参考資料5. 開所式プログラム

JICA SIRIM

Official Opening

5 DECEMBER 1995

By

H.E. MR. ISSEI NOMURA
AMBASSADOR OF JAPAN TO MALAYSIA

HAZARDOUS CHEMICALS AND WASTES
LABORATORY OPENING CEREMONY

0930	Arrival of guests
1000	Welcoming Address by Y.Bhg. Dato' Dr. Ahmad Tajuddin Ali Director General, SIRIM
	Address by Ms. Kayoko MIZUTA Resident Representative JICA Malaysia
	Opening Speech by H.E. Mr. Issei NOMURA Ambassador of Japan to Malaysia
1050	Official Opening of Laboratory
1100	Visit of Laboratory/Refreshment
1130	Press Conference

MESSAGE FROM

Y.B. Datuk Law Hieng Ding
Minister of Science, Technology and the Environment, Malaysia

The Malaysian economy has been maintaining its strong growth in the past few years achieving a real GDP of 9.6% this year, with the manufacturing sector generating a robust output growth of 14.7% and accounting for 79.7% of the total export earnings. With such rapid advances in industrial development, many kinds of chemical substances are manufactured, imported or consumed as raw materials, or as intermediate products. Many of these chemical substances are hazardous or potentially toxic to human health and the environment. On the other hand, the intensification of such developmental activities is expected to bring about significant impact on the environment through the unavoidable generation and discharge of wastes and the positive increase in the number of polluting sources. In fact, hazardous industrial wastes have been identified as major contributors to pollution in Malaysia and have caused serious concern. The Malaysian Government shares this concern and is taking positive steps to address these issues.

Under the circumstances, the implementation of this SIRIM-JICA collaborative project, which aims to intensify the functions of evaluation and analysis of hazardous chemical substances and the biological treatment of hazardous wastes, is indeed timely. I am confident that this project will contribute significantly to our efforts in achieving sustainable development through the enhancement of chemical safety and environmental protection while forging ahead with economic growth.

The official opening of the Hazardous Chemicals and Wastes Laboratory established under the aforementioned collaborative project at SIRIM therefore marks an important milestone in technological development in Malaysia.

On behalf of the Malaysian Government, I wish to express our sincere thanks to the Japanese Government for providing generous assistance in the establishment of this facility and technology transfer through the despatch of experts and counterpart training.

(Datuk Law Hieng Ding)
Minister of Science, Technology
and the Environment, Malaysia

Y. Bhg. Tan Sri Dato' Seri Ahmad Sarji bin Abdul Hamid
Chairman, SIRIM Board

Technology is the key to industrialisation and at the same time the provider of solutions for the associated problems. In order that Malaysia will be able to forge ahead in its technology race and industrialisation process within the context of sustainable development, R&D activities must be intensified and directed towards economic betterment and problem solving. In response to this, SIRIM has been implementing various R&D programmes, aimed at upgrading the quality and productivity of local industries - whether by means of contract or commissioned research, or by undertaking relevant in-house and collaborative research projects. Several joint projects have been and are being implemented with foreign institutions through inter-governmental and inter-institutional technical cooperation arrangments in order to accelerate technology acquisition and capability upgrading.

The Hazardous Chemicals and Wastes Project was one of the first two projects worldwide to be implemented under the new offer-type scheme initiated and adopted by JICA in 1993 to enable speedy implementation compared to the ordinary project-type technical cooperation which normally takes a much longer time from application to implemention. SIRIM is indeed honoured to be chosen for the implementation of the said scheme by JICA in Malaysia.

With the establishment of the Hazardous Chemicals and Wastes Laboratory, the Project is expected to generate the following outputs in Malaysia:

- Facilities and capabilities for evaluation and analysis of hazardous chemicals and biological treatment of hazardous wastes to support national programmes on chemical safety and hazardous waste management as an integral part of the country's industrialisation process.
- Databases on hazardous chemical substances and hazardous waste treatment technologies and their application software as a reference point for relevant agencies and industries involved in these areas.
- Upgraded capability and increased technical manpower in the above-mentioned areas.

I am confident that with the dedication and commitment of the Japanese experts and the Malaysian counterparts, the Project will achieve its set objectives.

(Tan Sri Dato' Seri Ahmad Sarji bin Abdul Hamid)
Chairman, SIRIM Board

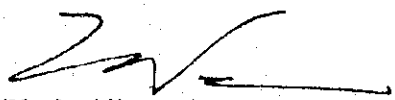
MESSAGE FROM

His Excellency
Mr. Issei Nomura
Ambassador of Japan to Malaysia

I would like to congratulate SIRIM on the opening of its new laboratory on hazardous chemicals and industrial wastes. Japanese assistance is based upon the philosophy of self-help. The construction of the laboratory by the Malaysian Government is a symbol of such self-help by Malaysia. The laboratory is going to house the equipment donated by the Japanese government.

In recent years, to the admiration of the entire world, Malaysia has been registering substantial economic growth through successful industrialization. But this remarkable growth has also exposed the country to potential environmental hazards. Proper management of these hazards is an absolute essential for sustainable development of the country. The SIRIM-JICA Collaborative Project is quite timely as it attempts to identify new approaches to the management of hazardous chemicals and industrial wastes.

I am aware that SIRIM plays a significant role in industrial research and development; while it strives to upgrade the technological capabilities and competitive advantages of industries, I am convinced that the SIRIM-JICA Project will reinforce the useful functions of SIRIM, thus contributing further to the socio-economic development of Malaysia. I hope this will also contribute to the enhancement of the friendly relations between Japan and Malaysia.



(Mr. Issei Nomura)
Ambassador of Japan to Malaysia

MESSAGE FROM

Ms. Kayoko Mizuta
Resident Representative
JICA Malaysia

It is my honour, on behalf of the Japan International Cooperation Agency (JICA), to give a message on the auspicious occasion of the Opening Ceremony of a New Laboratory especially meant for the utilisation of the SIRIM-JICA Project on Evaluation and Analysis of Hazardous Chemical Substances and Biological Treatment of Hazardous Wastes.

Potential environmental hazard is a serious matter in view of Malaysia's rapid development and her Vision 2020 of a fully developed nation. Therefore, I am pleased that Malaysia is treating this matter seriously by seeking new approaches to the Management of Hazardous Chemicals and Wastes.

This new extension will house some specialized laboratories meant to initiate research and development activities in hazardous chemicals and wastes management. Moreover the New Laboratory will be the symbol of SIRIM-JICA collaboration and partnership between Malaysia and Japan.

JICA's implementation of technical cooperation to SIRIM is much larger where science and technology is concerned; as SIRIM, being an important national standards and industrial research and development organisation, is responsible for the provision of scientific and technological services, and in this respect, we hope to be able to assist SIRIM to operate as a 'Centre of Excellence' for this purpose. Therefore, I trust that JICA and SIRIM will continue to work closely together towards the strengthening of our good relationship and mutual benefit of our two countries.

I take this opportunity to express our grateful thanks and appreciation to SIRIM for the kind assistance and cooperation extended to JICA and her experts, past and present, for a smooth transfer of technology.

Thank you.

Kayoko Mizuta

(Ms. Kayoko Mizuta)
Resident Representative
JICA Malaysia

MESSAGE FROM

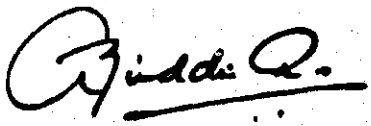
Y. Bhg. Dato' Dr. Ahmad Tajuddin bin Ali
Director General, SIRIM

SIRIM was established with the objectives to contribute to national economic development and to steer the nation towards industrialisation through its involvement in technological research and development, in addition to its traditional role in standardisation and quality assurance, as well as testing and technical evaluation activities. In response to the Government's policy on sustainable development, SIRIM is also playing a very crucial role in promoting public and industrial health and safety, and contributing to the Government's efforts to create greater private sector awareness of the need to protect public welfare and the environment while pursuing profit in their business ventures.

With the assistance provided by the Japanese Government through JICA, the SIRIM-JICA Hazardous Chemicals and Wastes Project was initiated to enhance environmental protection threatened by chemical substances which may be harmful to human health. With the establishment of this new laboratory, SIRIM will be able to build up its capability to contribute significantly to the streamlining and strengthening of the safety management system for hazardous chemical substances and wastes in Malaysia. This is to support a system of examination and implementation of the necessary regulations for the control of manufacture, import, transport, use and storage of chemical substances according to their properties.

Under the Project, several activities pertaining to chemical safety and hazardous waste treatment are carried out. These include the study on physical and chemical properties, research on biodegradability by microorganisms, investigation into the bioaccumulation potential of chemical substances in fish, assessment of safety and environmental distribution of hazardous chemicals substances, as well as the biological treatment of hazardous wastes. Databases on hazardous chemical substances and treatment technologies, when fully established, will serve as an excellent reference for the industry in particular, and the public at large.

On behalf of SIRIM, I wish to record our appreciation to JICA for the generous assistance provided.



(Dato' Dr. Ahmad Tajuddin bin Ali)
Director General, SIRIM

THE HAZARDOUS CHEMICALS AND WASTES PROJECT

The Project on ***Evaluation and Analysis of Hazardous Chemical Substances and Biological Treatment of Hazardous Wastes*** is a technical cooperation programme implemented by SIRIM together with Chemicals Inspection and Testing Institute (CITI) Japan as an offer-type project under the Japan International Cooperation Agency (JICA). The Project spans four years from September 1993. The overall objective of the Project is to intensify the functions of evaluation and analysis of hazardous chemical substances and biological treatment of hazardous wastes, thereby contributing to the streamlining and strengthening of the safety management system for hazardous chemical substances and wastes in Malaysia. The scope of research covers the following areas:

PHYSICAL AND CHEMICAL PROPERTIES

Physicochemical properties are of great importance to provide basic information in the assessment of chemical safety, such as in the evaluation of environmental distribution and in the selection of relevant test conditions. The work plan aims at setting up a coherent system of measurement whereby the nature and impact of hazardous substances on human health and the environment can be evaluated.

Chemical analysis using HPLC

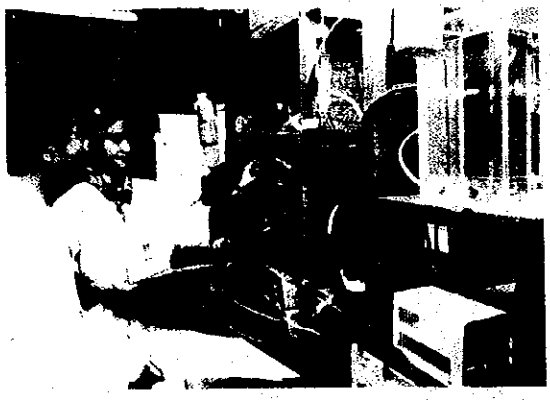
BIODEGRADATION

Work plan in this area involves the characterisation of chemical substances through the biodegradation of such substances using microorganisms. Microbial samples are collected from selected sites and cultured in the laboratory. This technology is essential for the prediction of persistence of chemicals in the environment. Persistent chemicals which are released to the environment become serious pollutants threatening human health and aquatic life.

Testing of biodegradability of toxic chemicals using BOD closed system

Analysis of chemicals using gas chromatograph

Fish culture for toxicity test



Chemical waste treatment system

BIOACCUMULATION

This activity aims at measuring the degree of accumulation of chemical substances in fish through exposure according to standard operating procedures. The significance of such work allows the evaluation of the cumulative potential of chemicals in living organisms thereby assessing the chronic effects which may be caused by them.

NURSING CONTROL OF TEST FISH

Expertise is being developed in the basic operation of fish culturing under specified conditions according to standard procedures to produce fish for use in toxicity tests. Toxicity evaluation of chemicals and wastes is an important integral part of chemical safety and waste management.

BIOLOGICAL TREATMENT OF HAZARDOUS WASTES

Under this activity, various biological processes, both aerobic and anaerobic, will be studied, with the aim of determining the feasibility of using indigenous microorganisms for the breakdown of waste containing hazardous pollutants. The studies will focus on the development of cost-effective treatment technologies suitable for on-site application to complement centralised treatment.

DATABASES

The Project plans to develop databases for chemical safety and hazardous waste treatment technology accessible to the public.

All research activities under the Project are to be carried out according to standard operating procedures and good laboratory practice. It is envisaged that the efforts of this collaborative project will contribute significantly to industrial development and environmental management in Malaysia.

YEAR		EVENT
1993	Apr	Dispatch of survey team
	Sep	Signing of the Record of Discussion between SIRIM and JICA
	Oct	Procurement of equipment Dispatch of short-term experts for hatchery construction
	Dec	Commencement of project site construction
1994	Mar	Counterpart (1) training in Japan Construction of hatchery
	Apr	Dispatch of Chief Advisor, Coordinator and three long-term experts
	Jun	Commencement of lectures for technology transfer
	Aug	Completion of construction of building
	Nov	Commencement of operation of fish hatchery
	Dec	Progress survey by JICA Consultation Team Building inspection for Certificate of Fitness Seminar on Chemical Safety and Hazardous Waste Treatment 1st Joint Coordinating Committee Meeting
1995	Jan	Dispatch of a short-term expert for waste treatment
	Mar	Dispatch of a short-term expert for equipment installation Counterpart (1) training in Japan Installation of laboratory facilities and equipment
	Apr	Dispatch of a short-term expert for waste treatment
	May	Counterparts (3) training in Japan
	Jul	Counterpart (1) training in Japan
	Aug	Dispatch of a short-term expert for waste treatment
	Sep	Dispatch of a short-term expert for database
	Dec	***Official opening of Laboratory for SIRIM-JICA Hazardous Chemicals and Wastes Project*** 2nd Joint Coordinating Committee Meeting Seminar on Management of Hazardous Chemical Substances

EQUIPMENT LIST

Gas Chromatograph

Gas Chromatograph Mass Spectrometer

Liquid Chromatograph Mass Spectrometer

Fourier Transfer Infra Red Spectrometer

High Performance Liquid Chromatograph

Total Organic Carbon Analyser

UV-Visible Spectrometer

Atomic Absorption Spectrometer

Capillary Ion Analyser

Elemental Analyser

BOD Meter (Biodegradation Test Equipment)

Microscopes

Computers

Microorganisms Cultivation Equipment

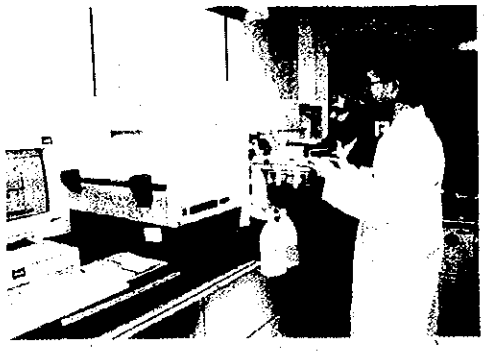
Bioaccumulation Testing Equipment

Fish Nursing Facilities

Biological Waste Treatment Facilities

Common Laboratory Equipment and Utensils

Injection of hormone into fish to reduce spawning

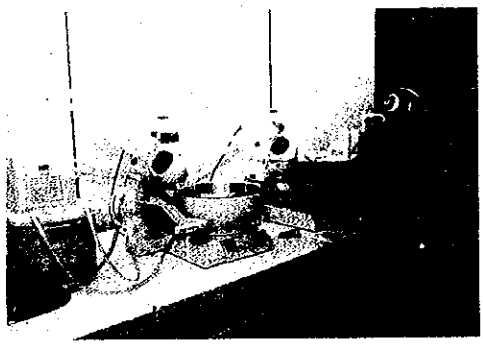


Heavy metal analysis for fish toxicity test with AAS

Analysis of volatile fatty acids to monitor conditions of treatment system

Elemental analysis for toxic chemicals

Standard activated sludge cultivation for biodegradation test



Preparation of bioaccumulation test

参考資料6. 野村大使　開所式あいさつ

Remarks

by H. E. Mr. Issei NOMURA
Ambassador of Japan to Malaysia

at Opening Ceremony of the New Laboratory

for the Project on Evaluation and
Analysis of Hazardous Chemical
Substances and Biological
Treatment of Hazardous Wastes

at SIRIM
(Standard and Industrial Research
Institude of Malaysia)

on 5 December 1995

Yang Berhormat Dato' Dr. Ahmad Tajuddin Ali Director General of SIRIM,

Distinguished Guests,

Ladies and Gentlemen,

It give me great pleasure to be here this morning and to say a few words of congratulations on the opening of the new laboratory. I appreciate the hard work by the SIRIM (Standard & Industrial Research Institute of Malaysia), the Ministry of Science, Technology and Evrironment (MOSTE) and JICA, which have been involved in this important undertaking. The laboratory symbolises their unswerving devotion and productive synergy.

Japanese assistance is based upon the philosophy of helping the recipient

countries stand on their own feet. In this regard,

I would call the JICA-SIRIM project a model of such joint endeavours.

After a series of studies and discussions, the two Governments agreed to embark on the project in September 1993. Since then five long-term and eight short-term experts have been assigned from Japan to the SIRIM, while seven Malaysian counterparts went to Japan for training. In addition, analysis equipment worth 230 million Japanese Yen or 5.75 million ringgit has been provided to the SIRIM. The Malaysian side, as we are all witnessing here, completed the laboratory building, which houses the equipment and research facilities.

Having served as Ambassador of Japan for the last fifty days, I am very much impressed by the vigorous economic activities of this nation. However, the remarkable economic growth has begun to expose the country to potential environmental hazards. Reduciotn of this potential environmental hazards has become one of the most pressing needs of Malaysia. The SIRIM-JICA project is quite opportune as it is intended to meet these needs of the nation. Specifically, the project is aimed at transferring the technology of safety evaluation and hazardous substance analysis as well as that of biological treatment of hazardous wastes. On top of all this, a data-base on hazardous substances and waste treatment technologies will be created and made available for public use.

Ladies and Gentlemen,

Malaysia has already reached an advanced stage of development with over 4,000 US dollar per capitaincome, and is at present making great strides toward Vision 2020. At the same time, Malaysia, as a nation in the process of rapid industrialization, is in need of expertise in advanced technology for its further economic upgranding and for the prevention of potential environmental hazards. The SIRIM has played a significant role in industrial development of Malaysia. I am convinced that this project will add more to the useful functions of the SIRIM, thus contributing further to the socio-economic development of Malaysia. And I shuold like to ask you all present here to give this project your unwavering

support.

With these remarks, I now have great pleasure in declaring the new laboratory for the project on Evaluation and Analysis of Hazardous Chemical Substances and Biological Treatment of Hazardous Wastes at the SIRIM officially open.

Thank you.

参考資料7. SIRIM長官　開所式あいさつ

Welcoming Address
by
Y. Bhg. Dato' Dr. Ahmad Tajuddin Ali
Director-General SIRIM
at
Official Opening of the SIRIM-JICA Laboratory
for Hazardous Chemicals and Wastes
on
5 December 1995
at
Block 15 Annex, SIRIM, Shah Alam

Your Excellency, Mr. Issei Nomura
Ambassador of Japan to Malaysia

Ms Kayoko Mizuta
Resident Representative of JICA Malaysia

Mr. Kazuhiro Yonedo
Leader of the Japanese Consultation Team

Mr. Hiroshi Matsunaka
Director of Chemical Biotesting Centre. CITI Japan

Members of the SIRIM Board

Members of the Japanese Consultation Team

Distinguished guests

Ladies and Gentlemen

It gives me great pleasure to welcome all of you. in particular our guests from Japan, to SIRIM this morning to witness the official opening of the Laboratory set up by the SIRIM-JICA Collaborative Project on Evaluation and Analysis of Hazardous Chemical Substances and Biological Treatment of Hazardous Wastes.

I am grateful to His Excellency Mr. Issei Nomura for taking time off his very busy schedule to officiate this opening ceremony.

Today's function signifies an important milestone in the implementation of this very significant SIRIM-JICA Collaborative Project. As you may be aware, the Project was one of the first two projects worldwide to be implemented under the new offer-type scheme initiated and adopted by JICA in 1993 to enable speedy implementation compared to the ordinary project-type technical cooperation which normally takes much longer time from the time of the "request" or application to the actual start or implementation of the project. Malaysia and indeed SIRIM is indeed honoured to be chosen for the implementation of this proto-type scheme by JICA.

Your Excellency, Ladies and Gentlemen,

In an article titled "Acid Rain" published in New York in 1987, the authors RH Boyle and A. Boyle wrote "*Into the sewer which was the global atmosphere, are being spewed every year 20 billion tonnes of carbon dioxide, 130 million tonnes of sulphur dioxide, 97 million tonnes of hydrocarbons, 53 million tonnes of arsenic, cadmium, lead, mercury, nickel and other toxic materials. Also being injected into it are a host of synthetic organic compounds such as polychlorinated biphenyls (PCB's) and toxaphene which are known to be capable of inducing a variety of cancers, birth defects or genetic mutations*". That was in 1987!

I do not wish to frighten everyone but it is obvious that from now we must take the necessary steps to minimise the emission and discharge of hazardous chemicals into the world around us. Although in the global context, what we do here in Malaysia is only a tiny speck in the ocean, we believe that this is the very thing that every nation should do. Many parties would say that this is the price the world has to pay for development but I believe that development also bring with it the solution in the form of better technology and more sophisticated equipment. For us in SIRIM, we believe that in the Malaysian context, what we do here in SIRIM, at providing technological solutions to environmental problems, can contribute significantly to the national effort aimed at making the environment us a more conducive place for all to live.

In the promotion of environmentally sound and sustainable development, the Government of Malaysia has established the necessary legal and institutional arrangements such that environmental factors are considered are considered at the early stages of industrial planning. In the review of The Environmental Quality Act, 1974 (Amendment) 1985, a provision to include the use of recycled substances and environmental labelling is proposed to be included. We believe that this is timely in view of the rapidly depleting natural resources, problems in treating wastes and the high amount of wastes, including toxic wastes, being generated presently.

SIRIM was established with the objectives to contribute to national economic development and to steer the nation towards industrialisation through its involvement in technological research and development, in addition to its traditional role in standardisation and quality assurance, as well as testing and technical evaluation

activities. In response to the Government's policy on sustainable development, SIRIM is also playing a very crucial role in promoting public and industrial health and safety, and contributing to the Government's efforts to create greater private sector awareness of the need to protect public welfare and the environment while pursuing profit in their business ventures.

With the assistance provided by the Japanese Government through JICA, this SIRIM-JICA Hazardous Chemicals and Wastes Project was initiated to enhance environmental protection threatened by chemical substances which may be harmful to human health. With the establishment of this new laboratory, SIRIM will be able to build up its capability to contribute significantly to the streamlining and strengthening of the safety management system for hazardous chemical substances and wastes in Malaysia. This is to support a system of examination and implementation of the necessary regulations for the control of manufacture, import, transport, use and storage of chemical substances according to their properties.

Your Excellency, Ladies and Gentlemen.

This project will be able to contribute significantly towards the achievement of a better environment and especially to assist the industrial sector of the country as this project is expected to generate the following outputs in Malaysia:

- Facilities and capabilities for evaluation and analysis of hazardous chemicals and biological treatment of hazardous wastes to support national programmes on

chemical safety and hazardous waste management as an integral part of the country's industrialisation process

- Databases on hazardous chemical substances and hazardous waste treatment technologies and their application software as a reference point for relevant agencies and industries involved in these areas.
- Upgraded capability and increased technical manpower in the above-mentioned areas.

Under the Project, several activities pertaining to chemical safety and hazardous waste treatment are to be carried out. These include the study on physical and chemical properties, research on biodegradability by microorganisms, investigation into the bioaccumulation potential of chemical substances in fish, assessment of safety and environmental distribution of hazardous chemical substances, and the biological treatment of hazardous wastes. Databases on hazardous chemical substances and treatment technologies, when fully established, will serve as an excellent reference for the industry in particular, and the public at large.

Your Excellency, Ladies and Gentlemen.

I am pleased to announce here that SIRIM will be strengthening our involvement in the Environmental Technology area from next year. The present Group on Environmental Technology within the Chemical and Bio-Technology Centre will be upgraded into a fully-fledge Environmental Technology Centre on 1 January 1996. This re-structuring is in line with our corporatisation which is targetted to come into effect on 1 March

1996. I sincerely hope that this re-structuring move will provide better focus on our activities in the environmental technology area, and corporatisation will enable us to be more flexible and responsive to the needs of our clients, be it government or the private sector.

Your Excellency, Ladies and Gentlemen,

On behalf of SIRIM and the Malaysian Government, I wish to record our appreciation to the Japanese Government and JICA for the generous assistance in the establishment of this facility and the technology transfer that will take place through the despatch of experts and counterpart training.

I also wish to take this opportunity to thank all the relevant Government agencies for their support in facilitating the implementation of this Project, which marks yet another important milestone in cooperation between Malaysia and Japan. I am confident that with the dedication and commitment of the Japanese experts and the Malaysian counterparts, this Project will achieve its set objectives.

Thank you.

参考資料8. 新聞記事

Hazardous chemicals databases to be set up

By Sa'odah Elias

SHAH ALAM, Tues. — The Standard and Industrial Research Institute of Malaysia (Sirim) is in the process of setting up databases on hazardous chemicals and wastes and the treatment and management technologies for such substances and wastes.

The setting up of the databases, which will be made accessible to the Government and industries, was made possible with the establishment of its hazardous chemicals and wastes laboratory.

The project, spanning a period of five years and costing nearly RM5 million, is part of a collaborative project between the institute and the Japan International Co-operation Agency (Jica).

Sirim director-general Datuk Dr Ahmad Tajuddin Ali said the databases, when fully established, would serve as a reference for industries and the public on the management and treatment of hazardous substances and wastes to enhance environmental protection in the country.

He said the laboratory, one of the most advanced in the region, would carry out various analytical studies pertaining to chemical safety and hazardous waste treatment.

"These include the study on physical and chemical properties, research on biodegradability by microorganisms, investigation into the bioaccumulation potential of chemical substances in fish, assessment of safety and environmental distribution of hazardous chemical substances as well as the biological treatment of hazardous wastes.

NEW HIGH TECH LABORATORY ... Nomura inspecting equipment used for High Performance Liquid Chromatography (HPLC) which is used for the measurement of organic material containing organic acid. On the left is Sirim director-general Ahmad Tajuddin.

"The findings will enable us to classify hazardous chemicals and wastes accordingly in order to complement and strengthen the safety management system for hazardous chemical substances and wastes in the country," he told reporters after the opening of the laboratory by the Japanese Ambassador to Malaysia Issei Nomura here today.

The project, he added, would provide support for the implementation of regulations for the control, manufacture, import, transport, use and storage of chemical substances according to their properties.

Ahmad Tajuddin said a team of researchers from the institute had been sent to Japan to undergo extensive training on waste management and treatment technologies at the Chemicals Inspection and Testing Institute of Japan.

On the institute's function with regard to its research activities once it was corporatised, Ahmad Tajuddin said there would not be much changes in its research and laboratory activities.

"However, we will operate as a private company on behalf of the Government on a contract basis. The Government will continue to finance the laboratory and research facilities while Sirim will manage them for a fee," he added.

He said the Bill on the corporatisation of Sirim was expected to be passed by Parliament in its current sitting to enable the institute to be corporatised in March.

参考資料9. 飛騨団員　有害化学物質セミナー原稿

SEMINAR ON MANAGEMENT OF HAZARDOUS CHEMICAL SUBSTANCES

PAPER 2

JAPANESE REGULATIONS AND OECD'S ACTIVITIES ON CHEMICAL SAFETY

BY

MR. HIDA
MINISTRY OF INTERNATIONAL TRADE AND INDUSTRY
JAPAN

JOINTLY ORGANISED
BY

SIRIM

JICA

1 ENFORCEMENT OF THE LAW CONCERNING THE EXAMINATION AND REGULATION OF MANUFACTURE, ETC., OF CHEMICAL SUBSTANCES

(1) An outline of the Law Concerning the Examination and Regulation of Manufacture, etc., of Chemical Substances (Chemical Substances Control Law)

The Chemical Substances Control Law was established in 1973 to prevent environmental pollution and hazards to human health by chemical substances used for various purposes, The impetus for its enactment was the problem of environmental pollution caused by PCB (polychlorinated biphenyl) in the late 1960s. It provided for examination of new chemical substances before they are manufactured or imported and has designated those chemical substances which have similar properties to PCB (low biodegradation, high bioaccumulation and chronic toxicity) as Class I Specified Chemical Substances, and in fact prohibited the manufacture and import of such substances. (Nine substances including PCB have been designated as Class I Specified Chemical Substances to date.)

Then, the Law was amended in 1986 which introduced the system designating Designated Chemical Substances and Class II Specified Chemical Substances, originating out of the necessity to regulate the substances having the properties of low bioaccumulation, but low biodegradability and chronic toxicity, depending on the degree of persistence in the environment.

With regard to Class II Specified Chemical Substances and Designated Chemical Substances, efforts are being made to reduce the accumulation of these substances in the environment through examination of the conditions of production, import and use of these substances, and guidance given to the companies using these substances.

[Purposes of the Chemical Substances Control Law (Article 1)]
This Law, in order to prevent pollution of the environment by chemical substances which have persistence and which may possibly be harmful to human health, has as its purpose the establishment of a system of examination to determine, before the manufacture or import of new chemical substances, whether such substances have persistence or other such properties, and the implementation of necessary regulations, in the manufacture, import, use, etc. of chemical substances according to their properties, etc.

With the enforcement of the Chemical Substances Control Law, the following is executed.

(2) Examination of new chemical substances

Any new chemical substance is examined for safety with respect to its biodegradation, bioaccumulation and chronic toxicity based on a notification submitted from companies before it is manufactured or imported. (Number of notifications in 1993: 229)

(3) Regulation of Class I Specified Chemical Substances

Designation of chemical substances having low biodegradation, high bioaccumulation and chronic toxicity by Cabinet Order; and Enforcement of regulation concerning permission for manufacture or import and restriction of use. (Heretofore, there have been no cases of permission for manufacture or import.)

-To date, nine substances have been designated, including PCB.

(4) Regulation of Designated Chemical Substances and Class II Specified Chemical Substances

Chemical substances, having low biodegradation, low bioaccumulation and suspected chronic toxicity, are identified as Designated Chemical Substances; reporting of the quantities of manufacture, import and shipment, quantitative assessment of environmental pollution and harm to the human based upon the reported quantities and additional tests on chronic toxicity.

Any substances determined as having chronic toxicity as the result of additional studies were designated as Class II Specified Chemical Substances by Cabinet Order; requiring regulation such as affixed labelling and publication of technical guidelines, reporting of the intended quantities for manufacture, import or delivery, and ordering, as required, alteration of the manufacturing or import quantity.

- Designated Chemical Substances: Chloroform and others, totaling 182 substances (as of the end of November 1994).
- Class II Specified Chemical Substances: trichloro-ethylene and others, totaling 23 substances (as of the end of November 1993).

(5) Recognition of new chemical substances in low volume

For any chemical substance of which the total volume of manufacture or import is 1 ton or less

a year throughout the nation; recognition is conducted based on reports submitted from the companies, and manufacture and import of the substances are approved.
(Reports in 1994: 7,567 cases)

(6) Promotion of Good Laboratory Practice (GLP) system

To promote mutual acceptance of test data among the member countries of the OECD, compliance with OECD-GLP standards was recommended at the OECD in 1981 as the standards testing facilities should comply with.

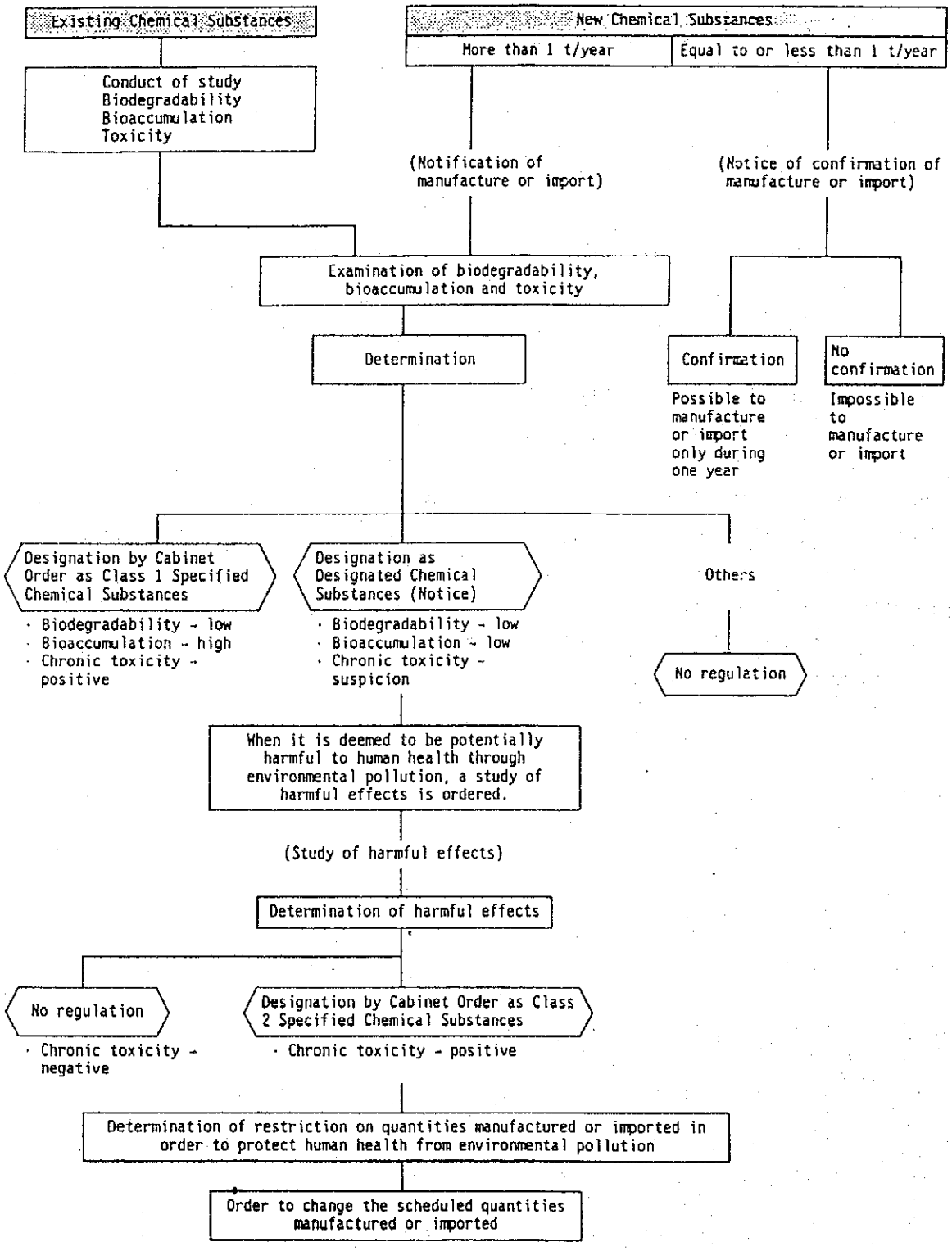
In Japan, "Guidance concerning Test Results as Data for Evaluation on Examination of New Chemical Substances" (notice) was enforced on March 18, 1985, which was applied to the tests carried out on and after October 1, 1985 (presently 16 facilities are authorized).

(7) Promotion of Inspection for Safety of Existing Chemical Substances

For about 20,000 chemical substances already actually manufactured or imported at the time of enactment of the Chemical Substances Control Law (existing chemical substances), the Government has been performing inspection for safety of existing chemical substances and designating Class I Specified Chemical Substances, Class II Specified Chemical Substances or Designated Chemical Substances, as required. The government has granted subsidies to the Chemicals Inspection & Testing Institute to perform inspection. (Inspection of 1,018 substances was completed by the end of 1994)

Appendix 1

Systematic Chart of Chemical Substances Control Law



Appendix 2

Regulation of Chemical Substances under Chemical Substances Control Law

	Chemical Substances	Control Measures
Class 1 Specified Chemical Substances	<Ordinance-designated> Polychlorinated biphenyls (PCB) Polychlorinated naphthalenes (PCN) Hexachlorobenzene Aldrin Dieldrin Endrin DDT Chlordane TBTO (9 substances)	<1> Authorization for manufacture or import (No actual authorization hitherto) [Article 6, Article 7, Article 11] <2> Restrictions on imports of product in which a Class 1 Specified Chemical Substance is contained (Cutting oil containing PCB etc.) [Article 13] <3> Restriction on use, Notification of use [Article 14, Article 15] The substances may only be used if it is difficult to find a substitute and there is no danger of contaminating the environment. However, notification of use is necessary. <4> Order to manufacturers or importers for recovery of the product etc.. Collection of Reports. [Article 22]
Class 2 Specified Chemical Substances	<Ordinance-designated> Trichloroethylene Tetrachloroethylene Carbon tetrachloride TPT Compounds (7 substances) TBT Compounds (13 substances) (23 substances)	<1> Notification of scheduled annual quantities manufactured or imported, and annual quantities manufactured or imported during the preceding year (up to the end of June) [Article 26] <2> Preparation and publication of a technical guideline concerning manufacture, storage, use, etc., of the substances. Persons handling them shall comply with the guideline. [Article 27] <3> Obligation of labeling on containers, packing or invoices (Items of labeling: name, general precautions for storage or handling) [Article 28] <4> Order to change the scheduled manufacturing or import quantities. [Article 26]
Designated Chemical Substances	<Notice> Chloroform, etc., 191 substances (already notified: 135 substances)	<1> Notification of annual quantities manufactured or imported during the preceding year up to the end of June. [Article 23] <2> Direction to conduct a study concerning harmful effects on human health corresponding to the status of environmental contamination. [Article 24] <3> Cancellation of designated Chemical Substances when the substances were designated as Class 2 Specified Chemical Substances or the substances were confirmed as having no possibility of harmful effects on human health based on the study results. [Article 25]

2 DEVELOPMENT OF ACTIVITIES AT OECD

(1) Initial stage (1973-1975) Started activities regarding specified chemicals such as PCB.

(2) Period I (1975-1983) Established the testing and evaluation procedures for determining safety of chemicals, and achieved international harmonization

a) Test guidelines (1977 Council Recommendation)

b) Minimum Pre-marketing Set of Data (MPD) (1982 Council Decision)

c) Guideline for GLP (1983 Council Recommendation)

(3) Period II (1983-1991) Promoted information exchange regarding safety of chemicals (1983, 1984 Council Recommendations)

(4) Period III (1991-present) Promoted activities on chemical safety

New activities:

a) Collection and inspection of safety data of high production volume chemicals

b) Promotion of risk reduction of selected chemicals

c) Preparation of guidance document on Pollutant Release and Transfer Register (PRTR)

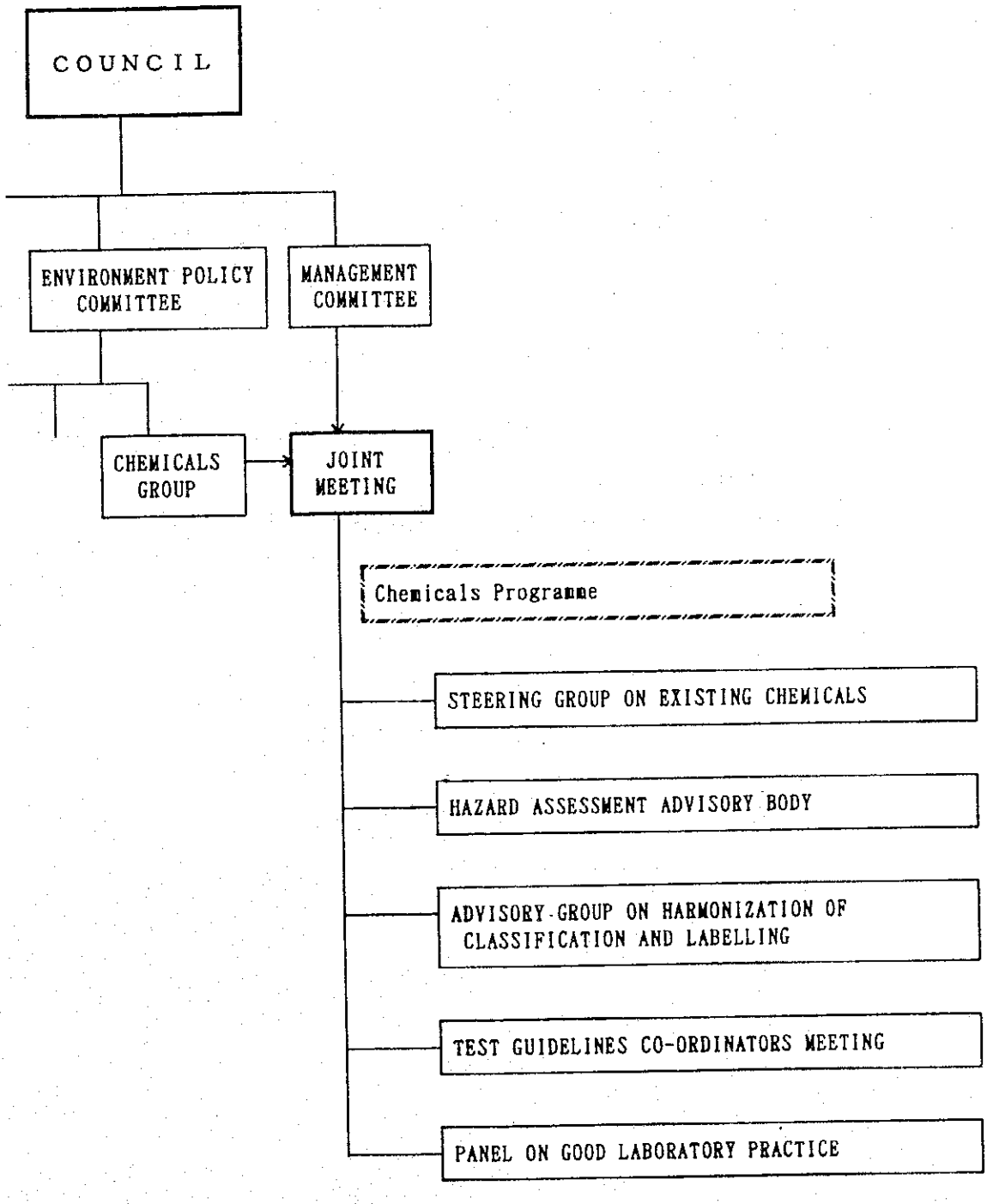
Activities-in-continuation:

d) Addition and revision of test guidelines, promotion of mutual recognition of GLP among countries, study and adjustment of hazard assessment procedures, exchange of safety data on individual chemicals

e) Enforcement of cooperation with other international organizations (IPCS, IRPTC, etc) regarding information exchange, etc.

f) Exchange of information on prevention of chemical accidents and contingency plans, and preparation and dissemination of basic guidelines

RELATIONSHIP OF EPOC, THE CHEMICALS GROUP AND THE MANAGEMENT COMMITEE WITH SUBSIDIARY BODIES AND GROUPS



THE OECD CHEMICALS PROGRAMME

TESTING AND ASSESSING CHEMICALS

-MINIMUM PRE-MARKETING SET OF DATA (MPD)
-TEST GUIDELINES
-GOOD LABORATORY PRACTICE (GLP)
-MUTUAL ACCEPTANCE OF DATA (MAD)
-HAZARD ASSESSMENT
-HARMONIZATION OF CLASSIFICATION AND LABELLING SYSTEMS

EXISTING CHEMICALS ACTIVITIES

-CO-OPERATIVE INVESTIGATION OF HIGH PRODUCTION VOLUME CHEMICALS (HPV)
-RISK REDUCTION OF SELECTED CHEMICALS

参考資料10. 佐野団員　有害化学物質セミナー原稿

SEMINAR ON MANAGEMENT OF HAZARDOUS CHEMICAL SUBSTANCES

PAPER 4

RISK MANAGEMENT ON CHEMICAL PRODUCTS

BY

MR. SANO
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JAPAN

JOINTLY ORGANISED
BY

SIRIM

JICA

The Risk Management of Chemical Products

HIROSHI SANO

Japan Petrochemical Industry Association
Industrial Hygiene & Toxicology Committee

I am greatly honored to be given this opportunity to speak before the officers and members of the government and the chemical industry of Malaysia, on the safe management of chemical substances as it is viewed and practiced in Japan.

Although chemical substances are indispensable to human life, they affect human health and the environment, throughout their life cycle - from research and development, through production, sale, and distribution, to use and disposal. Today I would like to describe how Japanese companies assess their effects and implement their safe management.

Hazard Identification

Chemical companies must evaluate the potential hazards of the chemicals they use and produce. This includes physical hazards, such as fire and explosion, and adverse effects on human health and the environment. The evaluation process is called hazard identification. It is conducted in step with each stage of product development, and consists essentially of the following determinations.

Physico-chemical properties:
- Boiling point, vapor pressure, hydrolytic property, flash point, explosivity, etc.

Effects on human health :
- Acute toxicity (oral and dermal routes, inhalation toxicity, eye and skin irritation and sensitization)
- Mutagenicity (Ames test, chromosomal aberration, microneucleus test, etc.)
- Repeated-dose and chronic toxicities, carcinogenicity, teratogenicity, reporductive toxicity

Environmental hazards:
- Biodegradability, bioconcentration
- Ecotoxicity (fish toxicity, *daphnia* sp., acute immobilisation test and reporduction test, algae growth inhibition test)

The test methods used to determine these properties and characteristics are generally given in the OECD Guidelines for the Testing of Chemicals, issued by the Organization for Economic Development and Cooperation. For toxicity screening, the OECD has also proposed the use of its Minimum Premarketing Data Set, or MPD.

Risk Assessment

The next step is risk assessment. The chemical companies must determine the degree of human exposure and environmental effects that would be involved in the production and use of the chemical. They must then assess the risk that this presents, to human health and the environment, in all of the following.

Production:
- Worker exposure, in working environment.
- Environmental effects of release to air, water, and soil.

Transport:
- Effects on humans and environment, in the case of normal transport and in the event of accidents.

Processing and consumption:
- Worker exposure, in processing environment.
- Consumer exposure, during use.

Disposal and treatment:
- Effects of disposal and treatment on human health and the environment.

Risk Management

On the basis of the risk assessment, the chemical companies must plan and implement the following.
- Workplace environment standards.
- Workplace environment control facilities.
- Waste treatment and disposal facilities.

The chemical companies must also provide the chemical transporters, recipients, and consumers with information on safe handling and use, in the form of labels, warning or precautionary statements, and technical documents. Material safety data sheets are provided to convey comprehensive safety information, including potential hazards, environmental effects, and emergency measures. The data sheets generally follow the international standard MSDS model, and incorporate the company's own technical expertise and know-how related to safe handling and use of the subject chemical. The documents describing the risk, and the recipients of these documents, are as follows.

Risk communication document	Document recipients
-Labelling statements on packaging and containers	Product receivers, consumers
-Warning statements on packaging and containers	Product receivers, consumers, transporters
-Material Safety Data Sheet	Product receivers, employees
-Technical documents, catalogues	Product receivers
-TREM cards	Transporters

The laws and regulations in effect in Japan, regarding risk communication, are shown in Appendix-1.

Responsible Care

The following laws and regulations are in effect in Japan, regarding safety assessment and safety management of chemical substances for general industrial use.

-Law concerning the examination and regulation of manufacture, etc., of chemical substances.
-Industrial safety and health law.
-Poisonous and deleterious substances control law.
-Air pollution control law.
-Water pollution control law.
-Ordinances for control of exportation and trade.

The chemical companies are required not only to comply with all of these applicable laws and regulations, but also to make a constant effort for safe management of chemical substances with due consideration of the industry association standards and the company's own standards.

For this purpose, the chemical companies must constantly study the available state-of-the-art safety information on their chemical substances, and assess their effects on human health and the environment in this light.

The chemical companies must communicate, to the product receivers, consumers, and other related parties, all necessary safety information fully based on this assessment.

Japanese companies are also widely adopting and implementing the Responsible Care program. The Responsible Care program consists of comprehensive, voluntary initiatives for the safe management of chemical substances, and protection of human health and the environment.

All of the efforts I have described today are based on the understanding that they are beneficial not only to workers, consumers, and society, but also in the knowledge that they are in the best interest of the chemical companies themselves. Chemical substances are deeply interrelated with human life. For this very reason, if we do not perceive the adverse effects of a chemical substance on health or environment, and fail to take timely, effective measures to eliminate these effects, the consequences may be disastrous and their remedy may be prohibitively expensive. This was exemplified by the Love Canal incident in the United States, and by the Minamata disease in Japan. We must work constantly, in good faith, to identify risk, preserve safety, and protect human health and the environment.

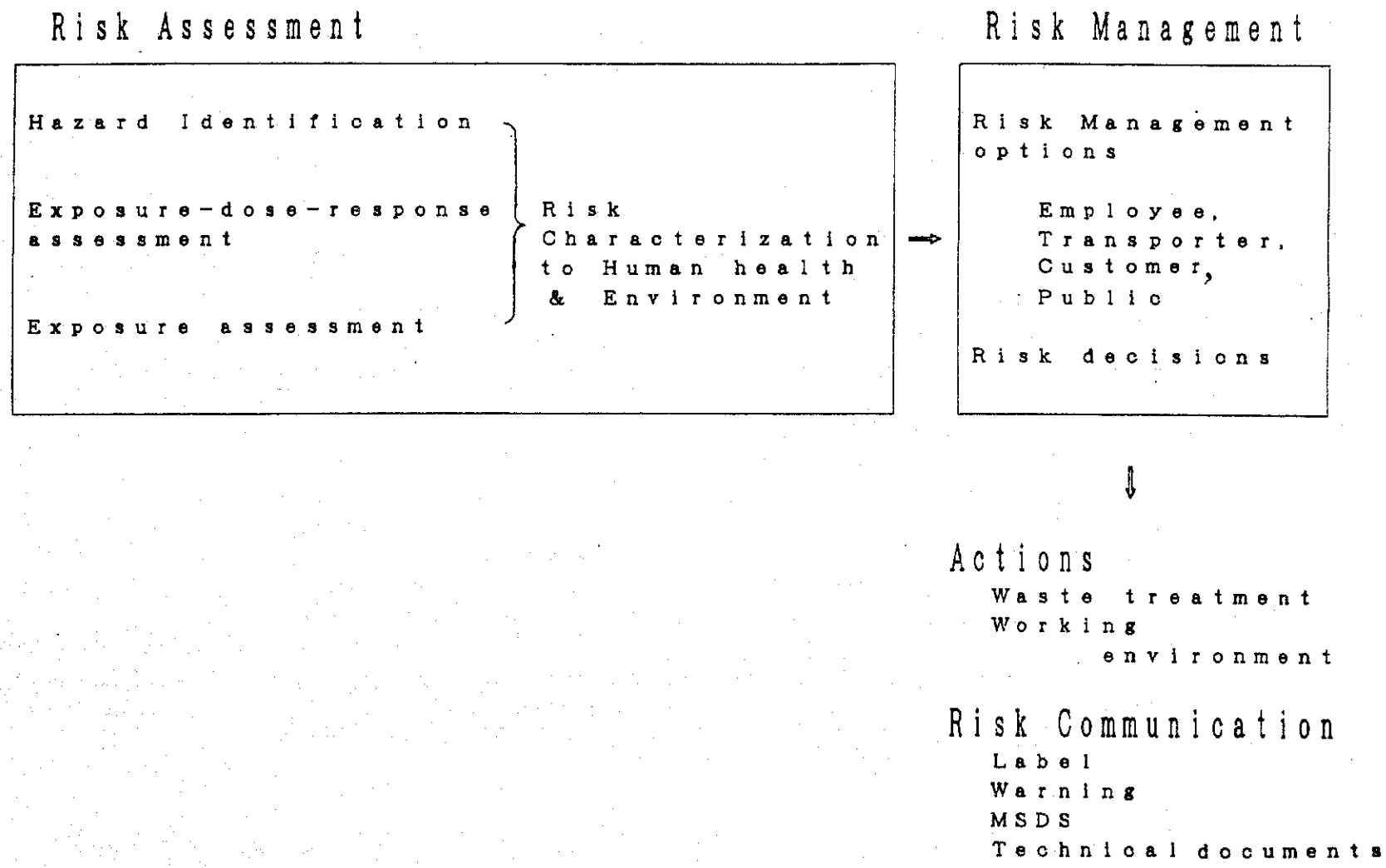
In closing, let me express my thanks also to the many people and organizations, and the Japan International Cooperation Agency, who have made our meeting possible. I am most grateful, to all of you here today, for your very kind consideration.

Appendix-1 Japanese Laws and Regulations and Chemical Associations' Standards Regarding Risk Communication

	Related laws and regulations	Chemical associations' standards
Label statements, warning statements on packagings and containers	•Ordinance on regulating dangerous substances •Poisonous and deleterious substances control law •Law concerning the examination and regulation of manufacture, etc. of chemical substances •Harmful substance containing household products control law •Industrial safety and health law •JIS Z9101(1995)	•Guideline for labelling of containers of chemical products (JCIA) •Guideline for labelling of petrochemical products (JPIA)
Material safety data sheet	•Ordinance No. 60, Ministry of Labor (1992) •Ordinance No. 1, Ministry of International Trade and Industry and Ministry of Health and Welfare(1993)	•Guideline for preparation of material safety data sheet(JCIA, 1992)
Technical documents and catalogues	•Law regulating improper labelling and premiums (Under anti-trust law)	•Guideline on instructions for customers etc of chemical products (JCIA)
TREM cards		•Guideline for chemical products transportation and distribution(JCIA)

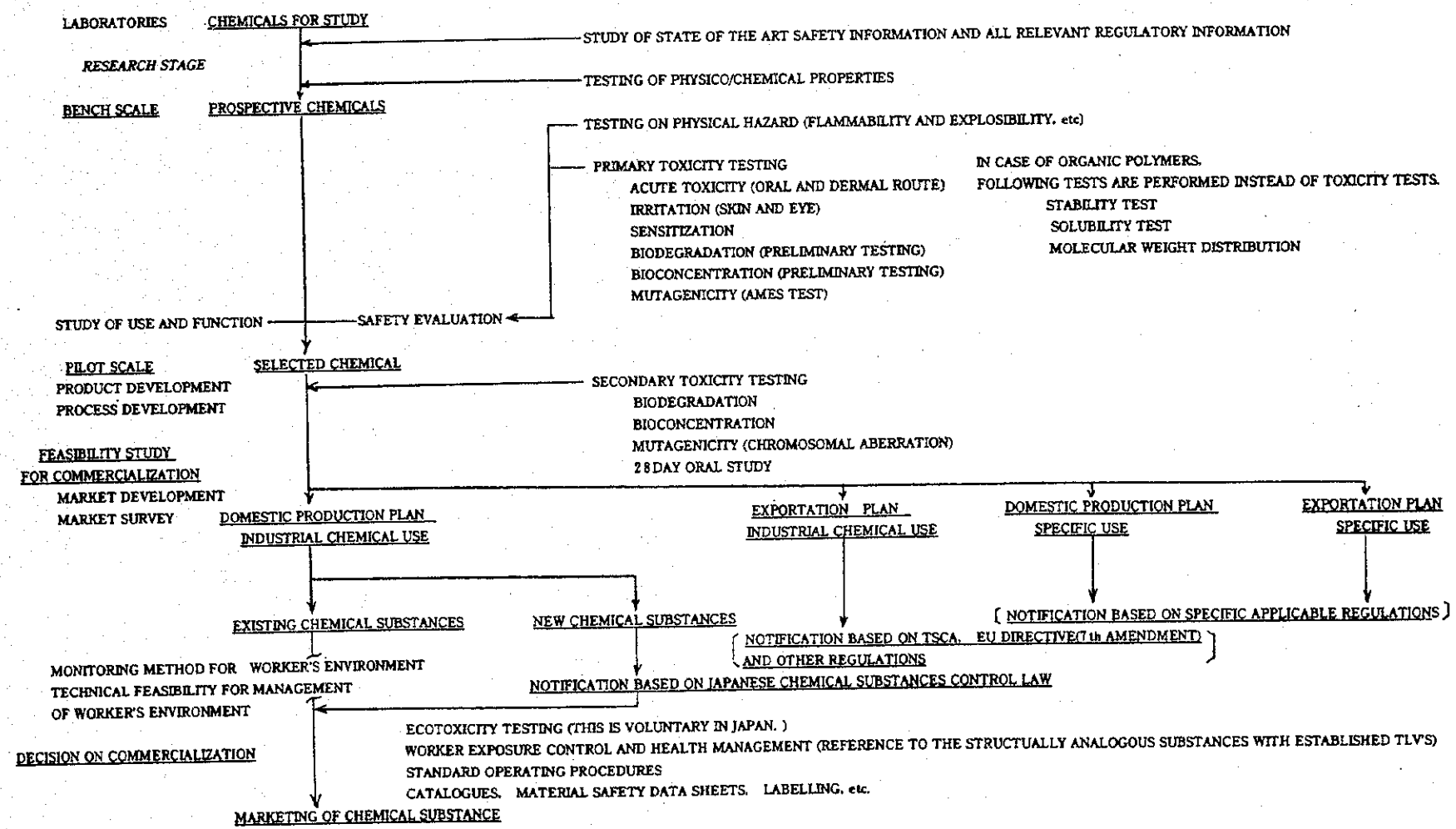
NOTES:
JCIA=JAPAN CHEMICAL INDUSTRY ASSOCIATION
JPIA=JAPAN PETROCHEMICAL INDUSTRY ASSOCIATION

Appendix-2


Risk Assessment
Hazard Identification
Exposure-dose-response assessment
Exposure assessment
Risk Characterization to Human health & Environment
Risk Management
Risk Management options
Employee,
Transporter,
Customer,
Public
Risk decisions
Actions
Waste treatment
Working environment
Risk Communication
Label
Warning
MSDS
Technical documents

Appendix-3

SAFETY ASSESSMENT OF CHEMICAL SUBSTANCES



Appendix 4 OECD Minimum premarketing data set(MPD) and

screening information data set(SIDS)

MPD	SIDS
Chemical Identification Data Name, e.g. IUPAC Other names Structural formula CAS-number Spectra Degree of purity Percentage by weight of impurities Percentage by weight of additives	Chemicals Identity
Physical/Chemical data Melting point Boiling point Density Vapour pressure Water solubility Partition coefficient Hydrolysis Spectra Adsorption - Desorption Dissociation constant Particle size	Physical chemistry Melting point Boiling point Vapour pressure Partition coefficient Water solubility Dissociation constant
Production/Use/Disposal data Estimated production, tons/year Intended uses Suggested disposal methods Expected mode of transportation	Exposure Sources Users Estimates of releases Estimates of exposure to man and environment
Degradation/Accumulation data Biodegradation: readily biodegradable Bioaccumulation: partitioning coefficient, n-octanol/water, fat solubility, water solubility, biodegradability	Environmental Fate and Pathways Biodegradation Abiotic degradability Distribution Estimates
Toxicity data Acute oral toxicity Acute dermal toxicity Acute inhalation toxicity Skin irritation Skin sensitisation Eye irritation Repeated dose toxicity Mutagenicity	Toxicity Acute toxicity Repeated dose toxicity Genetic toxicity - Point Mutation - Chromosomal aberration Reproductive toxicity
Ecotoxicity data Fish LC50 - at least 96 hours exposure Daphnia - reproduction 14 days Alga - growth inhibition 4 days	Ecotoxicity Acute fish toxicity Prolonged Daphnia toxicity Acute algae toxicity Terrestrial toxicity (if significant terrestrial exposure)
Recommended precautions and emergency measures	
Analytical methods	

Appendix-5

AA Chemical Co., Ltd.

The Corporate Commitment to Product Quality and Safety

1. Policy

The basic corporate tenet of AA Chemical, in all of its policies, activities, and operations, is the creation of a living environment of true value to humanity and human welfare, predicated on harmony between human activities and protection of the global environment, through research, development, and implementation of process and product technologies.

The corporate policy for product safety and quality is guided by this tenet. It seeks to contribute to human welfare and social development, with the creation and provision of better, safer products worthy of the customer's trust and satisfaction, particularly through:

- Product development guided by a full and accurate perception of the customer's needs and standpoint.
- Thoroughgoing quality control and constant enhancement of process technology and know-how, in all phases of production.
- Effective guidance and promotion of the safe and proper use of AA Chemical products.
- Full, effective consideration of the effects of AA Chemical products on safety and environment - throughout their life cycle of production, use, and final disposal.

2. Implementation

Effective implementation of this policy, by its nature, requires that it be regarded and actively pursued by both management and employees as an integral part of their normal everyday duties, and that it be held as an organizational and operational activity of the corporation.

AA has therefore adopted a mutually reinforcing, two-echelon framework for this purpose. In one echelon, the responsible corporate Director and the Quality Assurance and Product Safety Department promote and coordinate the conduct of activities in accord with this policy throughout the corporation. In the other echelon, each division is charged with the responsibility to implement and maintain this policy and activities for the control of its own product quality and safety, as appropriate to the needs and requirements of its product sector within the broad-ranging spectrum of the corporate operations.

In accordance with this policy, AA Chemical plays a leading role as a member of the Japan Responsible Care Council, and in the adoption of ISO 9001, ISO 9002, GLP, GMP, and other internationally recognized standards and control systems for product quality and safety.

参考資料 11. 大嶋団員　有害化学物質セミナー原稿

SEMINAR
ON
MANAGEMENT OF
HAZARDOUS CHEMICAL SUBSTANCES

PAPER 3

CHEMICAL SAFETY EVALUATION AND CONTROL ON CHEMICAL SUBSTANCES

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Chemical Safety Evaluation and Control on Chemical Substances

Yoshiharu Ohshima

Chemicals Inspection & Testing Institute, Japan

1. Evaluation and management of hazardous chemical substances in Japan

In Japan, to prevent the environmental pollution by chemical substances that have adverse effects on human health, the "Law concerning examination and regulation of manufacture, etc. of chemical substances" was enacted in 1973. New and existing chemical substances are controlled by the law though two characteristic systems, a premarketing examination system and a post marketing control system. Once environmental pollution by chemical substances occurred, recovery to the previous unpolluted stage requires tremendous efforts and is sometimes practically impossible. Therefore, the premarketing examination and control of chemical substances are essentially important and effective. The law was the first one in the world and then followed by the similar laws in Western countries as well as in Asian countries recently.

The premarketing examination system is to evaluate chemical substances in term of following three characteristics and to classify chemical substances to specified chemical substances based on the characteristics.

(1) Persistency or transformation of chemicals in the environment
(2) Degree of accumulation in aquatic organisms
(3) Toxicity to human health

Harmonization in methodology to estimate potential for the three characteristics above achieved and resulted in international test guidelines such as OECD Guidelines for Testing Of Chemicals. Further, harmonization in hazard assessment and risk assessment of chemical substances using the results regarding above-mentioned three characteristics and estimated or predicted environmental concentration of the chemical substances has been proceeded.
The specified chemical substances designated by the advance examination system are strictly controlled by the post marketing control system in their manufacture and use as well as import and export.

2. Biodegradation test, the prime examination

2.1 The meaning of biodegradation test in the law

In the Japanese chemical substances control law, a biodegradation test, a test to predict a part of the fate of chemicals in the environment is the first stage. The Japanese biodegradation test method is adopted into OECD guidelines for testing of chemicals, as 301C Modified MITI Test (1) and classified as a testing method for ready biodegradability. Readily biodegradable chemicals are finally decomposed to inorganic chemicals such as carbon dioxide and water in the natural environment before the presence of the chemicals threats the human health and the environment. From the point of view, the biodegradation test is of essential importance as the prime test in whole safety examination scheme of chemical substances.

Decomposition of some chemical substances may produce transformed intermediates in the environment and sometimes they are more hazardous to the human health and the environment than the parent chemicals. The 301C requires determination and identification of such intermediates, which are not required emphatically in other biodegradation test methods in the OECD guidelines. The hazardousness of chemicals may be underestimated in test methods without the determination and the identification of such intermediates. When a transformed form of a chemical substance is inferred from the biodegradation test results, the intermediate will be examined by bioaccumulation test and toxicity tests whether it has adverse effects.

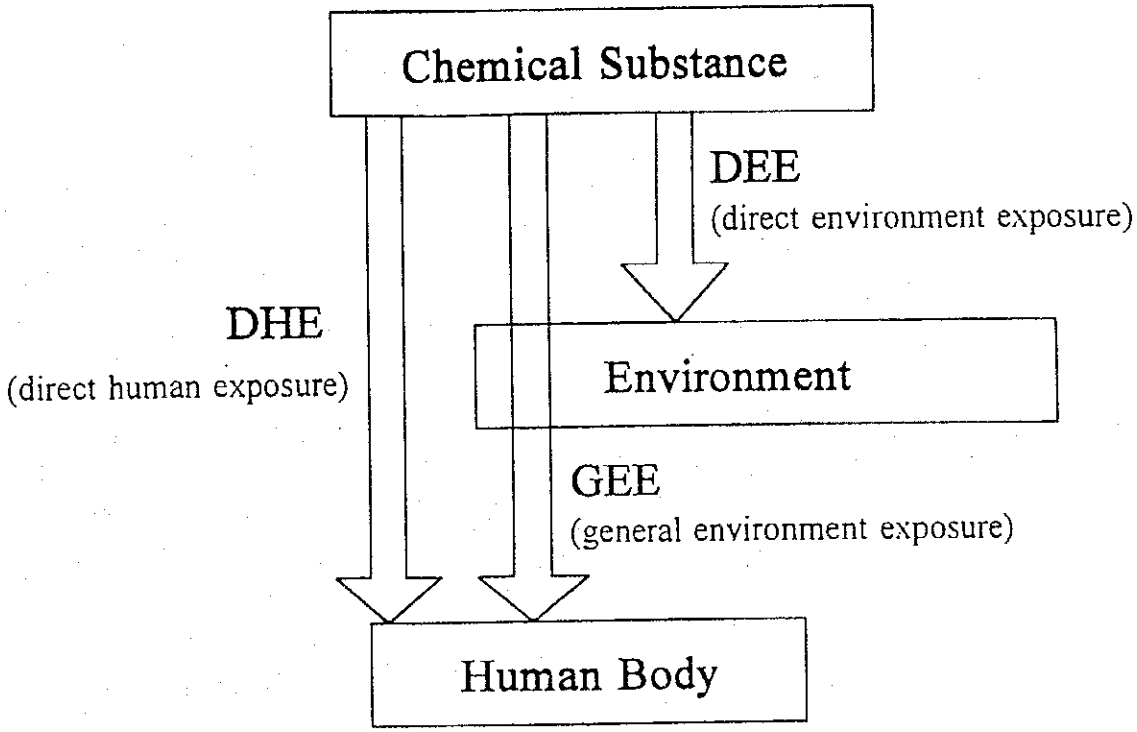
2.2 The activated sludge for biodegradation test

Actual biodegradation of chemical substances is different from condition to condition in the environment. Prediction of biodegradability in some northern countries may not be able to be applied to tropical countries, because microflora may be different from each other. In this connection preparation of test organisms in the biodegradation test, namely activated sludge, is essentially important to obtain meaningful result in the biodegradation tests.

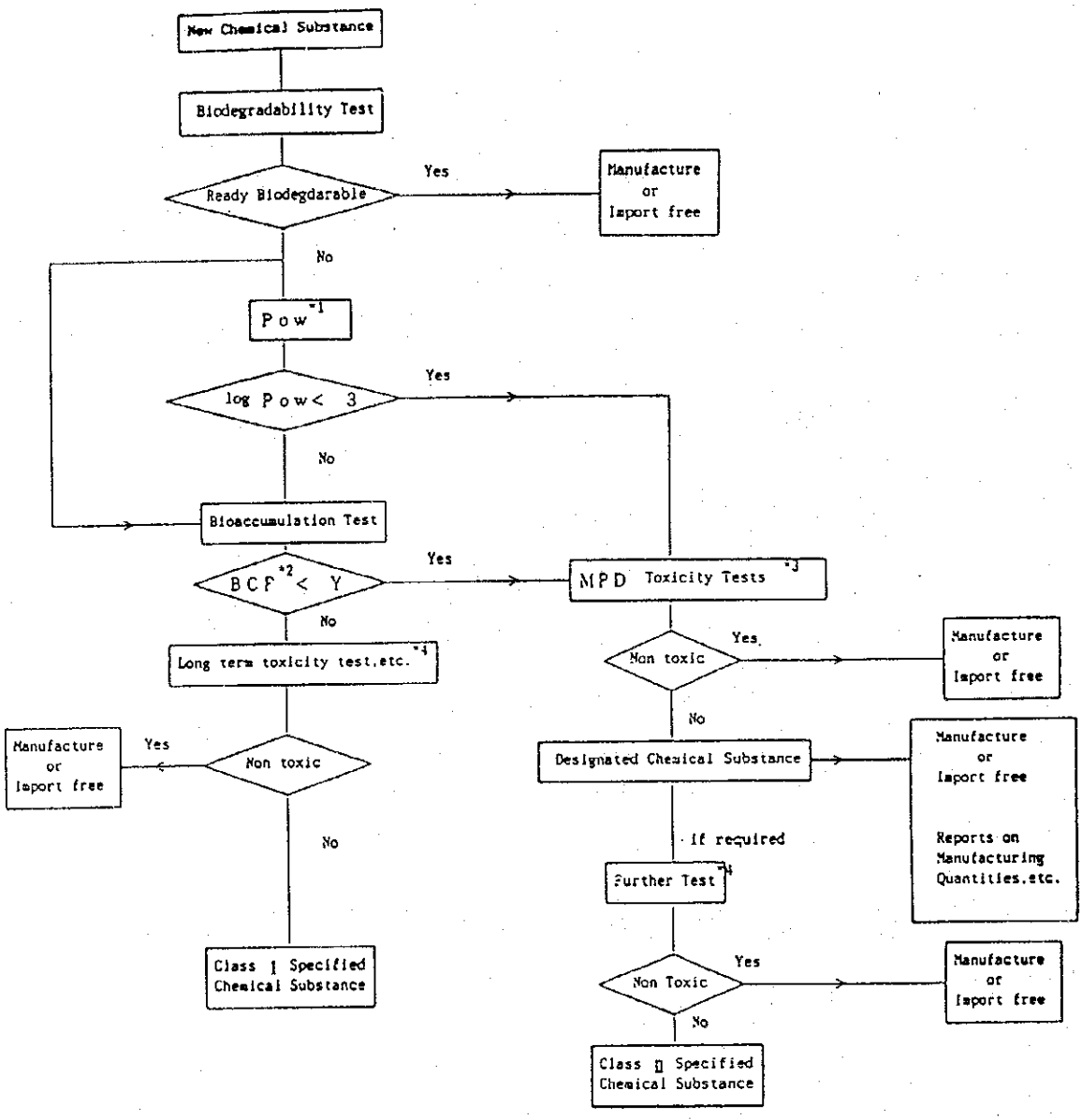
One major difference between the 301C and other biodegradation testing method adopted into the OECD guideline is in inoculum, namely activated sludge for the test. In 301C biodegradation test, the activated

sludge for the test is prepared by mixing sources of microorganisms collected from no fewer than ten sites, mainly in areas where a variety of chemicals are used and discharged. Though it takes more time and labor to prepare the activated sludge than to use simply a source of microorganisms sampled from one place, it is necessary for standardization in laboratory tests to use mixture of representative sources of microorganisms cultivated under a specified condition. To obtain reproducible test results using activated sludge, it is also necessary to consider variable factors such as seasonal difference.
Therefore, it is necessary to have tests that connect laboratory to the real environment, such as a simulation test.

$$\text{Chemical Harm(Safety)} = f(\text{Exposure} \times \text{Effect})$$



The Roots Of Chemical Substance To Human Body And Environment



*1 Pow = Partition coefficient (1-octanol/water)

*2 BCF = Bioconcentration Factor

*3 MPD Toxicity Tests:
- Repeated Dose Oral Toxicity (28-day)
- Reverse Mutation Assay
- Chromosomal Aberration

*4 Long term toxicity test,etc.
- General toxicity tests (Acute and Chronic)
- Special toxicity tests
- Pharamacokinetics study
- General biological tests

Examination And Regulations Concerning New Chemical Substances In Japan

OECD GUIDELINE For Ready Biodegradability

301A: DOC Die-Away
301B: CO_2 Evolution (Modified Sturm Test)
301C: MITI(I)
(Ministry of International Trade andIndustry, Japan)
301D: Closed Bottle
301E: Modified OECD Screening
301F: Manometric Respirometry

Sampling Sites Of Sludges On The 301C In Japan

Returned Sludges Of Sewage Treatment Plants At Each Cities

- Tokyo City (Capital City)
- Osaka City
- Sapporo City
- Kashima City(Main Manufacturing City)

Suface Water And Soil

Main Rivers

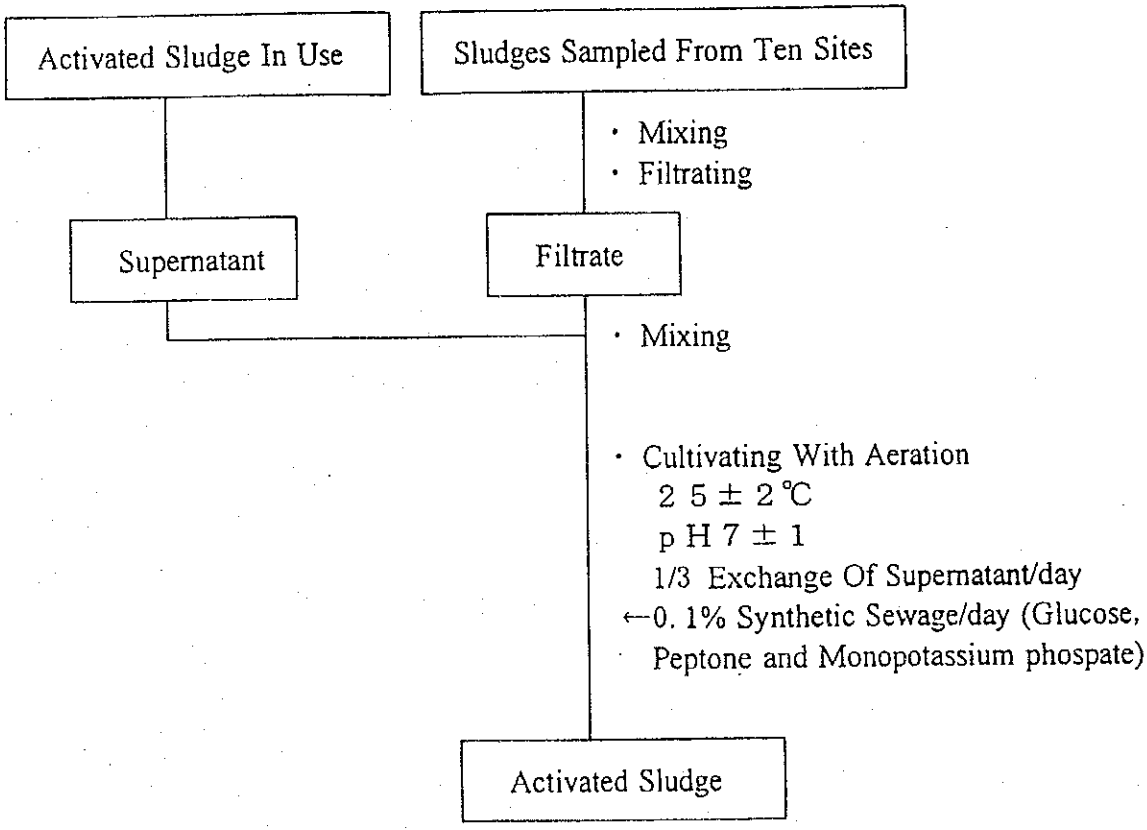
- Kitakami River
- Shinano River
- Yoshino River

Inland Sea

- Hiroshima Bay
- Dokai Bay

Lake

- Lake Biwa



Preparation Of Activated Sludge On The 301C