

Memorandum

To : Ronald Oshima, Branch Chief
Environmental Monitoring and
Pest Management

Date : July 13, 1989

Place : Sacramento

From : Department of Food and Agriculture Heinz Biermann, Sr. Env. Hazards Scientist
Environmental Hazards Assessment Program

Subject : Definition of a Second Analytical Method for the Purposes of AB2021

The attached document is intended to clarify what the Department considers a second analytical method for the purposes of AB 2021. I have tried to not just present a definition, but also provide some reasoning for its complexity.

Attachment

Approved: 
Ronald J. Oshima

Scope

Section 13149 of the Food and Agricultural Code requires the Director to initiate a review of pesticide ingredients found in ground water or at specified depths in soil, if certain conditions are met. Among these conditions is the requirement that the detection shall result from an analytical method approved by the Department, and that the detection shall **be** verified by a second analytical method or a second analytical laboratory approved by the Department.

The purpose of this document is to define what the Department considers a second analytical method.

Categories of Analytical Methods

The major criterion for the definition of a second analytical method is the specificity of the method. In the context of this definition, methods will be divided into specific/nonspecific categories. The requirements for a second method will vary depending on the specificities of both the primary and secondary method.

1. Specific Methods

A specific method provides positive identification of the measured chemical. This unequivocal identification implies that the detection system can distinguish the target compound from all other compounds in a given mixture, with or without the need for an additional separation procedure. A method is also considered to be specific if all known interferences yield insignificant responses, i.e., the sensitivity for the interfering compound is less than **0.1%** of the sensitivity for the target compound.

Examples for specific methods are spectroscopic techniques like mass spectroscopy (MS) and Fourier transform infrared (FTIR) spectroscopy, generally used together with separation techniques like gas chromatography (GC) or high performance liquid chromatography (HPLC).

2. Nonspecific Methods

All methods that respond to more than one chemical and use detectors that cannot distinguish between these different chemicals are considered to be nonspecific. Analytical methods that incorporate nonspecific detectors rely completely on separation procedures for identification. The problem with nonspecific detectors is that they can only prove the absence of a chemical when no signal is registered at the proper conditions for the chemical in question. When a signal is measured, however, one can only say that it is likely that the signal is caused by that chemical. But it is not a proven fact, as another component of the unknown mixture might interfere and the detector cannot distinguish between the two.

This definition of nonspecific includes the majority of gas chromatographic techniques. For example, nitrogen-phosphorus specific detectors used in GC

analysis are specific only on the atomic level: they can distinguish nitrogen and phosphorus atoms from other atoms, but they cannot distinguish between one nitrogen containing chemical and another.

Definition of a Second Method

Confirmation by a second method is intended to increase the confidence in the positive detection of a chemical by the first method. If the measurement procedures of the second method would vary only slightly from the first method, it is likely that an erroneous identification in the first determination would also occur in the second one. Therefore, the second method should be based on separation and/or detection processes as much different from the first method as feasible.

The minimum changes needed in the first method to qualify it to be considered a second method depend on the specificity of both methods. The following matrix lists the possible combinations.

Minimum requirements for procedural changes in a first method to qualify it as a second method:

		second method	
first method		nonspecific	specific
nonspecific	I	det. and sep.	det. only
specific	I	det. only	det. or sep.

det. and Sep.: Significant change in both detector and separation procedure.
det. only: Significant change in detector only.
det. or Sep.: Significant change in detector or separation procedure.

Significant Change

A significant change in detector means a change in detection principle (for GC, a change from a flame photometric detector [FPD] to a conductivity detector, for example). A significant change in the separation procedure is either a change in separation principle (from GC to HPLC, for example) or a change in the separation condition (i.e., using a different type of column), as long as this change will alter the sequence in which the compounds are registered.

Case 1

When both the first and the second method are nonspecific, both the detector and the separation procedure have to be changed significantly. For

example, a first method using GC separation and a flame photometric detector could use as a second method either a GC with a significantly different column and a nitrogen-phosphorus detector (changing separation conditions and detector) or a HPLC separation with a UV-detector (changing separation principle and detector).

Case 2

When only one of the methods is specific, just the detection principle has to be changed, the separation procedure may be kept the same (GC/FPD and GC/MS using the same column, for example).

Case 3

When both methods are specific, either the detector or the separation procedure may be changed. Examples for these cases are GC/MS and HPLC/MS (keeping the same detector) *or* GC/MS and GC/FTIR (keeping the same separation conditions).

In the cases where only a change in detector is needed (2 and 3), it is acceptable to use an integrated system where the effluent of the separation step is split and routed to two detectors. An example for this is GC/MS/FTIR, where the effluent of the GC is analyzed by MS and FTIR simultaneously. As this integrated analytical instrument uses two specific detectors, it counts as both first and second method.

Screening Methods

Special consideration has to be given to qualitative or semi-quantitative methods typically used for screening. Qualitative methods yield only detected/not detected results, semi-quantitative methods indicate the order of magnitude for the concentration of the identified chemical. Samples identified as positive will be forwarded for analysis by a quantitative method.

In this case, the qualitative screen is considered to be the first method. The quantitative method is then selected based on the above criteria for a second method. A second quantitative method (i.e., a third analysis method) is required only when verification is needed not only for the identity of the compound but also for its concentration. Analogously, a qualitative method may be used as a second method if verification of the concentration level is not required. A qualitative method cannot be used as a second method when the first method is qualitative also.

To give some examples: a specific enzyme-linked immunosorbent assay (ELISA) may be used as a first method, even if it is used just as a detected/not detected screen. Or a nonspecific ELISA qualifies as a second detector for the effluent from an HPLC. Note, however, that any ELISA which shows significant cross-reactivity to other compounds is considered to be nonspecific and would also require a change in the separation procedure (case B).