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CERN and the environment

R. Aymar º, M. Bona˚

CERN

º *CERN Director-General*
˚ *Head of CERN Integrated Safety and Environment Group*

Abstract

The impact of CERN's activities on the surrounding environment is carefully monitored by the Organization via a complete environmental monitoring programme, which is defined and run in agreement with the authorities of Switzerland and France. This programme covers both radiological and conventional aspects. So far the environmental impact of CERN was shown to be negligible. In particular, CERN's radiological impact is a fraction of the variation of the natural exposure at different locations of the surrounding region. As the site of the Organization is on the territory of two countries and straddles the Swiss-French border, the implementation of its environmental policy requires specific procedures and a very transparent communication towards the Host States authorities and the public opinion. This paper reports the official CERN speech delivered for the opening of the international conference Enviroinfo 2004 that was held at CERN in October 2004.

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It is with great pleasure that CERN accepted the proposal, formulated by the administration of the Canton of Geneva, to hoist the EnviroInfo 2004 Conference on its premises. This request came at a particular moment in time, when the Organization was preparing celebrations for its 50th anniversary. CERN has decided to include this Conference in the events accompanying its 50th anniversary, which official ceremony was held two days ago in this room, in the presence of Heads of State and Government.

Placing this Conference in the official frame of CERN celebrations does not only mark the excellent state of the relations between CERN and the Canton of Geneva, but also highlights the very good terms that do exist with the French local authorities and, to a larger extent, with both Host States, Switzerland and France. This decision was also intended to stress the importance that CERN attributes to the environment and to environmental protection.

Our Organization has no direct or political role in the ongoing studies on environment, environmental protection and sustainable development, and is not involved in the important related debate. The CERN mandate is very clearly defined, and limited, to fundamental research on particle physics. Other institutions like Governments, governmental agencies and specialized international Organizations have the responsibility to lead this debate and to confront existing political views with the expectations and the requests of the civil society.

CERN feels nonetheless concerned with the matter, for two main reasons. The first is that its activities may impact on the surrounding environment, and the Organization is strongly committed to limit its impact to the lowest possible level. In this respect it is essential to communicate on environmental matters, in order to prove to the Host States authorities and the public opinion that the actual environmental impact of CERN is very limited and often negligible. The second reason is that CERN is aware that some of its activities and researches, as well as its "corporate culture", may help the knowledge on these matters to develop.

This is what I will try to show you, by giving first a brief presentation of CERN, followed by the involvements of our Organization in the three main themes of the Conference: environment, informatics and, most of all, sharing.

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CERN, which official name is "European Organization for Nuclear Research", is an intergovernmental organization established in 1954 by 12 Member States, as one of Europe's first joint ventures. Geneva is the official seat of the Organization. Since the beginning of 1970s the CERN site extends on both sides of the French-Swiss border. Today CERN counts 20 Member States, six Observer States and two Observer Organizations (European Commission and UNESCO). Researchers from twenty-eight non-Member States are involved in CERN programmes. In its 50-years-long history CERN has become a laboratory for the world.

CERN mission is to provide the international high-energy physics community with accelerators and experimental facilities required to carry out their researches. At present CERN counts about 2500 staff members. More than 6500 fellows, associates, students and users from research institutes and universities worldwide participate in the CERN programmes.

CERN is bound by its convention to "… *provide for collaboration among European States in nuclear research of a pure scientific and fundamental character, and in research essentially related thereto*". The term "nuclear", which also appears in the official name of the Organization, is an historical heritage of the period when CERN was established. Especially during the last two decades, the increased environmental awareness and sensitivity of the public opinion has been justifying the request of explaining the meaning of the term "nuclear" referred to CERN. Discussing

why that term is still in the name of the Organization and what it exactly means would be too long. It is perhaps sufficient here to state that CERN is not at all involved in research on military applications, and is not a sort of nuclear power plant.

In a nuclear power plant energy is produced, under adequate conditions, as the result of reactions occurring in matter, thus transforming matter into energy. In a particle accelerator, collisions between particles release very little amounts of energy – of the order of the energy of motion of a flying mosquito - into extremely small volumes of space. The obtained very high energy densities reproduce conditions that only existed just after the Big Bang, and allow transforming collision energy into new particles that do not exist under ordinary conditions. Globally speaking, CERN transforms energy into matter, thus operating exactly the opposite compared to a nuclear power plant.

Developing accelerators results in considerable progress in many technological fields. Cancer therapy, medical and industrial imaging, radiation processing, electronics, measuring instruments, new manufacturing processes and materials, information technology, are just some of the fields that profited from developments done at CERN as spin-offs of its research on particle physics. CERN knowledge and know-how are offered via various educational programmes and opportunities to schools, teachers, undergraduate and post-graduate students as well as to the general public.

The next big project of CERN is the Large Hadron Collider (LHC), a particle accelerator that will probe deeper into matter than ever before. Due to begin operation in 2007, it will ultimately collide beams of protons at the unprecedented center-of-mass energy of 14 TeV. Beams of lead nuclei will be also accelerated, smashing together with collision energy of 1148 TeV. It is hoped that the LHC will open up a new window of discoveries in particle physics. In particular, it is expected that the elusive Higgs boson, which is a key-element predicted by the Standard Model, will be identified. The new accelerator, equipped with superconducting magnets operating in a bath of superfluid helium at 1.8 K, is being installed in the same 27-km-long tunnel previously occupied by the CERN Large Electron Positron collider (LEP). In addition to being the highest-energy accelerator, the LHC will also be the largest superconducting installation in the world.

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Although CERN is not directly working on environmental matters, the potential impact of its activities on the surrounding environment justifies a careful monitoring of the situation.

As far as their environmental impact is concerned, CERN activities can be divided in two groups. The first group concerns the “conventional” activities, those related to the technical systems of the Organization, its infrastructure, the technical services required to operate its accelerators, detectors and ancillary parts. The related potential environmental impacts of these activities are the same as those of any company or institution using the same technologies. Monitoring of these activities and of their actual impact on the environment is based on classical industrial standards, which comply with the Host States regulation. The second group concerns those activities that may have a radiological impact on the environment. Operating accelerators may imply the activation of solids, liquids and gases. Typical examples are some of the metallic structures our accelerators consists of, the water used in some cooling systems, the air extracted from some underground areas.

The Organization has two firm commitments, which apply to both its conventional and radiological activities. The first is to respect the limits imposed by the regulations of the two Host States. The second is to go even further, by aiming to reduce as much as possible its environmental impacts, according to the “as low as reasonably achievable” principle.

To do so, CERN disposes of an environmental monitoring programme that covers both the conventional and radiological parts of its activities. This programme, agreed with the Host States authorities, specifies the periodic measurements and checks to be carried out on installations located on the CERN premises and in the vicinity of the Organization, on the rejected water, and along some rivers of the surrounding region. CERN disposes also of an Environmental Management System, based on the ISO 14000 standards. The results of the monitoring programme are published in quarterly and annual reports, addressed to the Host States authorities. These authorities carry out independent measurements in the region surrounding CERN, which results have so far shown full consistency with those obtained by the Organization.

In addition to these institutional communications and contacts with the central authorities of Switzerland and France, CERN has promoted the creation of a Tripartite Committee on Environment. This Committee, in force since the year 2000, allows the exchange of information at the local level between CERN and both the Canton of Geneva and the "Département de l'Ain". The information for the general public is provided via a CERN website dedicated to environmental matters.

The real radiological impact of CERN can be quantified by the effective dose to members of the public due to the CERN activities. In the year 2003, the CERN-related annual effective dose to everyone outside the Organization was less than some 2.5% of the Swiss and French annual limit of 1 mSv. The CERN-related component is one order of magnitude smaller than the typical variation of the natural exposures measured at different location in the Geneva and French area surrounding CERN, as shown in Figure1. This proves that the actual radiological impact of CERN is indeed negligible.

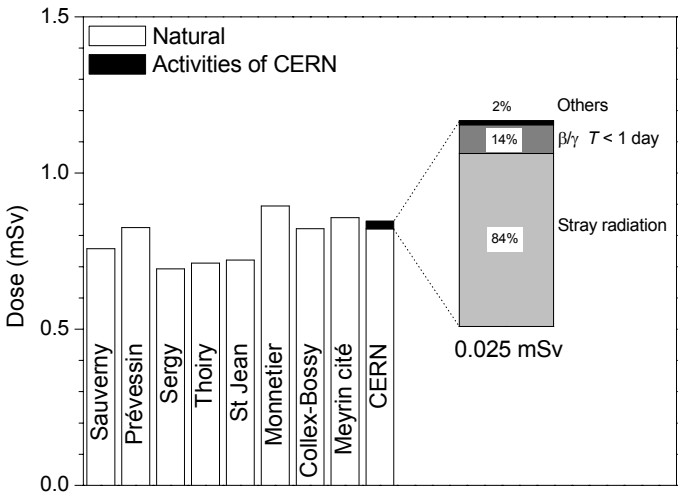

Figure 1
Exposure of members of the critical group of the population due to CERN's activities in 2003, in comparison with the natural external exposure in the Geneva region and Pays de Gex. The CERN-related component is a fraction of the typical variation of the natural exposure measured at different locations in the region.

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Information technology is essential for an Organization like CERN. The evolution of the research in particle physics in the last decades is strongly correlated to developments in information technology.

Since the 1980s, the availability of powerful information technology tools allowed scientists to abandon traditional detection systems like “bubble chambers”, where the “signature” of physics events was actually taken by cameras and recorded on films, in favor of computerized reconstructions of the physics events obtained in particle accelerators.

The need for the efficient exchanging of information between members of experimental groups, often not based at CERN, accelerated the development of communication protocols. The most famous of them, the World Wide Web, was invented here at CERN at the beginning of the 1990s. Researchers involved in the experiments of the LEP accelerator (which was operated from 1989 to 2000), greatly profited from the possibility to de-localize their activities by carrying out part of their work in their home institutes.

As said before CERN is at present installing the LHC, its new big accelerator. Operating the LHC requires the treating of huge amounts of data, which is only possible by sharing and putting together the processing power of a large number of CPUs located in various places throughout the world. This need has guided the development of new concepts like the Grid, in which CERN has been playing a leading role. The Grid is an integral part of the LHC technology. If working with LEP became easier and more effective thanks to the Web, the Grid is just as much an essential part of the LHC: without it, no physics can be done with the new accelerator.

These examples clearly indicate the absolute need for CERN to remain on the forefront of information technology and to take an active part in its development. Some side-applications of developments done by or with the collaboration of CERN may have important impact in fields other than particle physics. For instance, the World Wide Web has had an extraordinary impact on society, and its use has become an integral part of our everyday life. The Grid is likely to open new horizons in the near future.

CERN is also involved in other projects that perhaps are not so widely known as the World Wide Web or the Grid, but which may also have an important impact. An example, linked to environmental matters, is the UNOSAT project. UNOSAT is an internet-based service that provides the international community - UN agencies, NGOs and other humanitarian institutions – with high quality satellite maps. It aims to provide updated and accurate geographic information to support humanitarian operations, to study and prevent environmental risks and to plan sustainable reconstruction and rehabilitation of areas affected by natural phenomena. The UNOSAT Group is hosted by CERN, which allows its members to profit from the excellent CERN network and computer infrastructure. Moreover the Group can count on the collaboration of CERN experts and on the interaction with the computer Grid community. CERN know-how has greatly contributed to develop algorithms allowing effective processing and compression of raw satellite images into high quality maps, which must be easily readable even by those users who may have poor internet connections. Grid technology should improve the effectiveness of the process even further.

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The third, and main, theme of this Conference is sharing. This term has different meanings, and may be given different philosophical interpretations. I would refrain from adding a further, probably useless, definition of the concept, but I would rather try to underline how strongly and intimately sharing permeates the everyday life of CERN.

Sharing is in the mandate of CERN. The Convention for the establishment of the Organization, which entered into force on 29 September 1954, explicitly states that

the results of the "…. *experimental and theoretical work [of CERN] shall be published or otherwise made generally available*". This is not just a broad objective; it's a concrete obligation for the Organization.

Sharing is in the culture of CERN. During its 50 years of life, neither the Organization nor its staff needed to be reminded of its or their obligation to share. A community of people, of different nationalities and cultures, working at CERN on research of a "… *pure scientific and fundamental character...*", simply cannot afford not to share their knowledge and the results of their work. No scientific progress is possible without the sharing of knowledge. This cultural approach also proved its usefulness and effectiveness during delicate periods of international tension or crisis. For instance, even during the Cold War period scientists from countries belonging to different political blocks collaborated together on the scientific programs of the Organization, and shared their knowledge with the international scientific community.

Sharing is a practical must in many fields at CERN, environmental issues being one of them. A characteristic of CERN is that its site is on the territory of two countries and straddles the Swiss-French border. The different environmental legislation of the two Host States would make it impossible to apply the national laws of both countries simultaneously. CERN, in practice, has to operate as if there were no border. This is possible, in practice, thanks to the possibility for CERN, as for any other International Organization, to define its internal functioning rules. CERN environmental rules are based on European directives, or on the regulations of one of the Host States, generally the most advanced one. Once the rule is defined by CERN, it enters into force on the whole site of the Organization, both on the Swiss and on the French territory. Dealing with environmental matters outside the national legislative framework that normally applies, obliges CERN to share environmental information with the authorities of the two Host States. This entails making the information understandable to both parties, which may be used to different technical language in relation to environmental matters.

The experience of CERN in operating within a unique regulatory framework is sometimes helpful to the dialogue on environmental issues between the two sides of the border. On past occasions, following a request of the local authorities, CERN accepted with pleasure to act as a catalyzing element to facilitate the cooperation on environmental matters between the local Swiss and French areas.

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I hope I was able to show that despite its mandate is specifically focused on particle physics research CERN is involved in the three main themes of the EnviroInfo 2004 Conference.

Environment is a concern for CERN in so far its activities may have impact on the environment of the surrounding region. So far the Organization has achieved the objective of limiting its impact to a negligible extent, and is strongly committed to continue in the same direction.

CERN developments in information technology, which are essential to do physics with modern accelerators, can be profitably made available to institutions active on environmental matters. These tools offer more integrated approaches in the treatment of environmental issues, and a gain in the effectiveness of the environmental assessments.

Sharing is not only a key element for the successful management of environmental protection: it has been the key element for the success of CERN during its first fifty years of existence. The scientific and technical competence of its staff could not, alone, consecrate CERN as a center of excellence recognized worldwide. This result could be achieved thanks to the open-minded and sharing-oriented mentality of the Organization, and to the concrete application of these principles in its everyday life.

CERN is proud of its scientific achievements in the field of particle physics as well as of the cultural and operational models it represents. Since the beginning of its life CERN has been showing, against all prejudices, how effective an International Organization can be.

Nowadays the solution of large-scale problems more and more requires a direct implication of the international community. The quality of its intervention greatly depends on the effectiveness of the International Organizations involved. The first fifty years of CERN could be offered as a positive example to be possibly adopted by other International Organizations.

I would like to thank you for your attention, and wish you a very interesting and fruitful Conference.