1. CHEMICAL:

Common name: Zinc Borate

Structure: $2ZnO \cdot 3B_2O_3 \cdot 3.5H_2O$

Physical/Chemical properties:

formula weight: 434.66
solubility: Less than 0.28 wt.% in water at 25°C.

2. TEST MATERIAL:

a. Flexible PVC plastic impregnated with BOROGARD ZB (100% zinc borate) at 30 phr.

b. Acrylic paint formulation containing 1.0 pound/gallon of BOROGARD ZB (100% zinc borate).

3. STUDY/ACTION TYPE:

Evaluate leach rate studies of zinc and borate ions from a polyvinyl chloride (PVC) shower curtain formulated to contain zinc borate, and from an acrylic latex topcoat paint formulation into which zinc borate had been incorporated.

4. STUDY IDENTIFICATION:

Ourisson, Philippe. "Zinc and Borate Ions: A Leaching Study with BOROGARD ZB." Performed by Centre Analytical Laboratories, Inc. Laboratory Project ID: QAI No. 640-501, completed on March 11, 1993. Submitted by U.S. Borax Inc. Received by EPA on March 18, 1993. MRID #: 427004-01.

5. REVIEWED BY:

Dana Spatz
Chemist, CRS #2
EFGWB/EFED/OPP

Date: SEP 27 1993

6. APPROVED BY:

Mah T. Shamim, Ph.D.
Acting Section Head, CRS #2
EFGWB/EFED/OPP

Date: OCT 18 1993

7. CONCLUSIONS:

Leaching of zinc and borate ions from a polyvinyl chloride (PVC) shower curtain formulated to contain BOROGARD ZB (zinc borate) at the maximum rate recommended on the product label for application, and from an acrylic latex topcoat paint formulation into which BOROGARD ZB had been incorporated, was evaluated.

a. **Leach Rate Study With PVC Impregnated With BOROGARD ZB**

This study is acceptable and together with the acrylic paint study below, fulfills the data requirement imposed as part of the conditional registration of BOROGARD ZB (EPA Reg. No. 1624-120).

In distilled water at pH's 6, 7, and 9, the average release rate of zinc from the PVC over the 20-day exposure period was 1.3, 0.83, and 0.35 $\mu g/cm^2/day$, respectively. The release rate appeared to be pH dependent; decreasing with higher pH. This was expected since the solubility of zinc decreases with increasing pH. At pH 6, the average release rate remained fairly constant, whereas at pH 7 and 9, the rate decreased over time. After 20 days, the maximum amount of zinc leached was 1.3%.

In distilled water at pH's 6, 7, and 9, the average release rate of boron from the PVC over the 20-day exposure period was 1.4, 1.16, 0.86 $\mu g/cm^2/day$, respectively. The release rate was slightly higher at lower pH. After 20 days, the maximum amount of boron leached was 2.2%.

b. **Leach Rate Study With Acrylic Latex Paint Formulation Containing BOROGARD ZB**

This study is acceptable and together with the PVC study, fulfills the data requirement imposed as part of the conditional registration of BOROGARD ZB (EPA Reg. No. 1624-120).

The release rate for both zinc and boron was higher from the acrylic latex paint than from PVC. This was particularly true for boron. In distilled water at pH's 6, 7, and 9, the average release rate of zinc from the acrylic latex paint over the 20-day exposure period was 2.1, 1.2, and 0.28 $\mu g/cm^2/day$, respectively. The release rate appeared to be pH dependent; decreasing with higher pH. This was expected since the solubility of zinc

decreases with increasing pH. After 20 days, the maximum amount of zinc leached was 3.4%.

In distilled water at pH's 6, 7, and 9, the average release rate of boron from the acrylic latex paint over the 20-day exposure period was 19.4, 22.0, and 21.9 $\mu g/cm^2$/day, respectively. The release rate did not appear to be pH dependent and was significantly higher than in the PVC system. The release rates decreased from approximately 27 $\mu g/cm^2$/day at day 6 to approximately 12 $\mu g/cm^2$/day at day 20 at all three pH's. After 20 days, the maximum amount of boron leached was 30%.

8. RECOMMENDATIONS:

A condition of registration of zinc borate (BOROGARD ZB, 1624-120) required that an acceptable "product leaching study" be submitted that would qualitatively and quantitatively define leachates from finished end-use-products. All Environmental Fate data requirements for the use of the fungicide/biocide BOROGARD ZB as an additive in the plastic, coating, and wood composite products listed on the product label have been satisfied.

Under the conditions of the study, (i.e., pH 6, 7, and 9 at 35°C), borate ions and, to a lesser extent, zinc ions leached from the PVC and acrylic latex paint end-use-products. This data on the availability of zinc and boron provides exposure information that may be used for risk assessment purposes.

9. BACKGROUND:

BOROGARD ZB (zinc borate) is a free flowing, readily dispersible, white powder, that may be used as a corrosion inhibitor in both organic solvent-based and water-borne coatings, and as a preservative/fungicide in coating systems, plastic and rubber products, and wood composite materials. Currently, the only outdoor uses of BOROGARD ZB are polyolefin wire and cables, PVC tenting and awnings, and acrylic roof coatings. Zinc borate acts as a fungicide and mildewcide, preventing or retarding the growth of mildew-like fungi. Conditional registration was granted on July 15, 1991.

10. DISCUSSION OF INDIVIDUAL TESTS OR STUDIES:

**Materials and Methods**

The test substance was identified as BOROGARD ZB 12E5E8. Prior to the conduct of the leaching procedure, the test substance was digested for characterization. The characterization consisted of the determination of its concentration (in percent) of both B and Zn, as identification of the strength and purity of the test substance. Three samples of the test substance were analyzed on an Inductively Coupled Plasma Spectrophotometer (ICP) for Zinc (Zn) and Boron (B) concentration.

Two test systems were included in this study; one consisted of a standard plastic (PVC) and one was a top-coat paint. Each contained zinc borate in the form of BOROGARD ZB. These were evaluated for leaching of boron and zinc using an extraction cell and DI water (adjusted to three different pH values) as the extraction solvent.

Flexible PVC plastic was impregnated with BOROGARD ZB at 30 phr (parts per hundred parts polymer resin). This loading is typical of a PVC shower curtain formulation. The PVC plastic sheet was cut into samples measuring 3" x 1.25". The acrylic paint formulation contained 1.0 pound/gallon of BOROGARD ZB. The paint was spread on a flat teflon surface to obtain a paint dry film thickness of approximately 16 mils. After completely dry, the film was removed from the preparation surface, and cut into samples measuring 3" x 1.25". A full characterization of both formulations was made. The characterization was performed by an acid digestion of the test systems using an analytical microwave oven. The analysis was performed using an ICP spectrophotometer for the leachate samples. This procedure was used to measure the entire content of Zn and B in the samples. The PVC sample contained 15.7% BOROGARD ZB, or 4.7% Zn and 2.3% B. The acrylic paint contained 22.6% BOROGARD ZB in the dry film, or 6.8% Zn, and 3.4% B.

A total of 36 PVC and 36 paint strips (3 pH's x 4 time periods x 3 replicates) were placed in 60 ml polyethylene jars so that loosely curled crescents were formed. In addition, there were 9 additional jars in which no samples were placed (0-day). Jars were separated into 3 sets of 12 jars each for the PVC and paint samples, and 3 jars each for the 0-day jars.

50 ml of DI water (to which 2 ml/L of 1 M KCl was added to allow a reliable pH measurement to be taken), adjusted to pH 6.0 ± 0.25 was added to the 27 jars in the first set. The pH was adjusted using dilute NaOH or dilute HCl. The same

amount of water (and KCl) was added to the 27 jars in the next set, but with the pH adjusted to 7.0 ± 0.25. Lastly, the same amount of water (and KCl) was added to the 27 jars in the third set, but with the pH adjusted to 9.0 ± 0.25. Each sample was weighed. The plastic strips and acrylic paint strips were placed in the leaching solution, except the 0-day. A teflon-coated magnetic stir-bar was added to each sample, except the 0-day.

Each jar was capped with a teflon-lined cap and placed into a water bath maintained at 35°C ± 0.1°C. The 0-day jars were removed after one hour, and the digestion and analysis was conducted as described below. The pH of each solution was monitored each work day and adjusted as necessary. After about one week, the pH of the samples stabilized to the point where it was possible to only monitor the samples once every two working days, which was instituted after day 10 of the leaching.

Three jars were removed from each set (pH level) after 1, 6, 9, and 20 days and the leaching solution was digested and analyzed as described below. In order to determine if a steady state condition had been reached, the PVC or paint strips from the 20 day samples were placed into a fresh solution at the appropriate pH and re-exposed for an additional 6 days; the leaching solution was then digested and analyzed as described below. After the given days of exposure, the final pH of the solution in each jar was measured. The solution was filtered through a VWR 474 filter paper and collected in a pre-weighed flask. The test article and test vial were rinsed with small portions of DI water which were combined with the filtrate. The final volume was adjusted by weight to 100 ml (100 g) with DI water to standardize the final volume.

The sample was shaken, and exactly 50 ml of well-mixed sample was transferred to a teflon digestion vessel. To the sample was added 5.0 ml of concentrated $HNO_3$ and 5.0 ml of concentrated HCl. The sample was then digested in the microwave oven as described in the standard EPA method SW 846, method 3015. The sample was cooled and filtered. Sample volume was adjusted to 100 ml with DI water and analyzed by ICP.

11. COMPLETION OF ONE-LINER:

Amended as appropriate.

12. CBI APPENDIX:

Not applicable.

PROPOSED LABEL

# BOROGARD® ZB

## Corrosion Inhibitor, Biocide and Fire Retardent

For Use Only As a BIOCIDE (Fungicide/Preservative) Additive in the Manufacturing of, Coatings, Plastic and Wood Composite Products

ACTIVE INGREDIENT:

Zinc Borate ($2ZnO \bullet 3B_2O_3 \bullet 3.5H_2O$).....100.00%

KEEP OUT OF REACH OF CHILDREN

# CAUTION

PRECAUTIONARY STATEMENTS: Hazards to Humans and Domestic Animals. Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling. STATEMENT OF PRACTICAL TREATMENT: IF SWALLOWED, immediately contact a physician or Poison Control Center. If these are unavailable, give the victim 1 or 2 glasses of water and induce vomiting by touching back of throat with fingers. Do not induce vomiting or give anything by mouth to an unconscious person. IF IN EYES, flush with plenty of water. Call a physician if irritation persists. IF ON SKIN, remove contaminated clothing and wash skin with soap and water. IF INHALED, remove victim to fresh air.

### Environmental Hazards

Do not discharge effluent containing this product directly into lakes, stream, ponds, estuaries, oceans or public waters unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the Environmental Protection Agency.

DIRECTIONS FOR USE: Federal law prohibits use of this product in manner inconsistent with its labeling. Read BOROGARD® ZB Technical Data Sheet for formulation details.

### Storage and Disposal

Do not contaminate water, food or feed by storage or disposal.
STORAGE: Store in a dry place. Do not store where children or animals may gain access.
BOROGARD® ZB DISPOSAL: Wastes resulting from the use of the product may be disposed of on site or at an approved waste disposal facility.
CONTAINER DISPOSAL: Completely empty by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application equipment. Then dispose of liner in a sanitary landfill or by incineration if allowed by state and local authorities. If drum is contaminated and cannot be reused, dispose of in the same manner.

A 20 MULE TEAM® Product

Manufactured By
United States Borax & Chemical Corporation
3075 Wilshire Blvd. Los Angeles, CA 90010
Emergency Phone: 714-774-2673

EPA Est. 1624-CA-01
EPA Reg. No. 1624-120


CAS No. 12447-61-9 (12513-27-8)
TSCA No. 1332-07-6

Net Contents: 50 lbs. (22.7kg)

11/91

# PROPOSED TECHNICAL DATA SHEET

## BOROGARD® ZB

### GENERAL USE INSTRUCTIONS

BOROGARD® ZB is a free flowing, readily dispersible, white powder, which does not detract from bright colors or pure whites Its optimum performance as a corrosion inhibitor, biocide (in-can preservative and fungicide) and fire retardant is obtained whe BOROGARD® ZB is uniformly dispersed in coatings or resins. Therefore, it should be incorporated during the pigmen dispersion cycle in the coating preparation process.

CORROSION INHIBITOR APPLICATIONS

BOROGARD ZB is a unique form of zinc borate which can be used as a corrosion inhibitor in both organic solvent-based an water-borne coatings. BOROGARD ZB allows the formation of economical high performance coatings effectively without th use of chromium, lead or barium-based pigments. It may be used effectively as an equal weight replacement for zinc chromat in many formulations.

Synergistic enhancement of performance has also been noted for combinations of zinc borate with common corrosion inhibitiv pigments such as zinc phosphate and barium metaborate. The formal water of hydration of BOROGARD ZB is bound in nonreactive form and is retained at temperatures above 500°F, thereby allowing this product to be used in high temperatur baking systems. A good starting point formulation is 0.5-2 lb/gal. of BOROGARD ZB.

BIOCIDAL (IN-CAN PRESERVATIVE AND FUNGICIDE) APPLICATIONS

Coating Systems:
BOROGARD ZB (EPA Registration No. 1624-120) can also function as an in-can preservative and fungicide. It controls mixe fungi such as Aspergillius niger, Penicillium funiculosum, Chaetomium globosum, Glicocladium vivens and Aureobasidiu pullulans. It is also an effective in-can paint preservative for controlling bacteria such as, Acinetobacter sp., Corynebacteriu pseudodiphtheriticum, Enterobacter aerogenes, Pseudomonas aeruginosa, Pseudomonas putida and Staphylococcus epidermidis. A good starting point formulation is 0.5-1.0 lb/gal. of BOROGARD ZB in coatings.

Plastic and Rubber Products:
BOROGARD ZB controls mixed fungi such as Aspergillius niger, Penicillium funiculosum, Chaetomium globosum, Glicocladium vivens and Aureobasidium pullulans. The effective additive level is dependent on fungal susceptibility of the product, as well as the ultimate conditions for the use of the product. For interior applications, such as, PVC carpet-backing, wall coverings, auto upholstery, shower curtains, and urethane mattresses, a loading of 3-20 phr of BOROGARD ZB i recommended. For exterior applications, such as, polyolefin wire and cables, PVC tenting and awnings, acrylic roof coatings. 3-30 phr of BOROGARD ZB is recommended.

Wood Composite Materials:
BOROGARD ZB is an effective preservative for wood composite materials. BOROGARD ZB can be used as an additive in th manufacturing of wood composite materials in order to prevent the growth of "white" (Trametes versicolor) and "brown" (Gleophyllum trabeum) rot. BOROGARD ZB should be combined with the plastic resin and wood particles before the mixture sets. The loading of the BOROGARD ZB additive must not exceed 1 % by weight.

**FORMULA:** $2ZnO \bullet 3B_2O_3 \bullet 3.5H_2O$

% ZnO (theo.) .....37.45
% $B_2O_3$ (theo.) .....48.05
% $H_2O$ (theo.) .....14.50

**CAS No:** 12447-61-9 (12513-27-8) / **TSCA No:** 1332-07-6

**FORMULA WEIGHT** .....434.66

**COLOR:** White

**REFRACTIVE INDEX** .....1.58

**PARTICLE SIZE:** Mean particle size is typically in the range of 2 to 4 microns.

**CRYSTAL DENSITY** .....2.8 $g/cm^3$

**BULKING DENSITY** (Loose pack, typical).....25-40 $lb/ft^3$

**SOLUBILITY:** Less than 0.28 wt.% in water at room temperature. Can be hydrolyzed by strong acids and bases.

**OIL ABSORPTION** .....30g oil/100g
(ASTM 281-84)

**CONTAINERS**
Multiwall paper bags with a polyethylene moisture-resistant film barrier, 50 pounds (22.68kg) net; fiber drums with polyethyl liner, 250 pounds (113.4 kg) net.

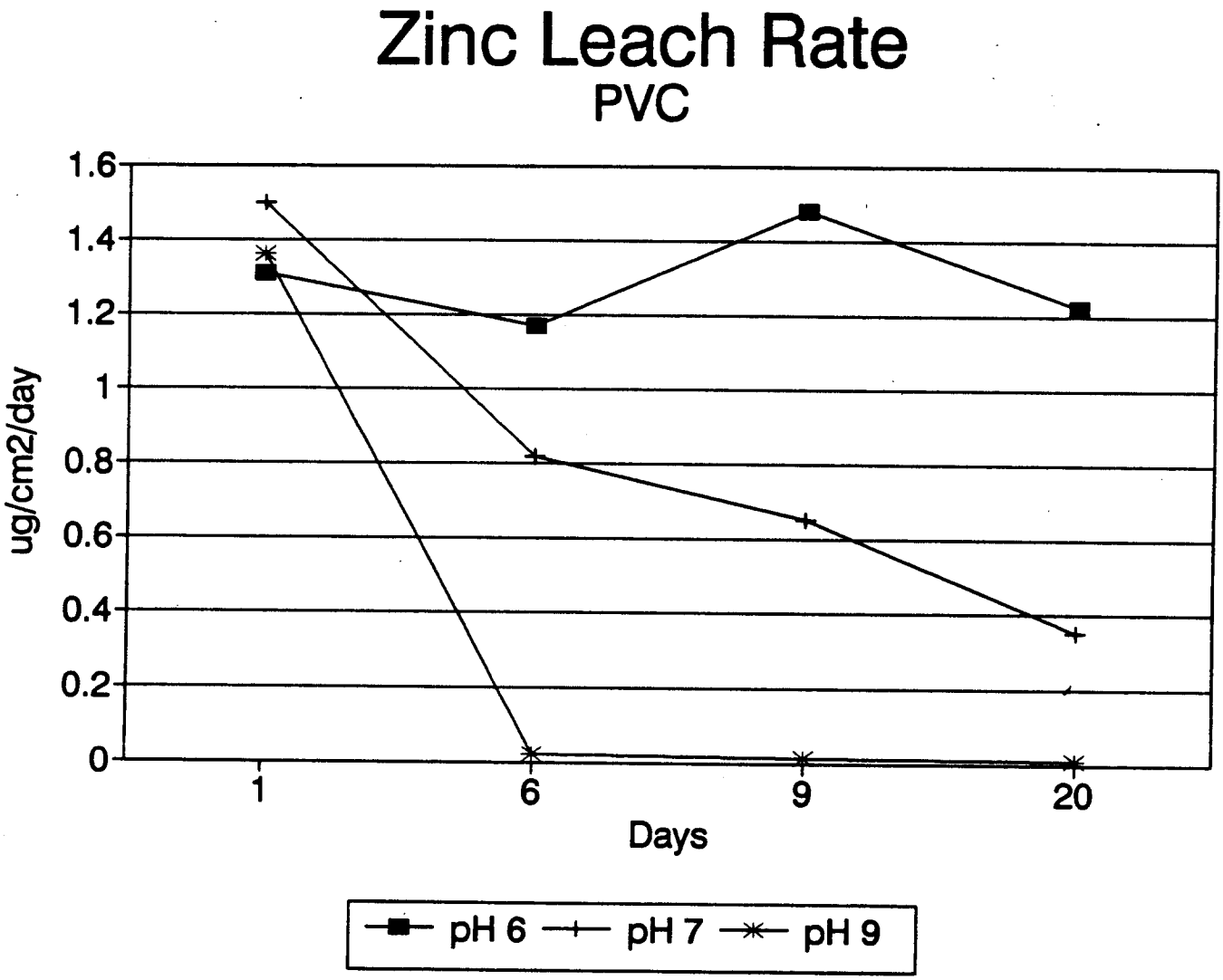
BOROGARD® is a registered trademark.

**NOTICE: THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED INCLUDING ANY WARRANTY OF FITNE FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THE DESCRIBED USED IN THIS BULLETIN.**

**WARNING: ON ALL PRODUCTS, AVOID PROLONGED INHALATION OR PROLONGED SKIN CONTACT. N FOR FOOD OR DRUG USE. READ MATERIAL SAFETY DATA SHEETS AND ALL INSTRUCTIONS RELATI TO THE PRODUCTS BEFORE USE.**

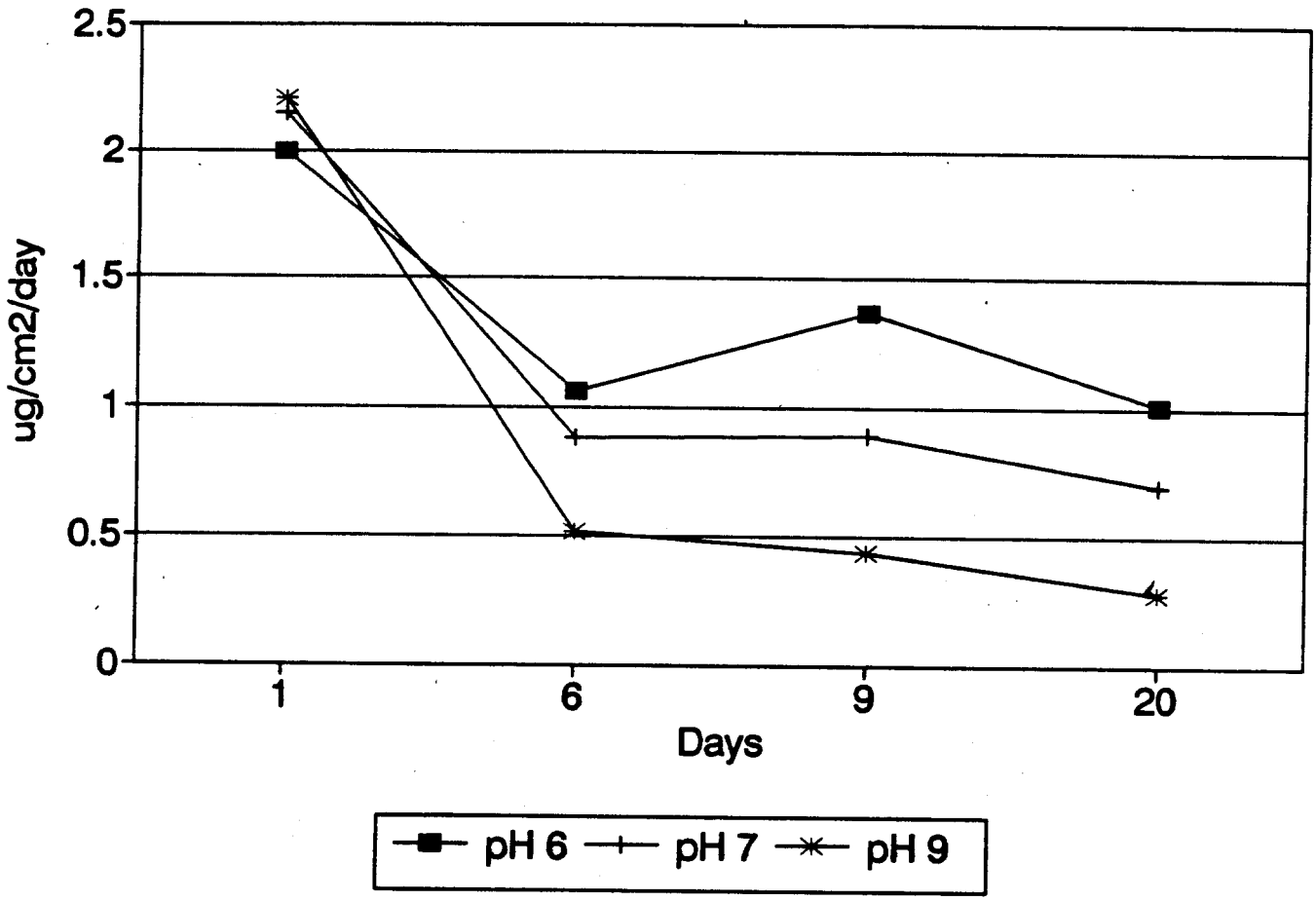
If possible uses of these products have been mentioned herein, it is not intended that the above products be used to practice applicable patent, whether mentioned in this Bulletin, or not, without procurement of a license, if necessary, from the own following investigation by the user. Nor is it intended or recommended that the products be used for any such described purpo without verification of their safety and efficacy for such purposes.

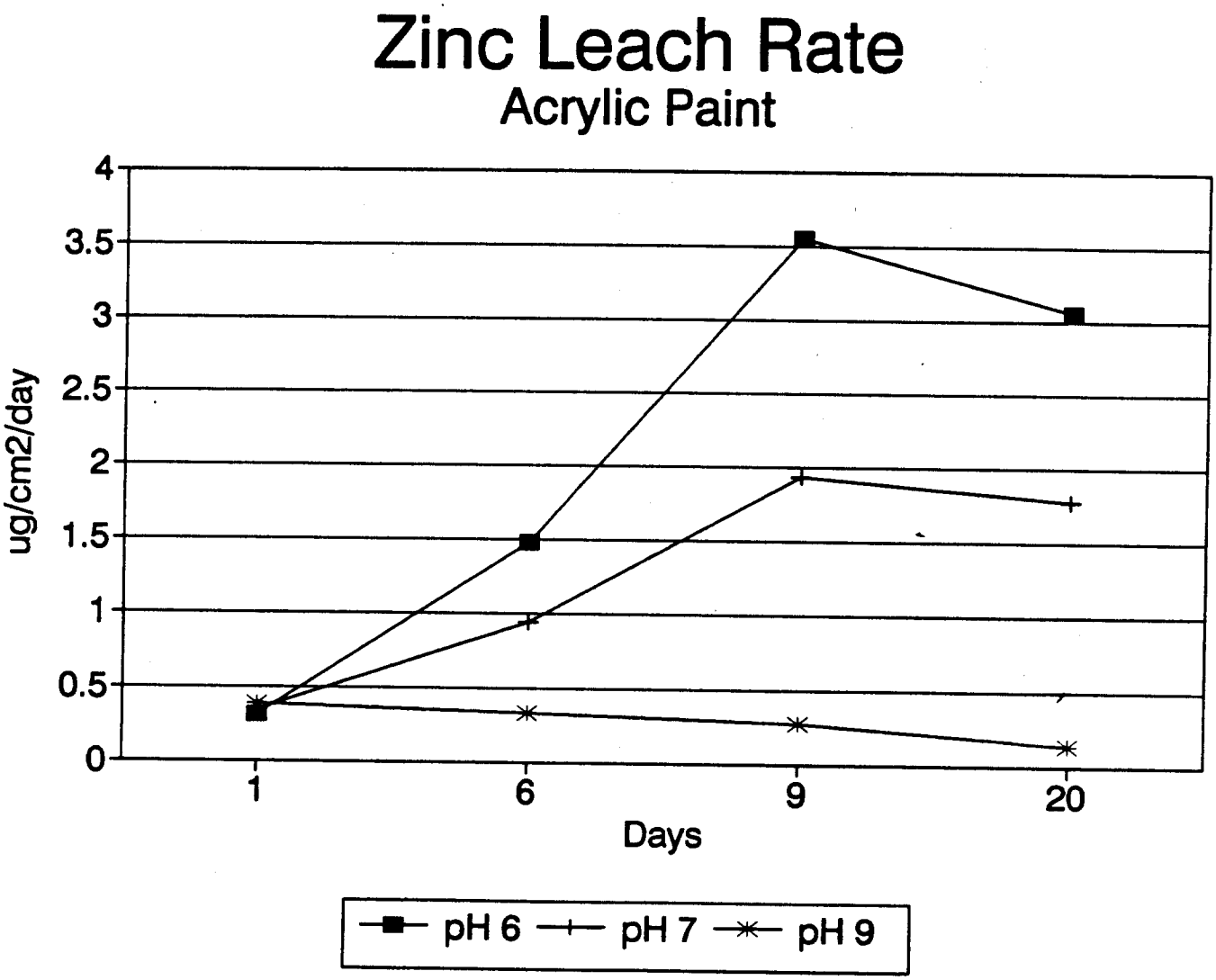
Our recommendations for use of this product are based upon data believed to be reliable. The use of this product being beyo the control of the manufacturer, no guarantee, expressed or implied, is made as to the effects of such or the result to be obtai if not used in accordance with directions or established safe practice. The buyer must assume all responsibility, including inj or damage, resulting from its misuse as such, or in combination with other materials.

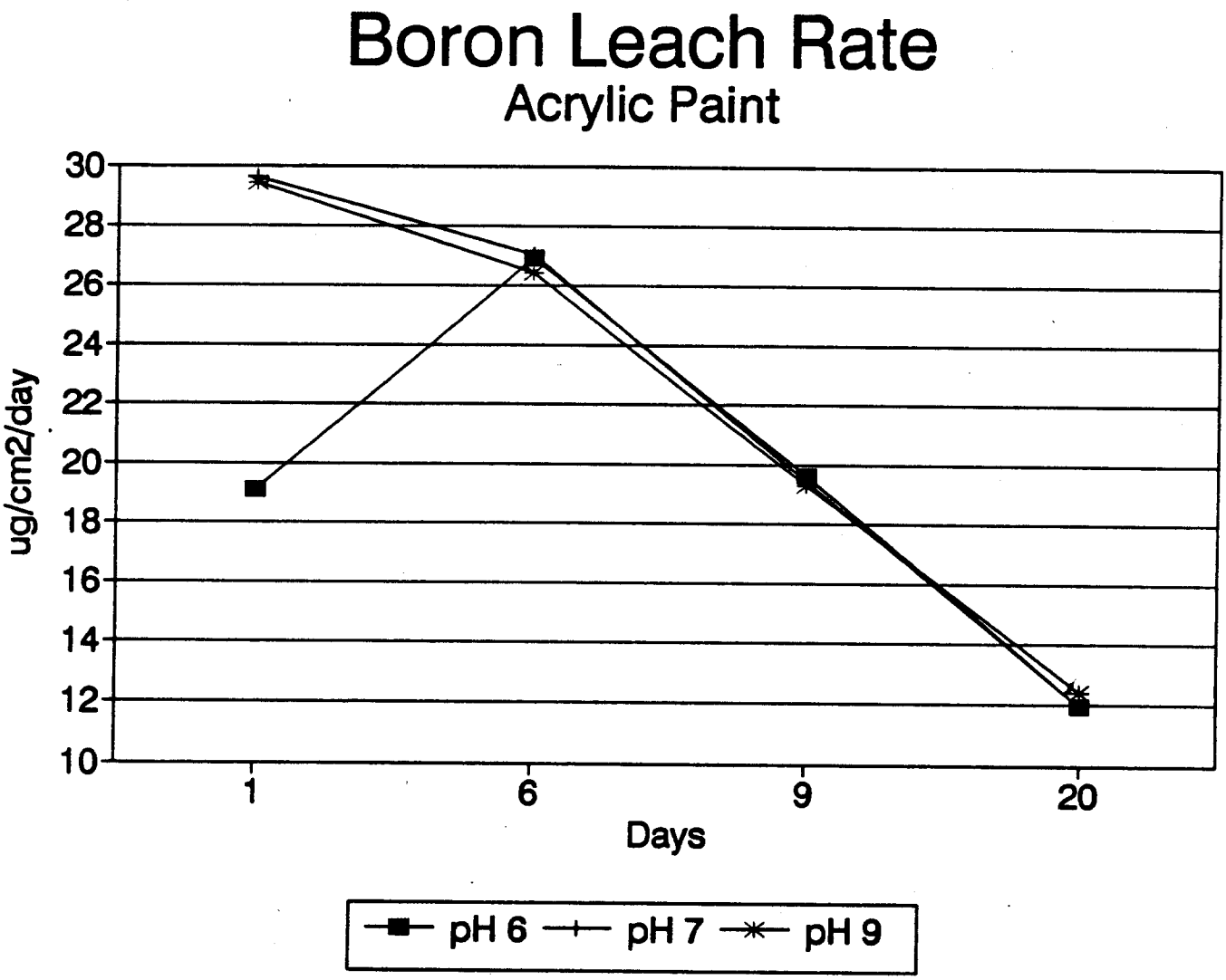

Zinc Leach Rate
PVC
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
ug/cm2/day
1
6
9
20
Days
pH 6
pH 7
pH 9

# Boron Leach Rate

## PVC




Zinc Leach Rate
Acrylic Paint
ug/cm2/day
4
3.5
3
2.5
2
1.5
1
0.5
0
1
6
9
20
Days
pH 6
pH 7
pH 9


Boron Leach Rate
Acrylic Paint
30
28
26
24
22
20
18
16
14
12
10
ug/cm2/day
1
6
9
20
Days
pH 6
pH 7
pH 9

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_____ Identity of product impurities.

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_____ Identity of the source of product ingredients.

_____ Sales or other commercial/financial information.

_____ A draft product label.

_____ The product confidential statement of formula.

_____ Information about a pending registration action.

✓ FIFRA registration data.

_____ The document is a duplicate of page(s) _____.

_____ The document is not responsive to the request.

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