ORIENTATIONS AND ACTIONS OF THE EUROPEAN COMMUNITY IN THE ASSESSMENT AND PREVENTION OF INDOOR AIR POLLUTION

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The European Community (EC) is undertaking at different levels a variety of activities regarding indoor air quality:

Research on indoor air quality is carried out at the Commission's Joint Research Centre (JRC) since 1981: objectives are to increase the knowledge of organic pollutant concentrations in indoor spaces, to develop adequate analytical techniques and to study the emission of such pollutants from materials and products used indoors.

European co-operation in the field of indoor air qualitiy has been developed through COST*) project 613 "Indoor Air Quality and Its Impact on Man", which aimes at sharing, developing and disseminating scientific knowledge and preparing the basis for potential regulatory actions.

Several EC regulations have already been issued regarding or including aspects of indoor air quality: Directive 89/106 on the approximation of laws related to contruction materials offers a framework for the definition of essential requirements regarding hygienic properties of these materials. A first requirement under consideration is the limitation of formaldehyde emission from wood based panels. Two directives (89/622) regard smoking. They prescribe the labelling of tobacco products with warning messages and limit the tar content of cigarettes.

The European Parliament recently approved a Resolution on indoor air quality, requesting to consider with greater attention this topic and demanding the Commission to present a specific directive on the subject.

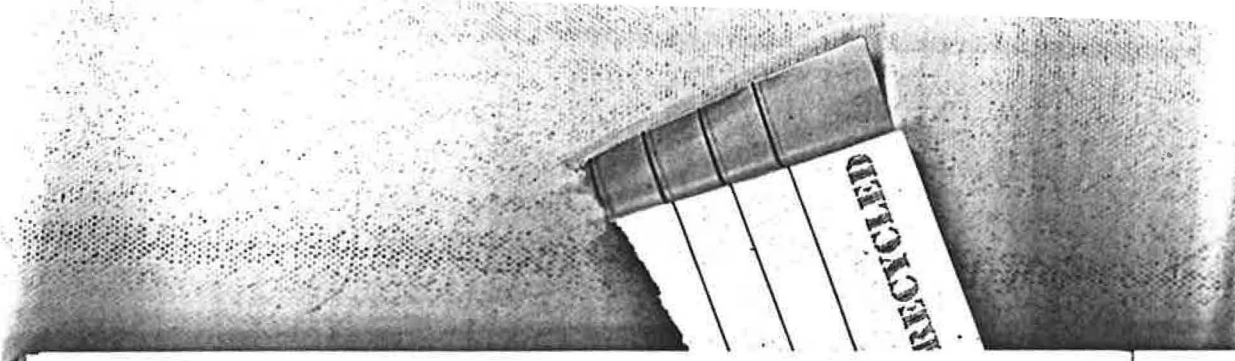
INTRODUCTION

Research activities of the Commission of the European Communities have been developed since 1981 by Directorate-General XII (Science, Research and Development) through its Joint Research Centre (Ispra).

Policy and regulatory actions on IAQ are being started by various Commission Services:

- Directorate-General XI (Environment, Nuclear Safety and Civil Protection) is charged "to define and implement preventive measures against indoor pollution from a growing number of substances";
- Directorate-General III (Internal Market and Industrial Affairs) is in charge of regulating hygienic properties of building materials;

*) for explanation see page 2



- Directorate-General V (Employment and Social Affairs) is in charge of Community actions against smoking and its consequences.
- The Consumer Protection Service is preparing a new action program which may consider the impact of consumer products on indoor air quality.

In the following the various activities and tasks are briefly described.

RESEARCH ACTIVITIES

As explicitely stated in the 4th "Policy and Action Programme on the Environment (1987-1992)" of the European Community, approved by the Council of Ministers on 19 October 1987, scientific research is an essential preparatory activity for almost any political action in the field of environmental protection. Moreover, under the title "actions in specific sectors, atmospheric pollution" the program specifies that a major objective of an overall longer-term strategy to reduce air pollution is "to identify the atmospheric pollutants (outdoor and indoor)...of greatest concern from the standpoint of the protection of human health".

Research supporting the environmental policy of the Community may be carried out within three different frames:

- in-house or "direct" research performed at the Joint Research Centre either within the frame of its specific multiannual research programmes or, as contract research, on request of other Commission services;
- contract or shared cost research performed in the Member Countries and co-financed by the Commission within the frame of multiannual research action programmes and
- concerted actions, which implement a co-operation at Community level among national research institutions in specific research areas which are also defined in the multiannual research action programme. The financial contribution of the Commission to concerted actions covers only expenses for a secretariat and for the organization of meetings.

European non-member countries may participate in the research action programme (shared cost research and concerted actions) via an agreement with the EC. They have also the possibility to participate in selected concerted actions in the COST frame. COST ("CO-opération européenne dans le domaine de la recherche Scientifique et Technique") is the name of a co-operation agreement between all European OECD Countries and the European Community (EC). Community concerted actions are becoming category A COST projects as soon as a COST country which is not EC member state is participating in it. (Category B COST projects are those developed and decided in the COST frame and which may or may not be included in the Commission's research action program.)

For the time being IAQ research has been implemented at Community level as in-house research and as a concerted action which has already become a category A COST project. Both are briefly described.

Research carried out at the JRC

Studies on indoor air pollution by organic chemicals started at the Ispra Establishment of the Joint Research Centre in 1981, with the scope of gaining knowledge on the actual concentrations of these compounds in indoor spaces and of developing proper analytical methods for such investigations. This research action is continuing and now part of the activity of the JRC's Institute for the Environment. Presently it addresses mainly the emission of volatile organic compounds (VOC) from building-furnishing materials and from household products.

The following studies have been performed :

- field studies: contribution of micro-environments to 24 hour exposure of a pupil to VOC (March 1981); analysis of aldehydes and other VOC present in different indoor spaces (15 homes indoors and outdoors in 1983-84), pentachlorophenol in homes and in a tannery (1985), semi-volatile and particulate organic matter in a home sample (1985), aldehydes and other VOC in the buildings of the European Parliament (1986-88);
- emission studies: headspace and chamber measurements of aldehydes and VOC emitted from building/furnishing materials and household products (since 1985); aldehydes and ketones in mainstream (active) and sidestream (passive) cigarette smoke (1987);
- methods development: development and testing of analytical and characterization methods, including the organization of and participation in interlaboratory comparisons (determination of aldehydes and ketones, diffusion or passive sampling of VOC, characterization of VOC emissions);
- biological effects: bioassays for mutagenicity on bacteria and mice to evidence genotoxicity of pollutants relevant in indoor air; on mice also *in vitro* and *in vivo* measurements to investigate embryotoxic effects of methylglyoxal and acetaldehyde .

COST project 613: "Indoor Air Quality and Its Impact on Man"

The most important activity in the field of IAQ at Community level is the concerted action "Indoor Air Quality and Its Impact on Man" which is part of the Community multiannual research programme for the protection of the environment (1986-1990) and has been approved in June 1986. The Concertation Committee met for the first time in March 1987. The concerted action has become COST project 613/1 through the association of Sweden and Switzerland. Norway and Finland are on the way to join the concerted action. The Institute for the Environment of the Joint Research Centre acts as leader of the project.

The scope of COST project 613/1 is to answer the question of which consequences for human health and comfort derive from air pollution existing in non industrial indoor environments (homes, schools, offices, etc.).

COST project 613/1 has the following objectives:

- identification and characterization of pollutants and sources
- assessment of population exposure
- assessment of health effects
- development and validation of reference methods
- collation synthesis and dissemination of data

The co-operation is implemented through a Concertation Committee composed of members of all participating countries, the Secretariat and through working groups (WGs). For the time being the following WGs have been established:

WG 1: preparation of a practical guide to "Sick building syndrome" investi-gations (task achieved) (1);
WG 2: preparation of a strategy for sampling chemical substances in indoor air (task achieved) (2);
WG 3: preparation of a guideline for the determination of steady state concen-trations of formaldehyde in large test chambers due to emissions from wood based materials (task achieved) (3);
WG 4: preparation of a discussion document on health effects of indoor air pollution;
WG 5: preparation of a guideline or standard procedure for the determination of microbiological pollutants;
WG 6: preparation of a guideline on ventilation requirements;
WG 7: "Sick building syndrome" research;

WG 8: preparation and validation of a method for the characterization of VOC emitted from indoor materials and products;
WG9: preparation and validation of protocols for VOC measurements in indoor air (follow-up of WG2)

In the attempt to overcome the increasing difficulty of having at hand essential information in a concise form, the Concertation Committee, through the Secretariat and the Working Groups, issues summary reports on single pollutants of high priority. Two such reports have been published: "Radon in Indoor Air" (4) and "Indoor Pollution by NO_2 in European Countries" (5).

Of particular importance is an inventory of investigations and research projects in the field of indoor air quality going on in the countries participating in COST project 613/1 (6). It may be interesting to have a look into some of the information contained in the inventory. Figures 1 and 2 show, respectively, the number of projects per country and the total number of projects in each of four important research areas. The inventory includes ongoing projects and projects terminated within the last two years before its edition in the EC and in Switzerland. Projects in other participating countries will be included in the next edition. The projects labeled C.E.C. are those carried out at the JRC.

POLICY AND REGULATORY ACTIVITIES

Before presenting actual and potential policy and regulatory activities it may prove worthwhile to rapidly recall the institutional framework for the implementation of Community policies and its terminology. Community policy is broken down into sectorial policies which usually are associated with one of the Directorates-General or Services assisting the Commission in its task. The Commission defines its policy objectives in sectorial multiannual Policy and Action Programmes approved by the Council of Ministers.

The regulatory process in the Community starts with a proposal of the Commission to the Council of Ministers which is the decisional organism, the European Parliament having only an advisory role with, however, some budgetary power. There are three types of legal acts with binding force at Community level: regulations, decisions and directives. Directives are the main tool of Community environmental policy. They define an objective to be achieved, but leave to the Member States the choice how to achieve it. The Commission has also the task of implementing the approved rules, respectively to verify their implementation by the Member States. Besides the three types of acts mentioned above, the Commission may propose and the Council may approve recommendations and resolutions which do not have binding force, but are just a commitment in principle. They may, however, exert a remarkable pressure on national governments and social forces.

Several sectorial policies of the Commission and, hence, the activity of several Directorates-General or Commission Services actually or potentially touch aspects of the IAQ issue. They are briefly described hereafter.

The presence of **radon in indoor air** is one of the major causes of concern for those working to protect human health from indoor pollutants. In 1989 a "recommendation of the Commission on the protection of the public against indoor exposure to radon" has been drafted and is now under discussion. The recommendation introduces "a reference level for consideration of remedial action" for existing housing (not intended for legal enforcement) and a "design level" for future housing. The two levels, in terms of effective dose equivalent, are respectively 20 and 10 mSv/year and, in terms of radon gas concentration, 400 and 200 Bq/m^3. This recommendation has been prepared by *Directorate-General XI (Environment, Nuclear Safety and Civil Protection),* which, among other tasks, is in charge of the environmental and radiation protection policiy of the Commission. Its 4th "Policy and Action

Programme on the Environment (1987-1992)", approved by the Council of Ministers on 19 October 1987, includes as one of the major objectives in "an overall longer-term strategy to reduce air pollution" also "to define and implement preventive measures against indoor pollution from a growing number of substances".

As a further preventive measure, an information booklet for the general population on potential hazards of indoor air pollution and on possibilities how to avoid or reduce them is under preparation.

The important directive 89/106 on the "approximation of laws, regulations and administrative provisions of the Member States relating to **construction products**", approved by the Council on 21 December 1988 has been prepared by *Directorate-General III (Internal Market and Industrial Affairs)*. This directive - issued in order to guarantee the free movement of goods - sets out a framework for regulations concerning construction products. It requires that such products "must be suitable for construction works which (as a whole and in their separate parts).....satisfy the...essential requirements".

One of these requirements regards "hygiene, health and environment" and specifies: "The construction work must be designed and built in such a way that it will not be a threat to the hygiene or health of the occupants or neighbours, in particular as a result of any of the following:

- the giving off of toxic gas;
- the presence of dangeroaus particles or gases in the air;
- the emission of dangerous radiation..".

Setting this basic rule, the directive committs to "interpretative documents the creation of the necessary links between the essential requirements" and standards, guidelines or other technical specifications.

Limiting the **emission of formaldehyde from wood-based materials** is presently under consideration as a first case to safegard the above mentioned essential requirement. For this scope CEN (Comité Européen de Normalisation), the organism recognized by the directive for the certification of technical specifications, has been charged to validate a method for the determination of formaldehyde emissions from wood based panels which previously had been specified by a Working Group of COST project 613 (see above).

A directive regarding **asbestos** has been issued by the Commission (87/217/CEE, in force since 19 March 1987). Though it makes no explicitly reference to indoor air pollution, nevertheless the directive, prepared by *DGIII*, has an indirect impact on indoor air quality. It introduces in fact measures to prevent and reduce air and other environmental pollution by asbestos and specifies also rules to be observed during removal of asbestos containing materials from buildings.

Smoking prevention which is the most important issue of indoor air pollution is in charge of *Directorate-General V (Employment and Social Affairs)*. In the frame of the programme "Europe against Cancer" the Council of Health Ministers adopted on 16 May 1989 a resolution banning smoking in public places, except clearly defined areas reserved for smokers. Moreover, two directives have been approved in the Council meeting of 13 November 1989: one (89/622) concerns the labelling of tobacco products with warning messages ("smoking causes heart diseases", "smoking causes cancer", etc.) and with the indication of the tar and nicotine content. The second directive approved by the Council, but still under discussion at the European Parliament, introduces limitations on the tar content of cigarettes (15 mg/cigarette at the end of 1992 and 12 mg five years later). A further directive, in the discussion phase, concerns the limitation of advertising by press and posters of tobacco products, but nothing can be said on the time needed for approval, if any.

The *Consumer Policy Service* is preparing a new action program. The impact of consumer products on indoor air quality is presently under consideration as a subject of the programme.

It is interesting to observe that all presently taken or prepared actions follow the criterion of reducing the exposure to indoor pollutants through the reduction or appropriate manipulations of the source. This, along with an appropriate information of the general population and of selected professional categories, appears in fact the only realistic way of reducing exposure of the population to pollutants in indoor air.

The European Parliament in October 1988 adopted a resolution on air quality in buildings. It states that "more attention should be devoted in Community environmental policy to the problem of the quality of air in indoor environments, reiterates the request (already) made with regard to bans on smoking....., considers ... that the Commission should promote further in depth research into the possible causes and effects of air pollution inside buildings on human health". Moreover, the resolution invites the Commission to prepare a directive on the subject, which should include: "(a) a list of substances whose use in construction works and in cleaning ... should be regulated or prohibited; (b) quality standards to be applied to air in indoor environments ...; (c) rules governing the planning, building, management and maintenance of air conditioning and ventilation systems ...; (d) minimum rules for the maintenance of buildings open to the public, in order to ensure the highest standard of hygiene and cleanliness".

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(2) "Strategy for sampling chemical substances in indoor air". COST project 613 - Report No. 6. Prepared by Working Group 2 on behalf of the Community-COST Concertation Committee. Commission of the European Communities, Directorate-General for Science, Research and Development, Joint Research Centre - Ispra Establishment. EUR 12617 EN, 1989

(3) "Formaldehyde emissions from wood based materials: guideline for the establishment of steady state concentrations in test chambers". COST project 613 - Report No. 2. Prepared by Working Group 3 on behalf of the Community-COST Concertation Committee. Commission of the European Communities, Directorate-General for Science, Research and Development, Joint Research Centre - Ispra Establishment. EUR 12196 EN, 1989

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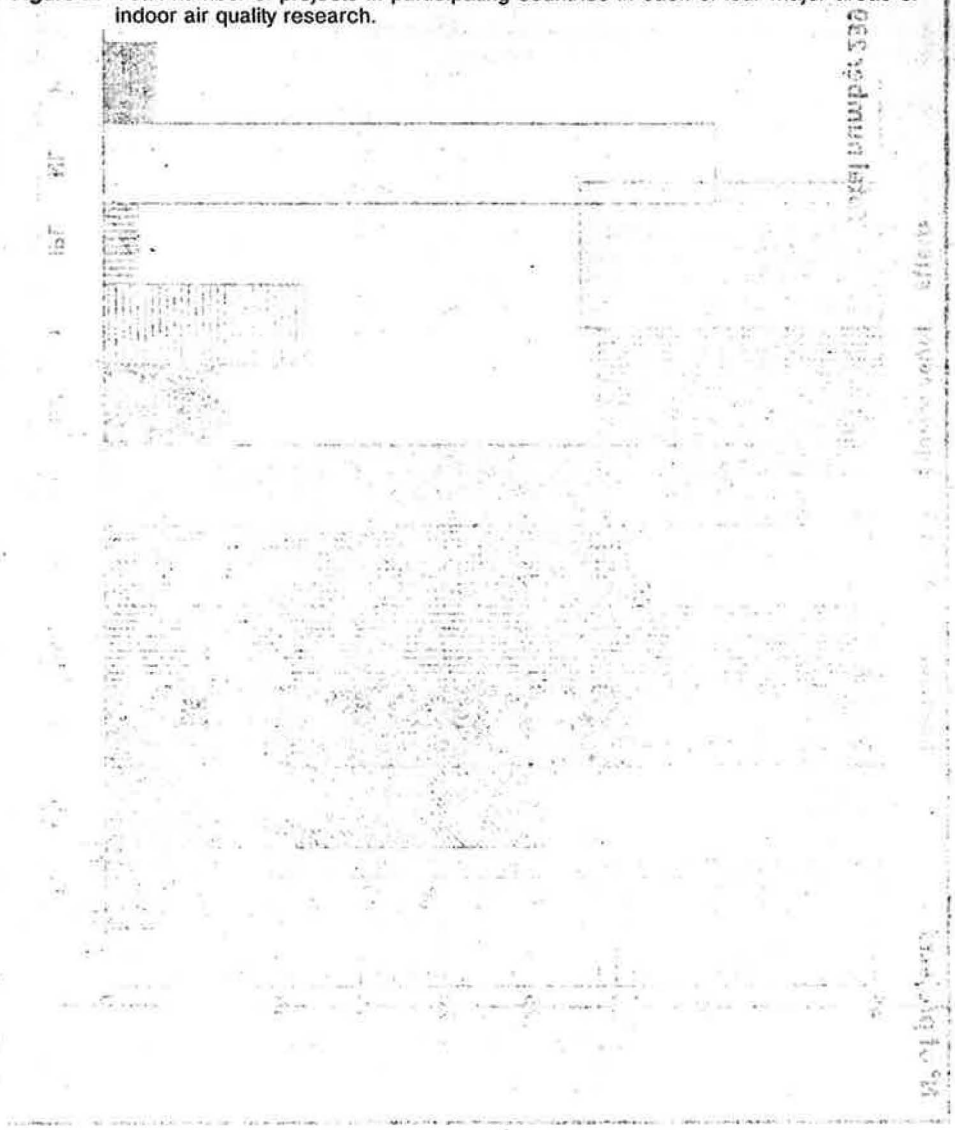
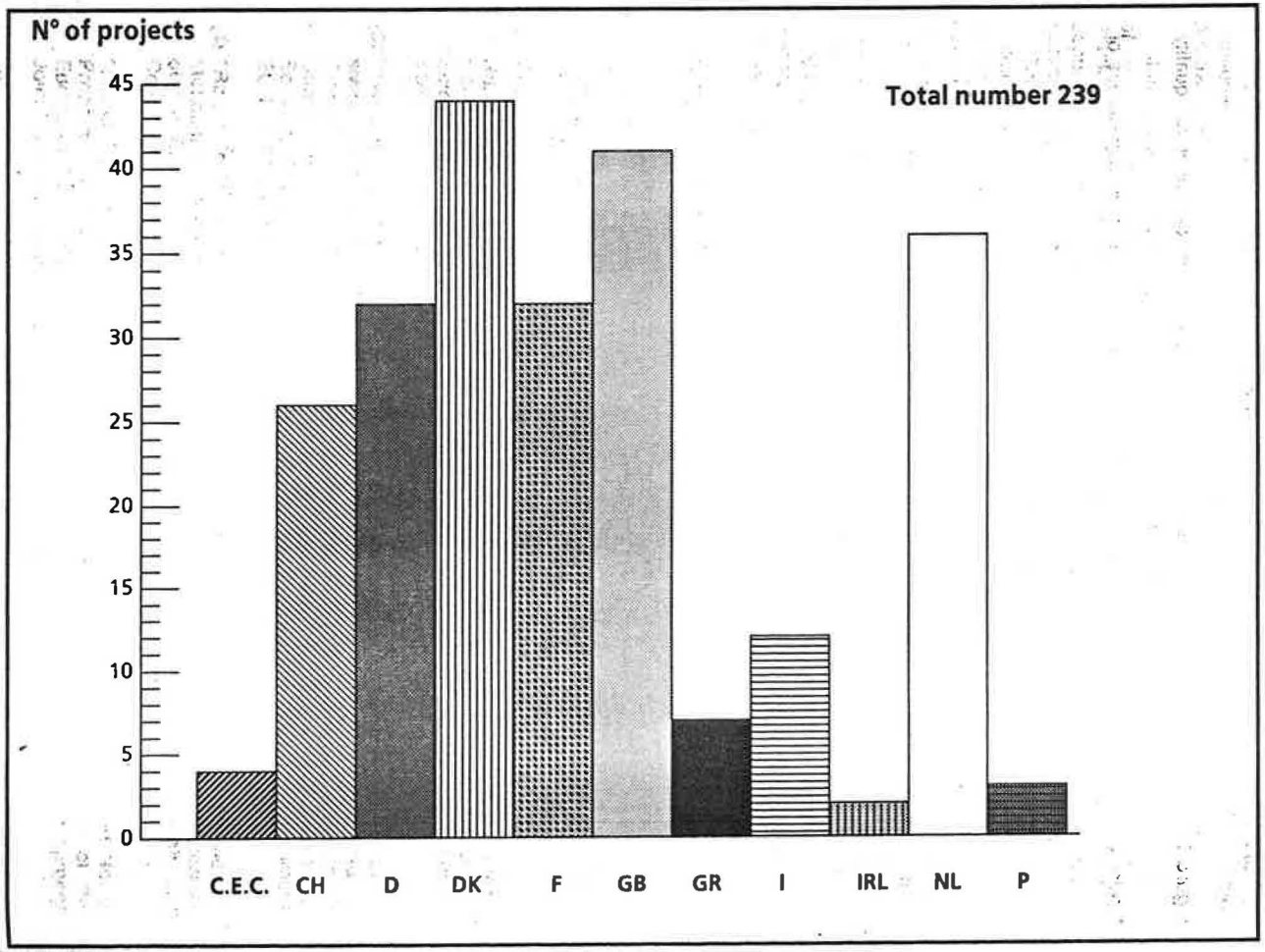
(6) "Project inventory". COST project 613 - Report No. 4. Prepared on behalf of the Community-COST Concertation Committee. Commission of the European Communities, Directorate-General for Science, Research and Development, Joint Research Centre - Ispra Establishment. S.P./1.89.33, 1989

FIGURE CAPTIONS

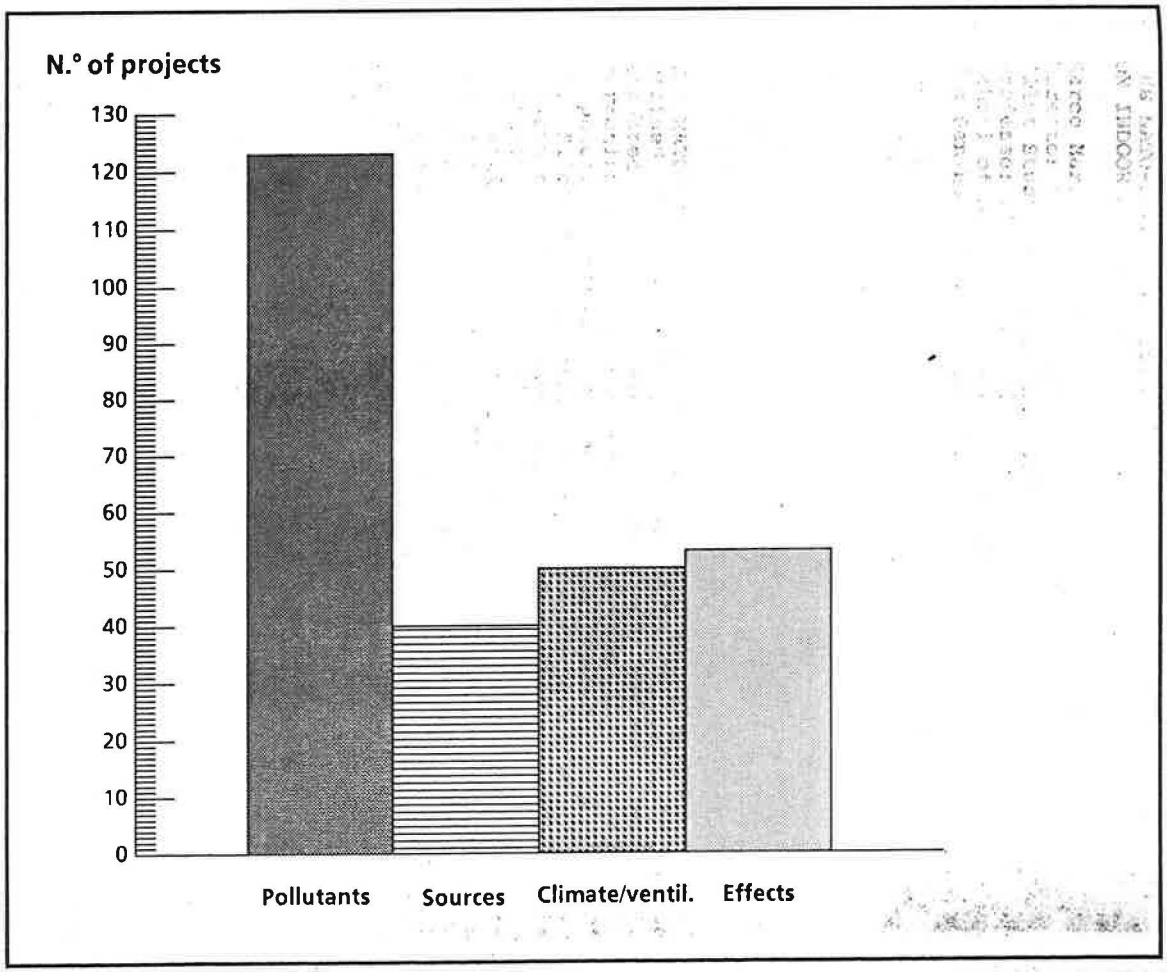
Figure 1. Number per participating country of projects in the field of indoor air quality research and investigation.

Figure 2. Total number of projects in participating countries in each of four major areas of indoor air quality research.





N.° of projects


N.° of projects
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120
110
100
90
80
70
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40
30
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0
Pollutants
Sources
Climate/ventil.
Effects