

**DISPOSAL OF  
RADIOACTIVE WASTES  
INTO MARINE  
AND FRESH WATERS**



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BIBLIOGRAPHICAL SERIES

No. 5

DISPOSAL OF RADIOACTIVE WASTES  
INTO MARINE AND FRESH WATERS

INTERNATIONAL ATOMIC ENERGY AGENCY  
VIENNA 1962

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## FOREWORD

The Bibliography on Disposal of Radioactive Wastes into Marine and Fresh Waters is the fifth in the "Bibliographical Series" published by the International Atomic Energy Agency for the purpose of assisting research workers, engineers, administrators and other interested persons to utilize the information which has been published throughout the world for development of peaceful uses of nuclear energy. The bibliography contains approximately 2000 references to reports and to published literature from more than twenty countries.

The need for a bibliography on the complex and very important subject of release of radioactive wastes into the hydrosphere was recognized by the Agency soon after it came into existence in 1957, and by 1959 several informal literature searches on related subjects had been prepared by Miss Sophie Stephens. However, in 1960 it was decided that a more comprehensive bibliography was needed, and accordingly this bibliography has been completed by Mrs. J. M. O'Leary of the Division of Scientific and Technical Information and edited by Mr. I. C. Roberts, Division of Health, Safety and Waste Disposal.

In view of the tremendous amount of literature on the subject, it is extremely difficult, if not impossible to claim that the bibliography is complete; however, every effort has been made to include pertinent information from all available sources, with emphasis on those listed in the Introduction.

Readers are invited to address their suggestions and other correspondence regarding the "Bibliographical Series" to: The Director, Division of Scientific and Technical Information, International Atomic Energy Agency, Vienna I, Kärntner Ring 11, Austria.

A. N. Rylov

Deputy Director General

March 1962



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## INTRODUCTION

This bibliography covers literature on the subject of radioactive waste disposal into marine and fresh waters published in English, French, Russian, German, Italian, Japanese and other languages. The following specialized bibliographical sources were used, for the period January 1955 to December 1960 inclusive: Nuclear Science Abstracts, Chemical Abstracts, Engineering Index, Water Pollution Abstracts, and IAEA List of References. It also contains references to the Geneva Conferences of 1955 and 1958, to the Agency's conference on Waste Disposal, Monaco, 1960, and to reports submitted by Member States to the United Nations Scientific Committee on the Effects of Atomic Radiation.

The references in this bibliography have been sorted into eight major categories which are believed to be logical divisions of the over-all subject. This belief has been confirmed by the ease with which this breakdown fitted existing literature. Further sub-division within these major categories is a compromise between the conflicting needs to distinguish individual topics and limit the number of reference sources included in each sub-division, on the one hand, and to minimize the number of cross-references necessary by minimizing the number of sub-divisions, on the other.

Under each heading the material is listed alphabetically by authors. Cross-references are listed by number at the end of each section to which they pertain.

For ease of reference, an author index is included at the end of the bibliography.

## INTRODUCTION

La présente bibliographie englobe la documentation relative à l'évacuation des déchets radioactifs dans l'eau de mer et dans l'eau douce, publiée en anglais, français, russe, allemand, italien, japonais et autres langues. Pour la période allant de janvier 1955 à décembre 1960, on a eu recours aux sources spécialisées suivantes: Nuclear Science Abstracts, Chemical Abstracts, Engineering Index, Water Pollution Abstracts et Liste de références de l'AIEA. La bibliographie contient aussi des références aux deux Conférences qui ont eu lieu à Genève en 1955 et en 1958, à la Conférence sur l'élimination des déchets que l'Agence a organisée à Monaco en 1960 et aux divers rapports que les Etats Membres ont soumis au Comité scientifique des Nations Unies pour l'étude des effets des radiations ionisantes.

Les références figurant dans la bibliographie ont été classées sous huit rubriques principales, que l'on estime être des divisions logiques du sujet. Cette opinion s'est trouvée confirmée par la facilité avec laquelle la documentation existante a pu être répartie dans les diverses rubriques. Les subdivisions à l'intérieur de ces huit rubriques résultent d'un compromis entre des besoins contradictoires: d'une part, distinguer tous les aspects de la question et limiter le nombre de références dans chaque subdivision; d'autre part, réduire au minimum le nombre de subdivisions pour avoir le moins possible de renvois.

Dans chaque subdivision, la documentation est classée dans l'ordre alphabétique des noms d'auteurs. A la fin de chaque section, on renvoie à des références figurant dans d'autres sections, en indiquant leur numéro d'ordre.

Pour plus de facilité, un index par auteurs est donné à la fin de la bibliographie.

## ВВЕДЕНИЕ

Настоящая библиография, посвященная сбросу радиоактивных отходов в моря и пресные воды, содержит материалы, опубликованные на английском, французском, русском, немецком, итальянском, японском и других языках за период с января 1955 г. по декабрь 1960 г. При составлении ее были использованы специализированные справочно-библиографические издания, как, например, журналы Нуклеар Сайэнс Абстрактс, Кемикэл Абстрактс, Энджиниринг Индекс, Вотэр Полутш Абстрактс и издаваемый МАГАТЭ Перечень публикаций по ядерной энергии; а также Труды Женевских конференций 1955 и 1958 годов и Труды Конференции по Сбросу отходов, созданной Агентством в 1960 г. в Монако. Кроме того, библиография содержит ссылки на научно-исследовательские отчеты, представляемые государствами-членами ООН Научному комитету ООН по действию атомной радиации.

Весь материал, вошедший в библиографию, сгруппирован по восьми основным разделам, на которые, по мнению составителей, логически распадается вся тема. Легкость, с которой удалось рассортировать все собранные ссылки по этим восьми категориям, явилась наилучшим подтверждением правильности подобной разбивки. Что же касается подразделов внутри каждой из основных групп, то, намечая их, составителям библиографии пришлось остановиться на некоем среднем решении, явившемся результатом желания примирить две тенденции — с одной стороны, провести четкое разграничение между отдельными подтемами и, соответственно, включить в каждую из них весь материал, относящийся к ней, и, с другой стороны, свести к минимуму количество перекрестных ссылок за счет сокращения числа подразделов.

В каждом разделе материал расположен по алфавиту в соответствии с фамилиями авторов. В конце каждого раздела приведены порядковые номера перекрестных ссылок.

В конце библиографии имеется авторский указатель, облегчающий пользование библиографией.

## INTRODUCCIÓN

La presente bibliografía se refiere a trabajos sobre el tema de la evacuación de desechos radiactivos en las aguas marinas y dulces, publicados en inglés, francés, ruso, alemán, italiano, japonés y otros idiomas. Para prepararla, se han utilizado las siguientes fuentes bibliográficas especializadas, publicadas entre enero de 1955 y diciembre de 1960, inclusive: Nuclear Science Abstracts, Chemical Abstracts, Engineering Index, Water Pollution Abstracts e IAEA List of References. También se hace referencia en ella a trabajos presentados en las conferencias de Ginebra, celebradas en 1955 y 1958, a las memorias presentadas en la Conferencia sobre evacuación de desechos, reunida por el Organismo en Mónaco, en 1960, y a los informes presentados por los Estados Miembros al Comité Científico de las Naciones Unidas para el Estudio de los Efectos de las Radiaciones Atómicas.

Las referencias que figuran en esta bibliografía se han clasificado en ocho categorías principales en las que se considera que lógicamente debe dividirse el tema. Esta opinión es confirmada por la facilidad con que la clasificación se adapta a las publicaciones existentes. Las subdivisiones de estas categorías principales se han establecido según un criterio que representa una fórmula de transacción entre las necesidades antagónicas de diferenciar cada materia y limitar el número de fuentes de referencia citadas en cada subdivisión, por una parte, y de reducir al mínimo el número de remisiones necesarias restringiendo en lo posible el número de subdivisiones, por otra.

Las publicaciones se enumeran bajo cada epígrafe por orden alfabético de autores. Las remisiones se relacionan por orden numérico al final de la sección a la que pertenecen.

Para facilitar la consulta de la bibliografía, se ha incluido un índice de autores al final de la misma.

## I GENERAL INFORMATION

- 1 Anon. ATOMIC WASTE-DISPOSAL PLANS PUSHED AS REACTOR PROGRAMS MULTIPLY. Power Eng. 60, 3 (1956) 94-5.

Concern is shown over radioactive leftovers; oceans only limited and temporary dispersion sink; two methods of ion exchange; other methods such as sea and land burial, storage of wastes in underground natural or man-made formations; lagooning of liquid wastes; best present method of evaporative concentration, mixing with concrete, and land or sea burial, will cost about 0.4 mils per electrical kw.

- 2 Anon. DISPOSAL AND DISPERSAL OF RADIOACTIVE WASTES. Science 124(1956) 17-19.

In the summary report of the Committee on Disposal and Dispersal of Radioactive wastes, which has been produced as part of the study on the biological effects of atomic radiation conducted by the National Academy of Sciences, it is stressed that the safe handling and ultimate disposal of radioactive wastes is an important aspect of the nuclear energy industry. The greatest difficulty is in the disposal of the highly radioactive waste waters. Wastes resulting from normal reactor operations constitute the largest volume but are more amenable to treatment. Technical and economic factors which must be considered in finding suitable methods for the disposal of radioactive waste waters are indicated.

- 3 Anon. PROGRAMME OF PHYSICAL OCEANOGRAPHY FOR THE INTERNATIONAL GEOPHYSICAL YEAR. Rept received from Argentina by U.N. Sci. Comm. Effects Atom. Radiation, A/AC.82/G/R.88, 1956, 33p.

- 4 Anon. REPORT ON GENEVA. Engrs' Digest 16 (1955) 405-22, 480-92, 533-40.

Report on the International Conference on Peaceful Uses of Atomic Energy, Aug. 8 to 20 1955; based on lectures, papers, publications, and personal observations; need for new source of energy; principles and types of nuclear reactors; power reactors in operation, in blueprint stage or under construction; capital investment required and cost of electricity from nuclear power; research reactors, waste disposal, health hazards, and potentialities of radioisotopes.

- 5 Abbott, J.D. HEALTH AND SAFETY IN THE DEVELOPMENT OF NUCLEAR ENERGY. G.E.C. Atomic Energy Review 1 (Sept. 1958) 195-8.

- 6 Anderson, E.C., Schuch, R.L., Fisher, W.R., Langham, W. RADIOACTIVITY OF PEOPLE AND FOODS. Science 125 (1957) 1273-8.

Discusses long term accumulation of fission products in the biosphere. Indicates the difficulties and importance of determining the fraction of Sr-90 entering the ecologic chain.

- 7 Arnold, E.D., ed. COMPILATION AND ANALYSIS OF WASTE DISPOSAL INFORMATION. (Oak Ridge Nat. Lab., Tenn.) CF-57-2-20, 1957, 285p.

A summary of waste processing, treatment and disposal information as extracted from many documents on the various aspects of the general problem is measured. In addition to an introduction to the complex of problems in waste treatment and handling, a summary of various ultimate disposal schemes, and related studies, the report covers disposal of wastes in deep wells, underground formations, and the ocean. A master reference list of pertinent documents is given.

- 8     **Atomics International Div. REACTOR EVALUATION. QUARTERLY PROGRESS REPORT, JANUARY-MARCH 1957.** North Am. Aviation, Canoga Park, Calif., NAA-SR-1938, 1957, 30p.  
  
Information is given on progress made from January to March 1957 in research on various aspects of nuclear reactor operation, including a survey of different methods for disposal of high-activity waste waters. It is concluded that the present method of storage in large underground tanks can be only a temporary expedient, and that more permanent methods of disposal must be found. Disposal at sea, either as a liquid or in packaged projectiles, is thought to be of doubtful safety, and permanent disposal by fixation in montmorillonite clay or in aluminium oxide appears to be the most promising method. Other methods of permanent disposal are being investigated.
- 9     **Běhounek, F., Bohun, A., Klumpar, J. RADIOLOGICKÁ FYSIKA (Radiological Physics).** 2nd ed., rev., and enlarged. (SNTL, Prague) 1958, 423p.  
  
A manual is presented which gives a simple introduction to nuclear physics and a general coverage of the field of radiation physics. The theory of radiology is given as well as the application of radiation techniques in industry, biology, chemistry, and medicine.
- 10    **Blatz, H., ed. RADIATION HYGIENE HANDBOOK.** First Edition (McGraw-Hill Book Co., New York) 1959, 947p.  
  
A compendium of information is presented which will be useful in industry and research involving peaceful uses of atomic energy. It includes: general reference data, glossary of terms, exposure standards and regulations, natural background, ionizing radiation, sources, effects on matter, attenuation data, lab design, detection and measurement, industrial and research and medical applications, determination of exposures, nuclear safety, radiation hygiene chemistry, equipment for handling, storage, and transportation of radioactive materials, surface contamination and decontamination, physiological effects of radiation, sampling equipment, waste disposal, control of radioactive air pollution, and personnel control.
- 11    **Bone, M.D. THE PROBLEMS OF THE COMMUNITY IN THE TREATMENT OF WASTE WATERS FROM THE PRODUCTIVITY POINT OF VIEW.** *Bull. mens. Centre belge Ét. Document. Eaux*, 90 (1958) 212-6.  
  
The author deals with the work of the Commission of the Organization of European Economic Co-operation (O.E.E.C.) for the prevention of air and water pollution in Europe, and discusses the history of the O.E.E.C.; the meeting of its representatives from Austria, Belgium, France, Germany, the Netherlands, Italy, Sweden, the United Kingdom and the United States in Paris in 1953, to discuss pollution problems; the discharge of trade waste waters, especially those from the chemical and iron and steel industries, to rivers and streams used for water supply; the problem of providing an adequate supply of potable water for domestic and industrial use; sewage treatment and its application to the treatment of trade waste waters; the re-use of water in industry; the assessment of the extent of pollution in rivers, from the public health aspect, by chemical and bacteriological analyses; and the problems of the prevention of pollution of water supplies by radioactivity, and the disposal of radioactive waste waters. The need for close co-operation between industry and the institutions providing water and sewage treatment facilities in the countries of Europe, to prevent the pollution of rivers, and to find adequate methods of treatment of trade waste waters, is emphasized.
- 12    **Brown, H. (Calif. Inst. of Technol., Pasadena, Calif.) OCEANOGRAPHY 1960 TO 1970 - A REPORT OF THE COMMITTEE ON OCEANOGRAPHY OF THE NATIONAL ACADEMY OF SCIENCES (FEBRUARY 1959). CHAPTER 1. INTRODUCTION AND SUMMARY OF RECOMMENDATIONS OF THE COMMITTEE ON OCEANOGRAPHY, NATIONAL ACADEMY OF SCIENCES-NATIONAL RESEARCH COUNCIL.** p.1324-65 of "Hearings on Industr. Radioactive Waste Disposal", Vol. 2 (Joint Committee on Atomic Energy, Washington) 1959.
- 13    **Brown, H., et al. OCEANOGRAPHY 1960-1970. CHAPTER 5. ARTIFICIAL RADIOACTIVITY IN THE MARINE ENVIRONMENT.** *Comm. Oceanog. Nat. Acad. of Sciences - Nat. Res. Council, Washington, D.C.*, 1959, 34p.

This paper outlines the joint opinion of the Committee on Oceanography and the Committee on Effects of Atomic Radiation on Oceanography and Fisheries regarding national policy on the disposal of radioactive wastes in the sea. Sections are included on the control and monitoring of radioactive discharges; present knowledge and research required on the fate and effects of radioactive wastes discharged to coastal waters, estuaries, or the open sea; field experiments using radioactive isotopes; and possible effects of a nuclear war on the marine environment.

- 14 Bruce, F.E. THE WORLD HEALTH ORGANIZATION AND ITS WORK IN ENVIRONMENTAL SANITATION. Paper pres. at a meeting of the Inst. of Pub. Hlth Eng., London, Oct. 1956.

The history, structure, and functions of the World Health Organization are outlined. Special consideration is given to work on environmental sanitation, which is defined and includes assistance in national sanitation programmes, which is illustrated by reference to the rural sanitation programme in Northern Greece. Other activities mentioned include the development of international standards for quality and analysis of drinking water, surveys of water pollution in European countries, and of fluoridation of water supplies, the preparation of a glossary of sanitary engineering terms, the publication of various advisory manuals, and work on radioactive contamination of water and disposal of radioactive waste waters. A bibliography of 20 references and a note on World Health Organization publications are appended.

- 15 Бурназян, А.И., Камышенко, И.Д., Неведов, Ю.Г. К ВОПРОСУ О САНИТАРНО-ГИГИЕНИЧЕСКИХ МЕРОПРИЯТИЯХ НА АТОМНОМ ЛЕДОКОЛЕ "ЛЕНИН" (Burnazjan, A.I., Kamyshenko, I.D., Nefedov, Ju. G. The Problem of Sanitation and Hygiene Measures in the Atomic Icebreaker "Lenin"). Мед. Радиол. (Med. Radiol.) 4, (1959) 70-2; JPRS-2592 (p.108-11).

Measures necessary for fulfilling health physics requirements in operation of the atomic ice-breaker "Lenin" are described.

- 16 Büsing, K.H. RIVER, POND, LAKE, AND SEA BATHING PLACES FROM THE HYGIENIC POINT OF VIEW. Arch. Badewesens 9 (1956) 364-89.

The author discusses the polluted condition of many rivers, with special reference to the amount of polluting matter carried by the Rhine. Visible pollution will discourage bathing but there is more danger in apparently clean waters infected with pathogenic organisms. He describes cases of such infection and concludes that such waters are always dangerous. A bathing water should be judged by the standards of a water supply. From this point of view, bathing should be prohibited in practically all German rivers and in all other waters where there is any possibility of infection or where the presence of pathogenic bacteria can be detected. Hygienic requirements for open-air bathing can only be met in baths subjected to continuous purification and disinfection. Sea water in coastal areas near the mouths of rivers is also dangerous. The danger of pollution by radioactive materials is discussed.

- 17 Butler, G.C. RADIATION SAFETY IN NUCLEAR SCIENCE. In "Atomic Power Symposium", held at Chalk River, Ont., May 4-5, 1959, Atomic Energy of Canada Ltd. AECL-799, 8p.

This paper summarizes the role of the Biology and Health Physics Organization, which includes experts in such diverse fields as chemical and civil engineering, electronics, physics, analytical chemistry, soil chemistry, biochemistry, physiology, ecology and genetics and its experience and knowledge of the methods of handling, measuring and controlling radiation in Canada. 8 Tables include the changes in maximum permissible doses from 1930-1959 and the amounts of radioactivity in water.

- 18 Butler, G.C., Cowper, G., Mawson, C.A., Neil, J., Stewart, C.G., Tait, G.W.C. (Atomic Energy of Canada Ltd., Chalk River, Ont.) HEALTH AND SAFETY IN CANADIAN OPERATIONS. 2nd U.N. Int. Conf. Peaceful Uses Atomic Energy, Geneva, A/Conf. 15/P/184, 1958, 15p.; AECL-594.

From experience at Atomic Energy of Canada, Limited, it is possible to draw some general conclusions about health and safety in atomic energy operations. Results of film monitoring and bioassay during 1957 indicate that in general it is possible to handle large amounts of radioactivity without exposing personnel to radiation

in excess of 100 mrem/week. Thirteen years ago this would have been considered impossible. A few difficulties remain, however, and these must be overcome by designing and installing improved working facilities and monitoring instruments. In spite of this generally encouraging picture accidental over-exposures may occur at any time. They usually come about in some unforeseen way during what are considered to be normal operations. It is the responsibility of health and safety organizations to reduce the number and severity of these to a minimum. An alert approach to the problem appears necessary, involving constant study and changes in regulations and instrumentation. From five years' investigation of the movement of radioactive wastes through soil and natural waters two conclusions emerge. In multi-curie amounts solid wastes should only be buried with some containment and large volumes of dilute liquid wastes should not be put into the ground indiscriminately. All liquid wastes should be pretreated to prevent increasing the acidity of the soil and then be discharged in such a location that there will be no increase in the flow of ground water through soil containing radioactivity.

- 19 Christ, W. KERNPHYSIKALISCHE UND KERNCHEMISCHE PROBLEME AUF DEM GEBIET DER WASSERWIRTSCHAFT (Problems of Nuclear Physics and Nuclear Chemistry in the Realm of Water Supply). Wasserw. - Wassertech. 6 (1956) 211-6.

After a survey of the fundamental points in nuclear physics, including types of radiation and units and methods of measurement, the possibilities of use of radioactive isotopes in connection with water supply are discussed. Among their uses are measurement of height of snow for forecasting high water flows, investigation of flow in ground water, lakes, reservoirs, rivers, and sewage-treatment plants, investigation of processes in biological treatment plants, and detection of leaks in pipes. Experiments have been started on tracing the movements of bacteria cultured on radioactive nutrient media. Gamma-radiation has been used experimentally in the U.S.A. for disinfection of waste waters; costs would be less than for chlorination. The protection of water supplies from radioactive pollution and the effects of such pollution on humans, the half-life and tolerance values of various isotopes, and the origin and properties of radioactive waste waters are discussed. Radioactive waste waters can be treated by storage, by dilution, or by removal of the active material by distillation, chemical precipitation, filtration, ion-exchange, or biological treatment. The final concentrate must be destroyed by burning, buried, or sunk in the sea. Experiments have shown that clay strata are best suited for disposal. Risks of accumulation of radioactive material in animals and plants are considered.

- 20 Claus, W.D. (U.S.A.E.C., Washington, D.C.) IMPACT OF THE ATOMIC ENERGY ON THE COMMUNITY. p.39-49 of "Symp. Hlth Phys. in Biol. & Med., Univ. of Puerto Rico Sch. of Med., San Juan, May 26-28, 1958", U.S.A.E.C., Washington, D.C., TID-7572, n.d.

The impact of atomic energy on the community is discussed. Shifts in populations, the attraction of additional industries, ecological effects due to advent of large installations, sociological and economic effects, public health aspects, and psychological attitudes influencing public acceptance of atomic industry installations are considered. Conditions in communities in the United States are reviewed as illustrations.

- 21 Cockcroft, J. ATOMIC ENERGY AND ITS BIOLOGICAL IMPLICATIONS. Nature 180(1957) 64-7.

- 22 Cohen, P. WHAT IS TO BE DONE WITH BY-PRODUCTS AND RADIOACTIVE WASTES? From Energie nucl., Chim. et Industr. 75, 2 (1956) Suppl.

- 23 Collins, J.C., ed. RADIOACTIVE WASTES - THEIR TREATMENT AND DISPOSAL. (E. & F. N. Spon, Ltd., London) 1960, 239p.

This work contains ten chapters aimed at those who are in any way concerned with public health and a wide range of the professions, including those branches in engineering, in the physical, biological and chemical sciences, and in industry. It deals with the nature, the sources, the hazards, the measurement of radioactivity and includes chapters on the treatment and disposal of liquid and solid radioactive wastes.

- 24 Comstock, M. STRONTIUM-90: BIBLIOGRAPHY. Brookhaven Nat. Lab., Upton, N.Y., M-6472, 1957, 10p.



Nuclear Science Abstracts, Chemical Abstracts, and the Brookhaven National Laboratory library files were searched for all aspects of the literature on strontium-90. One hundred forty-nine references are listed.

- 25 Culler, F.L. Jr., McLain, S. STATUS REPORT ON THE DISPOSAL OF RADIOACTIVE WASTES. Oak Ridge Nat. Lab., Tenn.; Argonne Nat. Lab., Lemont, Ill., CF-57-3-114(Rev.), 1957, 232p.

A comprehensive survey of waste disposal techniques, requirements, costs, hazards, and long-range considerations is presented. The nature of high level wastes from reactors and chemical processes, in the form of fission product gases, waste solutions, solid wastes, and particulate solids in gas phase, is described. Growth predictions for nuclear reactor capacity and the associated fission product and transplutonic waste problem are made and discussed on the basis of present knowledge. Biological hazards from accumulated wastes and potential hazards from reactor accidents, ore and feed material processing, chemical reprocessing plants, and handling of fissionable and fertile material after irradiation and decontamination are surveyed. The waste transportation problem is considered from the standpoints of magnitude of the problem, present regulations, costs, and cooling periods. The possibilities for ultimate waste management and/or disposal are reviewed and discussed. The costs of disposal, evaporation, storage tanks, and drum-drying are considered.

- 26 Dallas, J.L. "BACKGROUND" — CONTAMINATION — POLLUTION. Sanitalk 5, 4 (1957) 26-7.

The author discusses the meanings of "contamination" and "pollution" with special reference to their use in the radiological field, and distinguishes between "background radiation" and "natural radiation".

- 27 Dieterich, B. RADIOAKTIVE STOFFE IN WASSER UND ABWASSER (Radioactive Substances in Water and Waste Water). Vom Wasser 25 (1958) 163-80.

After a brief account of the dangers of radioactive pollution of water, the author describes the methods and calculations used in determining maximum permissible concentrations and gives figures obtained for some isotopes affecting different organs and parts of the body. The sources, types, and amounts of radioactive wastes are then described and an account is given of methods of treatment and their efficiency, including storage, evaporation, chemical treatment, ion exchange, and absorption in clay, and disposal at sea or in other suitable places, and a combination of processes as used at the reactor plant of Shippingport. An account is then given of the results of investigations by the U.S. Public Health Service into the effect of various methods of water treatment on the removal of radioactive pollution.

- 28 Dieterich, B. RADIOACTIVITY — A DANGER FOR OUR VITAL ELEMENT, WATER. Neue Deliwa Z. 11 (1956) 457-8.

The author gives a short summary of a paper presented at a meeting of the Deliwa Verein E. V. in Dortmund in August 1956. Risks of pollution from explosion of atomic bombs and from materials from atomic power plants are described, and the importance of supervision and control of radioactivity in water supplies is discussed.

- 29 Drobek, W. THE SPECIAL CARES AND PROBLEMS OF A WIDE-SPREAD WATER SUPPLY. Kommunalwirtschaft 6 (1955) 271.

Figures are given for the water demand per head in households of various kinds in West Germany and the grading of price according to the demand is discussed. The increase in demand expected in the future will necessitate more use of surface water and the protection of rivers from pollution is an urgent problem. Subjects dealt with include disinfection and fluorine treatment of water supplies, pollution of surface and ground water by radioactive substances, and protection of water from pollution from storage places for oil and benzole, and underground storage of gas. Finally the author deals with water losses through leaking pipes, fire protection, and the necessity for group water supplies to balance conditions in water-rich and water-poor districts.

- 30 Duhamel, F. THE ELIMINATION OF RADIOACTIVE WASTE (1960). C.E.A., Centre d'études nucléaires de Saclay, CEA-1738, 1960, 8p.