LIQUID WASTES	
Category	Activity level A (μCi/ml)
1	$A \leq 10^{-6}$
2	$10^{-6} < A \leq 10^{-3}$
3	$10^{-3} < A \leq 10^{-1}$
4	$10^{-1} < A \leq 10^{4}$
5	$10^{4} < A$

SOLID WASTES	
Category	Radiation dose on the surface of wastes D(R/h)
1	$D \leq 0.2$
2	$0.2 < D \leq 2$
3	$2 < D$
4	α-activity expressed in Ci/m³

GASEOUS WASTES	
Category	Activity level A(Ci/m³)
1	$A \leq 10^{-10}$
2	$10^{-10} < A \leq 10^{-6}$
3	$10^{-6} < A$

TECHNICAL REPORTS SERIES No. 101

Standardization of Radioactive Waste Categories

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1970

STANDARDIZATION
OF RADIOACTIVE WASTE CATEGORIES

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STANDARDIZATION OF RADIOACTIVE WASTE CATEGORIES

REPORT OF A PANEL
HELD IN VIENNA
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INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 1970

STANDARDIZATION OF RADIOACTIVE WASTE CATEGORIES
IAEA, VIENNA, 1970
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FOREWORD

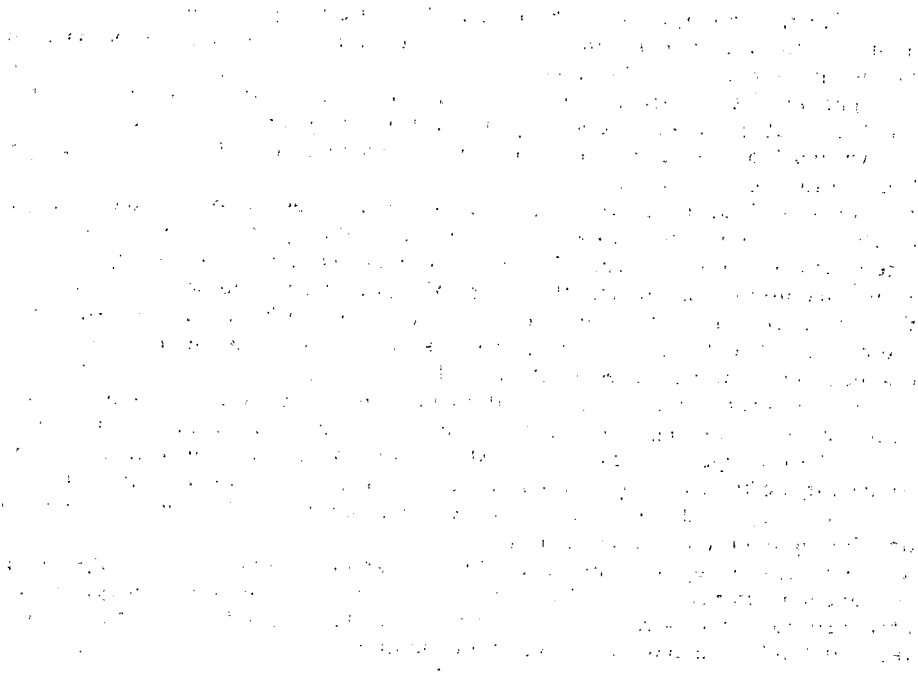
A large amount of information about most aspects of radioactive waste management has been accumulated and made available to interested nations in recent years.

The efficiency of this service has been somewhat hampered because the terminology used to describe the different types of radioactive waste has varied from country to country and indeed from installation to installation within a given country.

This publication is the outcome of a panel meeting on Standardization of Radioactive Waste Categories which was held at the headquarters of the International Atomic Energy Agency in Vienna from 6 to 10 November 1967. Some problems concerning the range of application were not solved during the panel meeting and were cleared up later with the interested panel members. The text, containing the results of the panel and the following discussions, was approved in October 1969.

It presents a simple standard to be used as a common language between people working in the field of waste management at nuclear installations. The purpose of the standard is only to act as a practical tool for increasing efficiency in communicating, collecting and assessing technical and economical information in the common interest of all nations and the developing countries in particular.

A future panel will be convened to assess the experience gained with the present standard. At that time the need to expand the concept of the standard so that it may also be used as a tool for regulatory action, and for legal and safety assessment, will be considered.



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1. INTRODUCTION AND SUMMARY

Recent panels held by the Agency, especially that on the Economics of Waste Management [1], have shown that the categories of radioactive wastes in various establishments are mostly based on local operating conditions. Therefore, the categories chosen may well fit the needs of the individual establishment but they are rarely identical to those used elsewhere. The terms low-level, intermediate-level and high-level radioactive wastes are widely used to describe different concentrations of radioactive materials in wastes. Unfortunately, these terms do not have quantitative definitions and in this way confusion arises when reference is made simply to high, low or medium-level wastes undefined by concentration or radioactivity level.

In various individual countries different considerations have determined the system of classification used for radioactive waste. These considerations include environmental limitations for the acceptance of waste and existing operational situations in terms of waste type and waste treatment systems. The different systems in turn lead to different regulations and make it much less easy for communication between countries on waste management topics.

Only very few countries, in their legal regulations, have defined the categories of wastes. The terminology is not precise and this may result in an obscurity between waste management staff and health and safety inspection as far as interpretation of such regulations is concerned.

The precise standardization of waste categories is a difficult and complex problem with many opposing views already within one country and the more so on an international scale.

As the first step, classification of waste categories, should help people who have to operate waste treatment plants so as to have a common language among themselves. This is the main aim of the standard waste categories proposal which is presented.

The waste categories are not suitable for regulatory purposes nor for use in health and safety evaluations.

A future panel might be convened to assess:

(i) the experience gained with the present standard

(ii) the need to expand the concept of the international standard so that it may also be used for regulatory as well as health and safety purposes, in the light of the experience gained with such advanced standards in certain countries.

2. PRESENT STATE OF WASTE CLASSIFICATION

The information submitted by eleven countries concerning their present systems for the classification of radioactive wastes has been examined.

There are no countries that have the same classification system and even within one country it may be different. The approach to the classification varies and seems to be dependent on the state of nuclear industry development.

There are no countries with official classification of radioactive wastes and any regulation of this type. In one country (Japan) there

exists the semi-official classification of radioactive wastes that was recommended by a special scientific group of the national Atomic Energy Commission. In the United States of America, the United States of America Standards Institute, a private organization sponsored by many US scientific societies and industries, has adopted a standard based on MPCs (maximum permissible concentration) [2].

Two countries [3, 4] have legal definitions of what is radioactive waste and what is not.

Varying classifications of liquid effluents are based on treatment [6-13], possibilities of discharge into the environment [13-17], or ICRP standards [18-20].

The classification of solid wastes is based on preconditioning [8] and transportation standards [5].

Gaseous effluents have been classified on the basis of the system employed, the quantity of material released, and in terms of multiples of MPCs.

2.1. Liquid wastes

It is common to categorize liquid wastes as 'low', 'medium', and 'high' activity. The principle of this categorization may be based on activity, on decontamination factors prior to discharge, or in relation to MPCs. This categorization may differ within countries and Fig. 1 illustrates the range of variation which may occur within, as well as between, countries. For example, the upper limit for 'low' active liquid waste ranges between 10^{-4} Ci/m^3 and 10^{-1} Ci/m^3, and the lower limit of 'high' active liquid wastes between 10^{-1} and 10^3Ci/m^3. Thus 'high' active wastes in Poland might be designated 'low' active in some establishments in the United Kingdom and Norway, whilst being considered 'intermediate' or 'medium' in other countries.

The range of activities within the unofficial systems of nomenclature in use is indicated in Fig. 1.

2.2. Solid wastes

The classification of solid wastes is more complicated because in different countries different bases are used. In France the solid wastes are classified according to type of container in which wastes are stored so that the exposure dose rate is less than 200 mR/h at contact and 10 mR/h at 1 metre (10 cm concrete wall - low active, 40 cm concrete wall - medium active, lead shielding - high active). In Japan the classification is based on the activity per volume (> 1 mCi/cm^3 - high active, 1 mCi/cm^3 to 1 μCi/cm^3 - intermediate active, 1 μCi/cm^3 to 10^{-3} μCi/cm^3 - low active); in Sweden and the UK the activity (mCi) per container is sometimes the basis and in the USSR the activity per unit weight.

2.3. Gaseous wastes

The experience gained in the classification of gaseous effluents is very limited. There exist considerable differences in activity levels and composition of gaseous effluents, but the range of activity is narrow and

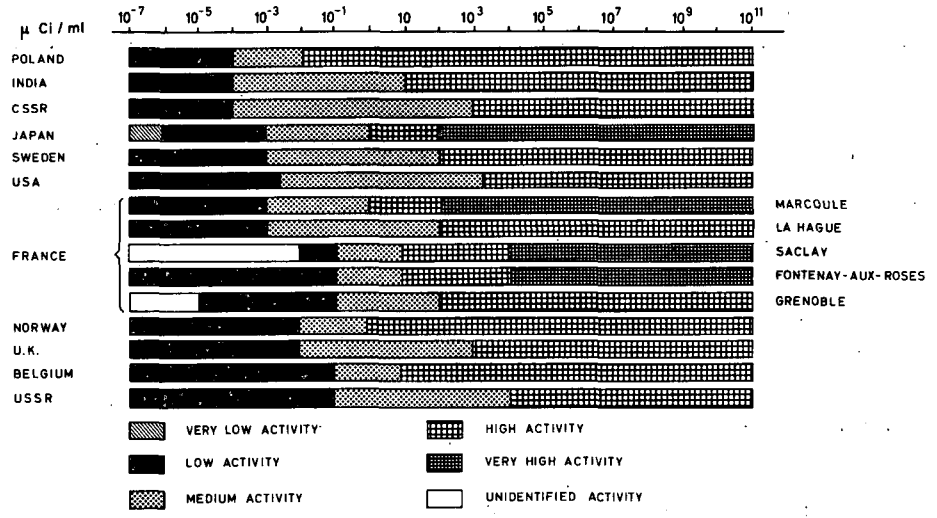

FIG.1. Unofficial classification of liquid radioactive wastes.

methods of treatment are few in comparison with liquid effluents. Gaseous effluents are usually not classified but only described by the total activity and activity per unit volume.

3. PREMISES OF WASTE STANDARDIZATION

The approach to standardization can be made from different points of view. The categories can be proposed on the basis of health and safety requirements, in accordance with practical experience at waste treatment plants or according to the regulations for the safe transport of radioactive materials. On an international scale the differences between legal regulations are very considerable especially as far as application of MPC is concerned.

From all these points of view the proposal of standard categories of radioactive wastes must be understood as a flexible proposal, based on the present knowledge and practical experience. With further experience it may be necessary to revise this first proposal.

It is not intended to recommend the standard categories to be converted into national regulations, but to use them mainly for improving communication between workers within the nuclear energy industry. The problem of the establishment of national regulations is better left to the responsibility of individual nations or groups of nations.

The categorization cannot serve directly as a basis for waste treatment and disposal or definition of safety after discharge, but rather to provide descriptive information about the character of the waste.

3.1. Definition of waste categories by MPC

In considering possible methods of defining categories of radioactive wastes, the first major alternative considered was the use of the radio-

activity content expressed as a ratio of the maximum permissible concentration (MPC). This would have the apparent advantage of including some thought of radiotoxicity. However, MPC of wastes is not, in itself, sufficient information to evaluate the radiation exposures which would eventually result from either intentional release or accidental leakage of the wastes. Having in mind that the primary purpose of the categorization is communication, the use of activity concentration as the basis for categorization, rather than the multiplication factors of MPC values for liquids and gases, was agreed upon as a compromise.

3.2. The nomenclature of waste categories

Because of widely varying interpretation of the terms 'low', 'medium' and 'high', the categories of all types of waste should be identified by number, in order to avoid further confusion by the use of the existing terminology.

4. CATEGORIES OF LIQUID RADIOACTIVE WASTES

Bearing in mind the primary requirements for the categorization, viz. to improve international communication, the simplest system of classification of liquid wastes by arbitrary activity concentration levels is recommended. The concentration should be expressed, as in other Agency documents, in μCi/ml or Ci/m^3.

The proposal of categories of liquid radioactive waste contains five categories and is a compromise between requirements of waste treatment at research establishments and at industrial plants treating irradiated nuclear fuel.

Category 1: comprises liquid wastes whose radionuclides concentration is equal or below 10^{-6} μCi/ml. Liquid effluents are not normally treated but discharged directly into the environment.

Category 2: comprises liquid wastes whose radionuclides concentration is higher than 10^{-6} μCi/ml and equal or lower than 10^{-3} μCi/ml. Liquid effluents are normally treated by usual methods[1] and shielding of equipment is not necessary.

Category 3: comprises liquid wastes whose radionuclides concentration is higher than 10^{-3} μCi/ml and equal or lower than 10^{-1} μCi/ml. Liquid effluents are treated by usual methods[1] and shielding of parts of equipment is sometimes needed.

Category 4: comprises liquid wastes whose radionuclides concentration is higher than 10^{-1} μCi/ml and equal or lower than 10^{4} μCi/ml. Liquid effluents are treated by usual methods[1] and shielding of equipment is necessary.

Category 5: comprises liquid wastes whose radionuclides concentration is higher than 10^{4} μCi/ml. Liquid effluents are stored and cooling is necessary.

The proposal for the categories of liquid wastes is summarized in Table I.

---

[1] Usual methods denote evaporation, ion-exchange, or chemical treatment [6-12].

TABLE I. PROPOSAL FOR THE CATEGORIES OF LIQUID WASTES

Category	Activity level A (μCi/ml)	Remarks	
1	$A \leq 10^{-6}$	not normally treated	
2	$10^{-6} < A \leq 10^{-3}$	without shielding	treatment by usual methods
3	$10^{-3} < A \leq 10^{-1}$	shielding possible	
4	$10^{-1} < A \leq 10^{4}$	shielding necessary	
5	$10^{4} < A$	cooling necessary	

5. CATEGORIES OF SOLID RADIOACTIVE WASTES

Classification of solid wastes is in comparison with liquid effluents a more complicated problem. While the classification of liquid effluents takes into account mainly treatment and discharge into the environment, for solid wastes new factors have to be considered, such as handling [8] and transportation [5] before and after treatment.

For the classification of solid wastes the present systems were examined and also considered were the basic parameters which might be involved in categorizing solid wastes. Amongst these were the composition of the waste, which may differ depending upon the nature of the process or laboratory from which it arises. Usually, high-level alpha emitters are segregated from beta and gamma emitters although this may not always be the case. At lower levels, mixtures may occur more frequently but usually, in both cases, one or other of alpha or beta-gamma emitters predominate, and the waste may be categorized in a simple way as one or the other, depending which is more important.

Solid wastes may be combustible or non-combustible and are frequently not homogeneous. Activity in such waste may be difficult to measure and, therefore, to classify in terms of activity per unit volume or weight is not satisfactory. Waste combining gamma and gamma plus beta emitters can usually be estimated by measurement of the radiation dose rate and only in the case of pure alpha emitters is this impracticable.

The radiation dose rate may be measured either at the surface of the waste or of its container. In transport regulations the dose rates at the surface and at one metre from the surface of the container are utilized [5]. Since a measurement made in this way involves the characteristics of the container, e.g. thickness of walls, and nature of construction, the basic nature of the waste may be more difficult to determine from radiation measurements and some beta emitters may remain undetected.

Following detailed consideration of these and other factors the categorization of solid radioactive wastes was recommended using the radiation dose rate at the surface for beta and gamma emitters. For some alpha emitters the problem of criticality must also be considered.

The overall measurement of the content of a container is always vague and estimates may have a 100% error, therefore the safety coefficient from the point of view of criticality must be considered. The possibility of sub-dividing solid wastes with alpha emitters into two categories according to the criticality was considered but it was found that

such a sub-division is unnecessary and recommended to leave only one alpha category. Criticality should be considered so that it can be discounted as a problem. Therefore, since it is not a problem, the solid waste classification does not take it into account.

The use of the same maximum amount of fissile materials in solid wastes as is given in additional requirements for packages containing fissile material is recommended [5].

In making these recommendations for the categorization of solid waste, it is recognized that a practical form of categorization can never define the exact nature of the waste and at best only forms a system which roughly defines the major characteristics of the waste under discussion.

It is recommended to classify solid wastes into four categories. Categories 1, 2 and 3 include beta and gamma activity with insignificant amounts of alpha emitters and category 4 alpha activity with insignificant amounts of beta and gamma emitters.

Category 1: comprises solid radioactive wastes with beta and gamma emitters and an insignificant amount of alpha emitters whose radiation dose on the surface is not higher than 0.2 R/h. Such solid wastes can usually be handled and transported without any special precautions.

Category 2: comprises solid radioactive wastes with beta and gamma emitters and an insignificant amount of alpha emitters whose radiation dose on the surface is higher than 0.2 R/h and equal or lower than 2 R/h. Such solid waste can usually be transported in simple containers shielded with a thin layer of concrete or lead.

Category 3: comprises solid radioactive wastes with beta and gamma emitters and an insignificant amount of alpha emitters whose radiation dose on the surface is higher than 2 R/h. Such solid wastes can be handled and transported only if special precautions are taken.

Category 4: comprises solid radioactive wastes with dominant alpha emitters and an insignificant amount of beta and gamma emitters which are not suspect from the point of view of criticality. The activity should be expressed in Ci/m^3.

The classification of solid radioactive wastes has two specific limitations: a) unlike the categories for liquid and gaseous wastes, the numbers do not represent increasing significance relative to a constant parameter; b) no category is provided for waste packages containing both alpha emitters and beta-gamma emitters.

TABLE II. PROPOSAL FOR THE CATEGORIES OF SOLID WASTES

Category	Radiation dose on the surface of wastes D(R/h)	Remarks
1	$D \leq 0.2$	β-γ-emitters α-emitters insignificant
2	$0.2 < D \leq 2$	
3	$2 < D$	
4	α-activity expressed in Ci/m^3	α-emitters dominant β-γ-emitters insignificant - not suspect from the point of view of criticality

The final proposal for the categories of solid wastes is summarized in Table II.

6. CATEGORIES OF GASEOUS RADIOACTIVE WASTES

The significance of the classification of gaseous effluents is debatable. In many countries gaseous wastes are not classified at all, sometimes the classification is connected with the ventilation system and effluents are classified in accordance with the origin. The present experience with handling of gaseous effluents is relatively small in comparison with liquid and solid wastes. The range of activity is restricted and methods of treatment are few but nevertheless there exist considerable differences in activity levels and composition of gaseous effluents that justify the classification of gaseous wastes into several categories.

From the hazard point of view, the total activity discharged is of importance and not concentration. The effects of total discharges, however, depend upon many local modifying factors such as location and height of stack, wind direction and wind speed. Since total activity does not usually have any significance in gaseous waste handling, it is accepted that classification by activity concentration appeared to offer the only solution if discharges are to be classified. It was appreciated that such a classification may not be of any real practical importance.

In the absence of any suitable alternative, it was recommended that the classification of gaseous wastes should be based on the same units as for liquid wastes, i.e. μCi/ml or Ci/m^3 and also on the method of treatment before discharge.

The proposal of classification of gaseous wastes contains three categories.

Category 1: comprises gaseous effluents whose radionuclides concentration is lower than 10^{-10} Ci/m^3. These gaseous effluents are usually not treated but discharged directly into the air.

Category 2: comprises gaseous effluents whose radionuclides concentration is higher than 10^{-10} Ci/m^3 and equal or lower than 10^{-6} Ci/m^3. The radioactivity is connected mainly with particles and gaseous effluents are usually treated by simple filtration.

Category 3: comprises gaseous effluents whose radionuclides concentration is higher than 10^{-6} Ci/m^3. The radioactivity is connected mainly with gases and gaseous effluents are usually treated with filtration in connection with other methods.

TABLE III. PROPOSAL FOR THE CATEGORIES OF GASEOUS WASTES

Category	Activity level A (Ci/m^3)	Remarks
1	$A \leq 10^{-10}$	Usually not treated effluents
2	$10^{-10} < A \leq 10^{-6}$	Effluents usually treated by filtration
3	$10^{-6} < A$	Effluents usually treated by other methods

The proposal for the categories of gaseous wastes is summarized in Table III.

7. THE LOWER LIMIT OF ACTIVITY OF RADIOACTIVE WASTES

The possibility of finding some figures below which the waste material can be considered as not being significantly radioactive was discussed. But the factors that influence this figure are very numerous and the local conditions differ to such an extent that it is not possible to establish any figures. It was recommended that the International Atomic Energy Agency should study this problem in the future.

The classifications of liquid, solid and gaseous wastes which are given above correspond to a certain level of activity. Below these figures there exist levels of activity which may be considered as negligible and consequently they may permit the disposal of wastes after certain measures of control have been carried out by the competent authority. For example, in the USSR [3] and in Czechoslovakia [4] legal definitions exist of what is radioactive and what is not. Such steps should be based on international recommendations laid down in the Basic Safety Standards for Radiation Protection [18-20]. As a guide, IAEA Safety Series No. 9, part 5.1.1.3.(ii) can be used [19].

8. COLOUR INDICATION OF RADIOACTIVE WASTE CATEGORIES

A colour indication code may be helpful but it should be as simple as possible. It is not possible to propose the standard colour indication code. The main reason is that there already exist different colours and signs which are widely used in several countries, especially in the chemical industry. Furthermore, the number of recommended categories of liquid, gaseous and solid wastes is not the same and in the case of solid wastes the order of categories does not correspond to the increasing danger.

Therefore it is only generally recommended to apply the colour indication code, corresponding to established categories. As far as colours and signs are concerned the choice lies in the hands of the competent authorities in individual countries because such a system should not interfere with conventional indication systems, experience, customs and habits of these countries.

Generally it is recommended to use red colour for the most dangerous category and there was no objection to the colour yellow. The colour orange is difficult to specify because it may easily be mistaken for yellow or red. The colour green is not recommended because it generally means safety. It is also possible to use white, black and blue.

REFERENCES

[1] Economics in Managing Radioactive Wastes, Technical Reports Series No. 83, IAEA, Vienna (1968).
[2] Proposed Definition of Radioactive Waste Categories, United States of America Standards Institute (1967).
[3] The Sanitary Regulations for Handling of Radioactive Materials and Ionizing Radiation Sources, No. 333/1960, Moscow (1960).

[4] Radiation Protection Law from 21 March 1963, Sbírka Zákonu No.34/1963, Prague (1963) 129.
[5] Regulations for the Safe Transport of Radioactive Materials, Safety Series No.6, IAEA, Vienna (1967).
[6] Technology of Radioactive Waste Management Avoiding Environmental Disposal, Technical Reports Series No.27, IAEA, Vienna (1964).
[7] Operation and Control of Ion-Exchange Processes for Treatment of Radioactive Wastes, Technical Reports Series No.78, IAEA, Vienna (1967).
[8] Treatment of Low- and Intermediate-Level Radioactive Waste Concentrates, Technical Reports Series No.82, IAEA, Vienna (1968).
[9] Design and Operation of Evaporators for Radioactive Wastes, Technical Reports Series No.87, IAEA, Vienna (1968).
[10] Chemical Treatment of Radioactive Wastes, Technical Reports Series No.89, IAEA, Vienna (1968).
[11] The Management of Radioactive Wastes Produced by Radioisotope Users, Safety Series No.12, IAEA, Vienna (1965).
[12] The Management of Radioactive Wastes Produced by Radioisotope Users, Technical Addendum, Safety Series No.19, IAEA, Vienna (1966).
[13] Basic Factors for the Treatment and Disposal of Radioactive Wastes, Safety Series No.24, IAEA, Vienna (1967).
[14] Radioactive Waste Disposal into the Sea, Safety Series No.5, IAEA, Vienna (1961).
[15] Disposal of Radioactive Wastes into Fresh Water, Safety Series No.10, IAEA, Vienna (1963).
[16] Radioactive Waste Disposal into the Ground, Safety Series No.15, IAEA, Vienna (1965).
[17] Techniques for Controlling Air Pollution from the Operation of Nuclear Facilities, Safety Series No.17, IAEA, Vienna (1966).
[18] Safe Handling of Radioisotopes, Safety Series No.1, IAEA, Vienna (1962).
[19] Basic Safety Standards for Radiation Protection, Safety Series No.9, IAEA, Vienna (1967).
[20] Recommendations of the International Commission on Radiological Protection, ICRP Publication 9, Pergamon Press, Oxford (1966).

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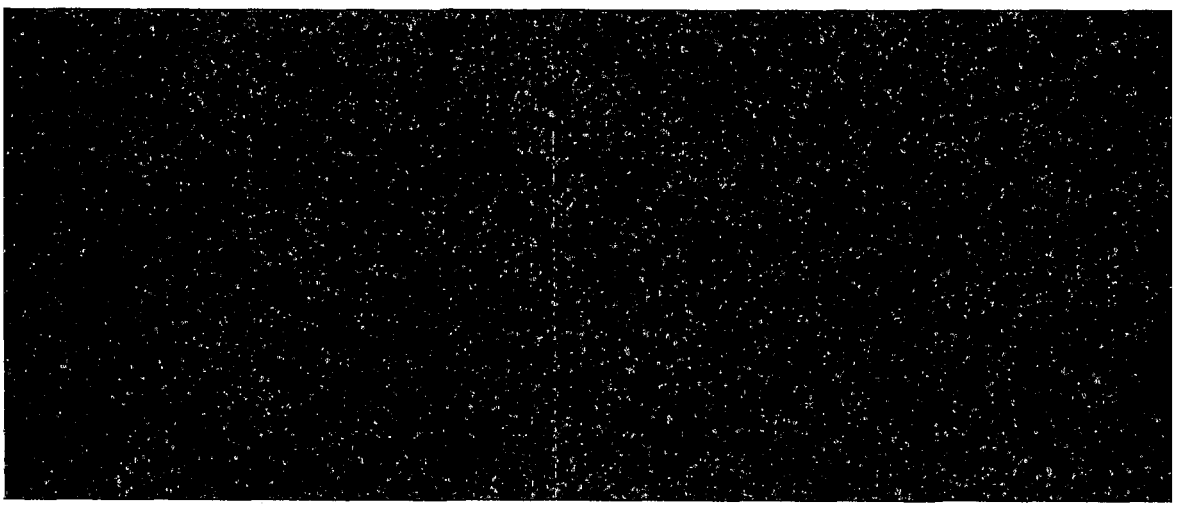

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