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TOXICOLOGY RESEARCH CENTRE

DP/ROK/82/028

REPUBLIC OF KOREA

Technical report: Aquatic Toxicology*

Prepared for the Government of the Republic of Korea
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of R.R. Stephenson,
expert in aquatic toxicology

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EXPLANATORY NOTES

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Abbreviations

KRICT	-	Korea Research Institute of Chemical Technology
TRC	-	Toxicology Research Centre
GLP	-	Good Laboratory Practice
SOP	-	Standard Operating Procedure
SRC	-	Sittingbourne Research Centre (- base laboratory of advising expert).

ABSTRACT

As part of the expert assistance programme defined for the Toxicology Research Centre (DP/ROK/82/028) a mission in Aquatic Toxicology is reported: undertaken from 30th September - 13th October 1987. This was a follow up visit to a previous two phase mission undertaken in March and June 1986.

The broad objective of the assistance is to aid the upgrading of experimental techniques in aquatic toxicology to a level internationally acceptable for the registration of pesticides and speciality chemicals.

Action items arising from the report of the 1986 assignment were reviewed and progress made assessed. The impression gained was that given the limited time and the resources available considerable progress had been made towards achieving objectives set during the 1986 assignment.

Other areas covered during the assignment were:-

i) Practical demonstration of a method for generating saturated solutions of substances of very low water solubility.

ii) Discussion of research on use of Diazinon in rice and its effects on fish.

iii) Discussion of draft of Mr Lee's Ph.D. thesis.

iv) Choice of reference substances for aquatic toxicology.

v) Future research in aquatic toxicology at TRC.

Whilst the assignment was short some useful discussions took place and an assessment of progress made.

The laboratory continues to make sound progress towards establishing the requirements for international acceptability, however, it will be some years before this objective is fully realised. Continued contact with facilities operating to internationally accepted standards in the field of aquatic toxicology will be required on a regular basis.

CONTENTS

INTRODUCTION

This report covers a mission of 14 days undertaken from 30th September 1987 - 13th October 1987 to the Toxicology Research Centre of the Korea Research Institute for Chemical Technology. The TRC, established with UNDP aid and guidance, is planned to develop as the main facility for contract toxicology in the Republic of Korea. Aquatic toxicology has been identified as one area in which expertise will be required.

Objectives specified for the mission were:

i) Assist in developing various test systems for aquatic toxicology.

ii) Discuss improvements to the laboratory standards.

iii) Discuss training requirements and assess developments since the last assignment.

iv) Advise on the expansion of species and matrix for test systems.

v) Prepare final report.

The objectives of the mission were fulfilled by discussions with the scientific staff.

RECOMMENDATIONS

1. Continued efforts be made to bring the aquatic toxicology into compliance with GLP. Support is given to the approach being taken i.e. priority is being given to attaining compliance in the area of mammalian toxicology, subsequent to which the attainment of compliance in aquatic toxicology will be achieved more easily.
2. The integration of biology and chemistry in field and laboratory studies should be continued.
3. Provision should be made for continued contact between TRC and other laboratories involved in aquatic toxicology for regulatory purposes.
4. Continued effort be made to ensure that all of the necessary test procedures are fully established at TRC; it is likely to take at least 2-3 years for all the following important laboratory tests to be established.
   i) acute toxicity tests with fish, Daphnia and an alga.
   ii) chronic toxicity test with Daphnia.
   iii) chronic toxicity test with fish e.g. fish early life stage test.
   iv) bioaccumulation test with fish.

In addition to these laboratory tests it is desirable that experience be gained in the design and conduct of field experiments which are increasingly required by regulatory authorities.

1. ACTIVITIES

Following discussions with the staff at TRC the activities outlined below were undertaken during the visit.

Review of actions recommended in report of previous mission (1986).

Recommendation	Action taken/present status
GLP	
Protocols (study plans) should be issued for all future studies in aquatic toxicology.	Planned for future but not in use at present.
SOPs should be prepared for all items of GLP significant equipment and for all routine procedures	SOPs for acute toxicity tests to fish, Daphnia and algae and equipment SOPs are in preparation.
Data collection (and storage) should be of a standard compatible with GLP.	Data collection still operating in the "research mode".
Facilities	
Certain recommendations were made regarding the new laboratory facilities including:-	
Increased capability to hold stock fish in flowing water and to carry out continuous flow testing with fish.	Incorporated in plans

Need for temperature controlled rooms.	Incorporated in plans
Separation of culture and testing.	Incorporated to the extent that space will allow.
Chemical laboratory for making up stock solutions etc.	Incorporated in plans.
It was recommended that experience of field testing should continue to be developed with a long term view of establishing permanent/semi-permanent facilities.	Field trials have been carried out to examine effects of pesticides on stream fauna.
Equipment for continuous flow tests with fish should be provided.	Apparatus built and tested. A bioaccumulation test is planned.
An improved facility for providing algal food for Daphnia should be established.	Present arrangement is satisfactory but improvement will come with the move to the new laboratory.
An improved system for algal toxicity testing was thought desirable.	Additional experiments with the existing equipment have given satisfactory results.

Knowledge and Skills

Provision for training in established laboratories operating to GLP standards.	Mr. Shin will spend a period at Natl. Institute for Environmental Studies. Yatade, Tsukabe, Ibaraki 305, Japan.
Efforts be made to ensure that an adequate and experienced analytical chemisty resource is available to support the aquatic toxicology programme.	A review of the annual report of the department indicates the efforts that are being made to integrate the chemical and biological work.

Overall satisfactory progress was being made to achieving the objectives identified in the detailed recommendations of the previous mission report (June 1986 Annex 1).

Demonstration of method of generating test solutions.

A method for generating test solutions of substances with extremely low water solubilities was demonstrated. This method or other similar approaches are often essential if continuous-flow testing is to be carried out with such substances.

Discussion of research work on effects of Diazinon on fish in paddy rice.

Observations had been made that Diazinon was toxic to loach when applied to rice. This observation was supported by farmers reporting decreased loach populations in areas where Diazinon had been used. The loach is a food fish in Korea.

Follow up laboratory studies had confirmed that loach were several times more susceptible to Diazinon than carp, a species widely used to establish the acceptability of pesticides. Possible further research was discussed. Three proposals were made:-

i) That experiments be carried out to confirm that loach were more susceptible than carp in the field.

ii) That further laboratory experiments be carried out to establish if loach was generally more susceptible (to pesticides in general and organo phosphate insecticides in particular) than carp.

iii) To examine the basis for the greater susceptibility of loach to diazinon.

Review of Mr. S.K. Lee's Ph.D. Thesis

I reviewed and discussed aspects of Mr Lee's PhD Thesis. In particular we discussed results obtained from field experiments that had been carried out as a result of a demonstration given during the June 1986 mission. The work carried out using this field technique for assessing effects of pesticides on stream fauna had provided interesting results which Mr. Lee had utilized in his thesis.

The successful use of this technique by Mr. Lee exemplifies the usefulness of practical demonstrations as a means of encouraging the taking up of new approaches.

Selection of reference chemicals

The role of reference substances in aquatic toxicology was discussed. Standard tests in aquatic toxicology do not usually require the use of reference substances. Nonetheless when establishing a procedure in a laboratory or when conducting a programme of research reference chemicals can prove valuable. The following were recommended as criteria to bear in mind when choosing reference

chemicals:-

i) Physico-chemical properties - these should be appropriate for the test being used.

ii) Analytical methods - the method of chemical analysis for the reference substance should be inexpensive and sufficiently sensitive for the purpose of the test.

iii) There should be a body of data on the effects of the reference substance on a variety of aquatic organisms for comparative purposes.

iv) If possible the reference substance should be one which has some "environmental relevance" i.e. the data generated will contribute to a body of knowledge which will have some practical value outside of the immediate validation of the test system.

Future Research Projects

A wide ranging discussion of future research projects took place. TRC staff were aware that it was likely to be some 2-4 years before they would begin to carry out a significant amount of contract aquatic toxicology for "regulatory purposes". In the interim they are keen to conduct a useful programme of research.

I expressed the view that whilst it was desirable to conduct some more fundamental research much of their effort would have to be directed to the establishing and validation of the basic aquatic toxicology tests likely to be required if they are to function as a contract laboratory serving industry.

II. FUTURE DEVELOPMENT IN AQUATIC TOXICOLOGY

Work should continue on the establishing of GLP and the basic aquatic toxicology tests. Considerable effort will be required if tests other than acute ones are to become fully established over the next 2-3 years. Particular emphasis should be placed on chronic toxicity tests with Daphnia and fish (an early life stage test) and with fish bioaccumulation testing.

The move to new laboratory facilities in the next few months should provide added impetus to the staff.

III. CONCLUSIONS

The aquatic toxicology laboratory has the resources necessary for it to develop into an internationally accepted laboratory. Significant progress has been made since the June 1986 mission. On the other hand the progress made during the 15 months between the two missions gives an indication of the time scale and effort required to achieve the final objective.

Future development should continue to focus on, the implementation of GLP, increased practical experience in the conduct of basic aquatic toxicology tests with fish, Daphnia and algae (including, where necessary chemical monitoring of exposure concentrations). Continued external input either in the form of training visits for TRC staff or visits to TRC by "experts" is strongly advised if the momentum of the development is to be maintained.