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Chlorpyrifos Use In Arizona

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Comments submitted by the Arizona Pest Management Center
University of Arizona

EPA Docket: EPA-HQ-OPP-2015-0653

Key Points

- *Current EPA risk assessment models for chlorpyrifos do not address many of the realities of Arizona agriculture (e.g., realistic use patterns, minimal runoff due to laser leveling, solar degradation of compound, lack of water bodies in proximity to agriculture, and actual groundwater measurement data). Furthermore, current label restrictions limit the use of chlorpyrifos more than an order of magnitude below the level of use assumed in EPA models.*
- *EPA's national economic analyses fail to account for significant impacts on a substantial number of small entities and the realities of state, regional and local crop economics.*
- *Chlorpyrifos, while not used often on most Arizona crops, remains an important "go-to" product in certain situations. Its broad-spectrum efficacy facilitates control of multiple targets, including less common but destructive pests for which there are few if any alternative AIs available.*
- *The majority of chlorpyrifos use in Arizona is on alfalfa. A large number of acres are treated in years when pest levels are high. This is an important chemistry in alfalfa because it is effective against multiple pests that can occur simultaneously, some of which have few other labeled options.*
- *Chlorpyrifos was previously a key active ingredient for the control of pink bollworm, a major economic pest of cotton which has been eradicated in AZ and surrounding regions. Investment in Bt cotton technology and a regional eradication program representing a combined investment of over $130million could be at risk if this invasive pest were to return and we did not have in place the most effective tool for its control: chlorpyrifos.*
- *Revoking of all tolerances for chlorpyrifos will have detrimental economic effects on Arizona agriculture and will even prevent the possibility of special local needs registrations.*
- *Chlorpyrifos, given current label restrictions and Arizona agricultural and pest management practices, can be used without significant risks to human or environmental health in Arizona.*
- *Ground water testing by the Arizona Department of Environmental Quality over a 20-year period in Arizona including in agriculturally intense rural communities and during periods of peak chlorpyrifos usage failed to detect any chlorpyrifos residues in any water supply.*

EPA is currently seeking information regarding revocation of all tolerances for chlorpyrifos, an organophosphate in use since 1965. The Arizona Pest Management Center provides the information below in support of this important active ingredient that confers broad spectrum benefits in insect control in certain cropping systems where alternatives are unavailable, less effective and/or much costlier to implement.

Who We Are

The Arizona Pest Management Center is host to the University of Arizona's expert IPM scientists including more than a dozen Ph.D. and other entomologists with expertise in the strategic tactical use of insecticides within IPM programs that protect economic, environmental and human health interests of stakeholders and the society at large. The authors have more than 40 years of experience and expertise in pesticide use assessment, pesticide user behaviors, and risk assessment / management in Arizona cropping systems.

Dr. Peter Ellsworth is Director of the APMC, State IPM and Pesticide Coordinator for Arizona and Professor of Entomology / Extension IPM Specialist with expertise in developing IPM systems in cotton and other crops and measuring implementation and impact of IPM and pest management practices. Dr. Al Fournier is Associate Director of the APMC / Adjunct Associate Specialist in Entomology, holds a Ph.D in Entomology, and has expertise in evaluating adoption and impact of integrated pest management and associated technologies. Mr. Wayne Dixon holds a B.S. in Computer Information Systems and develops tools and data used in IPM research, education and evaluation, including management of the APMC Pesticide Use Database. Dr. Channah Rock is an Associate Professor and Extension Specialist in Water Quality, and has expertise in microbial water quality including pathogen detection and mitigation for the protection of public health.

These comments are the independent assessment of the authors and the Arizona Pest Management Center as part of our role to contribute federal comments on issues of pest management importance and do not imply endorsement by the University of Arizona or USDA of any products, services, or organizations mentioned, shown, or indirectly implied in this document.

Our Data and Expert Information

Through cooperative agreements with Arizona Department of Agriculture, the Arizona Pest Management Center obtains use of, improves upon, and conducts studies with ADA's Form L-1080 data. Growers, pest control advisors and applicators complete and submit these forms to the state when required by statute as a record of pesticide use. These data contain information on 100% of custom-applied (i.e., for hire) pesticides in the state of Arizona. Grower self-applied pesticide applications may be under-represented in these data. In addition, the Arizona Pest Management Center is host to scientists in the discipline of IPM including experts in the usage of this compound in our agricultural systems. We actively solicit input from stakeholders in Arizona including those in the regulated user community, particularly to better understand use patterns, use benefits, and availability and efficacy of alternatives. The comments within are based on the extensive data contained in the Arizona Pest Management Center Pesticide Use Database, collected summary input from stakeholders and the expertise of APMC member faculty.

Where is Chlorpyrifos Used in Arizona Agriculture?

Arizona has progressively improved insect IPM systems over the last two decades such that organophosphate use has declined greatly, including chlorpyrifos (Figure 1). These gains are regularly tracked in cotton and lettuces of all types, but these trends extend to many crops in Arizona where alternative active ingredients and other IPM advances have been possible. That said, however, chlorpyrifos has been and remains an important active ingredient because of its unique spectrum of control, its relatively short environmental persistence, broad labeling that includes crops with few alternative products available, low cost, and efficiency of control.

EPA-BEAD has underestimated the utility (and therefore benefits) of this compound in its analysis by focusing almost solely on economic impact, in aggregate, on small entities and proportional farm-level impacts on gross revenues. This sort of approach will lead to the conclusion that many lower use, but strategically important, compounds will have negligible economic impact if lost through regulatory action. This, however, ignores locally important markets and economies as well as the important niches that these compounds occupy in our pest management arsenal. EPA-BEAD is not using an approach with sufficient granularity to detect SISNOSE (significant impact on substantial number of small entities) at a level that impacts States, regions within States and/or low acreage, but sometimes locally intense, cropping patterns.

EPA-BEAD's approach is also diametrically opposed to the assumptions used by other arms of US-EPA in their risk assessments where unrealistically high use patterns are assumed. This raises the question of how can there be substantial threats to local watersheds and water supplies in agriculturally intense areas if the product is relatively unimportant and not used that much except under very specific conditions?

In Arizona agriculture, there are many unique conditions and pest situations where chlorpyrifos is very important but only seldom used. As a niche product and as a basic tenet of IPM (i.e., use an effective chemistry only when needed as part of an overall approach that is based in prevention and avoidance tactics), chlorpyrifos helps growers of many crops in Arizona meet their pest management needs efficiently and economically. Pest control advisors (PCAs) always carefully consider its use. Professional PCA Greg Sprawls, with 18 years experience managing pests on 10,000 acres (50% in alfalfa hay) on Colorado River Indian Tribes land, describes chlorpyrifos as an important tool, even though it is **used only as a tool of last resort** because it is difficult to apply, requires posting and eliminates natural enemies from the field. Furthermore, EPA-BEAD's process of considering only losses equivalent to more than 3% gross revenues ignores the high costs of production in Arizona and the very thin profit margins growers have for many field, forage, and rotational crops that are produced here as part of a multi-crop management plan.

So while the usage of chlorpyrifos is limited in many crops in Arizona, **we maintain that a revocation of all tolerances on these crops will represent a significant economic hardship for these growers including SISNOSE and tribal entities**. Therefore, we request that EPA maintain tolerances for all of the crops shown in Table 1.

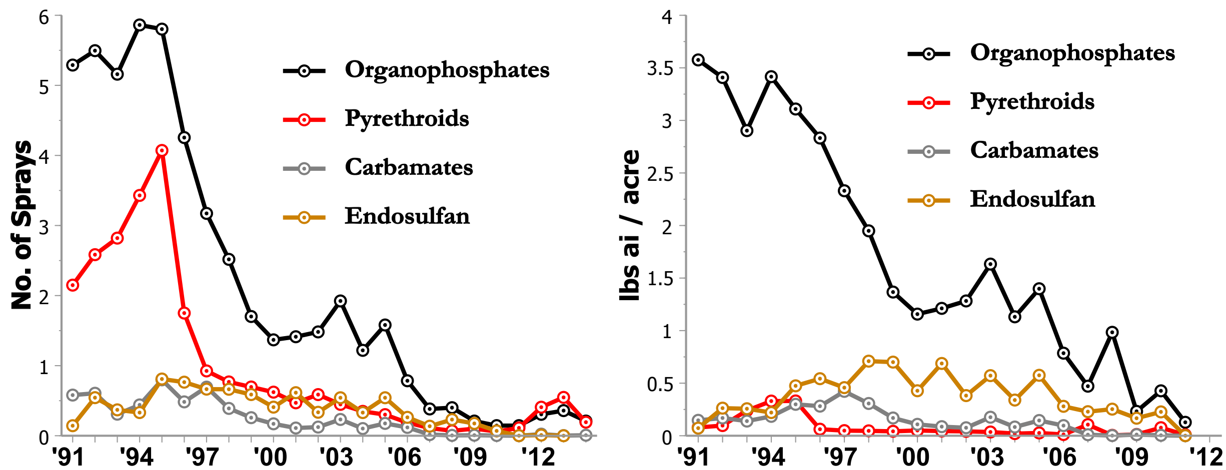

Figure 1. Acreage adjusted broad-spectrum insecticide use in Arizona cotton between 1991–2014 (number of sprays) and 1991–2012 (pounds active ingredient / acre). *Source: The Arizona Pest Management Center Pesticide Use Database, unpubl..*

Table 1. Sample crop and use patterns (number of uses and total acreage sprayed) for chlorpyrifos in Arizona between 2008–2015.

Crop	No. Uses	Total Acres
alfalfa	4771	419493
beans (all)	14	1686
beets (all)	19	539
broccoli	502	8733
cabbage	85	1085
cauliflower	108	1818
corn (all)	315	31142
cotton	378	28716
grass (all)	32	1322
lemon	24	436
onions (all)	23	456
orange	6	173
pecan	88	13132
sorghum (all)	157	17481
sunflower	6	59
wheat	34	3719

Source: The Arizona Pest Management Center Pesticide Use Database, unpubl. This database captures only reported usage, which may reflect only a fraction of total actual use.

Why is Chlorpyrifos Used and/or Needed in Arizona Agriculture?

As already noted, chlorpyrifos is a niche product with limited, sometimes very limited, use in Arizona. However, those uses are still strategically very important, because of the limited number of effective or economic options. Much of Arizona's major agriculture has transitioned to selective chemistries that more precisely target pest species with little to no harm to the natural enemies in the system. There are a number of lepidopteran, whitefly, and aphid specific insecticides and insect growth regulators that effectively address these major problems. However, there are important and very notable exceptions that in some cases were not examined by EPA-BEAD. In addition, there are a wide variety of targets for which there are no effective, narrow spectrum alternatives. **Thus, even well-constructed IPM plans that focus on prevention and limited deployment of selective technologies need to maintain access to broad-spectrum options for situations when these troublesome pests become economic challenges.** Furthermore, there are times when there are combinations of pests present for which there is no single product solution other than a broad-spectrum chemistry like chlopyrifos. Infrequent but potentially devastating targets (in multiple crops) include grasshoppers, crickets, aphids of all kinds, webworms and cutworms of all kinds, earwigs, cockroaches, false chinch bugs, leafhoppers, leaf miners, billbugs, springtails, and seed corn maggot and other maggots. There are few other options, if any, for many of these difficult targets.

In cotton, chlorpyrifos use has nearly gone to zero (Figure 2; and, see Figure 1). On the surface, it would seem an insignificant loss if registration were withdrawn. There are, in fact, alternatives for those few pests where chlorpyrifos would have historically been used (e.g., aphids, saltmarsh caterpillar and other foliar feeding lepidoperans). However, Arizona has invested over $123,000,000 in purchase of Bt technology to protect their cotton varieties from pink bollworm and other lepidopteran pests since 1996 (Ellsworth, unpubl. data). In addition, since 2007, growers directly invested another $10.9 million to eradicate the pink bollworm in an on-going effort to exclude this invasive species from our State and region (Ellsworth, unpubl. data; Williams 2008–2015). Meanwhile, resistances to Cry1Ac Bt technology have evolved in pink bollworm in the field in cotton in India (Dhurua & Gujar 2011, Fabrick et al. 2014; Monsanto 2010). Should transgenic Bt technology break down and pink bollworm be re-introduced to our region, the consequences would be devastating, **made even worse by the fact that lepidopteran-specific insecticides have no effect on this species**! As a boring insect that enters cotton tissues within hours of egg hatch, only adulticidal programs of chemical control provide any relief from this devastating pest. Methyl parathion (no longer available) and a special formulation of chlorpyrifos (Figure 2) were the mainstay chemical tactics available to combat this pest — emamectin benzoate, chlorantraniliprole, flubendiamide, spinosyns, indoxacarb, methoxyfenozide are each ineffective on pink bollworm. **Eliminating all tolerances, even for a crop like cotton that on the surface does not have a current major need for this active ingredient, would place all of southwestern cotton in a precarious position should pink bollworm ever return.** Even pheromone disruption technologies targeting pink bollworm specifically were dependent on very low rates of chlorpyrifos in an attract ’n kill formulation. These tools need to remain on the shelf, legally permitted and with legal tolerances, to allow growers to defend themselves from this destructive, invasive pest.

In contrast to the “infrequent” pests and safeguarding future needs already expressed, there is one major use pattern that currently impacts a significant percentage of our growers and their acreage (Figure 3). In alfalfa, chlorpyrifos provides an important spectrum of activity in simultaneously providing relief from Egyptian alfalfa weevil, a broad complex of winter and summer aphids, leafhoppers and various lepidopterans (Table 2). Arizona is among the most productive alfalfa producers in the world averaging over 8.3 tons / A from 10 cuttings per year — 3.4 tons / A is more typical in the rest of the U.S. The value of Arizona alfalfa hay production in 2013 was $405million (USDA-NASS 2014).

The EPA-BEAD review of chlorpyrifos examined alfalfa weevil only in its flawed analysis. As a national review, Arizona's needs in pest control are swamped out by the millions of other alfalfa acres that have very different crop and pest dynamics and pressures. At the very least, EPA should consider dormant and non-dormant alfalfas as two different and separate crops in any economic analysis. In addition, with a perennial crop like alfalfa the very nature of multiple cuttings and revenue from them can mask the true economic hardship experienced by growers. Even researchers have great difficulty in estimating losses to insect pests in forage alfalfa, especially when the impacts of these pests contribute to losses in stand longevity. Given the serious outbreaks of winter/spring aphid complex two years ago and the recent summer challenges from *Empoasca* leafhoppers stunting alfalfa crops throughout Arizona, it would be foolhardy to suggest that chlorpyrifos is a tool that would not be missed here given its spectrum of activity. **Losses to these pests without chlorpyrifos would surely exceed 3% for these farmers, including many small farmers with limited land-holdings as well as communal tribal farms who have made major investments in alfalfa production.**

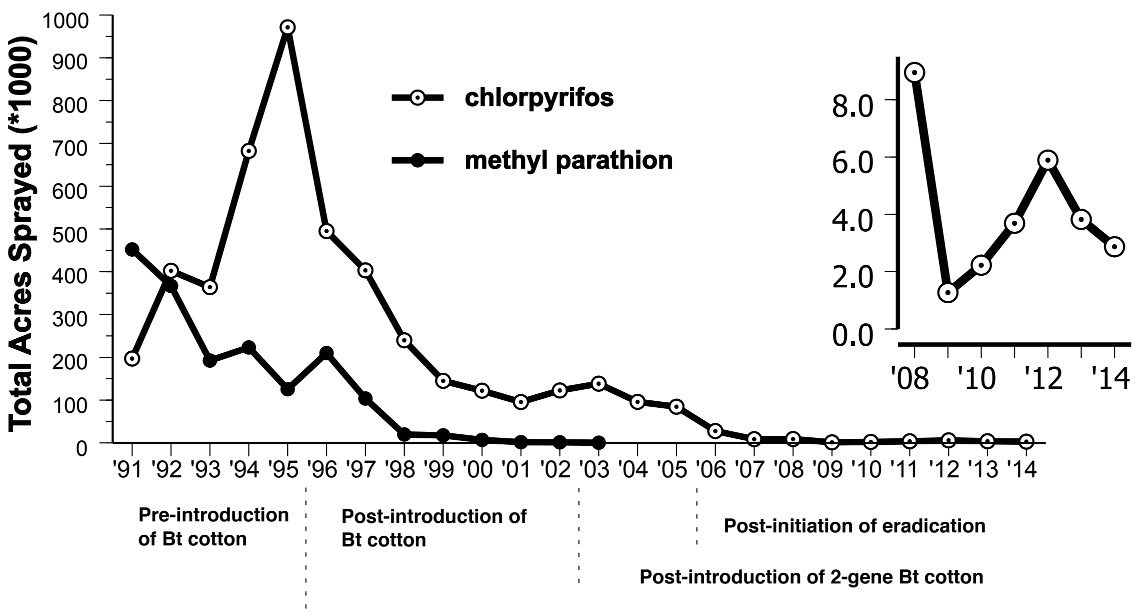

Figure 2. Key pink bollworm control chemicals in Arizona cotton between 1991–2014. Nearly 1 million acre-sprays were made in 1995 in part to control pink bollworm moths and in part to synergize pyrethroid activity against whiteflies (*Bemisia tabaci* MEAM1) and control other pests. As transgenic Bt cotton was adopted, improved with two genes, and used as a key eradication tool, the usage of pink bollworm control chemicals declined precipitously. However, resistances to Bt in pink bollworm have been detected in the field both in Arizona (Tabashnik et al. 2005) and India (Fabrick et al. 2014). Should Bt cottons fail to control pink bollworm and/or this devastating, invasive pest was to return to Arizona, the losses would be potentially catastrophic without chlorpyrifos as a control agent. Even in the absence of pink bollworm due to eradication efforts, small amounts of chlorpyrifos are still used to control other occasional pests (inset, 2008–2014), representing 5.1 (2009) to 24.4% (2011) of all organophosphate insecticides used in Arizona cotton. *Source: The Arizona Pest Management Center Pesticide Use Database, unpubl..*

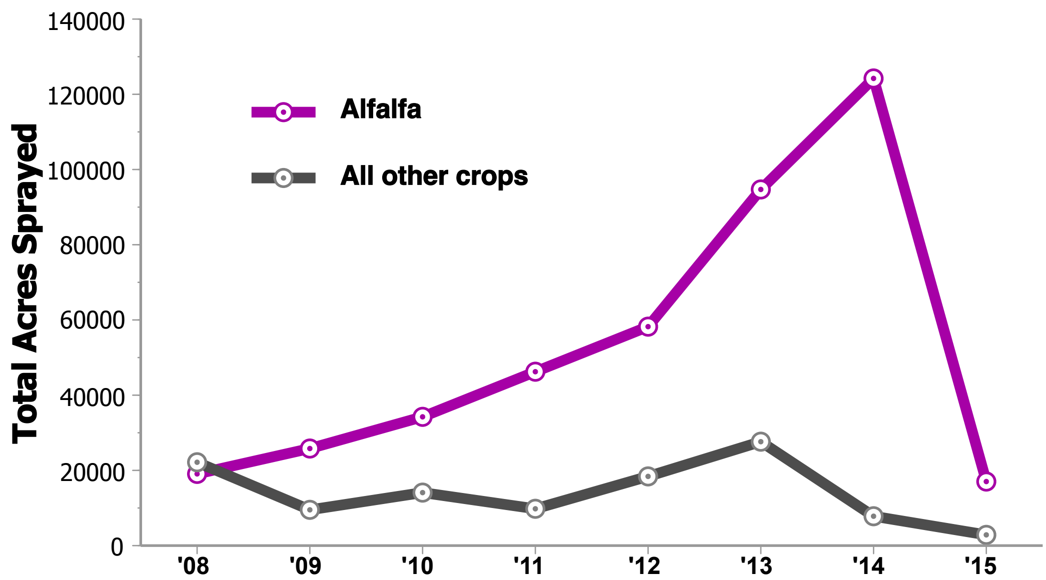

Figure 3. Total acres sprayed with chlorpyrifos in alfalfa and all other crops (see Table 1 for list) in Arizona between 2008–2015. *Source: The Arizona Pest Management Center Pesticide Use Database, unpubl. This database captures only reported usage, which may reflect only a fraction of total actual use (see narrative in next section). 2015 contains only a partial year's usage.*

Table 2. Labeled targets and rates for chlorpyrifos use in alfalfa.

Labeled Target	Rate[1]
corn rootworm adults (spotted cucumber beetle)	0.5-1 pt
grasshoppers	0.5-1 pt
leafhoppers	0.5-1 pt
alfalfa blotch leaf miner	1 pt
alfalfa caterpillar	1 pt
alfalfa weevil larvae and adults	1 pt
armyworms	1 pt
blue alfalfa aphid	1 pt
cowpea aphid	1 pt
cutworms	1 pt
Egyptian alfalfa weevil larvae and adults	1 pt
pea aphid	1 pt
plant bugs	1 pt
spittlebugs	1 pt
spotted alfalfa aphid (suppression)	1 pt
alfalfa webworm	1.5 pt

1, for chlorpyrifos formulated at 4 lbs ai / A.

Real World Use Data for Chlorpyrifos in Alfalfa & Local Watersheds

While Arizona has important niche needs for chlorpyrifos (that would not emerge in a national review; Table 1), alfalfa is by far the most important use pattern for our farmers. Between 43–94% of all fields treated with chlorpyrifos in the last 8 years have been alfalfa (Table 3). This reflects the great utility and spectrum of activity of this compound in this system, and the very limited number of options available to these growers for pest control in the low desert. Intensity of use ranged from 7.3% of acres up to 47.8% (Table 3). As already noted our data reflect only a subset of all pesticide use in alfalfa. Some grower-applied pesticides are not reported to this database; some alfalfa growers apply insecticides by ground with their own equipment. However, recent interviews with key pest control advisors knowledgeable about pesticide reporting practices on this crop suggest that our measurements of usage are very close to actual usage in this case. Thus assuming conservatively that our measurements fail to capture 10–20% of actual usage, we estimate that potentially as much as 50–60% of the annual alfalfa acreage may be sprayed with chlorpyrifos in years of peak need.

This pattern of use, while important, is far short of any assumptions EPA has made in parameterizing models of impact on local watersheds (i.e., all alfalfa in a community is never completely sprayed with chlorpyrifos, even in outbreak years). Furthermore, as the principal crop for chlorpyrifos use in Arizona, there is never a time when all of agriculture in a local watershed is subject to chlorpyrifos use as was assumed in EPA analyses (see next).

Arizona growers of alfalfa are generally engaged in a very active 3- to 4- year crop rotational program that includes cotton or summer grasses (corn, sorghum, milo, summer sudangrass), winter wheat and other small grains, fallow periods, and alfalfa. Structurally therefore, Arizona's landscape is never occupied by more than one third alfalfa at any given time, even in communities heavily invested in alfalfa production. This means that no more than 1/3rd of the land area is subject to chlorpyrifos sprays and even then on less than 60% of the area, netting less than 20% of the cropping area potentially treated with chlorpyrifos during peak years. These real world values for chlorpyrifos usage in Arizona approach an order of magnitude lower than EPA assumptions ("100% of the cropped watershed is treated"), reducing risk to local watersheds by at least an order of magnitude compared with what is predicted by EPA's model. While assumptions are often used in models and with all due respect to modeling efforts in the absence of real-world data, these assumptions simply do not apply to Arizona. Our data show this clearly.

Table 3. Summary of recent chlorpyrifos usage in alfalfa in Arizona between 2008–2015.

Year	Total Acres Sprayed	Uses in Alfalfa[1]	Intensity of Use[2]
2008	19061	43%	7.3%
2009	25808	53%	9.2%
2010	34236	51%	12.2%
2011	46235	62%	18.5%
2012	58217	64%	23.3%
2013	94695	77%	37.9%
2014	124212	94%	47.8%
2015	17029	84%	6.5%

1, as % of chlorpyrifos-sprayed fields that were alfalfa
2, as % of alfalfa acreage sprayed

Source: The Arizona Pest Management Center Pesticide Use Database, unpubl. This database captures only reported usage, which may reflect only a fraction of total actual use (see narrative above).

Structural & Environmental Protections Already Present in Arizona Agriculture

Arizona's low desert agriculture is characterized by a variety of structural and environmental factors that impact movement of pesticides of all kinds. National models that are derived from the Pacific Northwest and the Eastern Seaboard, such as have been used by US-EPA so far, are extremely poor predictors of pesticide fate in desert ecoregions, including Arizona agriculture production zones. To extrapolate these data to Arizona's situation with chlorpyrifos is dangerously flawed.

Arizona's irrigated agriculture is in a desert environment where rainfall averages less than 25 cm per year. In most of the places where alfalfa (our principal crop receiving chlorpyrifos sprays) is grown, rainfall levels are even lower, often less than 12 cm per year.

Because of the importance of irrigation water in our system, farmers are important stewards of this natural resource. This includes 100% use of laser-leveling technology (since the 1970s) to control slope in fields for the management of irrigation water. This means that little to no water leaves the site of application, the agricultural field.

These conditions are accompanied by extremely high temperatures and extremely low humidities, as low as 2% in 2015. These are harsh conditions under which to apply pesticides. Aerial applications at 3–7 GPA and even ground applications at 10–15 GPA typical for alfalfa sprays can barely reach and coat the top of the canopy, let alone the soil which is protected by both crop canopy and an organic layer of crop residue. Thus, off-target movement and duration of the liquid phase of applied pesticides in our system is very low.

Also related to our arid, desert climate is the dearth of water bodies that might be present to receive any off-target movement of pesticides. Most of agriculture in our State is devoid of running streams or rivers, and natural lakes or ponds. Furthermore, even the small amounts of pesticides that might reach our soils are subject to intense solar radiation (and heat) and the associated degradation processes. Even published studies of environmental fate for organophosphates including chlorpyrifos distinguish from dry areas (or seasons) and wet areas (or seasons) with far lower levels (and risks) measured under dry conditions (Jaipieam et al. 2009).

Groundwater Testing in the State of Arizona

Importantly, the Arizona Department of Environmental Quality works to safeguard Arizona's waters statewide. This includes regulations specific to the pesticide registration process that examines environmental fate in Arizona's soils for example. Any pesticide with potential for residues in groundwater or other waterways and otherwise cleared for use are maintained on a groundwater protection list. Once on this list, all applications to the soil of these active ingredients must be reported to the Arizona Department of Agriculture, where these data are ultimately captured by the APMC's Pesticide Use Database.

ADEQs charter also includes periodic testing of groundwater throughout the state. **A review of the public records of this program reveal that at no time in a 20-year period was chlorpyrifos detected in groundwater** (1989–2008, ADEQ, Jason D. Jones, personal communication; data available upon request). This testing was conducted 186 times over this 20-year period and included rural locations of agricultural intense communities (Figure 4) and during seasons and years of peak chlorpyrifos usage in Arizona (e.g., ca. 700,000 acres sprayed in cotton alone in 1994; see Figure 2). For reasons that are obvious (i.e., no detections ever), ADEQ does not maintain chlorpyrifos on its groundwater protection list

In short, despite EPA's concerns for levels of chlorpyrifos in drinking water supplies, there is not a single instance of detected levels in Arizona water supplies. On the strength of these data and the use patterns previously described, there should be no reason to cancel tolerances for chlorpyrifos in Arizona. Any action to do so nationally would be punitive to the State of Arizona and despite the wealth and weight of scientific evidence to the contrary.

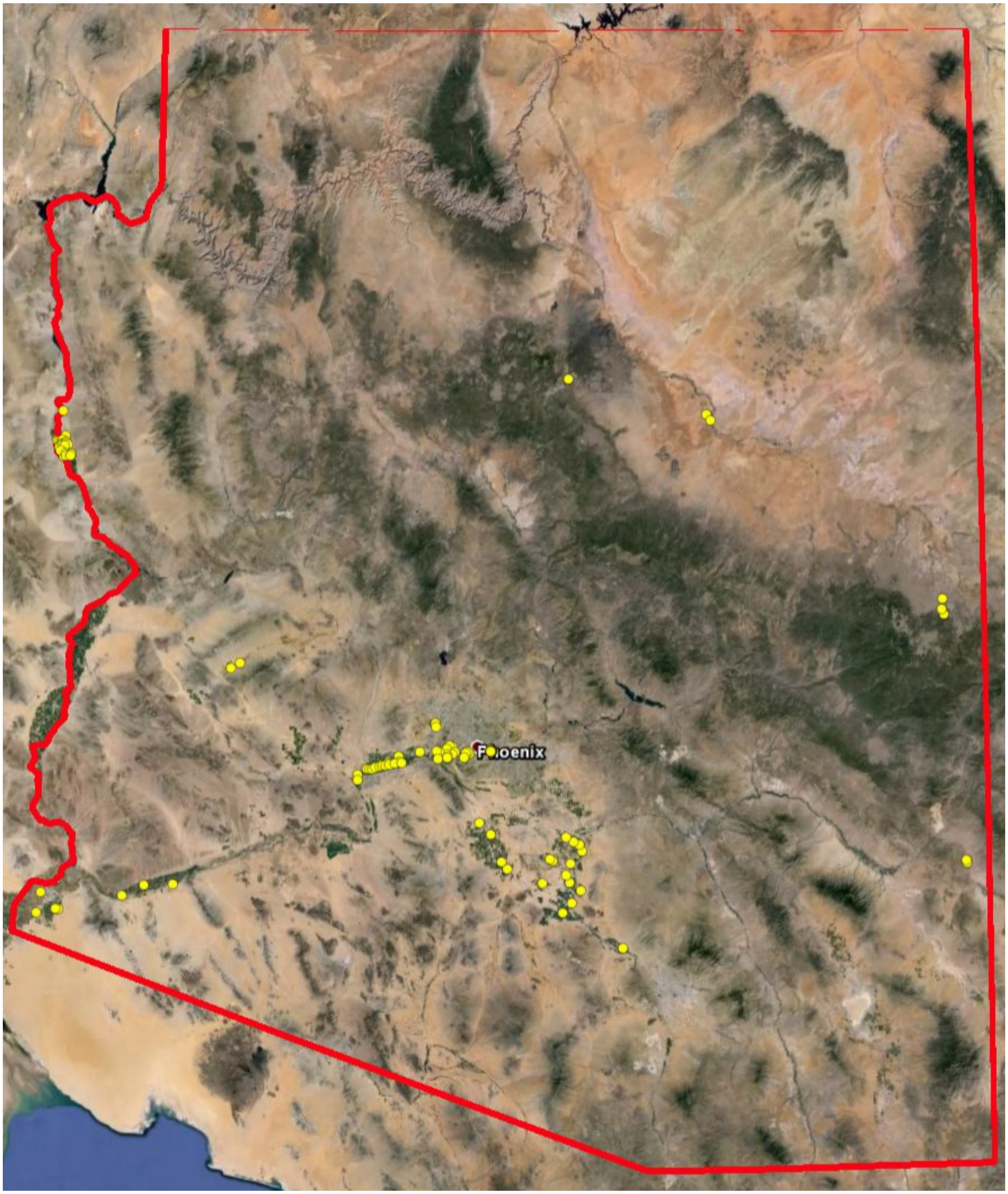

Figure 4. Maps of sample points for groundwater testing program of the Arizona Department of Environmental Quality between 1989–2008; entire state (above), and three agriculturally intense valleys (pages that follow): Mohave Valley, Yuma Valley including the balance of Yuma County, and several valleys along the Salt & Gila Rivers adjacent to metro Phoenix area. In 186 samples (yellow dots) of well water and other groundwater sources over a 20-year period, there was never a detection for chlorpyrifos. *Source: ADEQ (public database accessed 1/4/16), Jason D. Jones, personal communication).*

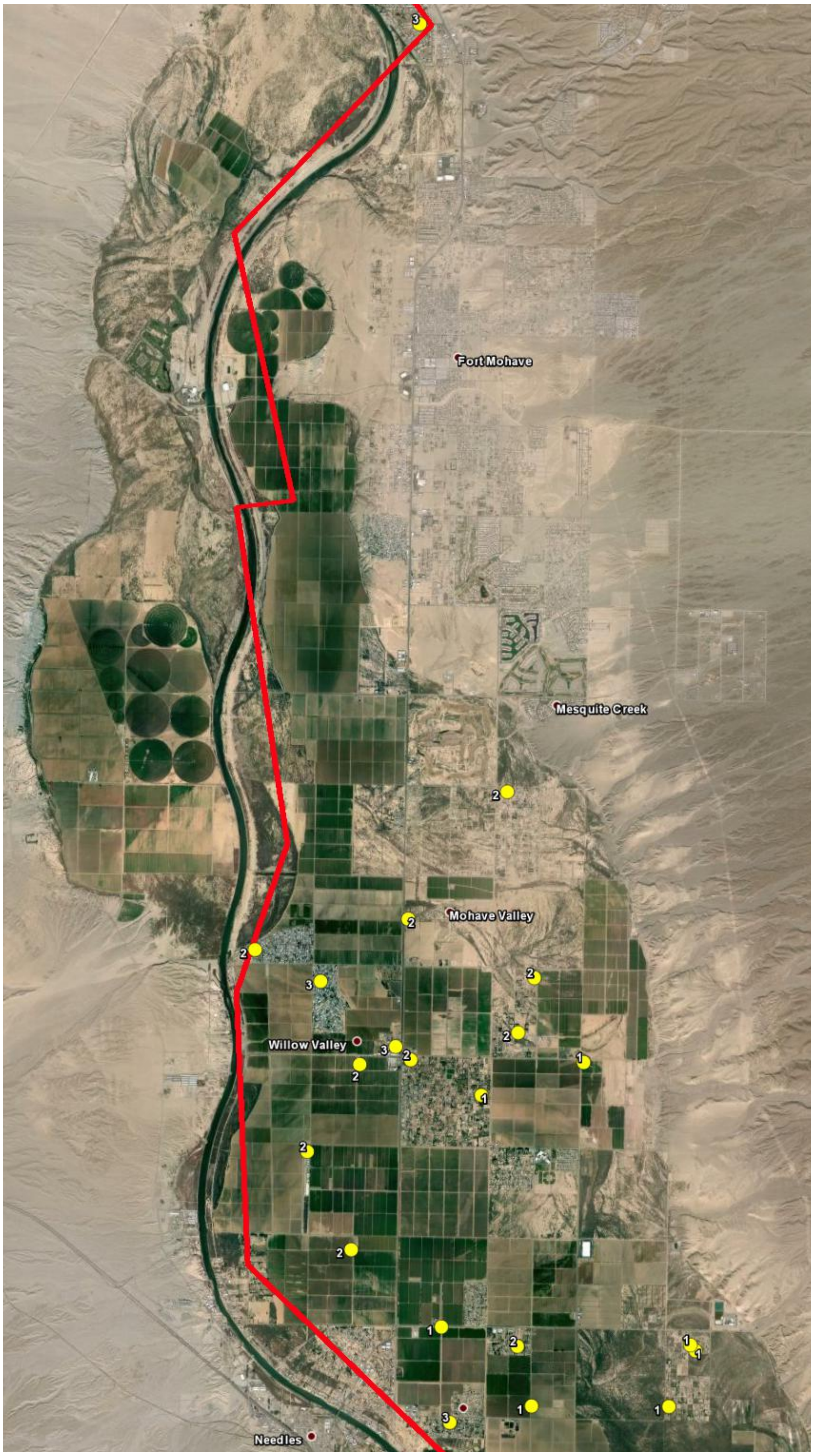

Figure 4 (continued). Maps of sample points for groundwater testing program of the Arizona Department of Environmental Quality between 1989–2008: Mohave Valley. Number of samples (white numbers) and locations (yellow dots) are shown in Arizona east of the state border with California (red line) and adjacent to the Colorado River running north to south (top to bottom). *Source: ADEQ (public database accessed 1/4/16), Jason D. Jones, personal communication).**

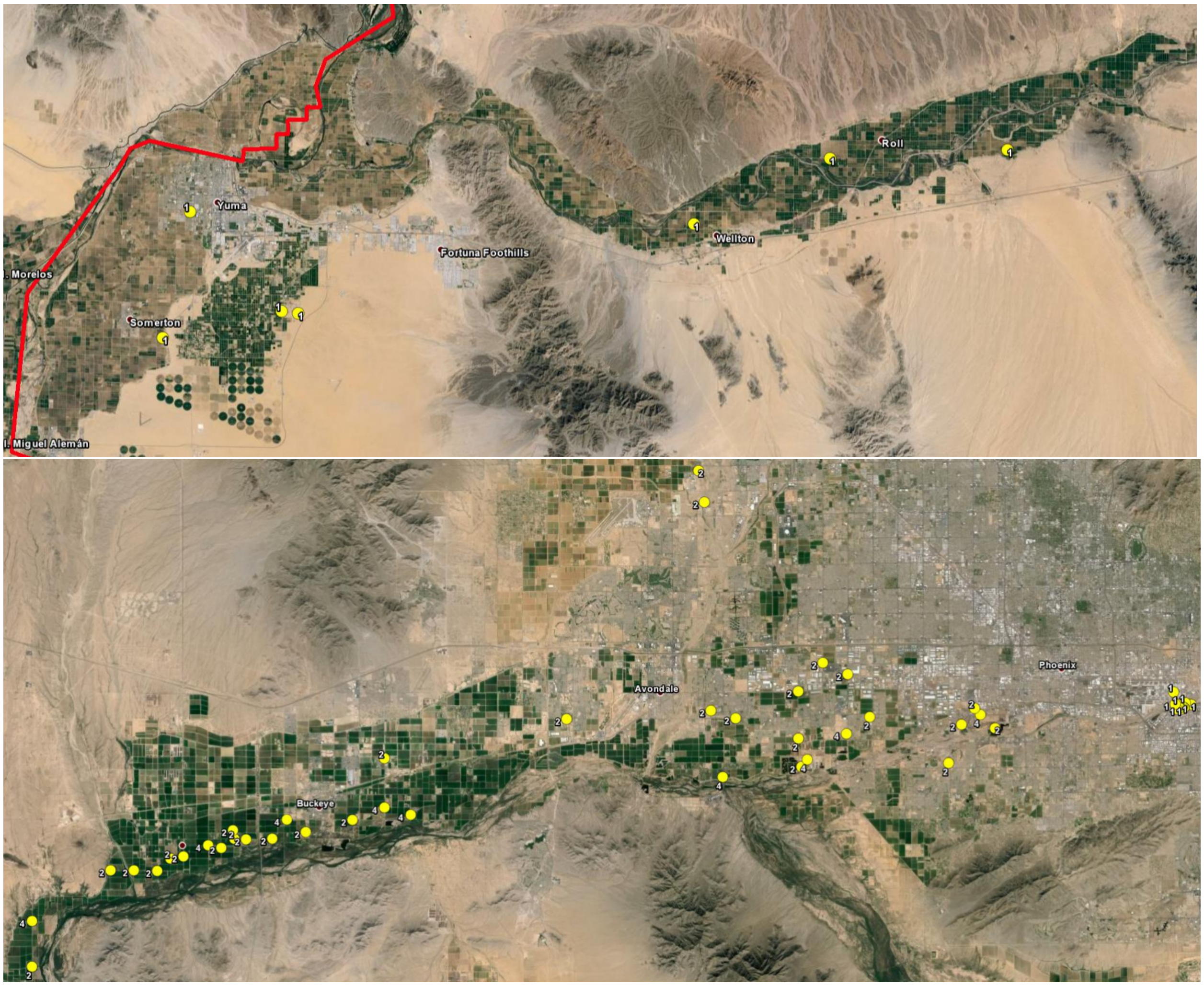

Figure 4 (continued). Maps of sample points for groundwater testing program of the Arizona Department of Environmental Quality between 1989–2008: Yuma Valley including the balance of Yuma County (top), and several valleys along the Salt & Gila Rivers adjacent to metro Phoenix area (bottom). Number of samples (white numbers) and locations (yellow dots) of wells are shown. Yuma (top): Arizona east of the state border with California (red line) and adjacent to the Colorado River running north to south (top to bottom); Buckeye Valley and surrounding area (bottom): Phoenix metro area appears to the east of this valley (right), and the Salt River / Gila River confluence runs east to west (right to left) through this area. *Source: ADEQ (public database accessed 1/4/16), Jason D. Jones, personal communication).**

*Details on groundwater testing program of ADEQ for chlorpyrifos. 186 samples were drawn from 110 wells over a 20-year period spanning the entire state. The average well depth was 301 ft (range: 30–1772 ft). All methods used are approved Clean Water Act test methods for organic compounds [CWA Section 304(h)]. Limits of detection averaged 2.68 ppb (range: 0.02–10 ppb). Limits of detection below 3.9 ppb (a threshold level of interest to EPA), near 3.9 ppb (i.e., 5 ppb) and at 10 ppb were used in 66%, 21%, and 13% of the samples taken. The parameters measured were: Chlorpyrifos Oxygen Analog; Chlorpyrifos-Methyl, Total Water; Chlorpyrifos, Total Recoverable. **Chlorpyrifos has never been found by AZDEQ in groundwater samples in Arizona.**

Regulatory Protections & Existing Safeguards for Chlorpyrifos Use in Alfalfa

This limited use pattern is not a reflection of reduced importance of the active ingredient, so much as the significant currently in-force label restrictions on its use (Table 4). The preharvest interval, no. of applications limits, and spray intervals prescribed on the label already constrain use of chlorpyrifos. **The conditions are so highly stipulated that it is not possible for "100% of the cropped watershed" to be treated, even if 100% of the area were planted to alfalfa**!

Table 4. "Specific Use Restrictions" for alfalfa on current chlorpyrifos label.

> **Preharvest Interval:** Do not cut or graze treated alfalfa within 7 days after application of 1/2 pint of [product] per acre, within 14 days after application of 1 pint per acre, or within 21 days after application of rates above 1 pint per acre.
> Do not make more than four applications of [product] or other product containing chlorpyrifos per season or apply any product containing chlorpyrifos more than once per alfalfa cutting.
> Maximum single application rate is 1 lb ai chlorpyrifos (2 pints of [product]) per acre.
> Do not make a second application of [product] or other product containing chlorpyrifos within 10 days of the first application.

The net result of these restrictions is that a farmer never applies more than 1 spray of chlorpyrifos per cutting. In practice, this usually translates to no more than 1 spray per year for Arizona farmers, because they are usually spraying ≥1 pint per acre that stipulates a 21 d preharvest interval. Alfalfa is typically cut on a 21- to 28-d cutting schedule, severely limiting when chlorpyrifos can be used. **Any model assumptions that assume more frequent or intense use of chlorpyrifos for this crop are incorrect for Arizona**.

There are many other label elements already in place that specifically protect water and water bodies, greatly enhancing protections of watersheds and the water supplied for drinking (Tables 5–9). Applicators already cannot spray chorpyrifos to water or near surface waters (Table 5). They are provided extensive directions on how to manage rinsate in mixing and application equipment (Table 6) so as not to contaminate water. Extensive guidelines and requirements are provided for buffer zones, drift management and chemigation (Table 7). There are also extensive application directions that direct protections of water systems and public water sources (Table 8). Uses specific to alfalfa also re-iterate key specific use precautions that limit impact exposure to water (Table 9).

Table 5. "Environmental Hazards" statement on the current chlorpyrifos label (emphasis added).

This pesticide is toxic to fish, **aquatic invertebrates**, small mammals and birds. **Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark**. Drift and runoff from treated areas may be hazardous to aquatic organisms **in water adjacent to treated areas**. **Do not contaminate water when disposing** of equipment washwaters or rinsate.

Table 6. "Storage and Disposal" statement on the current chlorpyrifos label (emphasis added).

Do not contaminate water, food, or feed by storage and disposal.

Table 7. "Use Precautions and Restrictions" statement on the current chlorpyrifos label (emphasis added).

Flood irrigation: To avoid contamination of irrigation tail waters, **do not flood irrigate within 24 hours following a soil surface or foliar application** of [product]….

Observe the following precautions when spraying [product] **adjacent to permanent bodies of water** such as rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries, and commercial fish ponds.
The following treatment setbacks or buffer zones must be utilized for **applications around the above-listed aquatic areas** with the following application equipment: ….

Sensitive Areas: The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, **bodies of water**, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas)."

Table 8. "Application Directions" statement on the current chlorpyrifos label (emphasis added).

Do not connect an irrigation system (including greenhouse systems) used for pesticide application **to a public water system**….

The system must contain a functional check valve, vacuum relief valve, and low-pressure drain appropriately located on the irrigation pipeline **to prevent water source contamination from back flow**. Refer to the American Society of Agricultural Engineer's Engineering Practice 409 for more information….

Do not apply when wind speed favors drift beyond the area intended for treatment. End guns must be turned off during the application if they irrigate non-target areas.
Do not allow irrigation water to collect or run off and pose a hazard to livestock, **wells**, or adjoining crops.

Table 9. "Uses" for alfalfa statement on the current chlorpyrifos label (emphasis added).

To avoid contamination of irrigation tail waters, do not flood irrigate within 24 hours following an application of [product].

The Safety Standard & Risks to Watersheds

EPA's requirement to adhere to FFDCA safety standards is clear. However, the radical move to eliminate all tolerances that are in place to protect food because of potentially inadequate understanding of risks to water supplies appears draconian, if not punitive. EPA has made it clear that non-occupational risks associated with chlorpyrifos residues on crops are not a source of human health concern. **The currently proposed action is being driven by a judicial process of litigation rather than by the very scientific standards that EPA is committed to.**

An alternative, temporary regulatory solution is needed in place of the wholesale cancellation of all tolerances, which would have the unintended consequence of unacceptable economic losses, even in small business entities, as well as the potential for increased pest problems and increased usage of other organophosphates, carbamates, pyrethroids and other broad spectrum biocides. The regulatory alternative should be commensurate with the remaining risk(s) EPA wishes to better measure, understand, or mitigate. Thus, EPA should be looking specifically at environments believed to be at greatest risk and/or those most aligned with the "conservative" set of assumptions driving risk models. **Arizona is not one of these environments nor does it conform to the set of assumptions used by EPA's models**. There are likely many other states, especially in the arid West that do not have significant risk to water bodies or water supplies. On the strength of this knowledge alone, EPA must preserve tolerances so that legal and constrained use of this active ingredient in these areas is possible. Even using worst case scenario assumptions, EPA should be able to identify site-specific rules that would impose additional temporary restrictions on use for some locations/regions without canceling all tolerances.

Several options exist. For example, EPA could impose temporary additional use restrictions (lower rates, frequencies and/or intervals, buffer zones) on limited geographies (e.g., regions with rainfall in excess of 30 cm / year or with riparian habitat important to drinking water supplies). EPA should not simply eliminate all tolerances, which would shutdown access to other provisions under FIFRA such as 24c registrations. Special local needs (SLN, 24c) registrations are critical in meeting the pesticide needs of stakeholders threatened by locally important pest conditions. Without tolerances in place, an orderly and appropriate SLN could not be established even if it could be demonstrated that the set of environmental conditions present are not subject to the conditions EPA deems associated with unacceptable risk in their current models. Other emergency exemptions (e.g., Section 18) may also not be possible.

Summary

Not withstanding EPA model results based on regions of the country with rain-fed crops, sloped topographies, and sensitive aquatic habitats and based on improper and inaccurate use pattern assumptions (e.g., 100% treatment of cropped area), the weight of the evidence given here and the lack of directly measured evidence of drinking water contamination with chlorpyrifos in Arizona (despite 20 years of testing for this a.i. in groundwater here) **suggests that this pesticide can perform its intended function without unreasonable adverse effects on human health or the environment**. The current restrictions that preclude widespread, unconstrained use, especially in alfalfa, are sufficient to maintain use patterns without ever incurring conditions where 100% of a cropped area for a local watershed would be sprayed with chlorpyrifos. The current label carefully details environmental hazards, storage and disposal requirements, use precautions and restrictions, and application directions that are highly protective of water and the surrounding environment. There is critical need to maintain this chemical tool as a safeguard against occasional but severely destructive pests for which there are few, if any, alternatives for a number of crops including those with very limited acreages (e.g., seed corn maggot in brassicas). In addition, chlorpyrifos has been the chemical control cornerstone for pink bollworm in cotton with adulticidal sprays and/or extremely low-rate attract 'n kill pheromone disruption formulations. Without this tool, the entire southwestern U.S. and northern Mexico could lose major investments made to eradicate this severe, invasive pest from the entire region (including all of the U.S.). The environments where chlorpyrifos is used in Arizona are not prone to off-site movement of pesticide residues because of active water management, and other structural and environmental differences from the rest of the country. **Watersheds in Arizona are therefore highly unlikely to be subject to detectable residues of chlorpyrifos or its degradates, let alone any that are harmful to human health**. EPA knows this (quoted from the docket): "*EPA's drinking water analysis in the RHHRA also showed that the DWLOC exceedances are not expected to be uniformly distributed across the country*." Arizona is just such an area without exceedances. Do not cancel tolerances for this active ingredient.

Arizona supports the US-EPA mandate to protect human health and the environment and prides itself on the safe and productive co-existence of our sensitive desert ecosystems with some of the most productive agriculture in the world. Arizona has made major gains in the reductions of risks associated with pest control in agriculture. In the early 1990's, Arizona reached a tipping point in arthropod pest problems and broad-spectrum pesticide use with exclusive dependence on pyrethroid, organophosphate, cyclodiene and carbamate insecticides. Our IPM programs in cotton, leafy vegetables and melons have saved growers well over $500million in reduced chemical control costs over the last 20 years. Today, Arizona growers no longer use cyclodienes, have all but eliminated carbamates use, and have dramatically reduced pyrethroid and organophosphate (including chlorpyrifos) use. Our field crops today, including cotton and alfalfa, make major use of the ecosystem services of biological control through active programs of natural enemy conservation (Ellsworth & Martinez-Carrillo 2001; Ellsworth et al. 2006, 2011a,b, 2012; Naranjo & Ellsworth 2009a,b). Arizona supports comprehensive ecological risk assessments, especially those based in real world and site-specific use data as provided in this comment. Preserving chlorpyrifos tolerances so that we can continue constrained and strategic use of this active ingredient in alfalfa, cotton and 14 other crops provides the maximum flexibility in design of sustainable IPM strategies while safeguarding the producer from economic hardship and society from unnecessary environmental or human health risks from pests or pest management tactics.

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Disclosures

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