INTERIM CHEMICAL REVIEW COMMITTEE
First session
Geneva, 21-25 February 2000
Item 6 of the provisional agenda*

CONSIDERATION OF DRAFT DECISION GUIDANCE DOCUMENTS REFERRED TO THE INTERIM
CHEMICAL REVIEW COMMITTEE BY THE INTERGOVERNMENTAL NEGOTIATING COMMITTEE
FOR THE FOLLOWING FOUR CHEMICALS: ETHYLENE DICHLORIDE, ETHYLENE OXIDE,
MALEIC HYDRAZIDE AND BROMACIL

Note by the secretariat
Addendum

Annexed to the present addendum is the draft decision guidance document
for the following chemical:

<table>
<thead>
<tr>
<th>Chemical</th>
<th>CAS number</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromacil</td>
<td>314-40-9</td>
<td>Pesticide</td>
</tr>
</tbody>
</table>

* UNEP/FAO/PIC/ICRC.1/1.
Annex

PIC - Decision guidance document for a banned or severely restricted chemical

Bromacil

**Common name**  Bromacil (ISO)

**Other names/synonyms**  5-bromo-3-sec-butyl-6-methyluracil (IUPAC); 5-bromo-6-methyl-3-(1-methylpropyl)-uracil; 5-bromo-6-methyl-3-(1-methylpropyl)-2,4(1H,3H)-pyrimidinedione (CA); Pyrimidinedione.

**CAS No.**  314-40-9

**Use category**  Pesticide

**Use**  Bromacil is a herbicide used for brush control on non-cropland areas. It is especially effective against perennial grasses. It is also used for selective weed control in pineapple and citrus crops.

**Trade names**  Borea, Bromax 4G, Bromax 4L, Borocil, Rout, Cromptex; Cynogan, Du Pont herbicide 976; Isocil; Hyvar L; Hyvar X; Hyvar X 80W; Hyvar X-L; Hyvar XL 2L; Hyvarex; Krovar II; Nalkil; OnyxBorocil 1V; Uragan; Urox 'B'.

**Formulation types**  Granules (GR), soluble concentrate (SC), and wettable powder (WP) formulations.

**Basic manufacturers**  Du Pont Agricultural Products.

**Reasons for inclusion in the PIC procedure**

Bromacil is included in the PIC procedure as a pesticide. Inclusion was recommended at the eighth meeting of the FAO/UNEP Joint Group of Experts on Prior Informed Consent following detailed discussions during the Sixth and Seventh Meetings. It is included in the procedure on the basis of the control actions reported by a number of Governments.

**Summary of control actions** (see Annex 2 for details)

Control actions were reported by 4 countries. In 3 countries (Germany, Slovenia and Sweden), bromacil was reported as banned. Belize reports to have severely restricted bromacil for use in citrus only. Environmental concerns reported were high persistence in soil, high leaching potential and contamination of ground water. Human health concern reported was suspected carcinogenicity.

**Hazard classification by organization**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO</td>
<td>Unlikely to present acute hazard in normal use (WHO,1996).</td>
</tr>
<tr>
<td>EPA</td>
<td>Toxicity class IV – practically nontoxic in dry form, and class II - moderately toxic in the liquid form. Bromacil is classified as a general use herbicide.</td>
</tr>
<tr>
<td>IARC</td>
<td>Not classified.</td>
</tr>
</tbody>
</table>
Protective measures that have been applied concerning the chemical

Measures to reduce exposures

For the health and welfare of workers and the general public, the handling and application of the substance should be entrusted only to competently supervised and well-trained applicators who must follow adequate safety measures and use the chemical according to good application practices. Regularly exposed workers should receive appropriate monitoring and health evaluations. Protective clothing as indicated in the FAO Guidelines for Personal Protection when Working with Pesticides in Tropical Climates (FAO, 1990) is required.

Packaging and labelling

Follow FAO Revised Guidelines on Good Labelling Practice for Pesticides (FAO, 1995). The labelling requirements of the United States Environmental Protection Agency (USEPA) state: Dry formulations containing bromacil must bear the signal word "Caution" and liquid formulations must bear the signal word "Warning".

Alternatives

Germany reported that at present there are no soil acting alternatives registered for weed control on railway tracks (plant protection products containing diuron or glyphosate); on uncultivated land the use of glyphosate is possible. A non-chemical alternative is mechanical weed control (see Annex 2).

It is essential that before a country considers substituting any of the reported alternatives, it ensures that the use is relevant to its national needs. A first step may be to contact the designated national authority in the country where the alternative has been reported (see addresses of designated national authorities in Annex 3). It would then be necessary to determine the compatibility with national crop protection practices.

Waste disposal

Waste should be disposed of in accordance with the provisions of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and any guidelines thereunder (SBC, 1994). See the FAO Guidelines on Prevention of Accumulation of Obsolete Pesticide Stocks and The Pesticide Storage and Stock Control Manual (FAO,1996). Wear protective clothing and respiratory equipment suitable for toxic dusts. Sweep, scoop or pick up spilled material. Vacuuming or wet sweeping may be used to avoid dust dispersal. Do not flush to surface water or sanitary sewer system. Dispose of empty container in a sanitary landfill or by incineration (Dupont, MSDS).

Bromacil should be incinerated in a chemical incinerator unit operating at 850 °C equipped with off gas scrubbing equipment (IRPTC, 1985).

It should be noted that the methods recommended in the literature are often not suitable in all countries. High temperature incinerators may not be available. Consideration should be given to the use of alternative destruction technologies.
Exposure limits

<table>
<thead>
<tr>
<th>Type of limit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food</strong></td>
<td></td>
</tr>
<tr>
<td>National MRLs (Maximum Residue Limits in mg/kg) in</td>
<td>0.1 mg/kg citrus and pineapples (USA)</td>
</tr>
<tr>
<td>specified products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.05 mg/kg mandarins (Japan)</td>
</tr>
<tr>
<td></td>
<td>0.04 mg/kg pineapples (Australia)</td>
</tr>
<tr>
<td></td>
<td>0.05 mg/kg citrus (Spain)</td>
</tr>
<tr>
<td>RfD (Reference Dose for Chronic Oral Exposure) (USEPA, 1989).</td>
<td>0.13 mg/kg/day</td>
</tr>
<tr>
<td>JMPR ADI (Acceptable Daily Intake) in mg/kg diet.</td>
<td>No value.</td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td></td>
</tr>
<tr>
<td>(USEPA, 1983).</td>
<td>90 ìg/l</td>
</tr>
<tr>
<td><strong>Workplace</strong></td>
<td></td>
</tr>
<tr>
<td>USA (ACGIH) TLV-TWA (Threshold Limit Value, Time-Weighted</td>
<td>10 mg/m³</td>
</tr>
<tr>
<td>Average) (1986).</td>
<td></td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td></td>
</tr>
<tr>
<td>NIOSH.</td>
<td>1 ppm (10 mg/m³)</td>
</tr>
</tbody>
</table>

First aid

Persons who have been poisoned (accidentally or otherwise) should be transported immediately to a hospital and put under surveillance of properly trained medical staff.

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

Skin: Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes before removing contaminated clothing and shoes. Seek medical attention immediately. Contaminated skin should be washed with soap and water (Simplot).

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

Inhalation: Get medical aid immediately.

Annexes

Annex 1 Further Information on the substance
Annex 2 Details on reported control actions
Annex 3 List of designated national authorities
Annex 4 References
### Annex 1 - Further Information on the substance

#### 1 Chemical and physical properties

<table>
<thead>
<tr>
<th>1.1 Identity</th>
<th>Bromacil is an odorless, white crystalline solid (\text{(ACGIH, 1986; Clayton et al., 1981)}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.2 Formula</td>
<td>(\text{C}<em>{9}\text{H}</em>{13}\text{N}<em>{2}\text{O}</em>{2}\text{Br})</td>
</tr>
<tr>
<td>Chemical name</td>
<td>5-bromo-6-methyl-3-(1-methylpropyl)-2,4(1H,3H)-pyrimidinedione (CA).</td>
</tr>
<tr>
<td>Chemical type</td>
<td>Uracil</td>
</tr>
<tr>
<td>1.3 Solubility</td>
<td>813 - 815 ppm (0.0815%) at 25 °C (\text{(Worthing, 1983; Meister, 1992)})</td>
</tr>
<tr>
<td>(\text{logP}_{ow})</td>
<td>Log Pow = 2.61 (\text{(Li, 1982)})</td>
</tr>
<tr>
<td>1.4 Vapour pressure</td>
<td>(2.5 \times 10^{-4}) Torr at 25 °C</td>
</tr>
<tr>
<td>1.5 Melting point</td>
<td>157.5-160 °C (\text{(ACGIH, 1986; Clayton et al. 1981; Meister, 1992)})</td>
</tr>
<tr>
<td>1.6 Reactivity</td>
<td>It is chemically stable under normal storage conditions, but may pose a slight fire hazard when exposed to heat or flame. It slowly decomposes in the presence of strong acids and poses a fire and explosion hazard in the presence of strong oxidizers (\text{(Occupational Health Services, Inc. 1991)}). When heated to decomposition, bromacil emits highly toxic and corrosive fumes of bromides and toxic oxides of nitrogen and carbon (\text{(Occupational Health Services, Inc. 1991, Sax, 1984)}). Airborne bromacil dust may ignite (\text{(Gosselin, et al. 1984)}).</td>
</tr>
</tbody>
</table>

#### 2 Toxicity

<table>
<thead>
<tr>
<th>2.1 General</th>
<th>Rapid uptake through the roots. Bromacil inhibits photosynthesis. (\text{(Gosselin, et al. 1984; Meister, 1992)}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1.1 Mode of action</td>
<td>A number of studies show that the substituted uracils, the class of compounds to which bromacil belongs, are absorbed into the body from the gut and excreted primarily in the urine (\text{(National Research Council, 1977; Paulson, 1975, USEPA, 1989)}).</td>
</tr>
<tr>
<td>2.1.2 Uptake</td>
<td>Small amounts of bromacil were detected in the milk of lactating cows that were given 5 ppm in their food (\text{(Gosselin, 1984)}). No bromacil was found in the urine or faeces of these cows (\text{(Paulson, 1975)}). Experimental animals and humans occupationally exposed to bromacil excreted unchanged bromacil and the metabolite 5-bromo-3-sec-butyl-6-hydroxymethyluracil in the urine (\text{(USEPA, 1989)}).</td>
</tr>
</tbody>
</table>
2.2 Known Effects on human health

2.2.1 Acute toxicity

Liquid formulations of bromacil are moderately toxic, while dry formulations are relatively non-toxic (Meister, 1992). Hyvar X-L formulation can be harmful or fatal if swallowed (Gosselin, 1984, Hartley et al., 1983, Meister, 1992). The herbicide is irritating to the skin, eyes and respiratory tract (Morgan, 1982).

2.2.2 Short and long-term exposure

There are no short and long term exposure studies on effects on human health related to bromacil.

2.2.3 Epidemiological studies

There are no epidemiological studies on effects on human health related to bromacil.

2.3 Toxicity studies with laboratory animals and in vitro systems

2.3.1 Acute toxicity

When 100 mg/kg of the herbicide was fed to dogs, it caused vomiting, salivation, muscular weakness, excitability, diarrhoea, and dilation of the pupils of the eyes. Rats fed single doses of bromacil experienced initial weight loss, paleness, exhaustion and rapid breathing (Occupational Health Services, Inc. 1991). Within four hours of being given 250 mg/kg of bromacil, or a related material (isocil), sheep became bloated and walked with a stilted gait (Gosselin, 1984). The oral LD₅₀ value for rats was calculated to be 5200 mg/kg (USEPA, 1989).

Dermal

Bromacil caused mild dermal irritation when applied to the skin of guinea pigs. Rabbits did not show clinical signs of poisoning or toxicity in response to skin applications of 5000 mg/kg of the herbicide (ACGIH, 1986, Gosselin, 1984).

Bromacil did not produce skin sensitization (USEPA, 1989).

Inhalation

Because bromacil has a low vapour pressure, it is unlikely to produce vapours which can be inhaled. No deaths occurred when rats were exposed to approximately 4.8 milligrams of bromacil per litre of air (mg/l) for four hours (ACGIH, 1986; Occupational Health Services, Inc., 1991).

Irritation

When bromacil was put in the eyes of rabbits, there was irritation in the conjunctiva, the mucous membrane lining of the eye, but no injury to the cornea, the transparent portion of the eyeball (Gosselin, 1984).

2.3.2 Short and long-term exposure

Enlarged livers were revealed in autopsies on rats that died after five days of repeated doses of bromacil at 1500 mg/kg/day (Gosselin, 1984). Sheep that died after being given 250 mg/kg/day of bromacil on four successive days showed the following disease-related findings: inflammation of the mucus membrane that lines the stomach and intestines, or gastroenteritis; congestion and enlargement of the liver; weakened appearance of the adrenal glands; bleeding from the heart; swollen and bleeding lymph nodes (Gosselin, 1984).

In a 2-year study rats were fed dietary levels of bromacil of 0, 50, 250 or 1250 ppm bromacil (corresponding to about 0, 2.5, 12.5, or 62.5 mg/kg/day). Females in the highest dose group showed decreased body weight gain. The NOAEL was 12.5 mg/kg/day (USEPA, 1989).
In a 78-week study, CD-1 mice were fed dietary levels of 0, 250, 1250 and 5000 ppm (corresponding to 0, 39.6, 195 or 871 mg/kg/day for males and 0, 66.5, 329 or 1310 mg/kg/day for females). The LOAEL was 250 ppm for male mice and the NOAEL was 250 ppm for female mice (USEPA, 1989).

2.3.3 Effects on reproduction
Bromacil did not affect the reproduction and lactation performance of rats fed 0 or 12.5 mg/kg/day for 3 generations (TOXNET, USEPA, 1988). Toxic effects and developmental abnormalities of the musculoskeletal system were seen in the embryos or foetuses of female rats which inhaled 38 mg/m³ of bromacil for two hours daily, during the 7th to 14th day of pregnancy (NIOSH).

2.3.4 Mutagenicity
Bromacil was not mutagenic in a number of microbial and fungal gene mutation test systems. A number of indicator tests (for DNA damage) were also negative. In one Ames test, however, bromacil induced revertants in 3 of 6 Salmonella strains tested.
Bromacil was weakly mutagenic at the 2000 ppm dose level in a sex-linked recessive lethal test in *Drosophila melanogaster*. It did not cause chromosome aberration in an in vivo mouse dominant lethal assay (USEPA, 1989).

2.3.5 Carcinogenicity
In a two year study ChR-CD rats were fed dietary levels of 0, 50, 250 or 1250 ppm bromacil. No increased incidence of tumours was found (USEPA, 1989).
An increased incidence of hepatocellular adenomas plus carcinomas was observed in male but not in female CD-1 mice fed bromacil in the diet at dietary levels of 5000, found predominantly in mice that survived to terminal sacrifice (USEPA, 1989). According to USEPA (1989) bromacil has not been determined to be carcinogenic.
The International Agency for Research on Cancer has not evaluated the carcinogenic potential of bromacil.

3 Exposure

3.1 Food
Exposure through food is low as major uses of bromacil are on non-cultivated land.

3.2 Occupational
Industrial and agricultural workers are exposed to the wettable powders and aqueous emulsions of bromacil through two primary routes of exposure: inhalation of dusts and sprays, and skin contact with dusts, emulsions and sprays (Clayton et al., 1981).

4 Effects on the environment

4.1 Fate
4.1.1 Persistence
Bromacil adsorbs only lightly to soil particles (Koc = 32 g/ml), is soluble in water and has a relatively lengthy soil half-life (60 days). For these reasons, bromacil is expected to move (leach) quite readily through the soil and it can contaminate groundwater (VanDriesche, 1985). Bromacil is persistent and its half-life is greater than 100 days (Rao et al., 1983).
4.1.2 **Bioconcentration**  Using a flow-through system and a 17-day exposure period, (14)C labelled bromacil had a BCF of only 3.2 in fathead minnow fish; this indicates that bromacil does not accumulate in fish tissue to a large extent (Call, 1987).

4.1.3 **Groundwater concentrations**  Monitoring analyses of 10929 wells in California during 1975 to 1989 detected bromacil (detection limit and concentrations not reported) in 4 wells (Mackay, 1990). Bromacil concentrations of 30 to 147 ìg/l have been reported for upper ground water samples collected in West Germany (Frank, 1987); concentrations of <0.1-1.8 ìg/l were reported for water samples from boreholes (15-40 m deep) in three provinces in the Netherlands (Leistra, 1989). In a 1979-1984 analysis of 7 wells in Ontario, Canada that were in the vicinity of bromacil herbicide use, bromacil was detected (detection limit 0.1 ìg/l) in only one well (Frank, 1987).

4.1.4 **Aquatic fate**  Bromacil may degrade in natural water through microbial degradation and photo-sensitized degradation. No degradation occurred in the absence of the sensitizers (Acher 1980). The rate of photodegradation in natural water could vary dramatically depending upon concentration of sensitizing agents and sunlight intensity. A two-month half-life is suggested for this herbicide in clean river water which is low in sediment (VanDriesche, 1985).

4.2 **Ecotoxicity**

4.2.1 **Fish**  The median tolerance limit, or the concentration of bromacil that will kill 50% of the exposed fish after 48 hours of exposure, varies from 40 ppm to 164 ppm, depending on the type of fish tested (Clayton et al., 1981). The 48-hour LC50 for bromacil in bluegill sunfish is 71 ppm, in rainbow trout is 56-75 ppm, and in carp is 164 ppm (TOXNET). The 96-hour LC50 in fathead minnows is 182 mg/l (Du Pont, 1990). Bromacil is slightly to very slightly toxic to fish with 48-96h LC50 values ranging from 28 mg/l for Oncorhyncus mykiss to 182 mg/l Pimephales promelas (RIVM/CSR, 1988).

4.2.2 **Aquatic invertebrates**  Bromacil is slightly toxic to the marine crustacea Artemia salina with a 24 hour LD50 of 71 mg/l (Wilkins and Metcalfe, 1993).

**Aquatic plants**  For 17 algal strains belonging to the Chlorophyceae EC50-values range from 0.05 to 10 mg/l, indicating that bromacil is toxic to very toxic to algae (Cullimore, 1975).

4.2.3 **Birds**  The 8-day oral LD50 for bromacil is over 10000 ppm in mallards and quail (Clayton et al., 1981).

4.2.4 **Bees**  Bromacil is slightly to very slightly toxic to honeybees with the contact and oral LD50S being >16 and >40 ìg/bee, respectively (RIVM/CSR, 1988).
### Annex 2 - Details on reported control actions

#### BELIZE
- **Effective:** 1990
- **Control action:** Severely restricted.
- **Uses still allowed:** For use in citrus only.

#### GERMANY
- **Effective:** 1993
- **Control action:** Totally banned for use as plant protection product.
- **Uses still allowed:** No remaining uses allowed.
- **Reasons:** High persistence of bromacil in soil combined with high leaching potential with the likelihood that application of bromacil would exceed a regulatory limit of 0.1 µg/l in ground water. The action is based on a national review of scientific data.
- **Alternatives:** At present there are no soil acting alternatives registered for weed control on railway tracks (plant protection products containing diuron or glyphosate); on uncultivated land the use of glyphosate is possible, a non chemical alternative is mechanical weed control.

#### SLOVENIA
- **Effective:** 1997
- **Control action:** Banned for use in agriculture.
- **Reasons:** This chemical was banned from the use in agriculture due to the effect of its toxic properties to human health and the environment according to the opinion given by the Commission on Poisons.

#### SWEDEN
- **Effective:** 1990
- **Control action:** The substance is banned for use as pesticide. No remaining uses allowed.
- **Reasons:** Suspended due to the substance’s suspected carcinogenic properties and mobility in soil.
Annex 3 - List of designated national authorities

**BELIZE**

| P | The Secretary  
Department of Agriculture  
Pesticides Control Board  
Central Farm  
Cayo  
Mr Mario Fernandez  
Fax +501 92 2640  
Phone +501 92 2640 / 92 3772  
Telex 102 Foreign Bz |

| C | Sanitation Engineer  
Public Health Bureau  
Ministry of Health  
Belize City |

**GERMANY**

| P | Abteilung fuer Pflanzenschutzmittel und Anwendungstechnik Koordinierungsgruppe  
Biologische Bundesanstalt fuer Land- und Forstwirtschaft  
Messeweg 11-12  
Braunschweig, D-38104  
Dr. A. Holzmann  
e-mail A.Holzmann@bba.de  
Fax +49 531 299 3003  
Phone +49 531 299 3452 |

| CP | Anmeldestelle Chemikaliengesetz  
Bundesanstalt fuer Arbeitsschutz und Arbeitsmedizin  
Friedrich-Henkel-Weg 1-25  
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SLOVENIA

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CP DNA Industrial Chemicals and Pesticides
P DNA Pesticides
C DNA Industrial Chemicals
Annex 4 - References


DUPONT E.I. -- Hyvar x herbicide - herbicide, bromacil - Material safety data sheet.


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