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Registrants receiving a notice of intent from the EPA to cancel a registration are able to demand a hearing.<sup>287</sup> Cancellation under this mechanism must consider impacts “on production and prices of agricultural commodities, retail food prices, and otherwise on the agricultural economy.”<sup>288</sup> This provision was intended to protect the economic interests of farmers and consumers.<sup>289</sup> The EPA also considers mandatory restrictions on usage and the availability of an alternative pesticide.<sup>290</sup> To assist producers facing hardship, federal regulations allow a canceled or an unregistered pesticide to be

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<sup>283</sup> 7 U.S.C. § 136n (2018). *See, e.g.*, *Reckitt Benckiser Inc. v. EPA*, 613 F.3d 1131, 1134 (D.C. Cir. 2010) (opining that parties secure district court review of the EPA's refusal to cancel a registration).

<sup>284</sup> *Def. Wildlife v. Jackson*, 791 F. Supp. 2d 96, 101 (D.D.C. 2011). The “‘proponent of cancellation or change in classification’ must present an ‘affirmative case for the cancellation or change in the classification of the registration.’” *Id.* (citing 40 C.F.R. § 164.80(a)). “[T]he ultimate burden of persuasion shall rest with the proponent of the registration.” 40 C.F.R. § 164.80(b) (2019). Courts have noted a strong presumption in favor of judicial review of administrative actions regarding registrations of pesticides. *See New York v. EPA*, 350 F. Supp. 2d 429, 434 (S.D.N.Y. 2004) (citing the Administrative Procedure Act's presumption favoring judicial review); *Woodstream Corp.*, 845 F. Supp. 2d at 177 (observing that a court does not substitute its construction of a statutory provision for an interpretation made by the agency).

<sup>285</sup> *See EPA AZINPHOS-METHYL INTERIM DECISION*, *supra* note 47, at vii (noting that the termination of azinphos-methyl uses would lead producers to use alternative products in some cases).

<sup>286</sup> *See Pollinator Stewardship Council v. EPA*, 806 F.3d 520, 531 (9th Cir. 2015) (showing the manufacturer arguing to continue with its registration); *Nat'l Corn Growers Ass'n v. EPA*, 613 F.3d 266, 269 (D.C. Cir. 2010) (concerning producer groups opposing the revocation of tolerances); *Ellis v. Housenger*, 252 F. Supp. 3d, 800, 805 (showing four intervenors opposing suspension of registrations).

<sup>287</sup> 7 U.S.C. § 136d(b)–(d) (2018); 40 C.F.R. § 164.20 (2019).

<sup>288</sup> 7 U.S.C. § 136d(b) (2018).

<sup>289</sup> *See McGill v. EPA*, 593 F.2d 631, 635 (5th Cir. 1979).

<sup>290</sup> *See Timothy F. Malloy, Principled Prevention*, 46 ARIZ. STATE L.J. 105, 115–16 (2008) (observing that the existence of a significantly safer alternative pesticide may mean a pesticide no longer qualifies for registration).

distributed or sold under an emergency exemption.<sup>291</sup> Emergency exemptions are rather common.<sup>292</sup>

For the initial registration of glyphosate in 1974, Monsanto submitted four studies conducted by the Industrial Bio-Test Laboratory to justify qualification.<sup>293</sup> Subsequently, it was discovered that the lab had misrepresented data to support the use of hundreds of pesticides it had tested,<sup>294</sup> and the lab was convicted of falsifying product-safety tests.<sup>295</sup> Monsanto's Roundup was one of the products registered based on the laboratory's invalid tests.<sup>296</sup> Despite learning that the lab's studies were fraudulent, Monsanto's glyphosate products remained on the market,<sup>297</sup> although subsequent tests were conducted.<sup>298</sup> Cancellation under federal law required proof that the risks were greater than the benefits, which was not available.<sup>299</sup>

Petitioners applying for cancellation of a pesticide's registration often argue its use is causing "unreasonable adverse effects on the environment" in violation of federal law.<sup>300</sup> Unreasonable adverse effects on the environment involve an unreasonable risk to humans accounting for "economic, social, and environmental costs and benefits."<sup>301</sup> The EPA conducts a detailed cost-benefit analysis that takes into account the costs related to anticipated harm compared to the

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<sup>291</sup> 40 C.F.R. § 152.30 (2019).

<sup>292</sup> See, e.g., *Pesticide Registration: Emergency Exemption Database: Section 18 Database: Apple*, EPA, <https://iaspub.epa.gov/apex/pesticides/f?p=SECTION18:3::NO::> (last visited Nov. 3, 2020) (listing 49 emergency exemptions requested since 2010 for apples, with most exemptions allowing applications of a pesticide for a few months).

<sup>293</sup> Testimony of Charles Benbrook, Day 11 at 3523–27, *Pilliod v. Monsanto*, No. RG17862702 (Cal. Super. Ct. Apr. 4, 2019) [hereinafter *Pilliod Benbrook Testimony*] (testifying that the laboratory submitted four studies used to justify glyphosate's registration and they were all subsequently found to be invalid because they were not supported by the raw data).

<sup>294</sup> Nathaniel Sheppard Jr., *Fraud in Toxicology Studies Charged to Big Laboratory*, N.Y. TIMES, Apr. 13, 1983, at A18 (reporting of jury selection for a trial involving the misrepresentation of data that was used to justify health safety studies).

<sup>295</sup> See Dow Jones & Co., *Three Convicted of Falsifying Data at Nalco's IBT Unit*, WALL ST. J., Oct. 24, 1983 (noting that the EPA declared the laboratory had conducted invalid tests on over 200 pesticides); see also *Pilliod Benbrook Testimony*, *supra* note 293, at 3529 (testifying that the laboratory studies used to justify registration were by a laboratory engaged in fraud).

<sup>296</sup> See Mary Thornton, *EPA Review Finds Flawed Tests Made by Research Firm*, WASH. POST, May 13, 1983, at A3.

<sup>297</sup> *Pilliod Benbrook Testimony*, *supra* note 293, at 3529.

<sup>298</sup> See Thornton, *supra* note 296.

<sup>299</sup> 7 U.S.C. § 136d(b) (2018). See *Pilliod Benbrook Testimony*, *supra* note 293, at 3533.

<sup>300</sup> 7 U.S.C. § 136d. See *Defs. Wildlife v. Jackson*, 791 F. Supp. 2d 96 (D.D.C. 2011).

<sup>301</sup> 7 U.S.C. § 136(bb)(1).

benefits of allowing a pesticide product to be used.<sup>302</sup> Costs include both direct and indirect costs as well as explicit and implicit costs.<sup>303</sup> A registration may be canceled when credible evidence shows there is an unreasonable adverse effect on the environment<sup>304</sup> and the pesticide's costs outweigh its benefits.<sup>305</sup> The EPA may require several years to complete its analysis of whether a registration needs to be canceled.<sup>306</sup>

For glyphosate, considerable data and analyses show that the costs and benefits employed for registrations have changed.<sup>307</sup> Yields and prices are different, so they need to be reconsidered.<sup>308</sup> The evolution of glyphosate-resistant weeds probably means that benefits calculated at registration involving higher yields were overestimated.<sup>309</sup> Simultaneously, GBH use has lowered the prices of food products<sup>310</sup> and contributes to food security for many persons who lack sufficient

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<sup>302</sup> EPA GUIDELINES, *supra* note 94, at pt. 7.4. *See* Li, *supra* note 122, at 1424 (noting the balancing of potential risks and benefits).

<sup>303</sup> EPA GUIDELINES, *supra* note 94, at pts. 5.12, 7.3, 8.7.

<sup>304</sup> 7 U.S.C. § 136d(b). *See* Ciby-Geigy Corp. v. EPA, 874 F.2d 277, 279 (5th Cir. 1989) (noting that only a significant probability of adverse effects is needed to justify cancellation); Nat'l Coal. Against the Misuse of Pesticides v. EPA, 867 F.2d 636, 643 (D.C. Cir. 1989) (noting that a notice to cancel may be issued if it appears that a pesticide "generally causes unreasonable adverse effects on the environment").

<sup>305</sup> *See* Nat'l Coal. Against the Misuse of Pesticides, 867 F.2d at 639 (observing that the EPA intended to cancel a pesticide registration as the risks outweighed the benefits); Ctr. for Biological Diversity v. EPA, 847 F.3d 1075, 1085 n.9 (9th Cir. 2017) (noting the possibility of not reregistering a pesticide if the costs outweigh the benefits).

<sup>306</sup> *See* EPA AZINPHOS-METHYL FINAL DECISIONS, *supra* note 47, at 1. The cancellation proceeding for azinphos-methyl shows time is needed. Because the pesticide was providing significant economic benefits for a small group of uses, the agency granted producers more time to adopt alternative pest control measures. Some pesticide stocks were used more than a decade after the findings that azinphos-methyl failed to meet registration requirements. *Azinphos-Methyl Phase-Out*, *supra* note 126.

<sup>307</sup> *See* Centner, Russell & Mays, *supra* note 31, at 614–15 (identifying preferred strategies for allowing uses of glyphosate dependent upon the magnitude of adverse effects on human health and food insecurity).

<sup>308</sup> *See* MICHAEL LIVINGSTON ET AL., THE ECONOMICS OF GLYPHOSATE RESISTANCE MANAGEMENT IN CORN AND SOYBEAN PRODUCTION 24 (USDA 2015) (surmising benefits from using a GBH in conjunction with another herbicide); C.L. Keene & W.S. Curran, *Optimizing High-Residue Cultivation Timing and Frequency in Reduced-Tillage Soybean and Corn*, 108 AGRONOMY J. 1897, 1897 (2016) (advocating "new integrated weed management approaches" given weed resistance that developed since registration of GBHs).

<sup>309</sup> *See* Heap & Duke, *supra* note 191, at 1042 (noting that resistant weeds can devastate corn and soybean yields).

<sup>310</sup> *See* Brookes, Taheripour & Tyner, *supra* note 31, at 224 (projecting a 5.4% increase in soybean prices if glyphosate use was discontinued).

financial resources to buy food.<sup>311</sup> These benefits may not have been included in a registrant's registration materials. For many registrations, insufficient numbers of studies on potential health costs were conducted, and only later were health issues identified.<sup>312</sup> If subsequent significant health costs related to exposure to glyphosate are known, a new cost-benefit analysis is needed.<sup>313</sup>

Numerous new risks have been identified concerning adverse health effects from uses of GBHs.<sup>314</sup> Yet, a majority of the results of reported studies acknowledge that the risks do not definitively show adverse effects to human health.<sup>315</sup> Rather, many of the studies analyzed nonhuman animals to show changes without defining their expected toxicity or the degree of risk for human health.<sup>316</sup> Others involved case studies with results that were not statistically significant.<sup>317</sup> Until more definitive data exist, it is unclear that health costs justify canceling GBH registrations. However, the expenses and damage awards from litigation against manufacturers such as Monsanto might alter a registration's cost-benefit analysis to support its cancellation.<sup>318</sup>

### ***B. Revocation of Tolerances***

Exceeding tolerances established for pesticide residues on or in food products provides a justification for ending a pesticide registration, and

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<sup>311</sup> See Christian A. Gregory & Alisha Coleman-Jensen, *Do High Food Prices Increase Food Insecurity in the United States?* 35 APPLIED ECON. PERSPS. & POL'Y 679, 679 (2013) (observing that food prices affect food security).

<sup>312</sup> See, e.g., Notice of Receipt of Requests to Voluntarily Cancel Certain Pesticide Registrations, 68 Fed. Reg. 36,786 (June 19, 2003) (delineating 45 cancellations of pesticides); EPA Chlorpyrifos Human Health, *supra* note 119 (reporting new epidemiological studies providing evidence that uses of chlorpyrifos were associated with neurodevelopmental effects).

<sup>313</sup> See EPA DECISION 0178, *supra* note 56, at 10 (acknowledging new studies on non-Hodgkin's lymphoma but concluding they did not affect the agency's assessment).

<sup>314</sup> See *supra* notes 237–62 and accompanying text.

<sup>315</sup> E.g., Anneclaire J. De Roos et al., *Cancer Incidence Among Glyphosate-Exposed Pesticide Applicators in the Agricultural Health Study*, 113 ENV'T. HEALTH PERSP. 49, 52 (2005) (finding no association between glyphosate exposure and non-Hodgkin's lymphoma); Leon et al., *supra* note 242, at 1533 (failing to observe a risk); Davoren & Schiestl, *supra* note 245, at 1210 (raising a concern); Nielsen et al., *supra* note 247, at 375 (observing no adverse effects but expressing a concern).

<sup>316</sup> See *supra* notes 250–58 and accompanying text (discussing studies involving animal reproduction).

<sup>317</sup> See De Roos et al., *supra* note 240, at E7 (reporting a Swedish study finding an association involved a small case-control study); Chang & Delzell, *supra* note 242 (summarizing studies looking at the relationship of glyphosate and non-Hodgkin's lymphoma and noting limitations of the researchers' findings).

<sup>318</sup> See *infra* notes 345–81 and accompanying text.

revocation of tolerances is a third mechanism for reducing pesticide usage.<sup>319</sup> FIFRA incorporates the FFDCA's provisions on food safety to make it illegal to sell food products with unsafe pesticide residues.<sup>320</sup> For residues that are safe, tolerances delineate the maximum amount of the residue permitted.<sup>321</sup> A residue in or on a food product "shall be deemed unsafe" unless a tolerance has been approved.<sup>322</sup> If new information shows harm will result from residues on a product with a tolerance, the tolerance should be revoked.<sup>323</sup> For situations where pesticide use results in unsafe residues in or on food products, the revocation of a tolerance would require the cancellation of a registration.<sup>324</sup> The EPA or others may initiate a revocation proceeding.<sup>325</sup>

Numerous tolerances have been established for residues of glyphosate and its metabolite, aminomethylphosphonic acid, in or on a wide variety of crops and processed foods.<sup>326</sup> The tolerances were calculated by determining that the combined exposure from drinking water and residential exposure was below a safe level so that people could be exposed to low amounts of residues in or on food products and continue to be safe.<sup>327</sup> If evidence shows the possibility of harm from residues in or on a food product, the tolerance needs to be lowered or revoked.<sup>328</sup>

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<sup>319</sup> See *League of United Latin Am. Citizens v. Wheeler*, 899 F.3d 814, 829 (9th Cir. 2018), *rev'd en banc* 922 F.3d 443 (9th Cir. 2019) (noting that failing to meet tolerances mandated by the FFDCA can lead to the cancellation of registrations).

<sup>320</sup> *Id.*; 21 U.S.C. § 346a(b) (2019).

<sup>321</sup> 21 U.S.C. § 346a(b)(2)(A)(ii) (2019); see 40 C.F.R. pt. 180.1 (2016) for specific tolerances.

<sup>322</sup> 21 U.S.C. § 346a(a)(1) (2019).

<sup>323</sup> *Id.* § 346a(b)(2)(A)(i). "The Administrator shall modify or revoke a tolerance if the Administrator determines it is not safe." *Id.* See *NRDC v. Johnson*, 461 F.3d 164, 167–68 (2d Cir. 2006) (noting that an unsafe tolerance must be modified or revoked).

<sup>324</sup> See *Johnson*, 461 F.3d at 171 (challenging registrations due to changes in allowable tolerances).

<sup>325</sup> 21 U.S.C. § 346a(d)(1) (2019). Often, it is other parties. See *Petition To Modify the Tolerance and Product Labels for Glyphosate With Regard to Oats*; Notice of Filing, 84 Fed. Reg. 19,783, 19,784 (May 6, 2019) (lowering tolerances and preventing preharvest use of glyphosate on oats at the request of private vendors) [hereinafter *EPA Oats Tolerance Petition*]; see also *NRDC v. EPA*, 658 F.3d 200, 204 (2d Cir. 2011) (challenging tolerances established for numerous dichlorvos products).

<sup>326</sup> 40 C.F.R. § 180.364 (2013).

<sup>327</sup> Office of Pesticide Programs, *General Principles for Performing Aggregate Exposure and Risk Assessments* 12–22, EPA (Nov. 28, 2001), <https://www.epa.gov/sites/production/files/2015-07/documents/aggregate.pdf> [<https://perma.cc/4TPH-K8VB>].

<sup>328</sup> *Id.*

When existing tolerances were established, fewer quantities of GBHs were being used for agricultural production.<sup>329</sup> With increased usage of GBHs, dietary exposure has increased.<sup>330</sup> Research has shown that there are glyphosate residues in ground water, human and animal urine, and farmed-animal meat products.<sup>331</sup> Glyphosate tolerances may need to be reevaluated to determine whether total exposure meets the safety requirements prescribed by FIFRA. Given glyphosate's ubiquitous presence, the combined exposure from residential and drinking water sources may be so great that no residues should be allowed in or on food products.<sup>332</sup>

### *C. Mitigation Measures*

During interactions with registrants and others, while considering a registration application, the EPA has opportunities for incorporating mitigation measures into registrations to reduce risks and safeguard public welfare.<sup>333</sup> Mitigation measures are a fourth mechanism for lowering amounts of exposure that contribute to health costs and

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<sup>329</sup> See U.S. Department of the Interior, *Estimated Annual Agricultural Pesticide Use*, U.S. GEOLOGICAL SURVEY (June 18, 2020), [https://water.usgs.gov/nawqa/pnsp/usage/maps/show\\_map.php?year=2016&map=GLYPHOSATE&hilo=L](https://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=2016&map=GLYPHOSATE&hilo=L) (showing increased amounts being used over the past 24 years).

<sup>330</sup> Marek Cuhra, Thomas Böhn & Petr Cuhra, *Glyphosate: Too Much of a Good Thing?*, 4 FRONTIERS ENV'T. SCI. 1, 1 (2016), <https://www.frontiersin.org/articles/10.3389/fenvs.2016.00028/full> (noting that consumers are ingesting more glyphosate residues in the foods they eat).

<sup>331</sup> See Vincenzo Torretta et al., *Critical Review of the Effects of Glyphosate Exposure to the Environment and Humans Through the Food Supply Chain*, 10(4) SUSTAINABILITY 1, 13 (2018), <https://www.mdpi.com/2071-1050/10/4/950/htm> [<https://perma.cc/C2KF-ETQP>] (reporting various exposures to humans).

<sup>332</sup> A recent petition to reduce glyphosate tolerances in oats due to residues in various granola, breakfast cereal, snack commodities, and instant oats shows new residues in food and expresses concern that children need more protection from residue exposure. EPA Oats Tolerance Petition, *supra* note 325, at 19,784. In 2018, the European Food Safety Authority lowered tolerances on many food products. European Food Safety Auth., *Review of the Existing Maximum Residue Levels for Glyphosate According to Article 12 of Regulation (EC) No 396/2005*, 16 EFSA J. 1,1 (2018).

<sup>333</sup> 40 C.F.R. §§ 155.53(c), 155.56, 155.58(B)(2) (2019). This may occur in an interim registration review or the registration review.

environmental damages.<sup>334</sup> Mitigation measures that reduce health costs may enable a pesticide to qualify for registration.<sup>335</sup>

Several voluntary or regulatory mitigation measures may be identified to reduce some of the adverse effects of GBH usage. Requiring a pesticide protection plan is a logical starting point.<sup>336</sup> By preparing a protection plan, producers can learn how to reduce the impacts of pesticide use on human health and the environment, avoid inappropriate uses of pesticides, and improve spray delivery.<sup>337</sup> For especially problematic pesticides, governments can provide training to applicators to prevent situations where improper use may lead to problems.<sup>338</sup> Governments may also adopt policies that offer producers greater encouragement in adopting integrated pest management practices and crop rotations to address problems of counterproductive

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<sup>334</sup> See, e.g., EPA, OFF. OF PESTICIDE PROGRAMS, NOTICE OF PESTICIDE REGISTRATION, EPA REG. NO. 62719-623, at 9 (2016) (considering the registration of Dow's Closer SC containing sulfoxaflor with precautions including an integrated pest management program and insecticide resistance management); EPA, OFF. OF PESTICIDE PROGRAMS, NOTICE OF PESTICIDE REGISTRATION, EPA REG. NO. 62719-625, at 10 (2016) (considering the registration of Dow's Transform WG containing sulfoxaflor with precautions including an integrated pest management program and insecticide resistance management).

<sup>335</sup> See Memorandum from Debra Edwards, Special Rev. & Registration Div., Off. of Pesticide Programs, Dir., to Jim Jones, EPA Off. of Pesticide Programs, Dir. Finalization of Interim Reregistration Eligibility Decisions (IREDs) and Interim Tolerance Reassessment and Risk Management Decisions (TREDs) for the Organophosphate Pesticides, and Completion of the Tolerance Reassessment and Reregistration Eligibility Process for the Organophosphate Pesticides (July 31, 2006) (reporting that with mitigation measures, worker risks from chlorpyrifos exposure will be below levels of concern facilitating registration).

<sup>336</sup> See WHITE HOUSE POLLINATOR HEALTH TASK FORCE, NATIONAL STRATEGY TO PROMOTE THE HEALTH OF HONEY BEES AND OTHER POLLINATORS (2015) (developing a strategy to protect pollinators).

<sup>337</sup> Juan J. Villaverde et al., *Biopesticides in the Framework of the European Pesticide Regulation (EC) No. 1107/2009*, 70 PEST MGMT. SCI. 2, 5 (2013) (commenting on how to reduce pesticide damages for European producers).

<sup>338</sup> See EPA, REGISTRATION DECISION FOR THE CONTINUATION OF USES OF DICAMBA ON DICAMBA TOLERANT COTTON AND SOYBEAN 20 (2018) (limiting application to certified applicators); *Using Pesticides Wisely: Required Training to Use Auxin Pesticides*, GA. DEP'T AGRIC., <http://agr.georgia.gov/24c.aspx> (last visited Nov. 3, 2020) [<https://perma.cc/9X5C-PJ44>]; *Pesticide Control: Dicamba Facts*, MO. DEP'T AGRIC., <http://agriculture.mo.gov/plants/pesticides/dicamba-facts.php> (last visited Nov. 3, 2020) [<https://perma.cc/L7WU-K9P6>].

pesticide applications.<sup>339</sup> Another measure might prohibit tank mixing with other products to reduce risks of harmful mixtures.<sup>340</sup>

For spray drift that damages neighboring properties, the requirement of a buffer area may be inserted into a registration.<sup>341</sup> The buffer area would reduce the likelihood of drift onto others' properties to reduce the risks of damages.<sup>342</sup> The adoption of drift reduction technology might lower the number of spray applications required to achieve pest control or might keep more spray on target.<sup>343</sup> This could reduce overall usage to lower concentrations in the environment. Drift problems can also be reduced by delineating limitations on nozzle size and sprayer heights in a registration.<sup>344</sup> The limitations established by one or more of these mitigation measures could reduce risks that spray drift will be transported to other properties and cause damages.

#### ***D. Litigation for Health Damages***

A fifth mechanism that might lead to reductions in GBH use is litigation. Approximately 125,000 plaintiffs have filed lawsuits against Monsanto Company and/or its parent company Bayer AG.<sup>345</sup> Most of these lawsuits were filed by persons who applied Monsanto's Roundup

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<sup>339</sup> Craig D. Osteen & Jorge Fernandez-Cornejo, *Economic and Policy Issues of U.S. Agricultural Pesticide Use Trends*, 69 PEST MGMT. SCI. 1001, 1018 (2013) (urging management policies to avoid pesticide applications that destroy beneficial organisms and pests' natural enemies).

<sup>340</sup> See, e.g., EPA, REGISTRATION OF SULFOXAFLOL FOR USE ON AGRICULTURAL CROPS, ORNAMENTALS AND TURF 10 (2016) (delineating a prohibition of mixing with other products).

<sup>341</sup> See, e.g., Letter from Stephanie M. Parent, Ctr. for Biological Diversity, to the Off. of Pesticide Programs, EPA Comments on EPA's Proposed Registration of Sulfoxaflor for Use on Agric. Crops, Ornamentals and Turf (June 17, 2016) (observing the need for buffer areas to minimize damages).

<sup>342</sup> See F.M. Fishel & J.A. Ferrell, *Managing Pesticide Drift*, UNIV. FLA. IFAS EXTENSION PUBL'N PI232, <http://edis.ifas.ufl.edu/pi232> (last visited Nov. 3, 2020) [<https://perma.cc/3AZ4-UYXA>] (noting that after pesticide applications, volatilization may be a problem).

<sup>343</sup> EPA, SUPPORTING STATEMENT FOR AN INFORMATION COLLECTION REQUEST (ICR), EPA ICR NO. 2472.01 (2012) (recommending a program to encourage the use of drift reduction technologies to reduce drift of pesticide spray droplets to nontarget areas).

<sup>344</sup> See J. Franklin Egan et al., *Herbicide Drift Can Affect Plant and Arthropod Communities*, 85 AGRIC. ECOSYSTEMS & ENV'T 77, 86 (2014) (noting that off-target pesticide "movement can be effectively reduced by using drift-reducing spray nozzles"); Nathan Palardy & Terence J. Centner, *Improvements in Pesticide Drift Reduction Technology (DRT) Call for Improving Liability Provisions to Offer Incentives for Adoption*, 69 LAND USE POL'Y 439, 440 (2017) (discussing spray-drift reduction technologies that consider nozzle size).

<sup>345</sup> See BAYER, *supra* note 1.



spray to control weeds and developed non-Hodgkin's lymphoma, a type of cancer.<sup>346</sup> The plaintiffs allege that their exposure to Roundup was a substantial cause of their cancer.<sup>347</sup> In addition, the cases include evidence that Monsanto engaged "in conduct with malice, oppression, or fraud committed by one or more officers, directors, or managing agents of Monsanto."<sup>348</sup> This evidence justified punitive damages.<sup>349</sup>

Juries in three lawsuits have awarded damages: *Johnson v. Monsanto Company*,<sup>350</sup> *Hardeman v. Monsanto Company*,<sup>351</sup> and *Pilliod v. Monsanto Company*.<sup>352</sup> These lawsuits may be referred to as the *Monsanto* cases.<sup>353</sup> In *Johnson v. Monsanto Co.*, a school groundskeeper brought a lawsuit with causes of action based on strict liability for a design defect, strict liability for failure to warn, negligence, breach of implied warranties, and punitive damages.<sup>354</sup> After being successful at trial court, the plaintiff accepted a reduction in punitive damages and was awarded \$78,506,418.70.<sup>355</sup> This has been appealed.<sup>356</sup>

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<sup>346</sup> Patricia Cohen, *Roundup Maker to Pay \$10 Billion to Settle Cancer Suits*, N.Y. TIMES (June 24, 2020), <https://www.nytimes.com/2020/06/24/business/roundup-settlement-lawsuits.html>.

<sup>347</sup> See Leora Friedman, *Litigating the Alleged Carcinogenicity of Glyphosate in Monsanto's Roundup: The Fairness (and Unfairness) of Deciding Causation Independent of Liability*, GEO. ENV'T. L. REV. ONLINE, Jan. 17, 2019 (summarizing the initial claims for health damages from glyphosate exposure).

<sup>348</sup> Transcript of Proceedings at 5748, *Pilliod v. Monsanto*, No. RG17862702 (Cal. Super. Ct. Alameda Cnty. May 13, 2019) <https://usrtk.org/wp-content/uploads/bsk-pdf-manager/2019/05/Trial-Transcript-Pilliod-Verdict.pdf> [<https://perma.cc/E9HZ-USN2>].

<sup>349</sup> *Id.* at 5750–51.

<sup>350</sup> *Johnson*, *supra* note 53.

<sup>351</sup> *Hardeman*, *supra* note 53.

<sup>352</sup> *Pilliod*, *supra* note 53, at 5748, 5750–51; see also Jeff Davis, *The Next Asbestos? What Do the Monsanto Trials Mean for the Future of Roundup*, AUSTRALIAN BROAD. CORP. NEWS (May 31, 2019), <https://www.abc.net.au/news/2019-06-01/is-roundup-the-next-asbestos/11167866> [<https://perma.cc/RRF8-SCPQ>].

<sup>353</sup> The term "*Monsanto* cases" distinguishes the three cases from other litigation against Monsanto including *In re Roundup Product Liability Litigation*. See *supra* notes 347–53 and accompanying text; *infra* notes 355–64 and accompanying text.

<sup>354</sup> Summons and Complaint at 1, *Johnson v. Monsanto Co.*, No. CGC-16-550128 (Cal. Super. Ct., S.F. Cnty. Jan. 28, 2016), <https://usrtk.org/wp-content/uploads/2016/09/Dwayne-Johnson-lawsuit.pdf> [<https://perma.cc/59YX-HXDF>].

<sup>355</sup> Plaintiff's Notice of Acceptance of Remittitur at 1, *Johnson v. Monsanto Co.*, No. CGC-16-550128 (Cal. Super. Ct., S.F. Cnty. Oct. 26, 2018), <https://usrtk.org/wp-content/uploads/2018/12/Johnsons-acceptance-of-reduced-award.pdf> [<https://perma.cc/X8HE-TZM3>].

<sup>356</sup> Defendant Monsanto Company's Notice of Appeal at 1, *Johnson v. Monsanto Co.*, No. CGC-16-550128 (Cal. Super. Ct., S.F. Cnty. Nov. 20, 2018).

A second case, *Hardeman v. Monsanto Co.*, was filed in the federal district court in the Northern District of California.<sup>357</sup> This court also has more than thirty filed glyphosate cases against Monsanto, which were consolidated into *In re Roundup Products Liability Litigation*.<sup>358</sup> Mr. Hardeman alleged negligence, defective product design, defective warnings, and breach of implied warranties.<sup>359</sup> The jury returned a verdict for more than \$5 million in compensatory damages and \$75 million for punitive damages.<sup>360</sup> The punitive damage award was reduced to \$20 million.<sup>361</sup> Subsequently, the *Hardeman* court noted it was the design defect that supported the verdict.<sup>362</sup> The consolidated cases are being referred to their home districts with the direction that *Daubert* motions<sup>363</sup> will be governed by Ninth Circuit law.<sup>364</sup>

A third lawsuit, *Pilliod v. Monsanto*, was heard by a California court in 2019 with causes of action based on design defect, strict liability-failure to warn, negligence, and negligent failure to warn.<sup>365</sup> The plaintiffs introduced considerable evidence questioning the quality of studies justifying the registration of Roundup and Monsanto's activities, thereby casting doubt on whether glyphosate was

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<sup>357</sup> First Amended Complaint, *Hardeman v. Monsanto Co.*, No. 16-cv-00525-DMR (N.D. Cal. Feb. 12, 2016) [hereinafter *Hardeman* First Amended Complaint].

<sup>358</sup> *In re Roundup Prod. Liab. Litig.*, Transfer Order, Case No. 16-md-02741-VC (N.D. Cal. Oct. 4, 2016), <https://www.cand.uscourts.gov/filelibrary/2886/JPML-transfer-order.pdf> [<https://perma.cc/TN8Y-BTW7>].

<sup>359</sup> First Amended Complaint at 18–28, *Hardeman*, No. 16-cv-00525-VC (N.D. Cal. Feb. 12, 2016).

<sup>360</sup> *Hardeman*, *supra* note 53, at 2.

<sup>361</sup> Pretrial Order No. 160 at 8, *Hardeman v. Monsanto Co.*, No. 16-cv-00525-VC (N.D. Cal. July 15, 2019).

<sup>362</sup> Pretrial Order No. 159 at 3, *Hardeman v. Monsanto Co.*, No. 16-cv-00525-VC (N.D. Cal. July 12, 2019). The court found that the failure-to-warn claim merged with the defective design claim. *Id.* at 4. The design defect was the absence of a warning. *Id.*

<sup>363</sup> *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993) (deciding whether expert witnesses or evidence qualifies for introduction at trial). See *Barrera v. Monsanto Co.*, No. N15C-10-118 VLM, 2019 WL 2331090 (Del. Super. Ct. May 31, 2019) (discussing the application of *Daubert* to testimony by experts on evidence that glyphosate causes health problems).

<sup>364</sup> The *Daubert* hearings in 2018 involved screening potential expert witnesses to determine whether testimony is sufficiently reliable to be admissible. Pretrial Order No. 147: Tentative Remand Plan, *In re Roundup Prod. Liab. Litig.*, No. 16-md-02741-VC (N.D. Cal. May 21, 2019), <https://www.cand.uscourts.gov/filelibrary/3694/PTO147.pdf> [<https://perma.cc/WUP5-2FJD>].

<sup>365</sup> Proceedings held on Friday, July 13, 2018, at 5745–50, *Pilliod v. Monsanto*, No. CGC-16-550128 (Cal. Super. Ct., S.F. Cnty. July 13, 2018), <https://usrtk.org/wp-content/uploads/bsk-pdf-manager/2019/05/Trial-Transcript-Pilliod-Verdict.pdf> [<https://perma.cc/T2W5-XCYJ>].

carcinogenic.<sup>366</sup> The jury found economic losses of more than \$52 million and awarded punitive damages of \$2 billion.<sup>367</sup> Monsanto has entered a settlement agreement.<sup>368</sup>

For the *Monsanto* cases, the defendants have appealed the verdicts and have presented courts with several arguments. An initial argument concerns sufficient causation.<sup>369</sup> Defendants claim the testimony of the expert witnesses did not establish a cause of action.<sup>370</sup> In the *Johnson* lawsuit, when the plaintiff developed non-Hodgkin's lymphoma from exposure to Roundup, glyphosate was not considered to be toxic.<sup>371</sup> The International Agency for Research on Cancer reached its conclusion in 2017 that glyphosate was probably carcinogenic to humans.<sup>372</sup> Thus, prior to 2017, there was no substantial evidence that glyphosate presented a potential cancer risk, so manufacturers may not have had a duty to warn.<sup>373</sup> In the absence of a duty, plaintiffs cannot establish a negligence cause of action. The absence of evidence of carcinogenicity at the time of the plaintiffs' exposure may mean Roundup's design was not defective and did not violate minimum safety requirements.<sup>374</sup> Thus, it may be argued that there is no substantial evidence supporting a failure-to-warn claim and the defective design cause of action.<sup>375</sup>

The verdicts in the *Monsanto* cases show plaintiffs being effective in convincing the juries that Monsanto knew glyphosate was dangerous and could cause health damages. The juries also believed that Monsanto had neglected to provide adequate warnings on the dangers of pesticide use and should pay large sums of punitive damages.<sup>376</sup> The

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<sup>366</sup> Proceedings held on April 2, 3, 4, 7, 16, 17, 2019 at 1533–3654, *Pilliod v. Monsanto*, No. RG17862702.

<sup>367</sup> Proceedings held on Friday, July 13, 2018 at 5647, 5751, *Pilliod v. Monsanto*, No. CGC-16-550128 (Cal. Super. Ct., S.F. Cnty July 13, 2018), <https://usrtk.org/wp-content/uploads/bsk-pdf-manager/2019/05/Trial-Transcript-Pilliod-Verdict.pdf> [<https://perma.cc/T2W5-XCYJ>].

<sup>368</sup> See BAYER, *supra* note 1.

<sup>369</sup> Monsanto Company's Notice of Motions and Motions for Judgment as a Matter of Law or, in the Alternative, For a New Trial at 1, *In re Roundup Prods. Liab. Litig.*, No. 16-cv-0525-VC (N.D. Cal. July 31, 2019) [hereinafter *Monsanto Motions*].

<sup>370</sup> *Id.*

<sup>371</sup> Appellant's Opening Brief at 25–26, *Johnson v. Monsanto Co.*, No. A155940 & A156706 (Cal. 1st Dist. Ct. App. Apr. 23, 2019) [hereinafter *Johnson* Opening Brief].

<sup>372</sup> WHO ORGANOPHOSPHATE, *supra* note 215, at 398.

<sup>373</sup> *Johnson* Opening Brief, *supra* note 371, at 15.

<sup>374</sup> *Id.* at 16.

<sup>375</sup> *Id.* at 39.

<sup>376</sup> See *Johnson*, *supra* note 53; *Hardeman*, *supra* note 53; *Pilliod*, *supra* note 53 (citing the verdicts from the three cases).

verdicts indicate that the jurors did not find Monsanto's defenses credible.

For the three *Monsanto* cases, issues about the impropriety of admitting some of plaintiffs' evidence and the statements made in the plaintiffs' closing arguments are being appealed. The judge in the *Johnson* case circumscribed the evidence admitted to counter the plaintiff's evidence on carcinogenicity.<sup>377</sup> In *Hardeman*, the trial court precluded the admission of significant EPA documents on registrations.<sup>378</sup> In the *Pilliod* lawsuit, plaintiffs' counsel highlighted a deficiency of Monsanto's warnings on product labels, but an earlier court ruling had determined that issue should not be discussed.<sup>379</sup> It is possible that statements by plaintiffs' counsel could be found to be improper and prejudicial.

## V

### NEW DIRECTIONS FOR PESTICIDE LIABILITY

The verdicts of the *Monsanto* cases suggest that people feel they should be protected from pesticides that injure their health. Due to FIFRA's undervaluation of human health and approval of pesticide registrations without sufficient mitigation measures, too many people may be injured by pesticide exposure. For several decades, FIFRA was interpreted as precluding many pesticide liability claims because it included a preemption provision.<sup>380</sup> The provision provided that states could not impose "any requirements for labeling or packaging in addition to or different from those required under" FIFRA.<sup>381</sup>

In *Bates v. Dow Agrisciences, LLC*, the Supreme Court clarified the meaning of the preemption provision: preemption only applies to labeling and packaging requirements.<sup>382</sup> Claims based on pesticide

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<sup>377</sup> *Johnson*, *supra* note 53, at 68.

<sup>378</sup> Monsanto Motions, *supra* note 369, at 25.

<sup>379</sup> Reporter's Transcript of Proceedings at 5612, *Pilliod v. Monsanto Co.*, No. RG17862702 (Cal. Super. Ct., Alameda Cnty. May 8, 2019).

<sup>380</sup> 7 U.S.C. § 136v (2018). See Joseph Frueh, *Pesticides, Preemption, and the Return of Tort Protection: Bates v. Dow Agrosiences LLC*, 125 *S. Ct.* 1788 (2005), 23 *YALE J. REG.* 299, 308 (2006) (noting the valuable counterbalance to the profit motive served by tort law that is not preempted by FIFRA).

<sup>381</sup> 7 U.S.C. § 136v (2018).

<sup>382</sup> *Bates v. Dow Agrosiences LLC*, 544 U.S. 431, 444 (2005). See *Mortellite v. Novartis Crop Prot., Inc.*, 460 F.3d 483, 489 (3rd Cir. 2006) (observing that an event inducing a registrant to change a label is not preempted).

use,<sup>383</sup> design defect,<sup>384</sup> manufacturing defect,<sup>385</sup> negligent testing,<sup>386</sup> negligent misrepresentation,<sup>387</sup> and fraud<sup>388</sup> are not preempted. The causes of action alleged in the *Monsanto* cases disclose that FIFRA's preemption provision is not as broad as manufacturers had envisioned.<sup>389</sup> The trial courts' rulings on liability for health-related damages were based on causes of action that did not involve labeling and packaging. The verdicts show that liability causes of action against manufacturers may lead to significant awards of damages.

The *Monsanto* cases herald a jurisprudential evolution under which courts are finding pesticide manufacturers have responsibilities for the safety of their consumers. These responsibilities are consistent with other jurisprudence on hazardous materials,<sup>390</sup> products liability,<sup>391</sup> and unsafe conditions.<sup>392</sup> Liability is based on the justification that

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<sup>383</sup> See *Schoenhofer v. McClaskey*, 861 F.3d 1170, 1174 (10th Cir. 2017) (finding a state application requirement was not preempted).

<sup>384</sup> See *Bates*, 544 U.S. at 444.

<sup>385</sup> See *id.*

<sup>386</sup> See *id.*

<sup>387</sup> See *Mortellite*, 460 F.3d at 486.

<sup>388</sup> See *id.*

<sup>389</sup> See *Bates*, 544 U.S. at 444 (interpreting the preemption of 7 U.S.C. § 136v(b) to acknowledge that FIFRA allows consistent state-law labeling requirements to meet special local needs); see also Terence J. Centner, *Damages from Pesticide Spray Drift Under Trespass Law*, 41 *ECOLOGY L. CURRENTS* 1 (2014) (discussing the nonapplicability of federal preemption to pesticide spray drift claims).

<sup>390</sup> 42 U.S.C. § 9607 (2018) (establishing strict liability for hazardous materials in section 107 of the Comprehensive Environmental Response and Compensation Act). Persons that caused the harm should be responsible for the costs of damages. The common law causes of action used in the *Monsanto* cases support the premise that liability for damages should be placed on parties responsible for creating the hazard. See *NCR Corp. v. George A. Whiting Paper Co.*, 768 F.3d 682, 689 (7th Cir. 2014) (noting that Congress wanted to shift the costs for the cleanup of hazardous substances to "parties responsible for creating the hazard").

<sup>391</sup> RESTATEMENT (SECOND) OF TORTS § 402A (AM. L. INST. 1965) imposes strict liability on manufacturers of defective products. See, e.g., *Berrier v. Simplicity Mfg., Inc.*, 563 F.3d 38, 59 (3rd Cir. 2007) (finding manufacturers guarantee safety for all foreseeable users and others).

<sup>392</sup> See, e.g., *Rodriguez v. Kroger Co.*, 422 P.3d 815, 823 (Utah 2018) (noting liability for the creation of an unsafe condition by an independent contractor under the state's "nondelegable duty to keep its premises . . . safe"); *QBE Ins. Corp. v. Brown & Mitchell, Inc.*, 591 F.3d 439 (5th Cir. 2009) (finding that a firm breached its professional responsibilities when it failed to stop an unsafe act causing an injury); *Nelson v. United States*, 915 F.3d 1243, 1256 (10th Cir. 2019) (finding a landowner was liable for failing to warn of a dangerous condition on its property). In many cases, liability is pursuant to statute. See, e.g., *Mut. Pharm. Co. v. Bartlett*, 133 U.S. 472, 475 (2013) (observing that state law imposed a duty on manufacturers to only market safe drugs).

manufacturers should pay for social costs associated with their products.<sup>393</sup> Pursuant to the judgments in the *Monsanto* cases, persons negatively afflicted by pesticide exposure can seek recompense from manufacturers for negligence, defective design, and inadequate warnings.<sup>394</sup> Similarly, persons with properties damaged by pesticides might maintain actions for compensation.<sup>395</sup> Moreover, it might be advisable for owners of lands receiving applications of pesticides to add indemnity provisions in their contracts with renters and applicators.<sup>396</sup>

Looking at the *Monsanto* verdicts from a public policy perspective, the preservation of tort law may be appropriate due to the information asymmetries of pesticide registration.<sup>397</sup> Not only have some registrants withheld important scientific data, but some have also engaged in activities to discredit credible scientific information.<sup>398</sup> Some pesticides including glyphosate were approved based on fraudulent data.<sup>399</sup> The adversarial system of tort law may be less susceptible to data manipulation by pesticide registrants than registration.<sup>400</sup>

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<sup>393</sup> See Sam F. Halabi, *The Scope of Preemption Under the 2009 Family Smoking Prevention and Tobacco Control Act*, 71 FOOD & DRUG L.J. 300, 307 (2016) (discussing payments by tobacco companies for damages related to their products).

<sup>394</sup> See *supra* Part IVD.

<sup>395</sup> For example, persons experiencing crop damages from their neighbors' use of the herbicide dicamba have advanced claims based on a design defect, failure to warn, and negligent training in the manufacturing of dicamba. See *Bader Farms, Inc. v. Monsanto*, 431 F. Supp. 3d 1084 (E.D. Mo. 2019) (advancing damage claims for injury to peach trees from dicamba applications on nearby crops and declining to grant the defendants summary judgment).

<sup>396</sup> See, e.g., *Plourde v. Gladstone*, 190 F. Supp. 2d 708 (D. Vt. 2002), *aff'd* 69 F. App'x. 485 (2d Cir. 2003) (holding that a plaintiff had presented evidence of harm from pesticide spray drift that precluded summary judgment on nuisance and negligence causes of action against a landowner who had hired the pesticide applicator spraying the pesticide).

<sup>397</sup> See Adam D.K. Abelkop, *Tort Law as an Environmental Policy Instrument*, 92 OR. L. REV. 381, 468 (2013) (noting that "strength of the tort system is its capacity to incorporate privately held information from both injured parties and risk-taking firms").

<sup>398</sup> *Id.* This has occurred with registrations of GBHs. See *supra* notes 293–99 and accompanying text. See also Katherine Drabiak, *Roundup Litigation: Using Discovery to Dissolve Doubt*, 31 GEO. INT'L ENV'T. L. REV. 697, 704 (2019) (discussing Monsanto's efforts to discredit the finding by the International Agency for Research on Cancer that glyphosate should be classified as a Group 2A carcinogen).

<sup>399</sup> See *Pilliod Benbrook Testimony*, *supra* note 293, at 3519–26 (disclosing that the research study supporting the registration of glyphosate was fraudulent).

<sup>400</sup> Evidence in the *Pilliod* case claimed that Monsanto knew in 1976 that the only study supporting the safety of glyphosate had been found to be fraudulent but waited until 1982 to conduct another study. Closing Arguments Day 21 at 5501, *Pilliod v. Monsanto Co.*, No. RG17862702 (Cal. Super. Ct., Alameda Cnty. May 13, 2019). After a dubious Knezevich and Hogan study, all subsequent mice studies showed malignant lymphoma. *Id.* at 2106–13.

### ***A. Undervaluing Human Health***

FIFRA undervalues human health by failing to consider the problems with co-formulant use and cumulative exposure. By only considering the health effects of active ingredients, FIFRA fails to account for situations where co-formulants exacerbate the negative effects of pesticide exposure.<sup>401</sup> Active ingredients are substances that “prevent, destroy, repel or mitigate any pest, or that functions as a plant regulator, desiccant, or defoliant.”<sup>402</sup> Active ingredients include any group of structurally similar substances specified by the EPA.<sup>403</sup> Inert ingredients are those “intentionally included in a pesticide product” that are not active ingredients.<sup>404</sup> Research shows that damages from pesticide use are not simply related to active ingredients.<sup>405</sup> This means the registration of a pesticide under FIFRA does not guarantee that ordinary usage is safe.

Situations involving cumulative exposure to other chemicals also mean people may suffer significant health damages from exposure to a registered pesticide.<sup>406</sup> Persons exposed to pesticides may be exposed to other nonpesticide chemicals that harm human tissues, organs, and systems.<sup>407</sup> FIFRA’s cost-benefit analysis allows human health to be overshadowed by benefits to producers and consumers. In pursuing more profitable food production, FIFRA fails to protect people from harm.<sup>408</sup> This legislative provision may no longer be consistent with American liability principles.<sup>409</sup>

Given damages occurring from pesticide exposure, requirements to keep people safe might be superior to the existing regulatory regime

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<sup>401</sup> See *supra* notes 178–82 & 229–34 and accompanying text.

<sup>402</sup> 40 C.F.R. § 152.3 (2019).

<sup>403</sup> *Id.*

<sup>404</sup> *Id.*

<sup>405</sup> See *supra* notes 229–34 and accompanying text.

<sup>406</sup> See *supra* Part IIB.

<sup>407</sup> See *supra* notes 129–31 and accompanying text.

<sup>408</sup> See Keating, *supra* note 77, at 242, 258 (acknowledging that although we allow people to pursue many activities accompanied by risks, the cost-benefit analysis conflicts with moral institutions).

<sup>409</sup> Changes in liability law since the enactment of FIFRA place a higher priority on human safety. Through § 402A of the Restatement of Torts, a rule of strict liability applies to manufacturers of products. RESTATEMENT (SECOND) OF TORTS § 402A (AM. L. INST. 1965). A strict liability standard is being projected for autonomous vehicles. See Mark A. Geistfeld, *A Roadmap for Autonomous Vehicles: State Tort Liability, Automobile Insurance, and Federal Safety Regulation*, 105 CALIF. L. REV. 1611, 1623 (2017). As sellers of a product, pesticide manufacturers might be held responsible for health damages.

that weighs costs and benefits.<sup>410</sup> In the absence of adequate protection of human health by FIFRA, state governments might consider further action.<sup>411</sup> States might adopt further safety measures so long as they do not offend preemptive federal pesticide labeling requirements.<sup>412</sup> States might decide that individual communities should be able to adopt safeguards to reduce the risks of cancer or other health maladies related to the use of pesticides,<sup>413</sup> preclude the sales and storage of pesticides in inappropriate locations,<sup>414</sup> and offer greater protection for wellhead production and water recharge areas from pesticide contamination.<sup>415</sup>

### ***B. Mitigation Measures***

FIFRA's registration requirements may underemphasize the importance of mitigation measures offering alternative solutions to reduce pesticide use.<sup>416</sup> Regulations require the EPA to identify proposed risk mitigation measures that are needed and to describe the basis for requiring mitigation measures.<sup>417</sup> In most cases, the requirement of a measure would be related to securing a favorable cost-benefit analysis.<sup>418</sup> Nevertheless, once a favorable cost-benefit analysis is achieved, further mitigation measures are not required despite

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<sup>410</sup> Frueh, *supra* note 380, at 309 (noting that manufacturers are not paying the full social costs of products because victims of negligence go uncompensated). *See also* Aceves, *supra* note 131, at 65 (advocating the minimization of partisan influence and bureaucratic bias in calculations of human life).

<sup>411</sup> *See, e.g.*, CAL. ENV'T. PROT. AGENCY, AGREEMENT REACHED TO END SALE OF CHLORPYRIFOS IN CALIFORNIA BY FEBRUARY 2020 (Oct. 9, 2019), <https://www.cdpr.ca.gov/docs/pressrls/2019/100919.htm> [<https://perma.cc/8GK7-SHLB>] (ending most uses of chlorpyrifos in California); Andrew M. Cuomo, Governor Cuomo Directs DEC to Ban the Use of Chlorpyrifos (Dec. 10, 2019), <https://www.governor.ny.gov/news/governor-cuomo-directs-dec-ban-use-chlorpyrifos> [<https://perma.cc/72MF-H3WZ>] (ending chlorpyrifos uses in New York).

<sup>412</sup> *See* *Bates v. Dow Agrosiences LLC.*, 544 U.S. 431, 444 (2005) (interpreting the preemption of 7 U.S.C. § 136v(b)).

<sup>413</sup> *See* Terence J. Centner & Davis Clarke Heric, *Anti-Community State Pesticide Preemption Laws Prevent Local Governments from Protecting People from Harm*, 17 INT'L J. AGRIC. SUSTAINABILITY 118 (2019) (discussing the benefits from local regulations of pesticides).

<sup>414</sup> *See, e.g.*, COLO. REV. STAT. § 35-10-112.5(3)(a)(I) (2018) (recognizing the need for local governments to regulate zoning of sales or storage facilities).

<sup>415</sup> *See, e.g.*, FLA. STAT. § 482.242(1)(d) (2018) (recognizing the need for communities to take action to protect water resources).

<sup>416</sup> *See* Torretta et al., *supra* note 331, at 16 (advocating implementing funding and resources for alternative weed control solutions).

<sup>417</sup> 40 C.F.R. §§ 155–58 (2019).

<sup>418</sup> *See* Centner, Brewer & Leal, *supra* note 118 (discussing the use of mitigation measures to protect pollinator species from lethal pesticides).



pesticide uses that cause human health damages. Mitigation measures altering existing practices that could lead to reductions in pesticide usage are not required even though they could contribute to reduced environmental and health problems.<sup>419</sup>

For example, would reductions in the use of GBHs as desiccants or defoliant to remove foliage prior to the harvest of oats, dry beans, and lentils be beneficial?<sup>420</sup> Would reductions in applications of GBHs as desiccants on cover crops lead to reductions in health maladies?<sup>421</sup> By discontinuing harvest aid uses, less glyphosate would be released into the environment.<sup>422</sup> Other mitigation approaches might be adopted to reduce the harm caused to the environment and human health by pesticide uses.<sup>423</sup>

### CONCLUSION

Americans are using large quantities of synthetic pesticides to manage pests that diminish crop yields, denigrate food quality, impair human health, and detract from general well-being. Despite the many benefits accruing from pesticide usage, negative externalities in the form of adverse human health and environmental effects detract from the benefits. Federal law considers a pesticide's negative externalities and a pesticide can only be registered if it does not cause an "unreasonable adverse effect[] on the environment."<sup>424</sup> However, the absence of a full accounting of co-formulants and cumulative exposure

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<sup>419</sup> *Id.*

<sup>420</sup> See, e.g., Kristen E. McNaughton et al., *Effect of Application Timing of Glyphosate and Saflufenacil as Desiccants in Dry Edible Bean* (*Phaseolus vulgaris* L.), 95 CANADIAN J. PLANT SCI. 369, 374 (2015) (noting that glyphosate applied as a desiccant increases residue levels in dry beans); Ti Zhang, Eric N. Johnson & Christian J. Willenborg, *Evaluation of Harvest-Aid Herbicides as Desiccants in Lentil Production*, 30 WEED TECH. 629, 636 (2016) (finding "that using glyphosate as a desiccant can result in unacceptable glyphosate seed residues").

<sup>421</sup> GBHs are used to kill the cover crop to enhance subsequent crop germination. See Ryan D. Lins et al., *Glyphosate Application Timing and Rate for Annual Ryegrass* (*Lolium multiflorum*) *Cover Crop Desiccation*, 21 WEED TECH. 602, 603-04 (2007).

<sup>422</sup> Some groups are supporting this idea. See Alex Formuzis, *More than 100,000 Americans Urge EPA To Restrict Unnecessary Use of Monsanto's Weedkiller on Oats*, ENV'T. WORKING GRP. (June 7, 2019), <https://www.ewg.org/release/more-100000-americans-urge-epa-restrict-unnecessary-use-monsanto-s-weedkiller-oats> [<https://perma.cc/FBE3-7EHN>] (urging the EPA to restrict uses of glyphosate on oats).

<sup>423</sup> See Larsen, Patton & Martin, *supra* note 42, at 828 (discussing "opportunities for crop-specific pest management and region-specific mitigation approaches" to reduce pesticide uses).

<sup>424</sup> 7 U.S.C. § 136a(a) (2018).

means that some external costs are not considered. Moreover, the lack of sufficient information on long-term chronic health effects at the time of a pesticide's initial registration may understate negative externalities.<sup>425</sup> A pesticide may qualify for registration without considering all its health costs.<sup>426</sup>

Furthermore, when post-registration studies reveal that pesticide use has significant health risks, the costs associated with these risks are not considered unless a registrant agrees to cancel a registration or a cancellation proceeding is initiated.<sup>427</sup> Administrative delays with the cancellation of a registration allow human health costs to be overshadowed for years by production benefits.<sup>428</sup> The application of FIFRA's registration provisions employing a cost-benefit analysis sacrifices human health to foster greater agricultural production. While food safety tolerances safeguard human health from pesticide residues in and on food,<sup>429</sup> the registration of pesticides allows pesticide exposure to harm people.

The jury verdicts of the three *Monsanto* cases holding the glyphosate manufacturer liable for health damages suggest that governments are not providing equitable resolutions to govern the use of pesticides. Persons injured from pesticide exposure should not suffer uncompensated damages while others reap the benefits of profitable pesticide sales and reduced food costs. Pesticide manufacturers and users inflicting health damages on others should provide recompense.<sup>430</sup> This will require manufacturers and users to budget health costs into business practices and prices for their products and services, which may be expected to lead to higher food prices and more expensive public-health pest control measures.<sup>431</sup> In some cases, manufacturers may want to amend or cancel registrations that are

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<sup>425</sup> See Roberts, Karr & Council on Environmental Health, *supra* note 129, at 1773 (noting "a growing body of literature that suggests that pesticides may induce chronic health complications in children, including neurodevelopmental or behavioral problems, birth defects, asthma, and cancer.").

<sup>426</sup> 7 U.S.C. § 136a(1)(5) (2018) (exceptions allowing residues above current legal provisions).

<sup>427</sup> *Id.* § 136d.

<sup>428</sup> See *Azinphos-Methyl Phase-Out*, *supra* note 126 (discussing ending azinphos-methyl use); *League of United Latin Am. Citizens v. Wheeler*, 899 F.3d 814, 817–18 (attempting to cancel registrations of chlorpyrifos over a 12-year timeframe).

<sup>429</sup> See 21 U.S.C. § 346a (2018).

<sup>430</sup> Alternatively, protecting public health may need to ignore costs. See *Driesen 2*, *supra* note 116, at 70 (advancing this idea).

<sup>431</sup> See Centner, Russell & Mays, *supra* note 31, at 613.

accompanied by significant health damages.<sup>432</sup> In February 2020, Corteva, the leading manufacturer of chlorpyrifos pesticides in the United States, announced it was discontinuing production.<sup>433</sup> While the company cited reduced demand and its agreement with California to end sales in that state, the known health damages presumably contributed to the decision.<sup>434</sup> Manufacturers may cease production of dangerous pesticides to avoid future allegations of health damages.

The judgments of the *Monsanto* cases have been appealed, and Bayer AG, the owner of Monsanto, has agreed to a settlement under which it will pay more than \$10 billion for current and future plaintiffs alleging health damages.<sup>435</sup> The placement of health costs on manufacturers may curtail pesticide usage, encourage practices to keep people safe, and reduce health costs related to pesticide exposure. However, the absence of statutory and regulatory provisions aligning pesticide liability with the public's expectations means that persons harmed by pesticide exposure need to pay their own health costs and resort to tort litigation to secure recompense. Until legislatures place greater emphasis on safeguarding human health and the use of mitigation measures, the costs associated with pesticide use will not be factored into production costs. To foster the adoption of greater safety measures and innovation, it may be time to hold manufacturers accountable for damages caused by the use of their products.<sup>436</sup>

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<sup>432</sup> See Chlorpyrifos Cancellation Order, *supra* note 41 (manufacturers agreeing to cancel multiple uses of chlorpyrifos due to human health risks).

<sup>433</sup> Britt E. Erickson, *Corteva to stop producing chlorpyrifos*, CHEM. & ENG'G NEWS (Feb. 7, 2020), <https://cen.acs.org/environment/pesticides/Corteva-stop-producing-chlorpyrifos/98/web/2020/02> [<https://perma.cc/TQ3E-DASC>].

<sup>434</sup> *Id.* See also EPA Chlorpyrifos Human Health, *supra* note 119 (discussing human health issues).

<sup>435</sup> See BAYER, *supra* note 1.

<sup>436</sup> See *Hyundai Motor Co. v. Alvarado*, 974 S.W.2d 1, 11 (Tex. 1998) (fostering safety included allowing the imposition of tort liability); Robert E. Litan, *The Safety and Innovation Effects of U. S. Liability Law: The Evidence*, 81 AM. ECON. REV. 59, 63 (1991) (noting that "liability . . . attempts to induce safety-enhancing behavior . . .").

