: Yes (4)
- Birth/Developmental: Not documented
- Detected in Groundwater: Not documented
- Potential Leacher: Not documented
- Toxic to Birds: Not documented
- Toxic to Fish/Aquatic Organisms: Yes (4)
- Toxic to Bees: Not documented

Residential Uses as Found in the ManageSafe™ Database

- [Mosquitoes](#)
- [Bed Bugs](#)
- [Carpet Beetle](#)
- [Centipedes](#)

Additional Information

- Regulatory Status:
 - [EPA Reregistration Eligibility Decision \(RED\)](#) signed (6/2006)
- Supporting information:
 - [Asthma, Children and Pesticides](#) (Beyond Pesticides)
 - [PAN Pesticides Database: PBO](#) (Pesticide Action Network)
- Studies [compiled from the [Pesticide-Induced Diseases Database](#)]
 - [Influence of pyrethroids and piperonyl butoxide on the Ca\(2+\)-ATPase activity of rat brain synaptosomes and leukocyte membranes.](#) Grosman, N. 2005. *Int Immunopharmacol.* 5(2):263-70.
 - [Global DNA methylation screening of liver in piperonyl butoxide-treated mice in a two-stage hepatocarcinogenesis model.](#) Yafune A, Kawai M, Itahashi M, et al. 2013. *Toxicol Lett.* 222(3):295-302
 - [Impact of Prenatal Exposure to Piperonyl Butoxide and Permethrin on 36-Month Neurodevelopment.](#) Horton, et al. 2011. *Pediatrics*, Online February 7, 2011 (doi:10.1542/peds.2010-0133)
 - [Occurrence of pesticide residues in indoor dust of farmworker households across Europe and Argentina.](#) Navarro, I., de la Torre, A., Sanz, P., Baldi, I., Harkes, P., Huerta-Lwanga, E., Nørgaard, T., Glavan, M., Pasković, I., Pasković, M.P. and Abrantes, N., 2023. *Science of The Total Environment*, p.167797.
 - [Organic farming reduces pesticide load in a bird of prey.](#) Fuentes, E. et al. (2024) *Organic farming reduces pesticide load in a bird of prey*, *Science of The Total Environment*. Available at: <https://www.sciencedirect.com/science/article/pii/S0048969724029255>.
 - [Exposure to pesticides, persistent and non – persistent pollutants in French 3.5-year-old children: Findings from comprehensive hair analysis in the ELFE national birth cohort.](#) Macheka, L. et al. (2024) *Exposure to pesticides, persistent and non – persistent pollutants in French 3.5-year-old children: Findings from comprehensive hair analysis in the ELFE national birth cohort*, *Environment International*. Available at: <https://www.sciencedirect.com/science/article/pii/S0160412024004677>.
 - [Advances and future prospects of pyrethroids: Toxicity and microbial degradation.](#) Singh, S. et al. (2022) *Advances and future prospects of pyrethroids: Toxicity and microbial degradation*, *Science of The Total Environment*. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0048969722016540>.
 - [Piperonyl butoxide, a synergist of pesticides can elicit male-mediated reproductive toxicity.](#) Bae, J.W. and Kwon, W.S. (2021) *Piperonyl butoxide, a synergist of pesticides can elicit male-mediated reproductive toxicity*, *Reproductive Toxicology*. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S0890623821000253>.
 - [A Review on Non-target Toxicity of Deltamethrin and Piperonyl Butoxide: Synergist.](#) Basak, Mrinmoy and Choudhury, Rejwan Ahmed and Goswami, Priyanka and Dey, Biplab Kumar and Laskar, Moksood Ahmed (2021) *A Review on Non-target Toxicity of Deltamethrin and Piperonyl Butoxide: Synergist*. *Journal of Pharmaceutical Research International*, <http://scholar.researcherseuropeans.com/id/eprint/323/>
 - [Pharmacokinetic analysis of acute and dietary exposure to piperonyl butoxide in the](#)

- [mouse](https://www.sciencedirect.com/science/article/pii/S2214750023001099). Jenkins, A. et al. (2023) Pharmacokinetic analysis of acute and dietary exposure to piperonyl butoxide in the mouse, *Toxicology Reports*. Available at: <https://www.sciencedirect.com/science/article/pii/S2214750023001099>.
- [Subacute oral toxicity of combinations of selected synthetic pyrethroids, piperonyl butoxide, and tetramethrin in rats](https://journals.sagepub.com/doi/abs/10.1177/0748233712469651). Yavuz O, Aksoy A, Das YK, et al. (2013). Subacute oral toxicity of combinations of selected synthetic pyrethroids, piperonyl butoxide, and tetramethrin in rats. *Toxicology and Industrial Health*. <https://journals.sagepub.com/doi/abs/10.1177/0748233712469651>
 - [Monitoring the aquatic toxicity of mosquito vector control spray pesticides to freshwater receiving waters](https://doi.org/10.1002/ieam.1534). Phillips, B. M., Anderson, B. S., Voorhees, J. P., Siegler, K., Denton, D., TenBrook, P., Larsen, K., Isorena, P., & Tjeerdema, R. S. (2014). Monitoring the aquatic toxicity of mosquito vector control spray pesticides to freshwater receiving waters. *Integrated environmental assessment and management*, 10(3), 449–455. <https://doi.org/10.1002/ieam.1534>
 - [American Healthy Homes Survey: A National Study of Residential Pesticides Measured from Floor Wipes](https://doi.org/10.1021/es8030243). Stout, D. M., 2nd, Bradham, K. D., Egeghy, P. P., Jones, P. A., Croghan, C. W., Ashley, P. A., Pinzer, E., Friedman, W., Brinkman, M. C., Nishioka, M. G., & Cox, D. C. (2009). American Healthy Homes Survey: a national study of residential pesticides measured from floor wipes. *Environmental science & technology*, 43(12), 4294–4300. <https://doi.org/10.1021/es8030243>
 - [Pesticide contamination in indoor home dust: A pilot study of non-occupational exposure in Argentina](https://doi.org/10.1016/j.envpol.2025.126208). Aparicio, Virginia & Kaseker, Jessica & Scheepers, Paul & Alaoui, Abdallah & Figueiredo, Daniel & Mol, H. & Silva, Vera & Harkes, Paula & dos Santos, Danilo & Geissen, Violette & Costa, José. (2025). Pesticide Contamination in Indoor Home Dust: A Pilot Study of Non-Occupational Exposure in Argentina. *Environmental Pollution*. 373. 126208. [10.1016/j.envpol.2025.126208](https://doi.org/10.1016/j.envpol.2025.126208).
 - [Monitoring of Non-Maximum-Residue-Level Pesticides in Animal Feed: A Study from 2019 to 2023](https://doi.org/10.3390/toxics12090680). Giugliano, R., Armenio, V., Savio, V., Vaccaro, E., Ciccotelli, V., & Vivaldi, B. (2024). Monitoring of Non-Maximum-Residue-Level Pesticides in Animal Feed: A Study from 2019 to 2023. *Toxics*, 12(9), 680. <https://doi.org/10.3390/toxics12090680>
 - [In Vitro Evaluation of the Combined Toxicity of Pirimiphos-methyl and Piperonyl Butoxide](https://doi.org/10.1590/0001-3765202520241526). Campos, F. et al. (2025). In Vitro Evaluation of the Combined Toxicity of Pirimiphos-methyl and Piperonyl Butoxide. *Anais da Academia Brasileira de Ciencias*, 97(4), e20241526. <https://doi.org/10.1590/0001-3765202520241526>
 - [High temporal resolution pollen analysis: New insights into current-use pesticides distribution in agricultural landscapes](https://www.sciencedirect.com/science/article/pii/S0269749126007189). Cirelli, S. et al. (2026) High temporal resolution pollen analysis: New insights into current-use pesticides distribution in agricultural landscapes, *Environmental Pollution*. Available at: <https://www.sciencedirect.com/science/article/pii/S0269749126007189>.

Gateway Health and Environmental Effects Citations

1. US EPA, Office of Prevention, Pesticides and Toxic Substances, Reregistration Eligibility Decisions (REDs), Interim REDs (iREDs) and RED Factsheets.

<https://archive.epa.gov/pesticides/reregistration/web/html/status.html>.

2. European Commission. Endocrine Disruptors: Study on Gathering Information on 435 Substances with Insufficient Data. Final Report. EU DG Environment: B4-3040/2001/325850/MAR/C2. BKH Consulting Engineers: M0355037. November 2002.

http://ec.europa.eu/environment/chemicals/endocrine/pdf/bkh_report.pdf#page=76.

3. Northwest Coalition for Alternatives to Pesticides (NCAP), Pesticide Factsheets.

<http://www.pesticide.org/pesticide-factsheets>.

4. Beyond Pesticides ChemWatch Factsheets. (Cited under factsheets on [Beyond Pesticides Gateway](#); see top of individual chemical page)

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