

THE APPROVAL, EFFICIENCY AND RECOMMENDATIONS FOR USE OF AQUATIC HERBICIDES

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THE AGRICULTURAL CHEMICALS APPROVAL SCHEME

The Agricultural Chemicals Approval Scheme was set up in 1948 and reconstituted in its present form in 1960. It is a voluntary scheme under which proprietary brands of agricultural chemicals can be approved for the uses recommended. The scheme is operated on behalf of the Agricultural Departments of the United Kingdom, namely those of England, Scotland, Wales, Northern Ireland, the Channel Islands and the Isle of Man. It covers the use of pesticides in agriculture, horticulture, forestry, home gardens, amenity areas and non-crop situations such as those in or near water.

The purpose of the scheme is to approve recommendations on labels so that engineers, advisors and users can select the appropriate product for use in the aquatic environment

Approval is conditional on the recommendation being first cleared by the Pesticides Safety Precautions Scheme for use in or near water. It is also a requirement that the product labels carry the correct precautions for its use as laid down by the Safety Scheme. This is a valuable aid to the man in the field in that the granting of approval is a means of ensuring that the requirements of the Safety Scheme are complied with. In the case of new compounds the Safety Scheme will grant trials clearance and limited clearance in order that data can be obtained for both clearance and efficacy purposes. Approval cannot be granted until a product or recommendation has been granted provisional or full commercial clearance by the Safety Scheme.

The Approval Scheme is a voluntary scheme and manufacturers can if they wish market a non approved product, or one that has failed to be approved. The onus for approval lies with the manufacturer or distributor, it being considered that it is of commercial advantage to receive approval. All major manufacturers support the scheme and at present there are some 460 herbicide and growth regulator products approved for all uses. Fees are charged for approval which are related to the cost of the work involved and there is an annual re-registration fee in order to keep a product in the scheme.

Approved products are published annually in the 'List of Approved Products for Farmers and Growers'. This list contains details on most pertinent aspects of pesticide use, including the following:

1. Introduction and description of the Safety and Approval schemes.
2. Some Advice on the Safe Use of Agricultural Chemicals.
3. Chemicals included in the Health and Safety (Agriculture) (Poisonous Substances) Regulations.
4. Chemicals subject to the Poison Rules.
5. Poisoning by Pesticides - First Aid Measures.
6. Aerial Application of Pesticides.
7. Some points to note on the Application of Agricultural Chemicals.
8. Glossary of Technical Terms.

This is followed by a crop guide which enables the user to find which chemical is recommended for a particular problem. The main body of the list contains the chemical guide which gives the approved uses of the chemical, the important limitations, the main precautions and finally the approved product names and the manufacturer. In the case of aquatic herbicides distinction is made on the specific aquatic use, the reference to the Code of Practice and the River Authorities, and in the 1976 list the interval between treatment and irrigation. Clearly a list of such a comprehensive nature cannot give the full rates of use or the detailed recommendations which appear on the label itself. Full information on these aspects of approved herbicides can be found in the Weed Control Handbook and the bulletin: 'The Control of Aquatic Weeds'. At the end of this paper there is a discussion of the efficacy of the various approved aquatic herbicides in which approved products are linked to the appropriate recommendations.

THE GRANTING OF APPROVAL

In granting approval it is the formulation that is approved and not simply the active substance. When an application is made data must be supplied on all materials present in the formulation plus methods of analysis of the active ingredient(s). Beside the effect of the formulants on biological activity the formulants can have important side effects in such matters as taint. Information is also required on storage stability, compatibility with other spray materials and additives and also copies of the proposed label. The importance of the label cannot be overstated as this is the vehicle for the agreed recommendations of both schemes. Where a product label is becoming overloaded a leaflet can replace it provided the label still carries the name of the product, its contents, the precautions and the 'A' mark and approval number. The leaflet then replaces the label as the agreed document and will contain all the above information plus the necessary details of the recommendations for use. It is important that when comparing products or looking at the merits of any single one that the approved label is read thoroughly. There will probably be available promotional literature that will not fully explain the limitations of the product or the weeds that the chemical will not control, or other pieces of information that could affect the success of the treatment.

Once approval is granted the wording on the label or the formulation cannot be altered without the agreement of the scheme. Each year when the product is re-registered the manufacturer or distributor gives an undertaking that the product and recommendations have not changed. All approved recommendations are kept under review. The Scheme has the right to withdraw approval or change recommendations if evidence subsequently shows this to be necessary.

BIOLOGICAL DATA AND APPROVAL

The main concern of the Approval Scheme is the evaluation of biological data supplied by the applicant in support of his recommendation. Each application is considered in the light of the available information. There is no formal requirement on the nature of the data required or the nature of the trials to be carried out in order to obtain it. Since however it is necessary to establish reliable recommendations some general guide-lines are given.

It is generally necessary that new recommendations require a minimum of two years trials before approval can be granted. The type and number of trials will be determined by the likely use envisaged. For aquatic herbicides this can best be considered according to the nature of the problem concerned.

Herbicides to be used on land adjacent to water for the control of non-aquatic weeds can be evaluated by suitable replicated small plot trials in non-aquatic situations. It will be necessary to test the material in its aquatic setting but

simple commercial treatments spread over a wide area can be used. The maximum rate of use will be determined by the terms of the clearance granted.

Contact and foliar acting herbicides for use on emergent aquatic weeds can be evaluated in trial plots situated along the bank and sprayed with suitable knapsack sprayers. Treatments should consist of untreated controls, differing rates of the test materials and a standard spray. At least four replicates should be aimed at with a plot size from 5 to 40 m x 2 m depending on the flora present. More information is likely to be obtained from increased replication than increased plot size. In such trials one would aim to obtain as great a number of weed species as possible. A minimum of six such trials should be attempted in any one year, associated with at least twice as many simple commercial applications.

The evaluation of herbicides acting via the water or bottom mud is considerably more difficult due to the effects of water flow, change in level, drying out and routine maintenance. Replicated small plot trials are not feasible in this situation and the only practical alternative is the use of a large number of simple treated versus untreated sites. For this type of herbicide replication is replaced by geographical coverage. In rivers, dykes and streams where flow can occur the control plot must lie upstream of the treated area. The treated area will need to cover the full width of the river and be at least 35 m long. Barriers, such as locks, stop boards and weirs should be used where possible to separate the treated and untreated areas.

In enclosed water such as ponds and lakes, part only of the area can be treated although movement of the water will inevitably carry the test herbicide to all parts. An alternative technique is to use clear polythene enclosures (Gallaher et al., 1968.) to seal off small areas of water in the order of 2 - 10 m². These are anchored to the bottom mud and held slightly above the water surface by floats or stakes. The advantage of this type of treatment is that only small volumes of water are involved and many differing treatments can be simultaneously applied. Errors in application would be accentuated due to their small size and there may be practical difficulties in maintaining the stability of the enclosures.

Where herbicides for the control of submerged or floating weeds are to be tested at least twelve different comparative sites should be selected per year linked to confirmatory commercial applications elsewhere.

The assessment of trials will depend on individual techniques. Whatever method is used it must initially quantify the relative amount of each weed species present at treatment and be repeated several times during the season of treatment and in some cases into the following season.

RECOMMENDATIONS FOR THE USE OF AQUATIC HERBICIDES

The decision whether to use an aquatic herbicide or not will be determined by the considerable number of other factors discussed elsewhere. Assuming that it has been decided that a herbicide should be used, considerable care should be taken to select the most appropriate material cleared for the purpose and to then correctly use it according to the Approved recommendations. A full understanding of the label wording is necessary as it is seldom that any material will fully satisfy the need at hand and knowledge of the shortfall of a product will enable the user to carry out the appropriate associated management measures. Attention must similarly be given to the recommendations on the method of application to get the most out of the treatment.

The control of waterside and Emergent weeds

It is often necessary for those responsible for the maintenance of watercourses to be also responsible for the control of vegetation on the banks and sides of the watercourse. The vegetation is generally not aquatic but the danger of spray or

drift getting into the water makes aquatic clearance a necessity for such treatments. Emergent weeds are those growing either at the edge of the water or in shallow water but with all their leaves and stems above the water. They are most commonly grasses of which Phragmites australis (Common Reed) is the commonest.

2,4-D amine

2,4-D is approved at 2.24 to 4.48 Kg/ha (2-4 lbs/acre) for the control of broad leaved weeds on banks and emergent broad-leaved weeds in water. Due to problems of taint its use is now mostly confined to banks and cutting sides. Only the amine formulation is cleared for aquatic use as esters and emulsions are toxic to fish. It should be applied to actively growing plants in the summer months and can be used with maleic hydrazide or dalapon.

Susceptible and Moderately Susceptible Aquatic Weeds

Alisma plantago-aquatica (Water Plantain)
Epilobium hirsutum (Great Willow-herb)
Juncus effusus (Soft Rush)
Mentha aquatica (Water Mint)
Rorippa nasturtium-aquaticum (Water-cress)
Sparganium Erectum (Branched Bur-reed)
Nuphar lutea (Yellow Water-lily)
Nymphaea alba (White Water-lily)

Approved products, rates of use and firm

Chipman 2,4-D	2.8 - 4.2 l/ha(2-3 pts/acre)	<u>Chipman</u>
Dormone	2.8 - 9.0 l/ha(2-6 $\frac{1}{2}$ pts/acre)	<u>Burts and Harvey</u>

Maleic Hydrazide

Maleic hydrazide is approved 5.6 kg/ha (5 lbs/acre) for the suppression of grass growth in vegetation adjacent to watercourses. It needs to be applied as a coarse spray at high volume rates (450 - 900 l/ha) when the grass begins growing between March and April. Continued use encourages fine-leaved grasses such as Poa pratensis (Smooth Meadow-grass) and Festuca rubra (Red Fescue). Broad-leaved weeds can be controlled by the addition of 2,4-D amine.

Approved products, rates of use and firm

Maleic hydrazide alone

Chipman Grass Growth Retarder	11.2 - 17.0 l/ha (8-12 pts/acre)	<u>Chipman</u>
Regulox W	11.2-17.0 l/ha (8-12 pts/acre)	<u>Burts and Harvey</u>
Regulox 36	17.0 l/ha (12 pts/acre)	<u>Burts and Harvey</u>
Regulox 50	8-11 l/ha (5 $\frac{3}{8}$ - 8 pts/acre)	<u>Burts and Harvey</u>
Vondalhyd	11.2 - 17.0 l/ha (8-12 pts/acre)	<u>Bos</u>

Maleic hydrazide with 2,4-D

BH 43	20.0 - 28.0 l/ha (14-20 pts/acre)	<u>Burts and Harvey</u>
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Dalapon sodium

Dalapon has a wide range of approved uses and there is a difference between those used within the cleared recommendation. This distinction is between those carrying aquatic weed control recommendations and those with a recommendation for the control of Phragmites australis (Common Reed) invading agricultural land adjacent to water courses. It is recommended at 19.0 - 48.0 kg/ha (17.0 - 45.0 lbs/acre) to emergent weed foliage during the summer months although best results are obtained in late summer when the plants are flowering. It is damaging to grass species and care should be taken to avoid spraying adjacent banks. Where broad-leaved weeds are present 2,4-D amine can be added.

Susceptible and Moderately Susceptible Aquatic Weeds

Carex Riparia (Greater Pond-sedge)
Carex spp. (Sedges)
Phalaris arundinacea (Reed Canary Grass)
Phragmites australis (Common Reed)
Schoenoplectus lacustris (Common Clubrush)
Sparganium erectum (Branched Bur-reed)
Typha angustifolia (Lesser Bulrush)
Typha Latifolia (Bulrush)

Approved product, rates of use and firm

- with full aquatic weed recommendations

B.H. Dalapon 22.4 - 28.0 Kg/ha (20 - 25 lbs/acre)	<u>Burts and Harvey</u>
Boots Dalapon 16.8 - 22.4 Kg/ha (15 - 20 lbs/acre)	<u>Boots</u>
Bugges Dalapon 22.4 - 33.6 Kg/ha (20-30 lbs/acre)	<u>Bugges</u>
Chipman Dalapon 22.4 - 67.2 Kg/ha (20-60 lbs/acre)	<u>Chipman</u>
Chafer Dalapon 22.4 - 56.0 Kg/ha (20-50 lbs/acre)	<u>Chafer</u>
Dowpon 22.4 - 56.0 Kg/ha (20-50 lbs/acre)	<u>Dow</u>
Dowpon 22.4 - 56.0 Kg/ha (20-50 lbs/acre)	<u>Plant Protection</u>
Dowpon 22.4 - 56.0 Kg/ha (20-50 lbs/acre)	<u>Farm Protection</u>
Herbon Dalapon 22.4 - 56.0 Kg/ha (20-50 lbs/acre)	<u>Crossafe</u>

- with mainly agricultural recommendations

Basfapon 33.6 Kg/ha (30 lbs/acre)	<u>BASF</u>
Campbell's Dalapon 22.4 - 33.6 Kg/ha (20-30 lbs/acre)	<u>Campbell</u>
S.D.C. Dalapon 11.2 - 33.6 Kg/ha (10-30 lbs/acre)	<u>Stanhope</u>
Southern's Dalapon 22.4 - 33.6 Kg/ha (20-30 lbs/acre)	<u>Thos Southern</u>

Paraquat

The clearance of paraquat in aquatic situations is a very specific one and concerns only the enhancement of the collapse of Phragmites australis (Common Reed) in conjunction with the application of dalapon. Dalapon alone leaves the dead stems intact and which normally have to be cut by hand some five weeks after spraying. The addition of paraquat to dalapon leads to a relatively rapid rotting and collapse of the plant remains without the need to cut manually. It is also important to understand that one specific formulation only is cleared. Ordinary paraquat is marketed as Gramoxone and contains a wetting agent that is toxic to fish. The product cleared for use with dalapon contains no wetter. As with dalapon paraquat use in other situations can cause extensive damage to emergent and water-side plants.

Approved product, rates of use and firm

Esgram, 2.8 l/ha in 22.4 Kg/ha - Chipman dalapon
(2 pts/acre in 20 lbs/acre) CHIPMAN

The control of Floating and submerged weeds and Algae

Floating weeds consist of those species that are either free floating or which root in the bottom mud. Although the leaves of these species float on the water surface they react in much the same manner as submerged weeds with respect to aquatic herbicides. Submerged weeds have all their leaves below the water surface and most are rooted to the bed. As a group both forms of aquatic plant play a very important role in the aquatic ecosystem providing food and cover for fish, molluscs and the micro fauna that abounds in water.

Plant-growth is also bound up with the balance of nutrients and gases in the water, the amount of light penetrating the water and the use of the water in different amenity situations. The effect of herbicides on these plants is generally both dramatic and persistent and the effect on the factors above must therefore be taken into account in deciding on the use and application of a herbicide.

Algae occur in many forms in water. Those of concern to the water engineer are the filamentous forms which are collectively known as blanket weed, cott or hair weed. They are troublesome in still or very slow moving water and very often appear after major disturbance such as dredging. As a group they are resistant to most aquatic herbicides and only with the advent of triazine herbicides has control become a feasible proposition.

Dichlobenil

This chemical is only available as granule formulations. It is approved at a concentration of 1 ppm in the water. It is essential that it is applied as weed growth begins in the spring. Accurate application is essential in order that the correct concentration of chemical in the water is obtained. The material has a wide spectrum of activity and some emergent weeds are controlled by it.

Susceptible and Moderately Susceptible Aquatic Weeds

- + - Emergent species = - Filamentous Algae
- + Alisma plantago-aquatica (Water Plantain)
- Callitriche Spp. (Water Starwort)
- Ceratophyllum demersum (Rigid Hornwort)
- = Chara spp.
- Elodea canadensis (Canadian Water-weed)
- Fontinalis spp (Willow-moss)
- Glyceria fluitans (Floating Sweet-grass)
- Hippuris vulgaris (Marestail)
- Hottonia palustris (Water Violet)
- Hydrocharis morsus-ranae (Frog-bit)
- Myriophyllum spicatum (Spiked Water-milfoil)
- Myriophyllum verticillatum (Whorled Water-milfoil)
- + Oenanthe aquatica (Fine-leaved Water-dropwort)
- + Oenanthe crocata (Hemlock Water-dropwort)
- Potamogeton crispus (Curled Pondweed)
- P. lucens (Shining Pondweed)
- P. natans (Broad-leaved Pondweed)
- P. pectinatus (Fennel Pondweed)
- Ranunculus aquatilis (Common Water Crowfoot)
- R. acutiformis
- + Rorippa nasturtium - aquaticum (Water-cress)
- + Rumex hydrolapathium (Water Dock)
- + Sagittaria sagittifolia (Arrowhead)
- Stratiotes aloides (Water Soldier)
- Zannichellia pulustris (Horned Pondweed)

Approved Products, rates of use and firm

- Casoron G, 45 kg/ha for ea. 300 mm depth
(40 lbs/acre for each 1 ft depth) Duphar Midox
- Casoron GSR, * 28 kg/ha for each 300 mm depth
(25 lbs/acre for each 1 ft depth) Duphar Midox

* NOT TO BE USED IN WATER BODIES LESS THAN 1.5 m (5 ft) WIDE
OR 600 mm (2 ft) DEEP.

Chlorthiamid

This is a granular herbicide that breaks down into dichlobenil. It is similar to dichlobenil in most respects and is approved at a concentration of 1 ppm in the water at the commencement of weed growth. There is little evidence to show that there is any difference in weed control between chlorthiamid and dichlobenil but only the following species are shown on the label.

Susceptible and Moderately Susceptible Aquatic Weeds

+ Emergent Species

- Callitriche stagnalis (Water Starwort)
- Ceratophyllum demersum (Rigid Hornwort)
- Elodea canadensis (Canadian Water-weed)
- Potamogeton crispus (Curled Pondweed)
- P. pectinatus (Fennel Pondweed)
- P. natans (Broad-leaved Pondweed)
- + Rorippa nasturtium-aquaticum (Water-cress)

Approved Products, rates of use and firm

Prefix, 45 kg/ha for each 300 mm depth
(40 lbs / acre for each 1 ft depth.) Shell

Diquat

Diquat is approved for use against floating and submerged weeds at a concentration of 1 ppm in the water. It is also effective against a few emergent weeds. Diquat is a liquid and is applied either by surface spraying or by injecting appropriate doses of the concentrate below the surface at 5 m intervals. It is applied during the growing period and causes a rapid kill of a wide range of aquatic plants. Treatment of still water can cause fish death by deoxygenation from the decaying plant matter. This can be avoided by treating only small portions of the water body at any one time.

Susceptible and Moderately Susceptible Aquatic Weeds

+ Emergent species - - Filamentous algae

- + Alisma plantago-aquatica (Water Plantain)
- Callitriche spp (Water Starwort)
- = Cladophara spp
- Elodea canadensis (Canadian Water-weed)
- Hottonia palustris (Water Violet)
- Hydrocharis morsus-ranae (Frog-bit)
- + Juncus effusus (Soft Rush)
- Lemna spp. (Duckweeds)
- Lemna trisulca (Ivy-leaved Duckweed)
- Myriophyllum spicatum (Spiked Water-riffoil)
- M. verticillatum (Whorled Water-riffoil)
- Potamogeton berchtoldii (Small Pondweed)
- P. crispus (Curled Pondweed)
- P. lucens (Shining Pondweed)
- P. natans (Broad-leaved Pondweed)
- P. pectinatus (Fennel Pondweed)
- P. praelongus (Long-stalked Pondweed)
- P. pusillus (Lesser Pondweed)
- Ranunculus aquatilis (Common Water Crowfoot)
- R. acutiformis
- + Rorippa nasturtium - aquaticum (Water-cress)
- + Sagittaria sagittifolia (Arrowhead)

Sparganium emersum (Unbranched Bur-reed)
+ Sparganium erectum (Branched Bur-reed)

Approved products, rates of use and firm

Aquacide	11.2 - 22.4 l/ha per 300 mm depth (8 - 16 pts/acre per 1 ft depth)	<u>Chipman</u>
Reglone	11.2 - 22.4 l/ha per 300 mm depth (8-16 pts/acre per 1 ft depth)	<u>Plant Protection</u>

References

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DISCUSSION ON SESSION 2

Mr. D. Spencer-Jones asked Mr. J.A.R. Bates, who referred in his paper to "Government Departments", to give some idea as to what these departments are, what they do and roughly how many there are of them. He also mentioned that provided information is available from abroad, a notification may be submitted now "en bloc" but it is not as simple as that as in addition, PSPS require data actually obtained in this country.

Mr. Bates agreed and said the words he used were that companies can submit data "en bloc" but clearance is not necessarily given on this. All countries require home-produced data. Pesticides are an international subject and discussions are currently taking place in Brussels on the possibility of an EEC Registration Scheme, which is now in draft form. Thus moves are in force towards an International Registration Scheme. PSPS hopes companies will not find it necessary to have to obtain a separate registration for the same product in each different country as there is a considerable nucleus of information which is basically acceptable in all countries. All countries certainly require some home-produced data, particularly for residues, as growing conditions vary from country to country. Ecosystems however are separate and individual.

The Government Departments which are interested and involved in pesticides comprise the Ministries of Agriculture; Health & Social Security; Environment; Education and Science and Employment, and all corresponding departments in Scotland and Northern Ireland.

Dr. N.W. Moore said Mr. Bates had emphasised the environmental difficulties arising from the use of pesticides but took issue with him for giving the impression that the PSPS committee did not need any outside help, particularly as regards environmental matters. He agreed that, after clearance has been granted, a systemic watch by biologists should be kept for wildlife casualties during the first few years of use of a new chemical and that the reporting of significant observations or data should be encouraged. Incidents involving fish kills should be reported likewise.

Mr. Bates agreeing said because of the shortage of specialists and in particular of toxicologists, the Scientific Sub Committee looked to expert panels for specific help and meetings are held regularly with various specialists to discuss problems, methods of assessment and further protocols for the future.

Mr. C. Newbold enquired why, for terbutryne, the time interval between application and the use of treated water for irrigation had been reduced. In reply, Mr. Bates explained that this was because the manufacturers have produced evidence which satisfied both the Scheme and themselves that this recommendation would be quite safe for crops. Dr. H.C. Gough also pointed out that in the absence of precise information the sub-committee tended to be cautious. As more data became available it was often possible to relax the original recommendation.

Mr. G. Stell drew attention to the technical data sheet for paraquat in the BAA folder which implied the granting of an aquatic clearance for "Gramoxone" when in fact the only formulation cleared for use in water is "Esgram". Unfortunately, the official recommendation sheet issued by MAFF for paraquat and any other chemical for that matter does not list individual formulations. In the case of paraquat this could give the impression that "Gramoxone" is safe to use as an aquatic herbicide which it is not because of the high content of wetting agent in this particular formulation.

Mr. Robson enquired how persons are actually informed when new materials are cleared. In his reply, Mr. Bates explained one aspect of the Scheme which is not widely appreciated is the publication of "clearances". The existence of an official recommendation sheet indicates that government has looked at a formulated active ingredient and pronounced it safe, but it does not generally identify the individual formulations which have been granted clearance. Clearance is given to the company for their product and the only expression of clearance is a letter from the government to the company concerned, a recommendations sheet giving all the relevant information being subsequently issued. These are published by HMSO and may be subject to a 6 month delay, a fact confirmed by Mr. N. Pickerin who pointed out that publication sometimes only took 3 to 4 months. Mr. Spencer-Jones questioned whether there would in practice be a six months delay in the dissemination of clearance information to those interested in view of the fact that the notifying company would in all probability promulgate this through its Publicity Department.

Mr. Guiver stressed the importance of Water Authorities receiving such information as quickly as possible. He further asked whether taint testing and the effect of chlorination on taints could be incorporated into the Scheme and whether chemicals cleared through the Scheme are ever reappraised. Mr. Bates explained that the Safety Scheme is concerned with hazard and because taints are not hazardous to health, the problems of taint are not taken into account. He confirmed that information is collated on the safe use of pesticides, and chemicals are reviewed whenever necessary. Reports of field incidents often highlight a problem which needs reviewing, e.g. if the extensive use of an aquatic herbicide was found to result in unacceptable fish deaths such incidents, properly documented, would be used by the Scheme in reviewing that herbicide use.

Dr. Gough said it would seem that various Water Authorities had different standards and asked if this was so and what could be done to improve the situation.

Mr. Spencer-Jones agreed and said there have been cases in the past where one River Authority refused the use of a cleared pesticide but sanctioned the use of Copper sulphate - toxic to fish and still not cleared through PSPS. This is exasperating to the manufacturer and probably also to those concerned with the Scheme.

Further, Mr. Guiver has suggested that taint testing should become an integral part of clearance but Mr. Bates has negated this on the grounds that taint is not a toxicological hazard. Testing for taint is one of the requirements for Ministry approval of chemicals used on crops for processing and he suggested this is an area where we give and take. He felt it would be fair to consider incorporating taint testing as a requirement for the approval of aquatic herbicides if this is what the Water Authorities want.

According to Mr. G. Stell the main concern of the Approvals Organisation was for crops likely to be adversely affected by treated water and it was thus not concerned with taints which did not occur in the crop.

Taking up the point of the existence of separate standards, Mr. T.R. Graham indicated that in the past, it was always left to the River Authorities to make up their own minds about the use of aquatic herbicides. Now we have the Control of Pollution Act, 1974, which states that pollution offences will not be caused if a herbicide is used in accordance with the Code of Practice. DOE are represented by Dr. King on the PSPS who conveys information to DOE and then consults the National Water Council who in turn can consult the Regional Water Authorities. DOE thus have their own consultation procedures.

Referring again to the responsibility for taint tests, Mr. Stovell drew attention to the folder prepared by BAA which includes taint threshold numbers for herbicides in water and suggested such tests are usually conducted before chemicals are cleared by chemical manufacturers.

Mr. Robson asked Mr. Bates the meaning of the term "permitted concentration" on the Recommendation Sheets. In reply, Mr. Bates explained that manufacturers submit data which justifies a safe application rate. They are then free to recommend any application rate equal to or less than that. He also emphasised the need for strict adherence to label recommendations.

Mr. Newbold queried the maximum permitted concentration for terbutryne given in the BAA data sheet. Mr. T.G. Marks confirmed that 0.1 mg per l was now correct.

Mr. D. Soper suggested a good starting point for the provision of technical data would be companies' product manuals, particularly if information from these manuals was collated and set out in laymen's terms for fuller understanding.

Mr. Makepeace agreed providing such a document were not too lengthy. It should however be reviewed every year to keep it up to date and should be easily available.

Mr. Spencer-Jones suggested the first start in providing technical information had already been made by the BAA in their folder. Approval however covers the recommendations on the label which also lists the relevant safety precautions which should be observed. A survey conducted by the WRO on the use of herbicides by drainage boards showed not only that herbicides not covered by PSPS clearance were being used, but of those that were, several were being used in the wrong way. There were for example instances of dichlobenil being used for control of emergent monocots which on the label are clearly listed as being resistant. This indicates people are not reading labels correctly which in turn would seem to point to the need for adequate training of operators.

Mr. J.H. Woods referred to a particular weed not listed in the folder (Japanese Knotweed) which causes considerable problems in Cornwall.

Mr. Makepeace suggested this might be controlled by glyphosate, when this chemical was cleared for aquatic use.

Mr. H.G. Fryer in referring to Mr. Spencer-Jones' point on training, stressed that although this is vitally necessary for IDBs, there are no facilities available for it.

Mr. Cave felt disturbed that comparatively few people understand the correct usage of aquatic herbicides. Many quite unsuitable herbicides are being used by some IDBs and others who seem to be willing to try anything and there is possibly some need for a licence or certificate to be issued to people before they are allowed to use aquatic herbicides. He stressed that with so much care taken at the outset there should be some safeguards at the end of the line to ensure proper use.

Mr. Makepeace mentioned that training courses for operators are held by MAFF Land Drainage Division but licencing would be completely beyond the present possibilities. It is a delicate situation. Mr. A. Bloomfield suggested that in regard to training the Agricultural Training Board or the Industrial Training Board could help. All major chemical firms co-operate with the former in this respect.

Mr. N.F. Low stressed his Authority have tried to persuade IDBs to inform them prior to using aquatic herbicides and reported an instance where the local representatives of a national chemical company suggested the use of two herbicides which were not in fact cleared through PSPS. Mr. Makepeace pointed out that this sort of thing sometimes happens, particularly in large companies where communication difficulties tend to be exaggerated. It should not however occur if products have been approved and the label read. Mr. Miles assured the Conference that ADA is doing all it can to instruct IDBs in the correct use of herbicides. As far as training is concerned, he suggested it should be the responsibility of engineers to ensure herbicides are applied correctly.

Mr. Cave accepted Mr. Miles' remark about engineers and felt certain large drainage boards do act in a responsible manner but he pointed out that there are a great many very small IDBs covering areas of 500 to 2000 acres who do not support an engineer and are thus more prone to make mistakes.

Mr. J. Clarke pointed out that he was Clerk to eight Internal Drainage Boards who were sufficiently interested to send him, and one of their Superintendents, to this Symposium. They had used chemicals for many years with good results and always in co-operation with Manufacturers in the first instance. Careful costings had been kept and chemicals applied by both helicopter and boat.

He did not want delegates to leave the Symposium thinking that small Authorities were necessarily incapable or inefficient, and reminded them that experience had shown that larger Authorities could make mistakes as well.

Mr. Makepeace suggested manufacturers are sometimes guilty of marketing products too early and in support of this argument drew attention to the BAA folder in which chemicals are listed whose clearance has not yet been finalised but because they have been included, could be mistakenly assumed to have been given clearance. Mr. Major mentioned that products with limited clearance had been included because it was generally felt that delegates would like to receive information on products which in all probability they would have heard about although some had only reached the limited clearance stage. Mr. Robson in fairness to BAA stated that it was the decision of the Programme Committee to include products on which there was only a limited clearance for the information of delegates.

Mr. B.C. Hadow referred back to Mr. Bates' paper and suggested that in his table on herbicides cleared for aquatic use, two more should be added, namely cyanatryn and glyphosate since they occurred in the table of cleared herbicides compiled by BAA and this could be confusing. Mr. Bates explained that the reason they were not listed was because neither of the two have yet been fully cleared.

Mr. Graham asked whether any data was available on the effect of power boats in the control of the type of weed growth one might find in Draycote Water. He mentioned that if water skiing is allowed, this tended to break up weeds.

Mr. Tomlins (British Waterways Board) in reply to Mr. Graham's query stated that craft movement, especially that of the heavier craft does reduce weeds, a point confirmed by Mr. Price who drew attention to the marked decline in the growth of macrophytes in the Norfolk Broads in recent years possibly due to boat movement. In this connection, Mr. R. Crossland said he could remove 10 cm. off the top of Myriophyllum spicatum by propeller action, and it did not appear to sprout again.

Mr. A.D. Courtney enquired what procedures if any are adopted in notifying farmers adjacent to water courses prior to chemical treatment. In reply, Mr. Miles

stated that some farmers have licences to use water from the drains and all who have such licences are notified prior to treatment. Notices are also attached to bridges in the hope that they too would be seen.

Mr. R.W. Noakes stated that in the Doncaster area, the IDB places an advertisement in the local press in addition to notifying the NFU of such intent. Mr. Clark maintains a register of farmers who abstract water from the Board's drains so that they likewise can be notified.

Mr. J.B. Shorthose felt the BAA should remove from their folder those herbicides not yet fully cleared as this information could easily become misinterpreted by the less informed. However, Mr. Bates said removal would be no answer as clearances are going through all the time and the situation is never static.

Mr. Stovell referred to problems with public opinion in Commander Dunn's paper and asked if the Water Authorities had any views on this. Prof. L. Broadbent stated that one of the functions of the BCPC education committee was to enlighten the public. It has under consideration a procedure in respect of aquatic herbicides. Mr. P.R.F. Barrett was of the opinion that as the use of chemicals increased, people would get used to these as they have with everything else. Mr. F.N. Midmer could not recall any serious objections on the part of farmers to the use of chemicals and no real problems have been reported. Mr. Guiver agreed with Mr. Midmer as far as farmers are concerned but questioned publicity aimed at the general public quoting the adverse reaction to the addition of fluoride. In this regard he found it difficult to accept the use of herbicides in Draycote Water. He felt some distinction should be made between water taken for public supply and the treatment of Fenland water to overcome drainage problems.

Mr. Bates recalling a reference to aerial application drew attention to the fact that there is a permitted list of chemicals which may be applied from the air. This list is published in the front of the Approval book.