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CITY OF SACRAMENTO



DEPARTMENT OF ENGINEERING

915 I STREET
CITY HALL ROOM 207

SACRAMENTO, CALIFORNIA 95814
TELEPHONE (916) 449-5281

CITY MANAGER'S OFFICE
RECEIVED
APR 1 1983

J.F. VAROZZA
CITY ENGINEER
M.H. JOHNSON
ASSISTANT CITY ENGINEER

April 1, 1983

City Council
Sacramento, California

Honorable Members in Session:

SUBJECT: Registration of Bolero

On March 30th, the day before the Department of Food and Agriculture announced their intent to register the rice herbicide Bolero, this office received a large packet from the DFA. This packet contained the items received in response to the Notice of Proposed Registration for Bolero and the Department of Food and Agriculture's comments on these responses. We are including only those responses and comments with substance.

There are many short letters either urging the registration of Bolero from rice growers or opposing the registration from interested citizens. This is for the information of City Council.

Respectfully submitted,

J. F. Varozza
J. F. VAROZZA
City Engineer

For Council Information:

Walter J. Slipes
For: Walter J. Slipes, City Manager

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By the City Council
Office of the City Clerk

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DEPARTMENT OF FOOD AND AGRICULTURE

1220 N Street
Sacramento
95814



March 28, 1983

RECEIVED
CITY OF SACRAMENTO
ENGINEERING DEPT.

MAR 30 1983

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7 8 9 10 11 12 1 2 3 4 5 6

Mr. John F. Varozza
City Engineer
City of Sacramento
915 I Street, Room 207
Sacramento, California 95814

Dear Mr. Varozza

Your letters of February 23 and March 17, 1983, have been received and reviewed. Many of the items mentioned in your letters were considered earlier in separate letters from Assemblyman Lloyd Connelly and the Water Resources Control Board. Since the same information responding to those letters is applicable to the subjects you have mentioned, we are providing copies of their original letters and our letters of response.

In your letter of March 17, you mentioned an internal memorandum by Dr. Keith Maddy of the Worker Health and Safety Unit and indicated you believed it "illustrated a number of unanswered questions that remain concerning Bolero." Memoranda of this type are used as a positive mechanism for initiating internal discussion on a variety of subjects requiring interaction between individual units within the Department. In this case, the memorandum referred to items needing consideration as a part of the registration process. Such consideration has proceeded.

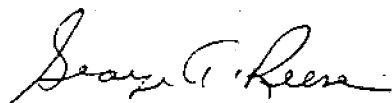
Your letter of February 23 mentioned several items that (as mentioned above) were covered originally in letters from the Water Resources Control Board and Assemblyman Connelly. In item three, however, you expressed concern about financial liability and indicated a substantial cost would accrue in the event of treating water having an unacceptable taste. ~~It should be recognized that~~ through mitigative measures such as the monitoring of rice water outflow, lengthening of the rice water holding period, educational meetings for growers and applicators, the 24-hour pretreatment notification, and the expanded regulatory overview by county agricultural commissioners offices, ~~there is minimal likelihood of water contamination due to Bolero.~~ We believe that steps such as these will be successful to the extent that Bolero will not adversely affect water used by the City of Sacramento and that it will, therefore, not be necessary to consider treatment. If treatment should be necessary, Chevron's tests conclude that the worldwide recognized treatment for removing odors and tastes from drinking water (potassium permanganate) is effective. I understand that Chevron has agreed to a compensation program should treatment be necessary.

Mr. J. F. Varozza
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In the next to the last paragraph of the same letter, you indicated the City of Sacramento was "disappointed and dismayed that the recommendations of the Rice Pesticide Subcommittee as outlined in their memorandum of November 18 were not acted upon." You also indicated that if they had been "we would not be in the present situation." Since sending your letter of February 23, you have probably become aware ~~that all recommendations of the Rice Pesticide Subcommittee have been acted upon~~ and, therefore, now believe that we are no longer in the "present situation" as recognized on February 23.

We have appreciated the opportunity to work with you in consideration of the Bolero registration action and believe that when the appropriate registration decision is made you will find that it is fully considerate of the water related concerns you have expressed.

Sincerely



George A. Reese, Chief
Pesticide Registration and
Agricultural Productivity
(915) 322-5130

DEPARTMENT OF FOOD AND AGRICULTURE



1220 N Street
Sacramento
95814

March 29, 1983

Honorable Lloyd G. Connelly
Assemblyman, Sixth District
State Capitol
Sacramento, California 95814

Dear Mr. Connelly

Your letter of March 11, 1983, expressed an opinion opposing registration of Bolero and you enclosed comments in a position paper stating reasons for your opinion. Response to your position paper and the questions that were included is provided as follows:

- A. Registration of Bolero will result in contamination of the Sacramento River and Sacramento City's drinking water supply. It will result in excessive toxicity levels in fish - specifically fish found in the Colusa Drain.

Response

The objective for the coming use season is to keep Bolero out of the Sacramento River and subsequently out of Sacramento drinking water. As a means of accomplishing this objective, a six-day water-holding period has been established for treated fields. In addition, a 24-hour pretreatment notification is required for advising enforcement officials of application times and locations. This will enable county agricultural commissioners to be present for the purpose of monitoring Bolero applications. In addition, Chevron Chemical Company (the registrant) is conducting an educational program for pest control operators and growers. The educational program stresses water-holding procedures, pretreatment notification and use methods necessary to comply with label requirements. The University of California in cooperation with the Central Valley Regional Water Quality Control Board has printed and distributed literature stressing the need for water management and pest control in rice. The California Department of Food and Agriculture, Department of Fish and Game, and Chevron will also carry out an extensive water monitoring procedure throughout the treated area as an additional means of controlling river contamination.

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Information evaluated in support of registration of Bolero as a part of the registration process does not confirm your concerns about toxicity levels in fish. The Department of Fish and Game has gone on record saying they "cannot oppose the registration of Bolero based on fish toxicology data..." Available toxicology data and monitoring information indicates that concentrations of thiobencarb will be kept below 10 percent of the LC₅₀ (lethal concentration to 50 percent of test organisms) values for aquatic organisms in the agricultural drains and the Sacramento River. We expect that maintenance of thiobencarb concentrations below these no-effect levels will not have an adverse effect on fish and other aquatic organisms. Chevron Chemical Company will be working with the Department in developing more detailed, site-specific aquatic toxicological and monitoring information during 1983, with a view toward confirming the present data evaluation results and alleviating any concerns associated with the agricultural drain and the Sacramento River fisheries.

In addition, Department of Food and Agriculture Wildlife Biologists have been reviewing data and investigating the Bolero use pattern for rice and concur with the Department of Fish and Game's findings relative to the fish toxicity question. If Bolero is used this season, Chevron will be cooperating with the Department of Fish and Game in a fish health monitoring program in the major agricultural drains and also the Sacramento River.

8. Registration of Bolero would constitute a violation of specific statutory and regulatory standards adopted by the Legislature and the Department of Food and Agriculture to prevent contamination of drinking water.

Response

In carrying out the registration review for Bolero, there were no findings indicating that allowing use would constitute a violation of any laws and regulations administered by the Department of Food and Agriculture. In consultation with cooperating state and local regulatory agencies, the Department has not been informed that the registration and use of Bolero would violate any other laws, regulations or local ordinances.

- C. Registration of Bolero is being sought by Chevron Corporation before it has provided adequate information, including health and safety data, to meet the requirements for full registration. The "data gaps" regarding public health issues are simply too great to permit use this season.

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Response

The registrant has met all federal and State legal requirements for the registration being sought. Both Department of Food and Agriculture's toxicologists and the Department of Health Services' experts on human health and toxicology have put in writing that they do not have any professional concerns that the use of Bolero would result in any adverse health effects.

- D. A number of questions, to which the community has a right to demand responses remain unanswered.

Response

The questions are not repeated, and are responded to in the order listed in the position paper.

1. The breakdown products, sulfoxide and sulfonic acid observed during thiobencarb chlorination are the same metabolites which occur in animals fed thiobencarb. Thus, these metabolites have been thoroughly tested with respect to their mammalian toxicity and the results reflect the conclusions stated by both the Department of Food and Agriculture and the Department of Health Services' experts as previously stated.

Chlorinated toluene has not been identified as a metabolite of Bolero. In the letter dated January 18, 1983 by Lorin R. Stelzer (Chevron) to John F. Varozza (City of Sacramento), Chevron stated "our researchers have never observed chlorinated toluene as a metabolite of thiobencarb and are not aware of any reports of its occurrence. We would very much like to see the study on which your report is based."

The water department may have been confused by some residual chlorinated toluene that is present in the raw materials used in the manufacture of Bolero.

2. The updated data which involved isolation and identification of all the chemical species of thiobencarb chlorination are summarized in the enclosed table.

The degradation of thiobencarb by oxidation to sulfonic acid is considered to be a detoxification pathway, which means the sulfonic acid itself has a lower order of toxicity than its parent compound thiobencarb.

3. It is true that sulfoxide metabolites (degradation product of Bolero) exhibit phytotoxic properties, however, their practical use

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as herbicides are prohibitive due to their unstable nature and short life. Many other substances, including naturally occurring chemicals, have herbicidal properties, but are not used, or classified, as herbicides. The low levels of Bolero in the Sacramento River, as determined by the Department of Fish and Game, could not be considered phytotoxic, therefore, the breakdown products would not have herbicidal effects and would be present at many orders of magnitude less than the parent compound.

When thiobencarb is administered to animals, the intermediate metabolite, thiobencarb sulfoxide, undergoes biotransformation so quickly to the sulfonic acid, it was virtually impossible to isolate the sulfoxide from the in vivo system.

- 4. The extremely low levels of Bolero detected in the agricultural drains and in the Sacramento River never approached the LC₅₀ values for any species of fish yet tested.

Kubota and Ochiai (1979) found that Bolero pretreatment enhanced the toxicity of Ordram to carp. The mortality of carp exposed to Bolero and Ordram together was greater than that of carp exposed to each pesticide alone. In this study, the concentration of Bolero affecting the toxicity of Ordram to the carp was between 56 ppb and 32 ppb. The highest level of Bolero detected in the Sacramento River by the Department of Fish and Game was 6 ppb, therefore, no combination effect would be anticipated.

Insecticides are applied after rice fields are drained, much later in the season, when the plants are in the head stage.

- 5. The herbicides, Bolero and Ordram are applied to the flooded rice fields early in the season when the seedlings are at the two-leaf stage. Due to this separation of time of application of herbicides and insecticides, they would not occur together and there would be no possibility of synergistic effects.
- 6. Oxidation of thiobencarb sulfoxide with one part per million of potassium permanganate in water is rapid. The oxidation follows pseudo first order kinetics with a half-life of thiobencarb sulfoxide of 13 minutes. Thiobencarb sulfoxide is oxidized to thiobencarb sulfone then oxidized to p-chlorobenzyl sulfonic acid. Thiobencarb sulfone has a half-life of three and one half hours. No thiobencarb sulfoxide is detectable one hour after treatment with potassium permanganate.

Under the conditions of treatment in the plant, virtually no thiobencarb sulfone will be present when the treated water reaches the consumer.

7. In order to reduce pollution as a result of burning rice stubble and to remain competitive in the rice market, California producers have shifted to high yield, short-statured varieties. Previous herbicide use practices were not compatible with the short-statured varieties. The rice growers recognized that they needed an additional herbicide in order to enable continued production under the new cropping patterns. Bolero was, and still is, found to be the only effective herbicide available for production of the short-statured rice. A Section 18 emergency exemption is for local crisis resolution and requires documentation of the emergency. The Department requires enough data to be reasonably certain that the emergency use is safe. The City of Sacramento did not inform the Department of their concerns or conclusions until late summer of 1982. However, the Department has lead the way for other agencies and the registrant to resolve the problems relating to the off-taste water and is satisfied that the issue is resolved.

8. The proposed pesticide registration decision is a regulatory requirement that the Department must meet in order to advise the public of registration actions being considered. This procedure is necessary if the Department is going to obtain information from the public about registration proposals being considered.

The various comments and information received during the 45-day posting period are evaluated and fully considered before final registration decisions are reached. You questioned the initial public notice of a proposed registration action which does not deal with a finalized registration decision. It only advises the public of a registration action that is being considered.

9. The answer to this question is provided in the response to question seven and item three of the summary.
10. Use restrictions necessary for Bolero have been established by adopting label provisions requiring a six-day water-holding period for treated fields and a 24-hour preapplication notice for county agricultural commissioners. Preapplication notification will allow enforcement personnel to be available for monitoring applications in potential problem areas.
11. Toxicology data dealing with the effects of long-term Bolero exposure do not identify any possibilities of adverse effects. Any exposure likely to result from use of Bolero during a four-to-six week treatment schedule for certain rice localities could not be considered hazardous when recognizing that no adverse effects resulted from long periods of continued high-level exposure to test animals.


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12. Review of Chevron's degradation data indicated that a four-day holding period would not be appropriate. The Department, therefore, required a six-day holding period and Chevron agreed to put that restriction on the label.
13. Same answer as 12.
14. County agricultural commissioners and rice producers advise that water in treated fields can be held for the six-day period needed to permit Bolero degradation.
15. Yes. California rice producers, University researchers, and the rice research board advise that water can be held for a sufficient length of time.
16. Bolero and Ordram are not exceptions. The present six-day holding period is established as a means of providing the necessary confinement period.
17. See answers to question 16 and item two of the summary.
18. The acceptable daily intake criterion is not an absolute limit that cannot be exceeded. It is a guideline which is one-100th of the maximum amount ingested by the most sensitive test animal for a lifetime with no observable effects occurring. Bolero use is limited to a four-to-six-week application period and dissipates rapidly from fish and water. The Chevron ADI is based on a lifetime daily exposure to Bolero and it is therefore a worst case estimate. A lifetime ADI cannot be applied to a short-term limited exposure of four to six weeks when Bolero is being applied.

The issues surrounding the final decision whether to register Bolero are complex and further compounded by a great deal of incorrect information and questionable concern. Your comments are acknowledged and given full consideration.

Sincerely


Clare Berryhill
Director
(916) 445-7126

Enclosures

Quantification of ^{14}C Products
from River Water Containing 22 ppb of ^{14}C Thiobencarb
After Chlorination Treatment

^{14}C -Characterization	Percent of ^{14}C Treatment	
	Day 0	Day 8
Thiobencarb	2.0	1.7
Thiobencarb-sulfoxide	66.0	2.1
p-chlorobenzyl sulfonic acid	30.2	89.9
p-chlorobenzyl alcohol	1.1	1.7
p-chlorobenzoic acid	0.4	2.1
others unidentified	0.3	2.5

The results of this study show that chlorination of water containing thiobencarb does not produce chlorination products. The major initial product is the oxygenated derivative of thiobencarb, thiobencarb-sulfoxide, which decomposes to p-chlorobenzyl sulfonic acid during storage.

Notebook Reference: 6691.

ACKNOWLEDGEMENT

I wish to thank the following persons:

- E. I. Aoyagi, for synthesizing p-chlorobenzyl sulfonic acid;
- R. H. Iwamoto, for taking GC/MS;
- B. J. Clarke, for her technical assistance.

H. MING CHENG

HMC:mj

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445-2484

Assembly California Legislature

COMMITTEES
JUDICIARY (VICE CHAIR)
REVENUE AND TAXATION
FINANCE AND INSURANCE
HUMAN SERVICES

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LLOYD G. CONNELLY
MEMBER OF THE LEGISLATURE
SIXTH ASSEMBLY DISTRICT

March 11, 1983

Mr. Clare Berryhill, Director
Department of Food and Agriculture
1220 N Street,
Sacramento, California 95814

Dear Mr. Berryhill:

Enclosed are my comments on the proposed conditional registration of Bolero.

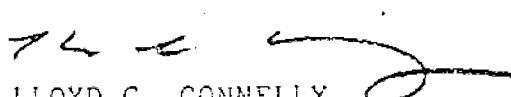
As you can see, I remain opposed to permitting its use this coming season under a conditional registration.

My comments include a number of reasons why registration should not be permitted, including violations of law and regulations. In addition, I have developed a list of questions which remain unanswered.

If the Department intends to proceed with registration, I would request that you provide a written rebuttal to the arguments we present, as well as answers to the questions.

I appreciate the opportunity to express my opinion. Thank you for your cooperation.

Cordially,


LLOYD G. CONNELLY
Member of the Assembly

LGC:ptz

Enclosure

cc: Mr. George Reese, Chief
Pesticide Registration and
Agricultural Productivity

POSITION PAPER ON PROPOSED CONDITIONAL REGISTRATION OF BOLERO

Submitted by: LLOYD G. CONNELLY
Member of the Legislature
Sixth Assembly District

Summary

Based on information that is available regarding Bolero, I have no choice but to oppose its conditional registration. I have decided to oppose the conditional registration of Bolero by the California Department of Food and Agriculture because:

- 1) registration of Bolero will result in contamination of the Sacramento River and Sacramento City's drinking water supply. It will also result in excessive toxicity levels in fish - specifically fish found in the Colusa Drain; and
- 2) registration of Bolero would constitute a violation of specific statutory and regulatory standards adopted by the Legislature and the California Department of Food and Agriculture to prevent contamination of drinking water; and
- 3) registration of Bolero is being sought by Chevron Corporation before it has provided adequate information, including health and safety data, to meet the requirements of full registration. The "data gaps" regarding public health issues are simply too great to permit use this season.
- 4) a number of questions, to which the community has a right to demand responses, remain unanswered.

I. PESTICIDES SHOULD NOT BE ALLOWED TO ENTER PUBLIC DRINKING WATER

The conditional registration of Bolero and the resultant use of this herbicide will inevitably result in Bolero entering the Sacramento River, Sacramento City's drinking water and fish in the Colusa Drain. Virtually no opinion or information points to the contrary. To permit this contamination of drinking water and fish is unacceptable and inconsistent with the Federal Clean Water Act, the Porter-Cologne Act, and Regional Water Quality Control Board's Basin Plan and good common sense.

The California Department of Food and Agriculture has asserted that this contamination does not represent a problem because the water used to irrigate rice will be held on the fields until Bolero dissipates, decomposes or breakdown. Several minimum holding time periods have been suggested to reduce the amount of Bolero entering in the water by achieving a "maximum" breakdown of the product prior to its release from the rice fields. However, there is little agreement even within the Department of

Food and Agriculture about the length of this holding period. For example, Chevron has admitted that the originally established 4-day holding period was based on experience with OrDRAM, a distinctly different herbicide. Unfortunately, the two toxics, Bolero and OrDRAM, have shown significantly different breakdown characteristics, so using OrDRAM as a standard is virtually meaningless. Recently, the California Department of Food and Agriculture (CDFA) and Chevron Chemical Corporation apparently agreed to increase the required period from 4 to 6 days. Dr. Keith Maddy, Chief Staff Toxicologist, Worker Health and Safety Unit, CDFA, in a January 17, 1983 memorandum to George Reese, states, however, "that unless a holding period of almost twice as long (as 4 days) is required, there will again be excessive levels of OrDRAM and Bolero in the rice water going into public drinking water."

An 8 or 9 day period generally conforms with the findings of the University of California Division of Agricultural Sciences Leaflet 21298, "Pest Control and Water Management in Rice." Field studies conducted by the Regional Water Quality Control Board indicate the necessary holding periods may be even greater because of an abrupt slowing of the rate of deconcentration at lower levels. At this time no one knows for sure how long a holding period is required or even if it will work.

Moreover, according to Rudy Schnagl of the Regional Water Quality Control Board, it may be impossible to hold water in the fields for a sufficient length of time to permit breakdown without incurring detrimental effects on the rice crop. Furthermore, the entire discussion about the effectiveness of a holding time may be moot because it is virtually impossible to enforce such regulations.

The confusion about required holding time is but one example of the absence of specific knowledge about Bolero, and it only serves to highlight how little is known about this product.

What is known, however, is that Bolero has entered Sacramento's drinking water in the past and will likely do so again this year if the conditional registration is granted.

II. PROPOSED REGISTRATION IS PROHIBITED BY STATUTORY AND REGULATORY STANDARDS

The pesticide registration procedure in California is designed to protect the safety and health of the public and to eliminate any pesticide "...which endangers the agricultural or nonagricultural environment" (Food and Agriculture Code Sections 12824 and 12825.) The department has established two distinct pesticide registration programs: one for full registration and a second program for "conditional" or temporary registration. The

data currently on hand for Bolero show that it will unavoidably contaminate the Sacramento River, Sacramento City's drinking water and fish. I believe this information establishes that Bolero cannot properly qualify for registration in California under either of the Department's programs.

The conditional registration program was established to allow temporary registration of a pesticide for up to three years while certain missing data are developed by the pesticide company (3 Cal. Admin. 2369.5.) Although the minimum data requirements are somewhat relaxed under the conditional registration program, the actual standards or requirements for registration are stronger.

Conditional registration requires the director to find, in writing, that there is no expectation of "any significant adverse effect on the environment." 3 Cal. Admin. 2369.5 (f). If a significant adverse effect on the environment is expected, a product cannot be conditionally registered. A weighing of risk versus benefits -- a "balancing" test -- may be applied by the Director to overcome an expected significant adverse effect.

(Id.)

The director cannot make this requisite finding for Bolero because the widespread water contamination is not merely an expectation, but a virtual certainty. Nor can he credibly find that contamination of a major river, the Sacramento metropolitan water supply and fish is not significant or adverse. Both the significance and the extent of Bolero contamination have been demonstrated by the vociferous complaints from Sacramento residents, as well as monitoring data showing Bolero in river water and in fish tissue. A finding that Bolero contamination is "insignificant" or "not adverse" would make a mockery of the regulation.

Because the conditional registration regulation incorporates by reference the statutory and regulatory criteria for full registration (3 Cal. Admin. 2360 (c) and Code Sections 11501, 12824-12826, 14102, and 14102), Bolero also fails to meet these full registration standards. Specifically, 3 Cal. Admin. 2360 (e) (3) and (4) require the Director's special attention to:

(3) Potential for environmental damage, including interference with the attainment of applicable environmental standards (e.g., air quality standards and water quality objectives).

(4) Toxicity to aquatic biota or wildlife.

The existing data demonstrate that Bolero interferes with the attainment of the existing water quality objectives (pure water) as well as contaminating aquatic biota (fish). While 3 Cal. Admin. 2360 (e) seems to allow the director to grant a full

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registration for a pesticide in the face of such significant adverse effects based upon a risk-benefit analysis, the validity of the risk versus benefit provision of 2360 (e) is in doubt, because the underlying statute does not provide for such a tradeoff. Food and Agriculture Code Section 12825 established that the director may cancel or refuse to register a pesticide:

(a) Which has demonstrated serious uncontrollable adverse effects either within or outside the agricultural environment.

(b) The use of which is of less public value or greater detriment to the environment than the benefit received by its use.

(c) For which there is a reasonably effective and practicable alternate material or procedure which is demonstrably less destructive to the environment.

(d) Which, when properly used, is detrimental to vegetation, except weeds, to domestic animals, or to the public health and safety.

The authorizing statute, Section 12825, governs full and conditional registration. It establishes risk versus benefit evaluations as one of several alternative standards for declining registration. It does not apply the risk versus benefit standard to override other criteria. 3 Cal Admin Code 2360 (e), the Department's regulation, attempts to allow such an override. As such, it is beyond the scope of the statute and therefore invalid. This is crucial because Bolero fails the standard set forth under (a) or Code Section 12825, above. Section 12825 (a) calls for rejection of a pesticide that causes "serious uncontrollable adverse effects". The "serious" and "adverse" standard is clearly triggered as discussed above. Furthermore, a zero-release level of Bolero into the river is impossible (Rice Subcommittee Report, November 18, 1982, Olaf Leifson to George Reese) and bio-concentration of Bolero in fish has been found. These impacts are unavoidable, cannot be mitigated and are therefore, "uncontrollable" within the meaning of Section 12825 (a). Therefore, the risk-benefit evaluation cannot be applied in the future by the director to allow a full registration of Bolero. Even if it were applicable, the evidence does not demonstrate that the benefit to rice growers and Chevron Chemical Corporation outweighs the risk to the people of Sacramento.

The purpose of conditional registration is to allow temporary use of a pesticide while the pesticide company completes a few additional tests (3 Cal Admin. 2369.5). The regulation permits such temporary use under the assumption that the pesticide will pass its "final exam", that is, achieve full registration when

the final tests are completed. Bolero cannot pass its final exam (obtain full registration) because existing data show uncontrollable adverse effects. (Furthermore, to reiterate what has been stated above, Bolero has failed its "midterm" (conditional registration) under the stricter standard of 3 Cal. Admin. 2369.5).

Section 14102 of the Food and Agriculture Code, required to be given special attention under 2360 (e) above, states that "the Director shall prohibit or regulate the use of environmentally harmful materials..." Given the statutory definition of "environment" as "the aggregate of all factors that influence the conditions of life...", and the obvious inclusion of so basic a commodity as drinking water as among the aggregate, it would appear that this statute would prohibit the conditional registration of Bolero as well.

Section 14004.5 of the Agriculture Code establishes the criteria for designation of substances as "restricted materials".

- (a) Danger of impairment of public health
- (b) Hazards to applicators and farmworkers
- (c) Hazards to domestic animals, including honey bees, or to crops from direct application or drift.
- (d) Hazard to the environment from drift onto streams, lakes, and wildlife sanctuaries.
- (e) Hazards related to persistent residues in the soil resulting ultimately in contamination of the air waterways, estuaries, or lakes, with consequent damage to fish wild birds, and other wildlife.
- (f) Hazards to subsequent crops through persistent soil residues.

Keith Maddy, in his January 17, 1983 memo to George Reese, states that the criteria for placement of Bolero on the restricted materials list is "more than met at this time". As there is obvious applicability to the above criteria and agreement from within the department, such a designation should be made. Acceptance of Bolero as a restricted material almost certainly should prohibit registration. If not, the legislative intent as evidenced by statutory commands would be circumvented by mere administrative regulations.

In summary, the only way Chevron or CDFA can clear the way for conditional or full registration is by proving that Bolero will be fully contained in the rice fields, a goal that cannot be practically achieved, by all accounts.

III. DATA GAPS IN REQUIRED INFORMATION ARE TOO GREAT TO PERMIT USE THIS SEASON

Chevron has yet to submit the required toxicity data that will ultimately be necessary for full registration. For example, a rat reproduction study begun in June, 1982 by Chevron is more than a year from completion. Moreover, the most important missing element at this time is a second teratology (birth defect) study. Chevron contracted with Industrial BioTest Laboratories to conduct an analysis to meet this requirement. However, the study was subsequently found to be invalid by an Environmental Protection Agency audit.

My office has requested information about this study and an explanation of why it has been invalidated from several state agencies, the E.P.A. and Chevron. To date all requests have been either denied or are unanswered. Chevron has stated that a new analysis is underway to replace the IBT study, of which the pilot aspect has been completed. Although we have been given verbal assurances that this study is negative, we have been denied access to it as well. Chevron acknowledges that the information in the pilot study falls far short of what will be required for full registration.

This lack of information extends far beyond the potential direct toxic affects of Bolero. A letter written by Sacramento City Engineer John Varozza to George Reese of CDFA on January 4, 1983 addresses the problem of the unknown effects of Bolero's breakdown products that result from the water treatment process:

...it (calculations) failed to address the real issue of the health effects of the pesticide metabolites. In addition to the sulfoxide and sulfone, the City has recently identified chlorinated toluene as being a metabolite of Bolero. The Department of Health Services has confirmed this finding. So the question becomes, What are the toxicological implications regarding the sulfoxide, sulfone, chlorinated toluene and other breakdown metabolites and possible recombinates?

In addition, our recent finding that the sulfoxide metabolites are also classified as herbicides means that the consumer may be exposed to an acknowledged herbicide in his drinking water.

In addition to the breakdown products which have been chemically isolated by Chevron, DOHS or the Sacramento City water treatment plant chemists, there appear to be some unaccounted for breakdown products. Keith Maddy, in his January 17, 1983 memo to George Reese states in regards to Bolero:

We are told by Chevron that there were some additional chlorination breakdown products (about 6% of the total); we do not know what they or what their toxicity profile is.

Furthermore, no one knows definitively what chemical products will result from treatment of Bolero's breakdown products with potassium permanganate, which is the chemical proposed to be used to eliminate the foul taste.

Monitoring data exist that indicate fish are bioaccumulating Bolero. In a letter dated February 11, 1983, David Cohen, Manager of the Toxic Substances Control Program at the State Water Resources Control Board states:

Thiobencarb (active ingredient in Bolero) does bioaccumulate in fish residing in several of the agricultural drains in the Sacramento Valley during the 6-8 week period of Bolero application. Seasonal residue level would be expected to increase above the 1982 values with greater usage of Bolero. In addition, DFG studies during 1980-82 indicate that fish residing in these agricultural drains accumulate molinate (Ordram) as well (see report by Finlayson, 1982). We do not, however, currently have similar residue data concerning Sacramento River fish. It should be noted that although Department of Fish and Game (Brian Finlayson) provided us (as well as CDFA, DCHS and Chevron) with their preliminary field data (1982 monitoring results), they did not include comments concerning human health effects.

IV. PRIOR TO REGISTRATION, THE FOLLOWING QUESTIONS MUST BE ANSWERED

As an additional condition, if the Department intends to pursue conditional registration, the following questions should be specifically answered:

1. What health and safety data exists on the breakdown products, sulfoxide, sulfone, chlorinated toluene and other breakdown metabolites and possible recombinates?
2. There are additional chlorinated breakdown products totalling three percent (Sacramento City's chemist) to six percent (Chevron). What is the toxicity profile of these additional breakdown products?
3. Sulfoxide metabolites (breakdown products of Bolero) are classified as herbicides. Have considerations been made that

people will be exposed directly to an acknowledged herbicide in their drinking water?

4. What are the synergistic effects of Bolero and Ordram in the river?

5. What are the synergistic effects of rice insecticides and Bolero and/or Ordram?

6. What chemical products will result from treating Bolero's breakdown products with potassium permanganate (to remove the bad taste)?

7. Why was Bolero given a Section 18 Emergency Exemption when all of the health and safety data had not been completed?

8. Why did CDFA go ahead with a Notice to Register Bolero when the Rice Pesticide Subcommittee had delineated certain basic questions which needed to be answered prior to the Notice to Register?

9. What documented need exists for use of Bolero in the absence of important health and safety information?

10. Given the many problems in fully registering Bolero, why doesn't the proposed CDFA registration classifying Bolero as a restricted material?

11. Has consideration been given to the long term effects of continued yearly exposure to Bolero in the drinking water and food chain?

12. The original holding period requirements that were thought to be adequate (prepared from data on Ordram and not Bolero) were subsequently lengthened by Chevron. Controversy continues, however, on the appropriate holding time from eight days to 14 days. What specific data is available detailing holding time requirements?

13. What field tests are available which show the 50 percent degradation point for Bolero in the fields?

14. Can rice farmers possibly hold the water long enough for Bolero to sufficiently breakdown before it reaches Sacramento?

15. Given the delicate nature of rice growing and the fact that Bolero can actually kill the rice plant under certain situations, is it feasible to believe that the farmers can hold Bolero on their rice field for the required holding time?

16. State laws and regulations requires pesticides to be confined to the treatment site. Why are Bolero and Ordram exceptions?

people will be exposed directly to an acknowledged herbicide in their drinking water?

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16. State laws and regulations requires pesticides to be confined to the treatment site. Why are Bolero and Ordram exceptions?

AD

17. The Clean Water Act, Porter-Cologne, and the Regional Board's Basin Plan all give Californian's the right to clean drinking water, free of pollutants. Why should Bolero (and Ordram) be an exception to these regulations?

18. Monitoring data exists that indicate fish are bio-concentrating Bolero. Consumption of the fish in human diets would exceed the Acceptable Daily Intake recommended by Chevron. Why hasn't consideration been given to people ingesting both fish and drinking water?

Memorandum

David E. Cohen, Ph.D.
Program Manager
Toxic Substances Control Program
State Water Resources Control Board
P. O. Box 100
Sacramento, California 95801

Date: March 29, 1983

Place: Sacramento

From : Department of Food and Agriculture

Subject: Bolero

Your memorandum dated March 18, 1983, submitted to me at the Pesticide Registration and Evaluation Committee meeting has been reviewed and the information considered as follows:

A. Health Effects

The toxicology health and safety experts in both the Department of Food and Agriculture and Department of Health Services have reviewed all available data and stated they have no professional concerns surrounding the health aspects of the use of Bolero.

You also state that approximately 5 percent of the chlorination byproducts from Bolero and Ordram remain unidentified. All byproducts of Bolero have been identified and all but 4 percent of Ordram byproducts identified. Considering the levels of Ordram found at the intake last year, combined with the measures to meet our objective of keeping Ordram and Bolero out of the river this season, there is no scientific justification for concern of such minute amounts of unidentified byproducts.

B. Cause of Taste Problem

The Chevron taste study supports the conclusion that chlorination of Bolero produces a taste. It proves nothing else. Any other interpretation should be identified as a personal opinion. Chevron has concluded that the taste (identified in their study) is resulting from the sulfoxide metabolite.

C. Feasibility of Treatment

Potassium permanganate is recognized throughout the world as a water treatment process that removes tastes and odors. Chevron's test indicates that potassium permanganate does oxidize the sulfoxide of Bolero. A reasonable conclusion should be obvious from these facts. Potassium permanganate is not a cure for the use of Bolero. It is, however, an important aspect to be considered in the final decision.

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We are responsive to your statement that California and Federal law places the responsibility for solving discharge problems with the source of the discharge. Our objective is to keep these pesticides out of the Sacramento River. A great deal of effort is being expended to meet this objective. Chevron and Stauffer are committed to extensive educational programs. Water-holding restrictions and pre-application notification requirements are in place; extensive water monitoring and fish studies are being required. The Department of Food and Agriculture and county agricultural commissioners' monitoring of potential problem areas is expected.

You also state that requiring a water user to treat to remove pollution violates a basic principle. I believe that conclusion was made without adequate thought. Pollution is removed from the Sacramento drinking water on a daily basis through the use of an economic poison - chlorine. You may want to rethink that conclusion.

B. Label

You have stated that there is no assurance that a six-day holding period will be effective. You are correct. We make the best decision possible based upon the available scientific facts. The extension from four days to six days was a Department of Food and Agriculture decision after review of the existing data. Is there a holding period that your Board will recommend and stake your credibility that results will be guaranteed? I do not think so. The success of this program may depend more upon the rice producers and adherence to good cultural practices than any other aspect. The rice producers are however, well aware of the importance in mitigating the rice herbicide-Sacramento River problem.

E. Environmental Monitoring and Aquatic Toxicology Protocols

You are correct. One of the things the monitoring programs will verify is if progress has been made in controlling discharge of Ordram and Bolero.

You have recommended that registration (of Bolero) not be allowed unless certain conditions are complied with:

1. The Rice Pesticide Subcommittee has performed its task in relation to Bolero and submitted its recommendations to the full committee. Its recommendations have been complied with and further discussion by the subcommittee is not necessary.

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2. There is no scientific rationale that would support the requirement of restricting the use of Bolero other than the requirement for a specified water-holding period. The water-holding restriction is accomplished by label direction.
3. The appropriate water-holding time has been determined to be six days and is a label requirement.
4. Procedures for monitoring Bolero water levels and fish studies are in place. This information is not confidential and is available to the public.
5. We are hopeful that our objective to keep Bolero out of the river will be successful and there will be no impact on the City's water supply. However, Chevron will conduct tests to further the knowledge pertaining to the taste concerns. The byproducts of Bolero are known.
6. The Department of Food and Agriculture will take appropriate action pertaining to identified adverse effects of Bolero use.

It may be of some interest to point out that the State Water Resources Control Board has a member on the Pesticide Registration and Evaluation Committee. That individual is also a member of the Rice Pesticide Subcommittee. He also has access to all information and data available to the Department of Food and Agriculture staff for decision making purposes on the issues you have presented. It would seem that you could have been better informed and advised that the issues you have raised have either been satisfied or are in place for implementation should Bolero be registered.

George A. Reese, Chief
Pesticide Registration and
Agricultural Productivity
(916) 322-5130

bcc Lori Jonstou
Van Cheney
Paul Livingston

17/7B/10-12

Memorandum

To : Mr. George Reese
Department of Food and Agriculture
1220 N Street
Sacramento, CA 95814

Date : March 18, 1983

From : STATE WATER RESOURCES CONTROL BOARD

Subject : BOLERO

Since the February 11 memo to Jim Wells, the Water Board has received the Bolero taste study from Chevron and a toxicological review from the Department of Health Services. This new information addresses important issues raised by the DFA Rice Pesticide Subcommittee in its report dated November 10, 1983.

A. Health Effects

Dr. Keith Maddy (DFA/WHS) and Dr. Richard Jackson (DOHS) state that available data indicates Bolero residues should not pose a health risk at levels expected to be found in the Sacramento River.

However, uncertainty remains about unidentified chlorination byproducts from Bolero and Ordram in water treated and distributed by the City of Sacramento. Chevron, manufacturer of Bolero, and Stauffer, manufacturer of Ordram, have submitted analytical studies describing most byproducts, but approximately 5 percent remain unidentified.

B. Cause of Taste Problem

The Chevron taste study supports the conclusion that Bolero residues in water treated with the procedure used by the City of Sacramento produces a distinguishable off-taste. The test was conducted with water taken from the Sacramento River during the winter. The specific Bolero constituent that causes the taste remains unidentified.

C. Feasibility of Treatment

Chevron has submitted a taste panel study indicating that potassium permanganate treatment eliminated the off-taste in a small-scale test. The feasibility of large scale operational treatment has not been demonstrated. California and federal law places the responsibility for solving discharge problems with the source of the discharge. Requiring a water user to treat to remove pollution violates that basic principle.

D. Label

Chevron has submitted a revised label increasing the holding period from 4 to 6 days. Since the degradation of Bolero varies greatly with temperature and other conditions, there is no assurance that a 6 day holding period will be effective.

E. Environmental Monitoring and Aquatic Toxicology Protocols

State and industry officials are increasing testing and surveillance of fish and waters in the Delta, Sacramento River and major agricultural drains. These ongoing studies will verify if progress has been made in controlling discharge of rice field chemicals.

Since the November 10, 1982 report of the Rice Pesticide Subcommittee additional questions have been raised regarding the significance of Bolero residues in fish. The Department of Health Services points out that "it is likely that persons consuming fish from certain agricultural drains would consume Bolero residues in excess of Chevron's own maximum permissible intake."

The Water Board is concerned that Bolero discharges may adversely impact the City of Sacramento drinking water supply and fisheries downstream from rice field discharges.

We recommend that a one-year limited registration not be made unless:

1. Members of DFA Rice Pesticide Subcommittee meet and agree that concerns raised about Bolero have been adequately answered.
2. Bolero be classified as a restricted material.
3. The off-site movement of Bolero be mitigated by enforcement of an appropriate holding period.
4. Bolero residues in water and fish be monitored downstream and consumers be notified of residue levels detected.
5. The impact upon the City of Sacramento water supply be further clarified to define the specific cause of the taste problem and to further identify unknown byproducts.
6. DFA agrees to suspend use and registration if proposed restrictions do not prevent downstream impacts on water quality and beneficial uses.

Much progress has been made since questions were first raised about Bolero. The problems probably can be resolved if the cooperative effort by water quality officials, industry, farmers, pesticide regulators and city officials is allowed to take its proper and normal course. It is the fullness of that process that is needed to both solve the technical problems raised by the use of Bolero and to reassure the public that the regulatory system protects the public health and important resources.



David B. Cohen, Ph.D
Program Manager
Toxic Substances Control Program

Memorandum

David B. Cohen, Ph.D., Manager
 Toxic Substances Control Program
 Water Resources Control Board
 P. O. Box 100
 Sacramento, California 95801

Date : March 21, 1983

Place : Sacramento

From : Department of Food and Agriculture

Subject: Registration of Bolero

Thank you for your memorandum on Bolero and possible bioaccumulation in fish. I appreciate the concerns you have expressed. However, our evaluation of the data on Bolero, and specifically, the information from the Department of Fish and Game, indicates that Bolero's potential for bioconcentration is not significant. In our discussion we will use the term bioconcentration as it is more appropriate to the effects discussed.

Bioconcentration (the uptake and retention of a chemical by an organism or tissue from its environment to such an extent that the organism may temporarily acquire a higher concentration in its body than that in its environment) of thiobencarb, (Bolero), in fish has recently become an issue of concern with regard to California registration of this rice herbicide.

EPA data requirements for Aquatic Organism Accumulation Tests state that when a pesticide is used in or is expected to transport to water from the intended use site, major considerations for requiring these toxicity and residue tests include, but are not limited to:

1. Physico-chemical data indicating accumulation (e.g., water solubility less than 0.5 mg/l and octanol/water partition coefficient greater than 1000).
2. Persistence in water (e.g., half-life in water greater than 4 days).
3. Accumulation in organs and tissues, as indicated by mammalian or avian studies.

Thiobencarb (Bolero) Physico-chemical Data

1. The water solubility of thiobencarb at 20-25° is listed by Kanazawa at 30 mg/liter although the same author reports an octanol/water partition coefficient of 2650. Bolero meets one of these criteria, but not both as required.
2. The half-life of Bolero in water has been reported to be less than 4 days (Chevron data). Again Bolero does not meet the required criteria to be a bioconcentration of concern.

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3. Mammalian studies submitted by Chevron showed rapid metabolism and excretion of thiobencarb with no accumulation in organs and/or tissues. This data supports Bolero as not being a bioconcentrator of concern.

Additional data that was considered in arriving at our conclusion on the issue of bioconcentration were as follows:

Schaefer et al. (1982) state that "the evidence shows that exposures to thiobencarb will not result in long term residues in fish tissues." In static accumulation tests thiobencarb degraded in soil treated at the suggested use rate and there was no uptake by channel catfish. (Schaefer)

Kanazawa (1981) has reported the relative bioconcentration factors of 15 pesticides to the fresh water topmouth gudgeon (Pseudorasbora parva). Four pesticides and their bioconcentration factors (BCF's are listed as follows: Ordram (26), Bolero (170), Trifluralin (3142), and Leptofos (6058). Chevron has submitted comparison BCF's for both P, 'P'-DDT (49,600) and DDE (180,000) (attachment). These numbers describe the degree to which an organism can bioconcentrate an environmental substance. It is obtained by dividing the amount of chemical in the organism by that in its surrounding environment. It is clear that Bolero's ability to bioconcentrate is very limited and not significant.

Bioconcentration studies by Sanders and Hunn (1981) show that in most organisms the equilibrium concentration was reached after 48 hours of exposure. Once this equilibrium was reached, little accumulation of residue was detected after an additional 3 days of exposure. These authors further state that "in the United States, particularly Louisiana, this herbicide is applied in rice paddy fields where over 5,000 tons of red crayfish Procambarus clarki are harvested annually for food (Avault et al.)." In 1973, over 4,000 tons of this herbicide were applied to rice paddy fields in Japan (Suzuki, et al.).

Sanders and Hunn further state that "judging by the moderately acute toxicity, low bioconcentration, and rapid elimination of residues in fresh water, we suggest that the use of Bolero SEC will probably result in little environmental hazard to freshwater organisms." Schaefer et al. (1982) report that it is apparent that bluegills can concentrate thiobencarb to levels of ca. 200X within 24 hours, but for continuous exposures longer than this there is a reduced residue level. As mentioned earlier, Kanazawa reported a bioconcentration factor for Bolero of 170 for the topmouth gudgeon.

Preliminary data recently collected by the Department of Fish and Game showed residue levels of Bolero at .63, 1.3, 2.7, and 3.8 ppm in the skeletal muscles of four dead carp retrieved from various agricultural drains during the 1982 fish loss. The cause of this fish loss has not been determined. The levels of Bolero in water never approached the LC₅₀ values for bluegill or rainbow trout.

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If limited bioconcentration factors are estimated from Fish and Game preliminary data, BCF's of 51, 93, 131 and 216 can be assumed based on single water residue levels at the time of dead carp collection. These BCF's are not inconsistent with other scientific lab studies and, in fact, are considerably lower than those stated by Sanders and Hunn for Fathead Minnow and Longear Sunfish. Since there is no established tolerance for Bolero residues in fish the thrust of our enforcement and registration actions will be to prevent residues from occurring in fish.

Differences in Bolero residue levels existed between water samples taken in the agricultural drains (max. 170 ug/l(ppb) in CBD5) and those taken from the Sacramento River (max. 6 ug/l at SRL). Nine samples from the Sacramento River were reported at less than 1 ug/l.

Kubota and Ochiai (1979) found that benthocarb (Bolero) pretreatment enhanced the toxicity of Ordrum to carp. The mortality of carp exposed to benthocarb and Ordrum together was considerably more than that of carp exposed to each pesticide alone, suggesting a synergistic effect. While this is significant to fish toxicity it does not affect bioconcentration in tissues.

Kato and Muru (1978) found that carp became anemic in water containing Ordrum above 5 parts per billion. It seems possible that Ordrum exposure increases fish susceptibility to Bolero.

Certain mitigation measures will be in place in 1983 that will change Bolero's impact on the Sacramento River. In addition, other factors will affect rice acreage to be planted this year.

Estimates from the Sutter and Colusa County Agricultural Commissioners office (pers. comm.) indicate that overall planted rice acreage this season will be down 40-55% from normal, due to large quantities of stored rice awaiting a better market, inclement weather this spring and the Federal PIK (payment in kind) program providing funds for not growing rice. Obviously herbicide applications will likewise be reduced for 1983, and corresponding residue levels should be substantially less than in 1982.

CDEFA has a 24C label for 1983 requiring a six-day holding period for Bolero treated rice water. This holding period was not a requirement for the last two years. The required holding period should significantly reduce levels of Bolero entering the drainage basins and eliminate detectable levels of Bolero entering the Sacramento River. Field holding of treated rice water will allow more time for soil adsorption, plant uptake, and degradation of Bolero in the field.

In addition, extensive educational programs are conducted by Chevron to instruct growers, pest control advisors and pest control operators to properly manage their water to ensure efficacy and enhance safety to aquatic organisms.

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In summary, literature searches reveal a substantially low bioconcentration factor for Bolero (benthiocarb) and rapid elimination when exposure ceases. The Department is satisfied that this aspect of Bolero's use is adequately understood and does not pose any significant adverse effect. The Department will be recommending that the Department of Fish and Game repeat their 1982 fish residue sampling program for Ordram/Bolero in 1983 and that the raw data be analyzed by CDEFA.

Chevron will be cooperating with the Department of Fish and Game in a fish health monitoring program in the major agricultural drains and also the Sacramento River. In addition, a Grower Education Program (including applicators) will again be conducted by Chevron to be followed up by in-field monitoring of Bolero applications and analysis of residues under differing water holding periods (up to 12 days).

Additional aquatic toxicology studies are to be conducted by SRI International for Chevron on salmon, striped bass, sturgeon and carp (depending on when species are available) according to EPA testing protocol. The Neomysis (delta shrimp) flow-thru toxicology study has been completed by SRI and the data is to be mailed later this week for review.

ORIGINAL SIGNED BY
LORI JOHNSTON

Lori Johnston, Assistant Director
Pest Management, Environmental
Protection and Worker Safety
322-6315

Attachments

See Dennis Corcoran
Brian Finlayson
Richard Jackson
John Varozza
George Reese
Jon Shelgren
Olaf Leifson
Keith Maddy
Jim Wells

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Bioaccumulation of Thiobencarb
in Fish Tissue

Chevron Chemical Company
February 4, 1984

Bioaccumulation

The bioaccumulation (bioconcentration) potential of thiobencarb has been investigated in several species of fish and invertebrates. Overall, the bioconcentration factor of thiobencarb in aquatic organisms is low when compared to lipid soluble materials like DDT and other chlorinated hydrocarbons and does not suggest a hazard to the aquatic community. A summary of the thiobencarb bioconcentration studies completed to date are summarized below:

<u>Aquatic Organism</u>	<u>Days of Exposure</u>	<u>Bioconcentration Factor^(a)</u>	<u>Reference</u>
Channel catfish	49	167X	Sleight (1)
Channel catfish	5	120X	Sanders (2)
Bluegill sunfish	5	91X	Sanders (2)
Bluegill sunfish	4	43-296X	Schaefer (3)
Topmouth gudgeon	14	170X	Kanazawa (4)
Fathead minnow	5	471X	Sanders (2)
Longear sunfish	5	297X	Sanders (2)
Red crayfish	30	18X	Sanders (2)
Red crayfish	49	35X	Sleight (1)
Burrowing mayfly	5	85X	Sanders (2)
Chironomid midge	5	80X	Sanders (2)
<u>Gammarus amphipod</u>	5	168X	Sanders (2)
<u>Daphnia magna</u>	5	33X	Sanders (2)

(a) Ratio of the concentration of thiobencarb in the organism (wet weight) to the concentration in the water.

The bioconcentration factor of chlorinated hydrocarbons have been reported as high as 49,660X for P,P'-DDT (5) and estimated as high as 180,000X for DDE (5). The bioconcentration factors of thiobencarb are quite low in comparison and do not suggest any hazard to freshwater organisms. The Environmental Protection Agency does not consider pesticides with bioconcentration factors less than 500X to be harmful to the aquatic community and has not expressed concern with the bioaccumulation potential of thiobencarb. In Japan, over 4000 tons of this herbicide were applied over rice fields in 1973(2). It is a common Japanese practice to culture fish in thiobencarb-treated rice fields for human consumption. In spite of this practice, there are no reports of ecological effects to aquatic organisms or reports of adverse effects to humans in countries where fish culture is practiced in thiobencarb-treated rice paddies.

As you are aware, Chevron Chemical is conducting an extensive long-term study in Texas to evaluate the direct effects of thiobencarb to the aquatic community under field conditions. Extensive monitoring of thiobencarb residues will be done in water, fish and shrimp from rice application and will allow evaluation of bioconcentration potential under use conditions. Samples will be analyzed for thiobencarb residues during an entire rice growing season.

Human Safety Considerations

The California Department of Fish and Game has informed the State Water Resources Control Board that fish can bioconcentrate BOLERO (thiobencarb) to levels which exceed the Acceptable Daily Intake (ADI) of 0.01 milligram/kilogram/day (0.6 mg/day) recommended by Chevron to protect human health. Fish and Game further stated that consumers of fish caught in the Colusa Drain and the Sacramento River may be at risk particularly if discharges of BOLERO were to increase as a result of a decision to allow unlimited registration of BOLERO.

We have reviewed the thiobencarb fish residue data collected by Fish and Game from the Colusa Drain Basin during the peak of the 1982 rice growing season and have estimated the human daily intake from consumption of these fish. Calculations used by the Environmental Protection Agency to estimate the amount of a chemical ingested for comparison to a recommended safe level or Allowable Daily Intake are as follows:

Amount of Food Consumed (in kg) by a 150 lb. human x ppm of chemical residue in food x % of Fish in Diet = Calculated daily intake in mg/day

The highest level of thiobencarb in fish tissue collected by Fish and Game was 3,800 ng thiobencarb/gram fish tissue (3.8 ppm thiobencarb).

In a "worst case" situation assuming that (a) all fish caught in the Colusa Basin Drain during the rice growing season contain 3.8 ppm thiobencarb (b) fish comprise 1.08% of a human diet and (c) that these fish are consumed on a regular basis throughout the year, we arrive at the following calculations:

1.5 kg food x 3.8 ppm (residue in fish tissue) x 0.0108 (% in diet) = 0.0616 mg thiobencarb consumed per day

The Theoretical Maximum Residue Contribution (TMRC) of thiobencarb from other food sources is as follows:

<u>Food</u>	<u>% of Diet</u>	<u>Food Tolerance, ppm</u>	<u>TMRC mg/day</u>
Rice	0.55	0.2	0.0016
Meat	13.85	0.2	0.0414
Milk/Milk Products	28.62	0.05	0.0214
Eggs	2.77	0.2	0.0052
			<u>0.0726 mg/day</u>

FXXKp+

If the TMRC value of 0.0616 mg/day from eating fish (from the "worst case" situation) is considered, the TMRC increases to 0.1342 mg/day. This intake level does not exceed ADI of 0.60 mg/day.

It is estimated that the TMRC contribution from drinking 1.5 liters of Sacramento River water per day containing 20 ppb thiobencarb is 0.03 mg/day. If the contribution from drinking water is also considered, the TMRC is then increased to 0.1642 mg/day. Even with inclusion of drinking water containing thiobencarb, the ADI would not be exceeded.

At the TMRC of 0.1642 mg/day, it is estimated that fish tissue could contain up to 31.0 ppm thiobencarb and be consumed on a routine basis and not exceed the ADI of 0.6 mg/day.

Recent and accumulating toxicology data strongly suggest that the no-effect level of thiobencarb will be revised 5-fold higher resulting in an ADI of 3.0 mg/day*. A person then could consume 762 g (1.68 pounds) of Colusa Drain fish, containing 3.3 ppm thiobencarb, every day for life and not exceed the ADI. (This consumption rate assumes that fish comprises 50.8% of the normal human diet).

In summary, the use of BOLERO herbicide in rice culture in California does not pose a hazard to the aquatic community nor to people who might consume fish taken from rice drainage waters. Even if the use of thiobencarb were to increase in the coming years as proposed by Fish and Game, there is a more than adequate safety margin to prevent harm to aquatic organisms and humans.

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February 4, 1983

*Based on recently-completed in-life portion of rat lifetime feeding study run at Life Science Research. Histopathology will be completed by fall, 1983.

Memorandum

To : Mr. Jim Wells
Acting Assistant Director
Division of Pesticide Management,
Environmental Protection and Worker Safety
Department of Food and Agriculture
1220 N Street, Room A400
Sacramento, CA 95814

Date : February 11, 1983

From : STATE WATER RESOURCES CONTROL BOARD

Subject: REGISTRATION OF BOLERO

During the January 21, 1983, Pesticide Advisory Committee meeting, I presented to the Committee a potential new water quality concern not previously discussed by the Rice Pesticide Subcommittee, namely, bioaccumulation of Bolero^R (thiobencarb) in fish. This concern was also presented in the January 20, 1983, letter concerning registration of Bolero from W. Crooks (Executive Officer of the Central Valley Regional Water Quality Control Board) to Lori Johnston. This concern has recently received media attention. I would therefore like to clarify a few points to put this matter in its proper perspective.

1. Thiobencarb does bioaccumulate in fish residing in several of the agricultural drains in the Sacramento Valley during the 6-8 week period of Bolero application (see attached memo). Seasonal residue levels would be expected to increase above the 1982 values with greater usage of Bolero. In addition, DFG studies during 1980-82 indicate that fish residing in these agricultural drains accumulate molinate (Ordram^R) as well (see report by Finlayson, 1982). We do not, however, currently have similar residue data concerning Sacramento River fish. It should be noted that although Department of Fish and Game (Brian Finlayson) provided us (as well as DFA, DOHS and Chevron) with their preliminary field data (1982 monitoring results), they did not include comments concerning human health effects.
2. With respect to thiobencarb as a potential health hazard, an individual consuming 0.25 kg of fish containing 4 ug/g thiobencarb residue would ingest 1.0 mg/day of Bolero. This would exceed the maximum permissible level of daily intake (MPI). The MPI value for Bolero (.60 mg/day) was communicated to our staff by Nancy Rachman (Chevron Chemical Company). For a six week or greater period when the drain fishermen would be consuming these fish and a diet consisting of a greater proportion of fish than the EPA national average of 1.08 percent, could this level of exposure to thiobencarb be a potential human health hazard? If the concentrations of Bolero in fish

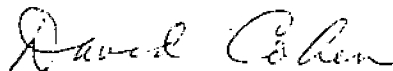
February 11, 1983

were to increase several-fold due to an increase in treated acreage, could this be of potential concern? Should a "safety margin" calculation take into account any potential additive or synergistic effects of molinate and thiobencarb since the presence of both herbicides in fish is known to occur? If, because of a lack of adequate information, there is reasonable doubt concerning the margin of safety, should the affected agricultural drains be restricted or closed to fishing during the 6-8 week use period of Bolero and Ordram? These are difficult, but important questions that need to be addressed in a comprehensive health risk assessment of Bolero.

3. I would like to reiterate that the State Board, as an active participant in your Department's Rice Pesticide Subcommittee, fully supports all of the subcommittee's recommendations contained in the memorandum of November 10, 1982, to George Reese.

At your suggestion, I am sending copies of this letter to Dr. Nancy Rachman of Chevron Chemical Company and Dr. Alex Kelter of DOHS for their comments and review.

If you have any further questions, please call me or Dr. John Cornacchia of my staff at 322-8401.



David B. Cohen, Ph.D., Manager
Toxic Substances Control Program

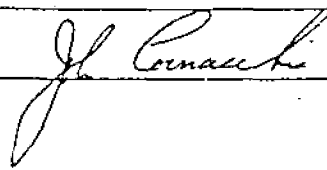
Attachment

cc: Ms. Nancy Rachman
ORTHO Chevron Chemical Company
940 Hensley Street
Richmond, CA 94804

Mr. Alex Kelter
Department of Health Services
714/744 P Street
Sacramento, CA 95814

INTERNAL MEMO

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TO: Dave CohenFROM: John CornacchiaDATE: February 10, 1983SIGNATURE: SUBJECT: BIOACCUMULATION OF BOLERO IN FISH

At your request, I have prepared an evaluation of available information concerning bioaccumulation of Bolero^R (thiobencarb or benthocarb) in fish. The data in my files indicates that Bolero concentrates in fish quite readily. The evidence for this comes from 3 sources including (1) two published studies by Saunders and Hunn (1982) and Kanazawa (1981); (2) Department of Fish and Game field studies, and (3) data submitted by Chevron to the Department of Food and Agriculture in support of registration. The following discussion is based on the first two sources.

The n-octanol:water partition coefficient (Pc) of a pesticide is often a useful indicator of its tendency to bioconcentrate (Figure 1). The bioconcentration factor (BCF) is expressed as the ratio of concentration of a chemical in the organism to that in water. Bolero, which has a Pc of 3.42, apparently has a higher bioconcentration factor than molinate (Ordram^R). Topmouth gudgeon (Pseudorasbora parva) exposed to a continuous flow of 5-20 ppb of Bolero for 14 days, had a BCF of 170 (Kanazawa 1981). A subsequent study by Saunders and Hunn (1982) using labeled Bolero (C¹⁴-Bolero) indicated that Bolero is absorbed rapidly into fish. Whole body residues in most species tested reached a maximum within 48-72 hours of exposure (Table 1). BCF values after 72 hours varied greatly between fish species tested ranging from 71 to 464. Both Kanazawa (1981) and Saunders and Hunn (1982) measured whole body residues. BCF values may differ for individual tissue such as muscle (edible portion).

Depuration of the radioactive residues in fish (presumably Bolero) was rapid. Fifty percent was eliminated after 1 day and 97 percent after seven days. However, it should be noted that depuration was measured in animals placed in clean (i.e., Bolero free) flowing water.

Field studies conducted in the Sacramento Valley by the Department of Fish and Game Pesticide Investigation Unit during 1982, confirmed that Bolero does indeed bioaccumulate in fish residing in the largest agricultural drains. Residue levels in muscle samples taken from live fish were as high as 2.8 ug/g (wet weight) and up to 3.8 ug/g from dead fish. This preliminary data was transmitted by DFG (Finlayson, personal communication) to the Department of Food and Agriculture (L. Johnston) in early January and to the Department of Health Services (J. Morehouse) last week.

A rough approximation of the field derived BCF values indicated that field BCF values were in a similar range as that observed in laboratory studies. The estimated time for completion of depuration of Bolero in fish residing in agricultural drains was not determined by DFG. However, assuming a rate of depuration similar to that reported by Saunders and Hunn (1982) fish in the agricultural drains probably eliminate Bolero within a month following the use period.

The Colusa Basin Drain, as well as the other large agricultural drains in the Sacramento Valley, is frequently used during the months of May and June for recreation and fishing. Previous work by DFG has demonstrated that Ordram also bioaccumulates in fish residing in the agricultural drains of the Sacramento Valley (Finlayson, et al. 1982). This raises the question whether there exists a potential human health hazard to fishermen consuming Bolero and Ordram laden fish. I recommend that you contact DFA and DOHS and request that a health-risk analysis be performed using an appropriate methodology.

References

- Finlayson, B. J., J. L. Nelson, and T. L. Lew. Colusa Basin Drain Monitoring Studies, 1980 and 1981. DFG Administrative Report 82-3 (1982).
- Sanders, H. O. and J. B. Hunn. Toxicity, Bioconcentration, and Depuration of the Herbicide BOLERO 8EC in Freshwater Invertebrates and Fish. Bulletin of Japanese Society of Scientific Fisheries. 48(8)1139-1143 (1982).
- Kanazawa, J. Measurement of the Bioconcentration Factors of Pesticides by Freshwater Fish and their Correlation with Physicochemical Properties or Acute Toxicities. Pesticide Science 12:417 (1981).

Figure 1 Relationship between the partition coefficients (PC) for 15 pesticides and the bioconcentration factors (BCF) for them by topmouth gudgeon: $r = 0.843$.

J Kanazawa (1981)

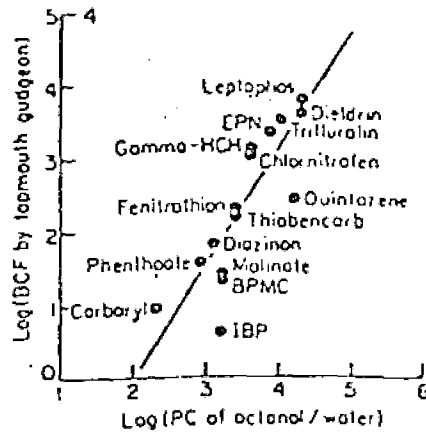


Table 1. Accumulation of ¹⁴C-Dieldrin BCC by four species of fish (Saunders and Hunn, 1982)

Species and mean water concentration ($\mu\text{g/l}$; SE in parentheses)	Whole body residues ($\mu\text{g/g}$) and bioconcentration factors* after different periods				
	1 day	2 days	3 days	4 days	5 days
Fathead minnow <i>Pimephales promelas</i> 28(2)	9.4 (336)	12.5 (446)	21.8 (464)	12.8 (457)	13.2 (471)
Channel catfish <i>Ictalurus punctatus</i> 25(0.9)	1.4 (48)	2.6 (89)	3.4 (120)	2.0 (70)	2.3 (80)
Bluegill <i>Lepomis macrochirus</i> 28(2)	1.6 (57)	1.9 (68)	2.0 (71)	2.4 (85)	2.6 (91)
Longear sunfish <i>Lepomis longichirus</i> 25(0.9)	8.2 (283)	8.3 (286)	8.6 (297)	8.5 (293)	9.6 (297)

* Residue values are means of three samples. Bioconcentration factor, in parentheses, is expressed as the ratio of the concentration in the organism (wet weight) to the concentration in water.

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David B. Cohen, Ph.D., Manager
Toxic Substances Control Program, WHRCB

March 14, 1983

Sacramento

William H. Crooks, Executive Officer
Central Valley Regional Water
Quality Control Board, SWRCB

Bolero

Your memorandum dated March 10, 1983 pertaining to the Bolero registration decision has been received.

One of the conditions of a final decision on the registration of Bolero was that the taste tests be completed and reviewed. We expect the recommendations of the Rice Pesticide Subcommittee to be fulfilled to the extent that a final decision can be made. Those recommendations are only a part of the total information to be assessed prior to a final decision.

Bolero has been placed on the Pesticide Registration and Evaluation Committee agenda for discussion at our March 18 meeting.

George A. Reese, Chief
Pesticide Registration and
Agricultural Productivity
322-5130

bc Lori Johnston
Barbara Bunn
Cheney/Levingston

SURNAME
50-105

Reese

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Memorandum

To : Mr. George Reese, Chief
Pesticide Registration and
Agricultural Productivity
Department of Food and Agriculture
1220 N Street, Room A-400
Sacramento, CA 95814

Date : March 10, 1983

From : STATE WATER RESOURCES CONTROL BOARD

Subject: BOLERO REGISTRATION DECISION

The 45-day public comment period on your Department's proposed decision to register Bolero ends March 11, 1983. Since a written report concerning the taste testing of Bolero in drinking water is not yet completed and will not be available until after March 11, 1983, we request that a decision on this registration be postponed until the taste test data and the Department of Health Services' assessment of the fish residue data can be reviewed by State and Regional Board staff.

Because of great public interest in the water quality and public health concerns surrounding this decision, it is important that these concerns be fully addressed prior to formal registration. The concerns were outlined in: (1) the November 18, 1982, recommendation by your Department's Rice Pesticide Subcommittee; (2) the January 20, 1983, letter to your Department from the Central Valley Regional Water Quality Control Board expressing its position on the registration review of Bolero; and (3) the February 11, 1983, State Water Resources Control Board letter to Jim Wells which reiterated our full support of DFA's Rice Pesticide Subcommittee recommendations and provided analysis of the fish residue data.

In view of the above, we request that the issue be placed on the agenda of the March 18, 1983, meeting of the Pesticide Registration and Evaluation Committee.

If you have any questions, please call us or Dennis Corcoran at 322-9879.



David B. Cohen, Ph.D., Manager
Toxic Substances Control Program
State Water Resources Control Board



William H. Crooks, Executive Officer
Central Valley Regional Water
Quality Control Board

Richard J. Jackson, M.D., M.P.H.
Alexander Kelter, M.D.
Anna Fan, Ph.D.
Community Toxics Unit
Epidemiological Studies Section
Department of Health Services
2151 Berkeley Way, Room 515
Berkeley, California 94704

March 17, 1983

Sacramento

Proposed Bolero Registration

Your recent memorandum concerning the registration of Bolero provided information and emphasis that will be helpful to us in finalizing a registration decision.

Considerable information has been submitted by concerned citizens, the agricultural community, the Legislature, and various state and local agencies. A decision will be made in the very near future. We are working diligently in evaluating all information, issues and concerns that require consideration before the final decision on Bolero registration can be concluded.

Thank you for sharing with us your comments on Bolero. We will advise you when the Bolero decision has been finalized.

George A. Reese, Chief
Pesticide Registration and
Agricultural Productivity
(916) 322-5130

bcc Lori Johnston
Barbara Bunn

8/11B/9

SURNAME
50-105

George A. Reese

R

Memorandum

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to : George A. Reese, Chief
Pesticide Registration & Agricultural
Productivity
Department of Food and Agriculture
1220 N Street, Room A-151
Sacramento, CA 95814

Date : March 9, 1983

Subject: Proposed Bolero
Registration

From : Community Toxics Unit
Epidemiological Studies Section
Toxic Substance Control Division
Berkeley ATSS 571-2669

The Department of Health Services' Community Toxics Unit has reviewed the toxicity of the herbicide Bolero (benthiocarb). A review of the findings and our concerns will be presented in this memorandum. Since our review relates to our overall roles and responsibilities on the California Department of Food and Agriculture's (CDFA's) Pesticide Advisory and Registration Committees, we will first discuss three selected issues raised by this proposed registration which are disturbing because of the precedents they may establish, namely:

1. Conditional registrations based on incomplete toxicologic data require that major policy decisions be made about the entry of new chemical substances into the occupational and non-occupational environments without the full reassurances normally provided to us by a complete data package, as would be submitted as required under the full CDFA pesticide registration process. New conditional registrations were to have been phased out by your Department late last year, however, for specific emergencies they continue to exist.
2. A precedent is established when a pesticide that can have adverse effect on the quality of life, for example, reduction of drinking water quality, is permitted entry into the environment. Sacramento water consumers derive no benefit from the Bolero use. Yet, they will be required to bear certain of the social costs of the use of Bolero--a substance without which rice has been cultivated for many years. It is also a precedent to require that a local water supply system treat its water chemically in order to prevent a man-made taste and odor problem. The impact of such a precedent could, for example, be seen in the re-registration of DBCP--a fumigant with cancer-causing potential that has leached into underground drinking water supplies--with the result that the affected communities will have to treat their water with activated charcoal.
3. There is also precedent in allowing the use of a substance whose adverse effects cannot be mitigated on-site. In the past, your Department has exerted efforts to control the potential adverse effects of a pesticide, such as the neurotoxicity of organophosphates, by instituting on-site control measures such as reentry intervals. There is no evidence to date

that suggests that the adverse effects on drinking water quality will be controlled at the point of exit of the Bolero from the rice fields. Will the approval of this registration lead to relaxation of other restrictions on the off-site migration of pesticides, such as by aerial spraying?

These three concerns about precedents being established which may be harmful to the health of the public are serious, and they should be taken into account in the registration decision-making process.

Review of toxicology data

The review of the available data related to the mammalian toxicity of Bolero indicates that technical grade Bolero has a no observable effect level (NOEL) of 20 parts per million (ppm) in rats in a chronic feeding study. This level is significantly greater than the levels expected to occur in the Sacramento River. Thus, we expect no acute health effects resulting from exposure to concentrations of 10-20 parts per billion (ppb) of Bolero in water beyond those that might be associated with the unacceptable taste and odor.

Teratogenicity Studies

In terms of teratogenicity testing our staff reviewed data from two studies. The first study was performed by Science Applications Incorporated. Technical grade Bolero was tested for its teratogenic potential in rats administered 0, 5, 25, or 150 mg/kg/day of Bolero by gavage. No teratogenic effect was noted at any level, although at the highest dose level, 150 mg/kg/day, a significant decrease in mean fetal weight and an increase in sternebral variations were noted. These changes are not considered to be teratogenic effects. Our toxicologist feels that this was an adequate study and that no teratogenic effect was found in the rat.

Data from a second study performed by the Industrial Bio-Test Laboratories, Inc. (IBT) was not on file at CDFA and was provided by Chevron Chemical Company. As you know, many of the IBT studies have been discredited which led to two further reviews of this study. The first review, performed in 1979 by Bob West Associates, Inc., indicated that existing data supported the conduct and findings of the IBT study which reported no teratogenic effects. The second review was done at the Environmental Protection Agency's (EPA's) request in 1981 by Clement Associates, Inc. These reviewers rejected the validity of the study because of various deficiencies and discrepancies noted, with the primary deficiency being the lack of raw data to substantiate the study. Their conclusion was that the study results were invalid.

Our toxicologist's review of the IBT study indicates that data were provided for rabbits exposed to thalidomide, which were the positive controls. There was no teratogenic effect noted from Bolero treatment at any of the dose levels tested. Based on our review of this data, we are uncomfortable in accepting any conclusion about this study. However, if one were to assume that the study were valid, our toxicologist concluded that Bolero was not a teratogen in this study.

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Because of concerns about the validity of the IBT study, a new rabbit teratology study is underway, with a final report expected in late 1983.

Reproductive Study

A two-generation reproductive study is now in progress. The pilot study in which the animals were dosed at 5, 25, and 50 mg/kg/day has been completed. At the 50 mg/kg/day level, there was a significant decrease in male body weight during the two-week prenatal treatment. No other adverse effect was noted. Following the pilot study, a full study started, the first generation of which has been completed. In this study, animals had been dosed at the 0, 2, 10, and 40 mg/kg/day levels. The status report on this first generation of animals exposed from the pre-mating period through gestation and through weaning showed no adverse effects. Randomly selected animals were sacrificed with postmortem findings were sporadic. At the high dose level, the survival index of the offspring for the 0-4 day period was significantly different from that of the controls. The full study is nearing completion. Given the doses used and the preliminary data, it would appear that no human health impact would be expected from a Bolero residue of 10 ppb in drinking water.

Mutagenicity Studies

The mutagenic potential of Bolero was evaluated in two assay systems--the Ames test in Salmonella typhimurium and the dominant lethal study in mice.

In both the spot test and the plate incorporation test, Benthocarb Technical and Benthocarb were toxic to S. typhimurium at dose levels of 50 ug/plate or higher. At the nontoxic levels of 1-33 ug/plate, the test materials were not mutagenic, with or without metabolic activation. Only three strains were tested.

In the dominant lethal study, mice were given Bolero by gavage as a single dose of 600 mg/kg, or as five daily doses of 33, 100 or 300 mg/kg. Pregnancy rate, implant number, and implant deaths were noted. No effects were observed following the acute exposure. Subacute administration did not produce dose-related effects on the parameters observed.

Chronic and Oncogenicity Studies

A mouse oncogenicity study has been completed. Results showed no evidence of oncogenic response attributable to treatment with Bolero Technical at 0, 25, 100, 400, and 1600 ppm mixed in the diet. Animals treated at 1600 ppm had a reduction in body weight gain, particularly in the females. Food consumption and food conversion efficiency were reduced marginally. Pathological findings noted at the high level were of doubtful toxicological significance and there was no other definite evidence of toxic response.

Available findings reported on a combined oncogenicity and chronic toxicity study with Bolero Technical administered to rats in the diet indicated dose-related reductions in food consumption and body weight gain at all dose

levels. The concentrations used were 0, 20, 100, and 500 ppm. At the highest level, there were inferior food utilization efficiency, slightly elevated serum urea concentrations, and lower serum alkaline phosphatase activities. The decreases in food consumption and body weight gain were consistent with the unpalatability of the test material to rats. Other serum biochemistry changes were noted at 100 ppm, but the toxicological significance of these changes is difficult to assess in the absence of complete histopathological findings. An interim report for the 0- to 52-week period indicated no pathological or neoplastic findings associated with the treatment with Bolero. On the basis of the absence of toxicity at 20ppm, this level is presently regarded as the no toxic effect level. Complete histopathology is expected in fall, 1983.

Fish Bioconcentration Data

We have reviewed the literature and the information from the California Department of Fish and Game (CDFG) on the determination of Bolero residues in fish sampled from certain agricultural drains. The bioconcentration factor (BCF) in aquatic organisms is reported in the literature as ranging from 17 to 471. The BCF in the Fish and Game data is somewhat similar, ranging from 9 to 311. In terms of bioaccumulation, a BCF of less than 100 is considered negligible, a BCF of greater than 100 and less than 500 may be considered appreciable, and a BCF greater than 500 would be of concern.

The highest concentration of Bolero found in fish caught in the agricultural drains was 3.8 ppm as measured in the muscle of carp. This level can be used to estimate the potential exposure to individuals consuming fish taken from the agricultural drains. Although the EPA suggests a figure of 1.08% as the amount of fish in the human diet, we understand that much high consumption practices are not unlikely since many people camp along these areas and fish for carp, catfish, etc. We have, therefore, developed our estimates on the premise that fish comprise the main portion of their diet. Our estimations of Bolero intake from fish consumption are as follows:

	Amount of Fish	Fish Residue CDFG	Bolero intake, human
1	0.25 kg/day	4 ppm*	1 mg/day
2	0.2 kg/day	4 ppm	.8 mg/day
3	0.15 kg/day	4 ppm	.6 mg/day
4	0.1 kg/day	4 ppm	.4 mg/day

* 3.8 ppm rounded to 4.0 ppm

These figures indicate that an individual consuming between 1/3 to 1/2 pound of fish daily would exceed the acceptable daily intake (0.6 mg/day) proposed by Chevron.

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In addition, the water quality data provided by CDFG indicate that concentrations of Bolero were as high as 170 ppb in the Colusa Basin Drain in 1982. Assuming similar levels will be reached during this use season and the CDFG's maximum DCF of 311, fish residues could be as high as 53 ppm.

$$\begin{aligned}\text{Residue} &= \text{BCF} \times \text{Conc. in Water} \\ &= 311 \times 170 \\ &= 53 \text{ ppm}\end{aligned}$$

Although this is a worst case example, it does serve to point out that the potential does exist for very high fish residues. Further compounding the problem is the fact that the Bolero concentrations in the agricultural drains and the Sacramento River are expected to increase as Bolero use replaces that of its competitor. This could result in concentrations reaching levels of several hundred parts per billion in subsequent years. Since our review of the bioconcentration data indicates that it is likely that persons consuming fish from certain of the agricultural drains would consume Bolero residues in excess of Chevron's own maximum permissible intake, our Department would have to consider, at the least, that a warning be issued to persons fishing along such agricultural drains that they not consume more than small amounts of these fish during the spring and summer months when it is likely that water residues of Bolero would be considerable.

In regard to organoleptic testing, Department of Health Services staff are following the protocols being developed by Chevron. We note with concern that one of the Rice Herbicide Subcommittee's recommendations was that the determination of the actual chemical agent responsible for the off-taste in drinking water should be done. Neither of the protocols currently submitted by Tragon Corporation to Chevron for organoleptic testing meet this requirement. We urge that this specific organoleptic testing be done.

We make the following recommendations; namely:

1. Both of our agencies and other agencies as appropriate should continue to track the progress of the toxicological studies noted in this memorandum. We hope that CDFA staff will review the full oncogenicity study.
2. The organoleptic testing protocol should proceed as outlined. Actual determination of the chemical substance causing the off-taste should be established. In addition, it may be necessary to conduct a taste-testing study to determine treatment effectiveness at doses higher than the currently proposed 10 ppb level if higher levels should be appear in the Sacramento river.
3. We doubt that the six-day holding time is adequate to enhance on-site degradation of the Bolero. We recommend vigorous enforcement of the recommended holding time in conjunction with the environmental sampling program.

4. We hope that the oxidation of the Bolero sulfoxide will remove the taste problems in water. Any reappearance of taste problems in the Sacramento drinking water should result in the prompt curtailment of the use of Bolero. If Bolero is subsequently incriminated, this must be assumed as de facto evidence of the inability to mitigate drinking water degradation problems.
5. We urge an extensive monitoring program to detect rice herbicides and their metabolites in the Sacramento River, in specific agricultural drains, and on-site at certain of the rice fields. We are concerned by the lack of evidence concerning degradation rates onsite and wish to have better evidence to indicate whether a six-day holding is adequate. In addition, monitoring of fish species to determine residual concentrations should be conducted.
6. If use of Bolero were to increase, we recommend that the monitoring program continue beyond 1983.

In summary, we cannot oppose this registration on purely toxicologic grounds. Despite this, we perceive that the registration of Bolero would be a poor decision both in terms of public health precedent, namely, the requiring of treatment of drinking water for removal of a man-made and unnecessary contaminant, and in terms of agricultural precedent, namely, the surrender of the goal of keeping the adverse effects of pesticides onsite, and not on workers, nearby residents, consumers, and the environment.

R.J. Jackson b, 4.k.
Richard J. Jackson, M.D., M.P.H.

Alex Kelter
Alexander Kelter, M.D.

Anna Fan b, 4.k.
Anna Fan, Ph.D.

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Table 1 Contribution of various parameters to human Bolero intake

Fish Consumption

	Amount of Fish	CDFG Data Fish Residue	Bolero intake, human
1	0.25 kg/day	4 ppm	1 mg/day
2	0.2 kg/day	4 ppm	.8 mg/day
3	0.15 kg/day	4 ppm	.6 mg/day
4	0.1 kg/day	4 ppm	.4 mg/day
(Literature)			
5	.25 kg/day	11 ppm	2.75 mg/day
6	0.2 kg/day	11 ppm	2.2 mg/day
7	0.15 kg/day	11 ppm	1.65 mg/day
8	0.1 kg/day	11 ppm	1.1 mg/day
CDFG Data			
9	0.1 kg/day	53 ppm	5.3 mg/day

Water Consumption

	Amount	Bolero conc.	Bolero intake, human
1	2 liters/day	33 ppm (1st rough estimates) coming years	0.06 mg/day
2	2 liters/day	20 ppb (Last year) Chevron	0.04 mg/day
3		6 ppb (Last year) (CDFG)	0.012 mg/day

C Food Consumption

1		0.0726 mg/day
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MPI = Maximum permissible intake.
MPI = 0.6 mg/day (60 kg person)

**ORTHO**Chevron Chemical Company
940 Hensley Street, Richmond, CA 94804

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March 10, 1983

Research and Development
Agricultural Chemicals Division

Mr. G. A. Reese, Chief
Pesticide Registration
California Department of Food &
Agriculture
1220 N Street
Sacramento, CA 95814

Dear Mr. Reese:

In accordance with the public report posted January 26, 1983, Chevron Chemical Company submits comments on the proposed action to conditionally register BOLERO 10G. Chevron agrees to comply with the conditions regarding the rat reproduction study, the rat oncogenicity study, and fish toxicity data. The following comments are according to the points recommended for resolution by the Rice Pesticides Subcommittee.

1. The Department of Health Services and the California Department of Food & Agriculture/Worker Health and Safety unit have both certified as to the lack of hazard to the Sacramento city domestic water. Those determinations are contained in the CDFA letter of December 7, 1982 to the city engineer and the DOHS memorandum of January 4, 1983 to CDFA.
2. It is not possible at this time to identify the cause of the taste problem in the Sacramento city water as it occurred during 1981 and 1982. When this recommendation was written by the Subcommittee it was assumed that BOLERO was the specific and sole cause of the taste problem. It has subsequently been shown that that assumption may not be valid. To require that Chevron identify the cause of the problem regardless of source is not a reasonable requirement or recommendation.

What Chevron will do is determine if BOLERO causes an off-flavor and if it does what can be done to remove it. Results of taste tests completed March 4 will be provided to CDFA on or about March 14, 1983. We plan to conduct additional studies during May and June 1983. Our consulting experts tell us that these studies cannot be run now since the conditions of the river (organic contaminants, temperature, etc.) are probably too much different and there is high likelihood that the reported off-taste is due to a combination of factors. The best possibility for duplicating the 1981 and 1982 experience is to conduct definitive studies during the same seasonal time frame. Further, to do these studies with good scientific validity, we are informed that it is necessary to have trained professional tasters evaluate the water just prior to and during the rice herbicide use season, compare the taste profiles and identify the sources of any differences. We have asked our contractor to develop a protocol for this extensive descriptive taste test work and will provide it to you before May 1, 1983.

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Mr. G. A. Reese, Chief

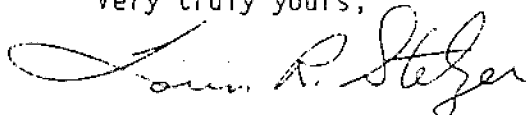
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March 10, 1983

3. As indicated above, the appropriate flavor evaluation studies are currently in progress that will demonstrate the ability of a treatment process to completely mitigate any off-flavor that may be caused by BOLERO. I understand that the City of Sacramento has agreed that the chosen treatment method is feasible if we demonstrate that it is effective in respect to thiobencarb.
4. Chevron has offered financial assistance to the City of Sacramento regarding point 3 above.
5. Chevron is continuing to work with the California Department of Fish & Game to finalize protocols on aquatic toxicology. The laboratory fish studies are in progress according to detailed protocols as discussed in the CDFA and CDF&G. Field studies including the analysis for residues in fish tissues will be discussed with CDF&G on March 15, 1983. Monitoring studies including water residue analyses in water from the rice fields, agricultural drains, and the Sacramento river will be done. Detailed protocols will be submitted as soon as we have them and certainly before May 1, 1983.

Chevron Chemical Company believes that it has satisfied all the regulatory requirements for the registration of BOLERO 10G in California. Further, we have responded to all the requests and recommendations of the Rice Pesticides subcommittee. We expect that the CDFA final decision to register BOLERO 10G will be announced on March 11, 1983.

Very truly yours,



Lorin R. Stelzer, Manager
Registration & Regulatory Affairs

LRS:db

