

**BULLETIN OF THE INSTITUTE  
FOR CHEMICAL RESEARCH**

**KYOTO UNIVERSITY**

**SUPPLEMENTARY ISSUE**

**THE RADIOACTIVE DUST  
FROM  
THE NUCLEAR DETONATION**

**THE INSTITUTE FOR CHEMICAL RESEARCH  
IN COLLABORATION WITH  
THE RADIOISOTOPE RESEARCH COMMITTEE  
KYOTO UNIVERSITY  
KYOTO, JAPAN.**

November, 1954

*(Bull. Inst. Chem. Res., Kyoto Univ.)*

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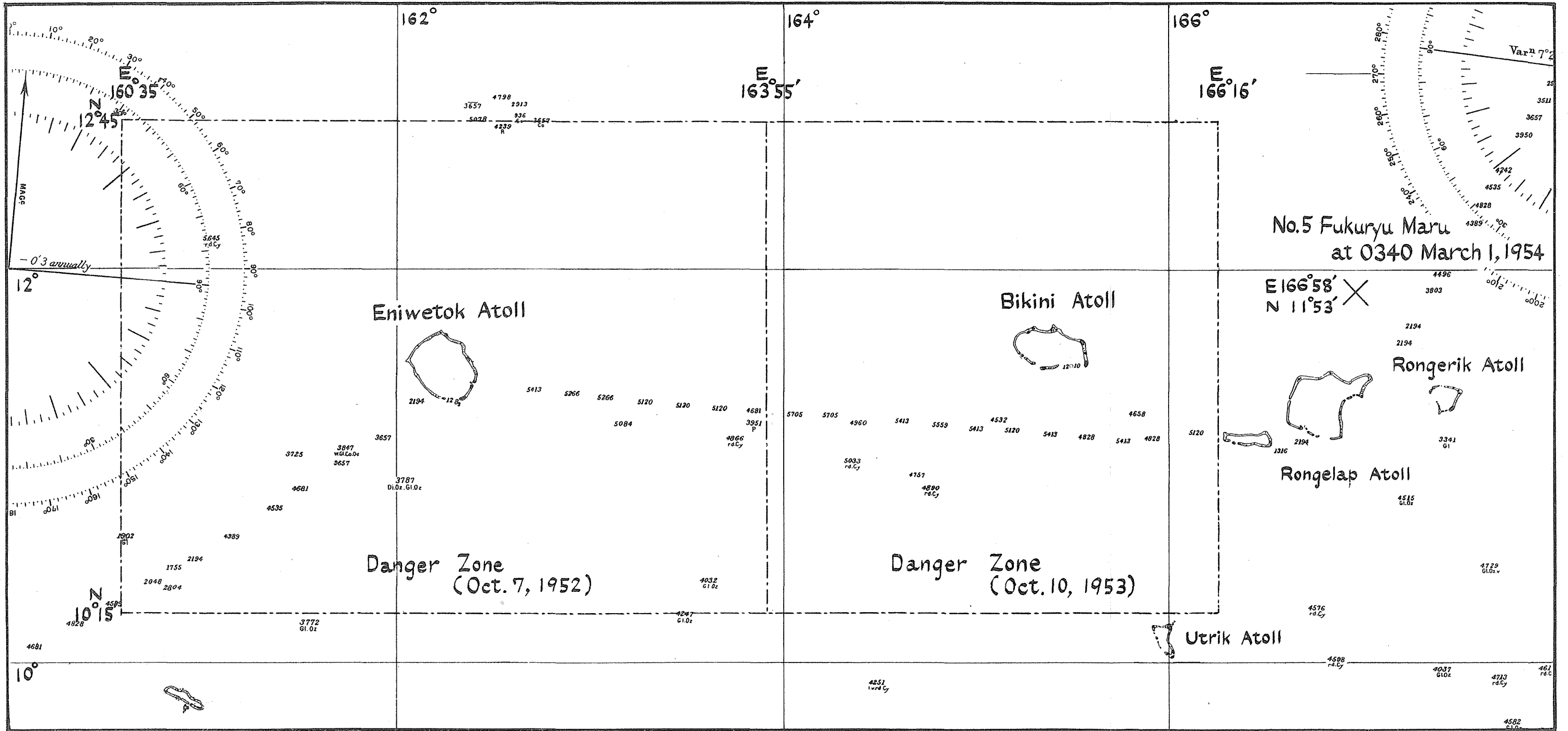
*Teranouchi Ogawa, Kamigyo-ku,*

*Kyoto, JAPAN*

November, 1954



The No. 5 Fukuryu Maru.



Position of the No. 5 Fukuryu Maru at the time of the nuclear detonation at Bikini Atoll (0340, March 1st, 1954, Tokyo time).  
 The mark "X" on the map shows her position.

## FOREWORD

It is with our heart-felt pleasure that through the collaboration of the Institute for Chemical Research of Kyoto University and the Radioisotope Research Committee of Kyoto University we are sending forth the present monograph on "Radioactive Dust from the Nuclear Detonation" as a supplementary issue of the Bulletin of the Institute. The problem concerning the contamination due to radioactive dust and its medical effect and decontamination are attracting the attention of the world to an extraordinary degree, and their researches are gaining in scientific importance. This monograph is the first to be published in this line of studies in Japan and it embodies, as we trust, the fruit of researches made in this country of highly technical significance. We shall feel that our labor is amply repaid if this publication should contribute, however slightly, toward solving the weighty problems of mankind.

The studies on nuclear physics had for a number of years been made in Kyoto University under the leadership of Professor Emeritus B. Arakatsu, assisted by a coterie of students in the Institute for Chemical Research with collaboration of the Faculty of Science. Even the construction of a cyclotron had been under way since 1941, until it had to be dismantled in the fall of 1945 in consequence of the termination of the war. In 1952 the construction of a more powerful cyclotron (42" pole diameter) was again started, and its completion is in prospect. At the present time the Institute is amply manned with physicists devoted to nuclear researches as well as many chemists and biochemists. In 1949, on the other hand, Kyoto University saw the institution of Radioisotope Research Committee under the Directionship of Dr. T. Kikuchi, Professor of Medicine, Kyoto University, with amply equipped laboratories, where research workers of many different faculties are participating in research activities. In practical operation both the Institute for Chemical Research and Radioisotope Research Committee are closely tied up.

The publication of the present monograph is a collaboration of these two, the impetus whereto was given when a fishing boat of Yaizu, Shizuoka Prefecture, "No. 5 FUKURYU MARU" was found accidentally victimized to radiation hazards in consequence of the nuclear detonation that took place on Bikini Atoll on March 1st, 1954. The extraordinary nature of the damage on the boat and crew led to scientific research engaged in by the research workers of Kyoto University. These research activities continued till August 1954 with their untiring efforts. The report of the researches is herein presented. We wish to express our sincere appreciation of the pains taken in the research activities by the authors of the monograph and not less by a number of assistants who participated in the researches without mention of their respective names.

We wish to express our sincere gratitude to Dr. T. Maekawa, Chief of Sanitation Division of Shizuoka Prefecture, to the officers of the Municipal Office of Yaizu City and to Dr. T. Shiokawa, Professor of Shizuoka University, for many

precious materials they have placed at our disposal and for every convenience afforded to our researches.

We wish to express our thanks also to Mr. K. Okano, Chief of Science Section, Higher Education and Science Bureau, Department of Education of the Government and his staff for their sympathetic cooperation, especially in the grant of necessary funds for publication.

Last but not least our thanks are due to Professor S. Shimizu of the Institute for his devotion to the publication of the monograph, in planning, editing, proof-reading, and what not, without which the monograph might not have seen the light after all.

Masao HORIO  
Director  
Institute for Chemical Research  
Kyoto University

*November 1954*

## P R E F A C E

On March 1st, 1954, at 3:40 a.m., twenty-three Japanese fishermen on board the fishing boat, No. 5 Fukuryu Maru, were engaged in fishing in the Middle Pacific about 90 miles north-east of Bikini Atoll, when a reddish white flash was seen on the horizon in a west-south-westerly direction, and seven or eight minutes later a loud explosion was heard. Afterwards it was learned that the flash and explosion had been caused by the hydrogen bomb test at Bikini Atoll. About three hours after the explosion, fine dust began to fall on the boat. The falling of dust lasted for several hours and ceased towards noon. The boat as well as the fishermen and the fishes caught by them were covered with a white sheet of fine dust. After a two weeks' voyage, on March 14th, the No. 5 Fukuryu Maru, contaminated by radioactive dust, returned to Yaizu Harbor, Shizuoka Prefecture, Japan.

During the voyage back to Yaizu Harbor, the crew of the No. 5 Fukuryu Maru complained of skin lesions and loss of hair due to the direct effects of the radioactive dust as well as general symptoms such as malaise, diarrhea, nausea and vomiting, which were commonly observed among those injured by the atomic bombs of Hiroshima and Nagasaki. Hearing the news of these fishermen, it was felt, however, that they were suffering from radiation sickness caused by a different type of exposure to radiation than that associated with the direct atomic bomb injuries observed in Hiroshima and Nagasaki. In Hiroshima, it was supposed that the fission products, which fell in the western area of the city on the day of the atomic bomb explosion, caused some radiation hazards among the people there. The details of these radiation hazards, however, were not known, and were frequently overlaid by the direct injuries caused by the explosion of the atomic bomb. In Nagasaki, radioactive dust evidently containing certain fission products fell all over the Nishiyama district. According to the examination, which was performed for the first time two months after the bombing, the influence of the radioactive dust here upon the human body was found in leukocytosis, showing an increase of the leukocyte count to 30,000~50,000 per cmm. in some cases. However, there were no symptoms of atomic bomb injuries such as loss of hair, bleeding etc. Leukopenia was not observed either, and since then no case of radiation hazards among the people there, which could be regarded as the result of the exposure to the radioactive dust, has been reported.

The crew of the No. 5 Fukuryu Maru spent two weeks on the boat, which was heavily contaminated by the radioactive dust. In addition to this, the surface of their bodies was contaminated by the radioactive dust, and there was also a possibility that some parts of the fission products might have been absorbed through the respiratory and digestive tracts. Because of this, it was thought that the crew of the No. 5 Fukuryu Maru were suffering from a different type of radiation sickness than that caused by the atomic bomb injuries observed in Hiroshima



and Nagasaki. As it was considered to be of great importance to study fully this type of radiation hazard as well, studies on the radioactive dust which fell on the No. 5 Fukuryu Maru were started in our laboratory soon after the arrival of the boat at Yaizu Harbor. Since all sufferers of the No. 5 Fukuryu Maru were sent to Tokyo, our investigation had to be confined to follow-up studies of the radioactivity of the No.5 Fukuryu Maru contaminated by the radioactive dust, investigation of the contamination of the fishes caught by her crew and of the foods manufactured from these fishes as well as physical, chemical and biological studies of the radioactive dust.

In 1949 a research committee for the application of radioisotopes was organized in Kyoto University. The committee consisted of investigators in the Faculties of Science, Engineering, Agriculture and Medicine, who made various researches by means of radioisotopes in their special fields. In 1952 a joint laboratory for radioisotopes, well-equipped with facilities for radioisotope studies, was established in Kyoto University, and since then various research works have been made in this laboratory. In examining the No. 5 Fukuryu Maru, contaminated by the radioactive dust produced by the hydrogen bomb test, and the radioactive dust collected from the boat, hard and efficient co-operative work by the members of this laboratory has made it possible to obtain the results, which are presented in this report. In publishing this report, we should like to appreciate deeply the efforts of the members of the laboratory, without whom the investigations would not have been carried out.

It is a pleasure to express our sincere thanks to Prof. S. Utzino and Prof. M. Horio, Former and Present Directors of the Institute for Chemical Research, Kyoto University, respectively, and to Mr. S. Terai and Mr. Y. Kawai, Former and Present Head Officials of the same institute, respectively, for their continual support and help for the organization and administration of our laboratory since its foundation.

We are also indebted to Dr. T. Maekawa, Chief of Sanitation Division of Shizuoka Prefecture, Prof. T. Shiokawa, Faculty of Science, Shizuoka University, the Mayor and Members of the Municipal Assembly of Yaizu City, as well as to Mr. K. Okano, Chief of Science Section, Higher Education and Science Bureau, Ministry of Education, for their kind help and courtesy in investigating the No. 5 Fukuryu Maru and in collecting and making available the radioactive dust, which was used in our studies. Furthermore, we should like to acknowledge with deep appreciation the kindness of Dr. John H. Harley, Chief of Analytical Branch, Health and Safety Division, New York Operations Office, United States Atomic Energy Commission, who provided us with many valuable literatures concerning the metabolism and internal dose determination of fission products.

It is our pleasure to note that the last paper in this report was specially con-

tributed to this issue by Mr. R. Yamamoto, Meteorological Research Institute, Kyoto University.

We should like to express our thanks again to Prof. S. Utzino, Prof. M. Horio and Mr. Y. Kawai for their encouragement and help in publishing this report. The works in this report and their publication were supported by a special research grant from the Ministry of Education, to which our thanks are due.

Takehiko KIKUCHI  
Chairman  
Radioisotope Research Committee  
Kyoto University

*November 1954*

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