A MULTI-COMPARTMENT SYSTEM APPROACH FOR
OPTIMAL ORGANIZATION OF RADIATION SAFETY

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Years of experience in radiation safety at universities and research institutes revealed the laboratory classification, radiation protection regulations and supervision practice usually applied, to be non-optimal. They are too rigid when applied to specific types of radiation work and are sometimes not rigid enough to enable the use of existing general purpose facilities for other types of radiation experiments.

In light of these considerations, a new and more specific approach to radiation protection organization, supervision and optimization is presented. It is based on a detailed classification of radiation sources of all kinds, which takes into consideration a large number of physical, chemical, biological, technical and quantitative parameters of the source and the mode of its use. Consequently, all other factors involved in radiation work and safety, such as the technical requirements concerning laboratories and control areas, supervision and monitoring, etc. on the one hand, and factors related to radiation workers like personal protection and monitoring, medical supervision, instrumentation, etc. on the other hand, are influenced by this classification. The factors involved in radiation work and safety are mutually dependent and form a multi-compartment system with linkage parameters between its components. A schematic block diagram of the successive information flow and the decision making is presented in fig. 1. Once the system is well defined, any variation in one of the components causes an iterative-like process, until the system is again in "steady state", resulting in an optimal procedure for safe radiation work and proper safety organization. This process enables an individual treatment for each case, and optimizes the safety demands from both the safety and economical aspects. The methodology of establishing the system is based upon a detailed analysis of those sub-blocks of "Personal Radiation Safety" and "Areal Radiation Safety" in fig. 1.

Suppose a block denoted S, which is responsible for a certain aspect of the radiation safety. There are N different means which can contribute to its goal, so that $\{S\} = S_i$, $i=1,N$. At this point all the combinations C_N^k of the S_i's are calculated. Each combination is examined as to its ability to be sufficient for facing a certain radiation source at a certain physical, chemical, biological or technological state. At the end of this process, a new group $\{R\}$ is formed, of radiation sources, where $\{R\} = \{R_j, j=1,M\}$. M is the number of different radiation sources that the block S can handle. This procedure is being carried out for each of the blocks which form the multi-compartment model, resulting in an enlarged group $\{R\}$ consisting of a fully detailed variety of radiation sources. A flow chart of the methodology is schemed in fig. 2.

Finally, based on professional experience and judgement, $\{R\}$ can be reduced to a more practical group $\{R^1\}$. Consequently, the blocks "Radiation Workers" and "Radiation Areas" are determined. At this stage, the system is ready for operation. It should be mentioned that the content of each of the sub-blocks of "Personal Radiation Safety" and "Areal Radiation Safety" should

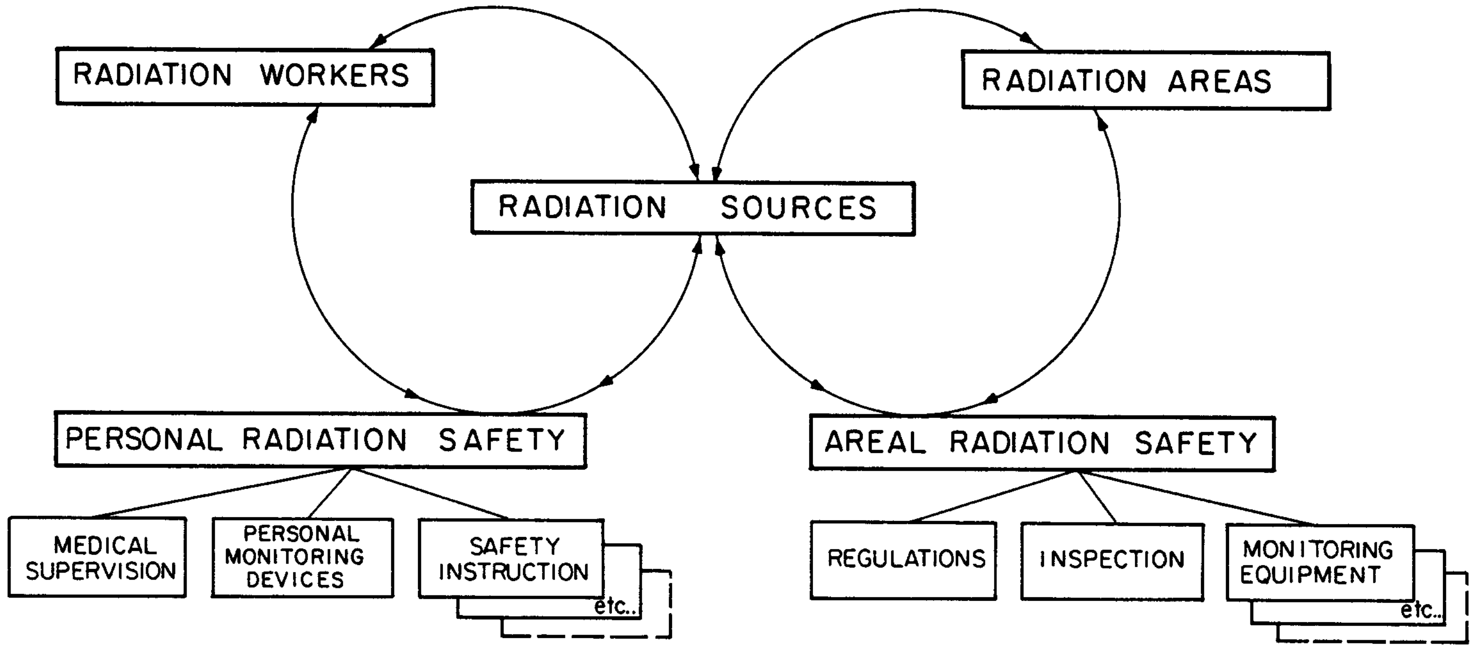

Fig 1 ! Schematic Block Diagram of the Successive Information Flow.

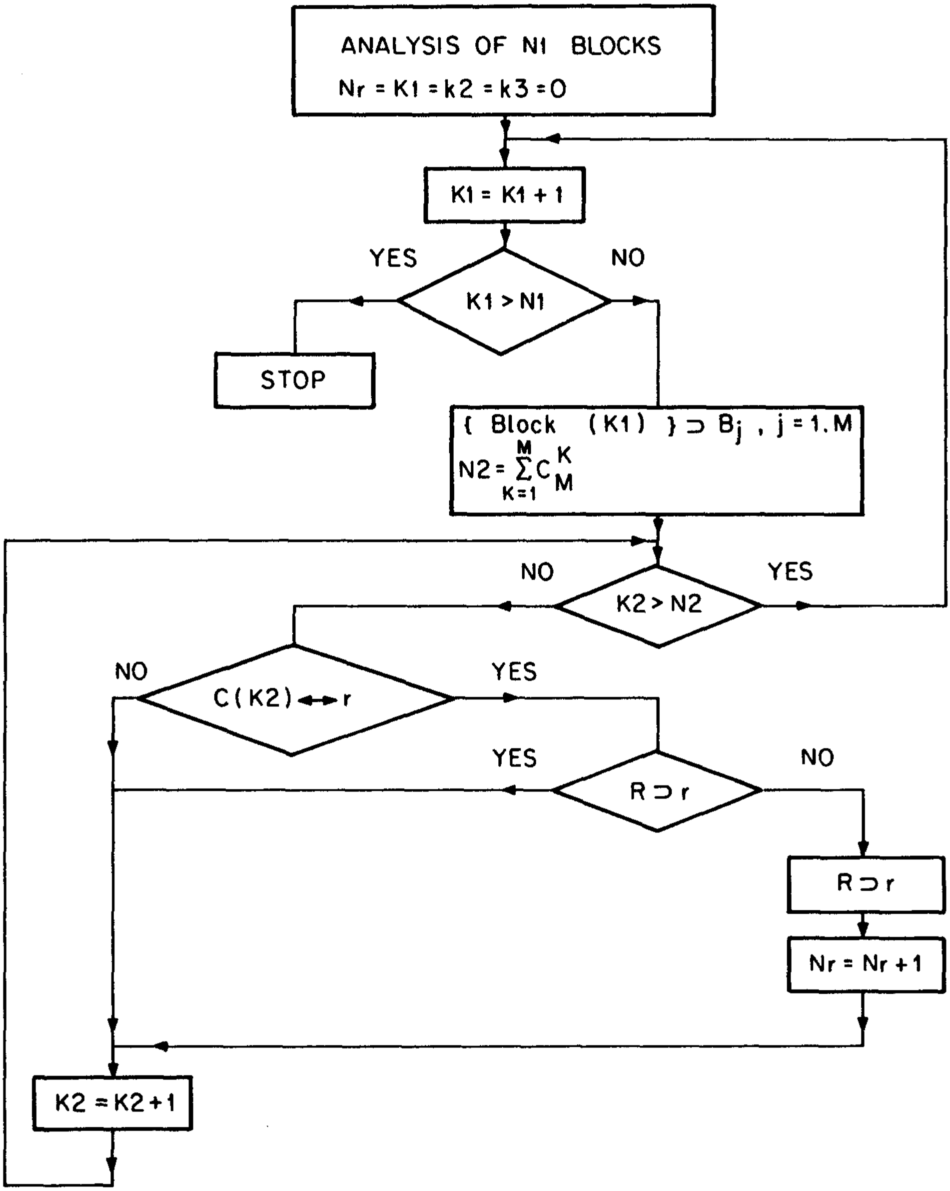

Fig 2 : Flow Chart for Classification of Radiation Sources.

Nr. K1. K2 – COUNTERS
N1 – # OF BLOCKS FOR ANALYSIS
Bj's – MEANS INCLUDED IN THE K1'th BLOCK
N2 – # OF COMBINATIONS OF Bj's
C(K2) – THE K2'th COMBINATION
R – THE SET OF DIFFERENT RADIATION SOURCES
r – RADIATION SOURCE

confirm with the regulations of ICRP.

The computerized integrated radiation safety system described is especially suitable for universities and research institutes where a large variety of open and sealed radioactive sources and radiation producing equipment is used. It interlinks all the steps and provisions to be taken and the necessary regulations to be issued for most practical types of radiation experiments. The flexibility of the system makes it possible to fit an almost individual solution for each case, adjusting a suitable procedure, optimal from both safety and economical aspects.