State of California

Exhibit 17

Memorandum

To : Jack C. Parnell

Date : September 3, 1987

Place : Sacramento

From : **Department of Food and Agriculture** – Lyndon S. Hawkins, Chair
Subcommittee of the Pesticide Registration and Evaluation Committee

Subject : Diuron

Attached is the Findings and Recommendations regarding Diuron. This report is pursuant to the requirements of the Pesticide Contamination and Prevention Act and is submitted on behalf of the Subcommittee of the Pesticide Registration and Evaluation Committee.

Attachment

cc: Don Mengle
Syed Ali
Tobi Jones

SURNAME

SO-106

SUBCOMMITTEE OF THE
PESTICIDE REGISTRATION AND EVALUATION COMMITTEE

IMPLEMENTATION OF THE PESTICIDE CONTAMINATION PREVENTION ACT
DIURON: FINDINGS AND RECOMMENDATIONS

September 3, 1987

Diuron has been found in ground water in Tulare County in 36 of 122 wells sampled at concentrations ranging from 0.05 to 2.8 ppb. Simulation models and the chemical properties of diuron indicate that it has a potential to leach to ground water. This information is on file at the California Department of Food and Agriculture.

Pursuant to California Notice 86-12, Notice of Diuron Finds in California Ground Water, and the Notice of Hearing Pertaining to Diuron (November 12, 1986), the subcommittee held hearings to review registrant reports, public comment, and other appropriate information regarding the presence of diuron in ground water and soil in California. After review of this information, the subcommittee offers the following findings and recommendations to the Director. These findings were unanimously agreed upon by the subcommittee on August 6, 1987.

FINDINGS

Finding One

The subcommittee finds that a pollution level for diuron cannot be identified due to lack of complete health data as specified in the Birth Defect Prevention Act (SB 950). Because a pollution level has not been established, it is not possible to determine that diuron has not polluted the ground waters of the state. Further, a decision regarding the threat to pollute cannot be made because of the lack of a pollution level and the lack of data regarding environmental fate. Therefore, the subcommittee cannot make Finding One in the Food and Agricultural Code, Section 13150(c)(1).

Finding Two

Although a pollution level has not been established, the subcommittee finds that the agricultural use of diuron can be modified to protect against further residues. The subcommittee concludes that this can only be ensured provided that the recommended monitoring of soil and ground water and accompanying specified actions are followed. Under these conditions, the subcommittee makes Finding Two in the Food and Agricultural Code, Section 13150(c)(2).

Finding Three

The subcommittee cannot determine whether modified use of diuron would cause severe economic hardship on the agricultural industry of the state because available information is not conclusive (Attachment 1). The subcommittee further cannot recommend a level of diuron that does not significantly diminish the margin of safety not to cause adverse health effects because the SB 950 health data are not complete. Therefore, the subcommittee cannot make Finding Three in the Food and Agricultural Code, Section 13150(c)(3).

Chronic Toxicity Determination

The toxicological data for diuron are not sufficient to establish its carcinogenicity, mutagenicity, teratogenicity, or neurotoxicity (Attachment 2).

RECOMMENDATIONS

Modification of Use

The subcommittee recommends that the Director require soil and ground water monitoring to demonstrate whether the following modifications of use specified in these recommendations prevent the movement of diuron to ground water. This monitoring program should be established in cooperation with the Department of Health Services, the State Water Resources Control Board, County Agricultural Commissioners, registrants, and users of diuron. If monitoring results indicate that modifications of use do not protect against further residues, the Director should further modify or consider banning the use of diuron.

a. Ban statewide the use of diuron in all recharge areas which receive water or waste water to replenish ground water or to manage excess surface water. Many of these areas are identified in the Department of Water Resources' draft publications, "Ground Water Recharge Projects within the USBR Mid-Pacific Region (October 19, 1983)" and "Ground Water Recharge Projects within the USBR Lower Colorado River Region (October 18, 1983)."

b. Allow the use of diuron only when recommended by a licensed pest control adviser. A licensed pest control adviser should not write a recommendation for diuron if there are effective alternative products or practices available that do not pose a threat to ground water.

c. For non-cropland uses, annual application rates should not exceed maximum application rates specified by soil type for cropland uses.

Research and Other Programs

a. Fund and conduct, cooperatively with the University of California and the agricultural industry, research to determine the relationship between the leaching potential of pesticides and the following factors: physical and chemical properties of soil; soil organic matter; pesticide application rates; time and method of application; chemical properties of pesticides; amount, timing, and method of irrigation; and depth to ground water. There are as yet no conclusive data which establish relationship between chemical properties, use and cultural practices, or geographical characteristics and the presence of pesticides in ground water.

b. Develop with appropriate state, county, and local agencies a program to minimize agency use of pesticides which have been detected in ground water or which are potential ground water contaminants. This program would involve evaluating alternative pesticides and practices, improving water use, and, in general, implementing integrated pest management techniques that could help prevent pollution of ground water. The program adopted by Los Angeles County is an example of such a program (County of Los Angeles. 1972. Report on the Use and Control of Simazin [sic] and other Herbicides by the County of Los Angeles).

c. In conjunction with county agricultural commissioners, re-emphasize the critical need for growers and Pest Control Operators to establish company programs that require employees handling pesticides to follow all laws and regulations regarding pesticide mixing and loading operations. These programs should give special focus to areas in proximity to wells, including dry wells, that are a potential source of ground water contamination. In this regard, recommendations by the Tulare County Farm Bureau regarding diuron are relevant and therefore should be consulted (Attachment 3).

d. Develop guidelines for storing pesticides around wells.

e. Act with the State Water Resources Control Board, Department of Water Resources, Department of Health Services, local agencies, and users to: (1) identify the locations of abandoned (dry and other) wells and provide for their proper destruction (as specified in Water Well Standards: State of California. 1981. Bulletin 74-81), and (2) establish guidelines for diuron users to prevent runoff water containing diuron residues from entering ground water through any well (Attachment 3).

ACKNOWLEDGMENTS

The subcommittee thanks those who provided information about diuron, including facts about toxicology, use, and potential relationships to ground water pollution. We also thank County Agricultural Commissioners, and U.C. Extension Service staff who took the time to discuss with us during our field investigations the agricultural practices in areas where diuron occurs in ground water.

Lyndon S. Hawkins
Chair of Subcommittee
Pest Management Specialist IV
California Department of Food and Agriculure

Syed M. Ali, Ph.D.
Environmental Specialist
State Water Resources Control Board

Donald C. Mengle
Research Scientist
Department of Health Services

ATTACHMENT 1

September 2, 1987

ALTERNATIVES TO DIURON

Diuron has been found in California ground water, under the conditions specified in the Pesticide Contamination Prevention Act (AB 2021). This Act requires the subcommittee of the Pesticide Registration and Evaluation Committee to make and the Director to adopt, one or more of three findings regarding the continued use of diuron. For two of these findings, the subcommittee/Director must determine whether there are alternative products or practices that can be effectively used to not cause ground water pollution. This report is an analysis of other herbicides and practices that are potential alternatives to the major reported uses of diuron.

Diuron is a selective herbicide with mainly residual and some foliar activity on many annual grasses and broadleaf weeds in cropland and on both annual and perennial weeds in non-cropland areas. Diuron is registered for use on over 30 different crops/sites in California. According to the 1985 CDFA Pesticide Use Report, the following uses of diuron were reported: rights-of-way, alfalfa, oranges, asparagus, landscape maintenance, water areas, citrus, non-agricultural areas, open land, grapes, and forage, among others. Because 89% of all reported diuron use occurs on rights-of-way, alfalfa, oranges, asparagus, and water areas, this analysis will focus on evaluating alternatives for these uses.

Diuron is formulated as a single active ingredient for crop and non-cropland uses, in combination with bromacil principally for use on citrus (Krovar), and in various combinations with sodium chlorate and sodium metaborate tetrahydrate for use on non-cropland areas.

Diuron is generally applied before or soon after susceptible weed seedlings emerge. On trees and vines, diuron can be applied either once in the fall or early winter, or as a split application at lower rates, once in October or November and again in March or April. Rates recommended for crop use vary from .4 - 4 lbs active ingredient per acre. In non-cropland areas, intermediate rates (4 - 16 lbs) can be used to control annual weeds and higher rates (16 - 48 lbs) are recommended to control perennial weeds. Within these general dosage ranges, lower rates are recommended for light (coarse) soils low in organic matter and higher rates for heavier or high organic matter soils. Some labels contain soil type limitation cautions stating that diuron should not be used as follows: on sand, loamy sand, or gravelly soils; on citrus and other specified crops where soil organic matter in less than 1%; and on alfalfa and other specified crops where organic matter is less than 2%.

Almost 700 species of weeds have been identified in California, and the University of California has described more than 200 weed species in the Grower's Weed Identification Handbook. Although individual fields are more likely to be infested with 10-30 species, the weed spectrum of those fields can vary widely. Because most herbicides are species specific, weed control programs are designed to use the herbicide or combination of herbicides that most economically control a given spectrum of weeds.

Typically, no single herbicide will economically control all species of weeds found in a particular crop or site. At best, combinations or sequential applications of two or more herbicides, along with various cultural practices are needed to control weeds. Each herbicide used in a program has its own combination of strengths and weaknesses that is never exactly the same as any other herbicide. For example, in grapes herbicide A may control seven out of ten weed

species present, and herbicide B the other three. Herbicide C, if substituted for A, may control four of the seven species controlled by herbicide A and all three species controlled by herbicide B. However, another herbicide, D, is required to control the remaining three species previously controlled by A. Thus, in this simplified example, there is no single herbicide alternative to herbicide A; rather, herbicides C and D are alternatives to herbicides A and B.

Herbicides, such as A-D above, are selected based on registration status in a given location, comparative efficacy under local conditions, cost, and possible adverse impacts. The latter three factors are in turn influenced by soil type and organic matter, irrigation method, topography, timing and amount of rainfall, specialized equipment needed, and application timing, among other considerations. Thus, selection of appropriate herbicides is a complex process.

In order to simplify the complexity of identifying alternatives to diuron for the principal uses, the following assumptions are made:

(1) Chemical alternatives to diuron are identified based on their ability to control, <u>under optimum conditions</u> (a) 24 common annual weed species in alfalfa identified in the <u>Growers Weed Management Guide</u> by Harold Kempen, (b) 23 common annual weed species in oranges identified in the UC Publication No. 3303, <u>Integrated Pest Management for Citrus</u> and (c) 20 common annual weed species in asparagus identified in the <u>Growers Weed Management Guide</u> by Harold Kempen (Table 1). It should be noted that although alternatives to diuron are compared on the basis of their ability to control a broad spectrum of weeds, in a situation with few weed species the best alternative may be a relatively narrow spectrum herbicide.

(2) Comparative costs of materials are based on application at rates that are the average of the lowest and highest rate allowed on the label for agricultural crop use, unless otherwise noted. Herbicide prices are based on those quoted in the April, 1987 edition of the publication Agchemprice or, if not available there, those quoted by selected distributors or registrants in California.

Rights-of-Way

Rights-of-way herbicides are used where crop tolerance levels and phytotoxicity to non-target species are not primary considerations. As a result, many active ingredients are registered for such uses. There are at least twelve residual and fifteen foliar active ingredients registered for rights-of-way that could be used in weed control programs designed to control the same weeds as diuron (Table 2).

If current weed control managers are making rational economic decisions, then the use of alternative herbicides will probably result in higher material and/or application costs than the current uses of diuron. It should also be noted that there is no apparent evidence that the nine residual alternative herbicides pose less of a threat to ground water than diuron.

Alfalfa

There are generally four situations when weed control is practiced in alfalfa: (1) fall planting period; (2) winter-spring planting period; (3) winter weeds in established stands, and (4) summer weeds in established stands. The principal use of diuron in alfalfa is to control winter weeds in established stands.

Winter weeds are primarily a problem in areas with cool winters where alfalfa becomes dormant or semi-dormant. Under these conditions, winter weeds thrive in alfalfa due to lack of crop competition. In seed alfalfa, winter weeds grow in the furrow because winter rainfall prevents mechanical cultivation. Thus, for both hay and seed alfalfa, the use of herbicides is generally the only practical option for controlling winter weeds.

The cost and efficacy of various alternative herbicides for control of winter weeds in established alfalfa compared to diuron are shown in Table 3. As shown, the most effective treatments are three combinations of herbicides, two of which include diuron. The terbacil and gramoxone combination is the most effective alternative to diuron combinations. However, it should be noted that terbacil can only be used north of Interstate 80.

It should be noted again that comparisons of alternative herbicides to diuron are based on the ability to provide broad-spectrum weed control. However, some of the narrow spectrum alternatives shown in Table 3 may be suitable alternatives to diuron in situations with narrow weed spectra.

Oranges

Chemical weed control in oranges is usually practiced both in tree rows and in middles between rows. It is commonly stated that such a program maximizes frost protection, minimizes root pruning, compaction, and "plow pans" caused by repeated tillage, and avoids competition for water and nutrients by weeds under a mowing regime.

The least expensive herbicide program in oranges generally involves the use of diuron and simazine in combination. However, in many groves this combination misses puncture vine, sprangletop, spurge, and various perennial weeds. To help control these missed weeds, the more expensive combination of diuron and bromacil may be substituted for simazine and diuron as needed. This rotation allows producers to achieve maximum weed control at minimum cost. In any case, diuron is the primary herbicide used to control weeds in citrus.

In Table 4, the efficacy and cost of diuron, glyphosate, weed oil and various two-herbicide combinations are compared to diuron + simazine. Because all other single herbicide alternatives fail to control 4 - 20 of the weed species in Table 1, glyphosate and weed oil, which both miss two species, are the only single herbicides compared. Only two contact herbicides, glyphosate and gramoxone, are included among the various two-herbicide combinations. Dalapon, MSMA, and 2,4-D are three other contact herbicide alternatives useful in specific situations. However, because they are generally less effective or pose greater safety risks to crops than either glyphosate or gramoxone, these three foliar herbicides are excluded from the comparisons.

The various potential alternatives are listed in order of decreasing efficacy and, within similar efficacy groups, in order of increasing cost. It should be noted that the UC sample cost estimate for herbicide use in oranges is $78 per acre, $35 more than the estimated cost of a single application of diuron + simazine. These differences result from producers either applying these herbicides at higher rates or frequencies than assumed in Table 4, or spot treating annual and especially perennial weeds not controlled solely by these herbicide combinations. Similarly, cost figures shown for all other two-herbicide combinations do not include costs of using such combinations at higher rates or frequencies, or of spot treating weeds not controlled.

The most effective alternatives to diuron on oranges are combinations of various residual herbicides plus the foliar herbicides glyphosate or gramoxone. The least expensive of these alternative herbicides (except combinations with trifluralin) increases costs by an estimated $89 per acre. However, alternative combinations that rely on foliar herbicides to control weeds missed by residual herbicides have several disadvantages:

1. Timing is critical. If not controlled when small, weeds become more difficult and expensive to control. Because the application "window" is smaller for foliar versus residual herbicides, sufficient equipment must be available to cover the crop acreage more quickly.

2. Wet ground in early spring may prevent timely application.

3. If operated on wet soil, standard spray rigs can damage soil structure and cause compaction, which decreases water infiltration rates, irrigation efficiency, root growth and crop yields.

4. Drift or misting during application increases the chance for target and adjacent crop phytotoxicity, foliage "feathering," or delayed fruiting the following spring.

5. Repeated applications are necessary as weeds germinate--thus both soil compaction, chance for phytotoxicity, and costs increase. Thus, reliance on foliar herbicides as alternatives to residual herbicides increases the risk of weed control failures. Such failures increase clean-up costs, interfere with other production operations, and can increase weed seed production as well as reduce crop yields.

It should be noted that because the use of trifluralin requires soil incorporation, two of the reported advantages of chemical weed control in citrus--to minimize root pruning in shallow rooted citrus and to prevent compaction--are lost. In addition, soil incorporation in effect prepares a favorable seed bed for weed species not controlled by trifluralin. Thus, although alternatives involving trifluralin + contact herbicides are the least expensive to apply, the

use of such combinations may result in increased overall weed control costs and reduced production.

The least costly and most effective alternative combinations of only residual herbicides (except as noted in Table 3) are oryzalin + terbacil and napropamide + terbacil. Both combinations miss two weed species and increase costs by an estimated $137-139.

Various characteristics of residual herbicides registered on oranges are given in Table 5. As indicated, not all combinations shown in Table 3 can be used in every orange grove situation. For example, the combination napropamide + norflurazon would not be an alternative in a Kern County citrus grove under flood irrigation because (1) norflurazon cannot be used in Kern County and (2) application of napropamide in a relatively low rainfall area like Kern County without sprinkler irrigation is likely to result in poor weed control.

Other weed control options in oranges are: (1) discing middles and applying herbicides in a band along the row, and (2) mowing middles and applying herbicides in a band along the row. Comparative direct cost figures of these alternatives are also presented in Table 4. Potential indirect costs, such as increased frost damage, mechanical damage to fruit, and yield reductions often mentioned by growers and UC specialists are not included.

Some growers control weeds without the use of any herbicide. Such a program involves either extensive hand hoeing, which would require a large manual labor force, or discing or mowing in two directions, which is only feasible under furrow or flood irrigation. However, it is estimated that more than 70% of orange groves in Tulare County are under either sprinkler, mini-sprinkler, mister, or

drip irrigation. Thus, controlling weeds without the use of any herbicide is not considered practicable for citrus in that area.

Asparagus

Diuron is used to control weeds in asparagus in two situations: (1) in established bedded plantings and (2) in the high organic matter soils of the San Joaquin Delta where year-old asparagus crowns are planted and covered with at least two inches of soil.

There are eight potential alternative herbicides to diuron for use in established bedded plantings depending on the weed species present, soil characteristics, and local restrictions on use. The relative efficacy and cost of these alternatives are shown in Table 6.

On newly planted crowns, the only chemical alternative to diuron is monuron applied as a post-emergent treatment. Comparative costs are very similar, however, monuron may the less effective on clay or organic soils. The other alternative is cultivation.

Water Areas

Diuron is the only residual herbicide currently registered to control annual and perennial weeds in bottoms of dewatered irrigation and drainage ditches. Label rates are 4-48 pounds active ingredient per treated acre. Chemical alternatives would include foliar herbicides, such as ammonium sulfamate, diquat, glyphosate, and petroleum oil depending on weed species. These alternatives and such non-chemical alternatives as burning, dragging, hoeing, and scraping would increase costs of weed control.

Table 1. Common Weed Species.

Oranges	Alfalfa	Asparagus
Cheeseweed	Annual bluegrass	Annual bluegrass
Chickweed	Bromegrass	Barnyardgrass
Fiddleneck	Canarygrass	Chickweed
Filaree	Cereals, volunteer	Crabgrass
Flax-leaved fleabane	Chickweed	Foxtail
Groundsel	Fiddleneck	Goundsel
Henbit	Groundsel	Henbit
Horseweed	Horseweed	Knotweed
Knotweed	Henbit	Lambsquarters
Lambsquarters	Lambsquarters	London rocket
Mustards	London rocket	Mustards
Nightshade	Miner's lettuce	Nettle, stinging
Pigweed	Mustards	Nightshade
Puncturevine	Nettle, stinging	Pigweed
Purslane	Prickly lettuce	Prickly lettuce
Shepherdspurse	Rabbitfootgrass	Purslane
Sowthistle	Redmaids	Russian thistle
Annual bluegrass	Shepherdspurse	Shepherdspurse
Barnyardgrass	Speedwell	Sowthistle
Crabgrass	Sowthistle	Wild oats
Foxtail	Wild barley	
Lovegrass	Wild oats	
Sprangletop	Wild radish	

Table 2. Herbicides Registered for Rights-of-way Use.[1]

Residual	Foliar
Chlorfenac	Ametryn
Chlorsulfuron	Ammonium thiosulfate
Hexazinone	Bentazon
Linuron	Chlorfenac
Metribuzin	Chlorsulfuron
Monuron	Dicamba
Oxyfluorfen	Glyphosate
Picloram	Gramoxone
Prometryn	Metsulfluron
Tebuthiuron	Oxyfluorfen
Terbutryn	Picloram
Trifluralin	Sodium chlorate
	Sulfometuron
	Terbutryn
	Triclopyr

1. Herbicides found in ground water in California are not included.

Table 3. Potential Alternatives to Diuron on Alfalfa.

	No. Species Not Controlled	Cost per Planted Acre[1]	% of Pre-harvest Cash Costs	Increase (Decrease) in Cost Compared to Diuron	Weed Species Not Controlled
UC Sample Cost	-	18	13	6-9	
Diuron	3	9-12	7-9	0	Groundsel, speedwell, wild oats
Diuron + hexazinone	1	14-17	10-13	5	Wild oats
Diuron + gramoxone	1	20-32	15-24	11-20	Wild oats
Terbacil + gramoxone	1	21-49	15-36	12-37	Wild oats
Pronamide + gramoxone	4	17-28	13-21	8-16	Horseweed, stinging nettles, prickly lettuce, sowthistle
Hexazinone	5	15-35	11-26	6-23	Provides partial control for five species
Terbacil	8	10-29	7-21	1-17	Many
Pronamide	10	6-8	4-6	(3-4)	Many
EPTC	12	6-8		(3-4)	
Gramoxone	12	16-26	12-18	7-13	Provides partial control for 11 of the 12 species
Metribuzin	20	9-22	7-16	0-10	Many

Table 4. Potential alternatives to diuron on oranges.

Potential[1,2] Alternatives	No. Weed Species in Table II Not Controlled	Cost per Planted Acre	% of Pre-harvest Cash Costs	Increase (Decrease) in Cost over Simazine + Diuron	Typical Weed Species Not Controlled
Diuron	3	28	3	(15)	Groundsel, puncturevine, sprangletop
UC Sample Cost	-	78	8	35	-
Simazine + diuron[3]	2	43	5	0	Puncturevine, sprangletop
Bromacil + diuron	0	69	7	26	-
Terbacil + glyphosate[4]	0	137	14	94	-
Trifluralin + gramoxone	1	76	8	33	Cheeseweed
Trifluralin + glyphosate	1	78	8	35	Cheeseweed
Oryzalin + gramoxone	1	132	14	89	Cheeseweed
Napropamide + gramoxone	1	134	14	91	Cheesewwed
Terbacil + gramoxone	1	135	14	92	Barnyardgrass
Napropamide + glyphosate	1	136	14	93	
EPTC + gramoxone	2	88	9	45	Cheeseweed, knotweed
EPTC + glyphosate	2	90	9	47	Cheeseweed, filare,
Norflurazon + glyphosate	2	118	12	75	Cheeseweed, filaree
Oryzalin + glyphosate	2	134	14	91	Cheeseweed, filaree
Oryzalin + terbacil	2	137	14	94	Groundsel, puncturevine
Napropamide + terbacil	2	139	15	96	Puncturevine, sprangletop
Weed oil[5]	2	207	22	164	Cheeseweed, sprangletop
Dichlobenil + glyphosate	2	210	22	167	Cheeseweed, filaree
Napropamide + norflurazon	3	120	13	77	Cheeseweed, flax-leaved fleabane, horseweed
Norflurazon + gramoxone	4	116	12	73	Many
Dichlobenil + trifluralin	4	156	16	113	Many
Dichlobenil + gramoxone	4	208	22	165	Many
Trifluralin + norflurazon	5	69	7	26	Many

Table 4 (Cont)

Potential[1,2] Alternatives	No. Weed Species in Table II Not Controlled	Cost per Planted Acre	% of Pre-harvest Cash Costs	Increase (Decrease) in Cost over Simazine + Diuron	Typical Weed Species Not Controlled
EPTC + trifluralin	6	34	4	(9)	Many
EPTC + norflurazon	6	74	8	31	Many
EPTC + napropamide	6	92	10	49	Many
Trifluralin + napropamide	7	87	9	44	Many
Norflurazon + oryzalin	7	118	12	75	Many
Dichlobenil + terbacil	7	213	22	170	Many
EPTC + oryzalin	8	90	9	47	Many
Napropamide + oryzalin	8	136	14	93	Many
Dichlobenil + norflurazon	8	194	20	151	Many
Trifluralin + oryzalin	9	85	9		Many
EPTC + dichlobenil	9	166	17	123	Many
Discing + herbicide banding[6]		146	15	103	
Mowing + herbicide banding[7]		136	14	93	

1. Assume all residual herbicides are applied with gramoxone plus one quart spreader in 100 gallon mixture per treated acre.
2. For alternatives shown as residual + foliar herbicide combinations, assume the foliar is applied two times by itself following the residual application.
3. Sample calculation: [simazine ($8) + diuron ($9) + gramoxone ($15) + spreader ($4) + application ($7)= $43
4. Sample calculation: [terbacil (57) + gramoxone ($15) + spreader ($4) + application ($7) + [glyphosate ($19) + spreader ($1) + application ($7)] x [2] = $137
5. Nine applications per year.
6. (8 passes per year) x ($11/pass) + [oryzalin ($4) + gramoxone ($14) + spreader ($4)] x [.33] + [application ($7)] + {[gramoxone ($15) + spreader ($4)] x [.33] + application ($7)} x {2}
7. (6 times per year) ($13/acre) + [oryzalin ($4) + gramoxone ($15) + spreader (4)] x [.33] + [application $7)] + {[gramoxone ($15) + spreader (4)] x [.33] + application ($7)] } x {2}

Table 5. Characteristics of Residual Herbicides.

Herbicide	Activation period rainfall or overhead irrigation	Cost	Other
Dichlobenil	Immediate	Very high	- Controls some perennials - Not for use on light sand soil - Frequently results in leaf symptoms
Diuron			- Activated by furrow irrgation
EPTC	Applied in irrigation	Low	- Apply in enough water to reach 3-4 inches in soil
Metribuzin	1 week		- Has some foliar activity - Cannot be used on alfalfa south of Interstate 80
Monuron			- Has some foliar activity - Activated by furrow irrigation - Cannot be used in Kern County
Oryzalin	3 weeks	High	- Suppresses some perennials - Trash reduces efficacy - Can be applied through sprinklers during dormancy
Napropamide	Immediate - 1 week	High	- Suppresses nutsedges under sprinklers - Trash reduces efficacy - Reduces burndown of glyphosate when used in combination - Works best under sprinklers
Norflurazon	Flood or sprinkler 4 weeks	Moderate	- Cannot be used south of the Monterey, Kings, and Tulare County lines - Suppresses some perennials

Table 5. (Cont)

Herbicide	Activation period rainfall or overhead irrigation	Cost	Other
Simazine	1 month	Low	- Little affected by trash - Contaminates ground water - Not for use on sand or loamy sand soils - May damage less vigorous black wine varieties grown in warmer areas under drip or sprinkler irrigation - Can cause damage where soils are low in organic matter or high in calcium and pH - Not activated by furrow irrigation
Terbacil	1 week	High	- Foliar activity on weeds less than 2" - Suppresses some perennials - Subject to leaching on sandy loams - Cannot be used in Kern County - Not for use on sands or other soils with less than 1% organic matter or poorly drained soils - Cannot be used on alfalfa south of Interstate 80
Trifluralin	Immediate soil incorporation required	Low	- Destroy all weeds with soil tillage before application - Incorporation may require specialized equipment - Does not work on soils with more than 10% organic matter

Table 6. Potential Alternatives to Diuron on Asparagus.

	No. Species Not Controlled	Cost per Planted Acre[1]	% of Pre-harvest Cash Costs	Increase (Decrease) in Cost Compared to Diuron	Species Not Controlled
UC Sample Cost	-	22[2]	10	10-19	
Diuron	3	3-12	1-5	-	Groundsel, Russian thistle wild oats
Glyphosate[3]	0	9-19	4-8	6-7	-
Simazine	3	2-10	1-4	(1-2)	Annual bluegrass, barnyard-grass, Russian thistle
Metribuzin	4	23-46	10-20	20-34	Barnyardgrass, groundsel, purslane, Russian thistle
Terbacil	4	29-57	13-25	26-45	Groundsel, henbit, Russian thistle, wild oats
Linuron	6	11-21	5-9	8-9	Many
Gramoxone[3]	6	15-27	7-12	12-15	Many
Napropamide	6	56	24	44-53	Many
Trifluralin	10	3-12	1-5	-	Many

1. Materials only.

2. Estimate based on adjusted 1980 figure.

3. See discussion of foliar herbicides on page 7.

State of California

Department of Health Services

Memorandum

ATTACHMENT 2

To : Donald C. Mengle, M.S.

Date : August 5, 1987

Subject: AB 2021 discussion meeting on diuron

From : Hazard Evaluation Section

In preparation for the AB 2021 meeting on diuron, August 6, 1987 at CDFA, I have the following comments.

Based upon the Summary of Toxicological Data prepared by the Medical Toxicology Branch of CDFA in implementing the SB 950 process, data gaps exist for most of the toxicological tests required for adequate evaluation. These data gaps include the combined chronic-oncogenic study on the rat, chronic dog study, reproduction study in the rat, teratogenicity studies on the rat and mouse and certain mutagenicity studies. In many cases, reports of these studies are on file but the studies are old, most of them being conducted 20 years ago and do not meet current FIFRA guidelines or comply with the good laboratory practice regulations. Certain currently required studies, such as oncogenicity on mice and teratology on rabbits, are absent altogether. Some recently conducted mutagenicity studies such as gene mutation and chromosomal aberrations are judged adequate. In the latter study, a questionnable adverse effect is reported.

No ADI for this compound has been recommended by the National Academy of Science/National Research Council. The EPA has established tolerances on a number of agricultural commodities but no published ADI value by this Agency has been located. Many of the data gaps noted in the SB 950 document are also pointed out by EPA (Chemical Information Fact Sheet for Diuron, fact sheet no. 9, September 30, 1983). However, in a recent (August 5, 1987) personal communication from Charles Frick, Tolerance Assessment System, EPA, a provisional acceptable daily intake (ADI) of 0.0021 mg/kg has been established by EPA, based on a no-effect level of 0.625 mg/kg/day in a two-year dog study on applying a safety factor of 300. This PADI was established in March 18, 1987.

I understand that Bayer have conducted a two-year rat study with diuron (1985) but only limited information was available to the Committee at the meeting of May 20, 1987. In my opinion, the results of this study will be critical in the final hazard assessment and possible identification of a pollution level.

In addition to the SB 950 criteria, answers to the questions provided in my letter to Mr. Link Bradley dated May 16, 1987 and our joint letter to Dr. Richard A. Jackson dated May 22, 1987 (attached) need to be discussed.

I am particularly concerned about the metabolism study conducted with carbonyl-labeled diuron which reportedly shows 3,4-chloroaniline as a metabolite (even though the label would have been lost in the final degradation step to form this compound) and also the questions of toxicity of 3,4-dichloroaniline (methemoglobinemia).

The registrant needs to address these issues.

Peter E. Berteau, Ph.D.

PEB:sr
Attachment
cc: Syad Ali
Lyn Hawkins/DFA
Richard J. Jackson, M.D./DHS

PEB

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY

GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704

Corrected copy

May 14, 1987

Mr. Lincoln M. Bradley
E.I. Dupont de Nemours and
Company, Inc.
Biochemicals Department
2180 Sand Hill Road
Menlo Park, CA 94025

Re: AB 2021 Hearing on Diuron

Dear Mr. Bradley:

As discussed in our telephone conversation of May 13, 1987, we would appreciate a response to the following questions related to the toxicology data on diuron at the AB 2021 oral testimony hearing to be held at 9:00 a.m., May 20, 1987, in the Consumer Affairs Building, Sacramento.

(i) The recently conducted oncogenicity study by Bayer is of some concern, especially since 33/60 bladder carcinomas occurred in the high dose (2500 ppm) male group and 11/60 in the females at this dose. This lesion appears to be not significant at 500 ppm or at lower doses. This finding should be discussed further. Are Dupont conducting a comprehensive oncogenicity study themselves?

(ii) Are the formation of bladder tumors thought to be one due to a metabolite of diuron; if so, has the metabolite been characterized?

(iii) Some information is needed on the chemical identity of diuron as found in groundwater. Is it the parent compound or a derivative? If the latter, there should be some discussion of its toxicological significance.

(iv) At present, the presence of diuron in groundwater is minimal in California. However, if use is to continue, might this situation get worse or the diuron possibly enter deeper aquifers?

If you have questions, please call me yourself or have your toxicologist at Wilmington call me at 415/540-3065.

Sincerely,

Peter E. Berteau

Peter E. Berteau, Ph.D.
Staff Toxicologist
Hazard Evaluation Section

PEB:sr

cc: Donald C. Mengle, M.S./HES
David P. Spath, Ph.D./SEB

CORRECTED COPY

STATE OF CALIFORNIA—HEALTH AND WELFARE AGENCY

GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF HEALTH SERVICES
2151 BERKELEY WAY
BERKELEY, CA 94704
(415) 540-3065

May 22, 1987

Dr. Richard A. Jackson
E.I. duPont de Nemours and Co.
Agricultural Products Department
Barley Mill Plaza
Wilmington, DE 19898

Dear Dr. Jackson:

During the oral testimony on May 20, 1987 at the Department of Consumer Affairs, Sacramento, California, you submitted toxicological information on diuron relative to the implementation of AB 2021, the Pesticide Contamination Prevention Act.

In response to a question from one of us, concerning the breakdown of diuron, you stated that the half-life in soil was about three months. You then showed a slide, a copy of which was not included in the package later given to us, which showed successive N-demethylation of diuron leading eventually to 3,4-dichlorophenylurea and subsequently 3,4-dichloroaniline. You mentioned that this study was performed with carbonyl C-labeled diuron. Although not specifically stated, I was given to understand that the breakdown in soil occurred by a similar route as the metabolism in animals; this fact should be clarified. In addition, I have two other questions:

(i) 4-Chloroaniline is a potent inducer of methemoglobinemia. I would expect 3,4-dichloroaniline to be the same. Why then was there <u>no</u> mention of methemoglobinemia having occurred in any of the toxicological studies reported?

(ii) If the formation of 3,4-dichloroaniline was determined from studies on carbonyl C-labeled diuron, would not the label be lost in the final degradation step to form 3,4-dichloroaniline? To detect this compound ring-labeled diuron would be required. Would you please clarify this observation.

Sincerely,

Peter E. Berteau, Ph.D., D.A.B.T.
Staff Toxicologist
Hazard Evaluation Section

for

Donald ~~C. Mengle~~, M.S.
Research Scientist
Hazard Evaluation Sectin

PEB:DCM:sr
cc: Lincoln Bradley/duPont, Menlo Park
Lyn Hawkins/CDFA

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
MEDICAL TOXICOLOGY BRANCH

SUMMARY OF TOXICOLOGY DATA

DIURON

SB 950-018, Tolerance # 106

December 8, 1986

I. DATA GAP STATUS

Combined (chronic + onco) rat: Data gap, inadequate study, possible adverse effect indicated

Chronic dog: Data gap, inadequate study, possible adverse effect indicated

Onco mouse: Data gap, no study on file

Repro rat: Data gap, inadequate study, no adverse effect indicated

Terato rat: Data gap, inadequate study, no adverse effect indicated

Terato rabbit: Data gap, no study on file

Terato mouse: Data gap, inadequate study, no adverse effect indicated

Gene mutation: No data gap, no adverse effect

Chromosome: No data gap, possible adverse effect

DNA damage: Data gap, incomplete study (missing pages)

Neurotox: Not required

Note, Toxicology one-liners are attached

** indicates acceptable study
Bold face indicates possible adverse effect
File name [3B] SB018DIU.JG1

12/12/86

II. TOXICOLOGY SUMMARY

012 Registration Standard.

COMBINED (CHRONIC + ONCO) RAT

016 036189 to -91 Title: Chronic Feeding Studies of Diuron in Rats. (Univ. of Rochester School of Medicine and Dentistry, NY, 7/30/64.) FM, 12/10/85. Two lots of Diuron, 80% a.i., no analysis included; fed to 35/sex/group for 2 years at 0, 25, 125, 250 or 2500 ppm; NOEL cannot be determined due to lack of diet analysis, description of feed mixing and not stated whether adjusted for 80% purity; unacceptable (inadequate number of animals at risk, no serum chemistry, no analysis of diet, incomplete histopathology, inconsistent sites for harvest of marrow.) Adverse effects include increased marrow and spleen erythropoiesis secondary to hemolytic anemia.
EPA 1-liner: No CORE grade. Systemic NOEL = 25 ppm (slight anemia, enlarged spleens, increased erythrogenic activity in bone marrow and abnormal pigments in the blood.)

001 14740 Title: Oral Toxicity and Metabolism of Diuron (N-(3,4-Dichlorophenyl)-N,N'-dimethylurea) in Rats and Dogs. (University of Rochester School of Medicine and Dentistry.) Publication: Food Cosmet. Toxicol. 5: 513-531 (1967). Appears to be the same data as in 036189 above.

018 036196, 36201 and 36202 Summaries of 36189 - 91.

CHRONIC DOG

017 036195, 036200 Title: Chronic Feeding Studies of Diuron in Dogs. (Univ. of Rochester School of Medicine and Dentistry, NY, 7/30/64.) FM, 12/9/85. Diuron, two lots, 80%; 3/sex/group Beagle dogs, age not given, were fed 0, 25, 125, 250 or 2500/1250 for two years, no analysis of diet provided; diets prepared weekly; unacceptable (lack of diet analysis for content and stability under use conditions, no food consumption - both of which prevent determination of actual compound intake for establishment of a NOEL). Adverse effects include significant decreases in RBC, HGB and HCT in mid- and high-dose groups, increased liver weight in high dose males, erythroid hyperplasia in marrow and hemosiderin accumulation in reticuloendothelial cells leading to anemia.
EPA 1-liner: No CORE grade. Systemic NOEL = 25 ppm (abnormal pigments in the blood.)

001 41964 Title: Oral Toxicity and Metabolism of Diuron (N-(3,4-dichlorophenyl)-N,N'-dimethylurea) in Rats and Dogs. (University of Rochester School of Medicine and Dentistry.) Publication: Food Cosmet. Toxicol. 5: 513-531 (1967). JPS, 3/1/85. Appears to be same study as 036195.

ONCOGENICITY RAT

See under Combined Rat above.

ONCOGENICITY MOUSE

No study on file.

REPRODUCTION RAT

016 036192, -93, -97 and -98 Title: Reproduction Study in Rats Fed Diuron (and) Second Reproduction Study in Rats Fed Diuron. (Univ. of Rochester School of Medicine and Dentistry, 7/30/64.) FM. 12/10/85. Two lots of Diuron, 80%, were fed to 8 males/16 females per group at 0 or 125 ppm; unacceptable (no analysis of diet, no food consumption, single dose, inadequate number of pregnant animals, parental animals were not necropsied.) NOEL cannot be determined because of defiencies in the report. Two studies were performed with the same numbers of animals. No adverse reproductive effect reported in the repeat study but postweaning growth retardation was noted in the first one. The reason for the difference remains undetermined.
EPA 1-liners: No CORE grades. Reproductive NOEL > 125 ppm (single dose tested). In the first study, systemic NOEL < 125 ppm (body weight depression observed at F2b and F3a litters). Systemic NOEL in second > 125 ppm.

001 38724 Summary in publication of 036192 etc. above. Hodge, H. C. et. al., Food Cosmet. Toxciol. 5: 513-531 (1967).

TERATOGENICITY-RAT

020 036209 Title: Teratogenicity Studies on Pesticidal Formulations of Dimethoate, Diuron and Lindane in Rats. (Publication: Bull. Envir. Contam. Toxicol. 22: 522-529 (1979) by Khera, K. S. et. al.) FM, 12/10/85. Karmex containing 80% diuron, given to 20 Wistar rats per group by oral gavage, days 6 to 15, at 0, 125, 250 or 500 mg/kg/day; unacceptable (lacking in methods and data - original report should be submitted. Insufficient information for determination of NOEL.) Fetal weight was reduced in the high dose group and wavy ribs were noted in the mid- and high-dose groups. The incidence in the controls was 3 and 7 in each of the mid- and high-dose groups. The number of fetuses examined for skeletal findings was 2/3's of the total number but the actual figure is not given. The total number of all fetuses was 199, 164 and 147 in the control, mid-and high-dose groups. No individual data is included for evaluation. Apparent maternal NOEL = 250 (reduced body weight.)
EPA 1-liner: Supplementary. Teratogenic NOEL > 500 mg/kg (HDT). Fetotoxic NOEL < 125 mg/kg. [This is apparently based on the occurrence in the low
(continued on next page)

dose group of a single incidence of calvarium delayed ossification with a significance = 0.05.]

001 931047 Exact duplicate of 03609.

TERATOGENICITY, MOUSE

020 036208 Title: Teratogenicity of Pesticides. Chapter 8. Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health. USEPA, December, 1969. (Publication, 1969) FM, 11/25/85. Only data is in Table 3 in which diuron is stated to be negative in 6 litters at 215 mg/kg. Unacceptable.

003 931049 Exact duplicate of 036208.

TERATOGENICITY, RABBIT

No study on file.

MUTAGENICITY, GNMU

Microbial Systems

** 019 036206 Title: Mutagenicity Evaluation in Salmonella typhimurium. (Haskell Lab, Report No. 471-84, 11/9/84) JR(G), 12/16/85. Diuron, 98%; tested in Salmonella strains TA1535, TA97, TA98 and TA100 with rat liver activation at 0, 10, 25, 50, 100 or 250 ug/plate and without activation at 0, 0.5, 1, 2.5, 5 or 10 ug/plate in duplicate, two trials; no increase in reversion rate reported; cytotoxicity with TA1535; acceptable.

013 014741 Exact duplicate of 036206

Other Systems

** 019 036204 Title: Mutagenicity Evaluation of Diuron in the CHO/HGPRT Assay. (Haskell Labs, Report No. 282-85, 6/28/85.) JR(G), 12/11/85. Diuron, 98.19%; tested in CHO cells at 0, 0.01, 0.5, 1.0, 1.125, 1.25 or 0.5 mM; 18-20 hours without activation, 5 hours with rat liver activation; duplicates, 3 trials; no increase in mutation frequency. Acceptable.

MUTAGENICITY, CHROMOSOME

** 019 036205 Title: In vivo Assay of Diuron for Chromosome Aberrations in Rat Bone Marrow Cells. (Haskell Labs, Report No. 366-85, 6/26/85) JR(G), 12/11/85. Sprague-Dawley rats. Diuron, 98.19%, given by oral gavage in a single dose of 0, 50, 500 or 5000 mg/kg to 15/sex/group; 5/sex/group were sacrificed at 6, 24 or 48 hours; 50 metaphases per rat scored; at high dose, weight loss, mitotic index decreased and average number of aberrations increased in the 48-hour sampling - no difference at 6 hours, questionable effect at 24 hours. **Acceptable.**

MUTAGENICITY, DNA/OTHER

019 036217 Title: Assessment of Diuron in the In vitro Unscheduled DNA Synthesis Assay in Primary Rat Hepatocytes. (Haskell Labs, Report No. 349-85, 7/10/85) JR(G), 12/11/85. Not reviewed. __Odd pages only.

NEUROTOXICITY

Not required.

ATTACHMENT 3

Tulare County
Farm Bureau

Post Office Box 748 • 737 North Ben Maddox Way • Visalia, California 93279 • (209) 732-8301

June 5, 1987

JUN 05 1987

Lyndon S. Hawkins, Chairman
Subcommittee, Pesticide Registration
and Evaluation Committee
California Department of Food & Agriculture
1220 N Street
Sacramento, CA 95814

Re: Diuron

Dear Mr. Hawkins:

Our organization is intensely concerned with your subcommittee's plans to implement the Pesticide Contamination Prevention Act with regard to Diuron in groundwater supplies.

The first and most important point for consideration is the fact that there are no viable substitutes for Diuron. To prohibit its use, or to restrict its use in the manner applied to Atrazine, would impose a tremendous economic hardship on production agriculture in Tulare County.

Diuron is the only product available for below water weed control. Without it our ditches and waterways would again be clogged with noxious weeds and would transmit great quantities of weed seed to crop production areas.

Diuron has been used in Tulare County for more than 25 years without oversight and strict use regulations. While we recognize that some level of detection was made in the 122 Tulare County wells tested by the State, we submit that if continued Diuron use is allowed under some controls the amount found in groundwater would drop sharply, if not disappear completely.

Therefore, it is our recommendation that certain rules be applied which might mitigate the danger but which will allow our farmers continued use of a necessary and irreplaceable production tool.

Among those mitigating standards might be:

- -closure of abandoned dry and drain wells
- -requirement that well heads be raised to meet current standards
- -requirement that all well heads be sealed to current standards
- -elimination of pump backflow from tank-fill operations through mandatory use of check valves or air gaps
- -institution of an educational program to ask voluntary compliance on all the above

It is clear the entire problem of groundwater contamination needs to be studied further with rational action levels established by state government.

Please feel free to call on Tulare County Farm Bureau for further assistance. Our farmers must be allowed to use beneficial chemicals to maintain a healthy agricultural economy, but we also recognize the responsibilities inherent in their use. We will do our part.

Yours very truly,

Shirley Kirkpatrick

Shirley Kirkpatrick, Chairman
Environmental Affairs Committee

SK:mer

cc: Clyde Churchill