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Activities and Plans for Compilation in the IAEA

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Summary of Recommendations

- (i) That plans for growth of staff and provision of computing facilities be endorsed by INDSWG.
- (ii) That suitable arrangements for access to nuclear data from various countries and organizations be agreed in principle as a prerequisite for the proposed activities and for the effective use of the existing computer and the facilities now being planned.
- (iii) That the long-term plans centre on an exchange of detailed measured data, bibliographic references to relevant publications, additional unpublished comments on measured data to supplement the data files held, and some critical review, analysis or evaluation work.
- (iv) That some activities of a research nature, as well as reviews, analysis or evaluation be allowed and encouraged as far as necessary to aid recruiting and retaining thoroughly competent staff.
- (v) That the setting up of a panel of compilation experts to review the IAEA activities be considered.
- (vi) That extension of the work to more specifically reactor constants be considered only at a later date.

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1. INTRODUCTION - ACTUAL STATUS AT 1 NOVEMBER 1964

1.1 Staff.

Apart from the authors, a junior physicist and an experienced computer programmer are already available.

Two more professional posts and the position of a card-handling machine operator/programmer-in-training may be filled soon, subject to the outcome of the present INDSWG meeting being satisfactory.

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During 1965 we have authorization to hire an additional secretarial/card-handling machine operator, and another professional staff member may be allowed; for 1966 further expansion of staff has been provided for in budget proposals now under examination.

1.2 Computing facilities

The IBM 7040 computer in the Wiener Technische Hochschule has been working satisfactorily for some months. It has a 16384-word memory and five magnetic tape units. Proposals to double the memory size are awaiting a decision.

The Scientific & Technical Information Division of the IAEA has now placed an order for an IBM 1401 for delivery about July 1965. Several extra facilities have been added in view of expected Nuclear Data needs; these include a tape unit for 800 characters/inch density and a Calcomp type graphical plotter. Thus input-output- and format conversion work preparatory for 7040 analysis, etc., can be done on the 1401 when it is available.

Cancellation clauses enable us to withdraw the purchase order for the plotter or to review the 1401 set-up within about one month after the INDSWG meeting. The decision on enlarging the 7040 memory will also be taken at roughly the same date.

1.3 It is therefore important to establish at the INDSWG meeting the outline programme and its feasibility.

2. NATURE OF THE WORK TO BE DONE

2.1 Present work

For reasons of pressure of work (to prepare a paper for the Geneva Conference and subsequently to complete the detailed publication of this work), as well as because of the lack of firm assurances concerning the availability of detailed data for exchange from various quarters, the operations of the IAEA Nuclear Data Unit have been confined to routine work for the INDSWG and the 2200 m/sec neutron constants study for Geneva paper P/717.

Planning has extended to computer arrangements and budget for a foreseen programme of a longer-term type, as outlined below.

A continuation of the present critical review type of activity is possible for a limited time, since resonance integrals or fission product absorption could be studied, but unless suggestions arise at Warsaw, we do not see a complete long-term programme of this type if other work is impossible.

2.2 Bibliographic studies

A letter to Dr. Goldstein explaining how this Agency could help his CINDA operation remains unanswered, but it is felt that this, too, may depend on some form of reciprocity, since this was put forward

so strongly at the second INDSWG meeting.

Work of the Agency's Scientific & Technical Information Division in the bibliographic field is of general scope similar to the work at Euratom and related to Nuclear Science Abstracts and Referativnyi Zhurnal. It is insufficiently detailed to replace CINDA in our special field.

What seems to be needed for the Nuclear Data unit is a service for preparing abstracts and punched cards in CINDA format (or at least providing information in detail corresponding to CINDA) relative to publications of Nuclear Data work in Russian journals and others, e.g., Czech or Indian Journal of Physics, not readily covered by the Columbia University and Saclay compiling groups. Whether prepublication information can be obtained for CINDA should be studied - this does not seem to be a quite straightforward problem even where the CINDA system is already in operation.

The question of establishing correspondents in Eastern Europe, Asia or Latin America who would provide information for CINDA with a minimum of delay from local sources can be examined as soon as the general basis for our work is established.

2.3 Gathering and exchanging experimental data

The exchange of reprints or preprints is to be extended as far as possible but is not here further considered, as not being "compilation".

Requests that we receive more detailed information than that published, preferably as punched cards (or paper or magnetic tape of computer-compatible format) has already been raised. It appears that the availability of such detailed data is crucial to our future plans.

Enquiries have shown that where paper tape is the first output from an experiment, this is fed to a computer for initial computations (run normalizations and comparisons, subtraction of background, conversion to transmission or similar operations) so that we would expect to receive copies of the computer output, which are generally IBM-type cards and not paper tape. The only technical problems then to be settled concern reading the particular formats used (e.g. decimal or binary, if binary, column, row or other), none of which seem to be difficult to arrange. It would be proposed to accept the original format for input data (save in exceptional cases or when the available format could easily be modified to suit our standards); all data sent out from the compiling centre would probably be in a standard format, or one of a few standard formats, of which one would be on magnetic tape.

2.4 Use of magnetic tape

For exchange of data, which might take place monthly, with the Brookhaven and Saclay centres, magnetic tape appears to be desirable. It will, however, be unlikely that the volume of new data from any other source would be sufficient that magnetic tape* would be used to receive data from elsewhere. Plans for sending out to national laboratories

* for footnote see next page

the data available would have to be worked out, but punched cards would be used for those laboratories which had no computer compatible with IBM-style magnetic tape. If the volume becomes large, however, it may be necessary to send out punched cards only on request, and to limit automatic onward transmission of all data to those receiving magnetic tapes.

By the middle of 1965 facilities would exist for reading and writing tapes of density 200, 556 and 800 characters per inch (IBM standards). These would give complete compatibility with the Saclay & Brookhaven centres. However, in 1967 the question of changing to an IBM 360 computer system might arise, and the tape format for this recently-designed IBM system differs from that of the older IBM machine. Other centres may also make similar changes so that planning for this contingency is premature.

2.5 Analysis and Evaluation

A necessary minimum of work of an evaluation and critical review nature will be undertaken; this involves assessing and annotating (e.g. with details of origin, resolution, any known uncertainties) all "raw" data held in archive or re-issued. Whether further analysis of the data is to be undertaken would depend on the volume and nature of the data received, its place of origin, and also on the specialist interests of the staff, which would be subject to change from time to time in accordance with the normal Agency staffing policy.

On the question of how much effort would be devoted to further analysis of experimental results, such as the derivation of Legendre polynomial coefficients or of resonance parameters, we do not now make any definite proposals for reasons given above. Concerning the "evaluation" of data in the sense of the production of a complete set of evaluated cross sections for all neutron energies for a given isotope or reaction, it would appear that initially this would not be attempted, since a number of national laboratories are already operating extensively in this field, and they could be supported by supplying bibliographic information or incomplete sets of data from our files. However, as a matter of principle it is clear that, in due course, we should endeavour to obtain and exchange internationally the results of such evaluations, and therefore we wish to keep fully in touch with what is being done. In particular we are interested in any discussions for standardized formats for presenting such evaluated data, and should contribute our ideas on such matters. If in due course it appears that we can usefully enter the evaluation field ourselves, or that this is requested as the "price" for access to the results of other evaluations, we should certainly aim at being in a position to do this. However, preparation of data for particular calculations, e.g.

* We assume magnetic tapes would be exchanged in the form of uncut full-length computer reels. The value or number of magnetic tapes sent out would have to be matched by the receipt of similar tapes, blank or containing data, or charges would have to be made for tapes transferred. The use of short sections of narrow tape would involve special techniques.

the production from the complete "evaluated" data of multi-group average cross sections should probably not be performed by the IAEA data unit, at least until internationally specified multi-group sets or other formats have agreed upon as being of general applicability for work in many countries

For staff planning purposes it is assumed that we should provide a staff sufficient to cope with peak loads of the basic work (bibliographic and detailed data exchange, plus normal support for the INDSWG) and allow other work to proceed between peak periods.

3. MISCELLANEOUS PROBLEMS

3.1 Relations with other centres

It is assumed that exchanges of data with the BNL and Saclay (ENEA) centres can be arranged, as well as cooperation in learning and developing the computer techniques involved. In the initial stages of the project this may involve members of the Nuclear Data unit spending periods (of a few months) in the Paris or New York areas. The converse process, of inviting other workers to Vienna should not be considered until the new 1401 computer has reached the stage of a completely routine operation.

The cooperation of the two centres mentioned in the initial learning and method-developing stages should therefore be requested.

3.2 Publications

The precedent of BNL in respect of the division of labour between producing printed publications and preparing computer-type files is not yet far enough advanced to serve as a guide for plans in Vienna. Indeed, the IAEA should have an interest in working on this aspect of the operations with (and at) Brookhaven at an early date, in an endeavour to arrive at a satisfactory pattern of effort for future planning. Similar cooperation with Saclay in this matter is also desirable, although the ENEA group may not plan to issue printed compilations like BNL-325 and BNL-400, while the IAEA has well-developed publication facilities.

3.3 Future projections

How this project will develop depends initially on getting cooperation in making data available from various national laboratories and other sources. We believe a good quality skeleton staff already exists but further hiring will depend on assurances of data-availability. A budget of \$80,000 for computation services, a staff of seven physicists plus a senior computer programmer and five clerical/computer assistants is at present being proposed as representing the state to be attained by 1967, and hiring at a rate which will make this possible without sacrifice of quality now appears possible providing the programmes can go forward as envisaged.

Although in the foregoing it was envisaged that any plans for IAEA staff to work at Saclay or Brookhaven would be temporary, at a later stage reciprocal interchanges of staff could be most valuable. Since so much of the measured data comes from the American continent, one might even consider attaching an IAEA Nuclear Data staff member to the UN Headquarters in New York on a continuing basis to cooperate in the data-gathering process, but any such proposal would depend on the trends of technical progress occurring at the existing BNL Sigma Centre and their reactions to the proposal. Other important centres (e.g. Paris and Moscow) are so near Vienna that no comparable arrangement seems now to be necessary.

4. CONCLUSIONS

4.1 Staffing - general considerations

It remains true that to attract and retain a staff capable of good critical review work some opportunities to do work of a research or at least an intrinsically interesting nature are essential. At present it also seems essential that some of the staff remain with the Agency for rather short periods (e.g. two years) so as to remain in touch with the advances in the field. Later, as the work becomes integrated with other centres, this may be less necessary (though one post, subject to rotation, in New York might then be advantageous). On the whole, the need seems to be for experimental specialists more than for theoretical physicists (say 2 : 1 or 3 : 1 ratio), but as the Trieste centre develops and cooperation with them develops this situation may change. It is of course easier for a theoretician to continue his own research in Vienna than for an experimental specialist measuring Nuclear Data.

4.2 "Watch-dog committee" or panel of experts

The INDSWG can continue to advise on the general scope and direction of the compilation work but a smaller panel of experts specialized on compilation problems could aid more on the exact programme. The IAEA would therefore plan, subject to the preconditions for the success of this project having been met, to use one of the two panel meetings planned for 1965 to convene such a specialist panel (with perhaps 6 - 7 members) to advise on our plans.

This group might become a continuing body depending on its successful operation and on the balance between data compiling work and other work in connection with the INDSWG's future programme which will also fall on the secretariat.

4.3 Reactor Physics Constants

The extension of the compilation work to some of the more basic reactor physics constants has been requested by some specialists, but this will only be considered after a period of successful exchange of information in the more basic field of neutron cross-sections and related constants.