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International Code of Conduct on the Distribution and Use of Pesticides

Guidelines on data requirements for the registration of pesticides

World Health Organization

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The Inter-Organisation Programme for the Sound Management of Chemicals (IOMC) was established in 1995 following recommendations made by the 1992 UN Conference on Environment and Development to strengthen cooperation and increase international coordination in the field of chemical safety. The participating organizations are the Food and Agriculture Organization of the United Nations (FAO), the International Labour Organization (ILO), the Organisation for Economic Co-operation and Development (OECD), the United Nations Environment Programme (UNEP), the United Nations Industrial Development Organization (UNIDO), the United Nations Institute for Training and Research (UNITAR) and the World Health Organization (WHO). The World Bank and the United Nations Development Programme (UNDP) are observers. The purpose of the IOMC is to promote coordination of the policies and activities pursued by the participating organizations, jointly or separately, to achieve the sound management of chemicals in relation to human health and the environment.

This publication was developed in the IOMC context. The contents do not necessarily reflect the views or stated policies of individual IOMC participating organizations.

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Abbreviations

CAS	Chemical Abstracts Service
CIPAC	Collaborative International Pesticides Analytical Council
FAO	Food and Agriculture Organization of the United Nations
GLP	Good Laboratory Practice
ISO	International Organization for Standardization
IUPAC	International Union of Pure and Applied Chemistry
LD_{50}	median lethal dose
MRL	maximum residue limit
OECD	Organisation for Economic Co-operation and Development
TGAI	technical-grade active ingredient
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Scheme

Definitions

Active ingredient: the part of the product that provides the pesticidal action

Applicant: the party (producer, importer or their representative) that makes an application for registration of a pesticide to the responsible authority

Biochemical pesticide: a substance or mixture of substances that occurs naturally and has a mode of action other than direct toxicity to the target pest (e.g. growth regulation, mating disruption, attraction). If the substance is synthesized, it should be structurally identical to a naturally occurring chemical.

Co-formulant: a non-active ingredient component of a formulated product

Equivalence: the determination of the similarity of the impurity and toxicological profile, as well as of the physical and chemical properties, presented by supposedly similar technical material originating from different manufacturers, in order to assess whether they present similar levels of risk

Formulated product: any formulation containing one or more active ingredients

Formulation: the combination of various ingredients designed to render the product useful and effective for the purpose claimed and for the envisaged mode of application

Good laboratory practice (GLP): a quality system concerned with the organizational process and the conditions under which non-clinical health and environmental safety studies are planned, performed, monitored, recorded, archived and reported

Hazard: the inherent property of a substance, agent or situation having the potential to cause undesirable consequences (e.g. properties that can cause adverse effects or damage to health, the environment or property)

Maximum residue limit (MRL): the maximum concentration of a residue that is legally permitted or recognized as acceptable in or on a food or agricultural commodity or animal feedstuff

Pest: any species, strain or biotype of plant, animal or pathogenic agent injurious to plants and plant products, materials or environments, and includes vectors of parasites or pathogens of human and animal disease and animals causing public health nuisance

Pesticide: any substance or mixture of substances of chemical or biological ingredients, intended for repelling, destroying or controlling any pest, or regulating plant growth

Pesticide industry: all organizations and individuals engaged in manufacturing, formulating or marketing pesticides and pesticide products

Pesticide registration: the process whereby the responsible national government or regional authority approves the sale and use of a pesticide following the evaluation of scientific data aimed at demonstrating that the product is effective for its intended purposes and does not pose an unacceptable risk to human or animal health or the environment under the conditions of use in the country or region

Product (or **pesticide product**): the formulated product (pesticide active ingredient(s) and co-formulants) in the form in which it is packaged and sold

Public health uses of pesticides: pesticides that are used in the control of pests of public health significance. They include disease vector control pesticides, household pesticide products and professional pest control pesticides (used by pest control operators in homes and public areas)

Registration dossier: the set of data that is submitted by applicants, in a structured manner, in support of their application for registration

Responsible authority: the government agency or agencies responsible for regulating pesticides and more generally for implementing pesticide legislation

Risk: the probability and severity of an adverse health or environmental effect occurring as a function of a hazard and the likelihood and the extent of exposure to a pesticide

Semiochemicals: chemicals emitted by a plant or animal that evoke a behavioural or physiological response in another organism. When the semiochemical affects an individual of the same species, it is called a 'pheromone'. When it affects an individual of a different species, it is called an 'allelochemical'

Technical material: technical-grade materials and technical concentrates; also known as technical-grade active ingredient (TGAI)

1. Introduction

Registration of pesticides is the process by which authorities (e.g. national governments or regional authorities) approve the sale and use of a pesticide after evaluation of comprehensive scientific data demonstrating that the product is effective for its intended purposes and does not pose an unacceptable risk to human or animal health or the environment. Registration also involves regular or unscheduled review of previously registered pesticides to determine whether they still meet the requirements. A re-evaluation may be made after relevant new information has become available, when criteria are being adjusted or after a predetermined interval has passed since initial registration.

Governments should introduce the necessary legislation for the registration of pesticides. This should include establishment of a registration procedure, on the principle that the sale and use of pesticides that have not been registered are prohibited. Furthermore, governments should make provision for effective monitoring and enforcement of pesticide regulations, including the establishment of licensing and inspection schemes for importers and retailers. Governments should establish procedures suited to their requirements and not necessarily adopt all the elements of comprehensive regulatory schemes in place in countries with more extensive resources. For example, the registration criteria should take full account of local circumstances and needs, social and economic conditions, literacy, climatic conditions and the availability of appropriate and affordable pesticide application and protective equipment.

Certain data requirements may also differ if the conditions of use of a product are likely to be different among registering countries or regions because of the effect of climatic conditions on pest species, pest life-cycles, possible application methods or likely exposure. Although the requirements should be tailored to the conditions of the registering country, many data requirements for registration will be the same, irrespective of the country or situation. This is the case, for instance, for many toxicity data, as outlined below.

These guidelines generally focus on the scientific data and other information that may be required to determine what products can be permitted for use and for what purposes. The data and other information described can be used to register all types of pesticides, including public health pesticides. Section 4.1 describes the types of data and information required and why; section 4.2 shows how the data may be used in decision-making; and section 4.3 explains factors that affect data requirements. The guidelines also address some special situations (section 5): biological pest control agents, emergency approvals and experimental use. The annexes provide comprehensive lists of recommended data requirements.

The data requirements presented in this document and its annexes are based on those required by advanced regulatory authorities, such as those of Canada, the European Union and the United States of America [*1–6*]. The requirements are extensive, and Member States may find it impractical to require and review all the data listed in the annexes. Nevertheless, as described in the 2010 FAO/WHO *Guidelines for the*

registration of pesticides [*1*], transparency and exchanges of information among responsible authorities in the pesticide registration process and during collection and review of data should be promoted to avoid duplication of efforts and to minimize the use of test animals, among other efficiency measures.

Governments and responsible authorities should facilitate such exchanges of information and should, when possible, use data that are in the public domain and, preferably, have been peer-reviewed, when considering an application for registration. Further, when possible and appropriate, mutual acceptance of data and mutual recognition of registrations within regional harmonized systems should be encouraged. Registration in the country of origin should not, however, be a requirement when mutual recognition of registration is not sought. The concept of work-sharing and data-sharing is discussed further in section 4.3.5.

These guidelines were prepared in accordance with Article 6 of the *International code of conduct on pesticides management* (Regulatory and technical requirements) [*7*] and under the umbrella pesticide registration guidelines, the FAO/WHO *Guidelines for the registration of pesticides* [*1*].

2. Scope and objectives

These guidelines are intended to:

- describe the scientific data and information that may be needed to allow governments to evaluate pesticides for the purpose of their registration. This information will help countries to ensure that all pesticides used in any sector, including agriculture and public health, are effective for their intended purpose and do not pose an unacceptable risk to human or animal health or the environment;

- facilitate the generation of data and submission of applications for pesticide registration in Member States;

- describe the circumstances and conditions in which different types of requirements are appropriate and guide countries in deciding what data to require; and

- further harmonize the data requirements for pesticide registration.

The guidelines do not address the data requirements for registration of biological control agents, such as predators, parasitoids and microbial pest control agents.

3. Responsibilities

Different sectors have different responsibilities with regard to data generation, identification of data requirements, satisfaction of data requirements and ensuring that the data generated to support pesticide registration are of high quality, authentic and useful for registration and re-registration. The responsibilities are set out in the Code of Conduct [*7*].

The pesticide industry should:

- ensure that each pesticide and pesticide product is adequately and effectively tested by recognized procedures and test methods so as to fully evaluate its inherent physical, chemical or biological properties, efficacy, behaviour, fate, hazard and risk with regard to the various anticipated uses and conditions in regions or countries of use [Article 4.1.1 of the Code of Conduct];

- ensure that such tests are conducted in accordance with sound scientific and experimental procedures, and the principles of good laboratory and experimental practice [Article 4.1.2];

- make available copies or summaries of the original reports of such tests for assessment by responsible government authorities in all countries where the pesticide is to be offered for sale or use. If translated documents are provided, their accuracy should be certified [Article 4.1.3];

- ensure that the proposed use, label claims and directions, packages, safety data sheets, technical literature and advertising truly reflect the outcome of these scientific tests and assessments [Article 4.1.4];

- provide, at the request of a country, methods for the analysis of any active ingredient, co-formulant or relevant impurity or formulation that they manufacture, and provide the necessary analytical standards [Article 4.1.5];

- provide advice and assistance in the training of technical staff involved in the relevant analytical work. Formulators should actively support this effort [Article 4.1.6]; and

- conduct residue trials prior to marketing, at least in accordance with Codex Alimentarius and FAO guidelines on good analytical practice and on crop residue data, in order to provide a basis for establishing appropriate maximum residue limits [Article 4.1.7].

Governments should:

- establish pesticide registration schemes and infrastructures under which each pesticide product is registered before it can be made available for use [Article 6.1.4];

- conduct risk evaluations and make risk management decisions based on all relevant available data and information, as part of the pesticide registration process [Article 6.1.5];

- promote the advantages of, and cooperate with other governments in, the establishment of harmonized (regionally or by groups of countries) pesticide registration requirements, procedures and evaluation criteria, taking into account appropriate, internationally agreed technical guidelines and standards, and, where possible, incorporate these standards into national or regional legislation [Article 6.1.8]; and

- allow for re-evaluation and establish a re-registration procedure to ensure the regular review of pesticides, thus ensuring that prompt and effective measures can be taken if new information or data on the performance or risks indicate that regulatory action is needed [Article 6.1.9].

Each country should possess, or have access to, facilities to verify and exercise control over the quality of pesticides offered for sale or export, to establish the quantity of the active ingredient or ingredients and the suitability of their formulation, according to FAO or WHO recommended specifications or national specifications, when available. Where a country lacks suitable facilities, access to laboratories in another country should be considered [Article 4.2].

Exporting governments and international organizations should play an active role in assisting developing countries in training personnel and providing guidance on the design and conduct of trials, the interpretation and evaluation of test data, and risk/benefit analysis. They should also promote maximum availability to, and use by developing countries of, appropriate international, regional and national assessments and evaluations of pesticide hazards and risks [Article 4.4].

The pesticide industry and governments should collaborate in post-registration surveillance and conducting monitoring studies to determine the fate of pesticides and their health and environmental effects under operational conditions [Article 4.5].

4. Data requirements for registration of pesticides

4.1 Types of data and information

4.1.1 Introduction

The data required to support an application for registration should cover all relevant aspects of the product, from manufacture to use and ultimate disposal. The following sections explain the categories of data and information that are required: information on the proposed application; data to identify the product (identity, composition, analysis); data to assess risks to humans and the environment; and data to assess the efficacy of the product. This information will help countries to determine whether and when these data may be applicable for the pesticide regulatory decisions it has to make. These sections apply to all pesticides, including the biochemical pesticides described in section 5.

Tiered approach to data requirements

Generally, countries should carefully consider the pesticide and uses being proposed to determine the data required. In evaluating pesticide products, many responsible authorities apply a tiered or step-wise approach to evaluation and data requirements. In this approach, a more limited data set is required in a first submission by an applicant. If, on the basis of the limited data set, assessments of efficacy, residues, hazard, and human and environmental risk show that the product is acceptable for registration, no further data will be required. If, however, the limited data set does not allow a conclusive assessment, either additional data are requested from the applicant for the areas that require further evaluation (e.g. more specific toxicity studies, more precise exposure data or larger-scale efficacy trials), or measures are put in place to limit the proposed uses of the product in order to prevent the identified risks or address other uncertainties. Such mitigation measures can include a reduction in the allowable use rate in order to reduce potential exposure, establishment of buffer zones around surface water as a condition of use to protect water resources, or a requirement that users wear protective clothing. A step-wise or tiered assessment may be repeated several times until a final decision on registration is made. This is a good example of how data and information requirements can change on a case-by-case basis.

Tiered assessments and data requirements have many advantages. For example, the time and costs for the applicant and for the responsible authority are reduced, as only the data necessary for a final decision are submitted by the applicant and evaluated by the responsible authority. This approach requires efficient communication and cooperation between the applicant and the responsible authority.

4.1.2 Intended use and additional information on the application

In order to determine what data are required to fully evaluate a pesticide registration application, the responsible authority needs the following information on the product and its intended uses:

- Applicant's company name, company address, contact name, telephone number and e-mail address

- Trade name, brand name or trademark of the product

- Common name (International Organization for Standardization [ISO]), International Union of Pure and Applied Chemistry (IUPAC) name, and Chemical Abstracts Service (CAS) name and number of the active ingredient

- Names of all co-formulants in the product and whether they influence the toxicity of the product

- Type of formulation (e.g. soluble concentrate, wettable powder, emulsifiable concentrate)

- Function of the product (e.g. herbicide, insecticide, fungicide) and target pest species

- Site of application (e.g. maize, greenhouse tomatoes, houses for termite control, mosquito larvicidal applications to water)

- Application rate per unit treated and concentration of active ingredient in the material as applied (for example, if the product is diluted before application)

- Application and mixing instructions, including method of application, type of equipment used, application techniques and rates for each use site, and type and volume of diluent per unit of area or volume

- Number, frequency and timing of applications (e.g. per year, per month, per crop cycle) and duration of protection expected

- Proposed instructions on how to use the product, including in a manner that protects human health and the environment (e.g. buffer zones; personal protective equipment such as gloves, coveralls, respirator; prohibited application areas such as aquatic areas and around homes; and prohibited tank mixes or incompatibility with other products)

- A statement about any risk arising from the recommended methods and precautions and handling procedures, in order to minimize those risks (e.g. precautionary statements of the *Globally harmonized system of classification and labelling of chemicals* [*8*])

- A statement about any risk for the development of resistance in the pest, resistance prevention methods and 'mode of action' codes [*9*]

- Procedures for cleaning application equipment, if relevant to the proposed use

- Withholding periods, pre-harvest intervals, re-entry periods (e.g. after space spray for mosquito control), waiting periods (to avoid damage to or residues in succeeding crops) and other precautions to protect people, livestock and the environment

- Disposal procedures, detailed actions in the event of an accident during transport, storage or use and decontamination procedures for use in the event of accidental spillage or fire

- Information on antidotes, if any, and medical treatment in the case of accidental exposure; names of co-formulants that may influence the toxicity of the product

- Proposed hazard classification, labelling and safety phrases and symbols

- Proposed complete, commercial label, packaging sizes, and materials and specimens of proposed packaging

- Information on whether the application is to import or manufacture (including repacking, formulating and manufacturing from raw materials) the pesticide product. If the application is for manufacturing, the applicant should give the location of the manufacturing plant.

Generally, much of the information listed above is on the proposed product label. In some cases, this information is provided with the application and is based on studies conducted according to the requirements described below (e.g. proposed hazard classification). In these cases, the responsible authorities should review the information provided in the proposal concurrently with the supporting data.

Responsible authorities may also receive or request information on authorizations in other countries, refusal of registration or cancellation of registration (including reasons) in other countries, existing FAO and WHO assessments, established residue limits in other countries, and intended container management and waste product disposal. This type of information can help regulatory authorities to identify whether registration (or disapproval) would result in trade barriers, to assist them in decision-making and to evaluate the proposed product fully.

4.1.3 Identity, composition, physical and chemical properties

Technical material

Generally, responsible authorities need the following data and information on technical materials in order to make regulatory decisions:

- *identity and composition*: to identify the technical material; to determine the quality of the pesticide submitted for registration; to identify impurities of toxicological or ecotoxicological concern or any other relevant impurity; and to identify other hazards

- *Manufacturing process*: to determine whether the manufacturing process is likely to result in any impurities or manufacturing by-products of toxicological concern

- *Analytical methods* for the technical material, relevant impurities and metabolites, if applicable, in order to detect the presence of the active ingredient in different matrices (food, water and biological matrices). Responsible authorities should require applicants to provide samples of a certified analytical standard, the technical material used in the formulated product and the formulated product.

- *Product specification* and information on whether it complies with published FAO/WHO specifications [*10, 11*]. These data can also be used after a material has been approved and registered to ensure that the material being evaluated and approved is the same as that tested and, when relevant, complies with international specifications. More information can be found in the FAO/WHO *Guidelines for quality control of pesticides* [*12*].

Formulated pesticide product

Responsible authorities require data on the identity and composition of a formulated pesticide product proposed for registration in order to:

- identify the specific chemical or mixture of chemicals being proposed,
- determine the quality of the pesticide being submitted for registration,
- identify co-formulants or inert ingredients of concern and
- identify other hazards.

For example, data on physical and chemical characteristics are needed to characterize the properties of the product and assess any physical or chemical hazards (e.g. corrosive or flammable) and the likelihood of compatibility with the proposed packaging. Data on storage stability help to determine the stability of the formulation as packaged for sale, and the appropriateness and safety of the packaging. Countries should also request 'material safety data sheets' (MSDS) or 'safety data sheets' (SDS) on the formulated product, the components of the product and co-formulating agents or safeners and surfactants proposed for use in the product, in order, for example, to determine whether any of them are health or environmental hazards. These data can also be used after a product has been registered to ensure that the material being sold is exactly that which was approved by the responsible authority. More information can be found in the FAO/WHO *Guidelines for quality control of pesticides* [*12*].

4.1.4 Human health assessment

In order to assess risks to human health from a pesticide proposed for registration, countries should consider the toxicity of the compounds and of any relevant impurities [*10*], metabolites or degradates, and potential exposure to the technical material, impurities, metabolites or degradates during or after application and resulting from the proposed uses. The scientific data and other types of information that countries require to determine whether the expected exposure is acceptable or is a concern are described below.

Toxicity, formulated product

Data on the acute toxicity of formulated pesticide products are generally used to determine the immediate hazard to human health and appropriate first aid and medical treatment. For example, data on acute toxicity are used to identify protective measures to prevent accidental poisoning and can be used to prepare precautionary label statements, such as protective clothing requirements for applicators. These data allow the responsible authorities to consider the toxicity of the entire formulated product,

including co-formulants and other active substances, if the formulated product contains more than one active ingredient.

Toxicity, technical material

Data on the acute toxicity of the active ingredient are generated for classification and labelling. Such data indicate any health hazards likely to arise soon after, and as a result of, short-term exposure.

Other tests, such as for subchronic and chronic effects, mutagenicity, carcinogenicity, and reproductive and developmental toxicity, provide information that allows responsible authorities to determine the risk that the pesticides pose to human health after prolonged or repeated exposure. Such studies are generally conducted with the active ingredient to test whether it induces adverse effects in mammals. The results of these studies, with data or estimates of exposure and uncertainty factors to account for extrapolation of data, are used to assess the risk to human health resulting from exposure to the active ingredients of pesticides in specific use scenarios.

Applicants can also perform screening tests to determine whether full testing is required. These tests (which may be performed in vitro) can reduce costs and the number of laboratory animals required for testing. For example, information on chemical properties or screening tests may indicate that testing for skin and eye irritation is not necessary.

Exposure

The emissions, pathways and rates of movement of an active substance or a substance of concern in a pesticide product and its transformation or degradation are determined in order to estimate the extent to which humans, animals or ecosystems are or may be exposed.

Exposure may be either direct, as a result of pesticide use (professional and other), or indirect, when pesticides are used in houses, on lawns or on produce, for example. The responsible authorities should carefully consider all possible routes of human exposure that may occur as a result of the uses being proposed and should conduct exposure assessments to make a quantitative or qualitative estimate of the dose or concentration of each active substance or substance of concern to which any person may be exposed during use of the product. Information on potential human exposure to a pesticide as a result of its proposed use in occupational and nonoccupational settings, data from poison control centres, exposure assessments and data on toxicity can be used by the responsible authorities to determine whether the proposed use presents risks of concern and, if so, what safety measures are appropriate to prevent those risks. The categories of information required to determine exposure by use pattern are listed in Table 1.

Estimates of exposure used in assessing the risk of pesticides can be obtained by many methods. Chemical-specific surveys of exposure after actual product use are sometimes available. In addition, data from poison control centres and information on adverse events can help to identify actual situations in which exposure occurred. When this information exists, the responsible authorities should use it in decision-making.

Table 1. Type of data and information on human exposure usually needed, by use pattern group

Broad use category	Use pattern	Data and information needed
Terrestrial outdoor	Food	Residues in plants or animals Exposure of workers or applicators
	Feed	
	Non-food	Exposure of workers or applicators Incidental exposure of bystanders
Aquatic outdoor	Food	Residues in food Exposure of workers or applicators
	Non-food	Exposure of workers or applicators
Greenhouse	Food	Residues in food Exposure of workers or applicators
	Non-food	Exposure of workers or applicators
Forestry	Forestry	Exposure of workers or applicators
Residential outdoor	Residential outdoor	Exposure of residential users or applicators Incidental exposure of residents
Indoor	Residential	Exposure of residential users or applicators Incidental exposure of residents
	Non-food, non-residential	
	Food	Residues in food Exposure of residential users or applicators Incidental exposure of residents
Direct application to humans	Direct application to humans	Exposure of residential users or applicators

In many cases, generic models can be used. These models are often based on worst-case assumptions and provide estimates of possible high exposure. If these estimates result in an acceptable risk, there is generally no need to refine the exposure estimate, and further data generation can be avoided. WHO has published specific risk assessment models for application of public health insecticides, as this type of uses requires unique consideration [*13*]. The responsible authority should also use assessments conducted by WHO Pesticide Evaluation Scheme (WHOPES) for public health pesticides, when available and appropriate.

For all uses of pesticides on food and feed crops, the applicant should provide the necessary residue data generated in accordance with the *Codex Alimentarius* [*14*], and guidelines published by the Organisation for Economic Co-operation and Development (OECD) on good laboratory practice [*15*] and by the Food and Agriculture Organization of the United Nations (FAO) guidelines on crop residues

[*16*] for assessment by the responsible authority. Residue assessments need not always be based on local residue trials; in some cases, it may suffice to review the results of trials conducted in other countries on similar crops grown with relevant agricultural practices under comparable climatic conditions, especially if previous studies showed similar residues. FAO and WHO recommend use of maximum residue limits (MRLs) defined by the *Codex Alimentarius*, when applicable to the national situation. The responsible authority, in collaboration with relevant national agencies, should also use the assessment to set national MRLs for food, particularly in situations that are not covered by the *Codex Alimentarius*.

Countries should use the results of dietary surveys or data on food and water consumption to determine the probable exposure of their population to pesticide residues in food [*17*, *18*]. This type of information can be shared in regions in which the populations have similar dietary habits. Further, this type of survey is often in the public domain and was not generated specifically for pesticide registration purposes. For example, information on food consumption in the United States can be obtained from the United States Department of Agriculture [*19*].

Responsible authorities may have to make more cautious estimates of residues if their country has populations that are uniquely susceptible or vulnerable to pesticides or pesticide residues, including immunosuppressed or malnourished populations or subsistence communities.

4.1.5 Environmental fate and assessment

In order to assess the risks to the environment posed by a proposed pesticide registration, countries should consider:

- the toxicity of the compounds being proposed for registration (as typically formulated and the technical material itself);
- the toxicity of any relevant impurities [*10*], metabolites or degradates; and
- any potential exposure to the technical material, impurities, metabolites or degradates after application and resulting from the proposed uses.

The scientific data and other types of information that countries need to determine whether the expected levels of exposure are acceptable or are a concern are described below. The information should cover adverse effects in air, soil and water (including sediment) and in biota after use of the pesticide product.

Ecotoxicity

Data on the hazard and toxicity of pesticides and their metabolites and degradates are used in order to determine whether the substance can induce adverse effects in non-target organisms in the environment, which generally include birds, mammals, fish, terrestrial invertebrates and arthropods (e.g. honeybees), aquatic invertebrates, algae and plants. This list may be extended to include valuable species or groups of organisms that are specific to the climatic conditions of the proposed site and country in which registration is being sought, e.g. amphibians (usually considered to be covered by testing fish) or reptiles.

Generally, data on mammalian toxicity generated to determine human safety can also be used to determine the risk to non-target mammalian species.

Countries use the results of these studies, combined with exposure data or estimates, to assess risks to non-target organisms and the ecosystem in which the product is proposed to be used.

Exposure

As for human exposure, the responsible authority can estimate the potential exposure of non-target species and the environment to a pesticide and can determine risk by a variety of methods. In many cases, generic models can be used, which include information such as the physical and chemical characteristics of the pesticide, its environmental fate and properties, product formulation and climatic conditions; they are often based on worst-case assumptions and therefore estimate high exposure. If the high exposure estimate results in an acceptable risk, there is no need to refine the exposure estimate, and further data generation can be avoided. Examples of such models can be found elsewhere [e.g. *20*, *21*]. If high exposure estimates result in unacceptable risks, more precise exposure data can be generated to allow the responsible authorities to estimate the amount of active ingredient that may end up in an ecosystem.

As for human health, real exposure data may sometimes be available. For example, monitoring of water for some chemicals and information on environmental incidents (e.g. bird kill events) may be available in the open literature. In these cases, the responsible authorities can use these data to make better estimates of environmental exposure and/or make better regulatory decisions, provided the quality of the data is ensured.

Responsible authorities use exposure information and toxicity data to determine whether there are risks of concern to non-target organisms as a result of the proposed use of a pesticide and, if so, to determine what safety measures are appropriate to prevent those risks (also see section 4.1.1). Ecological exposure data can also be used to determine the expected environmental concentrations in areas where threatened or endangered species or other vulnerable wildlife populations are found. Table 2 lists the types of exposure information needed to assess these risks by use pattern.

4.1.6 Product efficacy

Countries need data on the efficacy of pesticides for their registration to ensure that the products, when used according to the label instructions, are effective for their intended purpose and that there is a benefit in the use (new or continued) of that product. Data submitted by industry or held by the competent authorities should demonstrate the efficacy of the product against the target organism when used in accordance with the conditions of authorization. Additional data may be required to confirm efficacy, depending on the physical form of the product, uses, the results of other studies, resistance issues (e.g. reported resistance of pests to similar compounds) or the climatic conditions of the country. Reviewing these data can help determine the instructions for use that result in the most effective use.

Table 2. Types of data and information on environmental exposure usually needed, by use pattern

Broad use category	Use pattern	Data and information needed
Terrestrial outdoor	Food	Environmental fate: soil and water; air, if applicable
	Feed	
	Non-food	
Aquatic outdoor	Food	Environmental fate: water
	Feed	
Greenhouse	Food	Environmental fate: air, if applicable (e.g. fumigants)
	Feed	
Forestry	Forestry	Environmental fate: soil and water
Residential outdoor	Residential outdoor	Environmental fate: soil and water; air, if applicable (e.g. fumigants)
Indoor	Residential	Environmental fate: air, if applicable (e.g. fumigants) Environmental fate: water, for products disposed of in drains, toilets, pit latrines (e.g. after washing of repellent clothing)
	Non-food, non-residential	
	Food	
Direct application to humans	Direct application to humans	None

Resistance to pesticides is a major concern in the control of vectors and pests of public health importance, as well as in the agricultural sector. The responsible authority should therefore assess the potential risk for the development of resistance to the product. This may require routine submission of data and information on efficacy in cases in which the risk for resistance is either highly likely or the adverse effects resulting from resistance are great (e.g. product for vector control) [*9, 22*]. Applicants should inform the responsible authority of any evidence of resistance as soon as it is detected.

References are available to assist responsible authorities in evaluating the efficacy of proposed formulated pesticide products, from FAO for agricultural pesticides [*23*] and from WHO for public health pesticides [*24*].

4.2 How data may be used

As described in section 4.1, data obtained to support registration of pesticides should be evaluated objectively by the responsible authority to determine:

- their authenticity and quality;
- whether the proposed product or products is effective for its intended use; and
- whether use of the proposed product poses an unacceptable risk to human or animal health or the environment, as defined by the responsible authority.

In order to determine whether use of the proposed product poses an unacceptable risk to humans or the environment, countries conduct risk assessments based on information on hazard (i.e. toxicity) and exposure to determine the likelihood of exposure at a level that causes concern. Risks from all potential exposure pathways should be evaluated, including those of workers using the pesticide, of people exposed to residues in food, as a result of household uses of pesticides and the exposure of non-target organisms and the environment. Various approaches to risk assessment and management of pesticides are described elsewhere [e.g. *13*, *25*].

In addition, the responsible authority should define 'unacceptable risk'. Generally, this is defined individually by a country's laws and regulations on pesticide registration and other laws and regulations, including food safety.

The data submitted and evaluated to support a pesticide registration should also be used to evaluate the proposed labelling of the pesticide, to ensure that the proposed use and directions are consistent with the results of the data and that the label outlines restrictions to protect humans and the environment and to prevent any adverse effects. The FAO *Guidelines on good labelling practice for pesticides* provide further information [*26*].

4.3 Factors that affect data requirements

For any pesticide registration, the precise information that a country should obtain or consider in approving use of the pesticide depends on:

- the intended use of the pesticide product and the consequences on expected routes of exposure;
- the climatic and geographical characteristics of the registering country;
- the nature of the proposed product (e.g. biological pest control agent, conventional chemical);
- equivalence;
- data access and work-sharing;

- the scientific relevance of the test; and

- the scientific and technical feasibility of the test (e.g. for substances that are very volatile or unstable).

This document provides some general guidance on how the factors listed above can affect the amount of information needed to support a pesticide registration. Applicants may propose to adapt the requirements according to the intended uses, the characteristics of the pesticide or other factors. In these cases, the applicant should explain to the responsible authority the reasons for adapting the data requirements on the basis of the factors listed below. Similarly, the responsible authority may adapt the data requirements to their needs. As noted in the introduction, every situation is different: a pesticide regulatory situation may require a limited subset of data or may require additional data to address uncertainties when the potential adverse effects (of use or of lack of availability) are great. Every proposal should be considered individually.

4.3.1 Intended use

Information on the intended use (e.g. site of application, frequency of application, target user, application rate, formulation, method of application, projected total expected volume of use (i.e. expected market for a new active ingredient), significance of the target pest, benefits of use) of the pesticide should be considered by the responsible authority in determining the information needed to review a registration application. This information should be considered in tandem with the conditions in the country or region where the pesticide is intended for use.

These guidelines propose seven broad use categories: terrestrial outdoor uses, aquatic outdoor uses, greenhouse uses, forestry uses, residential outdoor uses, indoor uses of all types and direct application to humans (skin-applied repellents and repellent clothing). Within those broad use categories, there are several use pattern groups listed in Table 3. These use categories (and, in some cases, use pattern groups) correspond to the header rows in the tables of data requirements provided in the annexes to this document. In order to define specific data requirements, the regulatory authority should determine the use(s) of the proposed product and cross-reference the uses with the data requirements in annexes A and B for conventional pesticides and annexes C and D for biochemical pest control agents. Regulatory authorities may then further evaluate the proposed use and the data requirements, especially when data are conditionally required, to determine whether it is appropriate and useful to require these data for decision-making.

Table 3. Pesticide use categories, use patterns and examples

Broad use categories	Use pattern	Examples
Terrestrial	Food	Fruits and vegetable crops, seed treatment (if residues end up in food), rodenticides used in food crops and food storage, post-harvest treatments (if treated outdoors and environmental exposure is expected)
	Feed	Maize grown for forage
	Non-food	Turf, crops grown for seed, seed treatment (if residues do not end up in food), mammalian repellents, recreational areas, parks, electricity poles, train tracks, weed control in paved areas, roadsides
Aquatic	Food	Aquatic rice
	Non-food	Ornamental ponds, application to water bodies to treat aquatic weeds, mosquito larviciding, wood treatments for wood used in aquatic settings (piers), antifoulant paint
Greenhouse	Food	Greenhouse tomatoes, peppers, horticulture-strawberries
	Non-food	Ornamentals shrubs, cut flowers, other ornamental plants
Forestry	Forestry	Forests, removal of alien vegetation
Residential outdoor	Residential outdoor	Lawn products for use around homes, space sprays (to control flying vectors, thermal or cold fogging), rodenticides used around residential premises, mammalian repellents, wood treatments (decking materials)
Indoor	Residential	Mosquito coils and vaporizers, aerosols, flea and tick products used on animals (veterinary uses), long-lasting insecticidal nets, residual sprays, space sprays for mosquito and fly control, rodenticides, wood treatments (termiticide uses)
	Non-food, non-residential	Non-residential indoor uses (e.g. office buildings), animal premises (e.g. kennels), wood treatment (non-residential construction), aeroplanes
	Food	Animal premises (e.g. barns, shelters), post-harvest treatments (if treated indoor)
Direct application to humans	Direct application to humans	Repellents, insecticides for lice and scabies control

4.3.2 Climatic and geographical characteristics of the registering country

The data provided to support registration should reflect the conditions in the country or region where the pesticides are to be used. In particular, for use patterns involving direct release of the pesticides into the environment (e.g. terrestrial, aquatic, forestry, residential outdoor and, to a lesser degree, greenhouse use), applicants should take into consideration specific climatic and geographical characteristics that could influence the fate and behaviour of the pesticide or the expected effects on non-target organisms. For example, some pesticides may degrade more readily in wet climatic conditions, and the degradate may be more or less toxic than the parent. Similarly, climatic and geographical characteristics may influence the degree of protection of operators, workers, bystanders, consumers and non-target organisms and environmental compartments because of local conditions of use, local agricultural practices or difficulty in implementing risk mitigation measures (e.g. personal protective equipment). Climatic conditions may also affect the efficacy of the pesticide by increasing pest infestations or degradation of the chemical itself.

To address these concerns, the responsible authorities should use assessment models that include consideration of climatic conditions (e.g. models to determine residues remaining on surfaces of crops or lumber); in some cases, studies should be conducted under actual use conditions (e.g. efficacy data, to the extent possible). FAO and WHO recommend that expert judgement be used for reasonable extrapolation of data from similar climates or climates known to produce worst-case scenarios.

4.3.3 Nature of the proposed product

Information on the nature and characteristics of a chemical or substance being proposed for registration should be considered by the responsible authority in determining the information needed to review a registration application. This type of information should be provided at the time an application is submitted for review. For example, different data may be required for biochemical pesticides than for synthetic chemical pesticides (see section 5). In addition, the environmental fate characteristics of a chemical, determined by environmental fate studies (e.g. persistence, potential for bioaccumulation), may trigger additional data requirements. Chemical structure may also trigger specific assessments; for example, organophosphates and pyrethroids have unique toxicological characteristics related to isomers and impurities.

4.3.4 Equivalence

Equivalence determination consists of evaluating whether the impurity and toxicological profiles and the physical and chemical properties of supposedly similar technical material originating from different manufacturers are indeed similar, in order to assess whether the products pose the same levels of risk. Equivalence determination can be a step in the registration of generic pesticides.

The responsible authority should establish national principles and criteria for determining the equivalence of pesticide products from different manufacturers in order to avoid wastage of resources and to facilitate market access of products of acceptable standards. Governments should use the requirements and principles described in the *Manual on the development and use of FAO and WHO specifications*

for pesticides [*10*] to determine equivalence. The manual also stipulates which data are required for equivalence assessment.

Health and environmental hazard and risk assessments are usually not required when (i) the technical-grade active ingredient (TGAI) of the pesticide being registered has been demonstrated to be equivalent to an already registered TGAI, (ii) the formulation type has been previously registered, (iii) the intended use of the formulated product (based on the equivalent TGAI) is the same as that of the product already on the market, and (iv) any applicable period of data protection has expired.

4.3.5 Work-sharing and data access within registration schemes

Work-sharing

Simultaneous submission of registration applications in countries allows work-sharing on a regional basis and promotes transparency and exchange of information between responsible authorities in pesticide registration. Mutual recognition of registration is encouraged, when possible and appropriate.

Much international work has been done to harmonize the basic data requirements for pesticide registration and to review that information jointly. In 1994, the OECD established the Pesticide Forum, now known as the Working Group on Pesticides, to help countries with the increasingly burdensome work of conducting new risk assessments for hundreds of pesticides that have been on the market for years, and assessing pesticides with new active ingredients. OECD Member countries are involved in a number of work-sharing projects, ranging from information exchange to parallel and joint reviews. OECD has an electronic database to facilitate such exchanges and collaboration [*27*].

Data access

Information on previous approvals of a pesticide active ingredient or formulated product should be considered by any responsible authority in determining what additional information may be needed to review a pesticide registration application. These guidelines recommend that, when pesticides submitted to countries for review and approval and/or previously approved products are similar, the supporting data and risk assessments should be accessible within and across countries to the extent allowed by international agreements and national laws on the protection of regulatory data and the safeguarding of confidential business information. This can reduce costs, including laboratory costs, numbers of laboratory animals and cost to review studies. ‘Similar’ means the same percentage of the same active ingredient at the same application rate, the same intended use or uses, the same formulation type and similar co-formulants with the same or improved hazard profile.

Hazard assessments conducted by the FAO/WHO Joint Meeting on Pesticide Residues (JMPR), the FAO/WHO Joint Meeting on Pesticide Specifications (JMPS), WHOPES (public health pesticides) and other authorities responsible for pesticides may be available. Responsible authorities should make use of such assessments when relevant (e.g. comparable eco-epidemiological setting and agro-ecological conditions) and within the constraints put on using such reviews, in order to avoid duplication of effort and to minimize local testing of a product.

Generally, more data are required to support the first registration of a novel active ingredient than for subsequent registration applications, for a number of reasons. In subsequent applications, previously generated data can be used to satisfy data requirements, in accordance with Section 5.5 of the *Guidelines for the registration of pesticides* [*1*], which covers the protection of regulatory data and confidential business information and additional relevant laws and regulations for data-sharing, data protection and compensation, and intellectual property.

4.3.6 Scientific or technical feasibility of requiring data

Responsible authorities may omit or waive the requirement to test a specific end-point if it is technically impossible to conduct the study because of the properties of the substance. For example, some highly volatile, reactive or unstable substances cannot be tested (or safely tested), as mixing the substance with water may cause danger of fire or explosion, or it may be impossible to radiolabel a substance as recommended in certain guidelines. In another example, the pesticide applicant may propose that the required test be waived if the intrinsic properties of the substance (e.g. corrosivity) would lead to unnecessary suffering of test animals. The guidance given in the relevant test methods, and especially the technical limitations of a method, should always be respected.

4.3.7 Scientific relevance of the data requirements

Pesticide registration applicants may propose adaptation of the data requirements on the basis of the scientific relevance of the test, because of the intrinsic properties and effects of an active substance. The factors that might determine whether the higher-tiered tests recommended in these guidelines are scientifically relevant are listed below. Applicants and responsible authorities should discuss whether all the data requirements are necessary to ensure safety. If an applicant believes that some data are not necessary to ensure safety or cannot feasibly be obtained, they may request that a data requirement be waived. Waiver requests should be reviewed from the point of view of the scientific validity of the argument. Types of information that can affect the need for scientific data and that can be used in such discussions are:

- any indication of bioaccumulation potential;
- the persistence characteristics of the technical material;
- the shape of the toxicity–time curve in ecotoxicity testing (e.g. whether an effect occurs and dissipates rapidly after exposure or builds up over time);
- indications of other adverse effects in toxicity studies (e.g. classification as a mutagen);
- data on structurally analogous substances;
- information on past use (e.g. past safe use, ubiquitous use, absence of major incidents); and
- endocrine-disrupting effects.

Data requirements can change over time. For example, ongoing research indicates that toxicological evaluation of chemicals may be conducted with methods that do not require the use of live animals. While these techniques are not fully implemented for regulatory purposes, responsible authorities should remain aware of scientific

advancements when requesting and reviewing scientific data to support pesticide registration and re-evaluation.

5. Special considerations

The information that a country wishes to obtain or consider before approving use of a pesticide depends on a number of factors. In this section, some unique situations are described that should be considered by responsible authorities when determining the data requirements for a pesticide registration application. Generally, in the situations described below, there is close agreement between countries on how much or how little data are needed to support registration; therefore, there is potential for work-sharing and cost savings for these types of registrations.

5.1 Biochemical pesticides

Fewer studies are usually required to assess the risk associated with naturally occurring biochemical pesticides such as semiochemicals, hormones and natural plant regulators than for other pesticides, because of their unique mode of action and target species specificity, generally low mammalian toxicity and efficacy at low use volume.

A biochemical pesticide should occur naturally; if it is synthesized, it should be structurally identical to a naturally occurring chemical, i.e. the molecular structure of the major component of the synthetic chemical should be the same as the molecular structure of the naturally occurring analogue. Minor differences in the stereochemical isomer ratios of the naturally occurring and the synthetic compound will usually not rule out categorization of a chemical as a biochemical pest control agent, unless an isomer is found to have significantly different toxicological properties from another isomer.

Annexes C and D give comprehensive lists of recommended data requirements that responsible authorities should consider when determining whether to allow the use of biochemical pesticides.

5.2 Emergency use

In special circumstances, the responsible authority may have to consider allowing the use of pesticides that are unregistered, cancelled or registered for other purposes to control an outbreak of vector-borne disease, avert a significant risk to human health or the environment (e.g. a significant risk to endangered or threatened species or beneficial organisms) or to avert significant agricultural losses.

Responsible authorities should consider the validity of the request (i.e. the existence of alternative, viable control options, including the use of registered pesticides) and should require a minimum amount of data that will allow them to meet their legal standards and requirements in making an emergency use decision. This should result

in a risk–benefit assessment, including a human health risk assessment, an occupational risk assessment and an ecological risk assessment, and consideration of progress towards registration of the pesticide in question or other alternative pesticides to address the emergency situation.

In some cases, the minimum amount of data for assessing risk may not be available. In these cases, the responsible authority should use expert judgement and other resources in making a decision. The resources can include lists of WHO-recommended products for use in vector control [*28*], information on approval in other countries (particularly neighbouring countries), FAO recommendations and recommendations from other international organizations or other responsible authorities. Countries can also request assistance from other responsible authorities in more developed regulatory programmes, especially for emergency situations that have or could cross borders.

In emergency cases, the responsible authorities should restrict use to limited periods. This will help to prevent inappropriate, unsafe or continuing use of chemicals approved only for use in limited, high-benefit situations.

5.3 Experimental use permits

Governments should have regulations allowing importation of limited quantities of unregistered pesticides for the purposes of research, education or registration. Such regulations would enable the responsible authority to issue an experimental permit to any party that can comply with the conditions of the regulations to import a limited quantity of pesticide.

The regulations would require applicants to provide basic information on the pesticide (such as the code name, common name, type of pesticide, chemical group, percentage active ingredient, acute oral and dermal LD_{50} values, inhalation toxicity, toxicity to fish), the purpose of the importation, the quantity to be imported and where, when and by whom the experiment will be carried out. The responsible authority should then evaluate the application and decide whether an experimental permit should be issued and, if so, the conditions to be attached to its issuance. The conditions of the permit will depend on the stage of development of the chemical and the quantity of pesticide to be imported. The permit should include a requirement to destroy the crops after the experiment (if relevant) and the location and date of the experiment for inspection by the responsible authority.

The responsible authority should use expert judgement and other resources in making a decision. As above, these resources can include information on approval in other countries, particularly neighbouring countries, and information from other responsible authorities with more developed regulatory programmes, especially for the purpose of generating data in support of a full registration for public health products or products to be used in emergency situations.

6. Satisfying data requirements

Companies wishing to obtain approval for use of a pesticide can satisfy the necessary data requirements in a number of ways, with varying levels of detail, depending on the legal and regulatory requirements of the country or countries in which registration is being sought. Generally, complete study reports can be submitted to responsible authorities in writing or electronically in order to satisfy data requirements. In some cases, however, data requirements may be satisfied by providing summaries of studies previously reviewed and approved by other responsible authorities, copies of those reviews or documented and internationally agreed end-point values of concern, depending on the legal and regulatory requirements and laws and regulations on data-sharing. The concepts of work-sharing and data access are described more fully in section 4.3.5.

The data provided by the applicant should be of high quality and reliable and, when possible, based on nationally or internationally recognized testing guidelines and methods, such as those published by the OECD, the Collaborative International Pesticides Analytical Council (CIPAC), FAO and WHO [e.g. *15*, *23*, *24*, *29–31*]. If no testing guidelines are available (special studies, unique studies), data submitters should provide the responsible authority with a proposed scientific protocol, so that it can make a decision on the study in question. This may occur if a country has a unique ecosystem or non-target species of concern and scientific questions arise about that ecosystem or species that cannot be answered by studies conducted by recognized guidelines.

The data and information submitted should be credible and valid. Responsible authorities can help to ensure authenticity by asking the submitter to sign a statement documenting authenticity or by regularly inspecting laboratory facilities.

All studies provided should be conducted under the principles of good laboratory practice (GLP). Recognized guidelines associated with the OECD numbering system provided in the annexes are cited elsewhere [*2*].

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Annexes. Introduction

Inclusion of a study in the tables below does not mean that it should always be conducted. The comprehensive lists should be critically reviewed by the responsible authority to determine whether the data requirements apply in their country or to the proposed use pattern or registration situation. See section 4.3 of this document (*Factors that affect data requirements*) for situations in which the full data set may not be needed. In addition, see the information in each table and footnotes to determine the test substance, applicable uses and whether the data are always recommended to be required or only for certain use patterns or situations.

Data requirement codes used in the tables

Conditionality of the data requirements

R: Recommended to be required

CR: Conditionally recommended to be required

NR: Not recommended to be required

Type of test substance

PAI: Pure active ingredient

PAIRA: Radiolabelled pure active ingredient

TGAI: Technical-grade active ingredient

FP: Formulated product

TEP: Typical end-use product

Annex A. Chemical pesticides: recommended data requirements for registration of technical materials

The tests listed in this annex are generally conducted on the active substance itself. Field studies might be conducted with an appropriate, typical end-use product for practical reasons and scientific relevance.

Table A1. Identity and composition, physical and chemical properties

OECD data point number	Data requirement	All use patterns	Test substance
IIA 1	**IDENTITY AND MANUFACTURE** - Applicant name and contact information - Manufacturer name and contact information - ISO common name and synonyms - Existing CAS and CIPAC numbers - Chemical name - Trade name - Patent status - Molecular formula, molecular mass, and molecular structure - Method of manufacture, including starting materials, pathways, by-products, impurities - Specification of the purity of the active substance - Identity, content, structural formula of isomers, impurities, and additives - Batch analysis data	R	TGAI
IIA 2	**PHYSICAL AND CHEMICAL PROPERTIES** - Melting-point and boiling-point - Relative density - Vapour pressure and volatility - Appearance - Spectra	R	TGAI

OECD data point number	Data requirement	All use patterns	Test substance
	- Solubility in water - Solubility in organic solvents - Partition coefficient - Stability in water, hydrolysis rate, photochemical degradation, quantum yield and identity of breakdown products, dissociation constant - Photochemical oxidative degradation - Flammability - Flash point - Explosivity - Surface tension - Oxidizing properties - pH - Stability		

CAS, Chemical Abstracts Service; CIPAC, Collaborative International Pesticides Analytical Council; ISO, International Organization for Standardization; OECD, Organisation for Economic Co-operation and Development

Table A2. Analytical methods

OECD data point number	Data requirement	Use pattern		Test substance	Test notes
		Food, feed Terrestrial outdoor Aquatic outdoor Greenhouse Residential outdoor Indoor	**Non-food** Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans		
IIA 4	**ANALYTICAL METHODS**				
IIA 4.1	Analytical standards and samples	R	R	PAI and TGAI	1
IIA 4.2	Methods for analysis of the active substance as manufactured	R	R	TGAI	
IIA 4.3	Description of analytical methods for the determination of residues to enable compliance with MRLs or to determine dislodgeable residues	R	CR	PAIRA and residue of concern	2
IIA 4.4	Description of methods for analysis of soil for parent compound and metabolites of toxicological, ecotoxicological or environmental concern	CR	CR	TGAI or PAIRA	3
IIA 4.5	Description of methods for analysis of water for parent compound and metabolites of toxicological, ecotoxicological or environmental concern	CR	CR	TGAI or PAIRA	4
IIA 4.6	Methods for determining pesticides in sediment	CR	CR	TGAI or PAIRA	5
IIA 4.7	Description of methods for analysis of air for parent compound and metabolites of toxicological, ecotoxicological or environmental concern	R	R	TGAI or PAIRA	6
IIA 4.8	Analytical methods forparent compound and metabolites of toxicological, ecotoxicological or environmental concern in body fluids and tissues	CR	CR	TGAI or PAIRA	7

MRL, maximum residue limit

Test notes:

1. If the TGAI cannot be isolated, data are required on the practical equivalent of the TGAI.
2. Not recommended for exemption from a tolerance provided that dietary exposure estimates are not needed because of low toxicity or that theoretical estimates of exposure are adequate to assess dietary risk. A residue analytical method suitable for enforcement purposes is recommended whenever a numerical tolerance (including temporary and time-limited tolerances) is proposed. New analytical methods to be used for enforcement purposes should include the results of an independent laboratory validation.
3. Recommended to be required for outdoor uses that may result in residues in soil only.
4. Recommended to be required for outdoor uses that may result in residues in water only.
5. Recommended to be required for outdoor uses that may result in residues in sediment only. Adsorption and desorption with a batch equilibrium method is preferred except, for example, when the pesticide degrades rapidly, in which case soil column leaching with unaged or aged columns may be more appropriate to fully characterize the potential mobility of the parent compound and major transformation products.
6. Recommended to be required, unless it can be justified that exposure of operators, workers or bystanders is not likely to occur
7. Protocols should be submitted for approval before initiation of the study. Biological monitoring data may be submitted in addition to, or in lieu of, dermal and inhalation exposure data, provided the human pharmocokinetics of the pesticide and/or metabolite or analogues (whichever method is selected as an indicator of body burden or internal dose) allow for back-calculation to the total internal dose. Data are recommended when passive dosimetry techniques are not applicable for a particular exposure scenario, such as exposure of a swimmer to pesticides.

Table A3. Toxicology and metabolism

Data may also be required to determine the toxicity of any relevant impurities, metabolites or degradates. Many toxicological studies conducted with the TGAI inherently identify toxicity to impurities. In addition, the responsible authority may assume that impurities, metabolites or degradates are equally toxic as the technical material when this is scientifically valid. To determine relevance of impurities, see the FAO/WHO manual on the development and use of FAO and WHO specifications for pesticides (http://www.fao.org/agriculture/crops/core-themes/theme/pests/jmps/manual/en/).

OECD data point number	Data requirement	Use pattern		Test substance	Test notes
		Food/Feed Terrestrial outdoor Aquatic outdoor Greenhouse Residential outdoor Indoor	**Non-food** Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans		
IIA 5	**TOXICOLOGICAL AND TOXICOKINETIC STUDIES ON THE ACTIVE SUBSTANCE**				
IIA 5.1.1, 5.1.2	Absorption, distribution, excretion and metabolism in mammals, with special reference to differences between laboratory animals and humans, kinetics, accumulation and half-lives Metabolism and pharmacokinetics	R	CR	PAI or PAIRA	1
IIA 5.2	**Acute toxicity**				
5.2.1	Acute oral toxicity – rat	R	R	TGAI	2
5.2.2	Acute dermal toxicity	R	R	TGAI	2, 3
5.2.3	Acute inhalation toxicity – rat	R	R	TGAI	4
5.2.5	Primary eye irritation – rabbit	R	R	TGAI	3
5.2.4	Primary dermal irritation	R	R	TGAI	2, 3
5.2.6	Dermal sensitization	R	R	TGAI	3, 5

OECD data point number	Data requirement	Use pattern		Test substance	Test notes
		Food/Feed Terrestrial outdoor Aquatic outdoor Greenhouse Residential outdoor Indoor	**Non-food** Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans		
IIA 5.3	**Short-term toxicity**				
5.3.2	90-day oral – rodent	R	CR	TGAI	6, 7
5.3.3	90-day oral – non-rodent	R	CR	TGAI	8
5.3.7	21 or 28-day dermal	CR	NR	TGAI	9, 10
5.3.8	90-day dermal	CR	CR	TGAI	10, 11
5.3.6	90-day inhalation	CR	CR	TGAI	12, 13
IIA 5.4	**Genotoxicity**				
5.4.1	Bacterial reverse mutation assay	R	R	TGAI	14
5.4.2, 5.4.3	In vitro mammalian cell assay	R	R	TGAI	14, 15
5.4.4	In vivo cytogenetics	R	R	TGAI	14, 16
IIA 5.5	**Long-term toxicity and carcinogenicity**				
5.5.1	Chronic oral – rodent	R	CR	TGAI	17, 18, 19
5.5.2, 5.5.3	Carcinogenicity – two rodent species; rat and mouse preferred	R	CR	TGAI	7, 17, 18, 19, 20, 21
IIA 5.6	**Reproductive toxicity**				
5.6.10, 5.6.11	Prenatal developmental toxicity – rat and rabbit, preferred	R	R	TGAI	22, 23, 24, 25

OECD data point number	Data requirement	Use pattern		Test substance	Test notes
		Food/Feed Terrestrial outdoor Aquatic outdoor Greenhouse Residential outdoor Indoor	**Non-food** Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans		
5.6.1, 5.6.2, 5.6.5, 5.6.6, 5.6.7, 5.6.8	Reproduction and fertility effects	R	R	TGAI	25, 26, 27
IIA 5.7	**Neurotoxicity**				
5.7.2	Delayed neurotoxicity (acute) – hen	CR	CR	TGAI	28
5.7.1	Acute neurotoxicity – rat	R	R	TGAI	29
5.7.2, 5.7.3	28-day delayed neurotoxicity – hen	CR	CR	TGAI	28, 30
5.7.4, 5.7.1	90-day neurotoxicity – rat	R	R	TGAI	29, 31
5.7.5	Developmental neurotoxicity	CR	CR	TGAI	26, 27, 32
IIA 5.8	**Toxicity studies on metabolites**	R	R	Metabolite of concern	
IIA 5.9	**Medical data**				
5.9.9	Dermal penetration	CR	CR	TGAI or TEP	33
None	**Immunotoxicity**	R	R	TGAI	

Test notes:

1. Recommended when chronic or carcinogenicity studies are recommended. May be recommended if significant adverse effects are seen in available toxicology studies and these effects can be further elucidated by metabolism studies.
2. Not recommended if test material is a gas or a highly volatile liquid.
3. Not recommended if the test material is corrosive to skin or has a pH of < 2 or > 11.5.
4. Recommended if the product consists of, or under conditions of use will result in, a respirable material (e.g. gas, vapour, aerosol, or particulate).
5. Recommended if repeated dermal exposure is likely to occur under conditions of use.
6. Recommended for non-food use pesticides if oral exposure could occur.
7. The 90-day study in rats is recommended for hazard characterization (possibly end-point selection) and dose-setting for the chronic toxicity or carcinogenicity study. The test in mice is not recommended, but the responsible authority may wish to strongly encourage the registrant to conduct a 90-day range finding study for the purposes of dose selection for the mouse carcinogenicity study to achieve adequate dosing and an acceptable study. The registrant is also encouraged to consult the responsible authority on the results of the 90-day mouse study before conducting the carcinogenicity study. It is recommended that all studies performed be submitted.
8. A 1-year non-rodent study (i.e. 1-year dog study) would be recommended if the responsible authority finds that a pesticide chemical is highly bioaccumulating and is eliminated so slowly that it does not achieve steady state or sufficient tissue concentrations to elicit an effect during a 90-day study. The responsible authority may recommend the appropriate tier II metabolism and pharmacokinetic studies to evaluate more precisely bioavailability, half-life and steady state to determine if a longer duration dog toxicity study is needed.
9. Recommended for agricultural uses or if repeated human dermal exposure may occur. Not recommended if an acceptable 90-day dermal toxicity study is performed and submitted.
10. End-product testing is recommended if the product, or any component of it, can increase dermal absorption of the active ingredient(s) as determined by testing the TGAI, or can increase toxic or pharmacological effects.
11. Recommended for food use if either of the following criteria is met:
    (i) The use pattern is such that the dermal route would be the primary route of exposure.
    (ii) The active ingredient is known or expected to be metabolized differently by the dermal route of exposure than by the oral route, and a metabolite is the toxic moiety.
12. Recommended if there is a likelihood of significant repeated inhalation exposure to the pesticide as a gas, vapour, or aerosol.
13. Depending on estimates of the magnitude and duration of human exposure, studies of shorter duration, e.g. 21 or 28 days, may be sufficient to satisfy this requirement. Applicants should consult the responsible authority to determine whether studies of shorter duration would meet this recommendation.
14. At a minimum, an initial battery of mutagenicity tests with possible confirmatory testing is recommended. Other relevant mutagenicity tests that may have been performed, plus a complete reference list, should also be submitted.
15. Choice of assay:
    (i) mouse lymphoma L5178Y cells, thymidine kinase (tk) gene locus, with assay conditions maximized for small colony expression or detection;
    (ii) Chinese hamster ovary or Chinese hamster lung fibroblast (V79) cells, hypoxanthine-guanine phosphoribosyl transferase (hgprt) gene locus, accompanied by an appropriate *in vitro* test for clastogenicity; or
    (iii) Chinese hamster ovary cells strain AS52, xanthine-guanine phosphoribosyl transferase (xprt) gene locus.
16. The micronucleus rodent bone marrow assay is preferred; however, rodent bone marrow assays with metaphase analysis (aberrations) are acceptable.

17. Recommended if either of the following is met:

    (i) The use of the pesticide is likely to result in repeated human exposure over a considerable portion of the human lifespan;

    (ii) The use requires a tolerance or an exemption from the requirement of a tolerance.

18. Based on the results of the acute and subchronic neurotoxicity studies, or other available data, a combined chronic toxicity and neurotoxicity study may be recommended.

19. Studies designed to simultaneously fulfil the requirements of both the chronic oral and carcinogenicity studies (i.e. a combined study) may be conducted. Minimum acceptable study durations are:

    (i) Chronic rodent study (food use): 24 months.

    (ii) Chronic rodent study (non-food use): 12 months.

    (iii) Mouse carcinogenicity study: 18 months.

    (iv) Rat carcinogenicity study: 24 months.

20. Recommended if any of the following are met:

    (i) The use of the pesticide is likely to result in significant human exposure over a considerable portion of the human lifespan which is significant in terms of either frequency, duration or magnitude of exposure;

    (ii) The use requires a tolerance or an exemption from the requirement of a tolerance; or

    (iii) The active ingredient, metabolite, degradate, or impurity (a) is structurally related to a recognized carcinogen, (b) causes mutagenic effects as demonstrated by in vitro or in vivo testing, or (c) produces a morphologic effect in any organ (e.g. hyperplasia, metaplasia) in subchronic studies that may lead to a neoplastic change.

21. If this study is modified or waived, a subchronic 90-day oral study conducted in the same species may be recommended.

22. Testing in two species is recommended for all uses.

23. The oral route, by oral intubation, is preferred unless the chemical or physical properties of the test substance or the pattern of exposure suggests a more appropriate route of exposure.

24. Additional testing by other routes may be recommended if the pesticide is determined to be a prenatal developmental toxicant after oral dosing.

25. Recommended to support products intended for food uses and to support products intended for non-food uses if use of the product is likely to result in significant human exposure over a portion of the human lifespan in terms of frequency, magnitude or duration of exposure.

26. An information-based approach to testing is preferred, which utilizes the best available knowledge on the chemical (hazard, pharmacokinetic, or mechanistic data) to determine whether a standard guideline study, an enhanced guideline study, or an alternative study should be conducted to assess potential hazard to the developing animal, or in some cases to support a waiver for such testing. Applicants should submit any alternative proposed testing protocols and supporting scientific rationale to the responsible authority prior to study initiation.

27. A combined study with the 2-generation reproduction study in rodents as the basic protocol for the addition of other endpoints or functional assessments in the immature animal is encouraged.

28. Recommended if the test material is an organophosphorus substance, which includes uncharged organophosphorus esters; thioesters or anhydrides of organophosphoric, organophosphonic, or organophosphoramidic acids; or of related phosphorothioic, phosponothioic, or phosphorothioamidic acids; or is structurally related to other substances that may cause the delayed neurotoxicity sometimes seen in this class of chemicals.

29. As determined by the responsible authority, additional measurements may also be recommended, such as cholinesterase activity for certain pesticides, e.g. organophosphates and some carbamates. The route of exposure should correspond with the primary route of exposure.

30. Recommended if results of acute neurotoxicity study indicate significant statistical or biological effects or if other available data indicate the potential for this type of delayed neurotoxicity, as determined by the responsible authority.

31. All 90-day subchronic studies in rats can be designed to simultaneously fulfil the requirements of the 90-day neurotoxicity study using separate groups of animals for testing. Although the subchronic guidelines include the measurement of neurological endpoints, they do not meet the requirement of the 90-day neurotoxicity study.

32. Study recommended using a weight-of-evidence approach considering:

    (i) The pesticide causes treatment-related neurological effects in adult animal studies (i.e. clinical signs of neurotoxicity, neuropathology, functional or behavioural effects).

    (ii) The pesticide causes treatment-related neurological effects in developing animals, following pre- and postnatal exposure (i.e. nervous system malformations or neuropathy, brain weight changes in offspring, functional or behavioural changes in the offspring).

    (iii) The pesticide elicits a causative association between exposures and adverse neurological effects in human epidemiological studies.

    (iv) The pesticide evokes a mechanism that is associated with adverse effects on the development of the nervous system (e.g. SAR relationship to known neurotoxicants, altered neuroreceptor or neurotransmitter responses).

33. A risk assessment assuming that dermal absorption is equal to oral absorption is recommended to be performed to determine if the study is recommended, and to identify the doses and duration of exposure for which dermal absorption is to be quantified.

Table A4. Residue chemistry

OECD data point number	Data requirement	Use pattern						Test substance	Test notes
		Terrestrial outdoor (Food or feed)	Aquatic outdoor (Food)	Green-house (Food)	Residential outdoor	Indoor (Food)	Forestry, direct application to humans, and other non-food uses		
IIA 6	**METABOLISM AND RESIDUES DATA**								
IIA 6.1	Stability of residues	R	R	R	CR	CR	NR	TEP or residue of concern	1, 2, 3, 4, 5
IIA 6.2	**Metabolism, distribution and expression of residues**								
6.2.1	Nature of the residue in plants	R	R	R	CR	CR	NR	PAIRA	2, 5, 6
6.2.2, 6.2.3	Nature of the residue in meat, milk, poultry or eggs	CR	CR	CR	NR	CR	NR	TGAI or plant metabolites	1, 5, 7, 8, 9
6.2.5	Fish	NR	R	NR	NR	NR	NR	TEP	5, 10
6.2.6	Chemical identity	R	R	R	CR	R	NR	TGAI	11
IIA 6.3	**Residue trials** for crops or plant product used as food or feed on which use is proposed or from which residues from soil can be taken up (crop field trials)	R	R	R	CR	CR	NR	TEP	2, 3, 4, 5
IIA 6.4	**Livestock feeding studies on the** nature of the residue in livestock	CR	CR	CR	NR	CR	NR	PAIRA or radiolabelled plant meta-bolite	1, 5, 12
IIA 6.5	**Effects of industrial processing and/or household preparation** on the nature of the residue, distribution of the residue, and residue levels	CR	CR	CR	NR	CR	NR	TEP	1, 13, 5

OECD data point number	Data requirement	Use pattern						Test substance	Test notes
		Terrestrial outdoor (Food or feed)	Aquatic outdoor (Food)	Green-house (Food)	Residential outdoor	Indoor (Food)	Forestry, direct application to humans, and other non-food uses		
6.5.3, 6.5.4	Anticipated residues	CR	CR	CR	NR	CR	NR	Residue of concern	1, 14, 15, 16
IIA 6.6	**Residues in succeeding crop** (rotational crops)	CR	CR	NR	NR	NR	NR	PAIRA	17
6.6.1, 6.6.2									
6.6.3	Field trials	CR	CR	NR	NR	NR	NR	TEP	16, 18
IIA 6.7	Proposed **residue definition and maximum residue limits**	R	R	R	NR	CR	NR	–	1

Test notes:

1. Recommended if indoor use could result in pesticide residues in or on food or feed.
2. Recommended for residential outdoor uses on food crops if the corresponding agricultural use is not approved or the residential use following label directions is expected to produce higher levels of residues.
3. A residue method, storage stability data and crop field trials are recommended for the non-food crop tobacco (green, freshly harvested). Depending on the level of residues found on the green tobacco, additional data may be recommended on cured or dried tobacco and pyrolysis products.
4. Data are recommended for any magnitude of the residue study unless analytical samples are stored frozen for 30 days or less and the active ingredient is not known to be volatile or labile.
5. Not required for an exemption from a tolerance provided that dietary exposure estimates are not needed due to low toxicity or that theoretical estimates of exposure are adequate to assess dietary risk.
6. Recommended for indoor use when the pesticide is applied directly to food, in order to determine metabolites and/or degradates. Not recommended when only indirect contact with food would occur (e.g. crack and crevice treatments).
7. Recommended when the pesticide use is a direct application to livestock.
8. Recommended if pesticide residues are present in or on livestock feed items or intentionally added to drinking-water. Such studies may not, however, be recommended if livestock metabolism studies indicate negligible transfer of the pesticide residues of concern to tissues, milk and eggs from animals exposed at the maximum expected level.
9. If the results from the plant metabolism study show differing metabolites from those found in animals, an additional livestock feeding study involving dosing with the plant metabolite(s) may also be recommended.
10. Data for fish are recommended for all pesticides applied directly to water inhabited, or to be inhabited, by fish that may be caught or harvested for human consumption.

11. Recommended only for food uses.

12. Recommended when a pesticide is to be applied directly to livestock, to livestock premises, to livestock drinking-water, or to crops used for livestock feed. If the results of the plant metabolism study show differing metabolites in plants and animals, an additional livestock metabolism study involving dosing with the plant metabolite(s) may also be recommended.

13. Data on the nature and level of residues in processed food or feed are recommended if residues could potentially concentrate during processing thus requiring the establishment of a separate tolerance higher than that of the raw agricultural commodity.

14. Studies with single-serving samples of a raw agricultural commodity may be needed for acutely toxic pesticides and/or their metabolites. The statistical design of the residue studies should be accepted by the responsible authority.

15. Recommended when residues at the tolerance level may result in a risk of concern. These data may include washing, cooking, processing or degradation studies as well as market basket surveys for a more precise residue determination.

16. Not recommended for an exemption from a tolerance.

17. Recommended when the responsible authority determines that it is reasonably foreseeable that a food or feed crop could subsequently be planted on the site of pesticide application after harvest or failure of the treated crop. Typically not recommended for pesticide uses in permanent food crops (e.g. various tree crops, vines) or semi-permanent crops (e.g. asparagus, pineapples).

18. Typically recommended if pesticide residues of concern are found at levels > 0.01 ppm in crops at the appropriate plant-back intervals (taking into account plant-back restrictions on product labels) in the confined rotational crop study. If residues of concern in the confined study are > 0.01 ppm but less than the limit of quantitation of the analytical method to be used on field trial samples, the responsible authority should consider not requiring, on a case-by-case basis, the limited field trials. If there is a particular toxicological concern with the parent pesticide or any metabolites, limited field studies may be needed if such residues are identified at levels < 0.01 ppm in the confined study.

Table A5. Environmental fate

OECD data point number	Data requirement	Use pattern							Test substance	Test notes
		Terrestrial outdoor	Aquatic outdoor	Forestry	Residential outdoor	Green-house	Indoor	Direct application to humans		
IIA 7	**FATE AND BEHAVIOUR IN THE ENVIRONMENT**									
IIA 7.1 and 7.2	**Route and rate of degradation in soil**									
7.1.1, 7.2.2, 7.2.3	Aerobic soil metabolism	R	CR	R	R	R	NR	NR	TGAI or PAIRA	1
7.1.2, 7.2.4, 7.2.5	Anaerobic soil metabolism	R	NR	NR	NR	NR	NR	NR	TGAI or PAIRA	
IIA 7.3	**Field studies**									
	Terrestrial	CR	CR	CR	CR	NR	NR	NR	TEP	1, 2, 3, 4
	Aquatic (sediment)	CR	R	NR	NR	NR	NR	NR	TEP	2, 5
	Forestry	NR	NR	CR	NR	NR	NR	NR	TEP	2, 3, 6
	Combination and tank mixes	CR	CR	NR	NR	NR	NR	NR	TEP	7
IIA 7.4	**Mobility studies**									
7.4.3, 7.4.4, 7.4.5, 7.4.6, 7.4.8	Leaching	CR	CR	CR	CR	CR	NR	NR	TGAI or PAIRA	8
7.4.1, 7.4.2	Adsorption and desorption	R	R	R	R	R	NR	NR	TGAI or PAIRA	8
7.4.9	Volatility – laboratory	CR	NR	NR	NR	CR	NR	NR	TEP	9
	Volatility – field	CR	NR	NR	NR	CR	NR	NR	TEP	
IIA 7.5	**Hydrolysis rate** of relevant metabolites, degradation and reaction products at pH 4, 7 and 9 under sterile conditions in the	R	R	R	R	R	CR	NR	TGAI or PAIRA	10

OECD data point number	Data requirement	Use pattern							Test substance	Test notes
		Terrestrial outdoor	Aquatic outdoor	Forestry	Residential outdoor	Green-house	Indoor	Direct application to humans		
	absence of light									
IIA 7.6	**Direct phototransformation** of relevant metabolites, degradation and reaction products in water with artificial light under sterile conditions	R	R	R	NR	NR	NR	NR	TGAI or PAIRA	11
IIA 7.8	**Degradation in aquatic systems**									
7.8.1	Aerobic aquatic metabolism	R	R	R	NR	NR	NR	NR	TGAI or PAIRA	
7.8.2	Anaerobic aquatic metabolism	R	R	R	NR	NR	NR	NR	TGAI or PAIRA	
IIA 7.10	**Rate and route of degradation in air**	CR	NR	CR	CR	CR	NR	NR	TGAI or PAIRA	9
IIA 7.12	**Monitoring data** on fate and behaviour of the active substance and of relevant metabolites, degradation and reaction products	CR	NR	CR	CR	NR	NR	NR	TEP	2, 6, 12

Test notes:

1. Recommended for aquatic food and non-food crop uses for aquatic sites that are intermittently dry, including cranberry bogs and rice paddies.
2. Environmental chemistry methods used to generate data in this study should include results of a successful confirmatory method trial by an independent laboratory. Test standards and procedures for independent laboratory validation are available as addenda to the guideline for this test requirement.
3. If the terrestrial dissipation study is inadequate to assess all the major routes of dissipation, the forestry study will be recommended.
4. Recommended if in a laboratory study the half-life (DT_{50}) is > 60 days or the DT_{90} > 200 days at 20 °C.
5. Requirement for terrestrial use is based on potential for aquatic exposure and whether the pesticide residues have the potential for persistence, mobility, non-target aquatic toxicity or bioaccumulation. Not recommended for aquatic residential uses. Field testing under the terrestrial field dissipation

requirement may be more appropriate for some aquatic food crops that have a dry-land period for production, such as rice and cranberry. The registrant is encouraged to consult the responsible authority on protocols.

6. Approval of a protocol is recommended prior to initiation of the study.

7. This study may be triggered if there is evidence that the presence of one pesticide can affect the dissipation characteristics of another pesticide when applied simultaneously or serially.

8. Adsorption and desorption studies with a batch equilibrium method are preferred. When, for example, the pesticide degrades rapidly, soil column leaching with unaged or aged columns may be more appropriate to fully characterize the potential mobility of the parent compound and major transformation products.

9. Requirement based on use patterns and other pertinent factors, including the Henry's Law Constant of the chemical. As the study of photodegradation in air is methodologically difficult, consultation with the responsible authority regarding the protocol is recommended before the test is performed.

10. Study is recommended for indoor uses when environmental exposure is likely to occur, including agricultural premises, in or around farm buildings, barnyards, and beehives.

11. Not recommended when the electronic absorption spectra, measured at pH 5, 7 and 9 of the chemical and its hydrolytic products, if any, show no absorption or tailing between 290 nm and 800 nm.

12. Recommended if the weight-of-evidence indicates that the pesticide and/or its degradates is likely to leach to ground water, taking into account other factors such as the toxicity of the chemicals(s), available monitoring data and the vulnerability of ground water resources in the pesticide use area.

Table A6. Environmental effects – Animals and microorganisms

OECD data point number	Data requirement	Use pattern							Test substance	Test note
		Terrestrial	Aquatic	Forestry	Residential outdoor	Green-house	Indoor	Direct application to humans		
IIA 8	**ECOTOXICOLOGICAL STUDIES**									
IIA 8.1	**Avian toxicity**									
8.1.1	Avian oral toxicity	R	R	R	R	CR	CR	NR	TGAI	1, 2, 3
8.1.4	Avian reproduction	R	R	R	R	NR	NR	NR	TGAI	1, 4
IIA 8.2	**Fish toxicity**									
8.2.1	Freshwater fish toxicity	R	R	R	R	CR	CR	NR	TGAI, TEP	1, 2, 5, 6, 7
8.2.4	Fish early-life stage (freshwater)	R	R	R	R	NR	NR	NR	TGAI	1, 8, 9
	Fish early-life stage (saltwater)	CR	CR	CR	CR	NR	NR	NR	TGAI	8, 10, 11
8.2.5	Fish life-cycle	CR	CR	CR	CR	NR	NR	NR	TGAI	12, 13
IIA 8.3	**Toxicity to aquatic species other than fish and aquatic species field testing**									
8.3.1	Acute toxicity freshwater invertebrates	R	R	R	R	CR	CR	NR	TGAI, TEP	1, 2, 6, 7, 14
8.3.2.1	Aquatic invertebrate life-cycle (freshwater)	R	R	R	R	NR	NR	NR	TGAI	1, 8, 14
8.3.2.3	Aquatic invertebrate life-cycle (saltwater)	CR	CR	CR	CR	NR	NR	NR	TGAI	8, 10, 15
IIA 8.5	**Effects on sediment-dwelling organisms**									
8.5.1	Whole sediment – acute – freshwater invertebrates	CR	CR	CR	CR	NR	NR	NR	TGAI	16
8.5.1	Whole sediment – acute – marine invertebrates	CR	CR	CR	CR	NR	NR	NR	TGAI	16, 17

OECD data point number	Data requirement	Use pattern							Test substance	Test note
		Terrestrial	Aquatic	Forestry	Residential outdoor	Green-house	Indoor	Direct application to humans		
8.5.2	Whole sediment – chronic – freshwater and marine invertebrates	CR	CR	CR	CR	NR	NR	NR	TGAI	17, 18
IIA 8.7	**Effects on bees**									
8.7.1	Honeybee – acute oral toxicity	R	CR	R	R	NR	NR	NR	TGAI	1
8.7.2	Honeybee – acute contact toxicity	R	CR	R	R	NR	NR	NR	TGAI	1
8.7.3	Honey bee – toxicity of residues on foliage	CR	CR	CR	CR	NR	NR	NR	TEP	19
8.7.4	Bee brood-feeding tests	CR	CR	CR	CR	NR	NR	NR	TGAI	20
IIA 8.8	**Effects on non-target terrestrial arthropods**	CR	CR	CR	CR	NR	NR	NR	TEP	21
IIA 8.9	**Effects on earthworms**	R	NR	R	R	NR	NR	NR	TGAI, TEP	
IIA 8.10	**Effects on soil microbial activity**	R	NR	R	R	NR	NR	NR	TGAI, TEP	
IIA 8.11	**Effects on marine and estuarine organisms**									
8.11.1	Oyster acute toxicity test (shell deposition)	CR	CR	CR	CR	NR	NR	NR	TGAI, TEP	1, 6, 22, 8, 7, 23
	Mysid – acute toxicity test	CR	CR	CR	CR	NR	NR	NR	TGAI, TEP	1, 6, 22, 8, 7, 23
	Penaeid – acute toxicity test	CR	CR	CR	CR	NR	NR	NR	TGAI, TEP	1, 6, 22, 8, 7, 23
	Bivalve – acute toxicity test (embryo-larval)	CR	CR	CR	CR	NR	NR	NR	TGAI, TEP	1, 6, 22, 8, 7, 23

Test notes:

1. Data with the TGAI are recommended to support all outdoor end-use product uses, including turf. Data are generally not recommended to support end-use products in the form of a gas, a highly volatile liquid, a highly reactive solid, or a highly corrosive material.
2. For greenhouse and indoor end-use products, data obtained with the TGAI are recommended to support manufacturing use products to be reformulated into these same end-use products, or to support end-use products when there is no registered manufacturing use product. Avian acute oral data are not recommended for liquid formulations for greenhouse and indoor uses. The study is not recommended if there is no potential for environmental exposure.
3. Data are recommended on one passerine species and either one waterfowl species or one upland game bird species for terrestrial, aquatic, forestry and residential outdoor uses. Data on waterfowl or upland game bird species are preferred for indoor and greenhouse uses.
4. Data are recommended on waterfowl and upland game bird species.
5. Data are recommended on one cold-water fish and one warm-water fish for terrestrial, aquatic, forestry and residential outdoor uses. For indoor and greenhouse uses, testing with only one of either fish species is recommended.
6. Testing with an end-use product or typical end-use product is recommended for products that meet any of the following conditions:
   (i) The end-use pesticide will be introduced directly into an aquatic environment (e.g. aquatic herbicides and mosquito larvicides) when used as directed.
   (ii) The maximum expected environmental concentration or the estimated environmental concentration in the aquatic environment is ≥ 50% of the LC_{50}or of the $EC_{50}$of the TGAI when the end-use product is used as directed.
   (iii) An ingredient in the end-use formulation other than the active ingredient is expected to enhance the toxicity of the active ingredient or to be toxic to aquatic organisms.
7. The freshwater fish test species for the TEP testing is the most sensitive of the species tested with the TGAI. Freshwater invertebrate and acute estuarine and marine organisms should also be tested with the EP or TEP using the same species tested with the TGAI.
8. Data are generally not recommended for outdoor residential uses, other than turf, unless data indicate that pesticide residues from the proposed use(s) can potentially enter waterways.
9. Data are recommended on one freshwater fish species. If the test species is different from the two species used for the freshwater fish acute toxicity tests, a 96-h LC_{50} for that species should also be provided.
10. Data are recommended on estuarine or marine species if the product meets any of the following conditions:
    (i) Intended for direct application to the estuarine or marine environment;
    (ii) Expected to enter this environment in significant concentrations because of its expected use or mobility patterns.
    (iii) The acute LC_{50} or EC_{50} is < 1 mg/l.
    (iv) The estimated environmental concentration in water is ≥ 0.01 of the acute EC_{50} or LC_{50}, or if any of the following conditions exist:
        a. Studies of other organisms indicate the reproductive physiology of fish and/or invertebrates may be affected.
        b. Physicochemical properties indicate bioaccumulation of the pesticide.
        c. The pesticide is persistent in water (e.g. half-life in water is > 4 days).
11. Data are recommended on one estuarine or marine fish species.
12. Data are recommended on estuarine or marine species if the product is intended for direct application to the estuarine or marine environment or if the product is expected to enter this environment in significant concentrations because of its expected use or mobility patterns.

13. Data are recommended on freshwater species if the end-use product is intended to be applied directly to water, or is expected to be transported to water from the intended use site, and when any of the following conditions apply:

    (i) The estimated environmental concentration is ≥ 10% of the no-observed-effect level in the fish early-life stage or invertebrate life-cycle test;

    (ii) If studies of other organisms indicate that the reproductive physiology of fish may be affected.

14. Data are recommended on one freshwater aquatic invertebrate species.

15. Data are recommended on one estuarine or marine invertebrate species.

16. Data are recommended if:

    (i) The half-life of the pesticide in the sediment is ≤ 10 days in either the aerobic soil or aquatic metabolism studies and if any of the following conditions exist:

        a. The soil partition coefficient (K_d) is ≥ 50.

        b. The log octanol-water partition coefficient (K_{ow}) is ≥ 3.

        c. The organic-carbon referenced sorption coefficient (K_{oc}) is ≥ 1000.

    (ii) Applicants should consult the responsible authority on appropriate test protocols before designing the study.

17. Sediment testing with estuarine or marine test species is recommended if the product is intended for direct application to the estuarine or marine environment or the product is expected to enter this environment by runoff or erosion in concentrations that the responsible authority considers significant because of its expected use or mobility pattern.

18. Data are recommended if:

    (i) The estimated environmental concentration in sediment is > 10% of the acute LC_{50} or EC_{50}; and

    (ii) The half-life of the pesticide in the sediment is > 10 days in either the aerobic soil or aquatic metabolism studies, and if any of the following conditions exist:

        a. The soil partition coefficient (K_d) is ≥ 50.

        b. The log octanol-water partition coefficient (K_{ow}) is ≥ 3.

        c. The organic-carbon referenced sorption coefficient (K_{oc}) is ≥ 1000.

    (iii) Applicants should consult the responsible authority on appropriate test protocols before designing the study.

19. Data are recommended only when the formulation contains one or more active ingredients with an acute LD_{50} of < 11 µg per bee as determined in the honeybee acute contact study, and the use pattern(s) indicate(s) that honeybees may be exposed to the pesticide.

20. Recommended to be carried out for substances for which sublethal effects on growth or development cannot be excluded, unless it can be justified that honeybee brood would not be exposed to the active substance (e.g. from the use of non-systemic seed treatment, non-systemic soil-applied treatment, pre-flowering non-systemic sprays).

21. Recommended if any of the following conditions are met:

    (i) Data from other sources (e.g. experimental use permit programme, university research, registrant submittals) indicate potential adverse effects on colonies or populations, especially effects other than acute mortality (e.g. reproductive, behavioural);

    (ii) Data from residual toxicity studies indicate extended residual toxicity.

    (iii) Data from studies with terrestrial arthropods other than bees indicate potential chronic, reproductive or behavioural effects.

22. Data are recommended on one estuarine or marine mollusc, one estuarine or marine invertebrate and one estuarine or marine fish species.

23. Recommended for countries with access to the sea for products proposed to be used in areas that may result in estuarine or marine exposure.

Table A7. Environmental effects – Algae and plants

OECD data point number	Data requirement	Use pattern							Test substance	Test note
		Terrestrial	Aquatic	Forestry	Residential outdoor	Green-house	Indoor	Direct application to humans		
IIA 8	**ECOTOXICOLOGICAL STUDIES – ALGAE AND PLANTS**									
IIA 8.4	**Effects on algal growth and growth rate; analytical data on concentrations in the test media**									
	Algal toxicity – tier I	R	R	R	R	NR	NR	NR	TEP or TGAI	1, 2, 3
	Algal toxicity – tier II	CR	CR	CR	CR	NR	NR	NR	TEP or TGAI	1, 3, 4, 5
IIA 8.6	**Effects on aquatic plants; analytical data on concentrations in the test media**									
	Aquatic plant toxicity test with *Lemna* spp. – tier I	R	R	R	R	NR	NR	NR	TEP or TGAI	1, 2, 3
	Aquatic plant toxicity test with *Lemna* spp. – tier II	CR	CR	CR	CR	NR	NR	NR	TEP or TGAI	1, 3, 4, 5
IIA 8.12	**Effects on terrestrial vascular plants**									
	Seedling emergence – tier I	R	R	R	R	NR	NR	NR	TEP	1, 2, 3
	Vegetative vigour – tier I	R	R	R	R	NR	NR	NR	TEP	1, 2, 3, 6
	Seedling emergence – tier II	CR	CR	CR	CR	NR	NR	NR	TEP	1, 3, 4, 7
	Vegetative vigour – tier II	CR	CR	CR	CR	NR	NR	NR	TEP	1, 3, 4, 6, 7

Test notes:

1. Not recommended for contained pesticide treatments, such as bait boxes and pheromone traps, unless adverse effects are reported.
2. Not recommended for known phytotoxicants.
3. Not recommended for aquatic residential uses.
4. Recommended for known phytotoxicants, such as herbicides, desiccants and defoliants.
5. Recommended if the tested aquatic species exhibits a ≥ 50% detrimental effect in the tier-I study. When tier-II testing is recommended, the test species should be the same as that which showed detrimental effects in the tier-I testing.

6. Generally not recommended for granular formulations; may be requested on a case-by-case basis.

7. Recommended if the tested terrestrial species exhibits a ≥ 25% detrimental effect in the tier-I study. When tier-II testing is recommended, the test species should be the same as that which showed detrimental effects in the tier-I testing.

Annex B. Chemical pesticides: recommended data requirements for registration of formulated products

Tests for the registration of formulated pesticide products according to this annex are generally conducted on the formulated pesticide itself. These data requirements are additional to the recommended data requirements in Annex A.

Table B1. Data requirements for all product types and all use patterns

In this table, the test substance is always the formulated product.

OECD data point number	Data requirement	Test notes
IIIA 1	**IDENTITY**	
IIIA 1.2	Manufacturer of the preparation, manufacturer and statement of purity (and detailed information on impurities) of the active substance(s)	
IIIA 1.3	Trade name	
IIIA 1.4	Detailed quantitative and qualitative information on the composition of the preparation, including: – content of technical active substance, pure active substance and formulants – certified limits of each compound – names and identifying codes of the active substance – salt, ester, anion or cation present for each active substance – for each formulant, or component of formulants: chemical name, structure or structural formula, CAS or CIPAC numbers, trade name, specification of formulation, function of each formulant – description of formulation process and discussion of the formation of impurities of toxicological concern	
IIIA 1.5	Type of preparation (formulation) and code	
IIIA 1.6	Function (e.g. herbicide, insecticide)	
IIIA 2	**PHYSICAL, CHEMICAL, AND TECHNICAL PROPERTIES**	
IIIA 2.1	Description of the physical state of the preparation (formulation) and its colour and odour	1

OECD data point number	Data requirement	Test notes
IIIA 2.2	Explosivity and oxidizing properties	
IIIA 2.3	Flash point and other indication of flammability or spontaneous ignition	
IIIA 2.4	Acidity or alkalinity and pH	
IIIA 2.5	Viscosity and surface tension	
IIIA 2.6	Relative density and bulk density	
IIIA 2.7	Storage stability and half-life	
IIIA 2.8	Technical properties of the product	
IIIA 2.9	Physical and chemical compatibility with other products	
IIIA 2.10	Distribution and adherence to seeds (seed treatment only)	
IIIA 2.11	Miscibility	
IIIA 2.12	Dielectric breakdown voltage	
IIIA 2.13	Corrosion characteristics	
IIIA 2.14	Container material	
IIIA 3	**INFORMATION ON APPLICATION**	
IIIA 3.1	Field of use (e.g. forestry, public health)	
IIIA 3.2	Nature of effects on harmful organisms (e.g. contact action)	
IIIA 3.3	Details of intended use	
IIIA 3.4	Rate of application per unit treated (e.g. per ha, m^2, m^3, tonne), in g or kg of formulation and active ingredient	
IIIA 3.5	Concentration of active ingredient in material used (e.g. diluted sprays, baits, treated seeds) in g/L, g/kg or g/tonne	
IIIA 3.6	Description of method of application, type of equipment used and type and volume of diluent per unit of area or volume	
IIIA 3.7	Number and timing of applications, and duration of protection afforded by each application	
IIIA 3.8	Necessary waiting periods or other precautions to avoid phytotoxic effects on succeeding crops	

OECD data point number	Data requirement	Test notes
IIIA 3.9	Proposed instructions for use as printed, or to be printed, on the label	
IIIA 4	**FURTHER INFORMATION ON THE FORMULATED (END-USE) PRODUCT**	
IIIA 4.1	Packaging and compatibility with the formulation	
IIIA 4.2	Procedures for cleaning application equipment	
IIIA 4.3	Re-entry periods, necessary waiting periods, pre-harvest periods or other precautions to protect people, livestock and the environment	
IIIA 4.4	Statement of risks arising from the recommended methods, and precautions and handling procedures to minimize those risks, including: storage; transport; fire; protective clothing; procedures to minimize generation of waste; and information of combustion products likely to be generated in case of fire	
IIIA 4.5	Detailed procedures in the event of an accident during transport, storage or use, including: containment of spillages; decontamination of areas, vehicles and buildings; disposal of damaged packaging, absorbents and other materials; protection of emergency workers and bystanders; and first-aid measures	
IIIA 4.6	Neutralization procedures for use in the event of accidental spillage	
IIIA 4.7	Pyrolytic behaviour of the active substance under controlled conditions at 800 ^{o}C and the content of polyhalogenated dibenzo-p-dioxins in the products of pyrolysis	
IIIA 4.8	Disposal procedures for the plant protection product	
IIIA 5	**ANALYTICAL METHODS**	
IIIA 5.2.1, IIIA 5.2.4, IIIA 5.2.5	Analytical methods for the determination of the active ingredient, impurities of toxicological concern and formulants in the formulated product	
IIIA 6	**EFFICACY DATA AND INFORMATION**	
IIIA 6.1	Efficacy data, specifically data demonstrating efficacy against pests described on the label	
IIIA 6.2	Adverse effects (e.g. phytotoxicity, effects on succeeding or adjacent crops, development of resistance)	
IIIA 6.3	Economics	

OECD data point number	Data requirement	Test notes
IIIA 6.4	Benefit	
IIIA 7	**TOXICOLOGICAL STUDIES**	
IIIA 7.1	**Acute toxicity**	
7.1.1	Acute oral toxicity	2, 3
7.1.2	Acute dermal toxicity	2, 3, 4
7.1.3	Acute inhalation toxicity	5
7.1.4	Primary dermal irritation	4
7.1.5	Primary eye irritation	2, 4
7.1.6	Dermal sensitization	4, 6

CAS, Chemicals Abstracts Service; CIPAC, Collaborative International Pesticides Analytical Council; OECD, Organisation for Economic Co-operation and Development

Test notes:

1. Not all parameters apply to all types of formulations; use common sense.
2. Not recommended if test material is a gas or a highly volatile liquid.
3. Testing of diluted end-use product recommended to support the end product registration if needed.
4. Not recommended if the test material is corrosive to skin or has a pH of < 2 or > 11.5.
5. Recommended if the product consists of, or under conditions of use will result in, a respirable material (e.g. gas, vapour, aerosol or particulate).
6. Recommended if repeated dermal exposure is likely under conditions of use.

Table B2. Exposure

OECD data point number	Data requirement	Use pattern		Test substance	Test notes
		Occupational Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans	**Residential** Terrestrial outdoor Aquatic outdoor Residential outdoor Indoor Direct application to humans		
IIIA 7	**EXPOSURE DATA AND INFORMATION**				
IIIA 7.3	**Operator exposure**	CR	CR	TEP	1, 2
7.3.1, 7.3.2, 7.3.3	Dermal outdoor exposure Dermal indoor exposure Inhalation outdoor exposure Inhalation indoor exposure Biological monitoring				
IIIA 7.4	**Bystander exposure**				
7.4.2, 7.4.2	Dermal exposure	CR	CR	TEP	1, 3, 4, 5, 6
	Inhalation exposure	CR	CR	TEP	1, 4, 5, 6
	Biological monitoring	CR	CR	TEP	1, 6, 7
	Non-dietary ingestion exposure	NR	CR	TEP	1, 5, 8
IIIA 7.5	**Worker exposure**				
7.5.1, 7.5.2, 7.5.3	Estimation of worker exposure assuming personal protective equipment is used, and is not used	CR	NR		1
7.5.4	Measurement of worker exposure	CR	NR		1

OECD data point number	Data requirement	Use pattern		Test substance	Test notes
		Occupational Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans	**Residential** Terrestrial outdoor Aquatic outdoor Residential outdoor Indoor Direct application to humans		
IIIA 7.7	**Dislodgeable residues**				
7.7.1	Dislodgeable foliar residue and turf transferable residues	CR	CR	TEP	1, 3, 9, 10, 11
7.7.2	Soil residue dissipation	CR	CR	TEP	1, 3, 12, 13
7.7.3	Indoor surface residue dissipation	CR	CR	TEP	1, 3, 14, 15
IIIA 7.8	**Epidemiology:** Description of human activity	CR	CR	Any	

Test notes:

1. Recommended only if default or generic data or conservative assumptions are not available or not sufficient to demonstrate safe use. If data are to be generated, protocols should be submitted for approval before initiation of the study.
2. Biological monitoring data may be submitted in addition to, or in lieu of, dermal and inhalation exposure data, provided the human pharmacokinetics of the pesticide and/or metabolite/analogue compounds (i.e. whichever method is selected as an indicator of body burden or internal dose) allow for the back-calculation to actual dose. Outdoor data are recommended to be required if the product is applied outdoors; indoor data are recommended to be required if the product is applied indoors.
3. Bridging applicable residue dissipation data to dermal exposure data is recommended.
4. Data are recommended for occupational sites if the human activity data indicate that workers are likely to have post-application exposure during typical activities.
5. Data are recommended for residential sites if post-application exposure is likely.
6. Biological monitoring data may be submitted in addition to, or in lieu of, dermal and inhalation exposure data provided the human pharmacokinetics of the pesticide and/or metabolite/analogue compounds (i.e. whichever method is selected as an indicator of body burden or internal dose) allow for a back-calculation to the total internal dose.

7. Data are recommended when passive dosimetry techniques are not applicable for a particular exposure scenario, such as a swimmer exposure to pesticides.

8. The choice of sampling method will depend on the non-dietary pathway(s) of interest. Data should be generated to consider all potential pathways of non-dietary ingestion exposure that are applicable (e.g. soil ingestion, hand-to-mouth transfer and object-to-mouth transfer of surface residues).

9. Data on dissipation of residues transferable from turf grass are recommended when pesticides are applied to turf grass. Data on dissipation of dislodgeable foliar residue are recommended when pesticides are applied to the foliage of plants other than turf grass.

10. Data are recommended for occupational sites if (i) there are uses on turf grass or other plant foliage, and (ii) the human activity data indicate that workers are likely to have post-application dermal contact with treated foliage during typical activities.

11. Data are recommended for residential sites if there are uses on turf grass or other plant foliage.

12. Data are recommended for occupational sites if (i) the pesticide is to be used outdoors, in greenhouses or around soil or other planting media, and (ii) the human activity data indicate that workers are likely to have post-application dermal contact with treated soil or planting media during typical activities.

13. Data are recommended for residential sites if the pesticide is applied to or around soil or other planting media both outdoors and indoors, e.g. residential greenhouse or houseplant uses.

14. Data are recommended for occupational sites if the pesticide is applied to or around non-plant surfaces, e.g. flooring or countertops, and if the human activity data indicate that workers are likely to have post-application dermal contact with treated indoor surfaces during typical activities.

15. Data are recommended for residential sites if the pesticide is applied to or around non-plant surfaces, e.g. flooring and countertops.

Annex C. Biochemical pesticides: recommended data requirements for registration of biochemical pest control agents

Tests listed in this annex are generally conducted on the active substance itself; however, several field studies might be conducted with an appropriate typical end-use product for ease of testing and scientific relevance of the tests.

Table C1. Identity and composition, physical and chemical properties

OECD data point number	Data requirement	All use patterns	Test substance	Test notes
IIP 1	**IDENTITY AND MANUFACTURE** - Applicant name and contact information - Manufacturer name and contact information - ISO common name and synonyms - Chemical name - Trade name - Patent status - Molecular formula, molecular mass and molecular structure - Method of manufacture, including starting materials, pathways, by-products, impurities - Specification of the purity of the active substance - Identity, content, structural formula of isomers, impurities and additives - Batch analysis data	R	TGAI	
IIP 2	**PHYSICAL AND CHEMICAL PROPERTIES** - Melting point - Boiling point - Relative density - Vapour pressure - Henry's law constant - Description of physical state, colour and odour (both technical material and as formulated)	R	TGAI	1

OECD data point number	Data requirement	All use patterns	Test substance	Test notes
	- Ultraviolet and visible spectra (UV/VIS) - Solubility in water - Solubility in organic solvents - Partition coefficient - Hydrolysis rate and direct phototransformation - Stability			

Test notes:

1. Hydrolysis rate and direct phototransformation are conditionally recommended to be required if ecotoxicity data or published literature indicate a hazard to biota.

Table C2. Analytical methods

OECD data point number	Data requirement	Use pattern		Test material	Test notes
		Food	**Non-food**		
		Terrestrial outdoor	Terrestrial outdoor		
		Aquatic outdoor	Aquatic outdoor		
		Greenhouse	Greenhouse		
		Residential outdoor	Forestry		
		Indoor	Residential outdoor		
			Indoor		
			Direct application to humans		
IIP 4	**ANALYTICAL METHODS**				
IIP 4.1	Analytical standards and samples	R	R	PAI and TGAI	
IIP 4.2.1	Methods for the analysis of the active substance as manufactured	R	R	TGAI	
IIP 4.2.2	Methods for the analysis of impurities of toxicological, ecotoxicological or environmental concern	CR	CR		1
IIP 4.3	Description of analytical methods for the determination of residues to enable compliance with MRLs or to determine dislodgeable residues	CR	CR	PAIRA and residue of concern	2

Test notes for Table 2

1. Required only if manufacturing methods and materials indicate potential presence of a toxic impurity

2. Recommended to be required if use description indicates significant potential exposure and/or if toxicity tests or published data indicate a concern. Solid-matrix dispensers are unlikely to present significant potential exposure, but some sprayed applications might.

Table C3. Toxicology and metabolism

OECD data point number		Data requirement	Use pattern		Test substance	Test notes
			Food Terrestrial outdoor Aquatic outdoor Greenhouse Residential outdoor Indoor	**Non-food** Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans		
IIP 5		**TOXICOLOGICAL AND TOXICOKINETIC STUDIES ON THE ACTIVE SUBSTANCE**				
	5.1.1	Toxicokinetic studies – single dose, oral route, rats	CR	CR	TGAI	1
IIP 5.2		**Acute toxicity**				
	5.2.1	Acute oral toxicity – rat	R	R	TGAI	2
	5.2.2	Acute dermal toxicity	R	R	TGAI	
	5.2.3	Acute inhalation toxicity – rat	R	R	TGAI	
	5.2.5	Primary eye irritation – rabbit	R	R	TGAI	
	5.2.4	Primary dermal irritation	R	R	TGAI	
	5.2.6	Dermal sensitization	R	R	TGAI	
IIP 5.3		**Short-term toxicity**				
	5.3.2	90-day oral toxicity – rodent	CR	CR	TGAI	3
	5.3.6	90-day inhalation toxicity – rodent	CR	CR	TGAI	
	5.3.8	Percutaneous 90-day toxicity – rodent	CR	CR	TGAI	
IIP 5.4		**Genotoxicity**				
	5.4.1	Bacterial reverse mutation assay	R	R	TGAI	4
	5.4.3	In vitro mammalian cell assay	R	R	TGAI	

OECD data point number		Data requirement	Use pattern		Test substance	Test notes
			Food Terrestrial outdoor Aquatic outdoor Greenhouse Residential outdoor Indoor	**Non-food** Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans		
IIP 5.5		**Long-term toxicity and carcinogenicity**				
	5.5.1	Chronic oral – rodent	CR	CR	TGAI	5
	5.5.2	Carcinogenicity - rat	CR	CR	TGAI	
	5.5.4	Mechanism of action and supporting data	R	R	TGAI	
IIP 5.6		**Reproductive toxicity**				
	5.6.1 5.6.2	Reproduction and fertility effects	CR	CR	TGAI	6
IIP 5.7		**Neurotoxicity**				
	5.7.1	Acute neurotoxicity – rat	CR	CR	TGAI	7
IIA 5.9		**Medical data**				
	5.9.7	Dermal penetration	CR	CR	TGAI or TEP	8

Test notes:

1. Recommended to be required if tolerance or MRL is required, i.e. for use on food or feed crops and if concern is raised by toxicity data.
2. May be waived for TGAI if the substance is a member of a well-characterized group and the acute toxicity of that group is described.
3. Short-term study by appropriate route, recommended to be required if there is a significant potential exposure, e.g. above background levels, or if a tolerance or MRL will be set. Data may be waived if the substance is a member of a well-characterized group and the repeated-dose toxicity of that group is described.

4. Data may be waived if the substance is a member of a well-characterized group and the mutagenicity of that group is described.
5. Recommended to be required if adverse effects have been found in mutagenicity or short-term studies; waived if long term exposure above background can be excluded.
6. Two-generation reproductive toxicity test in the rat recommended to be required if adverse effects or toxicity concerns from other data point to a health risk. Teratogenicity testing in rats recommended to be required if there is significant potential exposure, e.g. above background levels, or if a tolerance or MRL will be set. Data may be waived if the substance is a member of a well-characterized group and repeated-dose toxicity testing of the group is described. Teratogenicity testing in the rabbit is recommended to be required if adverse effects are found in mutagenicity or short-term studies; waived if long-term exposure above background can be excluded.
7. Recommended to be required if adverse effects or toxicity concerns from other data point to a health risk.
8. Recommended to be required if use description demonstrates significant potential exposure and/or if toxicity tests or published data indicate a concern. Solid matrix dispensers are unlikely to present significant potential exposure, but some sprayed applications might.

Table C4. Residue chemistry

OECD data point number	Data requirement	Use pattern						Test substance	Test notes
		Terrestrial (Food or feed)	Aquatic (Food)	Green-house (Food)	Residen-tial outdoor	Indoor (Food)	Forestry, direct application to humans, and other non-food uses		
IIP 6	**METABOLISM AND RESIDUE DATA**								
IIP 6.3	Residue trials for crops or plant products used as food or feed on which use is proposed or where residues from soil can be taken up (crop field trials)	CR	CR	CR	CR	CR	NR	TEP	1
IIP 6.4	Livestock feeding studies	CR	NR	NR	NR	CR	NR	PAIRA or radiolabeled plant metabolite	1
IIP 6.6	Residues in succeeding crop (rotational crops)	CR	CR	NR	NR	NR	NR	PAIRA	1
6.6.2	Metabolism and distribution studies on representative crops	CR	CR	NR	NR	NR	CR	PAIRA	1

Test notes:

1. Recommended to be required if tolerance or MRL is required, i.e. if the product is for use on food or feed crops and if concern is raised by toxicity data.

Table C5. Environmental fate

OECD data point number	Data requirement	Use pattern							Test substance	Test notes
		Terres-trial	Aquatic	Forestry	Residen-tial outdoor	Green-house	Indoor	Direct application to humans		
IIP 7	**FATE AND BEHAVIOUR IN THE ENVIRONMENT**									
IIP 7.4.3	Leaching	CR	CR	CR	CR	CR	NR	NR	TGAI or PAIRA	1
IIP 7.4.1	Adsorption and desorption	CR	CR	CR	CR	CR	NR	NR	TGAI or PAIRA	1
IIP 7.4.9	Volatility – laboratory	CR	NR	NR	NR	CR	NR	NR	TEP	1
IIP 7.6	Direct phototransformation of relevant metabolites, degradation and reaction products in water in artificial light under sterile conditions	CR	CR	CR	NR	NR	NR	NR	TGAI or PAIRA	1
IIP 7.12	Monitoring data on fate and behaviour of the active substance and of relevant metabolites, degradation and reaction products	CR	NR	CR	CR	NR	NR	NR	TEP	2

Test notes:

1. Recommended to be required if ecotoxicity data or published literature indicate a hazard to biota.
2. May be waived if exposure is unlikely to exceed background levels.

Table C6. Environmental effects

OECD data point number	Data requirement	Use pattern							Test substance	Test notes
		Terres-trial	Aquatic	Forestry	Residen-tial outdoor	Green-house	Indoor	Direct application to humans		
IIP 8	**ECOTOXICOLOGICAL STUDIES ON THE ACTIVE SUBSTANCE**									
IIP 8.2.1	Freshwater fish toxicity	R	R	R	R	CR	CR	NR	TEP	
IIP 8.3	Aquatic species other than fish and aquatic species field testing	CR	CR	CR	CR	CR	CR	NR	TEP	1
IIP 8.3.1	Acute toxicity freshwater invertebrates	CR	CR	CR	CR	CR	CR	NR	TEP	2
IIP 8.4	Effects on algal growth and growth rate	CR	CR	CR	CR	NR	NR	NR	TEP	3
IIP 8.6	Effects on aquatic plants	CR	CR	CR	CR	NR	NR	NR	TEP	1
IIP 8.7	Effects on bees	CR	CR	CR	CR	NR	NR	NR	TEP	4
IIP 8.8	Effects on non-target terrestrial arthropods	CR	CR	CR	CR	NR	NR	NR	TEP	4
IIP 8.9	Effects on earthworms	R	NR	R	R	NR	NR	NR	TGAI, TEP	5
IIP 8.10	Effects on soil microbial activity	R	NR	R	R	NR	NR	NR	TGAI, TEP	5
IIP 8.12	Effects on terrestrial vascular plants	CR	CR	CR	CR	NR	NR	NR	TEP	6

Test notes:

1. Recommended to be required on a case-by-case basis when results of acute tests, observations from efficacy trials or the literature indicate potential adverse effects and results of environmental fate tests indicate exposure of non-target organisms. Testing might include: bioaccumulation studies, chronic toxicology in freshwater invertebrates, long-term toxicology in freshwater fish.
2. Recommended to be required if applied by air, directly to water or at a rate exceeding natural background levels.
3. Waived for products dispensed on land; may be waived if exposure is unlikely to exceed natural background levels.

4. If exposure is likely to exceed natural background levels, discussion is recommended in order to address whether behaviour or reproduction would be affected.

5. Recommended to be required if product is applied to soil and can accumulate in soil. Recommended to be required if exposure exceeds natural background levels

6. Recommended to be required on a case-by-case basis when results of acute tests, observations from efficacy trials or the literature indicate potential adverse effects and results of environmental fate tests indicate exposure of non-target organisms.

Annex D. Biochemical pesticides: recommended data requirements for registration of formulated products

Tests for the registration of formulated biochemical pesticide products are generally conducted on the formulated pesticide. These data requirements are in addition to the recommended data requirements in Annex C, for the technical material.

Table D1. Data requirements for all product types and all use patterns

Note that the test substance is always the formulated product.

OECD data point number	Data requirement	Test notes
IIIP 1	**IDENTITY**	
IIIP 1.2.1, 1.2.2	Manufacturer of the preparation, manufacturer and purity of the active substance(s)	
IIIP 1.2.3	Statement of purity	
IIIP 1.3	Trade name or proposed trade name and manufacturer's code number	
IIIP 1.4.1	Contents of technical active substance, pure active substance, formulants	
IIIP 1.4.2.1	ISO common name proposed or accepted for active substance, and synonyms	
IIIP 1.4.3	For each formulant, or components in formulants: chemical name, structure or structural formula, CAS and/or CIPAC numbers, trade name, specifications of each formulant, function of each formulant	
IIIP 1.4.4.1	Description of formulation process	
IIIP 1.4.4.2	Discussion of the formation of impurities of toxicological concern	
IIIP 2	**PHYSICAL, CHEMICAL, AND TECHNICAL PROPERTIES**	
IIIP 2.1	Description of the physical state of the preparation (formulation) and its colour and odour	1
IIIP 2.2.1	Explosivity and oxidizing properties	
IIIP 2.4.1	Acidity or alkalinity and pH	
IIIP 2.5.2	Viscosity of the preparation and details of the test conditions	

OECD data point number	Data requirement	Test notes
IIIP 2.7.2	Stability after storage for other periods and temperatures	
IIIP 2.13	Corrosion characteristics	
IIIP 2.14	Container material	
IIIP 3	**DATA ON APPLICATION**	
IIIP 3.1	Field of use (e.g. forestry*)*	
IIIP 3.4	Rate of application per unit treated (e.g. per ha, m^2, m^3, tonne) in g or kg of formulation and active ingredient	
IIIP 3.6	Description of method of application, type of equipment used and type and volume of diluent per unit area or volume	
IIIP 3.7.1	Maximum number of applications and their timing	
IIIP 3.9	Proposed instructions for use as printed, or to be printed, on labels	
IIIP 4	**FURTHER INFORMATION ON THE FORMULATED PRODUCT**	
IIIP 4.1.2	Suitability of packaging and closures	2
IIIP 4.2.1	Procedures for cleaning application equipment and protective clothing	
IIIP 4.3.1	Pre-harvest interval for each relevant crop	
IIP 4.8.1.	Detailed instructions for safe disposal of the formulated product and its packaging	
IIIP 5	**ANALYTICAL METHODS**	
IIIP 5.2.1	Analytical methods for the pure active substance	
IIIP 6	**EFFICACY DATA AND INFORMATION**	
IIIP 6.1.3	Efficacy trials: operational, large scale	
IIIP 6.2.1	Phytotoxicity to host crop	
IIIP 6.2.3	Adverse effects on site of application	
IIIP 6.2.4	Adverse effects on beneficial organisms	3
IIIP 6.2.7	Impact on other plants, including adjacent crops	4

OECD data point number	Data requirement	Test notes
IIIP 7	**TOXICOLOGICAL STUDIES**	
IIIP 7.1	**Acute toxicity**	
IIIP 7.1.1	Acute oral toxicity	5
IIIP 7.1.2	Acute dermal toxicity	5
IIIP 7.1.3	Acute inhalation toxicity	5
IIIP 7.1.4	Primary dermal irritation	5
IIIP 7.1.5	Primary eye irritation	5
IIIP 7.1.6	Dermal sensitization	5

Test notes:

1. Not all parameters apply to all types of formulations;use common sense.
2. Required if use description demonstrates significant potential exposure and/or if toxicity tests or published data indicate concern.
3. If exposure is likely to exceed natural background levels, discussion is required to address whether behaviour or reproduction would be affected.
4. Recommended to be required on a case-by-case basis, when results of acute tests, observations from efficacy trials or the literature indicate potential adverse effects and results of environmental fate tests indicate exposure of non-target organisms.
5. Data may be waived for formulated product if the toxic potential of formulants is well known.

Table D2. Exposure

OECD data point number	Data requirement	Use pattern		Test substance	Test notes
		Occupational Terrestrial outdoor Aquatic outdoor Greenhouse Forestry Residential outdoor Indoor Direct application to humans	**Residential** Terrestrial outdoor Aquatic outdoor Residential outdoor Indoor Direct application to humans		
IIIP 7	**EXPOSURE DATA AND INFORMATION**				
IIIP 7.3.3	Measurement of operator exposure	CR	CR	TEP	1
IIIP 7.4.1	Estimation of bystander exposure	CR	CR	TEP	2
IIIP 7.5.2 IIIP 7.5.3	Worker exposure and estimates of worker exposure assuming use and non-use of personal protective equipment	CR	CR	TEP	1

Test notes for Table 4

1. Recommended to be required if use description indicates significant potential exposure and/or if toxicity tests or published data indicate a concern. Solid-matrix dispensers are unlikely to present significant potential exposure. Data are recommended to be required only if default, generic data or conservative assumptions are not available or not sufficient to demonstrate safe use.
2. Data are recommended to be required only if default, generic data or conservative assumptions are not available or not sufficient to demonstrate safe use.