A real Plan B Case Review. Every name, place, date and identifying detail has been changed.

Sam’s home environment

This is everything we found today about the house, the water and the fields around you: the mold, what has been sprayed nearby for ten years and on which dates it was worst, what the research done in farming communities says, and what to do next. It is information to discuss with Sam’s doctors, not a diagnosis.

The short version. Sam carries three loads at home: **hidden mold** (the house tested positive, the source was never found, and his own mold antibodies rose from 2024 to 2026), **farm spraying** (a steady background since before he was born), and **uranium in the city water** (small, but easy to remove). The mold is the main suspect for his flares, alongside infections. He does better away from home, which fits. The first steps are finding the mold, a structured away trial, and lowering the load in the house now.

Sam's timeline, before birth to now

From his records, today's call and the state spray records. Please correct anything that's off: this is your family's story and you know it best.

Life · Regression / flare · Treatment · Test / visit · Environment

2015–2016	ENVIRONMENT Chlorpyrifos sprayed on the farm field in your own square mile, about 670 lb a year (late August). It stops before the pregnancy and is phased out statewide in 2020.
Nov 2017	ENVIRONMENT About 20,000 lb of 1,3-D (a soil fumigant gas) applied 1.1 miles away before planting a new field.
Oct 11–12, 2018	ENVIRONMENT About 21,000 lb of 1,3-D applied 1.2 miles away, the largest in ten years, a few weeks before conception.
Nov 2018	ENVIRONMENT About 11,000 lb of metam-potassium (fumigant) on row-crop fields 1.7 miles away, early in the pregnancy. Pregnancy itself: "perfect."
Birth	LIFE Sam is born at term, big and healthy.
Oct 2019–Feb 2020	TEST / VISIT Baby vaccines (Oct 8, Dec 24, Feb 25).
Oct 11, 2019	ENVIRONMENT About 16,000 lb of 1,3-D applied 2.6 miles away when he is 2 months old. 2019–20 is the decade's peak year for glyphosate and DCPA within 5 miles.
Apr–May 2020	REGRESSION / FLARE Age 8–9 months: he and others in the household sick for 1–1½ months (ear and throat infection, cough, diarrhea; never identified). Amoxicillin Apr 15–May 27. A quiet spray month.
Mid 2020	REGRESSION / FLARE Sleep changes (awake at night), then stops responding to his name.
Aug 2020	REGRESSION / FLARE Age 1: stops eating overnight. Eats only a few foods for weeks (oatmeal among them). Loses weight. Yeast rash treated.
Oct 7, 2021	REGRESSION / FLARE Hep A and chickenpox shots. 2–3 days later his play becomes repetitive. Heavy fumigation season 2–3 miles away.
Oct 22, 2021	TEST / VISIT University developmental clinic: autism and global developmental delay. "There has been regression" (lost early gestures). A handful of words.
2021–2023	TREATMENT ABA 40 hours a week for a year: "it just got worse." Every illness brings a regression; words come and go, then all are lost. Amoxicillin again (several courses, the last Jun–Aug 2023).

~2022	TREATMENT	Age 3: covering ears and sound sensitivity appear. Nemechek protocol (fish oil, olive oil, inulin): “the fog lifted” for 3 months. Organic food, new water filter, first mold testing.
Mar 2023	REGRESSION / FLARE	Cough and wheeze: albuterol inhaler.
Jun 2023	TEST / VISIT	Hair test: uranium about 7 times the top of normal (city well water).
~Mid 2023	REGRESSION / FLARE	Almost 4: aggression begins.
Sep 2023–Mar 2024	TREATMENT	An integrative doctor: Neural Zoomer (Oct), Cunningham panel (Nov, high), mold toxins high (Nov, Jan), urine glyphosate above the 95th percentile (Nov), IGeneX (Dec). Supplements, charcoal binder, BioCidin, nystatin. Small improvement.
2023–24	TREATMENT	Itraconazole, half dose, 5 days: clearer but worse behavior; stopped. Amoxicillin 10 days then nystatin: calmer.
Mid 2024	TREATMENT	Byron White A-BAB and A-Bar herbs, 6–8 months: starts trying new foods.
~Jun 2024	TREATMENT	About six weeks of treatment abroad (diet changes and IV therapies). Comes home calmer, eating more, less stimming. Still no speech.
Jul–Aug 2024	TEST / VISIT	Exome and microarray: normal. Genetics doesn’t explain it.
Sep 2024	TEST / VISIT	Mold-toxin antibodies: all 14 positive.
Nov 2024	TEST / VISIT	MRI for “developmental skill loss”: a few small white-matter spots, sinus thickening.
Early 2025	TREATMENT	Chiropractic intensive: some words come, then are lost.
~Apr 2025	REGRESSION / FLARE	A family loss; another round of treatment abroad. He loses most of what he had gained. Strep and staph on swabs; Lyme and Babesia IgM positive (IGeneX). Augmentin.
Mid 2025	TREATMENT	A PANS specialist. Tonsils removed. Steroids: “better every day.”
Sep 3, 2025	TEST / VISIT	Immune tests normal (IgG and subclasses, complement). Interferon-gamma high, CD57 cells low, ferritin 21.
Sep 2025–Apr 2026	TREATMENT	IVIG monthly. #1: calm within 2 hours. #2–4: “horrible.” #5: “my son is coming back.” #6: steady. #7: April.

Jan 2026	TEST / VISIT	Mold-toxin antibodies higher than 2024; his own IgE up (Stachybotrys family, Penicillium, Cladosporium).
Feb 2026	TEST / VISIT	Stool calprotectin 213 (gut inflammation).
Apr 2026	TREATMENT	Ketotifen and LDN start. Probiotic "transplants" by enema 2–3 times a week; he starts refusing; behavior builds up.
Late Apr 2026	REGRESSION / FLARE	Full flare: rage, not eating, covering ears.
May 2, 2026	TREATMENT	Antibiotic started (28-day course): "2 hours later he's back."
May 12, 2026	LIFE	Plan B case-study call. Next: find the mold, away trial, daily tracking.

> **What the timeline shows:** every big drop followed an infection or an immune hit (the 8-month illness, the October 2021 shots, the spring of 2025), and every big gain followed treating infections, inflammation or the gut (antibiotics, steroids, herbs, treatment abroad, IVIG). Meanwhile the house and the fields have been there the whole time.

1. The mold

- **House:** ERMI test positive; mold dog, AC ducts and opened walls never found the source.
- **Sam, Nov 2023 urine:** ochratoxin 31 (normal under 7.5), aflatoxin 7.35 (under 0.5), mycophenolic acid 53.8 (under 37.4). Jan 2024: ochratoxin, trichothecenes (the Stachybotrys "black mold" family), gliotoxin and zearalenone all present.
- **Blood mold-toxin antibodies (MyMycoLab):** all positive in September 2024, and in January 2026 most were higher. IVIG adds donor IgG, but it carries almost no IgE, and his own IgE rose for the Stachybotrys family (verrucarin, satratoxin), Penicillium (mycophenolic acid) and Cladosporium. That pattern fits ongoing exposure.
- He gets clearer but also worse on itraconazole, and does better away from the house.

2. The best mold investigators to call

These investigators helped write the inspection standards that mold-illness doctors use. (Their names, firms and contact details were given to the family in the original report and are removed here.)

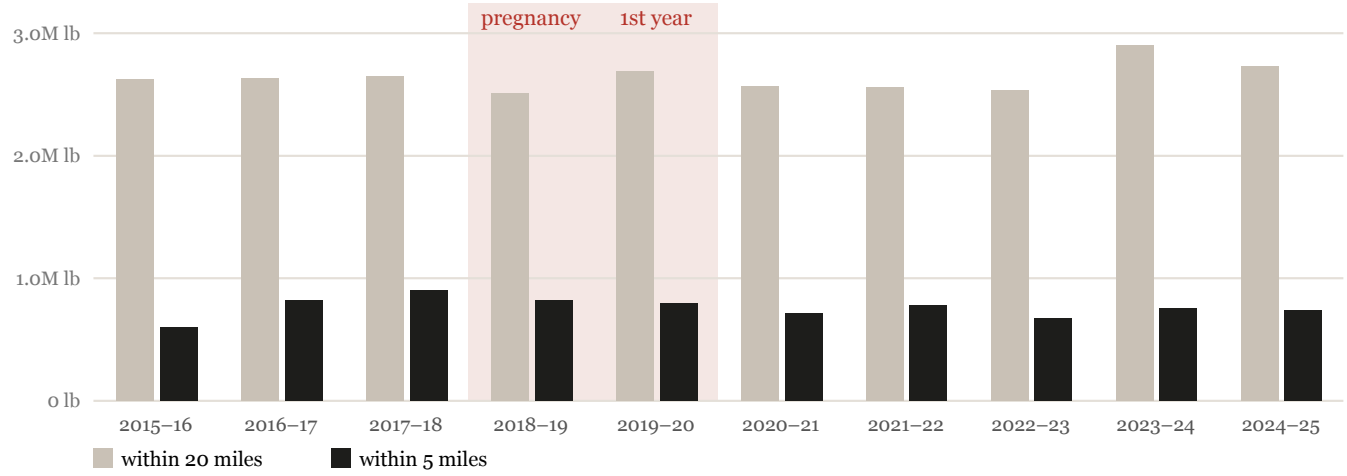
1. **Investigator A**, a veteran consultant a few hours' drive away, who developed a "pathways" method for hidden mold that nobody can find. Ask whether he or his team does the visit.
2. **Investigator B**, an ISEAI board member in another state: video consults first, then guides a local inspector or travels.
3. **Investigator C**, who wrote a chapter in a standard mold-illness textbook. Video consults and referrals.
4. **Investigator D**, on the ISEAI inspector committee, about 2 hours away. His company also does repairs: use him to find the problem and a different company to fix it.

Send them first: the ERMI report with the full species list; every past inspection report (where the dog alerted, which walls were opened); photos of bathrooms, laundry, under sinks, around toilets, windows, attic and the AC unit; Sam's mold labs; and "he does better away from home."

Where hidden mold hides in a house like this: outside walls where sprinklers hit them; under flooring along the foundation edge; shower pans; behind toilets, the dishwasher and the fridge water line; the washing machine and water-heater closet; the AC air handler, drain pan and condensate line; attic ducts and roof; window frames with condensation.

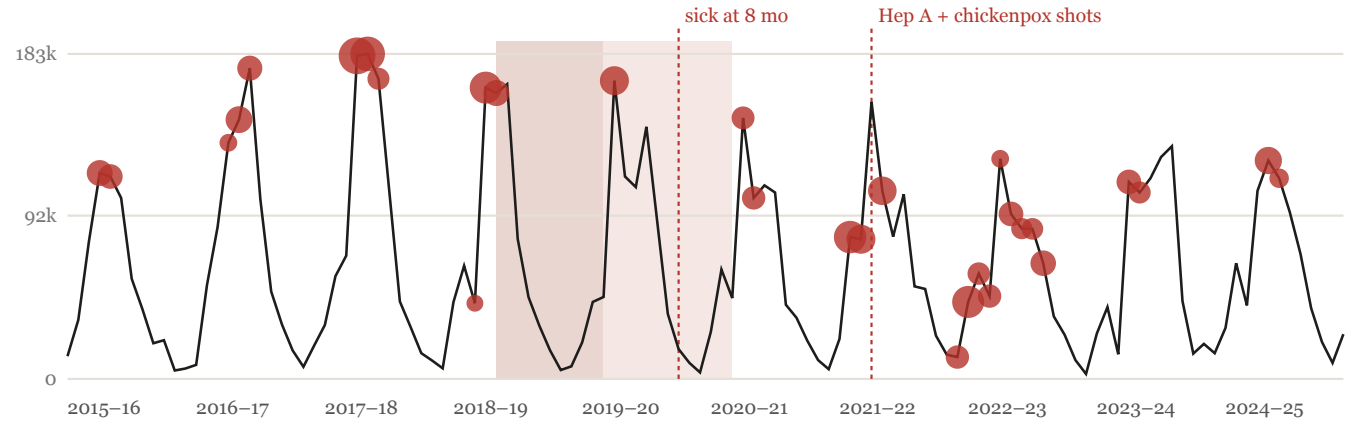
3. What has been sprayed near the house, 2015–2025

From the state's own pesticide records (every farm reports by square mile), for every section within 20 miles of the home. Most farmland right around the house is one perennial crop; row-crop fields start 1–2 miles out. 2024–25 is the latest year published. *(For privacy, each "year" below is a 12-month span moved with the rest of the dates, and pounds are rounded.)*



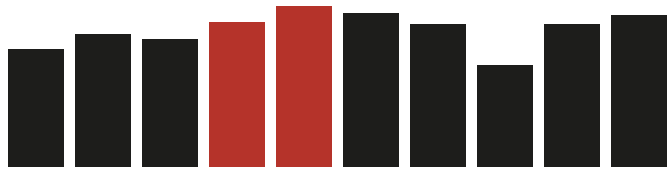
About **2.5–2.9 million pounds a year within 20 miles** and **600,000–900,000 within 5 miles**. Most of the volume is sulfur and oils on the main nearby crop. Pink = the pregnancy year and his first year.

Month by month within 5 miles (red dots = fumigant gas applications)

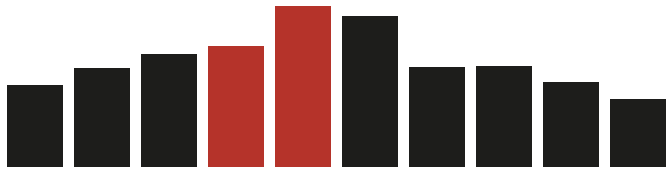


The chemicals that matter most for a developing child, within 5 miles, by year (red = 2018–19 pregnancy and 2019–20 first year)

Glyphosate (Roundup) peak 32k lb/yr



DCPA / Dacthal (EPA-suspended 2024) peak 19k lb/yr

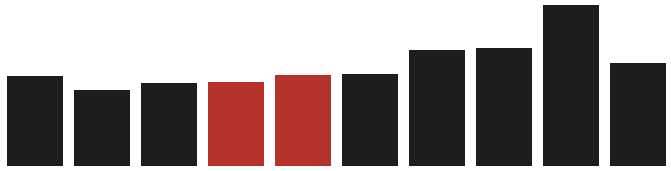


Mancozeb (manganese fungicide) peak 19k lb/yr



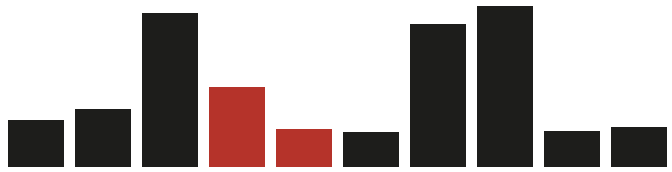
2015–16 2024–25

Organophosphate insecticides & bensulide peak 46k lb/yr



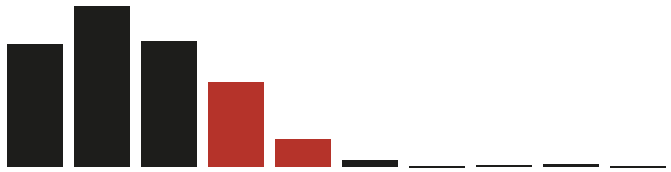
2015–16 2024–25

Fumigant gases (1,3-D, metam) peak 68k lb/yr



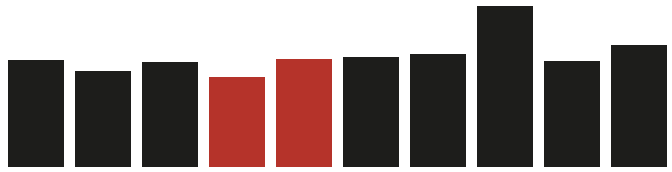
2015–16 2024–25

Paraquat peak 10k lb/yr



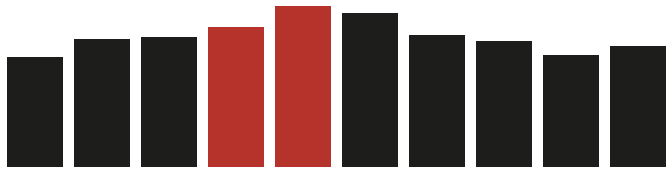
2015–16 2024–25

Carbamates (methomyl etc.) peak 16k lb/yr



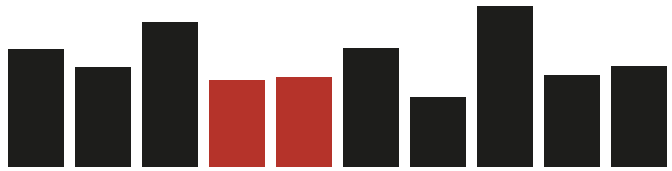
2015–16 2024–25

Pyrethroids peak 5k lb/yr



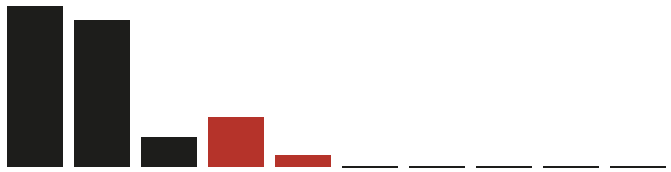
2015–16 2024–25

Neonicotinoids peak 7k lb/yr



2015–16 2024–25

Chlorpyrifos (phased out statewide 2020) peak 2k lb/yr



2015–16 2024–25

Glyphosate and DCPA (Dacthal) both peaked in 2019–20, his first year of life. DCPA is the weedkiller the EPA suspended in August 2024 because of risk to babies in the womb. Chlorpyrifos was sprayed on your own square mile in 2015–2016 (about 670 lb a year), then dropped to almost nothing before the pregnancy, and was phased out statewide in 2020.

4. When it was worst: dates

Around Sam's life (pounds, not counting sulfur and oils)

Window	Concern chemicals, 1.5 mi	Concern chemicals, 3 mi	Sulfur, 3 mi	Biggest
Pre-conception (Jul–Oct 2018)	28,400	51,800	25,600	1,3-Dichloropropene, Glyphosate potassium salt, Mancozeb, Chlorthal-Dimethyl
Pregnancy (Nov 2018–Aug 2019)	19,700	91,400	115,000	Potassium N-Methyldithiocarbamate, Bensulide, Fosetyl-Al, Glyphosate potassium salt
Birth to 8 mo (Aug 2019–Mar 2020)	23,700	111,000	69,900	1,3-Dichloropropene, Bensulide, Fosetyl-Al, Mancozeb
8-month illness (Apr–May 2020)	2,960	10,100	580	Fosetyl-Al, Burkholderia sp. strain A396 (biological), Glufosinate-Ammonium, Chlorthal-Dimethyl
Around Oct 2021 shots (Sep–Nov 2021)	4,780	44,600	46,200	Potassium N-Methyldithiocarbamate, 1,3-Dichloropropene, Mancozeb, Bensulide

The 8-month illness (Apr–May 2020) came in one of the quietest spray periods of the year. The fall of 2021, around the October shots and the diagnosis, had heavy soil fumigation 2–3 miles away (metam-potassium and 1,3-D).

The biggest fumigant (soil gas) weeks within 3 miles

Week	Pounds	Main chemicals (lb)
Oct 11 – Oct 17, 2018	21,000	1,3-Dichloropropene 21,000, Glyphosate isopropylamine salt 440, Mancozeb 360, Fosetyl-Al 320
Nov 4 – Nov 10, 2017	20,000	1,3-Dichloropropene 20,000, Fosetyl-Al 740, Boscalid 260, Glyphosate potassium salt 260
Oct 21 – Oct 27, 2017	18,000	1,3-Dichloropropene 13,000, Potassium N-Methyldithiocarbamate 4,900, Fosetyl-Al 460, Bensulide 270
Oct 11 – Oct 17, 2019	16,000	1,3-Dichloropropene 16,000, Fosetyl-Al 1,100, Bensulide 300, Chlorthal-Dimethyl 270
Aug 6 – Aug 12, 2021	14,000	Potassium N-Methyldithiocarbamate 14,000, Glyphosate potassium salt 820, Pendimethalin 190, Propyzamide 150
Jul 31 – Aug 6, 2022	10,000	Potassium N-Methyldithiocarbamate 10,000, Thiophanate-Methyl 140, Glyphosate potassium salt 100, Pendimethalin 96
Jul 8 – Jul 14, 2022	9,900	1,3-Dichloropropene 9,900, Glyphosate potassium salt 110, Glufosinate-Ammonium 75, Pendimethalin 60
Oct 23 – Oct 29, 2015	8,700	Potassium N-Methyldithiocarbamate 8,700, Fosetyl-Al 520, Methomyl 240, Mancozeb 240

The worst weeks for chemicals of concern within 1.5 miles

Week	Pounds	Main chemicals (lb)
Jun 1 – Jun 7, 2024	3,200	Bensulide 2,900, Glyphosate isopropylamine salt 270, Glufosinate-Ammonium 150, Glyphosate potassium salt 140

Week	Pounds	Main chemicals (lb)
Dec 23 – Dec 29, 2016	3,000	Potassium N-Methyldithiocarbamate 2,800, Pendimethalin 1,600, Glufosinate-Ammonium 750, Paraquat Dichloride 300
Aug 19 – Aug 25, 2016	2,900	Glyphosate potassium salt 1,600, Chlorpyrifos 800, Glufosinate-Ammonium 430, Oxyfluorfen 420
Jan 17 – Jan 23, 2022	2,100	Bensulide 1,400, Glyphosate potassium salt 1,300, Propyzamide 160, Mancozeb 150
Aug 25 – Aug 31, 2015	1,900	Chlorpyrifos 1,200, Mancozeb 390, Pendimethalin 260, Glyphosate potassium salt 200
Jan 25 – Jan 31, 2024	1,600	Bensulide 1,100, Mancozeb 810, Glyphosate potassium salt 790, Glufosinate-Ammonium 260
Feb 5 – Feb 11, 2018	1,500	Bensulide 900, Imidacloprid 420, Glufosinate-Ammonium 330, Mancozeb 300
Sep 20 – Sep 26, 2015	1,500	Fosetyl-Al 1,000, Chlorthal-Dimethyl 690, Methomyl 460, Pendimethalin 350

The heaviest sulfur weeks within 1.5 miles (airway irritant; October–January every year)

Week	Pounds of sulfur within 1.5 miles
Dec 11 – Dec 17, 2024	15,000
Dec 15 – Dec 21, 2023	14,000
Dec 11 – Dec 17, 2020	12,000
Nov 25 – Dec 1, 2018	11,000
Dec 7 – Dec 13, 2016	9,900
Dec 6 – Dec 12, 2017	9,800
Nov 23 – Nov 29, 2021	9,400
Dec 7 – Dec 13, 2022	9,300

About 1 in 4 nearby records were applied by aircraft, which drifts farther than ground spraying.

5. What the research done in farming communities says

- **Sulfur and breathing (closest match to your house).** In a long-running birth-cohort study of children in a farming community, 10 times more sulfur within about half a mile was linked to about 3.5 times the odds of using asthma medicine and twice the respiratory symptoms, plus lower lung function (Raanan 2017). A 2024 study in a second farming community found the same. The sulfur around your house is roughly 7 times that study's "high" level. Sam used an albuterol inhaler for cough and wheeze in 2023, and his 2024 MRI showed sinus thickening.
- **Mancozeb puts manganese into house dust.** Manganese fungicides within about 2 miles raised manganese in house dust and in children's teeth, and dust metals varied by area and soil type. The health effects found were small and mixed.
- **Glyphosate gets indoors.** Farm glyphosate within about 2.5 miles doubled glyphosate in house dust. In the farm cohort, childhood glyphosate exposure was linked to liver-enzyme changes and metabolic syndrome at 18. Sam's urine glyphosate (Nov 2023) was above the 95th percentile.
- **Organophosphates in pregnancy** were linked to lower IQ and more breathing symptoms in farm-cohort children. Near your house these have mostly been bensulide, acephate, dimethoate and naled; chlorpyrifos stopped before the pregnancy.
- **Autism.** Large statewide studies link pesticides near home in pregnancy and the first year to higher autism odds, but the largest one did not include your county, and the strongest findings were for chemicals (chlorpyrifos, certain row-crop fumigants) that were barely used near your house. So this evidence applies only partly.
- **Immune system.** Early-life pesticide exposure has been linked to more inflammation and weaker natural killer cells in reviews of children. Sam's CD57 natural killer cells were low in September 2025. No study has looked at pesticides and PANS.

> These are averages across many children; no study can say what happened to one child. For Sam, the spraying is best understood as a **steady background load** that adds to the mold and the infections, not the single cause.

5b. Does the spraying show up in Sam's own labs?

Short answer: the research makes spraying a likely background exposure, but his own labs show it only weakly. The mold shows up far more strongly.

Lab	Result	Does it point to spraying?
Urine glyphosate, Nov 2023	4.1, above the 95th percentile (2.5)	Yes, it's in his body. But it can't say where from: glyphosate also comes from food, especially non-organic oats, and oatmeal is one of his safe foods. Drift, house dust and diet all fit.
Urine glyphosate, Oct 2025	2.0 ppb (different lab and units)	Still detectable; can't be compared to 2023.
Hair manganese, Jun 2023	0.43, top of normal (0.10–0.50)	Weak. Mancozeb raises manganese in local house dust, but hair picks up metals from the outside and his level is still in range.
Hair copper, Jun 2023	33, high (11–18)	Weak. Copper fungicides are used nearby (about 1,000 lb a year within a mile), but water pipes and other sources fit too.

Lab	Result	Does it point to spraying?
Hair uranium, Jun 2023	About 7 times normal	No: this is the city well water (section 6).
Wheeze and inhaler (2023); sinus thickening (2024 MRI)	—	Fits the sulfur research, but fits mold and allergy just as well.
CD57 cells low, interferon-gamma high, stool calprotectin high	—	Not specific: mold, Lyme and viruses explain these as well as pesticides.

Never tested: the chemicals the research worries about most: organophosphates (bensulide, acephate, dimethoate, naled), pyrethroids, and DCPA. For those, we simply don't know yet.

> **Compared with mold.** Mold: urine ochratoxin 4 times the limit and aflatoxin 15 times, Stachybotrys-family toxins present, antibodies rising with his own IgE up, a positive house test, and better away from home: **strong and repeated**. Spraying: one high glyphosate result that may partly come from food, plus weak hair signals: **real, but thin**. Glyphosate is the only farm chemical confirmed in Sam. Spraying is a likely background load, not a proven driver.

How to find out whether the spraying is reaching him

1. Switch his staples to organic first (oats, peanut butter, berries, apples) for 2–3 weeks, so food doesn't muddy the next test.
2. Urine pesticide panel twice: once in November–December (heavy spraying) and once in May–June (quiet). An environmental toxin panel such as Mosaic's covers organophosphate breakdown products, a pyrethroid marker, 2,4-D and glyphosate. If his levels rise with the spray season while his food is organic, the drift is reaching him.
3. His airways: log coughing and wheezing in the tracker alongside spray days, especially October–January sulfur season, and bring the pattern to his doctor.

6. The water

The city's water comes from wells. Its most recent annual water-quality report lists uranium at about 5 pCi/L: under the legal limit (20) but more than 10 times the state's public health goal. Sam's hair uranium (Jun 2023) was about 7 times the top of normal. Your whole-house filter likely doesn't remove uranium or nitrate; reverse osmosis does, along with most pesticide residue.

1. **Frizzlife PD600-TAM3** (tankless): independent testing found at least 90% uranium removal. Best value.
2. **iSpring RCC7AK** or **Waterdrop G3P600**: certified to NSF/ANSI 58 (the reverse-osmosis standard).
3. **Kinetico K5** or **Culligan Aqua-Cleer** through a local dealer: installed and serviced; ask for the Performance Data Sheet and check uranium is on it.

Use the RO tap for everything that goes in his mouth (water, cups, ice, cooking water for rice, oats and pasta). Showers are fine. Test the kitchen tap for uranium, nitrate and 1,2,3-TCP before and after with a state-certified lab.

7. Lowering the load now

1. **Shoes off at the door.** A study of 168 farm-area homes found more pesticide in house dust near fields and where shoes stayed inside.
2. **Wet-mop and HEPA-vacuum** where he plays and sleeps, weekly or more. Both manganese and glyphosate travel indoors in dust.
3. **Spray-notice alerts for your address** (the state's spray-notice service). On spray days keep windows shut and the purifiers on high. Not every spray is listed, so plan around sulfur season (October–January) and dormant sprays (July–August) too.
4. **Air filters:** you already have HEPA purifiers; a good HEPA unit in every room he spends time in, filters changed every 3–4 months rather than by the reader, is the strongest version.
5. **Build box-fan air filters for every other room** (about $70–100 each). This is the Corsi-Rosenthal box, designed by air scientists and tested by universities; it cleans air about as well as expensive purifiers.

   > **You need:** one 20-inch box fan (a newer one, with a safety label and fuse), four or five 20×20×2-inch MERV-13 furnace filters, and strong duct tape. A piece of cardboard if you use four filters.
   >
   > Stand four filters on edge in a square, with the airflow arrows on the filters pointing inward. Put the fifth filter (or cardboard) on the bottom.
   >
   > Set the box fan on top, blowing up and out (air pulled in through the filters, out through the fan). Tape every seam so air can't sneak around the filters. Cut a cardboard ring to cover the fan's corners so air only goes through the round blade area.
   >
   > Run it on medium or high whenever someone's in the room, and on spray days. Replace the filters every 3–6 months, or sooner if they look gray.
   >
   > **Safety with Sam:** put it where he can't reach the fan or chew the filters, unplug when no one's home, and keep it off carpet edges and away from water.
6. **Organic for his staple foods:** peanut butter, oats, berries, apples. Non-organic oats are a common source of glyphosate, and peanuts and oats can also carry mold toxins (aflatoxin, ochratoxin).
7. **Reverse osmosis** for drinking and cooking water (section 6).
8. **Track daily in the Plan B app:** his symptoms, plus coughing or wheezing, spray days you see or smell, and any time away from home. Patterns show up within weeks.

8. Could the spraying have set him off? Our working hypothesis

This is a hypothesis, not a finding. No test can prove it for one child. Here is how we think the pieces fit, and why.

1. **Before he was born, the load was already building.** You lived in the house during the pregnancy, and the house tests positive for mold today. The heaviest soil-fumigant application in ten years (about 21,000 lb of 1,3-D, 1.2 miles away) happened a few weeks before conception, and metam-potassium was applied 1.7 miles away early in the first trimester. Mancozeb, glyphosate, DCPA and organophosphate weedkillers were applied nearby throughout.
2. **His first year** was the heaviest year of the decade for glyphosate and DCPA within 5 miles, and another large fumigation (about 16,000 lb, 2.6 miles away) came when he was 2 months old. In studies, this kind of early-life exposure is linked to more inflammation, weaker natural killer cells and more ear infections in children.
3. **Then the trigger: the infection at 8 months.** He and others at home were sick for a month or more with ear and throat infections, cough and diarrhea, and he needed amoxicillin. The sleep changes, losing response to his name, and then the sudden food restriction at one year followed. That illness came in a quiet spray month, so the spraying was not the trigger itself.
4. **After that, every new hit set off a new cycle:** the October 2021 shots (with heavy fumigation 2–3 miles away), illnesses during ABA, and a family loss with another round of treatment abroad in 2025. Each time, antibiotics, steroids or IVIG brought him partway back.

> **In one sentence:** mold in the house and farm chemicals in the air, water and dust likely loaded his immune system from before birth, so that an ordinary infection at 8 months tipped him into a cycle he hasn't been able to clear, and the house keeps refilling the bucket. If that's right, lowering the load (finding the mold, the away trial, the steps in section 7) should make every other treatment work better and last longer. The away trial and daily tracking are how we find out.

9. Should he move?

That is your family's decision, and here is how to make it with data instead of guesswork:

1. **Run a real away trial now:** 2–4 weeks somewhere newer and dry, away from farm fields, tracking him every day in the app before, during and after. A clear, fast improvement while away, and slipping back on return, points to the house. No change in one week does not rule it out.
2. **At the same time, get the investigator in** (section 2). If the source is found and can be properly removed and the house re-tested clean, staying may work.
3. **If he is clearly better away** and the source can't be found or fixed, moving is the most reliable fix. Look for a newer, dry house at least a mile from farm fields (ideally upwind), and test it (ERMI or HERTSMI-2) before you move in.

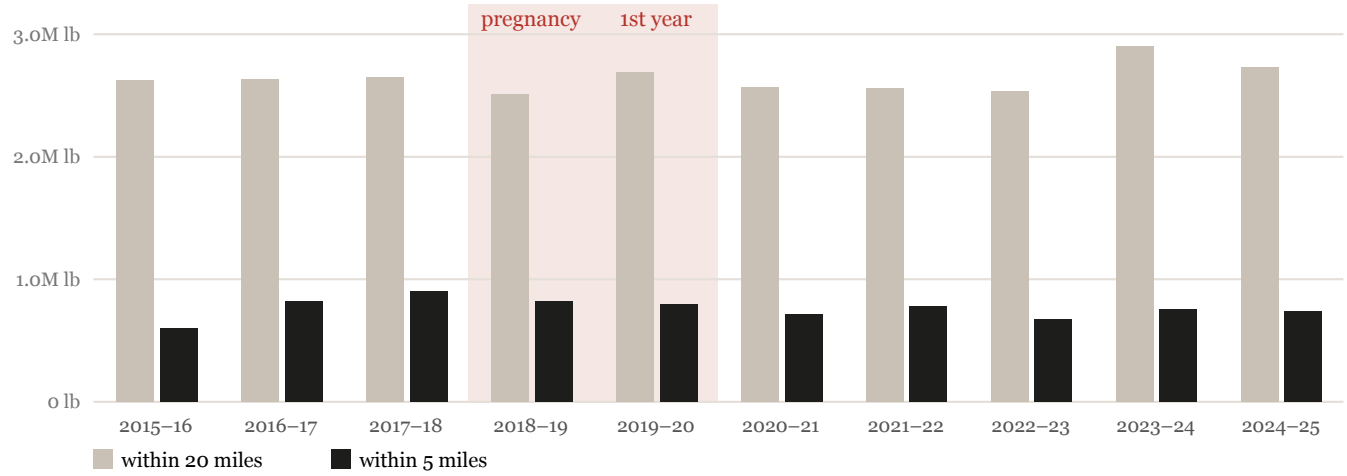
The away-trial tracking also gives everyone in the family the evidence to see for themselves.

Sources: the state's public pesticide-use records, ten most recent published years (the home county and one neighbor); public spray-notification data (checked 12 May 2026); the city's annual Consumer Confidence Report; farming-community birth-cohort publications (Raanan 2015–2017, Gunier 2013–2018, Eskenazi 2023, Bouchard 2011); von Ehrenstein 2019 BMJ; Shelton 2014 EHP; Madrigal 2024; Ornelas Van Horne 2024; ISEAI IEP list; IEP consensus statement (2021). Sam's labs as uploaded to Plan B. This report is information for you and Sam's doctors, not medical advice.

What's been sprayed near home, 2015–2025

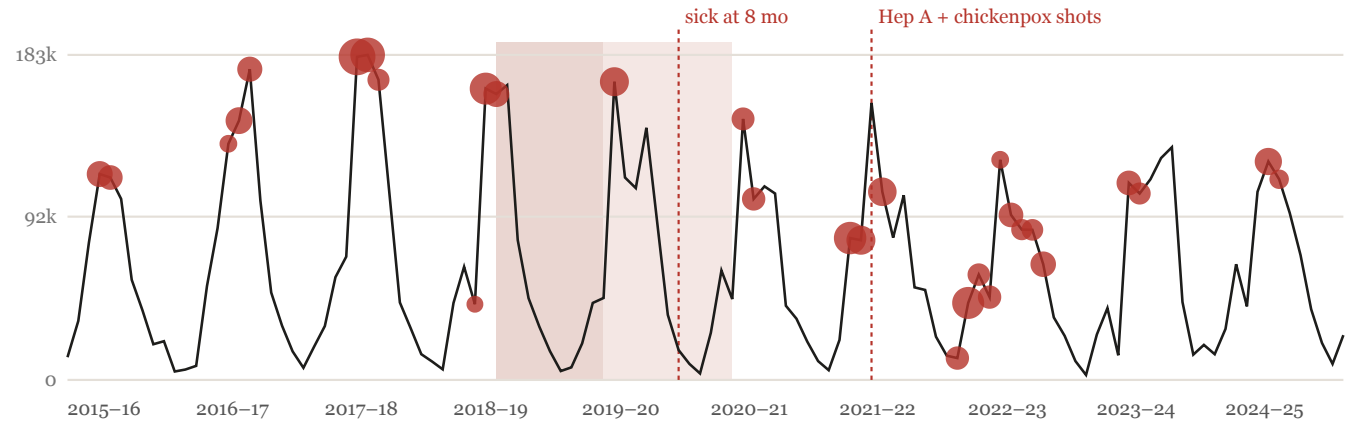
The state requires farms to report every pesticide application by square-mile section. These charts use the state's own records for every section within 20 miles of the home, for the ten most recent published years. Most farmland right around the house is one perennial crop; row-crop fields start 1–2 miles out.

1. How much, every year



About **2.5–2.9 million pounds** of pesticide ingredients a year within 20 miles, and **600,000–900,000 pounds within 5 miles**. Half or more goes on the main nearby crop, and most of that is sulfur and oils, which are low in toxicity. The years in red are the pregnancy and his first year of life.

2. Month by month, within 5 miles



Spraying peaks every year from about October to January and is quietest in April through June. Red dots are fumigant (soil gas) applications; bigger dots mean more pounds. Shading marks the pregnancy (darker) and first year. The illness at 8 months came in an ordinary, quiet month, not a spray spike.

3. The chemicals that matter most for a developing child, within 5 miles

Each bar is one year, 2015–16 to 2024–25. Red bars = pregnancy (2018–19) and first year (2019–20). Each chart has its own scale.

Glyphosate (Roundup) peak 32k lb/yr



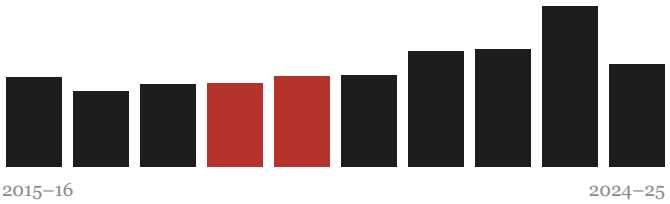
DCPA / Dacthal (EPA-suspended 2024) peak 19k lb/yr



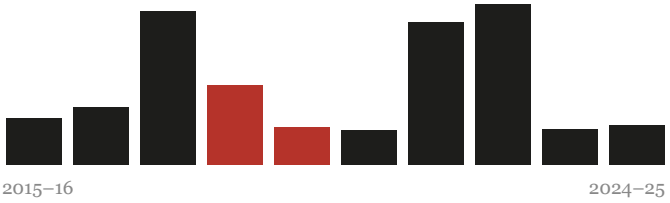
Mancozeb (manganese fungicide) peak 19k lb/yr



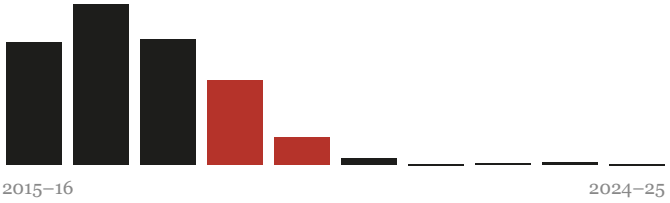
Organophosphate insecticides & bensulide peak 46k lb/yr



Fumigant gases (1,3-D, metam) peak 68k lb/yr



Paraquat peak 10k lb/yr



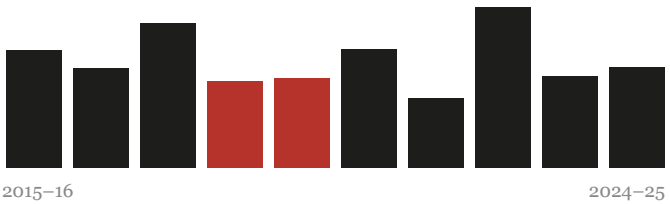
Carbamates (methomyl etc.) peak 16k lb/yr



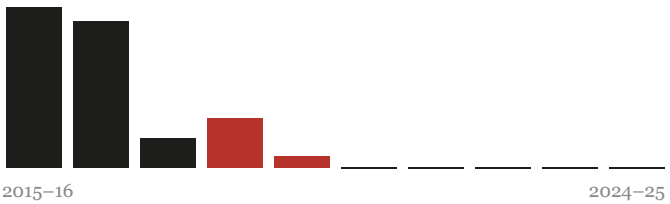
Pyrethroids peak 5k lb/yr



Neonicotinoids peak 7k lb/yr



Chlorpyrifos (phased out statewide 2020) peak 2k lb/yr



Glyphosate and DCPA (Dacthal) both peaked in 2019–20, his first year of life. DCPA is the weedkiller the EPA suspended in August 2024 because of risk to babies in the womb. Chlorpyrifos was sprayed on the home's own square mile in 2015–2016 (about 670 lb a year), then dropped to almost nothing before the pregnancy and was phased out statewide in 2020. Paraquat faded out after 2019–20.

4. The biggest fumigant (soil gas) applications within 5 miles

Date	Fumigant	Crop	Pounds	From home
2017-11-04	1,3-Dichloropropene	Main crop	20,000	1.1 mi WSW

Date	Fumigant	Crop	Pounds	From home
2018-10-12	1,3-Dichloropropene	Main crop	18,000	1.2 mi WNW
2019-10-11	1,3-Dichloropropene	Main crop	16,000	2.6 mi SSE
2017-10-25	1,3-Dichloropropene	Main crop	13,000	1.2 mi WNW
2021-09-29	1,3-Dichloropropene	Main crop	8,100	2.6 mi SSE
2022-07-08	1,3-Dichloropropene	Main crop	7,900	2.6 mi NW
2022-09-08	1,3-Dichloropropene	Main crop	7,600	2.6 mi SSE
2023-10-17	1,3-Dichloropropene	Main crop	7,400	2.6 mi SSE
2017-10-29	Metam-potassium	Main crop	7,000	3.1 mi SE
2017-10-28	Metam-potassium	Main crop	7,000	3.1 mi SE

> The three largest were all 1,3-dichloropropene before planting the main crop: November 2017 (1.1 miles), October 2018, a few weeks before conception (1.2 miles), and October 2019, when he was 2 months old (2.6 miles). No chloropicrin, methyl bromide or metam-sodium was reported within 20 miles in any year.

5. Chlorpyrifos within 20 miles, pounds per year

	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24	2024–25
lb	3,720	2,930	370	620	140	0	0	0	0	0

6. Most-used ingredients within 20 miles in his first year (2019–20)

#	Active ingredient (within 20 miles, 2019–20)	Pounds
1	Petroleum Distillates, Refined	736,000
2	Sulfur	496,000
3	Mineral Oil	156,000
4	Potassium Phosphite	128,000
5	Bensulide	83,600
6	Fosetyl-Al	82,500
7	Mancozeb	71,300
8	Glyphosate, Isopropylamine Salt	66,200
9	Lime-Sulfur	63,900
10	Glyphosate, Potassium Salt	61,400
11	Chlorthal-Dimethyl	50,800
12	Diatomaceous Earth	41,700

What this can and can’t tell us

- These are pounds applied by square mile, not what reached the house. Wind, timing, distance and house dust decide real exposure.
- Studies in farming communities link pregnancy and early-life exposure to these chemical groups with small average effects on child development. They can’t prove an effect on any one child.
- For Sam, the spraying is a steady background load. The mold in the house and his infections remain the main suspects for his flares.

- What helps now: shoes off at the door, wet-mopping and HEPA vacuuming, windows closed and air purifiers running on spray days (spray-notice alerts), organic versions of his staple foods, and a reverse osmosis filter for drinking water.

Source: the state's public pesticide-use records, ten most recent published years, the home county and one neighbor; sections located with the federal land survey grid; distances from each section's center to the home. Public spray-notification data checked 12 May 2026. Pounds rounded and dates moved for privacy.

Research appendix

The full research notes behind Sam's home environment report, with every source. These are technical working notes: effect sizes, evidence grades (established / supported / hypothesis), and items we could not verify are marked as such.

APPENDIX

A. Studies from a farming-community birth cohort and the surrounding area

Research note, literature only. Compiled 2026-05-12. No patient identifiers. Environmental-health review for the research file; not medical advice.

Relationship to other notes. This extends the companion note on agricultural pesticides, neurodevelopment and immunity (Appendix B), which already covers the farm-cohort IQ/PDD/SRS findings (Eskenazi 2007, Bouchard 2011, Gunier 2017 EHP, Gunier 2017 fumigants/IQ, Sagiv 2018, Engel 2016), the Shelton 2014 / von Ehrenstein 2019 / Roberts 2007 autism studies, and the meta-analyses. Those are only cross-referenced here. The household spray-record extraction (pounds by section) is in Appendix C and is used only in section 6.

Evidence grades (same scale as the companion note): ESTABLISHED: replicated across independent cohorts or designs, consistent direction. SUPPORTED: at least one good human study plus plausible mechanism, but single cohort, small effects, or residual confounding. HYPOTHESIS: animal/in vitro only, or no direct human data.

Verification. Effect sizes marked as verified were read from the abstract or full text (online full-text databases and state agency PDFs) during this session. Items marked [UNVERIFIED] were not confirmed and must be checked before quoting.

Bottom line

- **Elemental sulfur near the home and children's breathing:** SUPPORTED, and the most directly relevant finding for a home surrounded by sulfur-dusted fields. The farm cohort (Raanan 2017) found more asthma-medication use (OR 3.51), more respiratory symptoms (OR 2.09) and lower FEV1 per 10-fold more sulfur applied within 1 km in the prior year. An independent cohort in a second farming community (Ornelas Van Horne 2024) found 12 percentage points more wheeze with high sulfur use within 400 m. Two cohorts, same direction, both proximity-based.
- **Organophosphates and respiratory health:** SUPPORTED (the farm cohort; childhood urinary DAPs linked to symptoms and lower lung function at 7).
- **Fumigants and respiratory health:** no adverse association found in the farm cohort (Gunier 2018). Fumigants and IQ: modest decrements for methyl bromide and chloropicrin only (companion note).
- **Manganese fungicides (maneb/mancozeb):** SUPPORTED that agricultural use raises manganese in nearby house dust and in children's prenatal tooth dentin; effects on development are inconsistent (small transient infant decrements; mixed school-age results). HYPOTHESIS to SUPPORTED for harm.
- **Glyphosate:** SUPPORTED (single cohort) for later liver/metabolic effects (Eskenazi 2023) and, in one mixtures analysis, for more adolescent depression/anxiety with postnatal nearby use (Hyland 2021). Agricultural glyphosate use within 4 km doubles indoor dust concentrations (Madrigal 2024).
- **Immune outcomes:** thin. One farm-cohort study links maternal farm work (not a measured pesticide) to higher Th2 cytokines at 24 months; one links OP exposure to SARS-CoV-2 infection with confidence intervals crossing 1. No local study of autoimmunity, PANS, or infection frequency.
- **Air monitoring:** the state's air-monitoring stations in the county show fumigants (chloropicrin, 1,3-D) as the compounds closest to screening levels; no station exceeded the state's screening levels in the years reviewed. The network does not monitor sulfur, mancozeb or glyphosate, the main local crop chemicals.

- **Schools:** a 2014 state health-department report ranked the county among the highest of 15 high-use counties for the share of students at schools with the most nearby use of pesticides of public health concern.

1. The farming-community birth cohort: full record by outcome

About the cohort. 601 pregnant women enrolled 1999–2000 at clinics in a farming community; mostly farmworker families. Exposure was measured two ways: urinary dialkyl phosphates (DAPs) and, from the late 2000s on, residential proximity to public pesticide-use records. Crops were mostly fumigated row crops, not the perennial crop that surrounds this home. Grades reflect a single cohort unless replicated elsewhere.

1a. Neurodevelopment by age (items not in companion note)

Age	Study	n	Exposure	Key result (verified)	Grade
Neonate	Young 2005, Neurotoxicology 26:199	184 infants aged >3 days in key analysis (total n UNVERIFIED)	Prenatal DAPs	More abnormal reflexes: β 0.53 (0.23, 0.82) per log10 total DAP; OR 4.9 (1.5, 16.1) for >3 abnormal reflexes. No association for postnatal DAPs	SUPPORTED
6–24 mo	Gunier 2015, Environ Res 142:688	~200	Manganese in tooth dentin	Per 2-fold postnatal Mn: small MDI decrements at 6 and 12 mo; girls at 6 mo MDI −1.5 (−2.4, −0.6), PDI −1.8 (−3.3, −0.3); nothing at 24 mo	HYPOTHESIS–SUPPORTED
2 y	Eskenazi 2010, EHP 118:1775	353	DAPs × PON1	PON1-108T allele: poorer MDI; higher maternal PON1 enzyme activity: lower PDD odds. DAP × genotype interactions not consistently significant	SUPPORTED (susceptibility)
3.5 & 5 y	Marks 2010, EHP 118:1768	~330	Prenatal DAPs	At 5 y: CBCL attention β 0.7 (0.2, 1.2); ADHD β 1.3 (0.4, 2.1); K-CPT ADHD index >70th percentile OR 5.1 (1.7, 15.7); composite ADHD OR 3.5 (1.1, 10.7). Stronger in boys	SUPPORTED
7 y	Bouchard 2011; Gunier 2017 (both in companion note)				
10 y	Rowe 2016, Environ Res 150:128	~600 [n UNVERIFIED]	OP + carbamate use within 1 km in pregnancy	Top vs bottom quartile: FSIQ −3.0 (−5.6, −0.3), Perceptual Reasoning −4.0, Working Memory −2.8. Household and neighborhood poverty each independently cost about 2–4 points	SUPPORTED
7–10.5 y	Mora 2015, Environ Int 84:39	~250	Tooth Mn	Higher Mn: poorer behavior in boys and girls, but better memory/motor/cognition in boys; worse cognition when prenatal lead ≥0.8 µg/dL	Mixed
7–12 y	Eskenazi 2014, Environ Res 134:149		DAPs × PON1	Pregnancy arylesterase: +4.0 FSIQ per SD (1.6, 6.4); DAP-IQ association strongest in children of mothers with lowest arylesterase	SUPPORTED

PBDE flame retardants (not pesticides) were measured in the same children. Eskenazi 2013 (EHP 121:257) found prenatal and childhood PBDEs associated with poorer attention, fine motor coordination and lower IQ at 5 and 7. This matters as a co-exposure: farm-adjacent homes are not exposed to pesticides alone.

1b. Adolescence and young adulthood

- **Functional brain imaging:** Sagiv 2019, PNAS 116:18347, doi:10.1073/pnas.1903940116. fNIRS (near-infrared functional imaging, not fMRI) in 95 adolescents aged 15–17. Per 10-fold increase in OP use within 1 km during pregnancy, prefrontal activation during a cognitive-flexibility task fell (left β −4.74, 95% CI −8.18, −1.31; right −4.40, −7.96, −0.84). Sex differences in activation during a language task. Grade: SUPPORTED (small n; first study of its kind).
- **Behavior and mental health from prenatal urinary DAPs:** Sagiv 2023, EHP 131:067008, doi:10.1289/EHP11380. Ages 16–18; maternal report, 4th vs 1st quartile of prenatal DAPs: hyperactivity β 2.32 (0.18, 4.45), aggression 1.90 (0.15, 3.66), attention 2.78 (0.26, 5.30), depression 2.66 (0.08, 5.24). Youth-reported depression suggestive (2.15, −0.36, 4.67). Childhood DAPs were not associated. Grade: SUPPORTED.
- **Pesticide mixtures near home:** Hyland 2021, Environ Epidemiol 5:e150, doi:10.1097/EE9.0000000000000150. n = 593, BASC-2 at 16 and 18. Mostly null. Trends for prenatal OP use and internalizing/attention. Postnatal

glyphosate: per 2-fold increase in applications, youth-reported depression β 1.2 (credible interval 0.2, 2.2), maternal-reported internalizing 1.23 (0.2, 2.3) and anxiety 1.2 (0.2, 2.3). Imidacloprid appeared protective in some models, which argues for caution. Grade: HYPOTHESIS–SUPPORTED (exploratory mixture model, single cohort).

- **Adversity interaction:** Hyland 2022, Environ Res 204:111908. Little evidence that childhood adversity modified pesticide effects. One exception: malathion use was linked to internalizing problems only in youth with ≥3 adverse childhood experiences.
- **Risk-taking:** Sagiv 2022, Environ Health 21:8. Generally null.

1c. Respiratory

- **Elemental sulfur:** Raanan 2017, EHP 125:087007, doi:10.1289/EHP528 (PMC5783654). n = 347 with symptoms at age 7 and 279 with spirometry; 237 and 205 had full exposure and covariate data. Exposure: Reported sulfur within 0.5, 1 and 3 km over the week, month and 12 months before testing. Per 10-fold increase within 1 km in the prior year: asthma medication OR 3.51 (1.50, 8.23), respiratory symptoms OR 2.09 (1.27, 3.46), FEV1 −0.143 L/s (−0.248, −0.039). Associations appeared at the 0.5 and 1 km radii; the abstract does not report them at 3 km. Adjusted for maternal smoking, PM2.5, season, breastfeeding and child characteristics. The authors note sulfur is permitted in organic farming and is the most heavily used agricultural pesticide in the state. Grade: SUPPORTED (replicated in direction by Ornelas Van Horne 2024; section 5).
- **Organophosphates and symptoms:** Raanan 2015, EHP 123:179, doi:10.1289/ehp.1408235. n = 359. Prenatal DAPs: aOR 1.44 (0.98, 2.12), not significant; second half of pregnancy 1.77 (1.06, 2.95). Childhood DAPs: respiratory symptoms aOR 2.53 (1.32, 4.86); exercise-induced cough 5.40 (2.10, 13.91). Adjusted for mold and cockroaches in the home. Grade: SUPPORTED.
- **Organophosphates and lung function:** Raanan 2016, Thorax 71:148, doi:10.1136/thoraxjnl-2014-206622. n = 279. Childhood total DAPs: FEV1 −0.16 L/s (−0.30, −0.02) per 10-fold increase; FVC −0.17 L (−0.34, 0.01). Prenatal DAPs: not associated. Grade: SUPPORTED.
- **Fumigants:** Gunier 2018, Environ Res 164:93, doi:10.1016/j.envres.2018.02.022. n = 294. Methyl bromide, chloropicrin, metam sodium and 1,3-D use within 3, 5 and 8 km, prenatal and birth to 7 years. No adverse association with symptoms, asthma medication or lung function. Unexpectedly, slightly higher FEV1 with prenatal methyl bromide (β 0.06 L/s; 0.00, 0.12). Grade: evidence against a fumigant-respiratory link at these distances (single cohort).

1d. Immune

- Duramad 2006, EHP 114:1916, doi:10.1289/ehp.9306. Flow cytometry for intracellular IFN-γ (Th1) and IL-4 (Th2) at 12 and 24 months. Higher Th2 in children with doctor-diagnosed asthma or wheeze at age 2. Maternal agricultural work: +25.9% Th2 (p = 0.04). Gas stove: +46.5% Th2. Breastfeeding and pets were associated with higher Th1. Exposure was a proxy (farm work), not a measured pesticide. Grade: HYPOTHESIS–SUPPORTED.
- Duramad 2006, J Appl Toxicol 26:458 (in vitro). Chlorpyrifos-oxon alone did not induce cytokines but amplified LPS (endotoxin)-induced IFN-γ. The authors flagged OP plus endotoxin co-exposure as typical of farm communities. Grade: HYPOTHESIS.
- Lopez 2024, Environ Res 255:119214. Young adults 18–21. Prenatal OP biomarkers vs SARS-CoV-2 seropositivity: OR 1.94 (0.71, 5.58); ages 0–5: 1.90 (0.54, 6.95). Imprecise, not significant. Grade: HYPOTHESIS.
- No farm-cohort study of autoimmunity, antibody deficiency, recurrent infection, or neuroinflammatory markers was found. The 2025 meta-analysis in the companion note is the broader immune evidence.

1e. Birth outcomes and growth

- Eskenazi 2004, EHP 112:1116. No reduction in fetal growth. Shorter gestation with dimethyl DAPs: −0.41 weeks per log10 (−0.75, −0.02). Preterm rate (6.4%) was below the US reference. Grade: SUPPORTED for gestational length, weakly.

- Fenster 2006, EHP 114:597. Organochlorines (DDT/DDE etc.) were not associated with birth weight or length. Hexachlorobenzene was associated with shorter gestation (−0.47 weeks).
- Harley 2016, EHP 124:1084, four-cohort pooling. Size at birth was reduced among Black mothers only; no reduction among Hispanic or white mothers.

1f. Thyroid

- No farm-cohort paper linking agricultural pesticides to child thyroid function was located this session.
- Farm-cohort thyroid analyses concern PBDEs and PCBs (Chevrier et al.) [UNVERIFIED citations]. Eskenazi 2013 reported that PBDE-neurodevelopment associations were unchanged after adjusting for maternal thyroid hormone.
- The relevant mancozeb-thyroid work comes from a plantation-worker cohort abroad, via urinary ETU, the breakdown product of mancozeb (section 6). Grade: GAP.

1g. Epigenetics

- Huen 2014, Environ Mol Mutagen 55:209. n = 358. Prenatal DDT/DDE was associated with lower Alu repeat-element methylation at birth (p = 0.02 for o,p'-DDT).
- Huen 2018, Environ Int 121:31. n = 238. PON1 promoter methylation showed consistent but non-significant inverse associations with IQ; none survived multiple-comparison correction.
- Grade: HYPOTHESIS. The Children's Centers epigenetics working group (Breton 2017, EHP 125:511) notes that effect sizes in this field are typically small.

1h. Glyphosate and cardiometabolic outcomes

- Eskenazi 2023, EHP 131:037001, doi:10.1289/EHP11721 (PMC9976611). Urinary AMPA at age 5: elevated liver transaminases at 18, RR 1.27 per 2-fold increase (1.06, 1.53); metabolic syndrome RR 2.07 (1.38, 3.11). At age 14: AMPA RR 1.80 for metabolic syndrome; glyphosate residues RR 1.88. Agricultural glyphosate within 1 km from birth to age 5: metabolic syndrome RR 1.53 (1.16, 2.02). Grade: SUPPORTED (single cohort, nested case-control).
- Hu 2025, Environ Sci Technol 59:23702 (n = 505). Mixture of 12 pesticides used near the home in early childhood: metabolic syndrome at 18 in males, OR 1.76 (1.06, 2.05); none in females.
- Calderon 2024, Am J Epidemiol 193:1583 (mothers, n = 484). Per 10-fold increase within 1 km: glyphosate, pulse pressure +2.26 mmHg; paraquat, diastolic BP +2.60 mmHg.

1i. Manganese (from maneb/mancozeb fungicides)

- Gunier 2014, Sci Total Environ 497-498:360. House-dust manganese. Median concentration 171 μg/g; median loading 1,910 μg/m². Manganese rose with the number of farmworkers in the home and with manganese-fungicide use within 3 km in the prior month. Dust metals (Mn, Pb, Cd, Cr) differed by area and soil type, and were higher in homes with poorer housekeeping. Grade: SUPPORTED (exposure pathway).
- Gunier 2013, Environ Sci Technol 47:11249. Prenatal tooth dentin manganese (n = 207). Higher with farmworker shoes stored inside, maternal farm work, Mn-fungicide use within 3 km, soil type and dust Mn loading. The model explained 22–29% of variance. Grade: SUPPORTED (exposure reaches the fetus).
- Health effects: Gunier 2015 and Mora 2015 (table above) show transient, sex-specific, partly contradictory associations. Gunier 2017 EHP (companion note) found lower IQ at 7 with nearby manganese-fungicide use. Overall grade for harm at residential levels: HYPOTHESIS–SUPPORTED.

1j. Take-home and dust pathway

- Bradman 2007, J Expo Sci Environ Epidemiol 17:331. Twenty farmworker homes in the cohort's area. Chlorpyrifos, diazinon, DCPA (chlorthal-dimethyl) and permethrins were detected in 90–100% of dust, surface-wipe and clothing samples. Toddlers' socks and union suits carried more pesticide than younger crawling infants'.
- Harnly 2009, Environ Sci Technol 43:8767. n = 197 homes. Nearby agricultural use was associated with dust concentration: chlorpyrifos +83%, DCPA +19% and iprodione (fungicide) +49% per kg/day applied in the prior month

or season. Diazinon and permethrin use were not associated. Farmworkers' shoes stored inside also raised dust levels.

- Bradman 2009, JESEE 19:79. Gloves cut hand malathion loading (median 8.2 vs 777.2 µg per pair) and urinary MDA.
- Quirós-Alcalá 2011, Environ Health 10:19. Estimated non-dietary intake was below EPA reference doses, but home-use pesticides added to the agricultural share.
- Grade: ESTABLISHED that nearby agricultural use loads house dust (replicated statewide: Gunier 2011 EHP; Madrigal 2024).

1k. Fumigant proximity and cognition

Gunier 2017, Environ Res 158:358. Covered in the companion note: methyl bromide −2.6 and chloropicrin −2.4 IQ points per 10-fold use within 8 km; no association for metam or 1,3-D, and none for attention.

2. The state Air Monitoring Network (AMN): stations in the county

Network history (verified from state reports; station names removed for privacy). Station 1: at a city airport, 2011–2016, surrounded mainly by row crops. Station 2: about 10 miles from that city, on a private well site, 2017 to at least 2018, with row crops nearby. Station 3: at an elementary school in the north of the county, since late 2011, still operating in 2024. No station sits in the family's part of the county.

- **Station 1, 2016:** no pesticide exceeded any screening level or regulatory target. Chloropicrin came closest: highest 4-week average about two-thirds of the subchronic screening level; 1-year average about 14% of the chronic level. 1,3-D: 4-week average about 9%; annual about 2%. MITC: annual about 1%. Chlorpyrifos was not detected. Diazinon, malathion and DCPA (chlorthal-dimethyl) were at trace levels. 1,3-D cancer risk, 2011–2016 average: about 12% of the state's 10^{-5} lifetime goal; the highest single year reached about a third.
- **Station 2, 2018:** DCPA detected in 98% of samples, MITC 42%, 1,3-D 18%. The only exceedance anywhere in the network that year was 1,3-D at a station in another county. 1,3-D cancer risk: about 7% of goal.
- **Station 3, 2024:** no exceedances. Chloropicrin: highest 13-week average about 70% of the subchronic screening level; annual about 25% of chronic. 1,3-D cumulative cancer risk: about 15% of the state's goal.

How to read the "no exceedance" findings. The screening levels and the 10^{-5} cancer goal are the agency's own benchmarks; the agency notes that no state or federal ambient-air health standard exists for pesticides. Advocacy groups state that the averaged lifetime cancer risk at Station 3 exceeded the state health-hazard office's (more protective) threshold by more than 2× over 2012–2022. This is an advocacy calculation and was not reproduced here [UNVERIFIED]. **Key gap for areas like this one:** the monitoring panel (36–40 compounds) does not include elemental sulfur, lime-sulfur, mancozeb or its breakdown product ETU, or glyphosate. Fungicides on the panel include captan, chlorothalonil and iprodione. There is no public air-concentration data for the chemicals that dominate use around this home. Grade: ESTABLISHED that fumigants are the measured compounds closest to benchmarks in the county's air; not informative for sulfur or mancozeb.

3. The 2014 state school-proximity report and the 2018 school rule

State health department / Environmental Health Tracking Program, *Agricultural Pesticide Use Near Public Schools*, April 2014. Scope: 2,511 schools (1.46 million students) in the 15 highest-use counties; 2010 pesticide-use records, field-level; ¼-mile buffer. For this county (verified from the report tables; exact figures withheld here because they would name the county): it was at or near the top of the 15 counties for the share of schools and students in the top quartile of nearby use for pesticides of public health concern, cholinesterase inhibitors (OP/carbamate), carcinogens, reproductive/developmental toxicants and toxic air contaminants. Across all 15 counties, the top three pesticides of public health concern by pounds near schools were chloropicrin (150,285 lb), 1,3-D (136,241 lb) and methyl bromide (85,112 lb): row-crop fumigants. Sulfur was not among the report's categories of concern, so sulfur-dominant areas are under-represented in its rankings. Grade: ESTABLISHED as a descriptive exposure finding. It contains no health outcomes.

State school/day-care regulation (adopted Nov 2017, effective 2018; agency materials give 1 April 2018 for the restrictions [exact date UNVERIFIED]). Applies Monday–Friday, 6 a.m.–6 p.m., within ¼ mile of public K-12 schools and

licensed day-care centers. Prohibited in that window: aircraft, sprinkler chemigation, air-blast sprayer and all fumigant applications. The agency's release says "most dust and powder applications, such as sulfur" are also prohibited. No fumigation within 36 hours before the school week. Growers must give annual notification to schools. **Relevance:** in perennial crops, sulfur dust and air-blast sprays are the main application methods. The rule covers school hours only, not homes, evenings or weekends.

4. County-specific issues

Fumigant controversy. Row-crop fumigation (methyl bromide, then chloropicrin and 1,3-D) is the long-running local flashpoint in other parts of the county. A monitored elementary school is the focus. A 2024 news investigation estimated about 10,000 lb of 1,3-D within ¼ mile and more than 100,000 lb within 1 mile of it. The methyl iodide registration (2010) was withdrawn by its maker in 2012 after a regional campaign [from memory, UNVERIFIED]. No health-outcome study of the students there was found. The evidence base is air monitoring plus the farm cohort (Gunier 2017 and 2018).

Drinking water: nitrate. A university report to the state water board (Harter and Lund 2012) covered two major farm groundwater basins. About 2.6 million people rely on groundwater in the two regions; about 254,000 were judged at current risk of nitrate above the 45 mg/L (as NO_3) MCL. Agriculture (fertilizer and manure) is the dominant source. Child-health relevance: infant methemoglobinemia when formula is mixed with high-nitrate water; weaker associations with birth defects and thyroid effects in other literature. Grade: ESTABLISHED (exposure) / ESTABLISHED (infant methemoglobinemia at high levels).

1,2,3-TCP. An impurity of older soil fumigants (D-D mixtures). State MCL 5 ng/L (ppt), adopted December 2017; public health goal 0.7 ppt; carcinogen. The regional water board has a 2022 fact sheet. A nonprofit pilot treated private wells elsewhere in the county (final report June 2023). Well-level data for the family's part of the county were not located this session.

DBCP. A nematicide banned in the state in 1977. Residual well contamination persists in some agricultural basins. Area-specific data were not located [UNVERIFIED]. **Practical point:** if the household is on a private or small-system well, nitrate, 1,2,3-TCP and arsenic are the area-relevant tests. Municipal systems publish annual Consumer Confidence Reports.

5. Statewide use-record proximity studies

Study	Design / n	Includes this county?	Key result (verified)	Grade
von Ehrenstein 2019, BMJ 364:l962	Case-control, 2,961 ASD (445 with ID)	No. Setting is a different area	See companion note; glyphosate ASD OR 1.16, ASD+ID 1.33	SUPPORTED
Shelton 2014, EHP 122:1103	Case-control, n = 970	Inclusion of this county [UNVERIFIED]	See companion note	SUPPORTED
Rull 2009, Environ Res 109:891	Childhood leukemia study, 213 ALL cases / 268 controls; ½-mile buffer	Some counties [this county UNVERIFIED]	Higher ALL risk with moderate (not high) lifetime exposure to OPs, chlorinated phenols, triazines, insecticides and fumigants	HYPOTHESIS–SUPPORTED
Park 2020, Int J Hyg Environ Health 226:113486	Statewide rural births 1998–2011; 162 leukemia cases, 9,805 controls; 4 km buffer	Yes (statewide rural)	ALL: any carcinogenic pesticide aOR 2.83 (1.67, 4.82); diuron 2.38; phosmet 2.10; kresoxim-methyl 1.77; propanil 2.58	SUPPORTED
Ling 2018, Toxics 6:41	Statewide births 1998–2010 within 2 km of any application; 24,693 preterm	Yes	1st/2nd-trimester glyphosate, paraquat, imidacloprid: 3–7% higher preterm risk; myclobutanil and term low birth weight OR 1.11	SUPPORTED (small)
Liew 2020, Toxics 8:52	Statewide, 3,905 cerebral palsy cases	Yes	Any of 23 endocrine-disrupting pesticides, 1st trimester: CP OR 1.19 (1.05, 1.35) in girls; none in boys	HYPOTHESIS–SUPPORTED
Gunier 2011, EHP 119:970	Carpet dust, leukemia-study homes	Part of the state	Agricultural use within 1,250 m raised dust levels for 5 of 7 pesticides	ESTABLISHED (pathway)

Study	Design / n	Includes this county?	Key result (verified)	Grade
Madrigal 2024, Environ Int 192:109024	Carpet dust, children statewide	Statewide sample	Top tertile of glyphosate use within 4 km: +110% dust glyphosate (55, 183); 2,4-D, simazine and trifluralin 2–6×; DCPA and iprodione 5–10× odds of detection; chlorothalonil null	ESTABLISHED (pathway)
Ornelas Van Horne 2024, Environ Epidemiol 8:e325	A second farming community, 708 children 5–12; 400 m buffer	No (replication site)	High use (above the median) of sulfur only (≥80 kg within 400 m in prior 12 months): wheeze +12 percentage points (5, 20); all-except-sulfur +9; chlorpyrifos +15	SUPPORTED

Birth defects. The university use-record proximity birth-defect work (Carmichael, Shaw and others) used births from a different area and does not include this county [UNVERIFIED that no county analysis exists]. No Ritz-group birth-defect paper using this county's data was located.

6. Perennial-crop exposure vs fumigated row-crop exposure

What surrounds this home (from the household spray-record note, Appendix C; ~1-mile ring, 2018–19 to 2024–25, pounds of active ingredient per year): elemental sulfur 34,000–86,000 lb; lime-sulfur 22,000–44,000 lb; mineral oil 5,500–36,000 lb; glyphosate 3,200–7,100 lb; mancozeb 1,800–2,700 lb. Fumigants, intermittent: 1,3-D about 21,000 lb in 2018–19 and small amounts in 2020–21 and 2022–23; metam-potassium 3,700–18,000 lb in most years. Zero chloropicrin, methyl bromide, chlorpyrifos and maneb in the ring.

This is the opposite of the birth cohort's exposure profile, which was dominated by OPs and row-crop fumigants.

Chemical	Area-specific evidence	Strength for this profile
Elemental sulfur	Raanan 2017 (farm cohort, 1 km): asthma medication OR 3.51, symptoms OR 2.09, lower FEV1. Ornelas Van Horne 2024 (second area, 400 m): wheeze +12 points	Strongest area-specific signal for a home like this one. SUPPORTED. Respiratory, not neurodevelopmental. No study of sulfur and neurodevelopment or immune markers was found
Lime-sulfur (calcium polysulfide)	No epidemiologic study found. Caustic; can release hydrogen sulfide; labeled as a severe eye and skin irritant. No air monitoring	HYPOTHESIS (irritant by analogy)
Mancozeb (manganese and ETU)	Mn-fungicide use within 3 km raises house-dust and prenatal tooth Mn (Gunier 2013, 2014), with dust metals varying by area. Gunier 2017: IQ decrement with nearby Mn-fungicide use. A plantation-worker cohort abroad (Mora 2018, EHP 126:057007): urinary ETU and lower social-emotional scores in girls, β −7.4 per 10-fold (−15.2, 0.4); hair Mn and lower cognitive scores in girls, social-emotional in boys	SUPPORTED for the exposure pathway; HYPOTHESIS–SUPPORTED for developmental harm. Mancozeb poundage here is about 1/20th of sulfur's
Glyphosate	Eskenazi 2023 (metabolic syndrome RR 1.53 with use within 1 km, birth to 5); Hyland 2021 (postnatal use, adolescent depression/anxiety); von Ehrenstein 2019 (ASD OR 1.16); Ling 2018 (preterm birth); Madrigal 2024 (dust ×2)	SUPPORTED but small effects; multiple single studies
1,3-D / metam (intermittent here)	The farm cohort: no respiratory or IQ association for 1,3-D or metam (Gunier 2017, 2018). State air network: 1,3-D well under screening levels at the county stations	Weak evidence of harm at residential distances; cancer risk is the regulatory concern
Chloropicrin / methyl bromide	IQ decrements (Gunier 2017); highest share of screening levels in the county's air	Not applicable: none reported within 1 mile in any year analyzed
Organophosphates	Bulk of the farm-cohort literature	Mostly not applicable to this ring. Chlorpyrifos was zero; the OP herbicide bensulide (3,000–6,000 lb) has no specific child-health studies located

Rough density comparison (illustrative only). About 60,000 lb (27,000 kg) of sulfur per year over the ~9 square-mile ring (~23 km²), spread evenly, would put roughly 600 kg within any 400 m radius. That is about 7 times the "high" cut-point in the second-community study (80 kg). Applications are not spread evenly, and wind, timing and formulation (dust vs wettable) dominate actual exposure. Treat this only as an indication that the home is not in a low-sulfur setting.

Row-crop fields 1–2 miles away. Farm-cohort associations with OP and sulfur use were strongest within 0.5–1 km; fumigant analyses used 3–8 km. At 1.6–3.2 km, row-crop spraying contributes mainly through fumigant volatilization and

regional air. That is the exposure the state's air network characterizes, and it was below screening levels at the nearest station.

7. Limits, and what a family can measure now

Population vs individual inference. Every result above is a shift in group averages: about 2–3 IQ points, 10–15 percentage points of wheeze, odds ratios of 1.1–3.5. None allows attribution of a particular child's condition to pesticides. Most adjust for poverty, but poverty, housing quality, mold, farmwork and traffic all travel with field proximity. Rowe 2016 showed poverty effects of similar size to pesticide effects.

Measured vs modeled exposure. Proximity studies (use records + GIS) assume that pounds applied nearby equal dose; wind, application method and indoor time are not captured. Biomarker studies (DAPs, AMPA) suffer from half-lives of hours and dietary preformed metabolites (companion note). The two methods sometimes disagree: Sagiv 2018 found autism traits with DAPs but not with proximity; Hyland 2021 found mostly null proximity results where earlier DAP work was positive. Many outcomes come from one cohort, with many exposures × windows × outcomes tested. Some positive findings will be chance; isolated "protective" associations (imidacloprid; methyl bromide and FEV1) illustrate this.

Other cautions. Mixture confounding: crop chemicals are applied together (sulfur + mancozeb + oil + glyphosate), so single-chemical estimates cannot be cleanly separated. Generalizability: The cohort families lived mostly in larger towns and had high take-home exposure. A non-farmworker household near farm fields differs in both directions: no take-home pathway, but closer field proximity.

What an individual family can measure now.

1. **Pesticide-use history by section** (already done for this home): retrospective exposure by year and chemical, the same metric used by Raanan, Gunier, Hyland and Eskenazi. Applications can be matched to symptom diaries by date.
2. **The public spray-notification service**: 24–48 h notice for restricted materials (fumigants, some others). Sulfur, lime-sulfur, mancozeb and glyphosate are generally not restricted materials, so most sprays near this home will usually not appear. Notices for the nearby sections can be checked directly.
3. **House dust.** Dust integrates weeks to months of exposure and is the pathway with the best local evidence (Harnly 2009; Gunier 2014; Madrigal 2024). Dust manganese and metals can be tested by commercial labs; Gunier 2014's farm-cohort median of 171 μg/g gives a rough reference point. Dust glyphosate and multi-residue panels are available from some environmental labs [lab availability UNVERIFIED].
4. **Urinary glyphosate/AMPA and ETU (mancozeb):** short half-lives, so useful only as paired samples (spray week vs a week away). Diet confounds glyphosate. ETU testing is mainly a research assay [commercial availability UNVERIFIED].
5. **Respiratory tracking.** Given the sulfur evidence, the most informative low-cost measures are: a dated symptom and medication log against sulfur-application dates from the use records; peak-flow or home-spirometry readings for children old enough; indoor PM2.5 monitoring with windows closed vs open on spray days. Sulfur dust is particulate, so HEPA filtration is a plausible mitigation; this is untested for sulfur specifically.
6. **Water:** nitrate and 1,2,3-TCP if on a well; the Consumer Confidence Report if municipal.

Gaps specific to this area. No study of lime-sulfur, or of sulfur and neurodevelopment or immunity. No air monitoring for the main local crop chemicals. No cohort in the family's part of the county. No local study of immune dysregulation, autoimmunity or post-infectious neuropsychiatric conditions.

Key URLs (verified this session)

- Raanan 2017 (sulfur): https://doi.org/10.1289/EHP528
- Raanan 2015 (OP symptoms): https://doi.org/10.1289/ehp.1408235
- Raanan 2016 (OP lung function): https://doi.org/10.1136/thoraxjnl-2014-206622
- Gunier 2018 (fumigants, respiratory): https://doi.org/10.1016/j.envres.2018.02.022
- Duramad 2006 (Th1/Th2): https://doi.org/10.1289/ehp.9306

- Sagiv 2019 (fNIRS): https://doi.org/10.1073/pnas.1903940116
- Sagiv 2023 (adolescent behavior): https://doi.org/10.1289/EHP11380
- Hyland 2021 (mixtures, glyphosate): https://doi.org/10.1097/EE9.0000000000000150
- Eskenazi 2023 (glyphosate, liver/MetS): https://doi.org/10.1289/EHP11721
- Gunier 2014 (dust Mn): https://doi.org/10.1016/j.scitotenv.2014.08.005
- Gunier 2013 (tooth Mn): https://doi.org/10.1021/es4018688
- Mora 2018 (mancozeb, plantation cohort): https://doi.org/10.1289/EHP1955
- Madrigal 2024 (herbicide dust): https://doi.org/10.1016/j.envint.2024.109024
- Ornelas Van Horne 2024 (second-community wheeze): https://doi.org/10.1097/EE9.0000000000000325
- Park 2020 (leukemia): https://doi.org/10.1016/j.ijheh.2020.113486
- State air-monitoring reports and the 2014 schools report: links removed (they would name the county)

B. Farm pesticides, child development and the immune system

Research note, literature only. Compiled 2026-05-12. No patient identifiers.

The question. A child was born in a farming community. Sprayed, non-organic farm fields sat near the home from before conception. The child regressed at about 8 to 12 months, was diagnosed with autism at 2, and later had neuroimmune flares. There is also mold exposure, the child responds to IVIG, and does better away from home. How strong is the evidence that living near agricultural pesticides contributes to autism, developmental delay and immune dysregulation, and which chemicals matter?

Evidence grades. ESTABLISHED: replicated across independent cohorts or designs, with a consistent direction. SUPPORTED: one or more good human studies plus a plausible mechanism, but small effects, inconsistent replication, or residual confounding. HYPOTHESIS: only animal or in vitro data, or no direct human data.

Verification. "Verified" means I confirmed the figure from the abstract or full text through search results during this session. Items marked [UNVERIFIED] are from memory or secondary summaries and must be checked before anyone quotes them.

Bottom line

- **Prenatal organophosphate (OP) exposure and poorer child cognition:** ESTABLISHED as a population-level association. This rests on several independent birth cohorts, including the farming-community cohort. The effects are small to moderate per child: a few IQ points per standard deviation of exposure, and about 7 points between the top and bottom fifths.
- **Living near agricultural pesticide use during pregnancy and autism:** SUPPORTED, not established. Three large record-linkage studies in the state (Roberts 2007, Shelton 2014, von Ehrenstein 2019) all point the same way. Pooled meta-analytic odds ratios are about 1.1 to 1.4, with confidence intervals close to 1. Exposure is estimated from pesticide-use records, not measured in the body. Biomarker-based studies are weaker or null for an autism diagnosis.
- **First-year (infant) exposure and autism with intellectual disability:** SUPPORTED by one large study (von Ehrenstein 2019). It has not been independently replicated.
- **Immune effects in children:** SUPPORTED but heterogeneous. Both immune suppression and pro-inflammatory/allergic shifts are reported. No human study links pesticides to PANS/PANDAS, IVIG response, or tick-borne disease severity.
- **Pesticide plus mold/mycotoxin co-exposure:** HYPOTHESIS. The only data are cell-line synergy studies and small exposure-correlation pilots.
- For any one child, none of this proves cause. It shows the exposure is a plausible, documented contributor that adds to other risks.

1. The farming-community birth cohort (Eskenazi, Bradman, Gunier, Sagiv)

This is a long-running birth-cohort study of children in a farming community, mostly farmworker families, enrolled 1999 to 2000. It is the most directly relevant cohort here: heavy agricultural spraying nearby, and exposure assigned from the same kind of public pesticide-use records. Results are listed by outcome.

a. Pervasive developmental disorder at 24 months. Eskenazi et al. 2007, Environ Health Perspect 115:792. Prospective cohort, about 370 to 400 children [n UNVERIFIED]. Per 10-fold increase in prenatal urinary dialkyl phosphates (DAPs, the OP breakdown products): odds ratio for PDD risk on the CBCL 2.3 ($p = 0.05$). Per 10-fold increase in the child's own DAPs: OR 1.7 ($p = 0.04$). Chlorpyrifos-specific (TCPy) and malathion-specific (MDA) metabolites were not associated with any outcome. The authors urged caution: this was a screening scale, not a diagnosis. Link: https://stacks.cdc.gov/view/cdc/31266. Grade: SUPPORTED.

b. IQ at age 7 (urine metabolites). Bouchard et al. 2011, Environ Health Perspect 119:1189. n = 329. Higher maternal pregnancy DAPs went with poorer Working Memory, Processing Speed, Verbal Comprehension, Perceptual Reasoning and Full-Scale IQ. Highest vs lowest fifth of DAPs: −7.0 IQ points. The child's own (postnatal) DAPs were not consistently associated. Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC3237357. Grade: ESTABLISHED. Two independent urban cohorts found parallel results.

c. IQ at age 7 (residential proximity). Gunier et al. 2017, Environ Health Perspect 125(5):057002. n = 283. Exposure: agricultural pesticide use within 1 km of the home during pregnancy, from the state's public pesticide-use records. Per standard deviation of toxicity-weighted OP use: Full-Scale IQ −2.2 (95% CI −3.9, −0.5) and Verbal Comprehension −2.9. Similar decrements for acephate, oxydemeton-methyl, pyrethroids, neonicotinoids and manganese fungicides. Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC5644974. Grade: SUPPORTED. Several pesticide classes were correlated and the sample is small.

d. Fumigants. Gunier et al. 2017, Environ Res 158:358. Per 10-fold increase in use within 8 km: methyl bromide −2.6 IQ points (95% CI −5.2, 0.0) and chloropicrin −2.4 (−4.7, −0.2). No association for the other fumigants (metam sodium, 1,3-dichloropropene) with cognition. No association for any fumigant with attention or hyperactivity. One record describes the exposure window as birth to age 7; confirm in the full text. Fumigants have no valid biomarker, so proximity is the only exposure measure. Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC5739348. Grade: SUPPORTED (single cohort). Relevance: in the cohort's area, chloropicrin and 1,3-D had largely replaced methyl bromide by the time of this pregnancy [crop-use detail UNVERIFIED; check the pesticide-use records for the relevant township].

e. Autism-related traits at age 14. Sagiv et al. 2018, Environ Health Perspect 126:047012, doi:10.1289/EHP2580. Per 10-fold increase in prenatal DAPs: +2.7 T-score points (95% CI 0.9, 4.5) on the parent-rated SRS-2 (Social Responsiveness Scale, 2nd edition). No clear association with residential proximity to OP use during pregnancy. The authors call the evidence "mixed." Grade: SUPPORTED, with a modest effect.

f. Manganese fungicides (maneb, mancozeb). About 160,000 kg of these fungicides (20% manganese by weight) were used in the cohort's county in 1999 to 2000. Gunier 2017 (above) found an IQ decrement with nearby manganese-fungicide use. Studies of manganese measured in baby teeth found mixed results. Prenatal tooth manganese was linked to lower 6-month scores only in iron-deficient mothers. Later ages showed some positive associations, and some negative ones when lead was high. A plantation-worker cohort study (n = 355 infants) reported possible adverse, sex-specific effects of mancozeb. Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC4570875. Grade: HYPOTHESIS to SUPPORTED.

g. Glyphosate. Eskenazi et al. 2023, Environ Health Perspect 131(3), doi:10.1289/EHP11721. n = 480, with a nested case-control (60 cases, 91 controls). Urinary AMPA (glyphosate's breakdown product) at age 5 was associated with elevated liver enzymes (RR 1.27 per doubling). At age 14, AMPA and glyphosate were associated with metabolic syndrome at 18 (RR 1.80 and 1.88). Living near agricultural glyphosate use from birth to age 5 was also associated. This is not a neurodevelopment finding, but it shows early-childhood exposure in a farming community has measurable later effects. Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC10198618. Grade: SUPPORTED (single cohort).

h. Pooled 24-month analysis. Engel et al. 2016, Environ Health Perspect. Four cohorts, n = 936. The farm cohort had the strongest effect: Bayley mental development score −4.17 per 10-fold DAP increase. Results differed significantly by center, race/ethnicity and PON1 genotype. PON1 is an enzyme that detoxifies OPs, so this points to a genetic susceptibility subgroup. Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4892910/.

2. A population-based case-control study: Shelton et al. 2014

- Shelton et al. 2014, Environ Health Perspect 122(10):1103, doi:10.1289/ehp.1307044.
- Population-based case-control study linked to public pesticide-use records. n = 970: 486 ASD, 168 developmental delay (DD), 316 typically developing.
- About one-third of mothers lived within 1.5 km of an agricultural application during pregnancy.
- **Findings:** OPs at any time in gestation: about 60% higher ASD risk. Third trimester OPs: OR 2.0 (1.1, 3.6). Second-trimester chlorpyrifos: OR 3.3 (1.5, 7.4). Pyrethroids just before conception or in the third trimester: ORs 1.7 to 2.3 for

ASD and DD (the 1.82 and 1.87 values are from secondary write-ups only). Carbamates: higher DD risk, with no specific window identified; the secondary-source aOR of 2.48 is [UNVERIFIED].

- **Limitations:** small cells (many estimates rest on few exposed cases); many comparisons (classes × windows × buffers); exposure was assigned by address, with no biomarker.
- Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4181911/. Grade: SUPPORTED.

3. von Ehrenstein et al. 2019, BMJ

- BMJ 364:l962. Population-based case-control from a major agricultural region's birth records 1998 to 2010, with ASD cases from the state developmental services system. n = 2,961 cases and about 35,000 controls [counts UNVERIFIED; I could not open the full text].
- Exposure: 11 high-use pesticides applied within 2 km of the mother's home.
- **Prenatal exposure and ASD** (single-pesticide models): odds ratios 1.10 to 1.16. Glyphosate 1.16 (1.06, 1.27); chlorpyrifos 1.13 (1.05, 1.23); diazinon 1.11; malathion 1.11; avermectin 1.12; permethrin 1.10.
- **ASD with intellectual disability:** odds ratios about 30% higher. Glyphosate 1.33 (1.05, 1.69); chlorpyrifos 1.27 (1.04, 1.56); diazinon 1.41 (1.15, 1.73); permethrin 1.46 (1.20, 1.78); methyl bromide 1.33 (1.07, 1.64).
- **First-year-of-life exposure:** up to about 50% higher odds of ASD with intellectual disability for some chemicals.
- **Limitations:** estimates weaken when all 11 compounds are modeled together (the chemicals are applied together, so effects of individual chemicals cannot be separated); exposure was assigned by address only; residual confounding by socioeconomic status and rurality is possible; associations are small at the population level.
- Link: https://www.bmj.com/content/364/bmj.l962. Grade: SUPPORTED. This is the strongest single support for the infancy window and for regression-type autism with intellectual disability.

4. Roberts 2007, Keil, and meta-analyses

Roberts et al. 2007. Environ Health Perspect 115(10):1482. Agricultural-area case-control: 465 ASD cases vs 6,975 controls, births 1996 to 1998. Mothers within 500 m of the highest-use organochlorine fields (dicofol, endosulfan) around neural-tube closure (about weeks 3 to 8): OR 6.1 (2.4, 15.3). Exploratory: 249 hypotheses were tested and the key model was chosen after seeing the data. Organochlorines are largely obsolete now (endosulfan was phased out in the US by 2016 [UNVERIFIED date]), so this is less relevant to this pregnancy. Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2022638/. Grade: HYPOTHESIS to SUPPORTED.

Keil et al. 2014 [UNVERIFIED]. My recollection is that this was an analysis from the same case-control study of household flea/tick products (pyrethrins and others) and ASD, using bias analysis for exposure misclassification. The association weakened after correction. I did not confirm it this session.

Xu et al. 2023. Chemosphere 313:137459. Meta-analysis of 19 studies. Maternal pesticide exposure: ASD pooled OR 1.19; ADHD 1.20. By class: OPs 1.14 (1.04, 1.24); pyrethroids 1.40 (1.09, 1.80). Link: https://pubmed.ncbi.nlm.nih.gov/36470360/

2021 meta-analysis (pesticides and PCBs). Prenatal pesticides and ASD: pooled OR 1.20 (1.02, 1.39). Biomarker-based studies alone: null, 1.13 (0.83, 1.54). This is the key balancing point: the signal is clearer when exposure is estimated by proximity than when it is measured in the body. Link: https://link.springer.com/article/10.1007/s10803-021-05063-z

J Chem Health Risks 2023. Highest risk in the first trimester: OR 1.23 (1.15, 1.31). Adjusted odds ratios trend downward in later studies. Lower-tier journal. Link: https://sanad.iau.ir/Journal/jchr/Article/1087333

Overall grade for "pesticide exposure → ASD": SUPPORTED**.** The direction is consistent. The pooled effect is small: about 15 to 40% higher odds. Biomarker studies don't confirm it. Confounding by rural poverty, farmwork and co-exposures (air pollution, metals, mold in substandard housing) is not excluded.

5. Immune effects

Children (human data). Systematic review and meta-analysis, 2025, Science of the Total Environment (PROSPERO CRD42024510916). 17 studies, children 0 to 5, 14 of 17 on prenatal exposure. Pro-inflammatory cytokines: effect size 0.18 (0.08, 0.28). Mixed pesticide exposure and immunoglobulin responses: OR 1.42 (1.12, 1.80). Lower neutrophils and eosinophils. Reduced lymphocyte proliferation and NK-cell activity in functional tests. Prenatal organochlorines: lower lymphocyte counts and more otitis media (RR 1.52, 1.05 to 2.22). The direction is mixed (both suppression and inflammation) and depends on the exposure. Preprint protocol: https://www.medrxiv.org/content/10.1101/2024.09.06.24313180v1. First author [UNVERIFIED]. Th1/Th2 balance: Farm-cohort lab work showed chlorpyrifos shifts Th1/Th2 cytokine production, with children's lymphocytes differing from adults'. This is in vitro only.

Grade: SUPPORTED that early exposure alters immune parameters. HYPOTHESIS that this contributes to PANS-type flares, infection susceptibility, or IVIG responsiveness: no human study tests this.

Microglia. Developmental chlorpyrifos exposure in mice increased Iba1 (a microglial activation marker) and TSPO in the hippocampus and raised inflammatory cytokines through TLR4/TRIF and necroptosis pathways (Environ Pollut 2022; first author Du or Tu [UNVERIFIED]). Guinea pig and neonatal rat studies show microglial and astrocyte increases. Grade: HYPOTHESIS (animal data, mostly high doses).

Gut microbiome. Pu et al. 2020, PNAS: maternal formulated glyphosate in mice caused autism-like behavior and gut dysbiosis in offspring. Blocking the enzyme sEH prevented it. Doses far exceeded realistic exposure, and a co-author said the work does not support the epidemiology. Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC7260984. He et al. 2024, Ecotoxicol Environ Saf: lower-dose glyphosate-based herbicide; similar social deficits and microbiota shifts in mice. Grade: HYPOTHESIS.

Maternal immune activation. I found no study directly showing that agricultural pesticides induce maternal immune activation that leads to autism. This is a mechanistic bridge only. Grade: HYPOTHESIS.

Pesticide plus mold/mycotoxin co-exposure. Only in vitro studies: azoxystrobin (a fungicide) plus deoxynivalenol and other mycotoxins: synergistic toxicity in HepG2 liver cells (2025); DDT/DDE plus DON, ochratoxin A and zearalenone: enhanced toxicity in mouse Leydig cells (Eze 2018). A small pilot found urinary mycotoxins and pesticide metabolites correlated in humans. No human health-outcome study exists. Grade: HYPOTHESIS. It is worth stating plainly that the combination is untested, not that it is safe.

6. Timing windows

Preconception and first trimester (neural tube, early cortical neurogenesis): Roberts (organochlorines around embryogenesis); Shelton (pyrethroids just before conception); 2023 meta-analysis (first trimester highest).

Second and third trimester: Shelton: chlorpyrifos in the second trimester, OPs in the third. The farm cohort: prenatal DAPs averaged over pregnancy.

First year of life: von Ehrenstein 2019 is the main evidence: up to about 50% higher odds of ASD with intellectual disability. The farm cohort (2007) found child DAPs associated with PDD (OR 1.7), but Bouchard 2011 found postnatal DAPs not consistently associated with IQ. Infants crawl, put hands in their mouths and live close to floor dust, so their dose per kilogram from dust is higher.

Synthesis. For a home bordering fields from before conception through infancy, every proposed window was covered. The literature cannot say which window mattered for a given child. Regression at 8 to 12 months fits ASD with ongoing early-life exposure, but regression is not specifically linked to pesticides in any study I found. Treat that as HYPOTHESIS.

Chlorpyrifos in the state [UNVERIFIED from memory; check against agency records]. The state cancelled chlorpyrifos registrations; sales ended February 2020 and use ended 31 December 2020. So this pregnancy and infancy fall inside the chlorpyrifos-use era.

7. What can be measured now, and its limits

Urinary OP metabolites (DAPs: DMP, DMTP, DMDTP, DEP, DETP, DEDTP). Half-lives are hours, and a child's metabolite levels vary 2 to 8 times more within a child than between children (Bradman 2013). Spot samples more than a day apart correlate poorly (r about −0.21 to 0.38). Spot samples identify high-exposure children with only about 52 to 67% sensitivity. Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC3553429. Preformed DAPs in produce and juice raise DAP levels without true OP exposure, so DAPs overstate it (Weerasekera 2009; Tsuchiyama 2022). A current DAP result says nothing about exposure in the pregnancy and infancy years. Use: a series of urines (for example, a spray-season week vs a week away, several samples each) can show whether a current home-related exposure exists. It is not a diagnostic test.

Glyphosate and AMPA (urine). Same short half-life problem. Diet (non-organic grains and legumes) is a large confounder.

Fumigants (chloropicrin, 1,3-D, metam/MITC). No valid biomarker. Proximity, using pesticide-use records by section/township, is the only measure. Retrospective exposure for the pregnancy and infancy years can be rebuilt from public pesticide-use records for the home's square-mile section. That is how every study above assigned exposure.

Persistent compounds. Organochlorines can be measured in serum, but they are mostly legacy compounds.

Away-from-home improvement can't separate pesticides from mold. Leaving the home removes mold, mycotoxins, pesticide drift and pesticide-laden house dust together, along with other home-specific factors. An away trial rules the home environment in but does not say which component. Ways to tell them apart: timing against the spray calendar (spray-notification notices, use-record dates) vs against moisture or HVAC events; paired urine panels (DAPs and glyphosate alongside urinary mycotoxins) in the same samples; results of mold remediation done with the windows closed.

Household exposure reduction the literature supports.

1. Take shoes off at the door; store work shoes and clothes outside. Harnly 2009, 168 farm-area homes: OP dust concentrations rose with nearby agricultural use ($p < 0.01$). Dust levels were higher where farmworkers stored shoes inside ($p < 0.05$). Link: https://ehjournal.biomedcentral.com/track/pdf/10.1186/1476-069X-10-19 (related farm-cohort dust work). A meta-regression found that being closer to fields, having a farmworker in the house and indoor pesticide use all raise dust pesticide levels. Living within 1,250 m of farmland significantly raises indoor dust pesticide levels. Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC4059492
2. Wet-mop and HEPA-vacuum floors; wash hands before eating; keep infant play areas clean. These target the dust pathway. Plausible and low cost; direct trial evidence is limited.
3. Close windows and run indoor air filtration on application days. The public spray-notification service gives 24–48 h notice for restricted materials, including fumigants. Not every pesticide is a restricted material, so absence of a notice is not absence of spraying.
4. Wash produce; consider organic for the child's high-volume foods. Reduces dietary residue, a separate pathway from drift.
5. Take-home pathway: if anyone in the household works in agriculture, change clothes and shoes before entering and wash work clothes separately.

Gaps

- No human study links pesticide exposure to PANS, IVIG response or tick-borne disease.
- Mold/mycotoxin plus pesticide co-exposure: cell and animal data only.
- Individual-level attribution is not possible from population studies; exposure history must be reconstructed from public pesticide-use records by section.

(Note completed 2026-05-12 after the drafting agent's output was cut off mid-section 7.)

C. The spray records near the house: method and full tables

Prepared 2026-05-12. Source: the state pesticide agency's public pesticide-use records (raw files), parsed directly. All figures are pounds of active ingredient (AI) as reported by growers to the county agricultural commissioner. This is an environmental-data summary, not medical advice.

Privacy changes in this copy: the address, coordinates, county codes, survey township/section IDs and file names are removed; dates are moved, so each 12-month "year" below runs July to June; and pounds are rounded (single applications to 2 significant figures, totals to 3). Patterns, ratios and timing relative to the child are unchanged.

1. Method

Location. The home address was geocoded with the US Census geocoder. The home sits on land with no federally surveyed section, so the agency uses its own projected section grid. The state's public spray-notification service returned the home's section, and this matched the surrounding federal township corners: the home sits in the far north-west part of its section. [Address, coordinates and section IDs removed for privacy.]

Sections analyzed (3×3 ring = home section + 8 neighbors, ~1 mile around)

Position	Approx. distance home → section center	Home → nearest section edge
NW	1.9 km (1.2 mi)	~0.9 km
N	0.95 km (0.6 mi)	~0.15 km
NE	1.8 km (1.1 mi)	~0.7 km
W	1.8 km (1.1 mi)	~0.9 km
HOME	0.7 km	0 (home is inside it)
E	1.7 km (1.0 mi)	~0.7 km
SW	2.8 km (1.8 mi)	~1.7 km
S	2.3 km (1.4 mi)	~1.5 km
SE	2.7 km (1.7 mi)	~1.6 km

Because the home is at the north-west corner of its section, the 3×3 window is lopsided: the southern row is 1.4–1.8 mi away, while the northern sections are closer. A wider 5×5 ring (25 sections, ~2–2.5 mi) was also computed for context.

Nearest farmland. The home section reported only applications to the main perennial crop every year 2018–19 to 2024–25 (6,000–17,000 lb AI/yr). So a farm field lies within the same 1-square-mile section as the home, most likely within a few hundred meters. I could not confirm the exact field edge from imagery (map queries failed; the records have no field geometry).

Data. The agency's public pesticide-use archives, one zip per year, using the home county's application file plus the chemical and site lookup tables from the same zip. 2024–25 is the most recent year published (no newer file as of May 2026). Years covered in this ring analysis: 2018–19 to 2024–25. Records were selected by the section field (production-agriculture records; non-ag records such as landscape/structural have no section and are excluded). Pounds = sum of reported pounds; months from the application date. The spray-notification service was queried 2026-05-12 via its public notice-of-intent endpoint (no login needed).

2. Totals by year, 3×3 ring (~1 mile), pounds of active ingredient

Chemical	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24	2024–25
Sulfur (elemental)	85,700	33,700	59,500	60,100	35,700	64,100	59,700

Chemical	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24	2024–25
Lime-sulfur (calcium polysulfide)	35,200	27,100	25,600	30,800	30,700	21,800	44,000
Mineral oil / petroleum distillates	22,000	35,900	25,500	29,300	19,000	17,200	5,530
1,3-Dichloropropene (Telone, fumigant)	20,900	0	2,540	0	2,030	0	0
Metam-potassium (K-Pam, fumigant -> MITC)	11,000	0	5,040	18,200	7,010	5,910	3,720
Metam-sodium	0	0	0	0	0	0	0
Chloropicrin	0	0	0	0	0	0	0
Methyl bromide	0	0	0	0	0	0	0
Glyphosate (all salts)	5,400	6,800	7,070	6,730	3,160	5,690	4,150
Glufosinate-ammonium	2,310	2,300	2,660	2,170	2,860	1,680	1,490
Bensulide (organophosphate herbicide)	3,490	3,640	3,720	5,000	3,820	6,050	3,050
Chlorthal-dimethyl (DCPA / Dacthal)	1,580	2,840	1,930	1,430	1,140	1,010	560
Oxyfluorfen	430	540	600	350	280	580	530
Pendimethalin	790	990	680	700	730	760	860
Paraquat	75	88	120	0	0	0	0
Diuron	43	67	98	68	150	0	0
Mancozeb (manganese fungicide)	2,170	2,020	2,500	2,360	2,610	2,700	1,790
Maneb / captan	0	0	0	0	0	0	0
Chlorothalonil	730	1,060	560	520	260	500	460
Copper hydroxide	1,050	920	1,030	1,060	1,170	760	1,280
Chlorpyrifos (OP)	0	0	0	0	0	0	0
Diazinon (OP)	0	0	0	0	0	0	0
Malathion (OP)	0	0	38	14	0	0	34
Acephate (OP)	120	51	460	330	160	140	420
Dimethoate (OP)	140	65	150	33	46	43	140
Naled (OP)	450	250	230	180	71	32	21
Methomyl (carbamate)	750	990	1,160	940	1,240	970	810
Carbaryl (carbamate)	0	520	260	30	0	54	0
Oxamyl (carbamate)	81	140	170	0	0	95	100
Permethrin (pyrethroid)	170	280	440	430	420	270	350
Other pyrethroids (bifenthrin, cypermethrins, esfenvalerate, pyrethrins)	130	140	120	110	100	110	94
Imidacloprid (neonicotinoid)	510	81	720	500	710	720	97
Other neonic-type (clothianidin, thiamethoxam, acetamiprid, flupyradifurone, sulfoxaflor, dinotefuran)	580	500	420	460	550	240	460
All active ingredients, 3x3 ring	213,000	142,000	160,000	181,000	128,000	149,000	144,000
All active ingredients, 5x5 ring (~2 mi)	385,000	336,000	313,000	346,000	302,000	335,000	331,000

Per-section totals, 3×3 ring (lb AI)

Section	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24	2024–25
NW (~1.2 mi)	58,000	39,900	50,500	46,500	46,500	51,800	43,400
N (~0.6 mi)	950	1,940	1,170	2,400	1,020	970	880
NE (~1.1 mi)	2,110	5,200	2,500	2,880	1,630	4,370	2,570
W (~1.1 mi)	24,700	20,800	24,200	22,500	21,600	26,100	25,100
HOME section	15,500	17,400	6,030	12,700	6,860	9,220	8,040
E (~1.0 mi)	9,740	15,100	10,400	10,100	8,370	4,010	3,130
SW (~1.8 mi)	2,800	3,760	5,210	5,030	3,220	3,010	2,410
S (~1.4 mi)	53,700	19,400	31,900	48,900	21,600	34,500	44,900
SE (~1.7 mi)	45,900	18,400	27,900	30,200	17,600	15,500	14,000

The two sections touching the home's north side are low-use (likely mostly town), which fits the home sitting on the edge of town with farm fields to the south and west.

Home section, all the main perennial crop: top AIs every year are sulfur, mineral/petroleum oil, glyphosate, glufosinate, cyprodinil, oxyfluorfen; diuron 43–150 lb/yr 2018–19 to 2022–23. 2018–19: 15,500 lb (sulfur 8,260; mineral oil 3,890; glyphosate 1,260). 2019–20: 17,400 lb (sulfur 6,770; petroleum distillates 5,820; mineral oil 2,370; glyphosate 1,040).

Top crops (3×3, lb AI): the main perennial crop dominates every year (2018–19: 179,000 of 213,000 lb = 84%; 2019–20: 112,000 of 142,000 = 79%). Then row crops (one fumigated with metam-K most Novembers) and other vegetables.

Month distribution, 3×3 ring (lb AI)

12 months	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2018–19	17,500	24,200	9,110	44,600	47,700	42,000	12,800	6,810	4,700	1,970	980	870
2019–20	8,700	17,600	11,200	24,500	15,800	15,100	19,500	18,300	6,820	1,800	1,930	580
2020–21	13,500	19,200	4,740	24,000	25,800	31,800	25,800	6,850	2,820	3,140	1,450	640
2021–22	9,790	25,100	9,770	32,900	30,100	20,600	25,200	7,350	8,430	2,730	1,300	7,900
2022–23	15,500	20,500	8,190	20,700	19,600	19,500	9,740	7,330	3,780	2,240	720	430
2023–24	17,100	8,950	1,550	17,000	15,800	36,300	25,300	15,100	6,500	1,240	930	3,510
2024–25	11,700	26,700	6,050	14,800	21,100	30,200	9,720	8,630	3,490	1,450	440	10,200

Pattern: Jul–Aug dormant lime-sulfur and oil; October–January sulfur dusting (the bulk of the pounds); fumigations in October–November; April–May is the quietest period of the year.

3. Fumigant events, every one in the 3×3 ring

Date	Section (position)	Chemical	Crop	Acres	lb AI
2018-10-11	NW, ~1.2 mi	1,3-dichloropropene	main crop (pre-plant)	8.4	2,800
2018-10-12	NW, ~1.2 mi	1,3-dichloropropene	main crop (pre-plant)	55	18,000
2018-11-06	SE, ~1.7 mi	metam-potassium	row crop	20	3,700
2018-11-19	SE	metam-potassium	row crop	20	3,700
2018-11-25	SE	metam-potassium	row crop	20	3,700
2020-11-15	NW	1,3-dichloropropene	main crop	8	2,500
2020-11-15	SE	metam-potassium	row crop	28	5,000
2021-10-31 / 11-13 / 11-24	SE	metam-potassium	row crop	16–26	11,000
2022-06-11 / 06-13	SE	metam-potassium	row crop	17	7,600
2022-07-08	NW	1,3-dichloropropene	main crop	6.5	2,000
2022-11-15 / 11-21	SE	metam-potassium	row crop	18–20	7,000
2023-11-20	SE	metam-potassium	row crop	32	5,900
2024-11-05	SE	metam-potassium	row crop	20	3,700

Just outside the 3×3 ring (5×5): 1,3-D about 16,000 lb on 2019-10-11 (~2.6 mi SSE, main crop); 1,3-D about 8,100 lb (2021-09-29), 7,600 lb (2022-09-08) and 7,400 lb (2023-10-17) in the same section; metam-K repeatedly in two sections to the SE 2020–21 to 2024–25. Chlorpyrifos: only 3.9 lb in the 5×5 ring for the whole period (2018-09-27, a row crop, ~2 mi E). No chloropicrin, metam-sodium or methyl bromide anywhere in the 5×5 ring.

4. Pregnancy and infancy windows

(Pregnancy approximated as Nov 2018 – Aug 2019, assuming a term birth in Aug 2019.)

Around conception / pregnancy (2018–19). 2018–19 was the heaviest year in the series: 213,000 lb AI within the 3×3 ring (5×5: 385,000 lb). About 21,000 lb of 1,3-dichloropropene on 11–12 October 2018, ~1.2 mi NW (the largest single record in the whole 7-year dataset: about 18,000 lb). This is roughly 2–6 weeks before the estimated conception window. About 11,000 lb of metam-potassium (breaks down to the gas methyl isothiocyanate, MITC) on 6, 19 and 25 November 2018, ~1.7 mi SE: early first trimester. October–December 2018 sulfur: 77,500 lb (Oct 10,500; Nov 30,900; Dec 36,000). Nov 2018 – Aug 2019 total, 3×3 ring: 144,000 lb AI. Top: sulfur 73,000; lime-sulfur 22,700; metam-K 11,000; petroleum distillates 6,380; glyphosate (K salt) 3,650; bensulide 3,230; glufosinate 2,040; mancozeb 1,270; DCPA 1,210; chlorothalonil 730. Organophosphates in the 2018–19 year (3×3): bensulide 3,490; naled 450; dimethoate 140; acephate 117. Carbamate methomyl 750. Neonic-type 1,090 (imidacloprid 510). Mancozeb 2,170 (peaks Aug–Sep and Feb–Mar). Paraquat 75. No chlorpyrifos, diazinon, malathion within ~1 mile. DCPA (Dacthal), 1,580 lb in 2018–19 and 2,840 lb in 2019–20 within ~1 mile: noted because US EPA issued an emergency suspension of all DCPA registrations in August 2024, citing risk of thyroid-hormone changes in the developing fetus. (Regulatory fact only; no inference about this family.)

Infancy (Sep 2019 – Aug 2020). 148,000 lb AI in the 3×3 ring. Top: sulfur 33,700; petroleum distillates 33,500; lime-sulfur 30,100; glyphosate 8,040 (both salts); mineral oil 4,130; bensulide 3,700; fosetyl-Al 3,210; DCPA 2,760; glufosinate 2,300; mancozeb 2,180; chlorothalonil 1,060. No fumigation in the 3×3 ring in 2019–20; the nearest was about 16,000 lb of 1,3-D on 11 October 2019, ~2.6 mi SSE. 2019–20 carbamates: methomyl 990, carbaryl 520 (peak of 930 lb carbamates in February). OPs: bensulide 3,640, naled 250, dimethoate 65, acephate 51.

April–May 2020 (when the child became very sick). Only 3,730 lb AI in the 3×3 ring over both months, among the lowest two-month totals of the year (compare October 2019: 24,500 lb in one month). Comparable Apr–May totals: 2019 2,950; 2021 4,600; 2022 4,030. So Apr–May 2020 was ordinary for the season, not a spike. What was applied: fosetyl-Al 780; glufosinate 700; glyphosate 710 (both salts); DCPA 250; oxyfluorfen 220; potassium phosphite 160; copper octanoate/caprylic/capric acid ~250; naled 71; chlorothalonil 68; methomyl 47; permethrin 26; mancozeb 17. No fumigants. Crops: main perennial crop (post-harvest herbicide strip sprays) 1,410 lb; row crops 1,860. By section: S 920; E 730; NW 620; SW 420; W 370; N 300; home section 260.

5. Top chemicals by pounds within ~1 mile, 2018–19 to 2024–25 combined

1. Sulfur ~398,500 lb (powdery-mildew dust/spray, Oct–Jan)
2. Lime-sulfur ~215,300 lb (dormant-season spray, Jul–Aug, sometimes Jun)
3. Mineral oil / petroleum distillates ~154,400 lb
4. Metam-potassium ~50,900 lb (row-crop soil fumigation, mostly November)
5. Glyphosate ~39,000 lb
6. Bensulide ~28,800 lb
7. 1,3-dichloropropene ~25,500 lb (82% of it in October 2018)
8. Mancozeb ~16,100 lb
9. Glufosinate ~15,500 lb
10. DCPA ~10,500 lb; methomyl ~6,900 lb; copper hydroxide ~7,300 lb; chlorothalonil ~4,100 lb; imidacloprid ~3,300 lb; permethrin ~2,400 lb

6. Public spray-notification data (current restricted-material notices)

Queried 2026-05-12. No current or recent Notices of Intent in any of the 9 ring sections, nor in the other 16 sections of the 5×5 ring. The nearest active notices found: aerial methomyl (Lannate SP) scheduled 9 May 2026 on about 8 and 15 acres ~3 mi ENE. The service only shows a short window around the present, so it says nothing about past years. The family can subscribe anonymously by address to get an email/text before restricted-material applications nearby.

7. Data limits

- **Section, not field.** The records locate applications to a 1-square-mile section. Within a section the field could be 50 m or 1.5 km from the home. The 3×3 ring therefore approximates "within ~1–1.5 miles"; it is lopsided here because the home sits at the NW corner of its section.
- **Pounds applied is not exposure.** Actual exposure depends on volatility (fumigants like 1,3-D and MITC travel as gas, for days, and state air monitoring in the area regularly detects them), application method (shank, drip, tarp), wind (the local afternoon wind blows from the NW toward the SE; the large October 2018 Telone field was NW of the home, i.e. generally upwind), temperature inversions, and time spent indoors/outdoors.
- **Drift and dust.** Sulfur dust and spray drift travel; crop sulfur dust is a known respiratory irritant but low systemic toxicity.
- **Take-home pathway.** If anyone in the household worked in fields, packing, or applying, residues on clothes, shoes, cars and skin can be a larger source than drift. The records cannot capture that.
- **Not captured by the records:** household/garden/pet products, structural pest control and landscape/school/road uses (reported only as county monthly totals with no location), and anything misreported. Some records carry error flags (2018–19: about 300 records flagged in the ring; the 2024–25 file flags about 2,300 records with "X"); flagged values were kept as published.
- **Years:** 2024–25 is the latest year released.
- Active-ingredient names are grouped as the agency codes them; bensulide is an organophosphate used as a herbicide and is listed under herbicides above, not double-counted in totals.

20-mile, 10-year analysis (2015–16 to 2024–25)

Added 2026-05-12. Same source (pesticide-use raw files, pounds of active ingredient, production-agriculture records located to a survey section), widened to every section whose centroid lies within 20 miles of the home, and extended back three more years. Environmental data only, not medical advice.

Method

- **Years and files.** Three older annual archives were downloaded and combined with the archives already on disk. For every year the files for the home county and three neighboring counties were scanned; only the home county and one neighbor have any sections inside 20 miles. The neighbor contributed just 27–87 records a year (10–20 mi band); the other two contributed none.
- **Section centroids.** Federal land-survey township polygons for the surrounding townships were downloaded from the national survey map service. Each township's four corners were taken from its polygon and the 36 sections were placed by bilinear interpolation inside those corners (standard serpentine numbering). This follows the real township geometry (offsets, correction lines) but assumes sections are evenly spaced within each township. Most of the land here is unsurveyed land, where the agency itself uses a projected section grid, so this is the appropriate approximation. Distance = home point to section centroid (local flat-earth miles). Check: the home's computed position matched the earlier run; the home section centroid is 0.41 mi away.
- **Bands.** By section-centroid distance: 0–1 mi (2 sections: the home section and the one to its north), 1–3 mi (26), 3–5 mi (51), 5–10 mi (234), 10–20 mi (940); 1,253 sections in all. Note that the 0–1 band is much smaller than the earlier "3×3 ring": the neighboring farm sections to the E, W and NW have centroids at 1.0–1.2 mi and fall in the 1–3 band here.
- **Groups.** Fumigants = 1,3-dichloropropene, chloropicrin, metam-sodium, metam-potassium (agency name "potassium N-methyldithiocarbamate"), methyl bromide, dazomet. Organophosphates = chlorpyrifos, diazinon, malathion, acephate, dimethoate, naled, oxydemeton-methyl, bensulide, ethoprop, methyl parathion and the other OPs in the agency's list (phosmet etc. were searched; none reported). Bensulide is an OP herbicide used in volume on vegetables, so OPs are shown with and without it. Carbamates = methomyl, carbaryl, oxamyl (the only N-methyl carbamates present; dithiocarbamate fungicides are counted under mancozeb/maneb). Pyrethroids = all synthetic pyrethroids reported (permethrin, bifenthrin, lambda-cyhalothrin, cypermethrins, esfenvalerate, etc.). Neonicotinoids = imidacloprid, thiamethoxam, clothianidin, acetamiprid, dinotefuran (sulfoxaflor and flupyradifurone are not included). Glyphosate = all salts. Sulfur = elemental sulfur only (lime-sulfur separate).
- **Fumigant "applications."** One use record = one application of one product to one field on one date; a multi-ingredient product would be summed under its record.

Headline findings

- **Scale.** About 2.5–2.9 million lb AI per year within 20 miles and 0.60–0.90 million lb within 5 miles. The main perennial crop accounts for roughly 50–65% of the pounds every year (sulfur, mineral/petroleum oils, lime-sulfur); row crops and tree crops follow.
- **Fumigants.** Only 1,3-D and metam-potassium were used within 20 miles in any year. No chloropicrin, metam-sodium, methyl bromide or dazomet was reported within 20 miles in any of the ten years (chloropicrin is used in the north of the county, more than 20 miles away). Within 5 miles, fumigants ranged 14,700–67,900 lb/yr; the heaviest within-5-mile years were 2022–23 (67,900), 2017–18 (64,800) and 2021–22 (60,200). 2018–19 had 33,700 lb within 5 miles. The 20-mile total in 2015–16 (409,000 lb) is dominated by two May 2016 metam-potassium records (about 110,000 and 110,000 lb, ~430 acres, ~10 mi SE).
- **Largest fumigations near the home** were all pre-plant 1,3-D before planting the main crop: about 20,000 lb (4 Nov 2017, 1.1 mi WSW), 18,000 lb (12 Oct 2018, 1.2 mi WNW) and 16,000 lb (11 Oct 2019, 2.6 mi SSE).
- **Chlorpyrifos** within 20 miles fell from 3,720 lb (2015–16) and 2,930 lb (2016–17) to 371 (2017–18), 621 (2018–19), 138 (2019–20) and zero from 2020–21 on (state cancellation). In 2015–16 and 2016–17 about 670 lb/yr was applied in

the home section itself (dormant-season sprays in late August); none was reported within 20 miles during the pregnancy window, and 138 lb at 3–5 miles in the first year of life.

- **Paraquat** within 20 miles dropped from 21,000–30,000 lb/yr (2015–16 to 2018–19) to near zero after 2020–21. **DCPA** peaked in 2019–20 and 2020–21 (~50,800 lb within 20 mi; 18,600 lb within 5 mi in 2019–20) before its 2024 federal suspension. Organophosphates excluding bensulide declined from ~32,000 lb (2016–17 to 2017–18) to 16,000–22,000 lb/yr from 2018–19; bensulide rose.
- **Pregnancy window (Nov 2018 – Aug 2019):** 575,000 lb AI within 5 mi, 1.80 million within 20 mi. Fumigants within 5 mi: 11,000 lb (metam-potassium, Nov 2018, 1.7 mi SE); the large October 2018 1,3-D application fell just before the window.
- **First year of life (Sep 2019 – Aug 2020):** 821,000 lb within 5 mi, 2.78 million within 20 mi. Fumigants within 5 mi: about 16,000 lb (one 1,3-D application, 11 Oct 2019, 2.6 mi SSE).
- **April–May 2020** was ordinary for those months: 16,800 and 8,970 lb within 5 mi (April ranges 14,300–24,900 and May 4,700–19,700 across the ten years); no fumigants within 20 mi in April 2020 and 981 lb (outside 5 mi) in May 2020.
- **Seasonality** is the same every year: within 5 mi, October–December carries 100,000–183,000 lb per month, May–June usually under 15,000.

All active ingredients (lb AI, by distance band of section centroid)

Year	0–1 mi	1–3 mi	3–5 mi	5–10 mi	10–20 mi	within 5 mi	within 20 mi
2015–16	11,500	254,000	338,000	647,000	1,370,000	603,000	2,620,000
2016–17	15,200	353,000	454,000	690,000	1,120,000	822,000	2,630,000
2017–18	20,400	370,000	512,000	657,000	1,090,000	903,000	2,650,000
2018–19	16,400	365,000	443,000	587,000	1,100,000	824,000	2,510,000
2019–20	19,400	304,000	473,000	710,000	1,190,000	796,000	2,690,000
2020–21	7,190	312,000	392,000	664,000	1,200,000	711,000	2,570,000
2021–22	15,100	363,000	402,000	607,000	1,170,000	780,000	2,560,000
2022–23	7,880	294,000	372,000	611,000	1,250,000	674,000	2,530,000
2023–24	10,200	311,000	437,000	655,000	1,490,000	758,000	2,900,000
2024–25	8,920	322,000	405,000	679,000	1,310,000	736,000	2,730,000

Chemical groups by year, within 5 mi (lb AI)

Group	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24	2024–25
fumigants	19,800	24,200	64,800	33,700	15,800	14,700	60,200	67,900	15,100	16,800
1,3-D	0	0	33,200	20,900	15,800	7,410	8,070	25,200	9,160	0
metam-potassium	19,800	24,200	31,600	12,800	0	7,320	52,100	42,600	5,910	16,800
organophosphates	25,700	21,800	23,600	24,100	26,100	26,300	33,100	33,800	46,200	29,300
organophosphates excl. bensulide	8,830	11,300	8,950	6,890	5,120	7,140	7,790	7,290	4,910	6,260
chlorpyrifos	2,010	1,830	370	620	140	0	0	0	0	0
carbamates	10,700	9,590	10,500	9,020	10,800	11,000	11,300	16,200	10,600	12,200
pyrethroids	3,100	3,610	3,670	3,930	4,540	4,340	3,700	3,550	3,160	3,400
neonicotinoids	5,160	4,380	6,370	3,820	3,950	5,230	3,050	7,080	4,040	4,420
glyphosate	23,000	26,100	25,100	28,400	31,600	30,100	28,000	19,900	27,900	29,700
paraquat	7,500	9,880	7,700	5,220	1,670	420	0	52	140	0
mancozeb/maneb	14,600	17,400	17,000	17,900	17,300	17,800	18,100	18,800	17,000	13,300
DCPA	9,420	11,400	13,000	13,900	18,600	17,400	11,500	11,600	9,770	7,810
sulfur	205,000	263,000	272,000	293,000	150,000	175,000	150,000	115,000	168,000	155,000
chlorothalonil	5,620	6,030	4,520	4,080	5,320	5,740	4,120	4,320	4,410	3,870

Chemical groups by year, within 20 mi (lb AI)

Group	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24	2024–25
fumigants	409,000	59,500	124,000	87,100	47,700	40,100	108,000	117,000	46,500	65,500
1,3-D	44,700	28,800	73,300	73,400	40,900	27,400	52,800	60,900	28,600	28,300
metam-potassium	364,000	30,800	50,600	13,700	6,790	12,700	55,000	55,700	18,000	37,200
organophosphates	114,000	93,100	99,300	98,600	102,000	102,000	122,000	116,000	131,000	116,000
organophosphates excl. bensulide	26,700	32,400	31,500	21,900	17,900	18,800	21,500	20,400	16,200	19,800
chlorpyrifos	3,720	2,930	370	620	140	0	0	0	0	0
carbamates	51,200	43,700	39,400	35,700	34,800	44,100	43,800	59,400	43,200	48,200
pyrethroids	15,600	17,300	15,800	16,400	18,100	17,300	16,000	15,600	13,600	16,700
neonicotinoids	17,300	16,600	16,900	15,000	14,200	17,500	11,000	18,800	14,400	16,100
glyphosate	94,800	96,200	104,000	103,000	128,000	106,000	87,500	74,800	103,000	113,000
paraquat	21,500	30,000	29,900	24,300	15,900	3,390	680	66	140	0
mancozeb/maneb	69,100	72,200	71,100	72,400	71,300	69,900	74,100	74,600	71,700	64,100
DCPA	31,100	35,600	39,100	42,600	50,800	50,900	34,900	34,100	24,400	27,200
sulfur	474,000	603,000	524,000	601,000	496,000	462,000	390,000	345,000	491,000	543,000
chlorothalonil	16,200	16,700	14,900	11,700	11,900	12,000	9,730	9,800	11,600	10,700

Fumigants (1,3-D + metam-potassium; no chloropicrin, metam-sodium, methyl bromide or dazomet was reported in the 20-mile circle in any year) (lb AI, by distance band)

Year	0–1 mi	1–3 mi	3–5 mi	5–10 mi	10–20 mi	within 5 mi	within 20 mi
2015–16	0	20,000	0	40,000	350,000	20,000	410,000
2016–17	0	24,000	0	23,000	13,000	24,000	60,000
2017–18	0	51,000	14,000	33,000	26,000	65,000	120,000
2018–19	0	32,000	1,800	6,300	47,000	34,000	87,000
2019–20	0	16,000	0	17,000	15,000	16,000	48,000
2020–21	0	9,900	4,900	3,900	21,000	15,000	40,000
2021–22	0	49,000	12,000	18,000	30,000	60,000	110,000
2022–23	0	50,000	18,000	38,000	10,000	68,000	120,000
2023–24	0	15,000	0	12,000	19,000	15,000	47,000
2024–25	0	7,500	9,300	21,000	28,000	17,000	65,000

Chlorpyrifos (lb AI, by distance band)

Year	0–1 mi	1–3 mi	3–5 mi	5–10 mi	10–20 mi	within 5 mi	within 20 mi
2015–16	670	940	410	1,480	230	2,010	3,720
2016–17	670	830	330	1,040	61	1,830	2,930
2017–18	0	26	340	0	0	370	370
2018–19	0	4	620	0	0	620	620
2019–20	0	0	140	0	0	140	140
2020–21	0	0	0	0	0	0	0
2021–22	0	0	0	0	0	0	0
2022–23	0	0	0	0	0	0	0
2023–24	0	0	0	0	0	0	0
2024–25	0	0	0	0	0	0	0

Pregnancy (Nov 2018 – Aug 2019) (lb AI)

Group	0–1 mi	1–3 mi	3–5 mi	5–10 mi	10–20 mi	within 5 mi	within 20 mi
ALL	7,220	253,000	315,000	432,000	795,000	575,000	1,800,000
fumigants	0	11,000	0	5,410	0	11,000	16,400
1,3-D	0	0	0	5,410	0	0	5,410
metam-potassium	0	11,000	0	0	0	11,000	11,000
chloropicrin	0	0	0	0	0	0	0
metam-sodium	0	0	0	0	0	0	0
methyl bromide	0	0	0	0	0	0	0
dazomet	0	0	0	0	0	0	0
organophosphates	160	11,800	9,060	25,300	39,700	21,000	86,000
organophosphates excl. bensulide	130	2,840	2,290	4,760	7,530	5,260	17,500
chlorpyrifos	0	0	0	0	0	0	0
diazinon	0	0	0	0	0	0	0
malathion	0	340	260	810	900	600	2,310
acephate	60	890	830	1,660	3,490	1,780	6,930
dimethoate	72	610	830	900	930	1,510	3,340
naled	0	1,000	330	1,390	2,160	1,330	4,880
oxydemeton-methyl	0	0	0	0	0	0	0
bensulide	26	8,940	6,770	20,500	32,200	15,700	68,400
ethoprop	0	0	37	0	51	37	88
carbamates	49	3,950	4,660	9,170	15,700	8,660	33,500
pyrethroids	13	1,750	1,180	3,110	6,340	2,950	12,400
neonicotinoids	86	1,510	1,150	2,220	6,840	2,750	11,800
glyphosate	1,150	8,030	14,900	27,000	47,000	24,000	98,100
paraquat	0	540	4,210	3,510	13,700	4,750	22,000
mancozeb/maneb	0	5,700	6,200	9,110	31,900	11,900	52,900
DCPA	120	5,030	4,870	12,800	10,700	10,000	33,500
sulfur	3,590	111,000	146,000	93,800	152,000	261,000	507,000
chlorothalonil	180	1,510	2,330	3,830	2,980	4,020	10,800

First year of life (Sep 2019 – Aug 2020) (lb AI)

Group	0–1 mi	1–3 mi	3–5 mi	5–10 mi	10–20 mi	within 5 mi	within 20 mi
ALL	19,600	313,000	488,000	726,000	1,230,000	821,000	2,780,000
fumigants	0	15,800	0	13,100	15,100	15,800	44,000
1,3-D	0	15,800	0	13,100	8,300	15,800	37,200
metam-potassium	0	0	0	0	6,790	0	6,790
chloropicrin	0	0	0	0	0	0	0
metam-sodium	0	0	0	0	0	0	0
methyl bromide	0	0	0	0	0	0	0
dazomet	0	0	0	0	0	0	0
organophosphates	47	14,800	11,300	29,700	45,800	26,100	102,000
organophosphates excl. bensulide	47	2,580	2,520	4,570	8,290	5,150	18,000
chlorpyrifos	0	0	140	0	0	140	140
diazinon	0	0	0	0	0	0	0
malathion	0	240	420	670	1,100	660	2,430
acephate	0	770	950	1,100	3,690	1,720	6,520
dimethoate	47	400	580	710	940	1,020	2,670

Group	0–1 mi	1–3 mi	3–5 mi	5–10 mi	10–20 mi	within 5 mi	within 20 mi
naled	0	1,180	430	2,090	2,560	1,600	6,250
oxydemeton-methyl	0	0	0	0	0	0	0
bensulide	0	12,200	8,780	25,100	37,500	21,000	83,600
ethoprop	0	0	0	0	0	0	0
carbamates	100	5,110	5,620	8,790	15,000	10,800	34,600
pyrethroids	71	2,700	1,820	4,590	9,110	4,580	18,300
neonicotinoids	110	1,400	2,470	3,800	6,600	3,980	14,400
glyphosate	1,190	13,900	16,200	31,100	62,600	31,200	125,000
paraquat	0	440	1,180	3,710	10,500	1,620	15,900
mancozeb/maneb	60	7,820	10,300	14,000	40,000	18,100	72,200
DCPA	340	7,850	11,000	16,000	16,800	19,200	51,900
sulfur	6,770	64,700	78,900	116,000	229,000	150,000	495,000
chlorothalonil	310	2,210	2,970	2,970	3,690	5,490	12,200

Top 25 active ingredients in the 20-mile circle, ten years combined, with 2018–19 and 2019–20 (lb AI)

#	Ten years	lb	2018–19	lb	2019–20	lb
1	Sulfur	4,930,000	Sulfur	601,000	Petroleum Distillates, Refined	736,000
2	Mineral Oil	4,800,000	Petroleum Distillates, Refined	536,000	Sulfur	496,000
3	Petroleum Distillates, Refined	3,160,000	Potassium Phosphite	110,000	Mineral Oil	156,000
4	Potassium Phosphite	1,300,000	Lime-Sulfur	103,000	Potassium Phosphite	128,000
5	Bensulide	867,000	Mineral Oil	99,900	Bensulide	83,600
6	Lime-Sulfur	757,000	Bensulide	76,700	Fosetyl-Al	82,500
7	Mancozeb	711,000	1,3-Dichloropropene	73,400	Mancozeb	71,300
8	Potassium N-Methyldithiocarbamate	645,000	Mancozeb	72,400	Glyphosate, Isopropylamine Salt	66,200
9	Fosetyl-Al	639,000	Fosetyl-Al	60,900	Lime-Sulfur	63,900
10	Diatomaceous Earth	576,000	Glyphosate, Isopropylamine Salt	55,400	Glyphosate, Potassium Salt	61,400
11	Glyphosate, Isopropylamine Salt	529,000	Glyphosate, Potassium Salt	47,200	Chlorthal-Dimethyl	50,800
12	Glyphosate, Potassium Salt	480,000	Chlorthal-Dimethyl	42,600	Diatomaceous Earth	41,700
13	1,3-Dichloropropene	459,000	Methomyl	31,500	1,3-Dichloropropene	40,900
14	Methomyl	404,000	Glufosinate-Ammonium	31,100	Glufosinate-Ammonium	32,400
15	Chlorthal-Dimethyl	371,000	Propyzamide	28,200	Methomyl	29,600
16	Glufosinate-Ammonium	337,000	Copper Hydroxide	26,800	Propyzamide	28,200
17	Kaolin	264,000	Burkholderia sp. strain A396	25,200	Burkholderia sp. strain A396	23,600
18	Propyzamide	228,000	Paraquat Dichloride	24,300	Potassium Bicarbonate	22,700
19	Potassium Bicarbonate	220,000	Potash Soap	17,800	Copper Hydroxide	19,300
20	Copper Hydroxide	192,000	Caprylic Acid	17,100	Paraquat Dichloride	15,900
21	Bacillus thuringiensis subsp. kurstaki	143,000	Kaolin	17,000	PCNB	15,800
22	Boscalid	143,000	PCNB	16,900	Bacillus thuringiensis subsp. aizawai	15,600
23	Pendimethalin	136,000	Boscalid	15,500	Bacillus thuringiensis subsp. aizawai (GC-91)	14,700
24	Cycloate	134,000	Oxyfluorfen	14,500	Boscalid	14,000
25	Paraquat Dichloride	126,000	Potassium N-Methyldithiocarbamate	13,700	Cycloate	13,400

Top crops/sites by lb AI, 20-mile circle

Year	1	2	3	4	5
2015–16	Main crop 1,330,000	Row crop 2 439,000	Row crop 1 291,000	Row crop 4 115,000	Tree crop 73,700
2016–17	Main crop 1,610,000	Row crop 1 309,000	Row crop 2 131,000	Row crop 4 121,000	Row crop 3 71,900
2017–18	Main crop 1,650,000	Row crop 1 282,000	Row crop 2 145,000	Row crop 4 119,000	Uncultivated Ag 70,400
2018–19	Main crop 1,560,000	Row crop 1 284,000	Row crop 3 101,000	Row crop 2 93,900	Uncultivated Ag 88,400
2019–20	Main crop 1,640,000	Row crop 1 315,000	Row crop 2 122,000	Row crop 3 120,000	Uncultivated Ag 88,600
2020–21	Main crop 1,490,000	Row crop 1 315,000	Row crop 3 158,000	Row crop 2 112,000	Uncultivated Ag 82,500
2021–22	Main crop 1,390,000	Row crop 1 364,000	Row crop 3 140,000	Row crop 2 114,000	Row crop 4 74,100
2022–23	Main crop 1,280,000	Row crop 1 420,000	Row crop 3 140,000	Tree crop 125,000	Row crop 2 115,000
2023–24	Main crop 1,830,000	Row crop 1 339,000	Tree crop 131,000	Row crop 2 103,000	Row crop 3 98,100
2024–25	Main crop 1,620,000	Row crop 1 348,000	Row crop 3 140,000	Row crop 2 101,000	Tree crop 79,000
Ten years	Main crop 15,400,000	Row crop 1 3,270,000	Row crop 2 1,480,000	Row crop 3 1,090,000	Row crop 4 867,000

15 largest single fumigant applications within 5 miles

#	Date	Chemical	lb AI	Crop	Acres	Distance / direction
1	2017-11-04	1,3-D	20,000	Main crop	63	1.1 mi WSW
2	2018-10-12	1,3-D	18,000	Main crop	55	1.2 mi WNW
3	2019-10-11	1,3-D	16,000	Main crop	49	2.6 mi SSE
4	2017-10-25	1,3-D	13,000	Main crop	41	1.2 mi WNW
5	2021-09-29	1,3-D	8,100	Main crop	25	2.6 mi SSE
6	2022-07-08	1,3-D	7,900	Main crop	25	2.6 mi NW
7	2022-09-08	1,3-D	7,600	Main crop	24	2.6 mi SSE
8	2023-10-17	1,3-D	7,400	Main crop	25	2.6 mi SSE
9	2017-10-29	metam-potassium	7,000	Main crop	45	3.1 mi SE
10	2017-10-28	metam-potassium	7,000	Main crop	45	3.1 mi SE
11	2023-11-20	metam-potassium	5,900	Row crop	32	1.7 mi SE
12	2024-12-01	metam-potassium	5,600	Row crop	30	4.1 mi W
13	2021-08-06	metam-potassium	5,400	Row crop	20	2.6 mi N
14	2020-11-15	metam-potassium	5,000	Row crop	28	1.7 mi SE
15	2020-10-03	1,3-D	4,900	Main crop	16	3.3 mi NW

Monthly, all AI within 5 mi (lb AI)

12 months	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2015–16	12,800	33,200	77,400	116,000	114,000	102,000	56,400	39,100	20,100	21,800	4,740	5,800
2016–17	7,900	52,900	85,500	133,000	146,000	175,000	101,000	49,200	30,600	16,100	6,870	18,600
2017–18	30,300	57,800	69,400	182,000	183,000	169,000	107,000	43,600	29,100	14,500	10,400	5,920
2018–19	43,300	63,700	42,600	164,000	161,000	166,000	78,800	46,000	30,000	16,200	4,960	7,100
2019–20	20,600	43,300	46,100	168,000	114,000	108,000	142,000	88,700	36,700	16,800	8,970	3,690
2020–21	26,500	61,600	45,500	147,000	102,000	109,000	105,000	41,800	34,500	21,600	10,600	5,430
2021–22	22,500	79,900	78,700	156,000	106,000	80,200	104,000	52,100	50,700	24,400	13,600	12,300
2022–23	43,300	59,300	46,700	124,000	92,900	84,700	84,500	65,100	35,200	24,900	10,600	2,800
2023–24	25,600	40,400	13,900	111,000	105,000	113,000	125,000	131,000	43,900	14,300	19,700	14,500
2024–25	28,700	65,100	41,400	106,000	123,000	113,000	94,000	70,300	39,800	20,800	9,020	25,200

Monthly, all AI within 20 mi (lb AI)

12 months	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2015–16	56,400	97,600	305,000	392,000	369,000	361,000	249,000	177,000	105,000	124,000	326,000	57,800
2016–17	44,800	122,000	285,000	433,000	417,000	510,000	329,000	178,000	136,000	93,200	36,800	45,400
2017–18	83,800	116,000	213,000	537,000	490,000	394,000	367,000	184,000	134,000	78,800	34,900	20,800
2018–19	107,000	121,000	123,000	515,000	478,000	409,000	315,000	176,000	143,000	77,500	19,500	23,500
2019–20	67,000	91,200	161,000	527,000	481,000	409,000	436,000	238,000	151,000	91,100	25,600	15,100
2020–21	85,500	155,000	158,000	457,000	431,000	405,000	391,000	184,000	156,000	101,000	26,100	22,400
2021–22	43,900	148,000	177,000	499,000	390,000	349,000	340,000	222,000	198,000	103,000	57,100	29,100
2022–23	82,600	126,000	155,000	398,000	385,000	398,000	335,000	262,000	193,000	143,000	33,600	19,600
2023–24	57,000	84,700	62,900	412,000	429,000	448,000	491,000	544,000	234,000	63,800	38,400	33,800
2024–25	102,000	137,000	146,000	447,000	458,000	453,000	358,000	259,000	188,000	108,000	22,300	47,600

Monthly, fumigants within 5 mi (lb AI)

12 months	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2015–16	0	0	0	11,000	9,200	0	0	0	0	0	0	0
2016–17	0	0	0	2,300	12,000	9,600	0	0	0	0	0	0
2017–18	0	0	0	32,000	27,000	5,900	0	0	0	0	0	0
2018–19	0	0	1,800	21,000	11,000	0	0	0	0	0	0	0
2019–20	0	0	0	16,000	0	0	0	0	0	0	0	0
2020–21	0	0	0	7,200	7,600	0	0	0	0	0	0	0
2021–22	0	22,000	16,000	0	15,000	0	0	0	0	0	0	7,600
2022–23	22,000	6,300	7,600	2,300	9,300	5,300	5,500	10,000	0	0	0	0
2023–24	0	0	0	9,200	5,900	0	0	0	0	0	0	0
2024–25	0	0	0	0	13,000	3,700	0	0	0	0	0	0

Monthly, fumigants within 20 mi (lb AI)

12 months	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
2015–16	7,200	6,000	18,000	12,000	20,000	10,000	0	0	0	1,100	300,000	35,000
2016–17	0	2,900	0	10,000	14,000	16,000	0	0	0	0	4,600	12,000
2017–18	0	0	0	67,000	28,000	5,900	4,000	7,400	0	4,000	4,500	2,700
2018–19	2,700	1,800	2,700	68,000	12,000	0	0	0	0	0	0	0
2019–20	4,500	0	5,800	26,000	4,600	5,800	0	0	0	0	980	0
2020–21	0	790	16,000	7,200	7,600	5,400	0	0	0	0	3,100	0
2021–22	2,100	37,000	21,000	19,000	15,000	0	0	0	0	0	6,000	7,600
2022–23	29,000	18,000	19,000	2,300	9,300	5,300	8,100	20,000	0	0	5,400	0
2023–24	0	2,600	0	26,000	7,000	9,800	0	1,100	0	0	0	0
2024–25	0	0	4,800	18,000	18,000	3,700	0	0	9,800	7,700	2,900	0

Limits (in addition to section 7 above)

- **Centroid banding.** A section is assigned wholly to one band by its centroid; a field at the edge of a section can be up to ~0.7 mi nearer or farther than the band suggests. The 0–1 band holds only two sections, so it understates use within a mile; read “within 3 mi” together with it.
- **Grid approximation.** Section positions are interpolated inside federal township polygons; the agency’s projected grid for unsurveyed land may differ by a fraction of a mile in places. Irregular township edges lie outside 20 mi.
- **Name changes across years.** The agency reports refined petroleum distillates through 2019–20 and the same oils as “mineral oil” from 2020–21, so those two lines should be read together (combined oils ~0.64–1.13 million lb/yr within 20 mi). Glyphosate is the sum of its salts.

- **Outliers kept as published.** Values are the agency's post-review figures, with error-flagged records retained (2024–25's file flags many records with "X"). Notable large records: the May 2016 metam-potassium pair (~216,000 lb on ~840 acres, ~10 mi SE) and a ~25,000 lb biological (Bacillus amyloliquefaciens) record in 2024–25 reported on 10,000 "acres", which is likely a unit error; neither affects the 5-mile fumigant results.
- **Pounds are not exposure.** Wind (the afternoon NW wind), fumigation method, tarping and time indoors all change what reaches a home. Non-agricultural uses (structural, landscape, home and garden) are not located in the records and are excluded. Newer data are not yet published.
- Machine-readable files (yearly by band and group, windows, monthly series, top ingredients, top crops, chlorpyrifos records, top fumigant applications) were kept with the family's file and are not reproduced here.

End of report. A real Plan B Case Review. Every name, place, date and identifying detail has been changed.