

**Knowledge Resources on the Chernobyl Accident and its Consequences
in the INIS Database
- A Bibliometric Study -**

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Abstract

Literature on the Chernobyl accident and its consequences is an important subject covered by the International Nuclear Information System (INIS) Database. The INIS Database contains 19872 bibliographic records and 8400 full text documents on this subject from 1986 up to 04/2005. A bibliometric study of these records was made to generate statistical summaries that characterise, in general terms, the intellectual content of the records and the nature of the records in terms of its major bibliographic attributes. Environmental aspects and human health constitute the two dominant subjects with a respective contribution of 49% and 38%. The rest is evenly divided among legal aspects, reactor safety and socio-economic impacts of the accident. The three countries that are most affected by the accident, namely Ukraine, Russian Federation and Belarus contributed 44% of the total input. 57% of the literature analysed are conference papers and reports while 25% are journal articles. Most of the documents were written in English (47%) and in Russian (36%). Seven percent of the publications were written in German.

Introduction

The reactor accident at the Chernobyl Unit Four nuclear power plant and its consequences have been the subject of extensive investigation by affected countries and by the global community in general. The INIS Database contains an extensive knowledge base on the accident and its consequences. Currently INIS has 19,872 bibliographic records subject covering the years 1986 up to 04/2005. For 8400 (42%) records the full texts are available too. The collection, processing and preservation of electronic NCL documents that can not be easily acquired through normal commercial channels and the provision of document delivery services are important functions of INIS. During the same period (1986–04/2005) INIS acquired a total of **1,516,222 records** and **300,636 (20%)** records have corresponding full text documents at INIS. This shows that INIS collected a higher than average proportion of full text documents on the Chernobyl accident and its consequences.

The diverse aspects of Chernobyl accident are distributed over a number of the subject categories that INIS assigns to each piece of literature. In order to undertake this bibliometric analysis, the records have been grouped as follows:

1. **Environmental Aspects** cover environmental implications for ecosystems resulting from the release of radioactive substances. This category is further subdivided into:

- transport, monitoring and impacts of radioisotopes in terrestrial (land) ecosystems;
- transport, monitoring and impacts of radioisotopes in aquatic (water) ecosystems;
- transport and monitoring of radioisotopes in earth's atmosphere;
- remedial actions like land reclamation through decontamination and agricultural practices;
- radionuclides of significant ecological interest particularly the Cesium, Iodine, Plutonium and strontium isotopes were analysed separately.

2. **Human Health and Radiation Protection Aspects** cover:

- impacts on human health due to biological radiation effects;
 - thyroid monitoring;
- dosimetry and radiation protection activities including calculation and measurement of doses;
- occupational exposure and safety,

3. **Reactor Safety:** The engineering and human factor aspects of the accident and its implication on other similar reactors.

4. **Socio-economic Aspects and Public Attitude** This covers the immediate and long term economic and social consequences of the accident and public attitude towards nuclear power as a consequence of the of the Chernobyl accident.

5. **Legal Aspect:** National, regional and international regulations regarding issues like trans-frontier contamination, compensations and liabilities

In the absence of suitable pre-assigned subject categories, Boolean search statements, using a combination of free text terms and/or key words derived from the INIS Thesaurus, were used. The analysis was made using the INIS Database on CD-ROM with the WinSPIRS (the Silverplatter Information Retrieval System for Windows) covering the years 1986 to 04/2005. WinSPIRS provides powerful Boolean tools that are suited for the analysis of all the bibliographic attributes of records.

Because there are no suitable subject categories available, it is unavoidable that there is a major overlap among database queries. This is particularly true for the subjects “environment” and “human health”. Some documents are, for example discussing aspects of both environmental transport or radionuclide migration and its implication on human health in terms of environmental exposure by humans, etc.

Chernobyl Records in the INIS Database by Subject Groupings

The number of records in each of the five subject groupings that are described above is shown in Figure 1. Environmental Aspects and Public Health and Radiation Protection Aspects constitute almost ninety percent of all Chernobyl records, with 49% and 38%, respectively. This indicates in that environmental and health concerns are the two most dominant issues. We must bear in mind, however, that the Socio-economic and the Legal Aspects are likely to be published in social science publications that may not be regularly scanned for inclusion into the INIS Database by national INIS centres. While reactor safety generally is well covered in the INIS Database, the fraction of such documents related to the Chernobyl accident is only 4%. This should be of concern, as one would expect increasing R&D activities regarding the safety of related types of reactors after the Chernobyl accident.

As already mentioned one of the strengths of INIS is that it provides document delivery service on the grey literature it collects from member countries. Figure 2 shows that, 72% (6095 records) of the total 8462 NCL documents are on the environmental aspect of the accident.

Figure 1

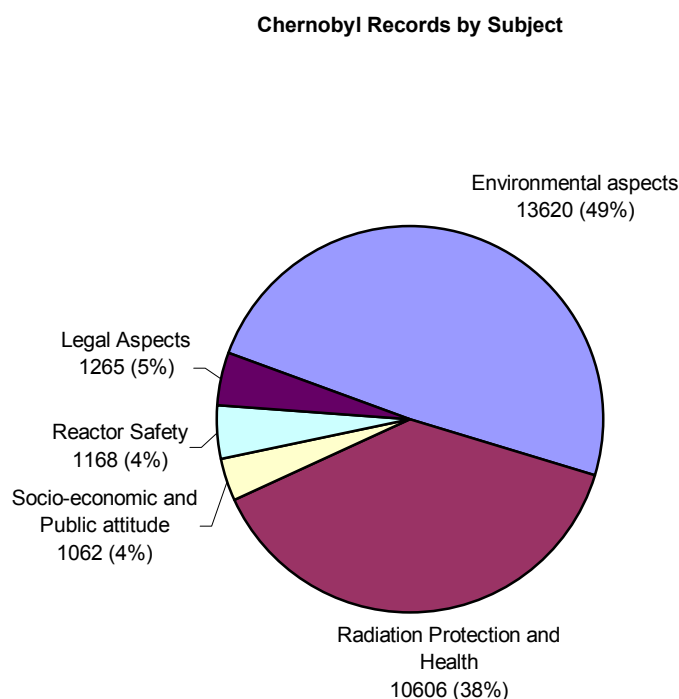
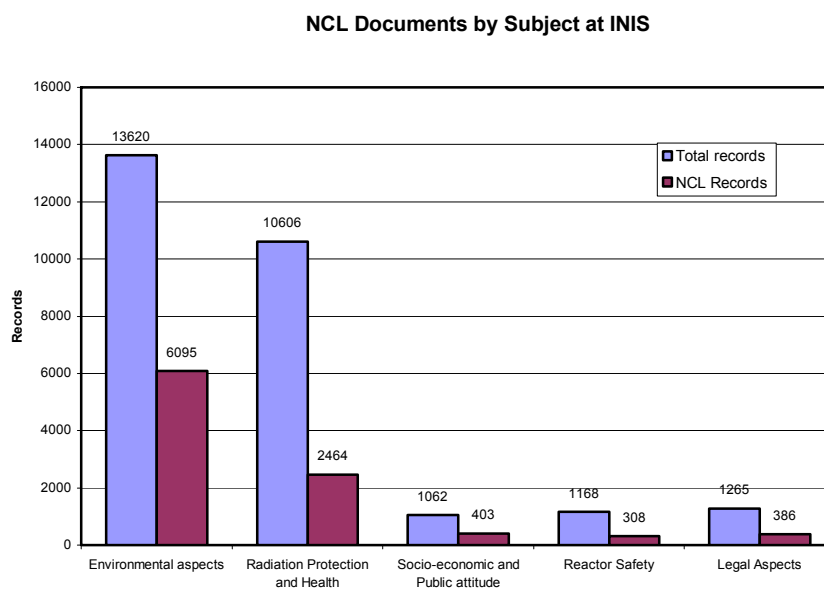


Figure 2



The total number of records and of NCL documents by detailed subject breakdown is presented in Table 1.

Table 1 **Chernobyl Records by Subject**

	Subject	Total Records	NCL Records
1	Environmental Aspects	13620	6095
	Land Contamination	4743	2118
	Land Reclamation	1269	604
	Water Contamination	1828	802
	Air Contamination	2440	857
	Radioecology Caesium Isotopes	5442	2295
	Radioecology Iodine Isotopes	1319	454
	Radioecology Plutonium Isotopes	609	251
	Radioecology Strontium Isotopes	1969	1005
2	Human Health and Radiation Protection	10606	4529
	Dosimetry and Radiation Protection	4436	1520
	Occupational Safety	1057	416
	Human Health	5458	2464
	Thyroid Monitoring	1291	497
3	Socio-economic Impacts and Public attitude	1062	403
	Socio-economic impacts	361	216
	Public Attitude	674	198

4	Reactor Safety	1168	308
5	Legal Aspects	1265	386

Country of Input

Each bibliographic record in the INIS Database is assigned with the country of origin of the publication as its attribute. Though this does not mean that all the documents published in a particular country are exclusively authored by the scientists of this country, it is still indicative. In the case of non journal publications, like reports and national conferences the bulk of the authorship is from the same country. The IAEA and countries with a major global publication industry like the Netherlands, are, however, notable exceptions.

Figure3

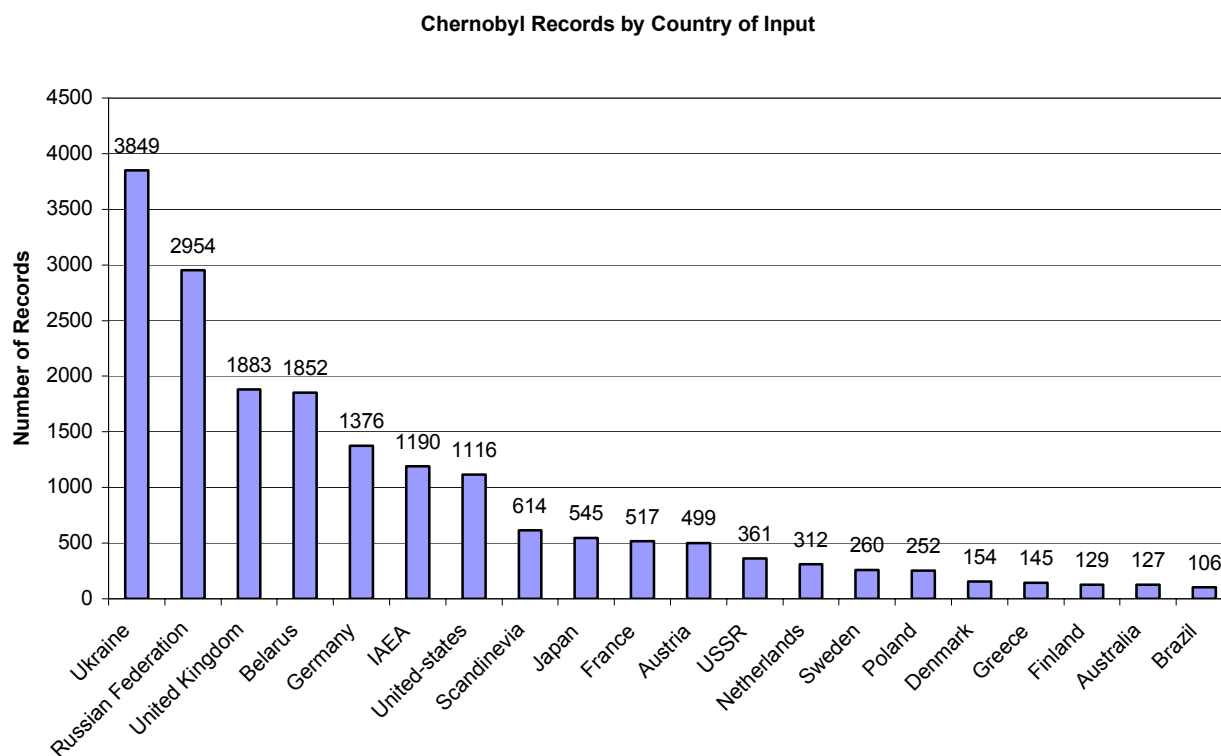


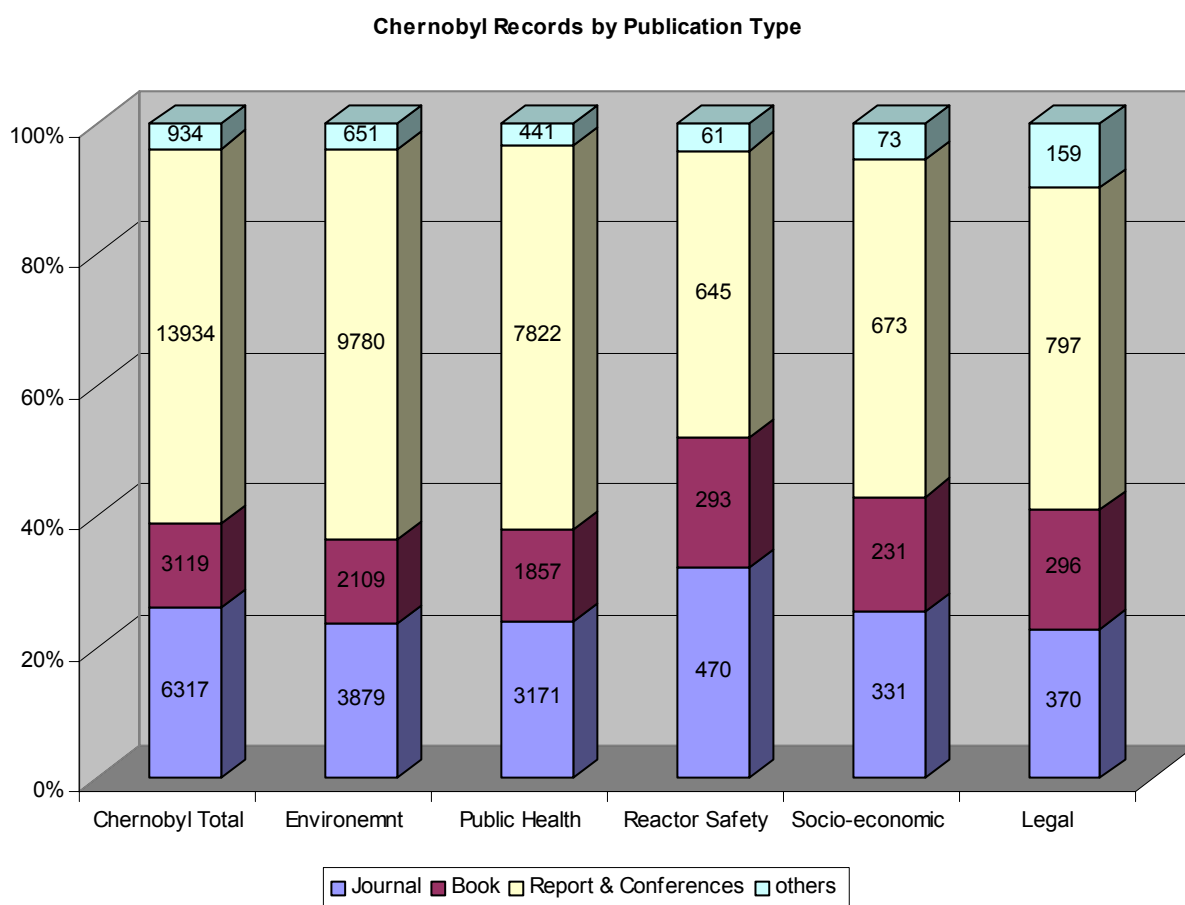
Figure 3 shows the number of records that were contributed by countries that submitted more than 100 records on the subject of the Chernobyl accident from 1986 to 04/2005 to INIS. As one would expect, Ukraine is the largest contributor to the database, followed by the Russian Federation. The contribution of Ukraine (3849), Russian Federation (2954) and Belarus (1852) take more significance because these were the countries that were highly affected by the fallout. The major INIS contributors, like United Kingdom, Germany and the USA, all contributed more than 1000 records each. There is no surprise that the IAEA as a sponsor of the major international conferences on the Chernobyl accident and its consequences is the fifth largest contributor. But it is interesting to observe that the total contribution of the Scandinavians is not very

high. In fact Austria's contribution is almost two fold of that of each of the Scandinavian countries and Poland which one would suppose should have had more stake in the accident. However, these figures could only mean that these countries may not be aggressive enough in sending their publications to the INIS Database.

Document Types

Documents input into the INIS Database are assigned one of seven pre-defined document types: book, journal-article, report, miscellaneous (grey literature with no report number), patent, computer medium, translation and audio-visual material. Besides, INIS records show whether a document is a conference material, dictionary, progress report, legal material, thesis, etc., through ten literary indicators. Using a combination of document types and literary indicators, records were grouped in to four major types namely, Journal-articles, books, conference-papers-and-reports and other publications. We identified which types of publication are most important. As shown in Figure 4, conferences and reports constitute 57% of all Chernobyl records, followed by journal articles with 25% , books 13% and 5% other types publications. These fractions are only indicative because there is an overlap of publication types in cases where an entire conference proceeding can be published as a book or a special issue of a journal. In such cases the record is assigned "book" for publication type and "k" as a literary indicator to indicate it is a conference paper. Counting only literary indicators, conference papers contribute 11559 records, which is 58% of all Chernobyl records. This is in agreement with the fraction for the entire INIS Database.

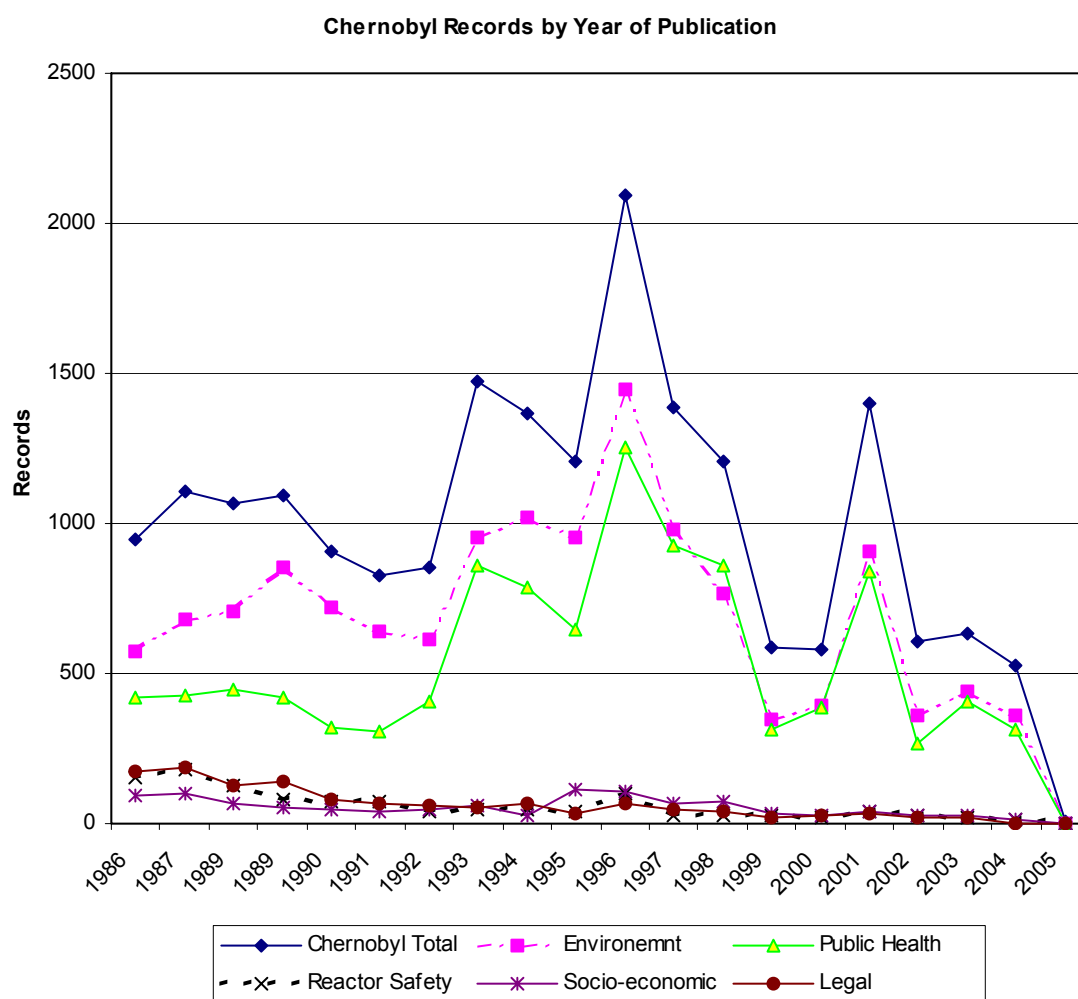
Figure 4.



Chernobyl Records by Year of Publication

Analysis of literature by publication year helps us to see the level of research and development activities over a given period of time on a given subject. It may also indicate which aspect of the subject garnered more interest over time. Figure 54 shows the number of records in the INIS Database by subject and by publication year in the last 19 years since the accident. For the first decade till year 1995 there had been a sustained but modest increase in the number of publications mostly because of environment and human health topics. The tenth and the fifteenth anniversary of the Chernobyl accident show the highest level of publication activities; major international conferences were held during these years. An increase is also observed for the various institutional periodic and evaluation reports and the largest input to the INIS Database, of 2091 records, was recorded during publication year 1996 – the tenth anniversary of the Chernobyl accident. Since the publication year 2001, which is the fifteenth anniversary the level of publication activity has been similar to the first decade after the accident. Another interesting observation is that publication activities on legal aspects like the issues of trans-frontier contamination regulations, compensation and radiation protection regulations were higher in the first five years after the accident. Documents published in 2004/2005 will continue to be input into the database, hence the graph doesn't show the real picture for those years. It is likely that the INIS Database will see a high level of input on the subject of Chernobyl in 2006 - the twentieth anniversary of the Chernobyl accident

Figure 5



Languages of Publications.

The language of indexing and abstracting in INIS Database is English and each record has either an original or translated English title and English abstract, but the full text of the document remains in its original language of publication and that is clearly indicated in the database. Unlike in the case of the total INIS database where 72% of the documents are in English, the picture is different here. As shown in Figure 6, while English is still the leading language of publication, Russian is a strong second with 36% of the document written on the Chernobyl accident. The Ukrainian language contributed 4.5% of the publications. This is a quite significant fraction compared to its negligible contribution to the total database. This figure also shows that most of the publications from Ukraine were written in Russian and English. It should also be noted that 6.8% of the publications were written in German language, which is higher than the average of all INIS records.

Figure 5

Chernobyl records by language of document

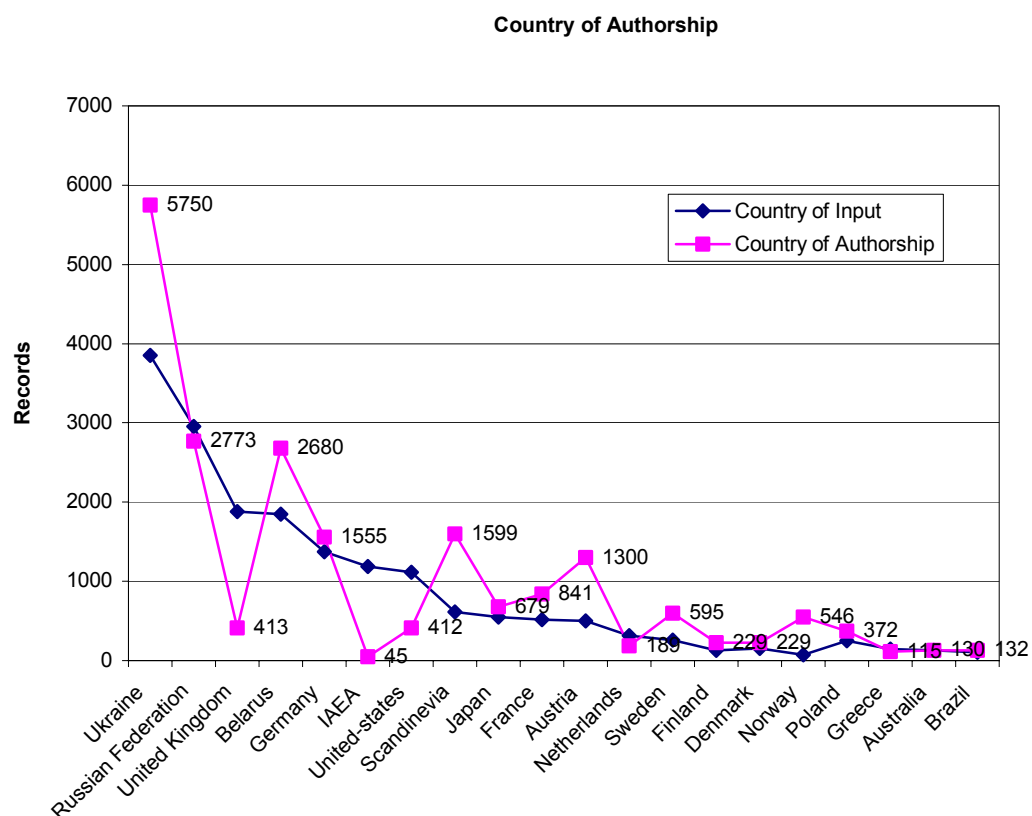


Some Insight into the Country of Authorship

The “Country of Input” data show the number publication that a country has contributed to the INIS Database. It is, however, not uncommon that authors published abroad. While, each record exactly indicates the country of input of a record, one has to try to extract the information on the country of the author from the author’s institutional affiliation or corporate authorship. Though this could not be applied consistently

applied and hence should be treated with some caution, still this study came up with some important statistics. Figure 6 shows countries of authors wherever they were available in the ‘author’ and ‘corporate author’ fields of a record. Documents with authors from several countries are accounted to each of those countries. Authors from Ukraine contributed 5750 records. That is more than the sum of the Russian (2773) and Belarussian (2680), which are the second and third contributors. German authors stand fourth. It is surprising to see that Austrian authors contributed only slightly less than the sum of the four much more affected The IAEA, the UK and the USA with a strong publication activity did not necessarily contribute much in terms of the intellectual content. It is also interesting to see that Norway which was omitted from the Figure 3 (Country of input) because it contributed less than 100 records to the INIS Database, stands ninth country with 546 records.

Figure 6



Concluding Remarks

This analysis showed that INIS achieved a high degree of comprehensiveness in the environmental and human health aspects. It also showed, against expectations, that safety engineering aspects contribute only 4% of the Chernobyl records. More attention must also be paid to cover to the social science aspect.

While the majority of publications are from the most affected countries, Ukraine, Russia, Belarus, surprisingly high levels of publication activities are also observed in Germany and Austria. The significantly affected Scandinavian countries, on the other hand, made less impact.

The full text resource of 8400 pieces of literature, which is 42% of the total Chernobyl records makes INIS a competitive document delivery service provider on this important subject.

The high percentage of Russian and German as languages of publications adds to the importance of a multilingual search and retrieval tools.

References

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