Fate, Transport and Transformation Test Guidelines

OPPTS 835.1410
Laboratory Volatility
INTRODUCTION

This guideline is one of a series of test guidelines that have been developed by the Office of Prevention, Pesticides and Toxic Substances (OPPTS), United States Environmental Protection Agency for use in the testing of pesticides and toxic substances, and the development of test data to meet the data requirements of the Agency under the Toxic Substances Control Act (TSCA) (15 U.S.C. 2601), the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) (7 U.S.C. 136, et seq.), and section 408 of the Federal Food, Drug and Cosmetic (FFDCA) (21 U.S.C. 346a).

OPPTS developed this guideline through a process of harmonization of the testing guidance and requirements that existed for the Office of Pollution Prevention and Toxics (OPPT) in Title 40, Chapter I, Subchapter R of the Code of Federal Regulations (CFR), the Office of Pesticide Programs (OPP) in publications of the National Technical Information Service (NTIS) and in the guidelines published by the Organization for Economic Cooperation and Development (OECD).

For additional information about OPPTS harmonized guidelines and to access this and other guidelines, please go to http://www.epa.gov/oppts and select “Test Methods & Guidelines” on the left side menu.
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(a) Scope—(1) Applicability. This guideline is intended for use in meeting testing requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (7 U.S.C. 136, et seq.). It describes procedures that, if followed, would result in data that would generally be of scientific merit for the purposes described in paragraph (b) of this guideline.

(2) Background. The source materials used in developing this OPPTS test guideline are OPP 163-2 Laboratory volatility studies, OPP 160-4 General test standards, and OPP 160-5 Reporting and evaluation of data (Pesticide Assessment Guidelines, Subdivision N - Chemistry: Environmental Fate, EPA report 540/9-82-021, October 1982).

(b) Purpose. Volatilization can be a major mode for the movement of pesticides from treated areas. Volatility studies determine the potential of a pesticide to move into the air and off-site. The laboratory volatility study provides a rate of volatilization and the resulting air concentration under confined conditions. The vapors resulting from volatilization of some pesticides can cause adverse effects to humans via inhalation exposure at sites of application or biological effects in nontarget organisms at some distance from the treated site.

(c) General considerations. (1) The laboratory volatility study is performed for pesticides with properties, e.g., vapor pressure and Henry’s Law Constant, suggesting that volatility may be a significant route of dissipation.

(2) Data from a laboratory volatility study are used to support end-use products intended for terrestrial and greenhouse uses or for manufacturing-use products which may legally be used to formulate such an end-use product.

(3) In view of methodological difficulties with the study of photodegradation in air, prior consultation with the Agency regarding the protocol is recommended before the test is performed.

(d) Test method.—(1) Test substance. The test substance should be a typical end-use product. The composition of the test substance should be determined, including the names and quantities of known contaminants and impurities, as far as is technically feasible.

(i) If the applicant’s product is an end-use product, the test substance should be a product whose formulation is typical of the formulation category (e.g., wettable powder, emulsifiable concentrate, etc.) to which the product belongs.

(ii) If the applicant’s product is a manufacturing-use product which could be used to make an end-use product, the test substance should be a product representative of the major formulation category which includes that end-use product. If the manufacturing-use product is usually formulated into end-use products comprising two or more major formulation categories, a separate study should be performed with a typical end-use product for each such category.

(2) Test procedure. A laboratory study should be conducted to determine the actual rate or
extent of pesticide volatilization from soil under controlled conditions.

(i) **Protocol development.** A number of published studies of pesticide volatility provide useful information for protocol development. Kearney and Kontson (paragraph (f)(1)) use a polyurethane foam trap and a potassium hydroxide trap to recover sequentially the parent compound and degradation product from air. The laboratory methods employed by Spencer and Cliath (paragraph (f)(2)) for determining volatilization of chemicals used in this study allow measurement effects of several variables. The use of hexane as a trapping medium limits the gas flow rates and volumes that can be used. A study by Spencer et al (paragraph (f)(3)) describes use of polyurethane foam traps and GLC detection largely specific for the compounds of interest. Specific detection avoids interference that may cause falsely high vapor levels in field testing. Volatilization studies call for methods for the trapping, extraction, cleanup, and quantitation of pesticides. A review of reported methods for laboratory investigations of pesticides in air can be found in Lewis (paragraph (f)(4)).

(ii) Laboratory experimental conditions should represent, to the extent possible, an environment where the pesticide is intended for use.

(iii) The rate of test substance application to soil should approximate the intended rate of field usage.

(iv) The following factors should be addressed in designing a laboratory volatility study:

(A) Properties of the pesticide such as vapor pressure, and water solubility, which can influence the trapping medium and air sampling rates.

(B) Properties relating to the soil, such as adsorption to soil and soil texture, to avoid untoward reduction of the rate of volatility (e.g., sandy soil is preferred). Soil from foreign sources may be used, providing the foreign soil will have the same characteristics as soil in the United States common to the proposed use area. Additional information on use of foreign soils may be obtained from the document “Guidance for Determining the Acceptability of Environmental Fate Studies Conducted with Foreign Soils,” at the U.S. Environmental Protection Agency’s Environmental Fate and Effects Division, Office of Pesticides (see paragraph (f)(5)).

(C) Environmental factors, such as air temperature, humidity, and movement, to avoid untoward dehydration or flooding of the soil and to assure efficiency of sampling

(v) Air samples should be collected and analyzed for residues in the laboratory experimental equipment used. Monitoring should be conducted continuously or at intervals which increase with time after the start of the experiment. Monitoring should continue until the nature of the residue decline curve has been clearly established.

(e) **Reporting and evaluation of data.** Reporting units should be in the metric system, but
the English system may be used in addition. The systems should not be mixed (e.g., kilograms/acre).

(1) **Test method.** A statement regarding the test method used, including a full description of the experimental design and procedures.

(2) **Test substance.** (i) The test substance should be identified including chemical name and percentage of active ingredient, molecular structure of the active ingredient, qualitative and quantitative description of the chemical composition, and the names and quantities of known contaminants and impurities;

(ii) Manufacturer and lot and sample numbers of the test substances.

(iii) Properties of the test substance, including physical state, pH and stability.

(3) **Control values.** Due to the wide diversity of pesticide properties, use patterns, and organisms likely to be exposed in the field environment, specific reporting elements for control values as to source, sampling regime, and total number submitted will depend upon the complexity and variability of the environment in which the test is to be conducted.

(4) **Test equipment.** A description of the laboratory test equipment used, and photographs or detailed descriptions of nonstandard equipment.

(5) **Soils.** Soils used should be characterized as to texture (percent sand, silt, and clay), percent organic matter, moisture content, pH, cation exchange capacity, and bulk density (under field conditions).

(6) **Volatility.** Volatility data expressed as $\mu g/cm^2/hour$.

(7) **Air concentrations.** Air concentrations expressed as $\mu g/m^3$ or mg/m$^3$.

(8) **Vapor pressure.** Vapor pressure expressed as torr or the equivalent expressed in other conventional units.

(9) **Temperature.** Temperature and relative humidity.

(10) **Calculation and tabular, graphic information.** The principal mathematical equations used in generating and analyzing data, as well as representative calculations using these equations. When rates of formation and decline of parent compounds or their degradates are reported in any test, data should be expressed as amounts, concentrations, and corresponding percentages. Rate constants, when appropriate, should be reported in conjunction with rate data. Tabular data, as well as graphs for decline curves and soil sorption, should be submitted.

(f) **References.** The following references should be consulted for additional background
information on this guideline:


(5) U.S. Environmental Protection Agency (2006). Guidance for Determining the Acceptability of Environmental Fate Studies Conducted with Foreign Soils. Environmental Fate and Effects Division, Office of Pesticide Programs, USEPA. Washington DC. This document can be found at: http://www.epa.gov/oppefed1/ecorisk_ders/soils_foreign.htm