EUR 4886 d,f,i,n,e

COMMISSION OF THE EUROPEAN COMMUNITIES

COMMUNITY SURVEY ON STANDARD REFERENCE MATERIALS

1973

PROVISIONAL SECRETARIAT
of the Community Bureau of Standards
Directorate-General
Joint Research Centre

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March 1973

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ABSTRACT

This report analyses the results of a survey carried out in 1971 by the JRC on the use of and demand for standard reference materials (SRMs) by scientific, industrial and commercial laboratories in the countries of the Community.

The first part of the report deals with the background to the survey, its mechanism and the laboratories consulted. The fields of activity of the laboratories, sources of supply, criteria for choice and criticisms of the SRMs currently available on the market are discussed in succession.

The demand is analysed in accordance with product families, the analytical methods which the SRMs are used to calibrate and the desired ranges of concentration. The main product families into which standard reference materials of certified composition and/or purity fall are : metallurgical products, organic and inorganic chemicals, pharmaceuticals, food products and medical analysis.

A separate section is devoted to standard reference materials having certified properties.

The final section deals with the possible participation of laboratories in a concerted European-scale action.

The extent to which the survey was successful is indicated by the conclusion.

KEYWORDS

CALIBRATION
SPECIFICATIONS
COMMODITIES
MECHANICAL PROPERTIES
MEASURING METHODS
METALLURGY
CHEMICALS
DRUGS
MEDICINE
TRADE
INDUSTRY
COMMON MARKET
MARKET
QUANTITATIVE ANALYSIS
ORGANIC COMPOUNDS
MINERALS
FOOD

CONTENTS

ACKNOWLEDGEMENTS

Thanks are due to the members of the Consultative Group and the representatives of the various firms and industrial federations who offered us their active cooperation and submitted valuable suggestions.

We also wish to thank the members of the scientific and technical departments of the JRC at Ispra who helped us with this survey, and in particular Messrs J. COLLIN, R. GILLOT, P. JEHENSON, G. ROSSI, S. SANDRONI, H. TANGUY and B. VERSINO.

Mr H. LAURENT was in charge of the conduct of this survey, assisted by A. COPET, Ch. MAURANDY and Mrs M. LAURENT, with the collaboration of the firm METRA INTERNATIONAL.

A. Introduction

A.1. BACKGROUND AND OBJECTIVES

In the context of the resolutions of the Council of Ministers of the European Communities of 13 October and 17 December 1970, and in connection with the project for the setting up of a **Community Bureau of Standards (CBS),** the Commission, assisted by a Consultative Group of national experts,* undertook a study of the desirability and possible conditions of implementation of this project. The Ispra establishment of the Joint Research Centre was charged with the carrying out of an initial survey on the use of and demand for standard reference materials (SRMs) in the six Common Market countries.

We define "**standard reference materials**"** as any product, whether simple or compound, natural or artificial, one or more of whose characteristics (chemical composition of a mixture, impurities in a "pure" body, breaking load of an alloy, reflectance of a surface, etc.) are determined with a maximum of accuracy and precision. These substances are therefore physical samples constituting information carriers, available to all who require them. Some of these substances are carefully preserved, but most are consumed, sometimes in considerable quantities; stocks must be periodically replenished and adapted to constantly changing requirements.

Standard reference materials are used for the verification of analytical methods and measurement techniques : their principal applications are as follows :

— In industry : following the stages of a manufacturing process and monitoring their efficiency.

— In transactions between manufacturers and purchasers : providing a common basis of reference for the verification of specifications.

— In relations between the manufacturer and the official control laboratory : verification that a product conforms to the regulations in force.

— For the legislator and standards organizations : provision of methods of checking conformity with specifications having sound and uniform foundations.

— For the research worker : providing a useful basis for comparison of his results with those of other laboratories both in his own country and abroad.

The survey was initiated with the assistance of the Consultative Group and the active participation of the representative federations of various industries, and was started in the second quarter of 1971. It was preceded by a preliminary survey, during the course of which we received valuable help from many organizations, firms and individuals, both in the formulation of the questionnaire and in the compilation of the lists of addressees.

Since the survey was in the nature of a pilot project, and in view of the resources available, we did not aim at blanket coverage of all laboratories concerned with standard reference materials. We picked out, perhaps somewhat arbitrarily, various sectors of activity of great economic,

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* Please find joined to this report the list of the Experts of the Consultative Group.

** Sometimes known as calibration standards, standard samples or reference substances.

scientific and medical importance, which we were assured by various sources were concerned with this problem. We then endeavoured to make a representative selection.

Other sectors—by no means insignificant ones—were provisionally omitted or merely touched upon.

A.2. QUESTIONS ASKED AND ORGANIZATIONS CONSULTED

A.2.1. Questionnaire

The questionnaire, a facsimile of which is appended to the report,* was accompanied by an explanatory letter and a brief definition of what we meant by "standard reference materials". It was not our intention in this initial survey to draw up an exhaustive list of all requirements, replete with a catalogue of the specifications demanded, but rather to identify families of products or materials in which interest was displayed.

The emphasis was laid on the demand for **standard reference materials of certified composition and/or purity,** this field being divided into six main families :

— SRMs for metallurgical products **(A)****
— SRMs for inorganic chemicals **(B)**
— SRMs for organic chemicals **(C)**
— SRMs for pharmaceuticals **(D)**
— SRMs for food products **(E)**
— SRMs for medical analysis **(F)**

Each of these families is itself divided into sub-families, and the questionnaire was designed so as to allow the establishment of correlations between product sub-families, the methods to be calibrated by these products, ranges of concentration of certified constituents and annual consumption.

In addition there was a section, included with a view to a specific survey at a later date, on the demand for other types of **standard reference materials** (SRMs for measurements of physical and mechanical properties, standard samples, etc.). This part of the questionnaire was relatively general.

In addition, in order to assess the difficulties encoutered by SRM users, laboratories were asked to specify their current sources of supply, the criteria governing their choice and the shortcomings of currently available standard reference materials, whether quantitative or qualitative. Furthermore, since follow-up actions, even on a restricted scale, in this exceedingly wide field would involve the participation of a large number of laboratories, we endeavoured to compile an initial list of bodies which, if the need arose, would be prepared to cooperate, specifying the limits of any such cooperation.

A.2.2. Compilation of the list of organizations/firms consulted

On the basis of the objectives set out above, the list of addressees was compiled in the following manner :

— An initial set of addresses was collected in the course of the preliminary survey.

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* The questionnaire does not exist in English. We join to this report, as an example, the French version.
** The letters in brackets are those used in the diagrams to identify the product families.

— Other important sources of addresses were certain national federations; some undertook the circulation of questionnaires to their members, whilst others introduced us to a selection of their membership through letters of recommendation.

— Most of the remaining addresses were taken from the thousand foremost European firms, the ten most important of which in each of the sectors of industry covered were systematically selected.

After elimination of duplications, the final list was made up of

1556 addresses.

We endeavoured as far as possible to strike a balance between the different Community countries. Again, especially in the case of large organizations, we attempted to identify the persons, departments and divisions likely to be directly concerned, without, however, neglecting to consult the central or head office.

Note that only large and medium-sized firms, which could be most readily located, were consulted. We did not approach any smaller firms (ones with a staff of less than about a hundred), although, since these firms are not in a position to produce their own SRMs, they should constitute, by virtue of their number, an intrinsically worthwhile "clientèle".

A.2.3. Classification of the organizations/firms consulted

To facilitate correlation of the types of requirements with the main field of activity of the organization consulted, we divided the 1 556 addresses in the final list into two broad categories, themselves subvided into eight sectors :

Goods sector

— ME * : metallurgical industries
— PR : processing industries
— CH : chemical industries
— PE : petroleum industries
— PH : pharmaceutical industries
— FO : food industries

Services sector

— MA : medical analysis
— RI : research institutes

We give below some details of the industries we have classified in the above sectors :

ME : includes all metallurgical and iron and steel making industries in general.

PR : automotive and aviation industries, plastics processors and a few large multi-sector undertakings (mechanical and electrical engineering, electronics).

CH : general (organic and inorganic) chemicals manufacturing industries, except pharmaceuticals and petroleum products.

PE : manufacturers of fuels, lubricating oils and, in general, all petroleum derivatives. Some difficulty was experienced with the classification of petrochemical industries, and their grouping is admittedly sometimes arbitrary.

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* These letters are used in the graphs to denote sectors.

PH : this heading covers industries producing raw materials and/or packaged medicines. Here again, the dividing line between this sector and the chemical industry (especially organic chemistry) is not always well defined.

FO : industries producing and/or processing food products. In this category we have also included a few specialist additive manufacturers, although most of these originate from the chemical, pharmaceutical and petrochemical industries.

MA : this sector consists primarily of laboratories attached to hospitals and clinics. It also includes certain specialized university laboratories.

RI : this group is made up primarily of the national research centres, which are as a rule multi-disciplinary. It also includes laboratories specializing in a single discipline (e.g., metallurgy) but not directly connected with the production of goods. National safety, hygiene, public health and similar inspectorates are also classified in this category.

It is important to note that in the present survey, virtually all the respondents to the questionnaire, either directly or indirectly, were *laboratories*. The above classification, apart from its generality, merely differentiates these laboratories in accordance with the main sector of activity of the organization or firm to which they belong.

B. Analysis of results

This analysis follows the plan of the questionnaire practically step by step. It is subdivided into four parts :

Part 1 : deals with the general results for *all* questionnaires received. The replies on the different subjects analysed are classified in accordance with the sector of activity (ME, PR, CH, etc.) of the respondents, in order to show up any characteristics specific to a particular type of laboratory. It was not felt appropriate to classify the results by countries, since the replies were on the whole well balanced.

Part 2 : this is the heart of the survey, where demands for new and/or improved standard reference materials *of certified composition and/or purity* are examined in detail with respect to various parameters.

It would have been desirable to pursue further the establishment of correlations between product families and the considerations dealt with in Part 1 (e.g., criteria of choice for SRMs or sources of supply). Unfortunately, unambiguous associations would have been possible only at the cost of greater complexity of the questionnaire. Only more or less precise cross-checks would have allowed certain deductions of this kind. It was felt preferable to confine ourselves to a smaller but reliable selection of results.

Part 3 : a simple poll as to the demand for standard reference materials *other* than those of certified composition and/or purity.

Part 4 : this part analyses the extent to which the respondent laboratories would be interested in principle in participating in a coordinated Community-wide programme.

B.1. THE RESULTS AS A WHOLE

Addressees replied either by returning the duly completed questionnaire, sometimes accompanied by an explanatory letter, or in the form of a simple letter.

In the latter case the reply was generally negative or consisted of a letter informing us that the questionnaires had been forwarded to a central federation. This was the procedure employed by certain federations—including some quite large ones—and contributed to reducing reply intensities in the relevant sectors.

B.1.1. Organizations consulted and replies received

The results are set in *figure 1.*

Replies marked "letters" represent letters not accompanied by questionnaires.

The left-hand portion of the diagram relates to the total number of firms consulted and which replied, followed by a breakdown of the same items for each of the chosen sectors (ME, PR, CH, etc.). On the right, the same results are converted into percentages of the firms/organizations

consulted. Thus, for example, in the pharmaceutical sector (PH), out of 272 firms consulted, 87 returned duly completed questionnaires and 19 sent letters not accompanied by questionnaires; the overall reply rate was therefore 39 %, the proportion of usable questionnaires being 32 %.

On average, therefore, and to the extent that our sampling was representative, slightly more than one third of the laboratories consulted completed a questionnaire. Indeed, this proportion exceeded 50 % in the case of the processing industries (PR) and research institutes (RI).

It should be noted that owing to our initial options the processing industries were not covered on a scale consistent with their importance in the economy of the Community countries. Their very high reply rate (53.6 %) shows that this sector merits examination in greater depth.

By contrast, the chemical and food industries yielded relatively few replies to our survey; however, it should be noted that the replies received came from large-scale firms.

B.1.2. Type and importance of activities of the laboratories which replied

The statistical distribution is shown in *figure 2.*

For each sector of industry, we have determined the intensity of replies for each type of activity and for three degrees of importance attributed to these activities.

The results are presented as percentages of the number of questionnaires received in the relevant sector.

It should be borne in mind that some multidisciplinary laboratories mentioned several activities with greater or lesser degrees of importance, whilst others—more specialized laboratories —stated only their main activity.

Consequently, the sum of the statements given within a single industrial sector for all activities may exceed—and even substantially exceed—the corresponding number of questionnaires.

Consideration of the activities classed as "essential" in *figure 2* reveals certain salient points. Although in some cases confusion may have arisen between quality control and production control on the one hand and development of methods of analysis and development of methods of measurement on the other, we find that quality control, closely followed by a production control, is one of the essential concerns of laboratories of the "goods production" family (from ME to FO). The "services" sectors display more diversification of activity, the emphasis being placed firmly on applied research in the case of research institutes and on other unspecified activities in the case of medical analysis laboratories. This latter point is due mainly to the fact that the activities of these laboratories, being highly specific, could not readily be classified under the relatively general headings of our questionnaire.

B.1.3. Users of standard reference materials

The main objective of this survey is to ascertain the demand for standard reference materials by laboratories in the Community. Because of inadequate information, some of the questionnaires were sent to firms not concerned with SRMs. For the purposes of the survey, the only usable questionnaires are ones submitted by SRM users. It is therefore necessary to examine to what extent the replies received were submitted by users.

The results are given in *figure 3* for each sector of activity. The left-hand side of the diagram gives the number of replies processed and the numbers of users and non-users; the right-hand portion of the figure shows the proportions of users as percentages of the number of replies processed.

Respondents were classified as users or non-users only where this fact was clearly stated in the relevant replies. Some replies could not be classified, either because they were too vague or because they stated that the information would be forthcoming at a later date but was never in fact received. A further group of replies, from company subsidiaries, stated that the information would be furnished through other channels.

For this reason the sum of users and non-users is not the same as the total number of replies.

For example, in the chemical sector 170 replies (letters and/or questionnaires) were processed. Of these 170 laboratories, 53 declared themselves to be non-users, whilst 99 stated that they used standard reference materials. The latter represent a proportion of 58.2 %.

It is difficult to draw precise conclusions from this graph, but it is clear that the percentage of users in the medical analysis sector is very high (94.5 %). Research institutes and laboratories in the processing sector are not far behind, whilst at the other end of the scale we find the laboratories of the chemical sector and, in particular, of the food sector (48.3 %).

B.1.4. Sources of supply of standard reference materials

Although this item came under the heading of "standard reference materials of certified composition" in our questionnaire, various correlations indicate that SRM users generally mentioned *all* their sources, including those of other types of SRMs.

246 distinct commercial sources were mentioned by the 500 SRM users identified on analysis of the returns. These sources are classified in six broad families, according to country of origin, in-house production being considered as a separate family :

1) In-house production
2) Origin in one of the 6 Community countries
3) Origin in the UK
4) Origin in the USA
5) Origin : international organizations
6) Other origins
7) Unidentified origins*.

Figure 4 shows the distribution of sources between the above families for each sector of activity. The distribution is unweighted, i.e., in each sector, a source is counted only once regardless of how many times it was mentioned by the laboratories in the sector.

The same source may also have been mentioned by laboratories in another sector, and in the latter sector too it will again be counted only once.

For example, of 30 SRM users in the petroleum sector, 9 produce SRMs for their own requirements, and they mention 46 different sources of supply, 13 of them in the EEC, 3 in the UK, 20 in the USA, etc.

Figure 5 indicates the frequency with which sources of supply are mentioned, each source being counted as many times as it was mentioned by laboratories. In this diagram, in contrast to the previous case, the sum of the values found in each sector of activity for a source family

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* It has not been possible to identify some of the addresses given in the returns, owing either to indecipherable handwriting or to excessively abbreviated information.

is equal to the value corresponding to this family for all users. For example, the 30 users in the petroleum sector mentioned EEC sources 28 times (we know from the previous diagram that there are 13 different sources), UK sources 3 times (3 different ones), US sources 60 times (20 different ones), etc.

It would have been useful if this diagram could have been accompanied by SRM consumption tables. Unfortunately, the relevant data in the returns were so fragmentary and scattered that no quantitative evaluation was possible.

It is clear from *figure 4* that a significant proportion of SRM users themselves produce SRMs for their own requirements. There are two main reasons for this situation, which applies principally to large-scale laboratories :

— Convenience of use (supplies readily available, price, etc.).

— Current gaps in the market, which is unable to meet all user requirements (ranges, accuracies, etc.).

Note that almost all laboratories which produce SRMs for their own use also make external purchases of SRMs.

The percentages of laboratories in the different sectors with in-house SRM production are as follows :

Sector	All	ME	PR	CH	PE	PH	FO	MA	RI
In-house production %	43	67	51	38	30	47	11	26	40

Il will be noted that in-house production is most significant in the metallurgical sector.

Examination of *figures 4* and *5* together shows that the number of US sources mentioned is generally less than the number of EEC sources. But USA and EEC sources practically tie in the frequency with which they are mentioned. This is due in particular to the importance of the NBS and to greater concentration of points of sale.

In the petroleum, pharmaceutical and medical analysis sectors, US sources predominate in frequency of occurrence.

Finally, attention is drawn to the wide dispersion of sources of supplies : 500 RS users resort to 246 different sources, not counting in-house production, which is considerable*.

Note on unidentified sources

At the time of writing of the above, it had not been possible to identify 32 sources of supply. After further inquiries, 22 of these sources have now been located, 12 of them being in EEC countries, 8 in the USA and 2 in the UK. The relevant corrections make very little difference

* Some laboratories did not fully identify their sources of supply, stating for example : "miscellaneous chemical firms", etc. Precise enumeration of these sources would still further intensify this dispersion.

to the results given in *figures 4* and *5*, merely slightly increasing the importance of the EEC countries and the USA but not affecting the relative proportions. For this reason we have not amended the diagrams, which were already in the press.

B.1.5. Criteria for the choice of standard reference materials

A knowledge of the factors determining user choice of a standard reference material is an important aspect of the planning of an eventual programme of development of SRMs. For some users price will be of secondary importance, whilst precision will be vital, whereas other users will be more price-sensitive and more concerned with ease of obtaining supplies than with precision.

The relevant section of the survey questionnaire gives six main criteria of choice :

— Exactitude

— Precision

— Ease of obtaining supplies

— Cost

— Stability and/or preservability

— Facility of use (physical forms)

— Miscellaneous criteria

In addition, each laboratory consulted could state whether the criterion mentioned was in its view essential, important or secondary.

The results are presented in *figure 6*. It will be seen, for instance, that of the 73 SRM user laboratories classified as research institutes (RI), 65 % regard exactitude as an essential criterion, 12 % consider it to be simply important and 4 % as secondary. 71 % of the same laboratories regard precision as essential, 29 % ease of obtaining supplies, 7 % cost, etc.

Exactitude and precision are the two criteria most frequently stated to be essential by the majority of laboratories, in all sectors. However, whilst exactitude comes (slightly) ahead of precision for "all sectors", in the food and medical analysis sectors precision assumes distinctly more importance. Further, the metallurgical industry sets considerable store by ease of use, suitable sample presentations greatly facilitating the use of high-speed analysis techniques (e.g. fluorescence or spectrography).

The next most important aspect is the stability of SRMs with time, a parameter of particular interest in the medical analysis field. This is followed in turn by ease of obtaining supplies, cost and ease of use, items deemed to be important but not essential.

B.1.6. Criticisms of available SRMs

It is not entirely clear to what extent the criticisms put forward relate to standard reference materials of certified composition only or to all standard reference materials at present available. In any case, over 50 % of SRM users are not satisfied, either because the "quality" of the products available is regarded as inadequate or because the products simply do not exist.

Figure 7 gives a statistical analysis of the main causes of dissatisfaction.

The arrows on the "scale" at the top of the diagram show the percentages of dissatisfied users in each sector of activity, without regard to the nature of their criticisms. The overall average of unsatisfied users is 50 %, with a peak value of 78 % for medical analysis. These

results show little apparent correlation with those of *figure 8*, except in the field of medical analysis : the percentages of dissatisfied users are generally lower than those of users desiring the introduction of new and/or improved SRMs.

The coloured portion of *figure 7* analyses the main criticisms of the current market expressed, namely :

— Lack of exactitude

— Lack of precision

— Difficulty of obtaining supplies

— Cost

— Lack of stability in time

— Forms and difficulties of use

— Insufficiency of product ranges

— Miscellaneous criticisms

The results are presented as percentages of the number of dissatisfied users, and are for this reason of little statistical significance for the petroleum and food sectors in view of the small number of questionnaires processed.

Difficulty in obtaining supplies is by far the most common criticism. This is particularly marked in the chemical (CH), petroleum (PE), pharmaceutical (PH) and food (FO) sectors. Lack of exactitude comes second, with clearly defined peaks in the food sector (FO) and medical analysis (MA). The medical analysis (MA) laboratories, closely followed by the petroleum sector (PE), complain of lack of stability in time. It will also be noted that the processing (PR) and metallurgical (ME) industries are not satisfied with the available product ranges. As far as the latter are concerned, this result is perhaps surprising, in view of the current wealth of catalogues of metals and alloys of all kinds whose composition and purity are certified; nevertheless, the fact was confirmed to us by a series of contacts and closer analysis of the documents received.

On the other hand, the cost of SRMs, although mentioned repeatedly, does not appear to constitute a fundamental cause of dissatisfaction.

Here are some examples of the complaints expressed :

Exactitude : lack of confidence in the values given (organic products), inconsistency between formula and structure, titre varying with methods employed (serums).

Precision : inhomogeneity, variation of composition from one manufacturer to another for the same nominal value (antibiotics).

Supplies : long delivery periods, scarcity of materials, delivery unit quantities inconsistent with requirements (either too much or too little), products reserved for specific user groups (closed clubs).

Stability : inadequate or unsuitable packaging, hygroscopicity.

Utilization : unsuitable presentation, products difficult to grind or not readily soluble, matrices unrepresentative of the actual products to be tested, unsuitable packaging, inadequacy (or even total absence) of information about the conditions of "certification" and directions for use, unspecified precision.

B.1.7. Demands for standard reference materials : overall situation

As already stated, the survey relates primarily to standard reference materials of certified composition and/or purity (CSRM), "other" standard reference materials (PSRM) being only touched upon on a poll basis. Again, the processing industries (PR), presumed to be the most important customers for PSRMs, were largely omitted from the survey. There is therefore reason to believe that the demands expressed, especially in the PSRM field, do not represent the entire true demand.

Figure 8, which is divided into two parts, shows the proportion of laboratories which expressed a demand as a percentage of all SRM user laboratories. The upper part of the diagram relates to laboratories requiring PSRMs, whilst the lower part analyses the distribution of CSRM-demanding laboratories and gives a breakdown of the main types of substances demanded. For instance, the column for all users shows that 83 % expressed at least one demand for a product in one of the families mentioned in the questionnaire, the distribution between CSRMs and PSRMs being as follows :

— 72 % of users require CSRMs

— 51 % of users require PSRMs

The requirements of these two main groups are in turn subdivided in accordance with the product families demanded and by the sectors to which the SRM user laboratories belong (columns ME, PR, ...RI).

We must at this point emphasize the extent of the demand for SRMs of all kinds, which amounts to 83 % for all users, with a maximum of 92 % in the metallurgical industry and a minimum of 69 % in pharmaceuticals. As a general rule, and with the reservation expressed at the beginning of the previous Section, the demand for CSRMs always exceeds that for PSRMs. Again, except in pharmaceuticals and the medical analysis laboratories, demands expressed for a specific product family are not the exclusive province of any one sector of activity. This is the case, for example, with CSRMs for metallurgical products, which, although required on a large scale by the metallurgical industries (78 %), are also of substantial importance to the processing industries (69 %) and research institutes (30 %). There is a general demand for PSRMs, except in medical analysis, ranging from a maximum of 64 % in the processing industries down to 41 % in the food industry. Demand centres on SRMs with specified physical and physicochemical properties, and may, as in the case of the petroleum sector, practically equal the demand for CSRMs. In the metallurgical and processing sectors, the demand is almost equally balanced between the product families specified in the questionnaire.

Whilst *figure 8* affords a general impression of the scale of demands, we were unable to draw serious quantitative conclusions as to the value and quantities of products required, since the data in our possession were too fragmentary and inhomogeneous. The same applies to the following Sections, which deal in greater detail with the different requirements of the users of standard reference materials.

B.1.8. Application of SRMs demanded

The structure of the questionnaire made it possible to establish immediate correlations between the certified composition standard reference material sub-families and the principal analytical methods to be calibrated.

Figure 9 gives a general picture of the correlations obtained between product families and analytical methods. The basis for our calculation was taken to be the *"indication"*, which exists when a cross is present at the intersection of the line for a product demanded with the column for

the method or methods to be calibrated. We would at this point mention that some laboratories, although demanding only one type of product, may have indicated several methods, whilst, others, expressing a demand for several products, may not have specified any method *.

The methods for calibration are classified in decreasing order of the number of "indications" and expressed as a percentage of the method most frequently mentioned.

It may at first sight appear surprising that gravimetry, titrimetry and other methods which are in principle absolute methods, are amongst the ones most frequently mentioned. In fact, especially in the case of gravimetry and titrimetry, the CSRMs are used here essentially to verify that a procedure is being correctly followed. This process is particularly important for commercial analyses, where huge economic interests may be at stake. The overwhelming importance of metallurgical products for "physical" analytical methods will also be noted, whilst the uses of organic products are as one might expect. We would also point out that many laboratories express demands for CSRMs for highly sophisticated methods, such as quantitative analysis by X-ray diffraction and by microprobe, and for activation analysis.

* The latter was most often the case in the field of CSRMs for medical analysis; this section of our questionnaire, unlike the other sections, did not specify any particular method as an example.

B.2. DEMANDS FOR STANDARD REFERENCE MATERIALS OF CERTIFIED COMPOSITION AND/OR PURITY (CSRMs)

This Section deals with the information given in the parts of the returns relating to each of the *broad product families* considered, viz. :

— SRMs for metallurgical products (A)*
— SRMs for inorganic products (B)
— SRMs for organic products (C)
— SRMs for pharmaceutical products (D)
— SRMs for food products (E)
— SRMs for medical analysis (F)

The presentation of each of these families is identical and comprises three groups of diagrams accompanied by textual discussion of the salient points :

Figures 10 A-F show the origin of the demands and indicate the 3 or 4 sectors evidencing the majority of the demand for the relevant product families. The lower part of these diagrams shows the distribution of each of the "majority" sectors as between the specified sub-families.

Figures 11 A-F (upper section) analyse for each sub-family the demands for new products and products for which quality improvement and/or enlargement of range is desired. The sum of these two types of demands may be greatly in excess of 100 %, since the laboratories consulted mostly gave separate replies to these two items. The bottom section of *figures 11 A-F* shows the desired ranges of concentration. All these results are related to the total number of returns in which a requirement of any kind in the product family concerned was expressed.

Figures 12 A-E compare the methods of measurement most frequently mentioned, giving the corresponding number of "indications"** (upper). The number of "indications" for each of these methods is in turn broken down in accordance with the main product sub-families of the family in question (lower). There is no *figure 12 F* (products for medical analysis).

In practice, many laboratories did not confine themselves in their replies to marking the relevant items with a cross. The essence of the additional information given is summarized in the Sections dealing with the different families of products demanded.

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* These letters, which also feature in the questionnaire, are used in the numbering of the diagrams for the respective product families.

** The term "indication" is defined in B.1.8.

B.2.1. Demands for SRMs for metallurgical products (A)

This product range is divided into nine principal sub-families, using the following notation :

A01 = ferrous metals and their alloys, iron, cast iron, etc.

A02 = the common non-ferrous metals (Cu, Pb, Sn, Zn) and their alloys

A03 = light metals (Al, Mg, Be, Ti, etc.) and their alloys

A04 = refractory metals (W, Nb, Ta, etc.) and their alloys

A05 = semiconductor elements (Ge, Si, etc.)

A06 = precious metals and their alloys

A07 = ores

A08 = by-products (slags, etc.)

Miscellaneous : grouping together composite alloys, rare metals, silico alloys.

This nomenclature is used in the figures 10 A and 11 A.

B.2.1.1. *Origin of demand*

Demands in this field were expressed in 143 questionnaires. *Figure 10 A* (upper) gives the breakdown by sector of the respondent laboratories. It will be noted that whilst metallurgy comes first (45 %), other sectors, such as the processing industries (27 %), research institutes (15 %) and the chemical industry (10 %), also expressed not inconsiderable demands in this sphere. The number of laboratories, represented by the number of questionnaires, belonging to the various relevant sectors is shown at the bottom of each column.

The lower part of the figure shows for each products sub-family the origin of the demand, the number of returns for the relevant headings being quoted at the bottom of each column. The bulk of the demands was represented by ferrous metals (63 %), common non-ferrous products (55 %), light non-ferrous metals (46 %) and ores (34 %). The principal originator of the demands is the metallurgical industry, especially in the case of ores. The processing industry occupies second place, and takes the lead for refractory metals and semiconductors. Note that the principal demand for SRMs for precious metals is due to the research institutes.

For the nine product sub-families, 143 different questionnaires formulated 418 demands, breaking down as follows :

172 from the ME sector
104 from the PR sector
89 from the RI sector
42 from the CH sector
9 from the PE sector } miscellaneous
2 from the PH sector }

B.2.1.2. *Types and concentrations required*

Figure 11 A (upper) shows the distribution of demands as between new and improved SRMs. The average ratio of demand for new SRMs (307) and improvements of existing SRMs (219) is about 3:2. The percentage of demands for new SRMs always exceeds that for improved SRMs, for all sub-families; this ratio reaches a maximum for semiconductors (83 % new, 39 % improved) and falls to a minimum for light non-ferrous metals (67 % new, 55 % improved). The highest average demand is for ferrous products (83 % new, 66 % improved).

Figure 11 A (lower) gives information on the desired concentrations. Those in the range 0.001-1 % were specified 321 times in about 70 % of returns. Concentrations of > 1 % appear 268 times, 1-10 ppm 160 times and < 1 ppm 59 times.

For metals and alloys in general (A01, A02, A03, A04, A06) the results correspond to the mean of the demands, giving the following ranges of concentration, in decreasing order of demands :

— 0.001-1 %
— > 1 %
— 1-10 ppm
— < 1 ppm.

For ores and by-products (slags, drosses, etc.) the demands in the ranges > 1 % and 0.001-1 % are practically equal.

The semiconductor sub-family shows a characteristic pattern, the majority of demands being for concentrations of < 1 ppm, the demand declining with increasing concentration.

B.2.1.3. *Application of the SRMs demanded*

Figure 12 A shows the distribution of the 1501 "indications" obtained for all metallurgical products demands, as related to the different methods to be calibrated, and in each case the breakdown by product sub-families.

Wet method (gravimetry, titrimetry and electrochemical methods) "indications" are the most numerous (240), followed by emission spectrography (230) and X-ray absorption and fluorescence (200).

The breakdown by product sub-families shows that for ores wet method indications are the most numerous. For all other groups, emission spectrography is the method most frequently mentioned.

SRMs for semiconductors are required most for activation analysis and mass spectrography, this being consistent with the results obtained for concentration ranges.

The distribution of indications by product sub-families gives the following results :

361 indications for ferrous metals
263 indications for common non-ferrous metals
218 indications for light metals
180 indications for ores
176 indications for refractory metals
84 indications for semiconductors
80 indications for precious metals
70 indications for by-products
69 indications for miscellaneous sub-groups.

B.2.1.4. *Trends of the main demands expressed*

Finally, it should be mentioned that of 143 returns expressing demands for SRMs for metallurgical products, a considerable number (76) gave more or less detailed particulars. These replies, although there are not enough of them for a statistical treatment of the results, nevertheless suffice to indicate a few general points.

Regarding all SRMs for metallurgical products, one general problem is revealed by the data obtained, namely that of the determination of gases (especially oxygen, hydrogen and nitrogen) in metals and alloys.

In addition, for each product sub-family, the following particular problems are highlighted :

— For ferrous products, the determination of inclusions (especially carbides and nitrides) and specific impurities. A number of specific demands were also expressed for stainless steels and hast alloys.

— In the field of the common non-ferrous metals, the main demand is for SRMs for verification of the specifications of metal (in particular, copper, zinc and lead) and alloys. In nearly all cases, the problem is one of composition and determination of the concentration of impurities.

— For light non-ferrous metals, the demand is spread widely over alloys with a broad spectrum of compositions.

— In refractories, the main demand is for determination of the concentration of impurities.

— For semiconductors, there are fewer demands, but a recurring requirement is determination of carbon and nitrogen in silicon and germanium.

— The problems arising with precious metals are that of the determination of precious metals in non-precious metals and vice versa.

— In ores, demand centres on the determination of elements forming the subject of a commercial transaction (both wanted and unwanted elements).

An example is the demand for ores having Ni contents of up to 1 %.

There is a somewhat smaller demand for SRMs for metallurgical raw materials (dolomite, limestone fluxes, etc.).

In superalloys, the demands, although small in number, centre on cobalt- and nickel-based alloys (especially the former).

B.2.2. Demands for SRMs for inorganic chemicals (B)

This group of products is divided into nine main sub-families, classified as follows :

B01 = elements and/or compounds in general

B02 = refractory and ceramic materials : common (bricks) and advanced (oxides, carbides, nitrides)

B03 = chemical fertilizers, simple and compound

B04 = ordinary and special glasses

B05 = cements

B06 = pigments

B07 = pure gases and mixtures thereof

B10 = minerals

Miscellaneous = enamels, water.

This nomenclature is used in the figures 10 B and 11 B.

126 laboratories expressed a total of 260 demands for SRMs for inorganic chemicals.

B.2.2.1. *Origin of demand*

As *figure 10 B* (upper) shows, the origins of the 126 returns expressing demands were as follows : 33 % from the chemical industry, 25 % institutes, 18 % metallurgy, 13 % the processing sector and 11 % other sectors (no demands were expressed by the food sector).

Figure 10 B (lower) gives the percentages of respondents demanding each product sub-family.

The products most frequently demanded are elements/compounds, refractory/ceramic products and pure gases and mixtures thereof. It will be seen that the demand for elements/compounds is headed by the chemical sector, whilst research institutes take first place for practically all the other product sub-families. The main demands of the metallurgical and processing sectors relate to refractory/ceramic products.

The 260 demands for miscellaneous inorganic chemical products break down by sector of origin as follows :

82 from the chemical sector

80 from research institutes

41 from the metallurgical sector

41 from the processing sector

12 from the petroleum sector
3 from the pharmaceutical sector
1 from the medical analysis sector
} miscellaneous

B.2.2.2. *Types and concentrations required*

Figure 11 B (upper) shows the distribution of the 150 demands for new SRMs and the 95 demands for improvement of existing SRMs. For these inorganic chemical products, the average ratio of new to improved substances is 3:2. This ratio varies from a maximum

approaching 10 for minerals to a minimum close to 1 for fertilizers. For the product sub-families most in demand, elements and compounds, ceramics, glasses and gases and mixtures thereof, this proportion approximates to the overall average.

Figure 11 B (lower) shows that the most frequently specified concentration ranges are :

— > 1 % (141 demands)

— and 0.001-1 % (146 demands).

For concentrations < 1 ppm there are only 33 demands.

For elements/compounds, pigments and minerals demand centres on the range 0.001-1 %. For all other product groups, in particular fertilizers and cements, the range > 1 % is the one most frequently mentioned.

The concentration range < 1 ppm displays some degree of consistency only for elements/compounds, minerals and glasses.

B.2.2.3. *Application of the SRMs demanded*

Figure 12 B gives the distribution of the 820 "indications" of methods relating to inorganic chemicals. The most frequently mentioned methods, for all products, are as follows :

— Chemical methods (130 indications)

— Spectrophotometry (110 indications)

— Flame spectrophotometry (99 indications)

— X-ray absorption and fluorescence (96 indications).

Analogous results are found for practically all the product sub-families. For gases and mixtures thereof, specific gas analysis methods take the lead, followed by chromatographic methods and mass spectrography.

Finally, X-ray diffraction assumes some degree of importance for refractory/ceramic products and cements.

The total of 820 "indications" is distributed among the product sub-families as follows :

— 214 indications for refractory/ceramic products

— 206 indications for elements/compounds

— 85 indications for gases and mixtures thereof

— 84 indications for cements

— 81 indications for glasses

— 58 indications for pigments

— 42 indications for fertilizers

— 50 indications for miscellaneous products.

B.2.2.4. *Trends of the main demands expressed*

126 laboratories expressed demands for SRMs in the field of inorganic chemicals. 47 of these (37 %) specified the nature of the substances demanded. In spite of the inevitable dispersion inherent in this type of data, one can nevertheless point to a certain frequency of desiderata and select the most significant demands from the results.

In the field of elements and compounds, the demand concentrates on the following products :

— Pure metals (2) and elements of purity greater than 99.9999 % (Si, Te, S, Se, Na, Sn, Sb, I, red lead, Br, graphite).

— Pure metallic oxides (Cu, Fe, rare earths, Mg, Ca).

— Ultra-pure salts (alkaline earth carbonates, As_2O_3, KCl, $AgNO_3$, $KMnO_4$, $KHCO_3$, $CaCl_2$, NaCl).

— Pure acids (HF, HNO_3, H_2SO_4, CH_3COOH, H_3PO_4).

Two types of demand predominate in refractory and ceramic materials :

— for analysis of gases in used bricks,

— for analysis of advanced refractory materials (oxides, carbides, nitrides).

In fertilizers, the demand relates to problems of analysis of total elements and soluble elements, and the physical characteristics of simple and compound fertilizers.

With glasses, a recurring problem appears to be that of determination of water and gases. RS demands centre on :

— ordinary, neutral, non-optical (hollow glass formula), soda-lime glasses,

— optical glasses.

Note that many demands for SRMs for glasses relate to standard reference materials with certified properties. This point will be dealt with in Section B.3.

For cements, the demand concerns filled materials in particular.

In pigments, the main requirement is that of pure constituents.

With gases and mixtures thereof, demands are evidenced for :

— Standard gases (impurities in Ar, O_2, N_2, CO_2, CO, H_2, He, HCl, H_2S, rare gases in CO_2),

— Gas-gas mixtures (N_2-O_2; permanent gases; illuminating gases),

— Gas-dust mixtures.

For water, SRM demands relate primarily to water pollutants.

In the mineral field, the demand for SRMs includes one for the following products : Sand, limestone, dolomite, feldspar and other aluminosilicates, fluorite (alkaline impurities, Cl, Ba, Sr, F), rare earths in clays.

B.2.3. Demands for SRMs for organic chemicals (C)

This group of products is subdivided into the following 11 sub-families :

C01 = pure subsances
C02 = solvents
C03 = industrial dyestuffs
C04 = petroleum products (motor spirits, additives, lubricants)
C05 = polymers
C06 = elastomers
C07 = semiproducts for plastics
C08 = organometallic compounds
C09 = pesticides (insecticides, fungicides, herbicides)
C10 = detergents
C11 = pure gases and mixtures thereof
Miscellaneous organic products.

This nomenclature is used in the figures 10 C and 11 C.

150 laboratories expressed a total of 436 demands for SRMs for this group of products.

B.2.3.1. *Origin of demand*

Figure 10 C (above) gives the percentages of returns for the corresponding sectors of activity. These results are summarized in the following table, which also shows the distribution of the demands (absolute values and percentages).

Sector	Number of Returns	Percentage Returns %	Number of Demands	Percentage Demands %
Chemicals	51	34	165	38
Research institutes	28	19	94	22
Pharmaceuticals	21	14	40	9
Petroleum	19	13	53	12
Processing	13	8	55	13
Food	8	5	15	3
Medical analysis	6	4	9	2
Metallurgy	4	3	5	1
Total	150	100 %	436	100 %

As might be expected, the chemical sector is by far the most important originator of demands for this type of product. However, the volume of demands from research institutes, which come second, the pharmaceutical sector and the petroleum industry is not inconsiderable.

Figure 10 C (lower) shows the distribution of demand for the sectors most involved for each product sub-family, the total number of demands being given at the bottom of each column.

Pure substances constitute the item most frequently demanded (by 56 % of laboratories). This is partly due to the fact that this heading covers a very wide range of products. The runners-up are, in the order stated, solvents (34 %), polymers (32 %), petroleum products (29 %), gases and mixtures thereof (28 %) and pesticides (27 %). The products least in demand are industrial dyestuffs (12 %).

The chemical sector is the prime originator of demands in almost all cases, except for petroleum products, where the petroleum industries lead. The latter also display considerable interest in gases and mixtures thereof, pure substances and organometallic compounds. The demands of research institutes extend over all fields, in particular pure substances, pesticides and gases. The demands of the pharmaceutical industry are confined to pure substances, pesticides solvents and dyestuffs.

The relatively important part played by the industrial sectors lumped together under the heading "Others" in pure substances, solvents, petroleum products, polymers and elastomers, is due almost entirely to the processing sector, including as it does the important automotive and aerospace industries.

B.2.3.2. *Types and concentrations required*

Figure 11 C (upper) shows for each product sub-family the distribution of the 257 demands for new reference substances and of the 179 demands for improvement of existing SRMs. Except for solvents, the percentage of demands for new SRMs always exceeds that for improved ones. This predominance is particularly marked in the case of elastomers (70 % new SRMs, 20 % improved), dyestuffs (56 % new, 22 % improved SRMs), petroleum products and polymers. The extreme case of elastomers highlights a gap in the current market for SRMs for these products. With organometallic compounds, on the other hand, the demand, which is substantial, is comparable as between new and improved standard reference materials (74 % for the former and 67 % for the latter).

Figure 11 C (lower) gives details of the desired concentrations. For almost all product sub-families, there is a clear majority of demands for concentrations in the "%" range (198 demands in all).

Concentrations in the "ppm" range, for which demands total 102, come first in the case of gases and mixtures thereof. Incidentally, the percentages for the "Miscellaneous" column are not statistically significant, since the number of demands is too small.

There were only 34 demands for concentrations of the order of 1 ppb, exhibiting some degree of consistency only for gases and mixtures thereof and for petroleum products.

As for pure substances, only concentrations in the "%" range are to be expected, by definition; the demands expressed for ppm or ppb concentrations obviously relate to impurities.

For solvents, polymers and elastomers, reasonably enough, there were no demands for ppb concentrations. On the other hand, the fact that demands for concentrations of this order were expressed for detergents and pesticides is somewhat surprising.

B.2.3.3. *Application of the SRMs demanded*

The number of method "indications" for SRMs for organic chemicals is very high (1162). The results are shown in *figure 12 C*. The upper part of the figure gives the frequency of "indications" for the principal methods mentioned in this sphere. Two methods stand out conspic-

uously : chromatography with 281 indications and spectrophotometry (UV, IR, visible) with 239 indications. Reference substances for physical properties occupy an important position (137 indications).

Figure 12 C (lower) shows that for all product sub-families except for polymers and gases, chromatography is the method for which the demand for SRMs is greatest. In the case of polymers, there is an appreciably higher demand for spectrophotometry. With gases and mixtures thereof, specific analytical methods for gases are slightly ahead of chromatography. In the case of the product sub-families not represented in the diagram (elastomers, plastics semiproducts, dyestuffs and detergents) the three main methods demanded are again :

— chromatography

— spectrophotometry

— measurements of physical properties

The breakdown of method indication by product groups is as follows :

263 indications for pure substances

139 indications for solvents

130 indications for petroleum products

124 indications for polymers

109 indications for pesticides

78 indications for pure gases and mixtures

71 indications for organometallic compounds

67 indications for elastomers

63 indications for plastics semiproducts

48 indications for industrial dyestuffs

62 indications for detergents

8 indications for miscellaneous products

B.2.3.4. *Trends of the main demands expressed*

150 laboratories expressed demands for standard reference materials for organic chemicals. 45 of them supplied detailed lists of the products they required. These products cover a very wide spectrum, as is consistent with the multiplicity of organic chemicals available. Nevertheless, it has been possible to distinguish the salient features of these demands.

In the field of pure substances, demands can be identified for spectrophotometry reagents, paraffins, olefins and diolefins, polynuclear hydrocarbons, amino acids and heterocyclic products.

The following solvents may be mentioned : trichloroethylene, acetone, methyl, butyl and isopropyl alcohols from C7 to C18, aliphatic ethers from C4 to C20, ketones from C7 to C 20 and aliphatic and aromatic halogen derivatives.

In petroleum products, the principal demands expressed relate to the following substances :

— Light and heavy motor spirits (hydrocarbon composition, S content, determination of Pb at the ppb level, determination of octane number)

— Oils (content of S and non-sulphonable substances)

— Standard oils with metallic elements in suspension

— Heavy oils (determination of Na and V by flame spectrometry).

In the field of polymers, the main types of products mentioned are :

— Isotope-marked polyolefins and polystyrenes (analysis of Cl and S contents)

— Branched polymers (analysis of impurities in ash, saponification number, etc.)

— Polypropylenes (isotactic, syndiotactic, atactic)

The demands for pesticides relates to pure substances and their metabolites. An important problem often raised is that of stability in time.

Finally, in gases and mixtures thereof, there are demands for :

— hydrocarbons with low carbon number

— hydrocarbon mixtures (mixtures of methane and butane for chromatography)

— impurities in carrier gases for chromatography

For petroleum products and for polymers, many demands relate to SRMs for properties, which are discussed in Section B.3.

B.2.4. Demands for SRMs for pharmaceutical products

This group of products has been subdivided into eight chief sub-families, namely :

D01 : steroids

D02 : vitamins

D03 : enzymes

D04 : antibiotics

D05 : barbiturates

D06 : vaccines and serums

D07 : organ extracts

D08 : excipients

Miscellaneous pharmaceutical products

This nomenclature is used in the figures 10 D and 11 D.

The pharmaceutical sector displayed keen interest in the problem of SRMs, for two partially related reasons : the importance of medicines in present-day society and the stringent national legislative provisions and internationaal recommendations (European Pharmacopeia, World Health Organization).

With a very small number of exceptions, the foremost representatives of the pharmaceutical industry and the most renowned scientific institutes in the sector collaborated in the survey, as did the subsidiaries of big concerns with headquarters outside the Community (either in Europe or in the USA).

74 laboratories expressed a total of 237 demands for SRMs for pharmaceutical products.

B.2.4.1. *Origin of demand*

Figure 10 D (upper) illustrates the concentration of the laboratories concerned in a small number of sectors : 68 % from the pharmaceutical industry alone, followed by medical analysis laboratories (13 %) and research institutes (12 %).

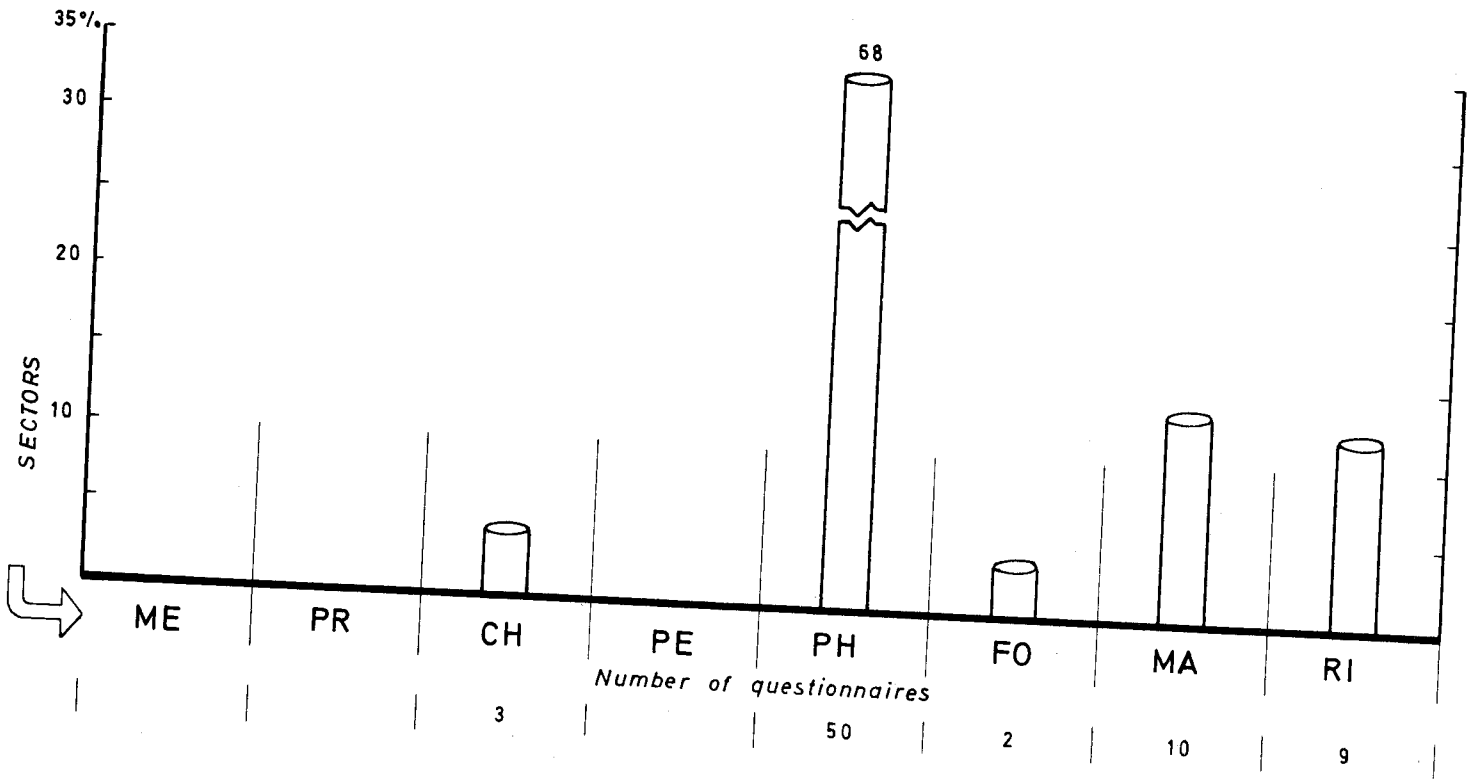
The following table summarizes the numbers and percentages of laboratories concerned and the demands for pharmaceutical products, classified by origin :

Sector	Number of laboratories	Percentage laboratories %	Number of demands	Percentage demands %
Pharmaceutical	50	68	170	72
Medical analysis	10	13	18	8
Research institutes	9	12	36	15
Chemicals	3	4	7	3
Food	2	3	6	2
Total	74	100 %	237	100 %

Figure 10 D (lower) shows the breakdown of demands by sectors of origin for each product sub-family considered.

DEMAND FOR SRMs
FOR PHARMACEUTICAL PRODUCTS

Number of questionnaires : 74



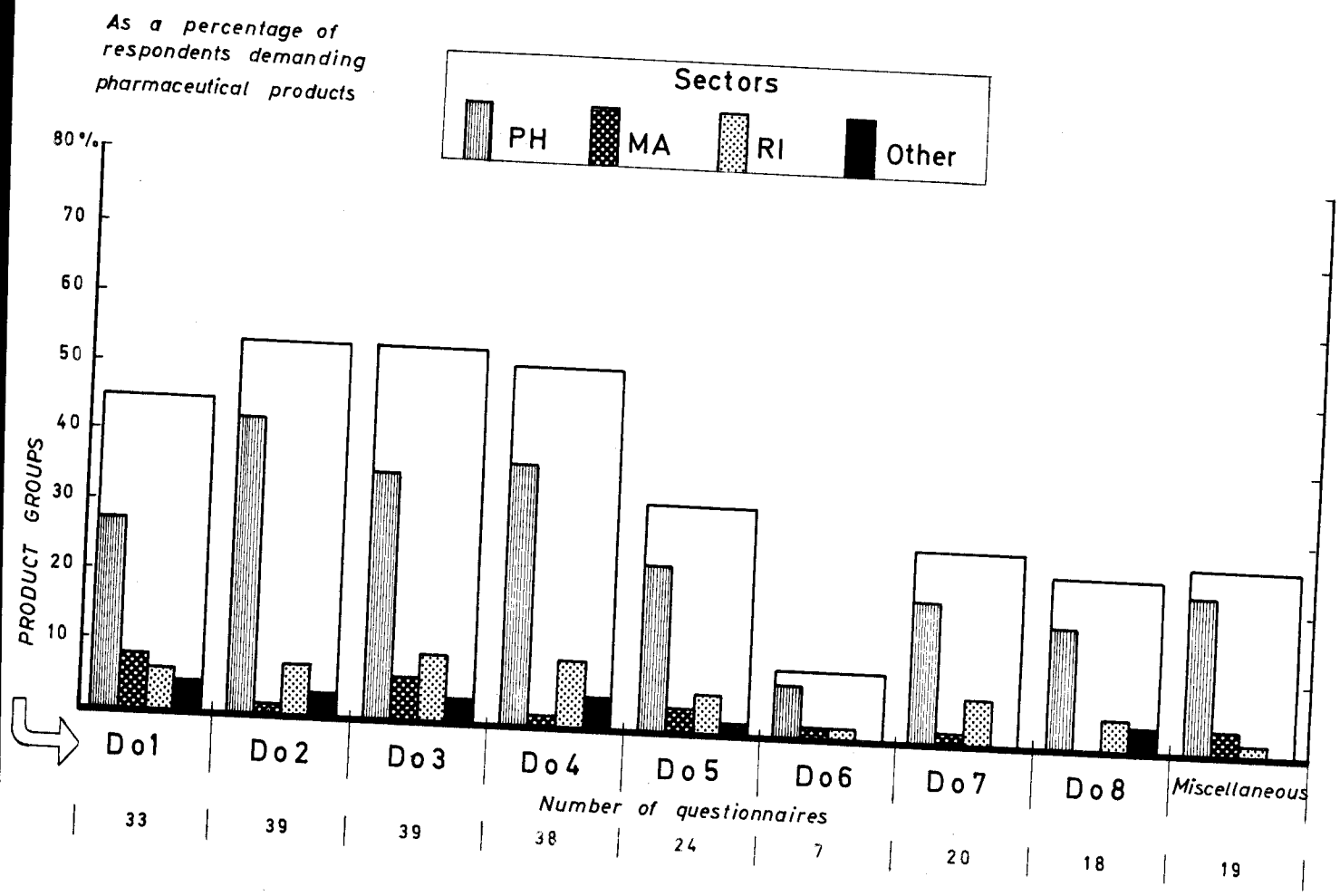


fig. 10 D

DEMAND FOR SRMs FOR PHARMACEUTICAL PRODUCTS

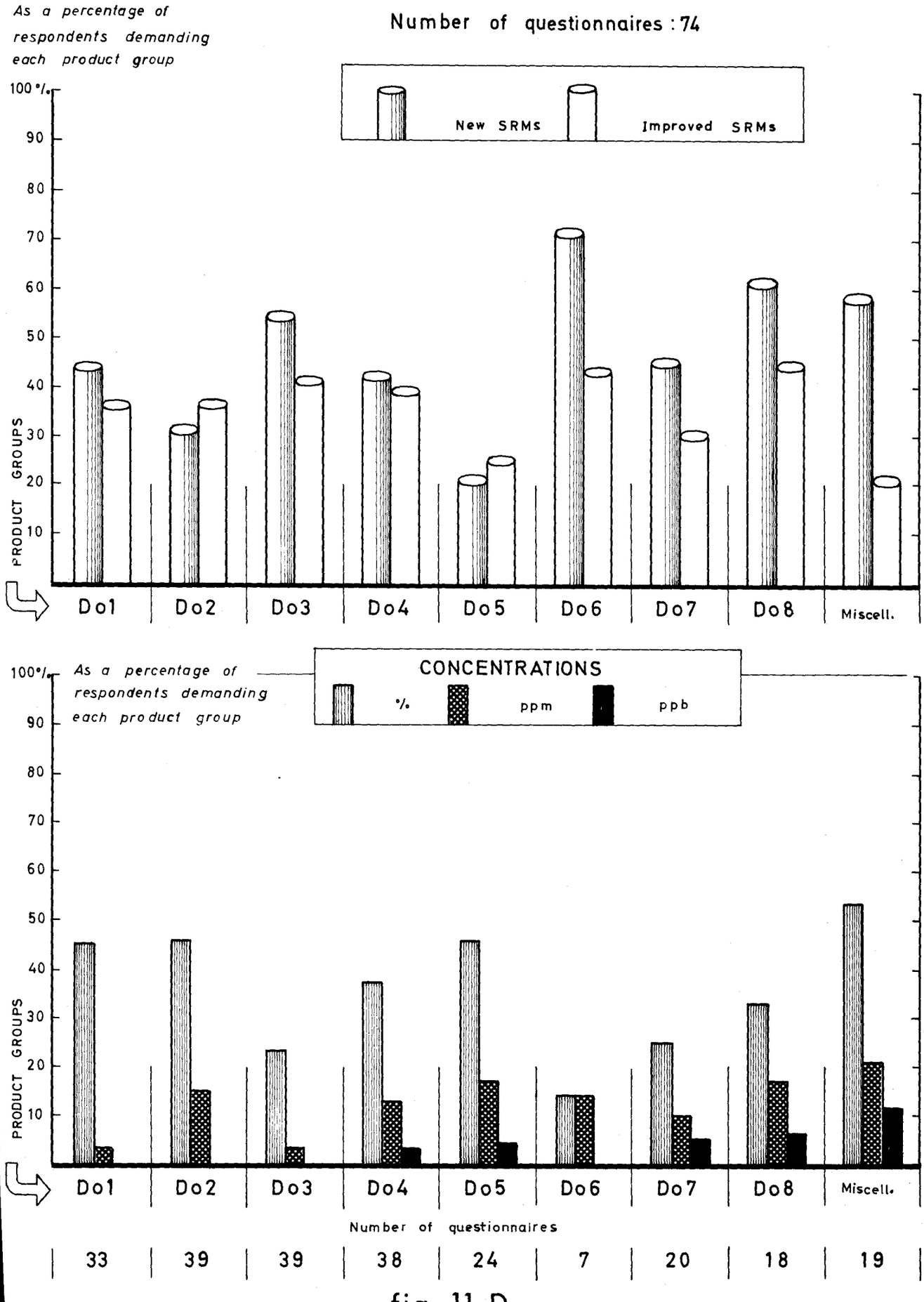
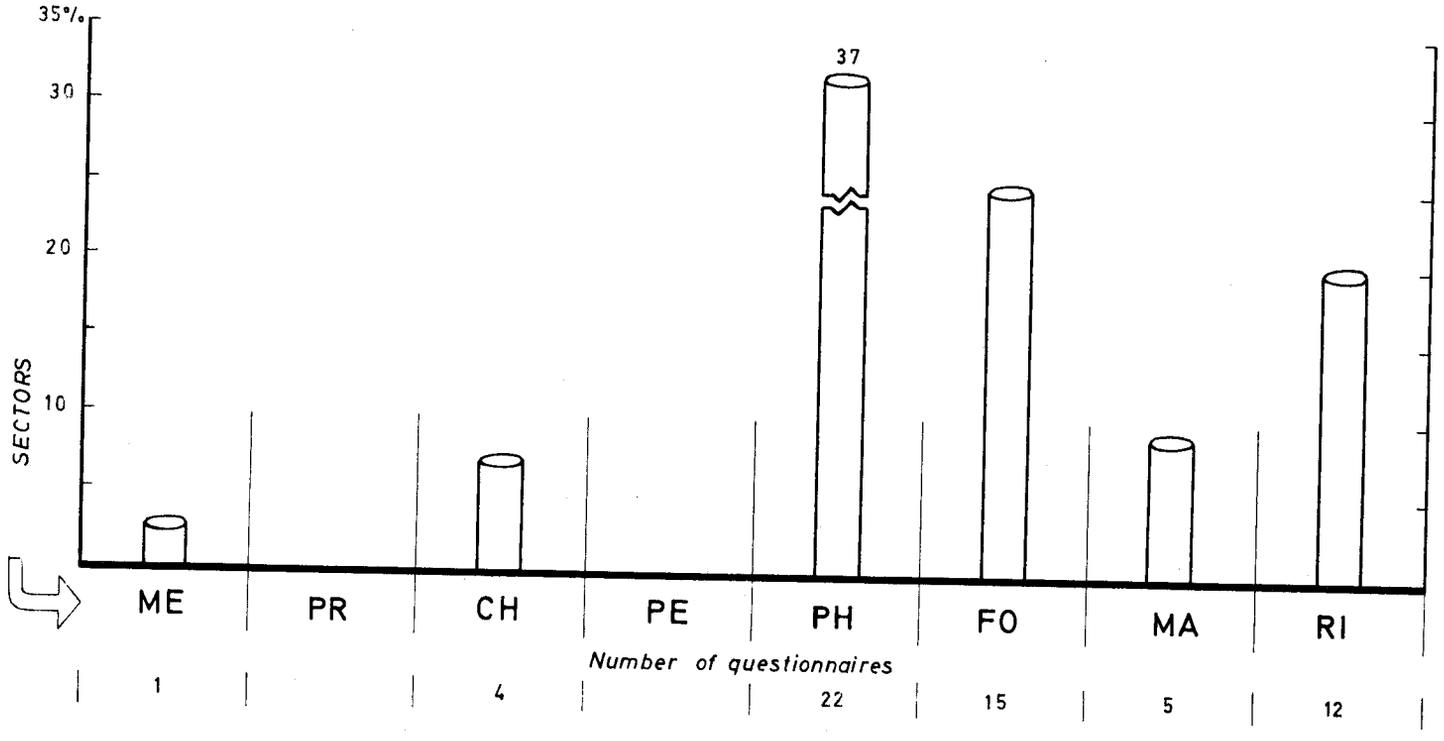


fig. 11 D

DEMAND FOR SRMs FOR FOODSTUFFS

Number of questionnaires : 59

As a percentage of respondents demanding products for foodstuffs



As a percentage of respondents demanding products for foodstuffs

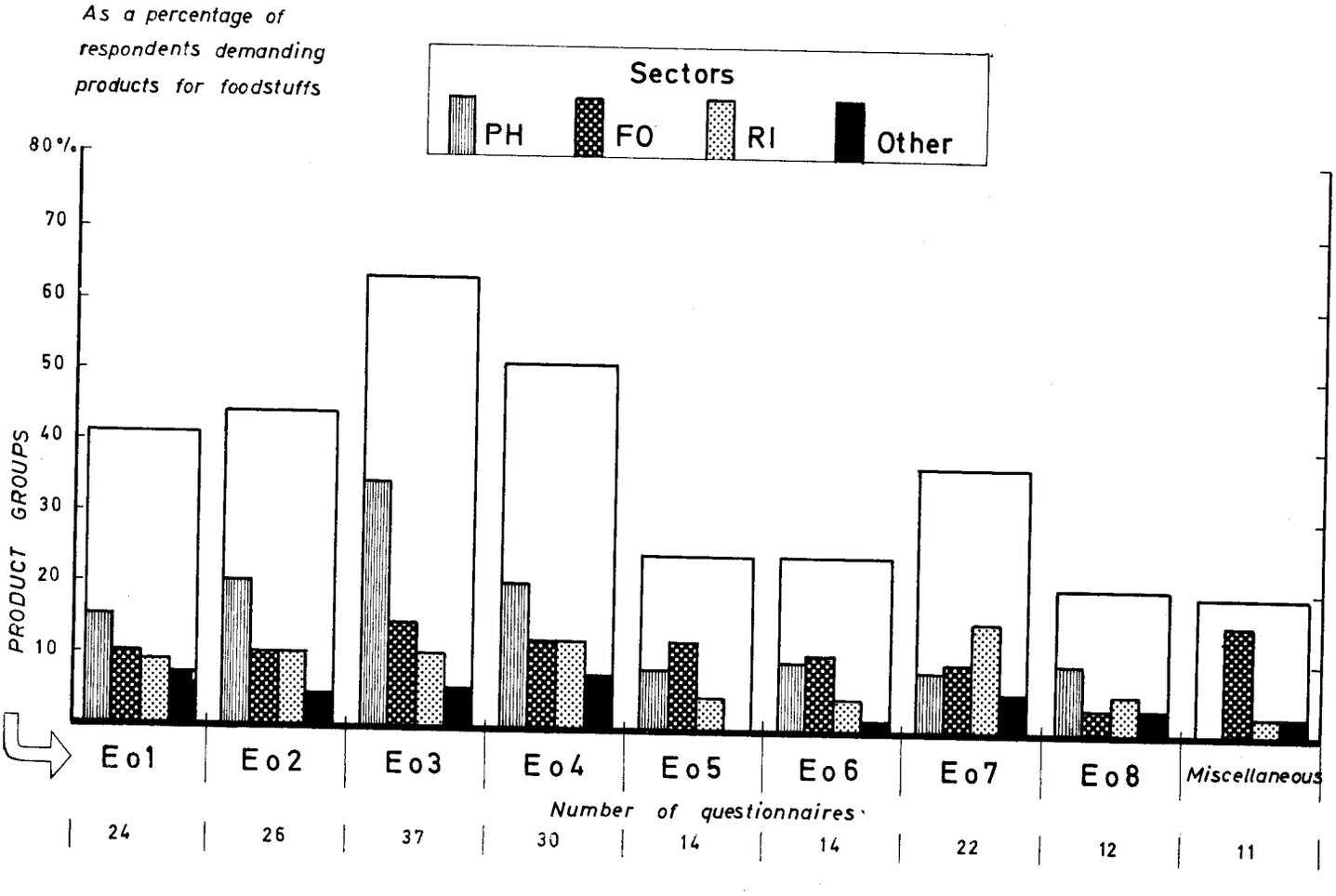


fig. 10 E

DEMAND FOR SRMs FOR FOODSTUFFS

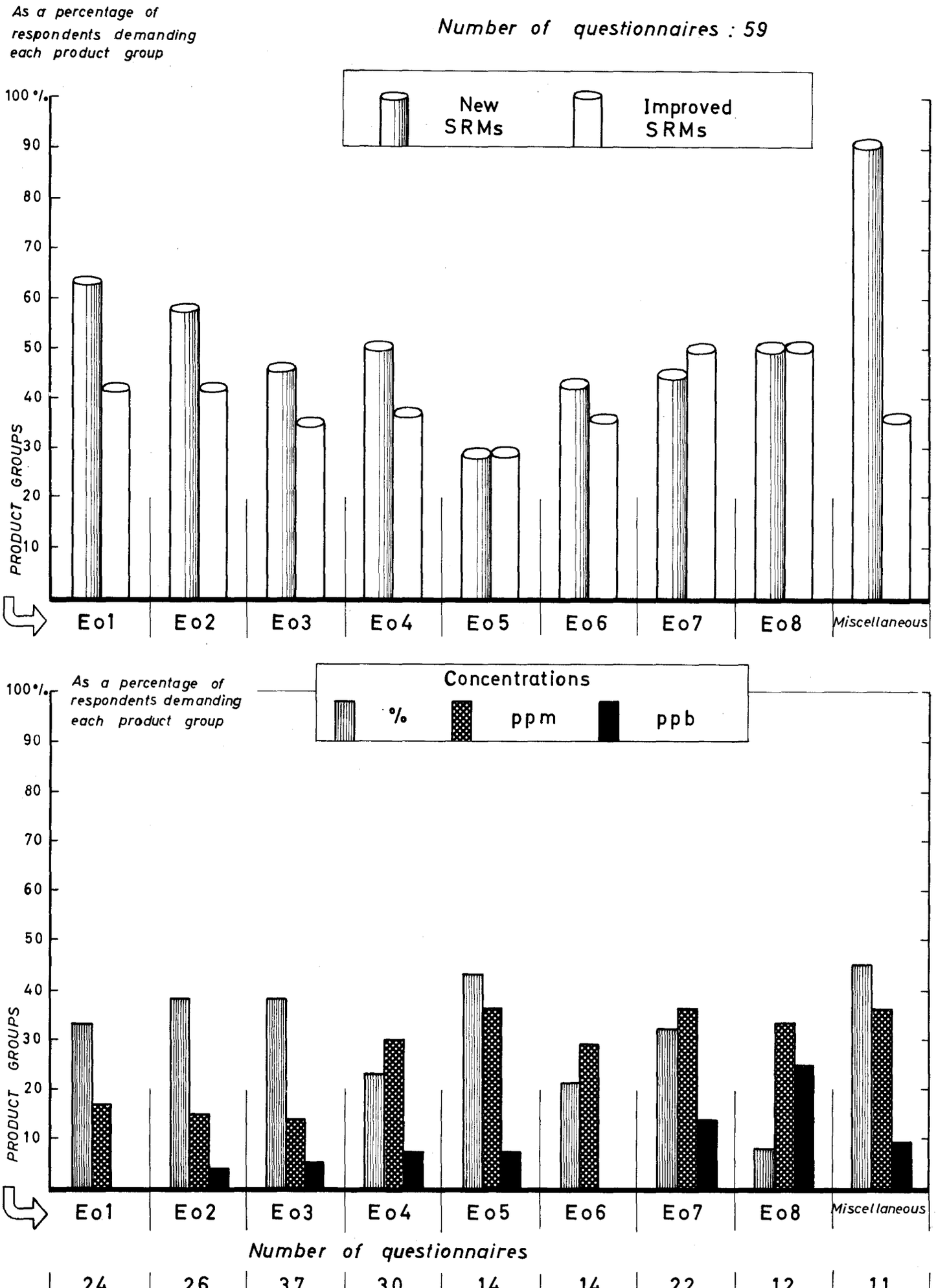


fig. 11 E

B.2.5.4. *Trends of the main demands expressed*

In the field of products for the food industry, the number of laboratories requiring standard reference materials is relatively small : 59 in all, only 12 of which describe their requirements in any detail.

In view of the customary scatter with this type of data and of the small number of questionnaires, it is impossible to demonstrate any convergence of demand on specific products.

The most that can be said is that in preservatives, antioxidants of the methyl-paraoxybenzoate and propylparaoxybenzoate type were mentioned several times.

In the field of SRMs with certified properties, there were also demands for standard reference materials for sugar classification on the basis of polarizing ability.

B.2.6. Demands for SRMs for medical analysis products

The products used in medical analysis have been divided in the questionnaire into 7 sub-families, namely :

F01 : biological products (serums, urine, etc.) of specified concentration (normal or pathological) for one or more elements

F02 : specific antiserums for biochemistry, bacteriology and hematology

F03 : standard solutions of specified biological products

F04 : standard suspensions for blood counts

F05 : pure biological products for biochemical, enzyme and other analyses (thromboplastin, fibrinogen, steroids, enzymes, etc.)

F06 : antigens for bacteriology and seriology

F07 : products for immunological techniques (immunohematology, immunoelectrophoresis and immunofluorescence)

Miscellaneous products : lipoproteins, cultures for bacteriology, etc.

This nomenclature is used in the figures 10 F and 11 F.

64 laboratories expressed demands for SRMs for this product family, the total number of demands being 243.

B.2.6.1. *Origin of demand*

Figure 10 F (upper) shows to which sectors the laboratories which expressed a demand for SRMs for medical analysis belonged.

As might be expected in such a specialized field, the results show considerable concentration by sectors. 63 % of demands originate from laboratories attached to the hospital sector, 19 % from the pharmaceutical industry and 11 % from research institutes, in this case, the national laboratories responsible for hygiene and public health.

Figure 10 F (lower) shows that on the whole the demands are fairly evenly distributed among the different product sub-families, the following, however, standing out to some extent :

— biological products (serums, urines) of specified concentration for one or more elements

— pure biological products.

These items appear in at least 70 % of returns. Also :

— standard suspensions for blood counts

— standard solutions of biological products.

These items recur in about 60 % of questionnaires.

B.2.6.2. *Types and concentrations required*

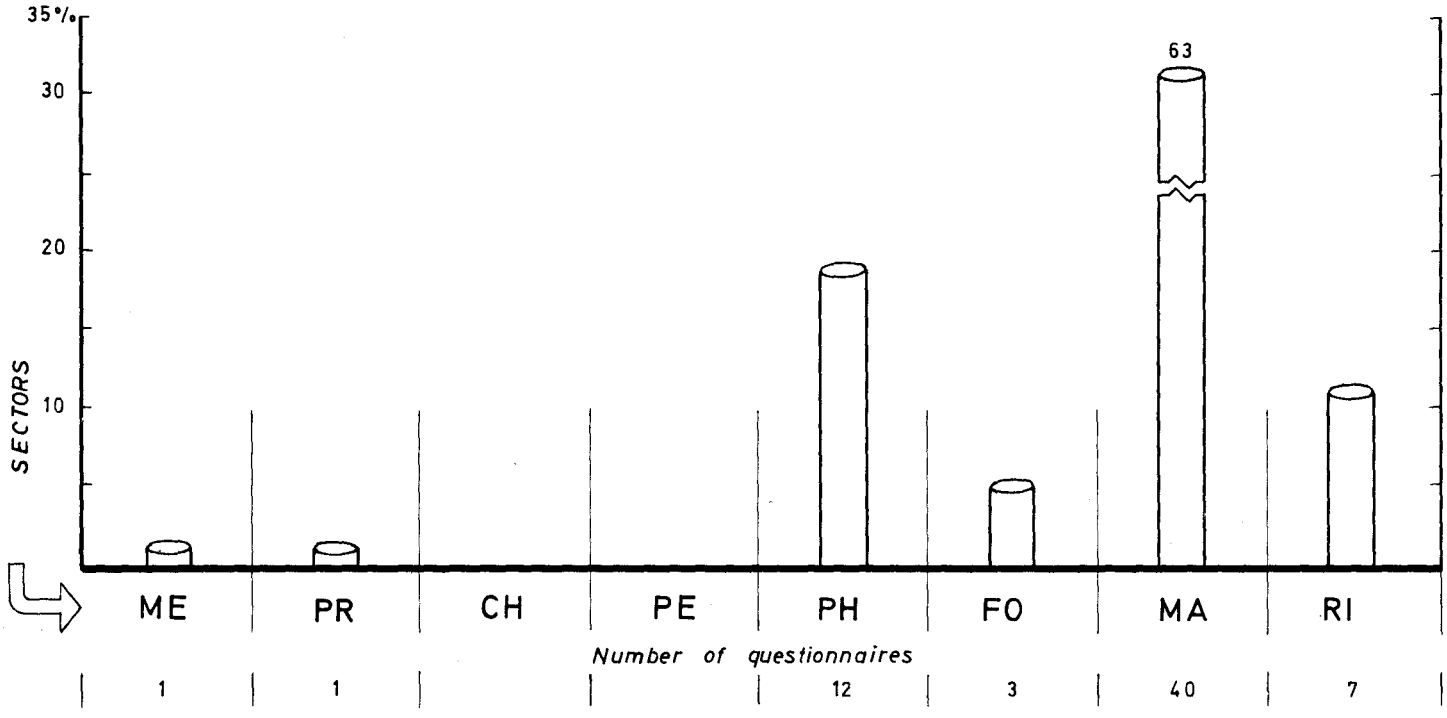
Figure 11 F shows that in the case of products for medical analysis, demand centres on the improvement of existing SRMs (172 demands) rather than the introduction of new substances (118 demands); as we have seen, the reverse is the case with the other main product families.

As already noted in the section on criticisms of existing SRMs (see Section B.1.6), users complain in particular of poor quality (deficient exactitude, precision and stability) in these products. Finally, it may be noted that the rapid expansion of medical analysis and the introduction of automatic series analysers appear to be generating a considerable need, of relatively recent origin, for SRMs in this field.

DEMAND FOR SRMs FOR MEDICAL ANALYSIS

Number of questionnaires: 64

As a percentage of respondents demanding products for medical analysis



As a percentage of respondents demanding products for medical analysis

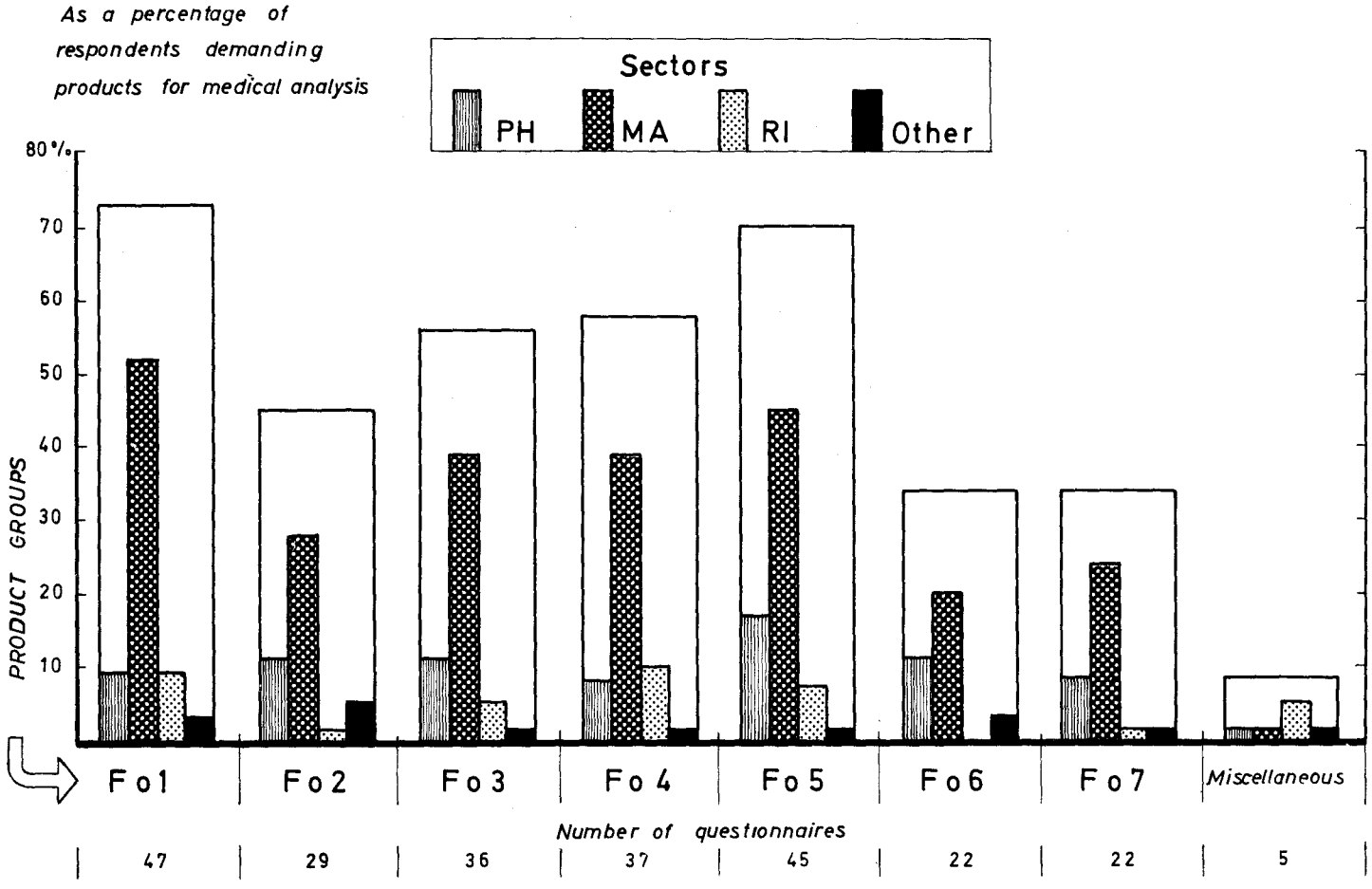


fig. 10 F

DEMAND FOR SRMs FOR MEDICAL ANALYSIS

Number of questionnaires : 64

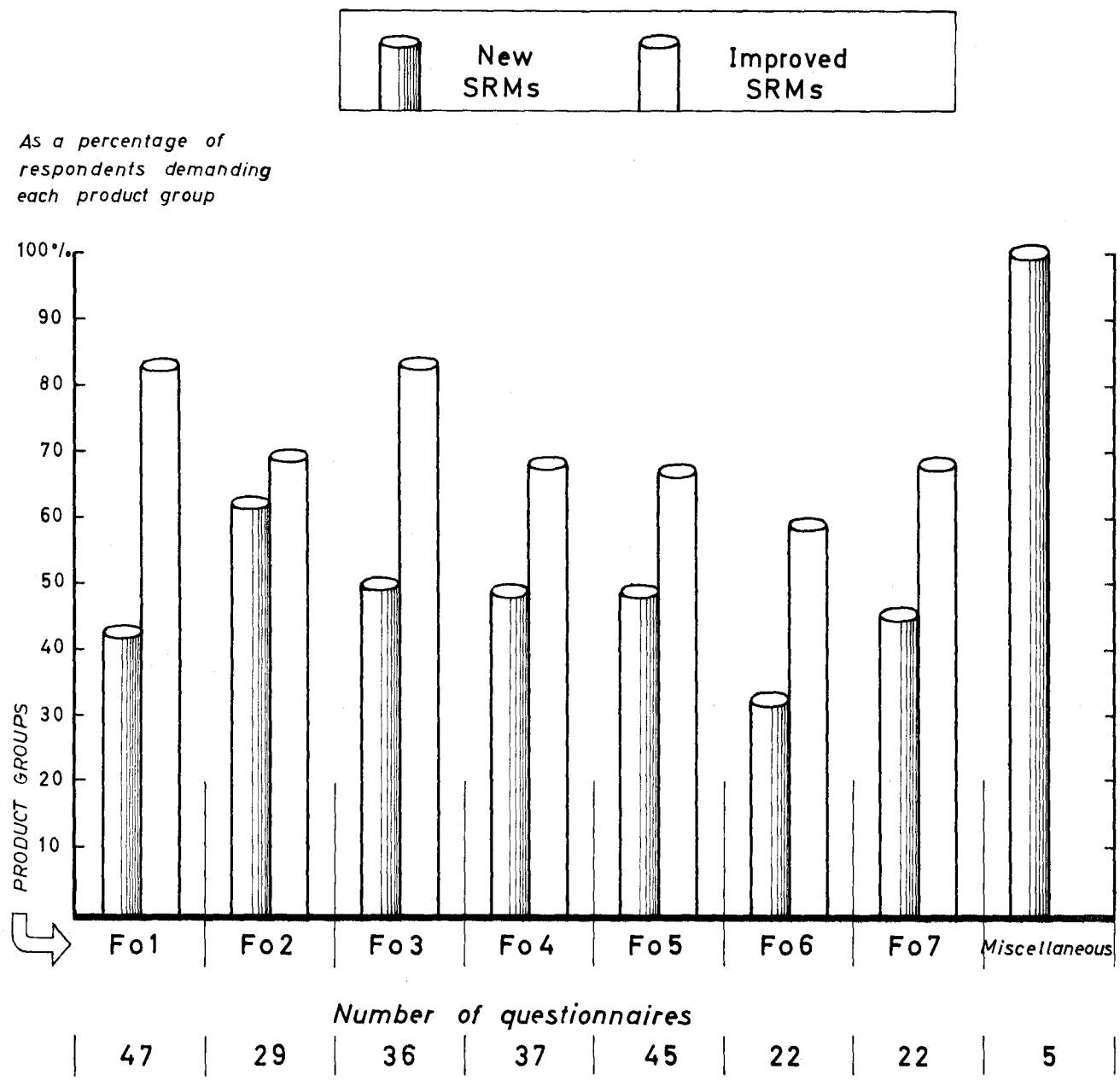


fig. 11 F

B.2.6.3. *Application of the SRMs demanded*

For the substances used in medical analysis, the replies to the particular problems mentioned in the questionnaires are disparate, and do not allow a statistical presentation of results relating to the calibration of analytical or measuring techniques. For this reason there is no *figure 12 F.*

B.2.6.4. *Trends of the main demands expressed*

Of the laboratories expressing a need for standard reference materials for medical analysis, 23 % spelt out the nature of their requirements in detail. The most significant demands are cited below.

The biological products group features a demand for reference serums independent of methods, which would allow valid comparisons between laboratories. In particular, there is a need for reference serums for enzyme determinations.

In the field of antiserums alone, some exceedingly specialized problems were adduced, e.g., antiserums for the detection of antitissue antibodies and their quantitative determination for diagnosis purposes.

A certain demand is evidenced for standard solutions of overall composition approximating to a biological medium, e.g., demands for histamine solutions.

In the sphere of automatic blood determinations, the demand relates to red cells, leucocytes and platelets, as well as the preparation of a reliable reference standard for automatic hemoglobin determination.

Under the heading of pure biological products, there are demands for the following products :

— Fibrinolysis products X, Y, D and E
— Reference plasmas II, V, VIII, IX, X, XII, XIII
— Enzymes
— Reference reagents for specific coagulation factors.

B.3. DEMAND FOR OTHER STANDARD REFERENCE MATERIALS (PSRMs)

As stated at the beginning of this report, the survey was concerned primarily with standard reference materials of certified purity and/or composition (CSRMs), as opposed to other SRMs (PSRMs); however, demands for the latter were expressed in a considerable number of returns.

A comparison of the demand for CSRMs and PSRMs is given in *figure 8* for the different sectors and this information is repeated for all returns in *figure 13* (left side). Details of specific demands for PSRMs are given in the following table :

Sector	All	ME	PR	CH	PE	PH	FO	MA	RI
Number of returns	550	85	58	120	31	87	42	51	76
Proportion of respondents demanding PSRMs as a percentage of total number of returns	46	57	60	46	59	42	8	26	60

These figures suffice to demonstrate the interest shown by industrial and research laboratories in this type of standard reference materials. Moreover, it must not be forgotten that the sector which is probably the most concerned, that of the processing industries, was not consulted on a sufficiently large scale. Although the reply rate in this sector was one of the highest, only 58 questionnaires are available for analysis (as against 120 in the chemical sector, 87 in pharmaceuticals and 85 in metallurgy), and these include relatively few representatives of the mechanical and electrical engineering industries.

The chief PSRM sub-groups covered in the questionnaires are :

— particle size distribution, particle counts,

— physical and physicochemical properties,

— mechanical properties,

— qualitative reference indicators,

— miscellaneous properties.

The results for all questionnaires are presented in *figure 13* (right side). They are broken down by sectors in *figure 14*. These results underscore the general interest shown in PSRMs, and the data are in line with expectations :

a) A substantial demand is evidenced by the metallurgical and processing industries and the research institutes; the requirements of the food industry are small, whilst those of the medical analysis laboratories are negligible. Note the substantial demand of the petroleum sector; however, these results may be coloured by the very small number of returns in this sector (31).

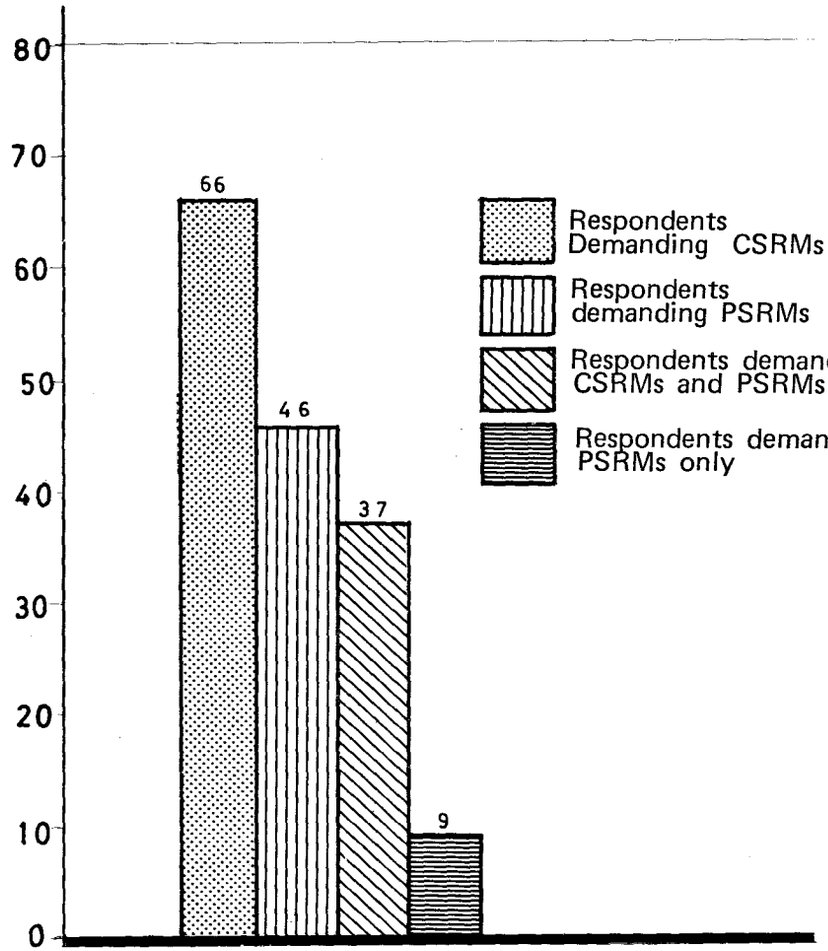
b) Regarding the properties themselves, overall, there is a clear preponderance of physical and physicochemical properties, especially in petroleum, the research institutes, chemicals and pharmaceuticals.

STANDARD REFERENCE MATERIALS with certified properties (PSRMs)

Comparison of demands for CSRMs and PSRMs

Total number of questionnaires: 550

percentage of total number of questionnaires



Analysis of all demands for CSRMs

Total number of respondents demanding PSRMs: 254

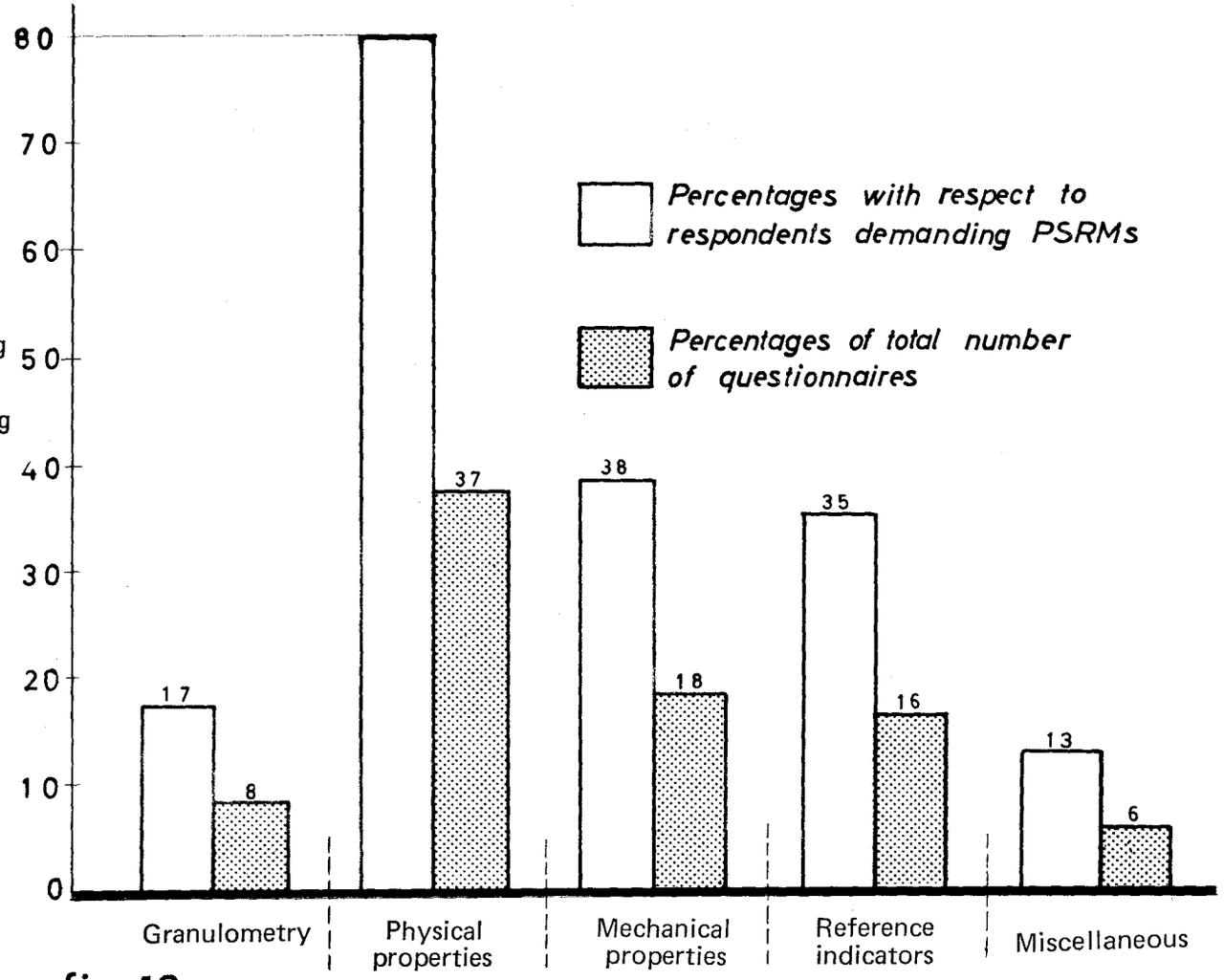


fig. 13

STANDARD REFERENCE MATERIALS WITH CERTIFIED PROPERTIES
Detailed analysis of demands

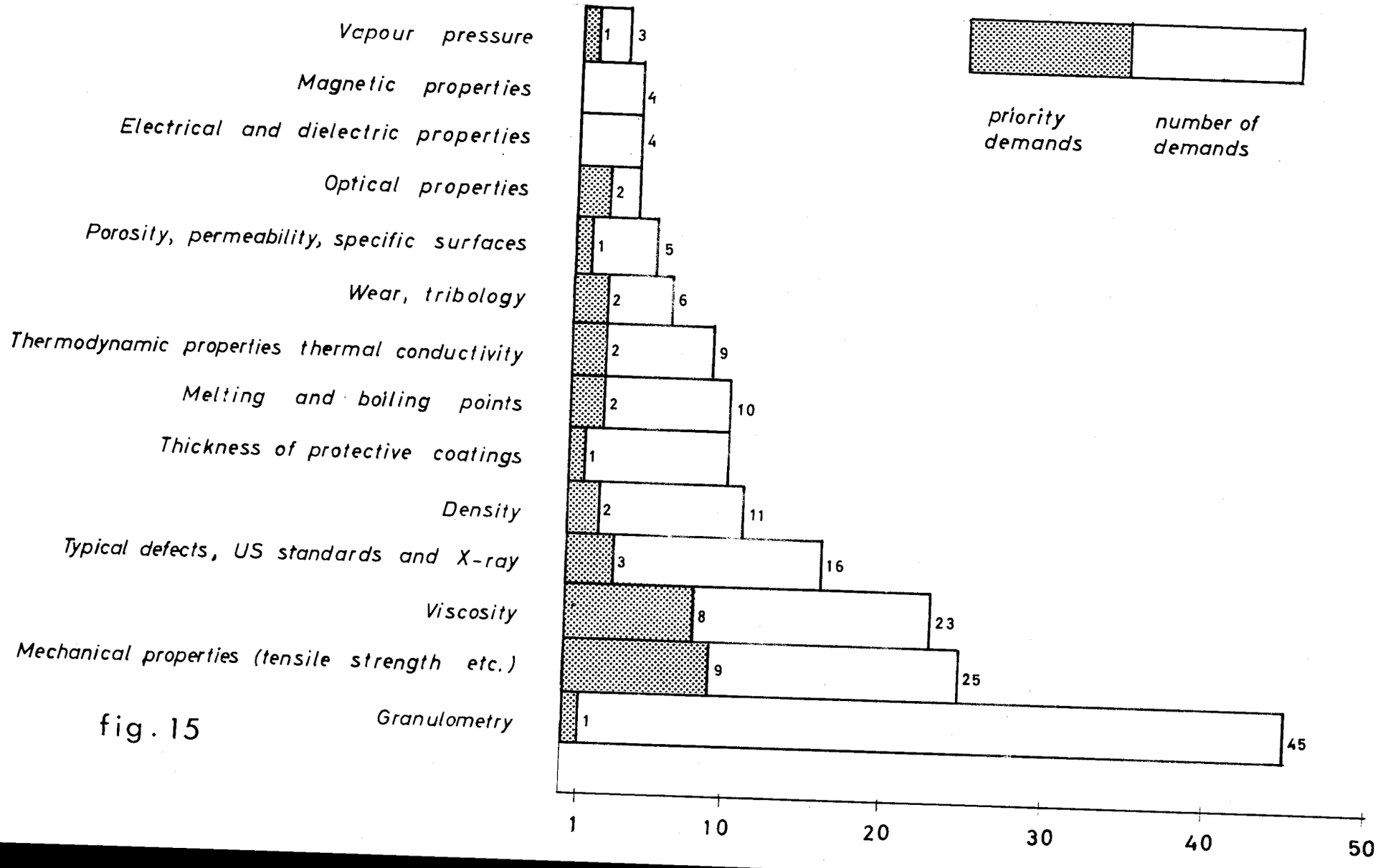


fig. 15

c) In contrast, demand in the metallurgical and processing industries is fairly equally divided among physical and physicochemical properties, mechanical properties and qualitative reference indicators.

Of the 46 % of returns expressing demands for standard reference materials for properties, 17 % gave a more or less detailed specification of the type of PSRM required. Some respondents confined themselves to underlining the property or properties which interested them in the text. Others gave some details on a separate sheet; 8 % also stated their order of priority. An analysis of all this information is given in *figure 15*, which sets out the frequency of demands for standard reference materials with defined properties. The predominance of demands for standard reference materials for particle size distribution will be noted. These are followed in decreasing order by standard reference materials for mechanical properties, viscosity and typical defects. However, the demands for some of these properties extend over exceedingly wide fields.

For viscosity, for instance, they range from light oils of a few cP to glasses of several thousand cP, including in between specific demands for standards at intervals of 100 or 1000 cP. Again, some respondents insist on certification of these properties in different temperature ranges (50 to 250 °C, 600 to 1500 °C).

The principal mechanical properties required are notch toughness, tensile strength, hardness, creep, bending strength, fatigue and compressive strength. In each of these cases, the number of demands is far too small for there to be any question of statistical significance. This applies in practically all cases to the specifications given in relation to defined properties. However, direct contact with the various industries and representative industrial federations have confirmed the validity of these results.

It should also be borne in mind that, as in the case of CSRMs, the data presented in the present Section cannot be weighted and that it is not possible to associate these demands with overall quantitative values based on the following criteria :

— The importance of the originator of the demand within his organization.

— The incidence of the PSRM demanded on production, development or research.

— Anticipated consumption of the PSRM demanded.

Nevertheless, this information constitutes a useful basis for the preparation of a more detailed survey of standard reference materials for certified properties and establishment of priorities in an action programme. On the basis of the 8 % of returns which gave details of priorities and scientific or technical criteria, it has been possible to compile a list of standard reference materials the choice of which is based on :

— chemical stability in time and according to application,

— absence of hazard during handling and storage,

— cost of basic substance.

In conclusion, there is no doubt that PSRMs, for which 46 % of laboratories expressed demands (51 % RS users), constitute an important area for an eventual standard reference material development programme. The main outlines of such a programme are suggested by the present results, which are, however, too incomplete for the details to be filled in. A more specific survey in this field would be extremely useful.

B.4. INTEREST IN PARTICIPATION IN A COORDINATED EUROPEAN-LEVEL PROGRAMME

Readers are reminded that the main purpose of the survey is to evaluate the demand for standard reference materials not at present available on the market, this appraisal possibly being followed by the execution of a suitable programme.

The question arises at what level it is desirable for standard reference materials to be certified. The laboratories' reply is unequivocal Of the 500 SRM users, 395 (79 %) felt that SRMs should be certified internationally. 46 gave detailed grounds in support of this view. There is little variation between sectors in this proportion, which ranges from a minimum of 71 % for the processing industries to a maximum of 88 % for the medical analysis laboratories. Of the 21 % of users who were not in favour of international certification, 92 (18 % of users) expressed no opinion, whilst only 13 (less than 3 %) appear to be opposed to the idea.

The implementation of a programme on a European scale necessarily entails the active collaboration of the laboratories. The last section of the survey analyses the interest shown by laboratories in different modes of participation.

For the sake of simplicity, we distinguish two types of participation :

— services which participating laboratories might contribute (cross-analysis, comparative measurements, provision of basic materials, etc.),

— preparation of the main groups of standard reference materials to whose certification laboratories might contribute (SRMs of certified composition, SRMs with certified physical properties, etc.).

Figure 16, which is in three separate parts, gives a statistical analysis of the replies received.

B.4.1. General aspects

These are dealt with in *figure 16* (upper), which relates the number of laboratories prepared to collaborate to the *total* number of questionnaires received, whether or not users of standard reference materials. Of the total of 550 laboratories which replied to the survey 268 (i.e., nearly half) stated that they were prepared to collaborate in one form of action or another. It should be remembered that the survey covered only a section of the laboratories concerned with standard reference materials, so that the significance of the figure is relative only. 265 laboratories (48 %) would be prepared to participate in a programme of the first type; cooperation in a programme of the second type, however, was a less favoured option (33 %). The most willingness to participate was expressed by the research institutes (68 %) and the medical analysis laboratories (75 %). On the whole, laboratories connected with production showed the least interest. Attention is directed to these figures, which reflect the interest aroused by the survey in scientific and industrial circles.

B.4.2. Types of services offered

This aspect is analysed in *figure 16* (centre). In each sector, the number of laboratories wishing to participate in a specific programme is related in each case to the total number of laboratories in the relevant sector which expressed an interest in cooperating on any one of the programmes.

Cross-analysis and comparative measurements are by far the most popular options for participation in all sectors, with the latter predominating in the processing and pharmaceutical industries and research institutes. Development of measuring techniques comes third and is particularly important in the case of research institutes.

The chemical and pharmaceutical industries, and to a lesser extent the metallurgical industry, would be willing to supply the basic materials and would in principle submit their own SRMs to European certification.

B.4.3. Participation in the preparation of standard reference materials

Figure 16 (lower) analyses the interest of laboratories in the preparation of different types of standard reference materials, on the basis described in the previous Section. As stated, there were fewer replies on this type of participation, and the replies that were forthcoming were in general more reserved.

On average, willingness to participate in the preparation of SRMs of certified composition predominates. The metallurgical industry leads the field here by a considerable margin, followed by pharmaceuticals, chemicals and medical analysis. The processing industry, in contrast, shows little interest in this type of activity.

The preparation of ultra-pure compounds, which have more limited applications, finds some degree of favour with the chemical, petroleum and pharmaceutical industries and with research institutes.

B.4.4. Participation in the preparation of "other SRMs"

With regard to "other" standard reference materials (PSRMs : see Section B.3.), it will be useful to tabulate offers of participation in the preparation of standard reference materials for physical, physicochemical and mechanical properties and qualitative reference indicators, as follows :

		All	ME	PR	CH	PE	PH	FO	MA	RI
Total number of participation offers		268	50	23	48	17	31	9	38	52
Number of participation offers for PSRMs		88 (33)	11 (22)	10 (43)	24 (50)	6 (35)	9 (29)	3 (33)	4 (11)	21 (40)
Number of offers of participation for the groups of SRMs stated	Physical and physicochemical properties	53 (20)	6 (12)	4 (17)	19 (40)	6 (35)	3 (10)	1 (11)	— —	14 (27)
	Mechanical properties	21 (8)	5 (10)	5 (22)	3 (6)	1 (6)	— —	— —	— —	7 (13)
	Qualitative reference indicators	41 (15)	3 (6)	4 (17)	8 (17)	2 (12)	7 (23)	2 (22)	4 (10)	11 (21)

The figures in parentheses are percentages of the total number of participation offers in the relevant sector.

It will be observed that a considerable proportion (33 %) of the participation offers relate to the PSRM field. These offers are headed by the chemical and processing sectors and the research institutes. The largest number of offers relates to SRMs for physical properties, and the second largest to qualitative reference indicators*.

In general, the demands for standard reference materials correlate to some degree with the participation offers. Qualitative reference indicators appear to be an exception, but this is no doubt due to the error in translation mentioned in the footnote; the ratio of participation offers to demands is appreciably higher in this instance than in the other two cases.

* Owing to a translation error in the section on participation of the German version of the questionnaire, the word "indicator" ("témoin") was translated as "comparative measurement". The results for this item are therefore likely to be to a considerable extent invalid.

C. Conclusion

In general, this survey aroused great interest in the scientific and industrial circles approached; by virtue of their scale, many of the sectors concerned are of great economic importance. The disparity of response rates between sectors, and *a fortiori* that between the percentages of SRM users, may be regarded in some cases as a test of "maturity" with regard to the use of standard reference materials.

However, it must be recognized that the task of SRM users, either current or potential, is not always easy, since the sources of supply are both numerous and widely dispersed. It would be in the general interest for a systematic information programme to be undertaken. In spite of the rationalization and in some cases concentration that have taken place in various sectors, contacts between sectors are still infrequent, and the "European" consumer, who is perhaps inadequately organized, has had very little success in making himself heard. Furthermore, the "brand image" of currently available standard reference materials is somewhat tarnished, and complaints are sometimes even voiced about their quality. These criticisms, which are particularly keen in the medical analysis sector, concern all product families alike. Another point worthy of mention is that certain theoretically available standard reference materials are in fact reserved for "clubs", sometimes of a highly exclusive nature, whilst others are supplied in infinitesimal quantities and with excessive periods of delivery.

An analysis of results shows that the demand for both new and improved products is considerable. Specific snap surveys (by questionnaire and by interview) undertaken in various sectors show that after elimination of "false demands", the list of new products needed on a priority basis is still very long. This situation is not peculiar to Europe : the US National Bureau of Standards, in spite of its substantial resources, has difficulty in keeping up with the growth of demand of SRM users in the United States.

Although the number of standard reference materials available probably runs into thousands, very few of them are to our knowledge certified internationally. Yet the vast majority of users emphasize the value of being able to obtain such substances. They also state that a larger number of internationally recognized methods should be available. However, we have not analysed this aspect of the problem since it does not fall within the terms of standard reference materials of this survey, but it would be worth while to take it up at a future date.

On taking cognizance of these results and without waiting for publication of this report, the Commission, assisted by the Consultative Group mentioned earlier and with the aid of specialized working groups made up of national experts, embarked on a more detailed study of the information obtained and outlined a programme to be set in train.

In consequence, work is now in hand on the compilation of an initial version of a general catologue of available standard reference materials and the first elements of a European "concerted action" to fill some of the most serious gaps have been formulated.

Obviously, the work initiated by the present survey will bear fruit only if followed up. The Commission of the European Communities hopes that it will be able to expand, bring forward and broaden the scope of its action in this field. A positive outcome will be assured only with the support and active participation of all concerned.

ANNEXES

— List of the experts of the Consultative Group on "Standard Reference Materials and Methods"

— Questionnaire employed in the general survey on the need of Standard Reference Material

LIST OF THE EXPERTS OF THE CONSULTATIVE GROUP ON "STANDARD REFERENCE MATERIALS AND METHODS"

BELGIQUE — BELGIË

Monsieur CLAESEN
Directeur Métrologiste en Chef
Ministère des Affaires Economiques
26, Rue De Mot
1040 BRUXELLES

Monsieur HANS
Centre National de
Recherches Métallurgiques
Abbaye du Val Benoît
4000 LIEGE

DEUTSCHLAND

Herr Prof. Dr. Gerhard Wilhelm BECKER
Vizepräsident Bundesanstalt für
Materialprüfung
Unter den Eichen 87
BERLIN 45

Herr Prof. Dr. H. KIENITZ
Direktor der Badische Anilin- und
Soda-Fabrik AG
6700 LUDWIGSHAFEN

Herr Prof. Dr. R. TAUBERT
Physikalisch-Technische
Bundesanstalt
Abteilung 6
Bundesallee 100
33 BRAUNSCHWEIG

FRANCE

Monsieur G. DENEGRE
Secrétaire Général du Bureau
National de la Métrologie
1, Rue Montgolfier
75 PARIS-3e

Monsieur J. HURE
Chef du Service d'Etudes
Chimiques et d'Analyse C.E.A.
B.P. N° 6
92 FONTENAY-aux-ROSES

Monsieur DOUILLET
Ingénieur en Chef de l'Armement
Délégation Générale à la Recherche
Scientifique et Technique
103, Rue de l'Université
75 PARIS-7e

Monsieur LALANNE
Ministère de la Santé Publique
Service Central de la Pharmacie et
des Médicaments
97, Blvd. Montparnasse
75 PARIS-6e

GRAND-DUCHE DE LUXEMBOURG

Monsieur A. WAGNER
Chef de Service de Laboratoire
ARBED Division d'Esch-Belval
ESCH-SUR-ALZETTE

ITALIA

Prof. L. GIUFFRÉ
Istituto di Chimica Industriale
Politecnico di Milano
Piazza L. da Vinci
MILANO

Prof. C. MASI
Direttore Centro Sperimentale
Metallurgico
Via di Castel Romano
00129 ROMA

Prof. M. DE MALDÉ
Direttore Laboratori Riuniti
Studi e Ricerche
ENI-SNAM PROGETTI
20097 SAN DONATO MILANESE

NEDERLAND

De Heer Oud-Directeur Ir. J.M. MADSEN
Nederlands Normalisatie Instituut
Winkelstede 22
DEN HAAG

De Heer G.J. VAN KOLMESCHATE
Analytisch Centrum
Centraal Laboratorium TNO
Tak van Poortvlietstraat 7
DELFT

De Heer Dr. W.J.A. PALM
Ministerie van Economische Zaken
Bezuidenhoutseweg 30
DEN HAAG

COMMISSION DES COMMUNAUTES EUROPEENNES
Direction Générale du
Centre Commun de Recherche

ISPRA, le

Messieurs,

Suite aux résolutions du Conseil des Ministres des Communautés Européennes des 13/10 et 17/12/70, la Commission a pris l'initiative de lancer une enquête sur les besoins en substances de référence (S.R.). Cette enquête s'adresse donc plus particulièrement aux services de recherche, d'analyse et de contrôle. Elle se déroule dans les six pays de la Communauté, en parallèle avec une enquête nationale sur les substances de référence existantes; sa réalisation a été confiée à la Direction Générale du Centre Commun de Recherche.

Vous avez été choisis, dans le cadre du plan de sondage élaboré par notre organisme en collaboration avec diverses fédérations professionnelles pour participer à cette enquête. Le questionnaire couvrant plusieurs secteurs d'activité, nous vous demandons de bien vouloir répondre aux seules questions vous concernant.

Soucieux de ne pas trop alourdir un questionnaire déjà volumineux nous n'avons pas cherché à être exhaustifs vous laissant le choix d'ajouter les détails complémentaires les plus significatifs. Nous souhaiterions également vous voir établir, chaque fois que cela vous sera possible, une liste des caractéristiques précises des substances de référence que vous désireriez trouver sur le marché.

Au cas où cette enquête mettrait en évidence des lacunes significatives, la Commission, appuyée par un Groupe Consultatif constitué d'experts des Etats Membres (*), proposera au Conseil des Ministres une action en vue de les combler.

Cette action s'appuiera sur le potentiel existant dans les six pays de la Communauté, c'est-à-dire qu'un large appel sera lancé aux organismes nationaux publics et privés.

C'est pourquoi la dernière partie de notre questionnaire vise à dresser une première liste des entreprises et laboratoires désireux de s'associer à cette action.

Les questionnaires seront traités comme des documents confidentiels et seuls les résultats d'ensemble seront publiés.

Pour toute autre information, nous vous prions de bien vouloir vous mettre en rapport avec:

Monsieur Henri LAURENT
EURATOM - C.C.R.
21020 - ISPRA (Varese)
Italie

Les questionnaires remplis, assortis, s'il y a lieu, des annexes complémentaires seront à retourner à la même adresse.

En vous remerciant par avance, veuillez agréer, Messieurs, l'assurance de nos sentiments distingués.

Pour la Direction Programmation

(*) Vous trouverez ci-joint la liste des experts nationaux.

COMMISSION DES COMMUNAUTES EUROPEENNES
Direction Générale du Centre
Commun de Recherche

ENQUETE SUR LES BESOINS EN SUBSTANCE DE REFERENCE (S.R.)

PREAMBULE

On entend par substance de référence (S.R.) toute substance bien définie susceptible d'être utilisée pour l'étalonnage d'un système de mesure ou pour l'obtention de données scientifiques et techniques pouvant se référer à une base commune.
« Bien définie » signifie que toute caractéristique certifiée de cette substance a été déterminée par deux ou plusieurs méthodes indépendantes ou, tout au moins pour les systèmes bien établis, par une seule méthode dont la fiabilité est parfaitement connue et l'erreur systématique faible par rapport au degré de précision requis.

Les caractéristiques susceptibles d'être certifiées étant très diverses, nous limitons essentiellement la présente enquête aux substances de référence **de composition et/ou de pureté certifiée** (S.R.C.), base d'étalonnage des instruments et méthodes d'analyse.

Le questionnaire rempli est à renvoyer à :

Monsieur Henri LAURENT
EURATOM – CCR
21020 ISPRA (Varese)
Italie

CONFIDENTIEL

QUESTIONNAIRE

Remarque : Nous vous demandons de placer une croix dans les carrés correspondant à vos réponses, sauf en page 2 où nous vous demandons des quantités à la question 1.2.

VOLET I

IDENTIFICATION DE L'ORGANISME/ENTREPRISE

1. Nom de l'organisme (entreprise) interrogé :

   – Adresse du siège social :

2. Nom et adresse du laboratoire ayant répondu :

   – Nom de son responsable :

3. Nom et adresse de la Division à laquelle appartient le Laboratoire :

   – Nom de son responsable :

4. Types et importance relative, des activités du laboratoire/division ayant répondu :

		Essentielle	Moyenne	Secondaire
4.1.	Contrôle de qualité	☐	☐	☐
4.2.	Contrôle de fabrication	☐	☐	☐
4.3.	Développement de méthodes d'analyse	☐	☐	☐
4.4.	Développement de méthodes de mesure	☐	☐	☐
4.5.	Recherche appliquée (au sens large)	☐	☐	☐
4.6.	Recherche fondamentale	☐	☐	☐
* 4.	.....	☐	☐	☐
4.	.....	☐	☐	☐

* à préciser

Secteur

Pays

VOLET II

SUBSTANCES DE REFERENCE DE COMPOSITION CERTIFIEE (S.R.C.)

1. GENERALITES

1.1. Votre organisme/entreprise utilise-t-il ou compte-t-il utiliser, en particulier dans ses laboratoires de recherches, d'analyse et de contrôle, des « S.R.C. » de composition et/ou de pureté certifiée ?

OUI ☐ NON ☐

1.2. Dans l'affirmative pouvez-vous indiquer l'origine de ces « S.R.C. » ?
leur nombre pour chaque source d'approvisionnement et leur consommation annuelle en précisant l'unité.

		Nombre	Consommation	
1.2.1.	Fabrication propre			
1.2.2.	National Bureau of Standards (NBS)			
1.2.3.	Bureau of Analysed Samples (BAS)			
1.2.4.	Bundesanstalt für Materialprüfung (BAM)			
1.2.5.	U.S. Pharmacopea			
1.2.6.	Food and Drug Administration (FDA)			
1.2.7.	World Health Organization (WHO)			
1.2.8.	Groupement pour l'Avancement des Méthodes Spectrographiques (GAMS)			
1.2.9.	Institut de Recherches de la Sidérurgie (IRSID)			
1.2.10.	Centre National de Recherches Métallurgiques (CNRM)			
	Autres Organismes (publics ou privés)			
1.2.	.....			
1.2.	.....			
1.2.	.....			
1.2.	.....			
1.2.	.....			
1.2.	.....			

1.3. Pour ces « S.R.C. » quels sont, par ordre de priorité, vos critères de choix ?

		Essentiel	Important	Secondaire	
1.3.1.	L'exactitude (titre exact)	☐	☐	☐	
1.3.2.	La précision (reproductibilité, constance de qualité)	☐	☐	☐	
1.3.3.	La facilité d'approvisionnement	☐	☐	☐	
1.3.4.	Le coût	☐	☐	☐	
1.3.5.	La stabilité et/ou la facilité de conservation	☐	☐	☐	
1.3.6.	La facilité d'utilisation (formes physiques, chimiques, géométriques)	☐	☐	☐	
* 1.3.	.....	☐	☐	☐	
1.3.	.....	☐	☐	☐	
1.3.	.....	☐	☐	☐	
1.3.	.....	☐	☐	☐	

1.4. Estimez-vous que, les « S.R.C. » actuellement disponibles, répondent à vos critères de choix ?

OUI ☐ NON ☐ PARTIELLEMENT ☐

1.5. En cas de réponse négative ou partiellement négative pouvez-vous préciser par ordre d'importance, les critères qui paraissent insuffisamment satisfaits :

.....

.....

.....

.....

* à préciser

2. BESOINS EN « S.R.C. » NOUVELLES ET/OU AMELIOREES

2.1. La gamme des « S.R.C. » actuellement disponibles couvre-t-elle tous vos besoins actuels ou prévisibles ?

OUI ☐ NON ☐ PARTIELLEMENT ☐

2.1.1. En cas de réponse positive reprendre le questionnaire page 12.

2.1.2. En cas de réponse négative ou partiellement négative, veuillez indiquer dans les pages de couleur suivantes :

Produits Métallurgiques	(Havane A.)
Produits Chimiques Inorganiques	(Bleu B.)
Produits Chimiques Organiques	(Vert C.)
Produits Pharmaceutiques	(Jaune D.)
Produits Alimentaires	(Orange E.)
Analyse Clinique	(Rouge F.)

- *Les sous-secteurs d'activité pour lesquels ces « S.R.C. » vous sont en général les plus nécessaires, en précisant pour chaque secteur les 2 ou 3 problèmes les plus importants.*

- *Les techniques analytiques qui sont, en fonction de vos besoins, les plus démunies, en rajoutant, s'il y a lieu, les techniques propres à votre secteur que nous aurions pu omettre.*

- *La gamme de concentration des éléments et/ou composés intéressants.*

- *L'ordre de grandeur de vos prévisions de consommation annuelle de « S.R.C. » améliorées ou nouvelles en précisant pour chaque sous-secteur, l'unité utilisée.*

- *En outre, nous vous demandons de fournir éventuellement en annexe à votre réponse, si vous n'avez pas trouvé la rubrique qui vous intéresse ou l'espace suffisant, une liste donnant les précisions suivantes : nature de la matrice, gamme de concentration des éléments et composés intéressants, consommation annuelle, forme physique, autres problèmes intéressant les sous-secteurs, etc . . .*

- *La page 5 constitue un exemple réduit concernant les produits métallurgiques.*

A. « S.R.C. » POUR PRODUITS METALLURGIQUES (Y COMPRIS ALLIAGES)

Exemple : La société ayant rempli ce tableau traite des métaux non ferreux.
Elle désirerait :

1 Des « S.R.C. » améliorées et nouvelles pour traiter des problèmes d'impuretés dans les non ferreux usuels par les méthodes spectrographie d'émission et absorption X.

2 Des « S.R.C. » nouvelles pour traiter des problèmes d'impuretés métalliques et de gaz, dans des métaux réfractaires par les méthodes — Analyse des Gaz — Spectrographie d'Emission — Spectrophotométrie de flamme — Absorption, fluorescence X.

3 Des « S.R.C. » nouvelles pour traiter des problèmes de minéraux non ferreux par méthode gravimétrique, titrimétrique, méthodes électrochimiques.

01 Analyse élémentaire	02 Gravimétrie, Titrimétrie, Méthodes Electrochimiques	03 Analyse des gaz	04 Spectrographie d'émission	05 Spectrophotométrie de flamme	06 Absorption, Fluorescence X	07 Spectrographie de masse	SOUS SECTEURS	S.R.C. A AMELIOREES	S.R.C. N NOUVELLES	CONCENTRATION > 1 %	CONCENTRATION 0.001 - 1 %	CONCENTRATION 1 - 10 PPM	CONCENTRATION < PPM	PREVISION DE CONSOMMATION ANNUELLE, ORDRE DE GRANDEUR. PRECISER L'UNITE.
							A01. FERREUX (fer, fonte, aciers)							
			X		X		A02. NON FERREUX USUELS (Cu, Pb, Sn, Zn, . . .) 1. Alliages : impuretés introduites 2. impuretés soumises à cahier de charge	X	X	X	X			
							A03. NON FERREUX LEGERS (Al, Mg, Be, Ti, . . .)							
		X	X	X	X		A04. REFRACTAIRES (W, Nb, Ta, . . .) 1. Impuretés métalliques 2. Gaz		X			X		1 Kg
							A05. SEMI-CONDUCTEURS (Ge, Si, . . .)							
							A06. METAUX PRECIEUX							
	X						A07. MINERAIS 1. Non ferreux		X	X	X			500 gr
							A08. SOUS-PRODUITS							
							A09. ALLIAGES COMPOSITES (phase dispersée, fibreux . . .)							
							A.							
							A.							
							A.							

METHODES D'ANALYSE

A. « S.R.C. » POUR PRODUITS METALLURGIQUES (Y COMPRIS ALLIAGES)

01 Analyse élémentaire	02 Gravimétrie, titrimétrie, méthodes électrochimiques	03 Analyse des gaz	04 Spectrographie d'émission	05 Spectrophotométrie de flamme (émission, absorption, fluorescence)	06 Absorption et fluorescence X	07 Spectrographie de masse	08 Méthodes chromatographiques	09 Analyse par activation	15 Spectrophotométrie	20 Microsonde et analyseur ionique	21 Diffraction X	25 Comptage particules, granulométrie.			Nous vous demandons de mettre une croix à l'intersection des colonnes (méthodes d'analyse) et des lignes (sous secteurs) (il peut exister plusieurs méthodes pour un même secteur) ainsi que dans les cases correspondantes aux rubriques « S.R.C. et Concentration ». SOUS SECTEURS	S.R.C. A. AMELIOREES	S.R.C. N. NOUVELLES	CONCENTRATION > 1 %	CONCENTRATION 0. 001 - 1 %	CONCENTRATION 1 - 10 PPM	CONCENTRATION < PPM	PREVISION DE CONSOMMATION ANNUELLE, ORDRE DE GRANDEUR. PRECISER L'UNITE.
															A01. FERREUX (fer, fonte, aciers)							
															A02. NON FERREUX USUELS (Cu, Pb, Sn, Zn, . . .)							
															A03. NON FERREUX LEGERS (Al, Mg, Be, Ti, . . .)							
															A04. REFRACTAIRES (W, Nb, Ta, . . .)							
															A05. SEMI-CONDUCTEURS (Ge, Si, . . .)							
															A06. METAUX PRECIEUX							
															A07. MINERAIS							
															A08. SOUS-PRODUITS							
															A09. ALLIAGES COMPOSITES (phase dispersée, fibreux, . . .)							
															A							
															A.							
															A.							

METHODES D'ANALYSE

B. « S.R.C. » POUR PRODUITS CHIMIQUES INORGANIQUES

01 Analyse élémentaire	02 Gravimétrie, titrimétrie, méthodes électrochimiques	03 Analyse des gaz	04 Spectrographie d'émission	05 Spectrophotométrie de flamme, (émission absorption, fluorescence)	06 Absorption et fluorescence X	07 Spectrographie de masse	08 Méthodes chromatographiques	09 Analyse par activation	15 Spectrophotométrie	20 Microsonde et analyseur ionique	21 Diffraction X	25 Comptage particules, granulométrie.			Nous vous demandons de mettre une croix à l'intersection des colonnes (méthodes d'analyse) et des lignes (sous secteurs) (il peut exister plusieurs méthodes pour un même secteur) ainsi que dans les cases correspondantes aux rubriques « S.R.C. et Concentration ». SOUS SECTEURS	S.R.C. AMELIOREES A	S.R.C. NOUVELLES N	CONCENTRATION > 1 %	CONCENTRATION 0.001 - 1 %	CONCENTRATION 1 - 10 PPM	CONCENTRATION < PPM	PREVISION DE CONSOMMATION ANNUELLE, ORDRE DE GRANDEUR. PRECISER L'UNITE.
															B01. ELEMENTS ET/OU COMPOSES							
															B02. MATERIAUX REFRACTAIRES ET CERAMIQUES usuels (briques) avancés (oxydes, carbures, nitrures, . . .)							
															B03. ENGRAIS CHIMIQUES simples (N, P, K) composés							
															B04. VERRES ordinaires spéciaux (optiques)							
															B05. CIMENTS							
															B06. PIGMENTS							
															B07. GAZ PURS ET LEURS MELANGES							
															B.							
															B.							
															B.							
															B.							
															B.							

C. « S.R.C. » POUR PRODUITS CHIMIQUES ORGANIQUES

01 Analyse élémentaire	02 Gravimétrie, titrimétrie, méthodes électrochimiques	03 Analyse des gaz	04 Spectrographie d'émission	05 Spectrophotométrie de flamme (émission, absorption, fluorescence)	06 Absorption et fluorescence X	07 Spectrographie de masse	08 Méthodes chromatographiques	09 Analyse par activation	15 Spectrophotométrie (U.V. - visible - I.R. - Raman-Fluorescence) - RMN	Propriétés physiques						SOUS SECTEURS	S.R.C. A AMELIOREES	S.R.C. N NOUVELLES	CONCENTRATION % EN POURCENT	CONCENTRATION PPM EN PPM	CONCENTRATION PPB EN PPB	PREVISION DE CONSOMMATION ANNUELLE, ORDRE DE GRANDEUR. PRECISER L'UNITE.
																C01. SUBSTANCES PURES						
																C02. SOLVANTS						
																C03. COLORANTS INDUSTRIELS						
																C04. PRODUITS PETROLIERS Essences Additifs Lubrifiants						
																C05. POLYMERES (macromolécules)						
																C06. ELASTOMERES						
																C07. SEMI-PRODUITS POUR MATIERES PLASTIQUES						
																C08. COMPOSES ORGANO-METALLIQUES						
																C09. PESTICIDES (insecticides, fongicides, herbicides)						
																C10. DETERGENTS						
																C11. GAZ PURS ET LEURS MELANGES						
																C.						

Nous vous demandons de mettre une croix à l'intersection des colonnes (méthodes d'analyse) et des lignes (sous secteurs) (il peut exister plusieurs méthodes pour un même secteur) ainsi que dans les cases correspondantes aux rubriques « S.R.C. » et « Concentration ».

D. « S.R.C. » POUR PRODUITS PHARMACEUTIQUES

01 Analyse élémentaire	02 Gravimétrie, titrimétrie, méthodes électrochimiques	04 Spectrographie d'émission	05 Spectrophotométrie de flamme (émission, absorption, fluorescence)	07 Spectrographie de masse	08 Méthodes chromatographiques	15 Spectrophotométrie (U.V. - visible - I.R-Raman-fluorescence) - RMN	« Tests » biologiques	« Tests » toxicologiques	Propriétés physiques						Nous vous demandons de mettre une croix à l'intersection des colonnes (méthodes d'analyse) et des lignes (sous secteurs) (il peut exister plusieurs méthodes pour un même secteur) ainsi que dans les cases correspondantes aux rubriques « S.R.C. et Concentration » Voir également C. (couleur verte) - Produits Chimiques Organiques SOUS SECTEURS	S.R.C.		CONCENTRATION			PREVISION DE CONSOMMATION ANNUELLE, ORDRE DE GRANDEUR. PRECISER L'UNITÉ
																A AMELIOREES	N NOUVELLES	% EN POURCENT	PPM EN PPM	PPB EN PPB	
															D01. STEROIDES						
															D02. VITAMINES						
															D03. ENZYMES						
															D04. ANTIBIOTIQUES						
															D05. BARBITURIQUES						
															D06. VACCINS–SERUMS						
															D07. EXTRAITS D'ORGANES						
															D08. EXCIPIENTS						
															D.						
															D.						
															D.						
															D.						

E. « S.R.C. » POUR PRODUITS ALIMENTAIRES

01 Analyse élémentaire	02 Gravimétrie, titrimétrie, méthodes électrochimiques	04 Spectrographie d'émission	05 Spectrophotométrie de flamme (émission, absorption, fluorescence)	07 Spectrographie de masse	08 Méthodes chromatographiques	15 Spectrophotométrie (U.V. - visible - I.R.-Raman - Fluorescence) - RMN	« Tests » biologiques	« Tests » toxicologiques							SOUS SECTEURS	S.R.C. A AMELIOREES	S.R.C. N NOUVELLES	CONCENTRATION % EN POURCENT	CONCENTRATION PPM EN PPM	CONCENTRATION PPB EN PPB	PREVISION DE CONSOMMATION ANNUELLE, ORDRE DE GRANDEUR. PRECISER L'UNITE
															E01. EDULCORANTS						
															E02 AROMATISANTS						
															E03. COLORANTS						
															E04. AGENTS DE CONSERVATION						
															E05. VITAMINES						
															E06. ENZYMES						
															E07. PESTICIDES						
															E08. ANTIBIOTIQUES						
															E.						
															E.						
															E.						
															E.						

Nous vous demandons de mettre une croix à l'intersection des colonnes (méthodes d'analyse) et des lignes (sous secteurs) (il peut exister plusieurs méthodes pour un même secteur) ainsi que dans les cases correspondantes aux rubriques « S.R.C. et Concentration »

Voir également C. (couleur verte) - Produits Chimiques Organiques
et D. (couleur jaune) — Produits Pharmaceutiques

PROBLEMES PARTICULIERS

F. « S.R.C. » POUR ANALYSE CLINIQUE

Nous vous demandons de mettre une croix à l'intersection des colonnes (problèmes particuliers) et des lignes (sous secteurs) ainsi que dans la case correspondante à « S.R.C. ».

SOUS SECTEURS	S.R.C. AMELIOREES A	S.R.C. NOUVELLES N				PREVISION DE CONSOMMATION ANNUELLE, ORDRE DE GRANDEUR. PRECISER L'UNITE
F01. Produits biologiques (sérum, urine, etc . . .) de concentration définie (normale ou pathologique) pour un ou plusieurs éléments.						
F02. Anti-sérums spécifiques pour biochimie, bactériologie et hématologie.						
F03. Solutions étalons de produits biologiques définis.						
F04. Suspensions étalons pour comptage de globules sanguins.						
F05. Produits biologiques purs pour analyses biochimiques, enzymatiques, etc (thromboplastine, fibrinogène, stéroides, enzymes, etc . . .).						
F06. Antigènes pour bactériologie et sérologie.						
F07. Produits pour techniques immunologiques (immunohématologie, immunoélectrophorèse, immunofluorescence).						
F.						
F.						
F.						
F.						
F.						

VOLET III

AUTRES TYPES DE « S.R.»

1. Dans le cadre des diverses activités de votre organisme (entreprise) êtes-vous intéressés à d'autres types de « S.R. », notamment celles liées aux **propriétés** des matériaux et des structures ?

   OUI ☐ NON ☐ SANS OPINION ☐

2. Dans l'affirmative, pourriez-vous indiquer quels sont les types de « S.R. » qu'il paraitrait opportun de développer ?

   2.1. « S.R. » de propriétés physiques et physico-chimiques (par ex. densité, viscosité, conductibilité thermique, résistivité, friction interne, compatibilité, propriétés thermodynamiques . . .) ☐

   2.2. « S.R. » de propriétés mécaniques (par ex. traction, fluage, fatigue, résilience, usure . . .) ☐

   2.3. Témoins qualitatifs de référence (défauts-types, couches protectrices, corrosion . . .) ☐

   Autres types, à préciser :

   2. . . . . ☐

   2. . . . . ☐

   2. . . . . ☐

3. Etes-vous en mesure de préciser, dès maintenant, quelles sont les « S.R. » qu'il vous parait urgent de développer ?

   OUI ☐ NON ☐ A ETUDIER ☐

4. Si oui, voulez-vous avoir l'obligeance de donner leurs spécifications ?

5. Pensez-vous à d'autres domaines qui requièrent des méthodes de mesure standardisées et des « S.R. » par exemple : hygiène du milieu (air, eau, . . .)

VOLET IV

INTERET VIS-A-VIS D'UNE ACTION COORDONNEE EN MATIERE DE « S.R. »

1. Vous parait-il souhaitable de disposer de « S.R. » reconnues à l'échelle internationale, bases de mesure plus aisément comparatives ?

OUI ☐ NON ☐ SANS OPINION ☐ ⌊__⌋

— Observations :

2. Pensez-vous que votre organisme (entreprise) serait, **en principe** dans le cadre d'une action coordonnée à l'échelle des Six Pays du Marché Commun, disposé à participer aux activités spécifiées aux points 3 et 4 ci-après ?

OUI ☐ NON ☐ SANS OPINION ☐ ⌊__⌋

Quelle est la personne (nom et fonction) à laquelle il faudrait s'adresser pour discuter les modalités d'une participation.

3. Si oui, à quelle activité pourriez-vous apporter votre collaboration :

3.1.	Participation à des analyses circulaires	☐	☐
3.2.	Participation à des mesures comparatives	☐	☐
3.3.	Participation à la mise au point de méthodes de mesure	☐	☐
3.4.	Fourniture et/ou fabrication de matériaux de base pour « S.R. »	☐	☐
3.5.	Soumission de vos « S.R. » propres à des mesures comparatives en vue d'une « certification » officielle	☐	☐
3.6.	Utilisation de vos circuits commerciaux pour l'écoulement de ces « S.R. »	☐	☐
	Autres		
3.	.....	☐	☐
3.	.....	☐	☐

4. A l'élaboration de quels types de « S.R. » pourriez-vous collaborer en principe ?

4.1.	Eléments et/ou composés ultra purs	☐	☐
4.2.	« S.R. » ou échantillons types de composition certifiée	☐	☐
4.3.	« S.R. » de propriétés physiques et physico-chimiques	☐	☐
4.4.	« S.R. » de propriétés mécaniques	☐	☐
4.5.	Témoins qualitatifs de référence	☐	☐
	Autres		
4.	.....	☐	☐
4.	.....	☐	☐

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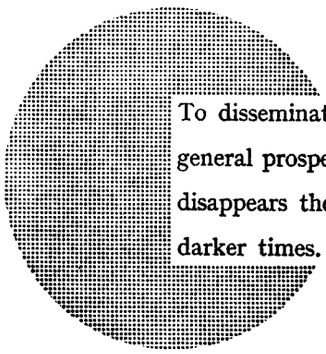

To disseminate knowledge is to disseminate prosperity — I mean general prosperity and not individual riches — and with prosperity disappears the greater part of the evil which is our heritage from darker times.

Alfred Nobel

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