THE INTERNATIONAL CHERNOBYL PROJECT

Abel J. González

Deputy Director, Division of Nuclear Safety
International Atomic Energy Agency, Vienna, Austria

ABSTRACT

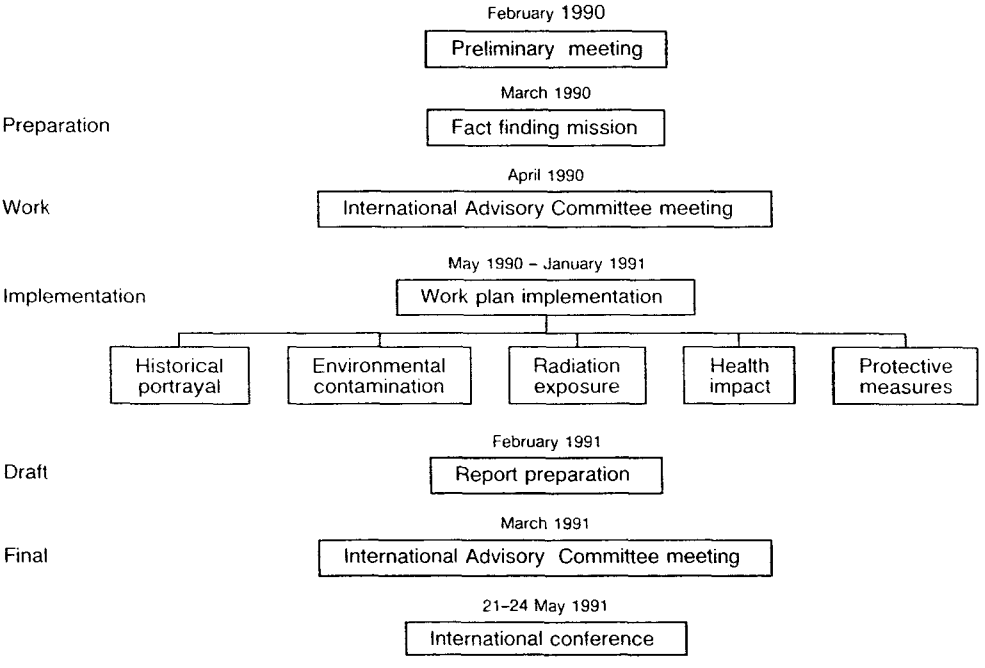
The findings of the International Chernobyl Project are summarized herewith. The project focused on four key issues related to the radiological consequences of the Chernobyl accident which are of concern to the population and policy makers: the true extent of the current contamination in inhabited areas of Belarus, Russia and the Ukraine; the past, current and future radiation exposure of the population; the actual and potential health effects; and the adequacy of measures being taken to protect the public. The project findings are expected to contribute towards alleviating the consequences of the accident by presenting factual information to allow future policy and worldwide assistance to be channelled to where it is most needed and where it can be best used.

INTRODUCTION

1. In response to a governmental request, the International Atomic Energy Agency (IAEA) organized a multinational team to assess the current radiological situation after the Chernobyl accident in the three more affected Republics, Belarus, Russia and the Ukraine. Seven international bodies participated: CEC, FAO, IAEA, ILO, UNSCEAR, WHO and WMO. Thus, the International Chernobyl Project was formalized in February 1990.

2. A group of ten scientists designed a strategic approach after a fact-finding mission in March 1990. This group met with officials in Moscow and the Republics' capitals, scientific organizations, hospitals, clinics and agricultural centres in the affected areas and in Kiev, Gomel and Moscow. They also discussed project plans with residents of seven settlements in the three Republics, who predominantly expressed anxieties about children's health and the adequacy of the Government's proposed measures for limiting radiation exposures within their lifetime, as well as mistrust against the authorities and against scientific and medical committees.

3. Subsequently, an International Advisory Committee (IAC), consisting of 21 members from 7 international organizations and 10 countries (including radiation specialists, medical practitioners and psychologists), was established to direct the project and assess findings. The IAC met 23–27 April 1990 in Kiev and Minsk to define the project structure and work plan to be completed in 1 year with limited resources. The task that evolved was to assess the quality and correctness of existing data and to conduct an independent study by means of laboratory analyses of field samples and internationally recognized assessment techniques. It focused on four key issues of concern to the population and policy makers: the true extent of the current contamination in the Republics' inhabited areas; the past, current and future radiation exposure of the population; the actual and potential health effects; and the adequacy of measures taken to protect the public. The project conclusions and recommendations were approved by the IAC in Vienna 18–22 March 1991 and presented for scrutiny to an international conference of experts in Vienna 21–24 May 1991. The findings are contained in a Technical Report which should be referred to for further technical details. (See Fig. 1.)



The International Chernobyl Project. *The Project was organized in response to a governmental request for an international assessment of the radiological consequences of the Chernobyl accident. The multinational effort was directed by the International Advisory Committee and included the participation of the CEC, FAO, IAEA, ILO, UNSCEAR, WHO and WMO. Five tasks defined the Project implementation: historical portrayal of the events leading to the current radiological situation, the evaluation of the environmental contamination, the evaluation of the radiation exposure of the population, the assessment of the health impact from radiation exposures and the evaluation of the protective measures.*

Figure 1

GOALS AND SCOPE

4. The project dealt exclusively with the radiological consequences for the inhabitants of affected areas: approx. 25,000 km^2 with ground concentration levels of Cs over 5 Ci/km^2 (58% located in Belarus, 32% in Russia and 9% in the Ukraine), covering a population of 825,000 (45% live in Belarus, 24% in Russia and 31% in the Ukraine) residing in over 2,000 settlements in the three Republics. The project did not cover the prohibited region (approximately 30 km in radius around the damaged reactor) or the emergency personnel ("liquidators") who carried out recovery operations after the accident.

WORK PLAN

5. Surveys were performed on 27 "surveyed contaminated settlements", some with relatively high soil surface contamination, others with relatively low soil surface contamination but with the potential for high radiation doses to the population through the food chain. For comparison, surveys were also conducted on 7 "surveyed control settlements" outside the contaminated areas. In addition, a number of information exchange activities were carried out to enhance the level of understanding of the problems involved among the local scientific community.

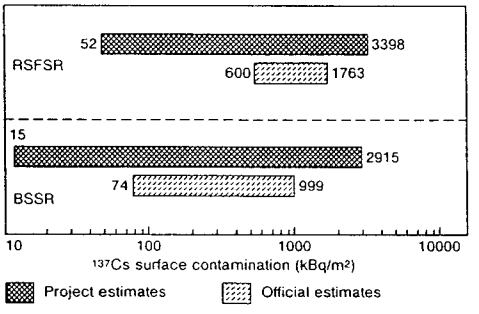
PARTICIPATION

6. Some 200 experts from research institutes, universities and organizations in 25 countries and 7 multinational organizations participated in the assessment. Approximately 50 missions were undertaken between March 1990 and January 1991. The IAEA Seibersdorf Laboratory together with 13 laboratories in 6 countries collected and analysed samples and conducted an intercomparison exercise with laboratories in Belarus,

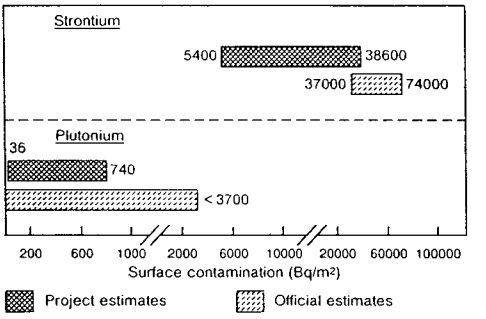
Russia and the Ukraine. Governmental authorities and commercial companies in 5 countries donated equipment, supplies, radiation monitors and computing time. Project teams made 2,000 measurements of external gamma dose rates, ecosystem and milk, monitored almost 22,000 inhabitants for external and internal exposures and performed approximately 1,500 medical examinations. Overall efforts concentrated on assessing the reliability and accuracy of data, techniques and methodologies used to estimate contamination levels, doses and health effects and evaluating radiological protection policies.

MAJOR FINDINGS

7. From the radiological point of view, the relevant radioactive contaminant still remaining in the area is Cs-137, Sr-90 and Pu-239 being potentially interesting. The contamination values in available maps for Cs-137 and Pu-239 were generally corroborated, while Sr-90 results were lower than reported. (See Fig. 2.) Water and food contamination was below Codex Alimentarius levels.



Comparison of Project measurements of caesium soil contamination with official values of caesium surface contamination for settlements of Belarus and Russia. *Limited Project sampling of caesium contamination in top-soils in five settlements of Belarus and four settlements of Russia indicated values that were consistent with the range of the official values based on comprehensive surveys carried out since the accident and reported for these settlements by the State Committee on Hydrometeorology and Environmental Monitoring, Moscow.*

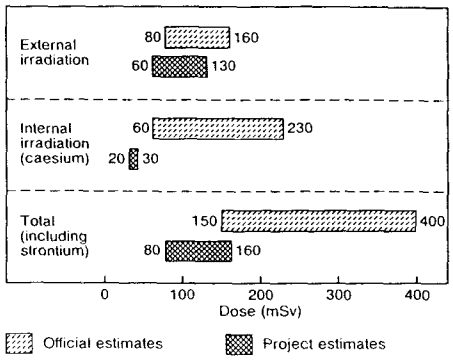


Comparison of Project measurements of strontium and plutonium soil contamination with official values for surface contamination in the Bragin region, Belarus. *The Project concluded that analytical results for a limited set of soil samples corresponded to the reported estimates for plutonium but were lower than those for strontium. As illustrated here for settlements in the Bragin region, the measurements of strontium contamination suggest the potential for overestimation in the official values reported by the State Committee on Hydrometeorology and Environmental Monitoring, Moscow.*

Figure 2

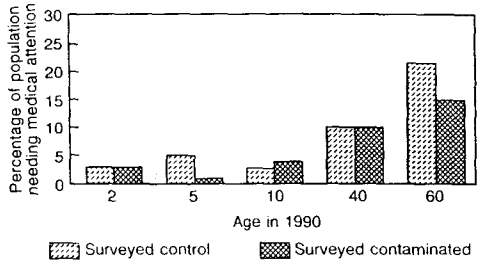
8. The official procedures for estimating doses were scientifically sound and the methodologies used were intended to provide results that would not underestimate the doses. However, independent project estimates were lower than the officially reported dose estimates. (See Fig. 3.)

9. No health disorders were found that could be attributed directly to radiation exposure; however, significant non-radiation-related health disorders do exist in the affected area. (See Fig. 4.) There are also substantial pyschological consequences in terms of anxiety and uncertainty. No current increase in the incidence of leukemia or cancer could be substantiated and future potential increases in cancer would be difficult to discern. These general conclusions on the health situation were followed by a number of detailed conclusions, some related to neoplasms, in particular to the many reported increases in cancer and to the potential future cancer increase, as follows: USSR data indicated that reported cancer incidence had been rising for the last decade and has continued to rise at the same rate since the accident; the project team considered that there had been incomplete reporting in the past and could not assess whether the rise is due to increased incidence, methodological differences, better detection and diagnosis or other causes; the data did not reveal a marked increase in leukemia or thyroid tumours since the accident; on the basis of estimated project doses and currently accepted radiation risk estimates, future increases over the natural incidence of all cancers or hereditary effects would be difficult to discern, even with large and well designed long term epidemiological studies; however, reported estimates of absorbed thyroid dose in children are such that there may be a statisti-



Comparison of Project estimates and officially reported estimates for radiation dose to the population in selected settlements. *Project dose estimates derived independently were compared with the official values for the population in the selected settlements as reported by the Institute of Biophysics, Moscow. As illustrated here, the Project estimates were lower than the officially reported dose estimates. Overall, there is general agreement within a factor of 2–3.*

Figure 3

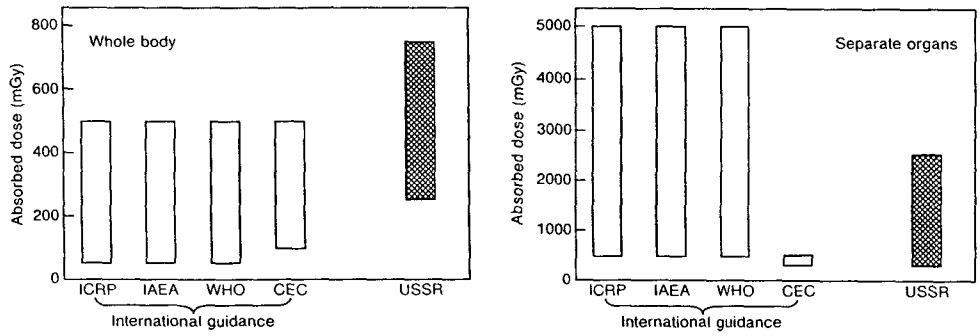


Project assessment of the general health of the population in selected settlements. *The Project assessment of reported increases in illness attributed to the Chernobyl accident included an investigation of the general health of the population in selected settlements. Independent medical examinations of inhabitants of both surveyed contaminated and surveyed control settlements revealed no health disorders that could be attributed directly to radiation exposure, but did indicate significant non-radiation-related health disorders among the adult population. As illustrated here, Project results indicated that 10–15 per cent of the adult population examined in both surveyed contaminated and surveyed control settlements should be referred to a physician for follow-up medical care.*

Figure 4

cally detectable increase in the incidence of thyroid tumours in the future. Examination of nearly 800 children showed no difference in height and weight between those living in contaminated settlements and those in control settlements with no contamination. Comparison with growth pattern norms in the USA indicate that children are generally healthy and their diet is adequate. Medical examinations showed that thyroid size and size distribution, as well as thyroid nodules, were similar to those reported in other countries.

10. With regard to protective measures, it was found that measures taken or planned exceed what is strictly necessary on radiological grounds. Relocation and foodstuff restrictions should have been less extensive. However, the project concluded that relaxing current policy could be counter-productive (although more restricted criteria should not be adopted) and social and political factors must be considered. (See Figs. 5 and 6.)



Criteria for evacuation of the population in the early phase of the Chernobyl accident. *While the Project team was not able to investigate in detail many of the early protective actions taken by the responsible authorities, it was judged that the general response of the authorities was broadly reasonable. As illustrated here, the intervention levels of absorbed dose for evacuation applied in the early phase of the post-accident response by the authorities were consistent with general guidance prevailing at the time of the accident (the vertical columns indicate the upper and lower levels of the guidance values.) Absorbed dose is defined as the energy absorbed per unit mass of tissue.*

Figure 5

LONG TERM RELOCATION CRITERIA

Long term relocation concepts were established at first on the basis of a lifetime dose of 350 mSv (35 rem) as the intervention level for relocation, the so-called 'lifetime dose limit'. Subsequently, a surface contamination of 40 Ci/km^2 (1480 kBq/m^2) was introduced as the intervention level for relocation. The bases on which the criteria for relocation were derived were not wholly consistent with the principles currently recommended internationally. However, the International Advisory Committee concluded that "The protective measures taken or planned for the longer term, albeit well intentioned, generally exceed what would have been strictly necessary from a radiological protection viewpoint." The table gives estimates of dose averted for the various intervention concepts. The Committee concluded that "measures are not justified on radiological protection grounds; however, any relaxation of the current policy would almost certainly be counterproductive in view of the present high levels of stress and anxiety amongst inhabitants of the contaminated areas of concern and people's present expectations."

Criterion	Year of application	Level	Lifetime dose averted from external radiation (mSv)	Lifetime dose averted from external radiation and residual ingestion dose (mSv)
Temporary	1986	100 mSv per annum		
annual	1987	30 mSv per annum	~140	<240
dose	1988	25 mSv per annum	~130	<230
limit	1989	25 mSv per annum	~150	<260
Lifetime dose limit	1990	350 mSv lifetime	~ 60	<130
Surface	1990	>40 Ci/km^2 surface	~ 80	<160
contamination	1990	<15 Ci/km^2 surface	~ 30	< 80

Figure 6

SUMMARY

11. The major conclusions of the International Chernobyl Project can be summarized as follows: the official surface contamination levels were generally corroborated; the radiation doses incurred and expected future doses are lower than originally estimated; significant non-radiation-related health disorders and negative psychological consequences in terms of stress and anxiety were found, but no health disorders were detected that could be directly attributed to radiation exposure; early protective measures were reasonable and consistent with international guidelines, measures taken or planned for the long term (relocations and foodstuff restrictions) exceed those which would be necessary on radiological grounds.

12. The findings have been published in an Overview for policy makers and the scientific audience and a comprehensive Technical Report for the scientific audience, both available in English and Russian. Several brochures for the general public have also been published in English and Russian. The full proceedings of the international conference that scrutinized the project are also available.

13. The International Chernobyl Project results as presented by the IAC represent an important contribution to alleviate the consequences of the Chernobyl accident. Factual information will allow future policy as well as worldwide assistance to be channelled to where it is most needed and to where it can be best used.