INTRODUCTION

Aims and starting points

In 1996 the Board of the Consorzio Interuniversitario Nazionale la Chimica per l'Ambiente (INCA) commissioned a research and management evaluation of the Consortiurn. The aim of the evaluation was twofold:

1. The assessment of the status of research in the chemistry for the environment, based on the individual assessments of the INCA units.
2. The assessment of the mission, strategies and plans (including the organizational structure) of the INCA consortium.

The main objectives of the assessment exercise were firstly to provide the individual research units with an appropriate tool for the improvement and further development of their research efforts, and secondly to provide the INCA consortium (throughout this report short named INCA) with a set of recommendations that could be used for improving its own organisation and for demonstrating to external stakeholders that the network paid due attention to the quality of its operations.

The methodology used for the Quality Review of INCA relied on traditional open communication among international colleagues ('peers') from foreign academic organisations in order to guarantee both independence and the use of international European standards of quality. Attention was focused both on the research units that make up the INCA Consortiurn as well as on the Consortium as a whole. It is important to stress that the Quality Review of INCA was *responsive* to INCA's needs, mission, culture(s) and situation, and *future-oriented,* with an emphasis on development of the quality of research. Moreover, it had formative intentions (i.e. intended to help form and improve the Consortium's quality management) rather than summative intentions (i.e. passing judgements for accountability reasons).

The fundamental aim of the Quality Review of INCA was to improve all aspects of the network's operations by assisting the Consortium and its constituent research units to maintain and enhance their quality. The Review Committee acted as a mirror for INCA and its units by making explicit the different qualities they have, and in this way also to assuring society (government, industry, etc.) about these qualities. In particular, regarding quality assurance, the aim was to find out how this Consortium fits the needs of the Italian science system, especially in the light of new policy developments in this area.

Based on this, in 1998 an international Review Committee produced the final report of the INCA quality review: *"Research and Management of the Consorzio Interuniversitario Nazionale La Chimica per l'Ambiente"*. In it the committee suggested that INCA should periodically ask for an international follow-up of the initial assessment exercise.

In March 2002, following a request from INCA, a follow-up of the initial assessment exercise was organized, its main focus being an analysis of the changes taking place after the 1998

assessment exercise and of the fulfilment of the recommendations contained in the 1998 evaluation report. The review exercise was organized in a way that allowed avoiding unnecessary wastage of time and effort. In that sense, each one of the INCA units already evaluated in 1998 was asked to produce a short self-evaluation report, reporting on the activities taking place since 1998 until 2002. The new INCA units (that adhere to the consortium after the 1998 assessment exercise) were asked to produce a full report using the guidelines set for the 1998 evaluation. A self-assessment report was also asked of the three INCA laboratories (Marghera, Catania and Cagliari), as well as of the INCA as a network.

The follow-up review was organised to reproduce as far as possible the conditions of the 1998 assessment, all the members of the follow-up Committee (with the exception of the secretary) having participated in the former quality exercise. The guidelines for self-reporting were maintained for the new units while being somewhat simplified for the old units (the structure was kept the same although avoiding the duplication of information given in 1998), the focus and goals of assessment were the same as before and the structure and organization of the visits were similar.

Therefore, as in 1998, the review of quality was focused on the quality of research, and on the value added as consequence of the units' membership of the network. Review of the quality of research took place at the level of research units, the goal of the review at this unit level being *maintenance and improvement of quality* of research, through feedback by external reviewers to the research unit members and the management.

The follow-up was structured, as in 1998, in the two traditional main stages common to most quality assessment activities. The follow-up was initiated by internal evaluations or *self-evaluations.* which were made available to an internationai Review Committee that was responsible for the *external evaluation.*

For the sake of better understanding by people not familiar with quaiity assessment procedures we repeat the definitions of *self-evaluation* and *external evaluation* as used in the 1998 quality assessment exercise.

A *self-evaluation* has an internal and an external goal. Internally a self-evaluation is the result of collective institutional reflection and an opportunity for quality enhancement of any aspect that is part of the self-evaluation. Externally it provides information to the review committee. The external function should be seen as an incentive to achieve the more important internal function. Confirmation and enhancement of quality is what is aimed at. The Quality Review of INCA wanted to help the Consortium and the research units to achieve that.

The *external evaluations* are meant to delve deeper into the Consortium's quality management and into the quality of research of the constituent research units. The purpose of the external review was to identify strengths and weaknesses in the organization structure of INCA, and to identify strengths and weaknesses in the quality of research of the associated research units. The external reviewers have probed the veracity of the self-evaluation reports. Based on their findings and on their knowledge of the relevant specialisations in chemistry in other countries, the reviewers were able to make some recommendations to the research units and the Consortium.

This follow-up review report gives an assessment of the quality of the research programmes of INCA from an international perspective, based on international scientific quality standards, taking into account the evolution that took place after the first assessment exercise (for the units already assessed). It also refers to the degree of fulfilment of the recommendations made by the Review Committee after the 1998 exercise and to the quality of operation of INCA's laboratories.

As in 1998 this follow-up assessment aims at the improvement of research programmes of the individual units as well as of the management of INCA and its laboratories. The management of INCA has decided that the report will be made public and forwarded to the relevant Italian public authorities.

Assignments to the Review Committee

The management of INCA asked for a follow-up of the previous 1998 international quality assessment exercise. To answer this demand the Review Committee was asked to assess the evolution of the quality of research of each one of the INCA's units since the 1998 first initial assessment exercise. Furthermore the Review Committee had to comment upon the evolution of the research profile, the structure and the management of the INCA consortium, as well as of its laboratories.

The quality assessment procedure was based on the protocol used for the 1998 quality assessment exercise. The assessments of the Review Committee were based on the self-evaluation reports produced by the individual research units, the INCA laboratories and INCA itself. For units being assessed for the first time the guidelines were the same used in 1998 for INCA research units. Units already assessed in 1998 were asked to follow simplified guidelines based on the 1998 protocol, and to concentrate all information in the period following 1998. New guidelines were prepared both for the self-assessment report of the INCA laboratories and for INCA itself. The findings of the Review Committee were laid down in this report made public by the management of INCA.

The management of INCA submitted a grand total of 69 research units to be assessed, between units already assessed (in 1998) and units to be assessed for the first time. The research units are from 28 universities. These universities are listed below:

1. University of Alessandria (1 research unit)
2. University of L'Aquila (2 research units)
3. University of Bari (2 research unit)
4. University of Bologna (8 research units)
5. University of Cagliari (3 research units)
6. University of Calabria (1 research unit)
7. University of Camerino (1 research unit)

8. University of Caserta (1 research unit)
9. University of Catania (6 research units)
10. University of Ferrara (1 research unit)
11. University of Firenze (1 research unit)
12. University of Genova (2 research units)
13. University of Lecce (1 research unit)
14. University of Messina (2 research units)
15. University of Milano (4 research units
16. University of Napoli (6 research units)
17. University of Palermo (3 research units)
18. University of Parma (2 research units)
19. University of Pavia (2 research units)
20. University of Perugia (1 research unit)
21. University of Roma (3 research units)
22. University of Sassari (1 research unit)
23. University of Torino (3 research units)
24. University of Trieste (3 research units)
25. University of Urbino (1 research unit)
26. University of Venezia (4 research units)
27. University of Verona (1 research unit)
28. University of Viterbo (I research unit)

All research units are doing chemistry research on one or more of the following thematic areas:

A. Enzymatic biological and biomimetic techniques for eco-sustainable synthesis and the decontamination of the environment (BIO)
B. Heterogeneous catalysis for eco-sustainable synthesis and the decontamination of the environment (HET)
C. Eco-sustainable synthesis (solvents control, photochemistry, catalysis, recycling, etc.) (SYN)
D. Decontamination techniques (membranes, sonochemistry, photocatalysis, electrochemistry, etc.) (DEC)
E. Chemistry of ecosystems (soil, water, and air chemistry; impact of synthetic materials on the environment) (ECO)
F. New monitoring techniques (MON)

Composition of the Review Committee

The Review Committee was composed by the Chairman, who was involved from the beginning of this review, in consultation with the Director and management of INCA, and three additional experts from different European countries. All members of the Review Committee are familiar with the university system and research structures in Italy. Each member possesses specific knowledge of one or more of the thematic areas that are distinguished by INCA. Moreover, the members cover the disciplinary field of chemistry. Other qualities within the Review Committee were expertise regarding quality assessment and quality audit activities, national research funding systems and expertise in research management. In addition, a secretary who was experienced in evaluation in higher education and research was made available to the Review Committee. The Review Committee was composed as follows:

Alberto Amaral
Professor of Chemistry, Director of the Centre for Research in Higher Education Policies (CIPES), Portugal (Chairman)

Harun Parlar
Professor of Chemistry, Chair for Chemical Technical Analyses, Technical University of Munich, Germany

Martin Preston
Doctor, Senior Lecturer in Marine Chemistry, Department of Earth and Ocean Sciences, University of Liverpool, England.

Binne Zwanenburg
Professor of Chemistry, Department of Organic Chemistry, University of Nijmegen, The Netherlands

Maria Joilo Pires da Rosa
Chemical Engineer, researcher of the Centre for Research in Higher Education Policies (CTPES), Portugal, was appointed Secretary of the Committee.

On behalf of the INCA Consortium, Professor Angelo Albini was appointed to coordinate the self-evaluation activities of the Consortium's members and to act as liaison officer between the Consortium and the Review Committee.

Data provided to the Review Committee

The whole follow-up Quality Review of INCA involved three levels: the research units within the associated universities, the INCA laboratories and the Consortium as a whole. On these different levels, different emphases were relevant and, in fact, three different self-evaluation processes were executed. Therefore the basis for the assessments consisted of the self-evaluation reports compiled and provided by the separate research units, the laboratories (Marghera and Cagliari) and the management of INCA. The self-evaluation reports were intended to be not just descriptive, but also evaluative, establishing a critical analysis of the improvements made since the previous assessment exercise (for the units already assessed and for the Consortium as a whole).

In the research units' self-evaluation reports, the emphasis has to be on their quality of research, and on the relevance of their activities to the INCA Consortium. In the self-evaluation of the Consortium as a whole, the self-evaluation report should be not only analytical, but also synthetic, in the sense of presenting the interconnectedness of the various elements of strategies and quality management. In the laboratories' self-evaluation reports the emphasis has to be on their quality of research, but also on their position regarding INCA network (fully integrated into an university or an independent entity) and the services they are intended to provide both for INCA's units and other interested external organisations.

For the sake of better understanding of the exercise we reproduce here some details of the contents of the self-evaluation reports as described in the 1998 report and which are still valid for the follow-up.

To prepare for the review, the Consortium INCA had to investigate its ways of 'handling' quality in its strategic management processes; it also had to give more insight into the actual quality of the research performed within the research units making up the Consortium.

The self-evaluation of the research unit

The documentation of each research unit consisted of a report in which descriptive information was provided about its research programme, the means they have and how they plan to develop the programme. Because of the self-evaluative nature of the process, information about the actual strengths and weaknesses of the programme was also provided. In a self-evaluation process weaknesses are seen as subjects for improvement more than criticisms of the past.

Each new research unit provided information about:

- The university and the position of the unit within its university;
- The organisational structure of the unit, teaching load, numbers of PhD-students, etc.;
- The composition and size of the scientific research staff;
- The funding (personnel and materials);
- Its mission statement;

- Its research programme (the design of the programme, the most impressive results over the past five years and an overview of the programme development in the future (the coming 5 years) including the means needed for realising the programmes mission);
- Its position in networks (intra-university co-operation, regional! co-operation national co-operation (including INCA) and international co-operation);
- Its society relevance and impact;
- The research output (number of dissertations, number of articles in scientific journals, etc.);
- The strengths and weaknesses and of the action taken or to be taken to further improve the quality of the unit and to strengthen its viability.

Old units were not asked to repeat information about the university or the position of the unit within its university unless some relevant changes had occurred, but were asked to comment on measures taken to answer critical! remarks made in the previous assessment. The self-evaluation section of their report should contain a critical self-analysis of the progress done after the 1998 review. The units were also asked to report on the weak and strong points detected in 1998 and comment on the way they have changed. In addition to the reports, each research unit had to identify five key-publications (the best publications of the research programme).

For each programme the research units provided an overview of the journal impact factors, according to the Institute of Scientific Information (ISI) journal of 1996, of all journals in which the unit published its results. The Journal Impact Factor of a Journal is defined as the number of citations in year T to documents published in the journal in years T-1 and T-2, divided by the number of citable documents published in that journal in the year in years T-1 and T-2.

A proxy for this method was not to analyse individual publications, but to look at the scientific journals that accepted publications of the unit and to compare the relative positions of Journals in specific fields based on their Journal Impact Factors. Although the use of Journal Impact Factors may be disputed, especially when used in a non -specialised environment, they may offer significant information as long as they are used and interpreted by experts and by a peer review panel.

The self-evaluation report, 10 pages long on average, was submitted to the secretariat of INCA, which collected all self-evaluation reports and sent them to the members of the Review Committee.

The self-evaluation of the laboratories

The guidelines for the laboratories were meant to instruct their leaders to provide detai!ed information about their research activities (as in the case of research units) and their services to outside contractors (inc!uding a list of contracts signed by the !aboratory) and to other research units of INCA (to evaluate the extent of the uti!isation of specialised equipment by members of the network).

Each laboratory provided information about:

- Its historical background and the relationship it maintains with the !oca! university;
- Its organisational structure and position both regionally and nationa lly;
- The composition of the INCA research staff and other INCA staff;
- The funding (personnel and materials and equipment);
- Its mission statement (including services to outside constituencies).
- Its research programme;
- Its services activities (services to industry or rental of equipment and space);
- The co-operation with the research units (referring the participation of INCA's research units in the laboratory activities);
- Its societal relevance and impact;
- The key publications (full bibliometric details of the laboratory five best scientific publication over the period 1998-2002);
- The strengths and weaknesses and the actions taken or to be taken to further improve the quality of the laboratory and to strengthen its viability. Information was also to be given on how the specialist laboratories have contributed to the research activities of the associated units.

The self-evaluation of INCA

The guidelines for INCA were meant to provide a detailed list of contents for the INCA Self-evaluation Report on the consortium level. These guidelines were intended to cover all written information needed by the Review Committee in a logical order. with emphasis on changes taking place after the 1998 assessment and its consequences.

Therefore:

- INCA was asked to present a critical report concerning the main changes that have taken place since the presentation of the Research and Management Evaluation report.
- INCA was asked to inform on its capacity to reinforce or to maintain its strong points and how far it has been able to alleviate or eliminate the weak points.
- INCA was asked to indicate how far the development plan presented to the 1998 Review Committee was accomplished.
- INCA was asked to inform how far it has been able to implement each of the recommendations of the 1998 report and if some of those recommendations were partly or completely ignored.
- INCA was asked to provide a list of those centres that have cancelled its membership, as well as a list of new members. INCA was asked to state the reasons for cancellation of membership and to list the criteria for membership of the newcomers.

- INCA was asked to provide a critical analysis of the success of the laboratories, namely regarding customer satisfaction, research activity, contracts with industry and iocal authorities and the balance between time allocated to researchers and time allocated to services.
- INCA was asked to report on the intensity of the use of those facilities by the members of the consortium.
- INCA was asked to explain the criteria used for defining the location of the new specialist facilities.
- INCA was asked to provide a brief and critical presentation of its development plan for the next three years.

Procedure of the Review Committee

Members of the Review Committee first read the self-evaluation reports from the research units and made their own preliminary assessments of the programmes. For each new programme a first and second reviewer was chosen. For the old units reviewers were whenever possible the same as in the 1998 exercise (the exceptions were those resulting from the absence of Professor L. Luisi). They were asked to read all the information and to provide preliminary assessments.

The Review Committee discussed the preliminary assessments during a four-day meeting in Venice (28th June to 1st July, 2003). During this meeting the initial assessments were approved and the Review Committee made a selection of the research units that were to be interviewed. In these discussions the aspects to be assessed were also clarified (see Chapter 2).

Taking into account the number of research units, the fact that this was a follow-up of the first self-assessment exercise and because of the limited time the Review Committee had for making their assessment, it was both impossible and unnecessary to meet with all research units. So only a small number of units were selected for the interviews (6 out of 66), being this selection mainly based in the concerns the Review Committee had about issues of relevance and viability of some of the INCA units under evaluation. It was also decided to interview the Director of the Catania laboratory.

The interviews took place on the 22nd September in Rome, and were accomplished during the final meeting of the Review Committee (20th to 23rd September 2003). Each interview followed a similar pattern, the representatives of the units being asked to discuss with the Committee the relevance of their unit to INCA and the viability of it in the long run (each interview took about one hour). During the 23r September the Committee interviewed the management of INCA, in order to get a full and thorough understanding of the INCA Consortium's main concerns and difficulties, special emphasis being given to its evolution since the first assessment exercise. Topics that were discussed were the situation of the Catania laboratory, issues related to relevance of some of the research units to INCA activities and questions about INCA membership and the process of

appointment of people to the governing bodies of the Consortium by the universities involved. During this final meeting a review of the individual evaluation reports was done, the assessments of all the individual units being collectively and unanimously decided by the Review Committee. The discussion and preparation of the final assessment report was initiated.