

Vol 1

MATERIALS 12 FOOD RADIATION PROGRAM

See previous material
on AEC 719 Re:
Materials - 12 - Waste Processing + Disposal

Materials 12 Food Radiation Programed Fo

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Materials - 12

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25 D C

NOV 2 1950

(11) H + 2-3

Mr. Chairman, Joint Committee on
Atomic Energy
Washington, D. C.

The Joint Committee was advised that the Commission would
consider the report of the Interdepartmental Committee
on Radiation Measurements of Mr. A. Compton, Chairman, and
submit it to the Joint Committee on the Commission plan
with regard to a radiation program for the program.

The Commission is planning to submit a report to the
Joint Committee on the Commission plan with regard to a
radiation program for the program.

Very truly yours,

[Signature]

Mr. Chairman,
Joint Committee on
Atomic Energy
Washington, D. C.

NOV 2 1950
(11) H + 2-3

5-9-60

SUMMARY STATEMENT OF AEC RADIATION PROCESSED FOOD PROGRAM

1. The AEC has approved the FY 1960 and 1961 phases of a five-year low dose radiation processed foods program. This program will include basic studies devoted to determining and resolving problems in food chemistry, microbiology and wholesomeness which may result from irradiation, as well as establishing radiation process technology, economic feasibility and marketability. A program of at least this duration is needed to obtain sufficient data to determine if there are toxicological, carcinogenic or related problems with foods processed by low doses of radiation. It is presently estimated that the five-year program costs will be about \$5,000,000.
2. The immediate objective of the radiation processed foods program will be to concentrate on a small number of selected food products which appear to promise early technical feasibility and market acceptance. It is expected that establishment of technical feasibility and market acceptance of a few radiation processed foods will prompt industry to extend independently the technology throughout the broad spectrum of food products.
3. The AEC radiation processed foods program is consistent in scope and with the objectives of the Interdepartmental Committee on Radiation Preservation of Food Report.
4. Because of the time required to establish the specific details of a sound integrated program, however, it does not appear feasible to proceed initially as rapidly as suggested in the Interdepartmental Committee report.
 - a. Initial start-up studies must be completed to establish the specific elements of a research program on wholesomeness and safety of low dose processed foods, including interrelated work such as radiation effects on uses and preservation factors for shelf life extension,

as well as selection of specific foods for study under the program.

- b. These considerations involve specific identification with the Food and Drug Administration of the scientific protocol to be followed in the establishment of safety of low dose radiation processed foods and their final clearance.
- c. It is expected that development of a fully defined research and wholesomeness program will require approximately six to eight months for completion.

- 5. The AEC program provides for two laboratory research irradiators through FY 1961. The research irradiators (containing 10-20 thousand curies of Cobalt-60) will be used to carry out basic studies to establish wholesomeness and safety of low dose radiation processed food, as well as to investigate the origin and control of factors affecting the food's odor, taste, color and texture.

The need for additional laboratory research irradiators, as well as for other types of irradiators, such as mobile units, will be determined as the Commission's program becomes more fully developed.

- 6. The AEC food program presently envisions partial use of the high intensity radiation development laboratory currently authorized for construction at the Brookhaven National Laboratory for conduct of future experimental work related to product and process development. This use would require limited modification of the facility. It is to be noted, however, that the Brookhaven facility, as originally authorized, will be used primarily for radiation source and engineering development, as well as radiation studies on chemical systems, etc.

7. Commercial food processing companies will be actively encouraged to participate in the proposed program through radiation study agreement where the government provides the service of irradiation of food and industry performs without cost food research and evaluation.
8. The Commission has approved expenditure of funds in the amount of \$115,000 in FY '60 and \$500,000 in FY '61 for initial activities of this new program. The details of the planned program are set forth below. The sub-program fund allocations would be subject to revision as the program develops.

	<u>FY '60</u>	<u>FY '61</u>
Initial Activities and Studies* . . .	75,000	100,000
Research Irradiators	40,000(1)	40,000
Food Chemistry		
Microbiology		
Supplementary Wholesomeness		
Preservation Factors	--	50,000
Nuclear Effects	--	25,000
Packaging Development	--	25,000
Commodity Procurement	--	10,000
Irradiation Services	<u>--</u>	<u>50,000</u>
	115,000	500,000

* A brief description of each of the following activities is set forth in paragraph 9.

9. A description of the major elements of the ARS radiation processed foods program are set forth below:

- a. Initial Activities. To intelligently pursue the radiation processed foods program, it is necessary to undertake certain initial activities. These include (1) collection and analysis of Army research and development work to date relevant to the civilian program; (2) identification of specific food products promising technical, economic or marketing advantages through radiation processing and research and development work required to develop them, and (3) design of irradiators.
- b. Food Chemistry. Radiation causes various chemical, vitamin, nutritional and organoleptic (odor, color, taste, texture) changes in food. Studies are required to identify precisely the nature and extent of these changes.
- c. Microbiology. Spoilage by microorganisms is often the prime cause of rapid spoilage of foods. The purpose of radiation processing is to destroy or inhibit these microorganisms. This requires study of radiation resistance of numerous spoilage microorganisms common to food stuffs, so as to determine radiation dosage for their growth inhibition.
- d. Supplementary Wholesomeness. The Army has been conducting and is expected to complete a definitive wholesomeness and safety program on radiation sterilized food. Although this program will contribute information of value for low dose radiation processed foods, additional wholesomeness and safety studies will be required to obtain FDA clearance for foods of interest in the civilian program.

- e. Preservation Factors. It is necessary to be able to routinely and reproducibly obtain acceptable radiation processed food products. This requires study of the affect of variation in irradiation conditions such as total dose, humidity, irradiation time, etc., on acceptability of a product.
- f. Nuclear Effects. Use of radiation for food processing entails study of unique factors not encountered in conventional food processing. These include possible effects on food depending upon the rate at which the radiation is delivered, investigation to assure absence of induced radioactivity in food, and evaluating systems for precisely measuring radiation dosage delivered to the food.
- g. Packaging Development. This involves development of food packaging materials that are radiation resistant, do not transmit toxic additives to the food, and are suitable for marketing purposes.
- h. Commodity Procurement and Shipping. This involves obtaining and transportation of foods required to carry out the foregoing research and development.
- i. Irradiation Services. A number of private organizations have cooperated in the Army food program by evaluating irradiated foods without charge. It is expected similar arrangements can be made in the civilian program. This item thus reflects cost of irradiating foods which are thereafter evaluated by private groups without charge.

Material 672

UNITED STATES GOVERNMENT

Memorandum

TO : File

DATE: April 5, 1960

FROM : Robert D. Goppedge
Recording Secretary

SUBJECT: JCAE HEARINGS ON RADIATION PROCESSING OF FOOD, MARCH 31, 1960

The attached copy of AEC Testimony on the subject was used by Commissioner Floberg at the JCAE Hearing on which he reported at Meeting 1603, on April 1, 1960.

4-5-60

AEC TESTIMONY

JCAE HEARINGS ON RADIATION PROCESSING OF FOOD, MARCH 31, 1960

1. Since our appearance before this Committee during the Hearings on radiation preservation of food in January, the Commission has approved a radiation processed foods program. The Committee was notified of the establishment of this program on March 9, 1960.

2. The Commission's program will be directed to the study of low dose radiation processing of perishable foods to extend their shelf life, using radiation doses ranging from a few hundred thousand rad up to one million rad. Initial emphasis will be on fish and fruit.

3. Low dose radiation processing promises to be the most immediately useful civilian application of ionizing radiation for food processing purposes.

a. It would contribute to civilian food distribution objectives of making food available in as near fresh condition as possible, minimizing processing effects in quality, and balancing supply with demand.

b. It would also have important economic value in the United States, as for example, by making it possible to distribute near fresh perishable foods in distant markets which cannot now be reached because of too rapid food spoilage.

4. The AEC low dose radiation processing program, as well as the Army's high dose radiation sterilization program, also give direct support to the President's Atoms-for-Peace program - other countries have great interest in the possibility of using radiation processing to improve their food distribution and increase the variety and quality of food products available. Many countries are conducting research and development in this area.

5. In low dose processing we are concerned with partially destroying and inhibiting the action of microorganisms causing rapid spoilage of foods. With high dose processing, such as the Army is studying, the objective is to sterilize the food by killing virtually 100 per cent of the spoilage organisms. Let me use milk as an analogy to illustrate this further. We all are aware that by a mild heat treatment we obtain pasteurized milk. This must be kept refrigerated and will remain unspoiled for several days. Pasteurization delays spoilage. By intense heat treatment we obtain sterilized milk which is canned. This can be stored indefinitely without refrigeration. For our purpose here low dose radiation processing could be compared to pasteurization and high dose radiation sterilization to heat sterilization.

6. Another characteristic of low dose radiation processing is that to extend the shelf life of food this way requires only about one-tenth as much radiation as is necessary for radiation sterilization. In other words, a facility designed for high dose radiation sterilization can process ten times as much low dose treated foods as sterilized foods.

7. Our preliminary investigations already give us confidence in the ultimate success of low dose radiation processing to extend shelf life. Such also is the consensus of a number of experts on radiation processing of foods whom we have consulted. This belief is further supported by preliminary research in the United States, primarily by the U. S. Army Quartermaster Corp. and in other countries. Further, such low dose processing is said generally to entail negligible or no changes in the foods taste, color, or odor.

8. With this background, I should like now to outline the Commission's program in detail. The objectives of the AEC program are to:

a. Concentrate on a relatively few low dose radiation processed foods, so as to achieve success sooner than would be possible if a multitude of food products were studied concurrently.

b. Establish wholesomeness and safety of selected low dose radiation processed foods.

c. Proceed as rapidly as possible, consistent with the state of the art and requirements for sound scientific research.

9. The Commission will conduct the basic research necessary for advancing low dose radiation processing of foods to the point of technical and practical feasibility. Emphasis will be placed on basic studies in food chemistry, microbiology, wholesomeness testing, pre-irradiation and post-irradiation factors of shelf

life extension and radiation process technology. However, such additional work as product and market development to establish low dose radiation processing as a routine commercial food processing method would be the responsibility of private industry.

10. The Commission has approved expenditure for this program of \$115,000 for FY 1960 and \$500,000 for FY 1961. We currently estimate the program will cost \$5,000,000 for five years.

11. The Commission is convinced that time will be gained and sounder results obtained by first carefully formulating the specific details of a sound, integrated scientific program. Accordingly, we have initiated comprehensive studies to design a low dose radiation research program for specific foods promising substantial technical and economic significance in food production, processing, distribution, marketing or consumption. It is expected this will require six to eight months for completion.

12. As stated earlier, we are immediately directing our attention to fish and fruit. The Committee has previously been provided with copies of a report prepared by the Massachusetts Institute of Technology under contract to the AEC which evaluated the technical, economic and practical feasibility of radiation preservation of fish. The report

a. Concludes that low dose radiation processing of certain selected marine products can provide important

advantages for the producer, processor, distributor, as well as the consumer, and

b. Recommends that a comprehensive program be initiated for the development of low dose radiation processing of marine products.

13. Preliminary experimental work, primarily by the Army Quartermaster Corps, on marine products has revealed several products meriting development. These include flounder, ocean perch, halibut, shrimp and crab. For example, cooked crab normally can be kept only about 7 days under refrigeration. Experiments indicate that radiation processed cooked crab treated with a low dose of 400,000 rad can be kept approximately 30 days under normal refrigeration. In texture and flavor the product is virtually indistinguishable from freshly cooked crab. Thus, through radiation processing, crab and other marine products can be introduced in as near a fresh condition as possible into areas which now can get only frozen or canned fish. Such fish can also be kept longer by the consumer.

14. Accordingly, a second phase of work has been initiated with MIT, in concert with the Bureau of Fisheries to develop a specific plan of research and development, including estimated costs leading to technical demonstration of low dose radiation processing of fish. We expect completion of this work by mid-summer and initiation of experimental studies promptly thereafter.

15. Preliminary experimental work, much of which was sponsored by the Army Quartermaster Corps, indicates that peaches, citrus fruits, grapes and strawberries are worthy of further investigation. One objective of radiation processing of fruits is to retard spoilage due to fungi. It appears that this can be accomplished with low doses on the order of 250,000 rad and increases the marketable life significantly. West Coast strawberries, for example, could be marketed in the East for an additional two to three days as compared to non-radiation processed berries. Even so short a shelf life extension as this could have significant market impact. Another possible application of radiation processing to fruits is to slow down the ripening process. Some fruits such as peaches often are picked while fairly green so that they will not be overripe by the time they reach the market. Preliminary experimental work indicates that low dose radiation processed fruits take longer to ripen. In this case the fruit could be allowed to ripen more before being picked, with consequent enhancement of flavor and quality, and will not be overripe by the time it reached the market.

16. Accordingly, we have begun an analysis of the technical and economic feasibility of low dose radiation processing of fruits under contract with Stanford Research Institute. The Department of Agriculture is working closely on this project with the AEC. We expect to complete this analysis and to design an experimental program within the next few months. This will permit

initiation of actual research on radiation processing of fruits during the early part of the next fiscal year.

17. Since our work during the next six to eight months will be the development of detailed research programs on low dose radiation processing of fish and fruit, it is not possible to be too specific on actual plans at this time. However, we can outline for the Committee the general pattern in which we expect to proceed.

18. We must first select the specific fish and fruits upon which our studies will concentrate. The selection process will involve cursory testing of many more varieties of fish and fruits than we plan to study in detail. We would then concentrate on representative varieties which appear to benefit materially from low dose radiation processing and which have marketing potential. We would determine how the selected fish and fruit are affected by various amounts of radiation with emphasis being placed on doing the processing in a manner that would be practical for commercial application. We would determine how much the useable life of the products is extended and ascertain the effects on taste, texture, appearance, vitamin content, etc.

19. One objective that would be kept in mind throughout this testing program is the determination of the practicable technical and commercial limitations within which to conduct our more extensive research work. By so proceeding we can have greater assurance that the results from subsequent long term and costly

wholesomeness experiments will be truly meaningful for practical commercial application.

20. Concurrently with the above studies, we will initiate work on developing guidelines for a research program to establish wholesomeness and safety of low dose radiation processed foods. Sufficient research has not yet been carried out on alteration of dietary constituents of food, i.e., proteins, vitamins, etc., treated with low radiation doses. We will want to conduct detailed food chemistry studies to establish that low dose radiation processing of foods does not alter the nutritional value of such foods to the extent of compromising their ultimate unrestricted clearance for human consumption.

21. We have established close liaison and are currently working with the Food and Drug Administration to design a comprehensive test program on the nutritional and toxicological safety of low dose radiation processed food, including the experimental protocol for animal feeding experiments. I am certain that the Committee recognizes and appreciates the high degree of competence which has been built up in the atomic energy program on the effects of very low doses of radiation on the biological and physiological behavior of animals. This competence can be brought to bear directly on evaluation of the toxicological safety of radiation processed foods under the Commission program.

22. It should be noted that additional data to that obtained in the wholesomeness and safety program of the Department of the Army on high dose radiation sterilization of foods may be needed to support clearance of similar classes of foods processed with low doses of radiation. We expect to clarify this matter as our work progresses with the Food and Drug Administration.

23. We would not expect to initiate a comprehensive animal feeding program to test the nutritional and toxicological safety of low dose processed foods until we have established the pre-irradiation and post-irradiation factors influencing product quality and optimum periods of shelf life extension for the specific foods selected for study in the low dose program. Therefore, the comprehensive animal feeding tests under wholesomeness and safety aspects of the Commission's low dose radiation processed foods program cannot be started until the latter part of the next fiscal year.

24. Important to the initiation and full development of the Commission's radiation processed foods program are adequate irradiation facilities. The type and number of such facilities will become more clearly established as the initial activities now underway are further along. Under its currently approved program, the Commission will, however, design and construct two portable laboratory research irradiators. These irradiators will employ 10-20 thousand curies of cobalt 60. The research irradiators will be used to carry out basic studies on the effect

of low dose radiation processing on the nutrition of foods as well as to investigate the origin and control of factors affecting the food's odor, taste, color and texture.

25. It may be that additional laboratory research irradiators will be required to properly support the fully implemented research activities of the low dose program. If these needs develop, the Commission will provide for them.

26. As full details of the research program on low dose radiation processed foods are evolved, the need for more specialized types of irradiation facilities will be established as well as specific design characteristics. It may be that mobile irradiators using 50 to 150 thousand curies of cobalt 60 will be required to test process selected foods at places where they are harvested and packaged for transportation to markets. This requirement would stem from a need to experimentally establish radiation process conditions preparatory to animal feeding studies as mentioned earlier. The product through-put of irradiators of the mobile type would also be sufficient to provide required quantities of low dose radiation processed foods for the animal feeding studies.

27. As the Committee knows, the Department of the Army has announced its revised program on radiation sterilization of foods which includes plans for construction of a radiation research center. The Center will include a one million curie cobalt 60 irradiator, a linear accelerator and a food preparation facility.

The cobalt 60 irradiator will be of a highly flexible design permitting its use in both high dose and low dose radiation processed foods research. The Department of the Army has indicated its willingness to make the radiation center available for conduct of studies under the Commission's low dose program. We shall certainly take advantage of the Army's invitation to the extent this is practical, both from the availability of the facility without interferences with the Army Research activities and as the facility meets our specific program needs.

28. The AEC has authorization and is currently proceeding with work to construct a High Intensity Radiation Development Laboratory. This facility, to be located at the Brookhaven National Laboratory, will be highly flexible and capable of safely handling one million curies of cobalt 60. The plan for the building includes small research laboratories, as well as two high intensity radiation source handling cells. The facility will be available for use in mid-summer 1962. The program with this new facility will include experimental studies of factors affecting the design of large irradiators, such as radiation dose delivered at different points within a target, source dimensions, target dimensions, optimum source and cladding dimensions, optimum design of high efficiency irradiators, heat generation and dissipation in high level sources, and radiation damage to source materials.

29. The High Intensity Radiation Development Laboratory is not intended as a food research center, but it will contain many of the elements required of an integrated research and development center for low dose radiation processing of foods. It may be as the AEC's radiation processed food program becomes more fully developed a requirement for such a research center will be established or some modification therefore, i.e., a marine products radiation research center or possibly an agricultural products radiation research center. If a need for an integrated research center becomes apparent, the Commission would consider its establishment at the Brookhaven National Laboratory and would provide for the additional facilities necessary such as food preparation and research laboratory space. In the meantime we envision partial use of the High Intensity Radiation Development Laboratory to carry out experimental work on radiation process development for foods.

30. In summary, with regard to radiation facilities, the Commission believes that it would be premature to seek authorization for its construction of a radiation research center for its low dose radiation processing of foods program. It is by no means clear at this time that such a center would be the type of facility to best support the program. Smaller radiation facilities placed near food production centers, and perhaps of a mobile nature, may prove to be the type of equipment that is needed. The detailed programming of the next six to eight months should serve to clarify this need. Meanwhile, the Army's decision to construct its

radiation research center which will be available to the Commission's program, and the Brookhaven facility now under construction should provide for such radiation center needs as can now be foreseen.

31. In developing its program, the Commission gave full consideration to the report of the Interdepartmental Committee on Radiation Preservation of Food on "A National Civilian Radiation Processed Foods Program." We believe the AEC program is fully consistent with the objectives and program elements set forth in that report. Although we do not find it feasible or wise to achieve the budgetary levels set forth in the report so quickly, our projected total expenditures over the next five years closely approximates the level recommended in the Interdepartmental Committee Report.

32. The Commission intends to administer its radiation processed foods program in an aggressive and productive manner. We plan to maintain full and active liaison with other interested Government agencies as well as to keep commercial food processing firms fully informed on our progress under the program. Further, in view of the international interest in low dose radiation processing of foods, we are currently establishing procedures for positive exchange of information with other countries carrying out research in this field.

33. The Commission and the Department of the Army have established close working relations for coordinating their respective radiation processing foods programs. We are confident that positive benefit can accrue from one program to the other and that the radiation processing foods activities of the Army and the AEC are complementary and not duplicative.

34. I should like to conclude my testimony by stating that the Commission intends to pursue its radiation processed foods program as vigorously and rapidly as scientific prudence indicates. On the other hand, food is a complex biological material so that methods for processing it with radiation as well as establishing its safety after radiation treatment is a formidable task. Thus, it is proper to end with an expression of confidence, but with a word of caution that we should not expect spectacular results in a short period of time.

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1603th 1. Hearing on Food Irradiation Program

AEC Meeting
4-1-60
048

Commissioner Floberg reported on the food irradiation hearing of the Research and Development Subcommittee of the JCAE on March 31, 1960. During the morning meeting, Mr. Richard S. Morse, Director of the Army Research and Development program, presented the Army's revised research program on radiation preservation of food.* Mr. Floberg presented the AEC's program in the afternoon.

Mr. Floberg said the Army program as presently conceived seemed sensible and he felt there was little the JCAE could criticize

except possibly the general de-emphasis of the logistic advantages of using irradiated food, the stop-and-go nature of the Army's program, and the Army plans for installation of a 12 MEV linear accelerator for surface irradiation of foods.

With respect to the AEC's program,* Mr. Floberg said the presentation appeared to be well received. He pointed out the AEC program emphasizes low dose "pasteurization" of perishable foods to extend their shelf life, and the AEC is orienting the program toward civilian utilization versus the Army's program for development of high level radiation sterilization. The Subcommittee members asked if the AEC program was being carried out aggressively, noting AEC funding was not as much as that recommended by the Interdepartmental Committee on Radiation Preservation of Food. Mr. Floberg told the JCAE that the AEC program had been reoriented since the Army's decision in October 1959 not to construct the Ionizing Radiation Center, and that the planned rate of expenditure represented an acceleration from essentially zero a few months ago. He said the AEC now had a civilian program emphasizing low-dose work, and that spending was at a rate current technology could absorb. Any increase in expenditures would require taking funds from other higher priority programs.

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Mr. Floberg described AEC plans to use cobalt-60 sources at some location, probably ENL, plus mobile irradiators and Mr. McCone asked if it would not be as satisfactory to fly material to ENL for tests rather than use mobile units. Mr. Floberg said this would be feasible under some circumstances but mobile units would be needed to simulate actual commercial marketing conditions. Dr. Dunham described some of the peculiar biological phenomena which had appeared during studies of the biological effects of using high-dose

irradiated foods. None of these phenomena, he said, had been traced directly to induced radiation and most of the results reported thus far were completely inconclusive. The Department of the Army is responsible for the continuation of studies on biological effects.

Mr. Floberg said low dose radiation probably would not be used commercially before five or ten years. He said the JCAE appeared to be pressing for more emphasis because preservation of food by radiation was a dramatic program easily understood by the public. It also was attractive to many foreign countries lacking adequate refrigeration facilities. In addition, Mr. Floberg said, the Army and the JCAE have publicized in such glowing terms the possibilities of food preservation by this means that the public expects rapid results. With the reorientation of both the Army and AEC programs to, in his opinion, an appropriate level and direction, the early results promised by the publicists will not be attained.

Mr. Floberg said the JCAE seemed to be satisfied with the AEC's program.

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Materials 12 - Food Irradiation

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

March 31, 1960

OFFICE OF THE CHAIRMAN

MEMORANDUM FOR: THE GENERAL MANAGER

General:

The Chairman has requested that a discussion with the Commissioners be arranged on the subject of food irradiation. He would like Mr. Floberg to describe the results of his testimony of today at the JCAE hearings. He would also like to review the status of the program from the standpoint of technical development, and any funding problems which may be involved.

He asked that such a meeting be set up on Friday, April 1st, at the downtown office. From the standpoint of the Chairman's schedule, I would suggest 3:00 P.M. If this hour is not convenient for the other Commissioners, or for you, we will try to reschedule it.


Howard C. Brown, Jr.
Special Assistant
to the Chairman

3-3110

UNCLASSIFIED

AEC 719/32

March 28, 1960

COPY NO. 78

ATOMIC ENERGY COMMISSION

FOOD PRESERVATION BY IONIZING ENERGY

Note by the Acting Secretary

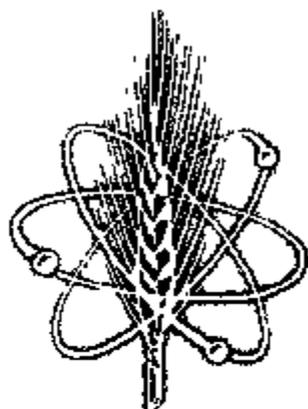
The attached report setting forth details of a revised Army research program on radiation preservation of food, as approved by the Department of Defense, is circulated for the information of the Commission by request of the Director, Office of Isotope Development.

Harold D. Anamosa
Acting Secretary

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AEC 719/32

3-31-60



**Revised
Program**



**FOOD
PRESERVATION
BY IONIZING
ENERGY**

DEPARTMENT OF THE ARMY, OFFICE OF THE QUARTERMASTER GENERAL

REVISED ARMY PROGRAM
ON
FOOD PRESERVATION BY IONIZING ENERGY

Approved: 11 March 1960

Department of the Army
Office of The Quartermaster General
Washington 25, D. C.

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I. POLICY

Inasmuch as nonmilitary departments are beginning to be in a position of carrying leadership responsibilities for the national Atoms-for-Peace Program in radiation processing of foods, the Army will effect a smooth transition toward focusing on military requirements. Research will be directed toward the objective of procurement from the civilian economy of the first generation of a relatively few food items of important military significance. The developmental lead time will be compressed to the maximum extent feasible, consistent with the state of the art and the requirement for the prior orderly resolution of the key unsolved fundamental research problems. The Army will work closely with industry during the research stage with the objective of facilitating the earliest possible transition to process engineering and production.

Inasmuch as the Army's activity will continue to serve as the backbone of the Nation's effort in this program area, generous collaboration will be extended to other organizations in the joint advancement of the President's Atoms-for-Peace Program.

Inasmuch as an adequate civilian production base is required before military subsistence requirements can be met, cooperation with American industry will be encouraged. Furthermore, information will be disseminated as widely as feasible in order to increase technical know-how in this country.

II. SIX-YEAR OBJECTIVES

1. To obtain wholesomeness clearances permitting unrestricted use of foods preserved by ionizing energy.
2. To conduct the necessary basic research to advance the technology of food radiation processing so that items of military significance and of quality far superior to analogous items available in the combat theatre can be procured:
 - a. Primary emphasis to be placed on high dose treated (sterilized) pork, smoked ham, chicken, and beef.
 - b. Secondary emphasis to be placed on those low dose treated (pasteurized) items of special military significance.
3. To conduct timely economic analyses.
4. To formulate such items into logistic-saving components for use in Army ration systems from those in the support areas to and including individual military feeding in the forward areas.
5. To develop components meeting special requirements of the Navy, Air Force, and Marines.
6. To develop process engineering data for efficient transition into industrial sponsorship.
7. To determine, within the coming 3 years, whether the transition pilot-production plant will be built by industry, the Atomic Energy Commission, the Army or another organization, and to effect the necessary transfer of relevant know-how.
8. To establish a reservoir of basic information for future improvement of radiation processed foods.

III. RESEARCH AND ENGINEERING PHASES

The program will be channelled essentially into the following tasks: Military applications and economic analysis, Assurance of wholesomeness, Pre and Post Irradiation Studies, Destruction of microorganisms, Nuclear effects on foods, Acceptance testing, and Packaging studies.

Prime interest will be focussed on four sterilized meats and their combat ration formulations. Secondary attention will be devoted to low dose treatment (pasteurization) of fresh fruits of high morale value. A description of the seven tasks is given below. The starting point in each of these tasks is the present state of the art. At the same time, they have been pointed directly toward the immediate six-year military objectives, delineated in Section II.

1. Military applications and economic analysis.

Attention will be devoted toward completing a comprehensive operations analysis to determine the logistic, operational and economic aspects of incorporating radiation processed foods into the combat feeding system of the armed forces. The studies will consider both limited and general warfare. Comparisons will be made between foods preserved by radiation and by other processes, together with the respective roles to be played by each in the optimum overall combat feeding system.

2. Assurance of wholesomeness.

This phase will continue to be directed by The Surgeon General and logistically supported by the Quartermaster Corps. The protocol under which the work is to be continued has been developed with full cooperation and concurrence of the Food and Drug Administration. It has been designed to result in clearances for unrestricted consumption of radiation processed foods by both military and civilian populations. Included are six principal sub-phases, namely:

a. Short term feeding to animals, principally rats, which has been completed.

b. Long term feeding of 21 representative foods to each of 2 species of animals for 2 years, followed by comprehensive histopathological examinations. The feeding work is 90 per cent completed. The tissue evaluations, which will be done by the Armed Forces Institute of Pathology, are currently in progress.

c. Carcinogenicity and enzyme studies which are approximately 50 per cent completed.

d. The resolution of several experimental anomalies, which have been noted in long-term animal feeding. These will require effort beyond that already in progress. Additional work in two areas, possible sterility in dogs and possible auricular rupture in mice, may extend over a period of 3 years.

e. Additional new work with regard to the biological aspects of possibly induced radioactivity.

f. Human feeding studies. Those conducted for evaluation of acceptability of radiation processed foods have been deferred pending the determination of residual induced radioactivity. It appears that the tests may be resumed in the not too distant future. Long-term human feeding will await adequate resolution of the animal anomalies and conclusive information on induced radioactivity.

3. Pre and Post Irradiation Studies

Efforts will be directed toward meeting requirements of field Army feeding. Usable sterilized beef, pork, chicken, and ham items in the individual combat meal and small group operational rations will be developed in accordance with Combat Developments Objectives Guide. In addition, the use of these prime components, either sterilized or pasteurized, as logistic-saving components in A and bulk B rations will be pursued. Morale-significant items, such as fresh fruits, will constitute a tertiary goal.

Processed foods will be studied with regard to their retention of color, flavor, texture, and nutritional quality. Pre-irradiation and post-irradiation factors will be considered, in addition to those acting during the exposure period. Interactions among these factors will also be taken into account.

Pre-irradiation processing treatments which will be investigated will include pre-cooking techniques such as steaming, roasting, broiling, and frying; time, temperature and method of heat application for enzyme inactivation; addition of salts, tenderizers, flavor accentuators, spices, and off-flavor suppressants; headspace composition; and oxygen odor scavengers.

The effects of processing conditions accompanying irradiation will be explored. Among those which may have significant influence on product quality are dose rate, dose fractionation, product temperature, and gaseous exchange.

Among the post-irradiation factors which will be studied are: the influence of residual enzyme activity, cause of excessive softening, time-temperature condition conducive to product improvement,

interactions between various components of formulated products, interaction between food and package, and time-temperature effect on general chemical degradation of stored irradiated foods.

A fundamental research program will be continued to determine the origin of the organoleptic changes, the mechanisms whereby they occur, and means for their control. Initially, this sub-phase will be focused principally on beef.

Studies will be conducted on identification of chemical changes occurring during the irradiation of meats, and subsequent storage under a variety of time and temperature, dose, dose rate, headspace composition, and additives.* Fractionated meat components and model systems of proteins and lipids will be studied to provide an understanding of the underlying reactions.

Optimum characteristics of odor scavengers, which are effective in "dry" packs, will be established. Further research will be undertaken to develop scavenger systems which can be effectively utilized with "wet" packs.

The mechanism of proteolytic enzyme reaction will be studied, with the hope of improving methods of enzyme control, superior to the present blanching technique.

4. Destruction of microorganisms.

Basic research will be conducted on the physiology and biochemistry of microorganisms with special emphasis on anaerobic spore formers of public health significance. The mechanism of action of ionizing energy on the various stages of development of these microorganisms will be determined.

A clear understanding of the influence of a variety of processing and substrate factors will be sought in order to develop conditions whereby foods can be safely irradiated at substantially lower doses than presently adopted to gain quality and economic advantages. Some of the processing factors will include: dose, dose rate, dwell time, beam spectra, heat-interaction, energy pulsing, and temperature. Some of the substrate factors to be analyzed are: type of food, moisture, pH, strength of inoculum, and chemicals.

Studies to determine the particular types and strains of Clostridium botulinum which are the most radioresistant will be undertaken in order to establish a definitive sterility reference for processing by ionizing energy.

*Usual sense of the term, not legal sense.

5. Nuclear effects on foods.

The pertinent isotopic content of selected foods of interest will be determined by literature analysis and experimentation. Efforts will be expanded to determine the probability and theoretical and measurable amounts of activity induced in actual food items and in food "phantoms" by radioisotopes, spent fuel rod, and electron beams of various energies.

A quality control procedure will be developed, which will be used to guarantee radiological safety of treated foods as established by Food and Drug Administration, Public Health, Atomic Energy Commission, and the Army Surgeon General, leading to early resumption of human feedings studies and eventual general acceptance of food so processed.

The above studies will be coordinated with The Surgeon General, particularly with reference to biological interpretations of the resulting data.

6. Acceptance testing.

Troop-feeding tests will be conducted on two levels following approval by and with the collaboration of The Surgeon General. The first, designed to determine acceptability, consists of single meals to about 200 soldiers per test. The second, designed to measure monotony factors and field utilization, will be operated as engineering tests.

An engineering test will be based upon 100,000 meals containing about 5.5 oz of irradiated meat per meal. About 2 to 4 engineering tests per year will be conducted, once the approved irradiated items can be provided.

7. Packaging studies.

Only minor studies will be conducted on tin plate cans, which have been shown to meet minimum requirements as a container for irradiated foods. Extended storage involving aluminum cans will be completed.

Investigations on flexible and semi-rigid containers will be directed toward materials and container research. An evaluation will be made of the nature and amount of extractives and possible induced radioactivity produced in various plastics by the irradiation process. Means of controlling the production of these substances will be sought. Work will be directed toward the development of new laminates with improved resistance to ionizing energy, in addition to the normal attributes of useful containers.

IV. TECHNICAL COORDINATION WITH OTHER ORGANIZATIONS

Within the Army, CONARC, CDEC, and other elements will be consulted in the conduct of operational analyses of irradiated foods in the Army subsistence complex. Additionally, collaboration will be maintained with the Navy, Air Force, and Marine Corps in meeting their special requirements.

Coordination with other government agencies and the Inter-departmental Committee on Radiation Preservation of Foods will be effected. Intimate bilateral working relations will be maintained especially with the Atomic Energy Commission, the Department of Health, Education and Welfare, the Department of Agriculture, the Department of Interior, and the National Bureau of Standards on special work phases of mutual interest.

Advice will be sought from various quasi-governmental bodies, such as the National Research Council.

The major portion of the actual research itself will be conducted by private industry and universities, although irradiation services from central sources will be provided. The plans and results of all workers in the program will be closely coordinated.

V. FACILITIES

Maximum use will be made of facilities available in industrial and academic institutions, in addition to those currently present in government establishments. The state of progress in the program is advancing at such a pace and in such a direction, however, that a moderate research facility is now needed to carry out necessary investigations.

The most desirable source from the standpoint of radio-logical safety is cobalt-60. The availability of such a source as soon as practicable is essential for major advances in the program, particularly in the human feeding phases. At the present time, adequate sources of cobalt-60 are not available. Based on an Army research requirement 2 years hence of about 50 tons of gamma-treated food per year; of a reasonable source time for research on such problems as source geometry, dose distribution in containers of different sizes and shapes, and flux uniformity of radiation field; for use by other Government agencies; and for irradiation services to industrial collaborators, it is estimated that about a megacurie of cobalt-60 will be required.

In order to provide the minimum amount of laboratory support, a small food sampling, preparation, and testing annex will be needed as an adjunct to the gamma facility.

The requirement for a source of electrons at the same location has been carefully considered, in view of the availability of a partially completed linear accelerator. There are good grounds to believe that future costs of commercial processing may favor electrons significantly over radioisotopes for some commodities. Certain treatments, such as restricted surface irradiations, can only be carried out with electrons of specified energies. It is desirable, on this basis, that electrons continue to be investigated.

The actual cost of the needed research facility, currently proposed to be constructed at QM R&D Command, cannot be determined without negotiations with potential contractors. Estimates are as follows: Cobalt-60 Irradiator, (1,000,000 curie) \$1,100,000; completion of linear accelerator (12 MEV), \$400,000; Food laboratory annex \$300,000. Total estimated cost amounts to \$1,800,000.

Current analysis indicates that the most suitable location of this research facility is at the Quartermaster Research and Engineering Center at Natick, Mass., where it can be utilized, not only for food research, but for other research requirements of the Army, other DOD elements, and the national civilian radiation foods program. However, a Joint Board will be formed by the Quartermaster General, composed of representatives of agencies most concerned with the location, for the purpose of recommending to the Chief of Research and Development the most appropriate location for the facility.

VI. FUNDING

The required funding is shown in Table I. It is to be noted that the Atomic Energy Commission has an unexpended balance of approximately \$2,100,000 as of this date. This money can be applied toward certain phases of the project funding, if approval is granted.

Breakdown of the figures follow the work phases described in Section III. The last entry covers the cost of radiation services furnished the various research contractors. The cost of food for troop testing is not included in this budget.

Table I

RESEARCH AND DEVELOPMENT BUDGET

FISCAL YEAR	61	62	63	64	65	66
Military applications and economic analysis	--	--	--	--	50,000	--
Assurance of wholesomeness	300,000	250,000	200,000	100,000	50,000	50,000
Pre and Post Irradiation Studies	340,000	340,000	340,000	440,000	320,000	250,000
Destruction of microorganism	90,000	80,000	60,000	50,000	25,000	25,000
Nuclear effects on foods	40,000	40,000	40,000	40,000	--	--
Acceptance testing	--	--	--	35,000	60,000	60,000
Packaging studies	50,000	50,000	50,000	100,000	75,000	50,000
Radiation services	180,000	180,000	180,000	180,000	180,000	180,000
TOTAL	1,000,000	940,000	870,000	945,000	760,000	615,000

FACILITY BUDGET FY '61*

Food Preparation Facility	\$ 300,000
Electron Accelerator	400,000
Cobalt-60 Irradiator	<u>1,100,000</u>
Total	\$1,800,000

*Can be funded from AEC unexpended R&D funds

Materials - 15 - Lead Sec

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Commissioners
General Manager
Secretary

MAR 1 1960

MEMORANDUM FOR: THE GENERAL MANAGER

I understand that further developments in the food irradiation program await action by the Army on their part of this program and possibly further meetings of the Interdepartmental Committee. I believe we must get in a position very quickly where we can proceed with a program and respond to Senator Anderson's letter of March 7, 1960, on this subject.

If there is any difficulty in doing this, I believe the Commissioners should know very quickly so that we can decide what further steps may be taken to expedite this matter.

John A. McCone

3-17-60

WALTER D. HENNING, JR., CHAIRMAN
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Congress of the United States
JOINT COMMITTEE ON ATOMIC ENERGY

March 7, 1960

Honorable John A. McCone
Chairman
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Mr. McCone:

On January 14, 1960 the Joint Committee held public hearings on the decision by the Department of the Army to cut back on its food irradiation research program. During the hearings, we discussed the report of the Ad Hoc Panel of the Interdepartmental Committee on Radiation Preservation of Food which report, in draft form at that time, contained recommendations for the formulation of a national civilian program with the Atomic Energy Commission designated as the operating Agency.

The final Ad Hoc Panel Report has been received by the Interdepartmental Committee and submitted to the interested agencies, including the Department of the Army and the Commission. I would hope that appropriate action can now be taken without further delay to carry out the recommendations of the report and that the Commission would be prepared to proceed immediately to carry forward a vigorous program.

As you know, the Joint Committee was quite disappointed and somewhat disturbed by the manner in which the Department of the Army in October 1959 suddenly announced its decision not to proceed with the Ionizing Radiation Center. Previously in 1955 and 1956, representatives of the Commission and the Department of the Army had testified favorably as to the economics and objectives of the program and had informed the Committee that construction of the Center would commence in 1957 and that it would be in operation in 1958.

Thereafter the Joint Committee was not properly kept "currently and fully informed" as to the program, particularly as it failed to proceed as scheduled and along the lines the Committee had been led to expect. The hearing on January 14, 1960, for example, brought out that construction of the Center never even commenced. It was ascertained that decisions were made by the Department of the Army without proper interagency coordination and that the decision to cancel construction came as a surprise to the AEC as well as the Joint Committee.

March 7, 1950

The Joint Committee hearing on January 14, 1950 also developed the fact that no adequate scientific data supported the Army's determination to cut back on the program. A report by the A. D. Little Company which was "used partially as a basis" for the Army decision to cancel was not even read by the Technical Director of the project. The Army, in a letter to a member of Congress a few days before deciding to cancel the project, went so far as to say that "progress has been substantial and encouraging and the program is now ready for the pilot plant testing phase."

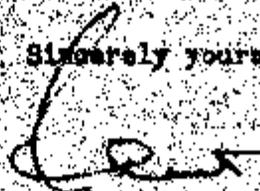
Whether or not the Army was justified in its decision either from a scientific or economic point of view, I believe it is of the utmost importance that the United States move ahead with a definite food irradiation program. I believe the Government should proceed to establish a food irradiation center and that necessary attention should be given immediately to this matter in order that authorization and appropriation legislation could be considered during this session of the Congress. Since the Department of the Army for one or more reasons decided not to follow through with the original objectives, I believe the Commission is the proper Agency to support this program in cooperation with private citizens and companies interested. The Joint Committee would endorse the assignment of the food irradiation program to the AEC and would be prepared to support a vigorous program to further the development of this concept of the peaceful atom.

The failure of our Government to adequately support the food irradiation program, I believe, is merely symptomatic of our entire atom-for-peace program. The many glowing promises which were made to the world during the period 1953-56 have not been fulfilled. It may still not be too late. We cannot, however, afford to waste any more time nor to make promises to our free world friends that are not being supported by our actions. The Commission today, I believe, should be in a position to go ahead with the program and endeavor to put it back into operation and further its advancement.

I have discussed the above with my colleagues on the Joint Committee, Congressman Carl T. Durham, Chet Helmsfeld, Mel Price, and James Van Zandt and they advise me that they concur in my views.

I am sending a copy of this letter to the Secretary of the Army.

Sincerely yours,



Clinton P. Anderson

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1595th AEC Meeting
2-25-60
DUU

3. AEC 719/31 - Establishment of a Radiation Processed Foods Program

Mr. Luedecke presented to the Commissioners a program for development of radiation processed foods based on a plan submitted by the Interdepartmental Committee on Radiation Preservation. He said the program does not attempt to implement the scope of activities recommended by the Committee but proposed a conservative investigation of the potential of irradiated foods.

Mr. Aebersold outlined for the Commissioners the projected activities set forth in AEC 719/31 - Establishment of a Radiation Processed Foods Program. In reviewing the program as undertaken by the Army in 1953 he emphasized the program had not included possible civilian applications of radiation processed foods. He said the Army performed wholesomeness experiments on twenty-six types of foods and had oriented their research toward development of high level sterilization of foods for unrefrigerated preservation up to one year. Only beef, pork, poultry and ham had been found to be reliable under these specifications. The Interdepartmental Committee, he said, recommended the AEC be designated as operating agency for a radiation processed foods program emphasizing low dose radiation processing to extend shelf life. The supporting reasons for AEC undertaking the program are:

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2-25-60

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a. The AEC has the basic national responsibility for advancing peaceful atomic energy application.

b. The President's Atoms-for-Peace policy is a further declaration of the national purpose of bringing about widespread and beneficial uses of atomic energy having influence throughout the world.

c. Much of the food process development work required involves technology of which AEC possesses unique knowledge and competence;

(1) radiation source technology and radiation engineering, and

(2) radiation effects on biological materials.

In response to a question by the Chairman Mr. Aebersold said the Army had cancelled the construction of the food irradiation processing facility near Fresno, California due to the unresolved problems in storage and logistics of large quantities of irradiated foods. Dr. Dunham explained that the Army discovered it was necessary to protect the radiation preserved foods from bacterial contamination by canning. He noted this applied only to the high level sterilized food intended for extended storage.

The Chairman said the program as presented by the staff held promise for revolutionary developments for the food industries of the world. He suggested consideration be given to centralizing the responsibility for the program in a national laboratory rather than dividing the work among university contractors. Mr. Luedcke said that elementary ground work must be done before a program could be established of the size which would require

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its assignment to a National Laboratory. Mr. Tammaro said neither the interest nor the talent exist in any of the National Laboratories at this time. When it becomes advisable to delegate the primary responsibility to a single institution he said he favored a university equipped with the attendant agricultural department. Dr. Dunham emphasized the need for a step by step program as proposed to prove the feasibility and demonstrate to the industry the usefulness of radiation extended self life of such foods as fresh fish, fresh fruits and other perishables.

Mr. Graham commented on the use of the phrase "market acceptability" as describing a problem for resolution by the proposed program. He suggested and the Commissioners agreed that suitable alternative words be found which would indicate the ABC is not concerned with the merchandizing and promotional aspects of radiation processed foods.

The program, Mr. Floberg said, should concern itself with preservation of essential foodstuffs not distribution of delicacies and garnishments.

At the request of Mr. Graham, Mr. Aebersold reviewed the history of ABC and Defense Department contracts for development of this program with special reference to the role of Curtis-Wright Corporation.

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After further discussions of the proposed program funding the Commission:

a. Approved undertaking by the AEC of a radiation processed foods program as set forth in paragraphs 7 through 13 of AEC 719/31;

b. Approved funds in the amount of \$115,000 in FY '60 and \$500,000 in FY '61 for this purpose;

c. Noted that funds for the program in FY '60 and FY '61 will be accommodated within the budgets of the Office of Isotopes Development and the Division of Biology and Medicine;

d. Noted that clearance from the Bureau of Budget will be obtained for use of these funds in the radiation processed foods program prior to its initiation;

e. Noted that close liaison has been established between the Department of the Army and AEC with regard to coordinating their respective radiation processed food programs;

f. Noted that a suitable public announcement will be issued covering the foregoing actions;

g. Noted that suitable notification of this action will be sent to the JCAB; and

h. Noted that AEC 719/31 is unclassified.

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Memorandum

Met 12-7 on the ...
Reference See

1 2 3 4 5 6 7 8 9 10 11 12

TO : Paul C. Asbergold
 Director of Isotope Development

DATE: March 1, 1960

FROM : W. B. McCool
 Secretary

SUBJECT: COMMISSION DECISION ON AEC 719/31 - ESTABLISHMENT OF A RADIATION
 PROCESSED FOODS PROGRAM

SYMBOL : SECY:AHE

1. As we informed your office on February 26, 1960, at Meeting 1595 on February 25, 1960, the Commission:

- a. Approved undertaking by the AEC of a radiation processed foods program as set forth in paragraphs 7 through 13 of AEC 719/31;
- b. Approved funds in the amount of \$115,000 in FY '60 and \$500,000 in FY '61 for this purpose;
- c. Noted that funds for the program in FY '60 and FY '61 will be accommodated within the budgets of the Office of Isotopes Development and the Division of Biology and Medicine;
- d. Noted that clearance from the Bureau of Budget will be obtained for use of these funds in the radiation processed foods program prior to its initiation;
- e. Noted that close liaison has been established between the Department of the Army and AEC with regard to coordinating their respective radiation processed food programs;
- f. Noted that a suitable public announcement will be issued covering the foregoing actions;
- g. Noted that suitable notification of this action will be sent to the JCAB; and
- h. Noted that this paper is unclassified.

2. As you will recall, the Commission commented on the use of the phrase "market acceptability" as describing a problem for resolution by the Food Radiation Program, and suggested that a suitable alternate

2-100c

Paul C. Asbersold
Director of Isotope Development

- 2 -

March 1, 1960

phrase be found to indicate that the AEC is not concerned with the merchandizing and promotional aspects of Radiation Processed Foods.

3. The General Manager has directed you to take the action necessary to implement the above decision. Copies of pertinent correspondence should be provided the Office of the Secretary.

cc:

General Manager
Deputy Gen. Mgr.
Asst. Gen. Mgr. Adm.
Asst. Gen. Mgr. R&D
General Counsel
Biology & Medicine
Congr. Relations
Information Services

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February 23, 1960

AEC 719/31

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ATOMIC ENERGY COMMISSION

ESTABLISHMENT OF A RADIATION PROCESSED FOODS PROGRAM

Note by the Secretary

The General Manager has requested that the attached report by the Director of Isotopes Development be circulated for consideration by the Commission during the week of February 22, 1960.

W. B. McCool

Secretary

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ATOMIC ENERGY COMMISSION

ESTABLISHMENT OF A RADIATION PROCESSED FOODS
PROGRAM

Report to the General Manager by the
Director, Office of Isotopes Development

THE PROBLEM

1. To consider a plan for radiation processed foods program by the Atomic Energy Commission.

SUMMARY

2. By letter dated February 17, 1960, the Interdepartmental Committee on Radiation Preservation of food presented to the Atomic Energy Commission for consideration and action a report setting forth recommendations for establishment of a radiation processed foods program to be administered by the AEC. The report is attached as Appendix "B".

3. The major conclusions of the Interdepartmental Committee report are that

a. A radiation processed foods program should be established emphasizing low dose (less than 1 million rad) radiation processing of foods to extend shelf life.

b. The Atomic Energy Commission be designated as the operating agency for the program.

4. Development of technology for radiation processed foods would provide for a major application of atomic energy promising significant benefit in the United States and throughout the world. Thus:

a. Aid to undernourished peoples in inland areas by providing freshlike food would become more practical.

b. World food losses through insect damage could be significantly reduced.

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c. Costs of merchandising food could be reduced through lesser food spoilage and more efficient distribution.

d. Increased trade and commerce would be feasible because of lifting of embargoes on food products which otherwise would be suspect of insect infestation.

e. Quality of some food may be improved because quality losses due to heat processing could be eliminated.

f. Availability of fresh-like foods, such as fresh fish and strawberries, to areas where they would not otherwise be obtainable would be feasible.

5. Low dose substerilization radiation treatment for extension of shelf life offers the most immediately useful civilian application of radiation for processing of food because

a. Nutritional factors (i.e., wholesomeness) do not appear to present a problem.

b. Radiation effect on odor, texture, and flavor in many cases is negligible.

c. For particular items, e.g., fish, low dose treatment meets a unique commercial need.

d. The radiation cost per pound of food is a factor of 10 less than for sterilization.

e. The food industry normally does not wish to hold a large inventory such as might be permitted by radiation sterilization, but does desire to match supply and demand as is possible through shelf life extension.

6. The radiation processed foods program is being proposed over a five year period with a projected total expenditure of \$5,000,000. This program will include basic studies devoted to resolving the problems in food chemistry, microbiology and wholesomeness which may result from irradiation, as well as establishing radiation process technology, economic feasibility and market acceptance. A program of at least this duration is needed to obtain sufficient data to evaluate toxicology, carcinogenicity, and related problems. A description of the major program elements is set forth in Appendix "C".

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7. The immediate objective of the proposed radiation processed foods program would be to concentrate on a small number of selected food products which appear to promise early technical feasibility and market acceptance. It is expected that establishment of technical feasibility and market acceptance of a few radiation processed foods will prompt industry to extend independently the technology throughout the broad spectrum of food products.

8. Essential to start-up activities in the proposed program are research irradiators (containing approximately 10,000 curies of Cobalt-60) to investigate fundamental problems such as biochemical effects in radiation processed foods and the origin and control of organoleptic factors (odor, taste, color and texture). One research irradiator is proposed in each of the fiscal years 1960 and 1961 to be used primarily in fundamental studies of radiation processing of fish, fruits, vegetables and grain. These irradiators will be made available for use primarily by AEC contractors and by the Departments of Interior and Agriculture. Discussions are underway with the Departments of Interior and Agriculture regarding their role in the use of these irradiators. These irradiators will be used to carry out experimental studies in support of the Commission's program for development of industrial processed radiation.

9. The Atomic Energy Commission presently has under construction a high intensity radiation engineering facility (capable of accommodating up to two million curies of Cobalt-60) at Brookhaven National Laboratory which, with some modification, could meet future program requirements related to product and process development. The research irradiators discussed above cannot accommodate this future need.

10. Commercial food processing companies will be actively encouraged to participate in the proposed program through radiation

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study agreement where the government provides the service of irradiation of food and industry performs without cost food research and evaluation.

11. The principal reasons supporting the desirability of AEC undertaking the proposed radiation processed foods program are:

a. The AEC has the basic national responsibility for advancing peaceful atomic energy application.

b. The President's Atoms-for-Peace policy is a further declaration of the national purpose of bringing about widespread and beneficial uses of atomic energy having influence throughout the world.

c. Much of the food process development work required involves technology of which AEC possesses unique knowledge and competence:

(1) radiation source technology and radiation engineering, and

(2) radiation effects on biological materials.

12. The scope of program activities and the funding requirements for fiscal years 1960 and 1961 are attached as Appendix "D". Funds being requested in FY '60 and FY '61 are \$115,000 and \$500,000 respectively. The scope of program activities planned for FY '60 and FY '61 represents a stretching-out of the level of program effort set forth on page 24 of Appendix "B".

13. Start-up activities to be carried out in FY '60 and FY '61 include:

a. Survey of all research and development work to date to analyze and collect data relevant to the low dose radiation processed foods program.

b. Identification of potential applications of low dose radiation processed foods which would have substantial technical, economic, or other significance in food production, processing, distribution, marketing, or consumption.

c. Development of guide lines for a research program to establish wholesomeness and safety of radiation processed foods.

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d. In selected cases, identification of scope and cost of research and development program needed and initiate preliminary experimental work.

e. Design of irradiators.

STAFF JUDGMENTS

14. The Divisions of Biology and Medicine and Finance concur in the recommendation of this paper.

RECOMMENDATION

15. The General Manager recommends that the Atomic Energy Commission:

a. Approve undertaking by the AEC of a radiation processed foods program as set forth in paragraphs 7 through 13 above.

b. Approve funds in the amount of \$115,000 in FY '60 and \$500,000 in FY '61 for this purpose.

c. Note that funds for the program in FY '60 and FY '61 will be accommodated within the budgets of the Office of Isotopes Development and the Division of Biology and Medicine.

d. Note that clearance from the Bureau of Budget will be obtained for use of these funds in the radiation processed foods program prior to its initiation.

e. Note that close liaison has been established between the Department of the Army and AEC with regard to coordinating their respective radiation processed food programs.

f. Note that a suitable public announcement will be issued covering the foregoing actions.

g. Note that suitable notification of this action will be sent to the JCAE.

h. Note that this paper is unclassified.

LIST OF ENCLOSURES

APPENDIX "A" - Background and Discussion

APPENDIX "B" - Interdepartmental Committee Report

APPENDIX "C" - Description of Major Program Elements

APPENDIX "D" - Fiscal Plan for the Radiation Processed Foods Program

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APPENDIX "A"

BACKGROUND AND DISCUSSION

1. The United States has assumed world leadership in the development of technology for radiation processing of foods. Throughout Latin America, Europe and Asia interest is being stimulated and programs developed around U.S. leadership. The radiation processing of foods program is a true expression of the President's Atoms-for-Peace Policy and has more recent declaration in India calling for international cooperation in a War-on-Hunger Program.

2. A recent International Conference on Preservation of Foods by Ionizing Radiation held at the Massachusetts Institute of Technology clearly demonstrates the world-wide interest in radiation processing of food and the faith that the United States will continue to be a leader in this development.

3. Early in 1950 the Atomic Energy Commission undertook and supported over the next three years a limited amount of work on radiation processing of food with specific reference to development of beneficial and economic uses of fission products.

4. Current efforts in the United States on radiation processing of food are centered in the program of the Department of Army to treat foods with sterilizing doses of radiation for long-term storage without refrigeration. The Department of Army program was established in 1953, at which time the AEC program was curtailed, to develop radiation processed foods to improve acceptability of field rations, as well as to provide better logistics and economics in food handling in the military establishment.

Appendix "A"

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5. The Joint Committee on Atomic Energy held a public hearing on the Army radiation preservation of food program in 1955 which resulted in broadening its scope into a national program, including civilian interests.

6. The Department of Army announced on October 22, 1959, deferral of plans for construction of the U.S. Army Ionizing Radiation Center (USAIRC), Sharpe General Depot, Stockton, California, pending a full study and review of its radiation sterilized foods program. The Center was to be an important part of the over-all national radiation processing of foods program. The Commission, at the request of the Department of Army and using Army funds, undertook the design and construction of the Cobalt-60 High Intensity Food Irradiator (HIFI). The HIFI was one of two irradiation facilities planned for the Center.

7. The Department of the Army decision was brought about by

a. The need for reappraisal of the economic logistic justification for radiation sterilized foods within the military establishment.

b. The need to establish the specific cause of certain biological anomalies observed in long term animal feeding experiments being carried out with radiation sterilized foods to establish their wholesomeness.

8. Due to the action by the Department of Army and the important nature of the radiation processing of foods program in the United States and throughout the world, the Interdepartmental Committee on Radiation Preservation of Food established an ad hoc work group to determine the need for, and elements of, a national civilian program on radiation processing of foods and recommended individual agency responsibilities.

Appendix "A"

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9. The Joint Committee on Atomic Energy held a public hearing on radiation preservation of food on January 14 and 15, 1960, to examine the basis for the Department of the Army decision to defer the Stockton facility as well as current and future program plans of the Army on radiation sterilized foods. At the hearing prospects for a national civilian radiation food program were discussed as well as desirability for the Atomic Energy Commission to carry out such a program.

Appendix "A"

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FEBRUARY 1960

AD HOC PANEL REPORT

to the

INTERDEPARTMENTAL COMMITTEE ON
RADIATION PRESERVATION OF FOODS

on

A NATIONAL CIVILIAN RADIATION PROCESSED FOODS PROGRAM

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PREFACE

At a meeting on November 24, 1959, the Interdepartmental Committee on Radiation Preservation of Food agreed to establish an ad hoc panel to formulate a national civilian radiation processed foods program. This was prompted primarily by the Department of the Army decision to reorient its program more toward research and to concentrate on radiation sterilization of a few items of military interest. It was therefore deemed necessary to consider a complementary program to implement civilian interest in radiation processed foods.

In appointing members of the ad hoc panel, Mr. H. B. McCoy, then Chairman of the Interdepartmental Committee, defined its task as follows:

1. Make an assessment of the current "state of the art."
2. Review progress achieved in Government activities.
3. Consider what problems or issues now need to be dealt with to advance the radiation processing of food.
4. List specific areas of further research and development.
5. Recommend how and in what way the future program in the Government may be administered.
6. Make suggestions and recommendations regarding size of the research and development program.
7. Indicate what, if anything, the Federal Government might do to encourage research and development by private firms, institutions, etc.

The following report has been concurred in by all members of the ad hoc panel, with the exception of David H. Rest. He desires that references in the report to cobalt 60 and x-ray machines be accompanied

by mention of electron accelerators as alternate on additional radiation sources. This matter should be considered at the meeting of the Inter-departmental Committee.

This report does not spell out in detail the technical elements of the proposed program. This would be one of the first program activities. Furthermore, the report does not embody a comprehensive analysis of the current state of technology of radiation processed foods but rather broadly identifies technical prospects for foods processed at sterilisation and pasteurization doses. It is to be noted also that the program has been developed without benefit of detailed knowledge of future Army plans.

This report is concerned only with conduct of research and development on radiation processing of foods. It does not attempt to define individual Government agency responsibilities in such areas as regulation, health and safety, etc., and does not imply any commitment by any Government agency with respect to any regulatory matter within its jurisdiction.

MEMBERSHIP

Paul C. Aebersold, Chairman	Atomic Energy Commission
John Holston	Department of the Interior
H. W. Koch	Department of Commerce
Jacob M. Schaffer	Department of Commerce
Samuel N. Klein	Small Business Administration
David H. Rest	Quartermaster Food & Container Institute for the Armed Forces

Colonel Lawrence Hursh

Wilbur T. Pentzer

Andrew Wheeler

Shelbey Grey

Office of The Surgeon General

Department of Agriculture

Health, Education & Welfare

Health, Education & Welfare

RECOMMENDATIONS

It is recommended that -

1. The Interdepartmental Committee approve the national civilian radiation processed foods program as set forth in Part "B" of the report and refer it to member Agencies for concurrence and implementation.
 2. The Atomic Energy Commission be designated as the operating Agency for the national civilian radiation processed foods program.
 3. The Interdepartmental Committee support the need for a complementary program by the Department of the Army on radiation preservation of foods and the requirement to pursue such a program aggressively.
 - *4. The Army complete its wholesomeness and safety program at sterilization doses to resolve biological anomalies that have arisen from long-term feeding studies and that AEC assist in this program as mutually agreed upon, as well as, initiate a wholesomeness program on selected foods at sub-sterilization doses.
 - *5. A Wholesomeness Program Working Panel to the Interdepartmental Committee be established consisting of the Army, AEC, FDA, Department of Agriculture and consultants as required to coordinate this program.
 6. The Interdepartmental Committee support the requirement by the Department of the Army for adequate food preparation and radiation facilities to carry out effectively its research and development program.
 7. Radiation research facilities established for either the Department of the Army program or the civilian radiation processed foods program be mutually accessible.
 8. Close liaison be established between the Department of the Army and the operating Agency for the civilian radiation processed foods program on technical and administrative matters including budgets and scope of program activities.
- * These recommendations were added at the meeting of the Interdepartmental Committee held on February 12, 1960, and were not a part of the report to the Committee by the Ad Hoc Panel.

INTRODUCTION

To understand the objectives and problems of food preservation by radiation, it is necessary to appreciate what causes food to deteriorate. Food deteriorates in many ways: through physical, chemical, and enzymatic changes, and by the activity of microorganisms and insects. Chemical and enzyme deterioration are only minutely affected by low doses of radiation contemplated for food processing, and physical changes, such as softening, may be promoted. The most promising areas for applications of low dose radiation are in control of insects and of microbiological damage.

Chemical spoilage of foods results from food components reacting with their environment or with other food components; for example, the reaction of fats with oxygen in air to cause rancidity. Radiation does no more or less to retard these reactions than does any other method of food preservation. These reactions are controlled to various degrees, however, with appropriate food technology.

Enzymatic spoilage results from enzymes in foods reacting with the food itself, i.e., "self digestion." Neither freezing nor irradiating stops this reaction although these processes may retard the reaction. Heat inactivates enzymes; hence, thermal processing does stop this reaction. In freezing, drying, or radiation preservation, a blanching or low heat treatment can be used to inactivate the enzymes during preservation.

Spoilage may result from the action of both insects and microorganisms. Ionizing radiation can destroy or inhibit these agents. This is the purpose of radiation processing.

Fresh untreated foods are generally subject to spoilage by all the mechanisms mentioned. Physical, chemical and enzymatic changes are of major concern in long-term storage, and they can be retarded by refrigeration. Spoilage by these mechanisms is generally not important during storage periods less than a month or two especially if adequate refrigeration is used. On the other hand, spoilage by microorganisms is often the prime cause of the rapid deterioration of perishable foods, and while refrigeration is helpful, it often will not do the job alone. Thus, the use of radiation to control microbiological spoilage and extend refrigerated shelf life of fresh-like products becomes a most important goal. Radiation is also a potent means of killing insects that damage foods.

Microorganisms and insects can be destroyed or their destructive action reduced by the use of irradiation, often with fewer deleterious effects on the product than caused by other methods. That is, a fresh or fresh-like product can, in some instances, be stored considerably longer than is now possible. For example, some fish and shell fish, can be treated with ionizing radiation so that the fresh product can be stored under refrigeration (not frozen) for weeks instead of days.

With regard to shell fish, it is worth noting that prepared, cooked, shrimp sterilized by irradiation can be stored at room temperature for many months and then be essentially undistinguishable from prepared, cooked, fresh shrimp. Other types of commodities can be so treated. In addition, successful results have been experienced in extending the refrigerated shelf life of chicken, fish, pork, beef, grapes, strawberries and citrus fruit irradiated at sub-sterilization doses.

Much need exists for improved food preservation to make wider distribution from product and food surplus areas. The recent International Conference on Preservation of Foods by Ionizing Radiations held at the Massachusetts Institute of Technology* clearly demonstrates the world-wide interest in radiation processing of food and the faith that the United States will continue to be a leader in this development.

Domestically, any method that can increase the storage, distribution, and utility of our food resources will be of great economic advantage. For example, wide distribution of fresh ocean products in the mid-west can mean added prosperity to the fish industry. The same is true about supplying strawberries, peaches, and tropical and citrus fruits to distant markets.

In the last five years, the U. S. Department of the Army has carried on an extensive program to develop radiation preservation of food mainly for military purposes. Military food needs, however, are not the same as the food needs for civilian distribution. The need to store food for extended periods under adverse conditions, to distribute food to widely dispersed fighting units, to feed under conditions of great stress, all give rise to a military feeding system that has no parallel in the civilian population. Military requirements for irradiated foods will thus not necessarily be compatible with the needs of irradiated foods in the civilian feeding system.

The military requires a sterile, ready-to-eat food of high nutritional density that will be acceptable and morale building to the fighting man even after repetitive feedings. This resolves itself in the irradiated

*Report available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

food field to completely sterilized meat products which comprise large tonnages of military subsistence, such as, beef, pork, ham and chicken. It is then reasonable to expect that the Army concentrate its efforts on developing these items.

The civilian needs on the other hand stem from the problem of distributing and utilizing foods in as near fresh condition as possible. At one time dried and salted foods were the closest to fresh foods that could be preserved and distributed. Subsequently, pickling and curing processes replaced some but not all of the drying and salting operations. The situation has been similar following the development of thermal processing, freezing and improved dehydration processes. Each process has developed very useful roles. So it may be with radiation processing. Some food items will yield outstanding products by irradiation. But the process will not be universally applicable. The amounts of dried, smoked, pickled, canned and frozen food items will not be greatly affected.

Sterility may be obtained by combining other treatments such as heat or antibiotics with radiation. In this case the irradiation dose can be considerably reduced thus minimizing the development of off-flavor or other undesirable effects. At the same time, beneficial effects can be obtained such as flavor and texture improvement by reducing the amount of heat needed to sterilize canned meats by combining heat with irradiation. This can be of interest for both Army and civilian needs.

While the fundamental problems in the development of both a moderately treated food and a completely sterilized food with radiation are the same, there are specific differences that require separate investigations. For example, the microbiology of completely sterile foods involve the killing

of the *Clostridium botulinum* (botulinus) organism, requiring very high dosages. The microbiology of pasteurizing strawberries depends upon interference with the metabolism of rhizopus, requiring much lower dosage. Also, the packaging of sterile foods must be sealed hermetically, whereas for pasteurized fruits, the package must allow for respiration.

Much evidence has thus been accumulated to show that a need exists to develop moderate dose radiation processing of foods to the point of commercial feasibility.

The foregoing has adequately shown that there is justification for both military and civilian programs for radiation processing of foods. The Army program would continue to concentrate on development of combat ration components for long term storage and the national civilian program should seek moderate shelf life extensions to produce foods of greater commercial utility.

These programs can be complementary and mutually beneficial in some areas but would be widely divergent in others. Fundamental research, dosimetry studies, wholesomeness, and radiation source technology are among those items which can be shared by both the military and civilian programs. Requirements of the two programs in such matters as microbiology, product development, process engineering, and packaging will be vastly different.

An important example where the two program requirements could overlap would be in the use of a national radiation processing of foods center. The requirements and plans for a national center are detailed in Attachment I to Part "B" of this report.

A summary of the current status of the technology of radiation processing of foods is given in Part "A" of this report, and a recommended national civilian radiation processed foods program is contained in Part "E".

PART "A"

CURRENT STATUS OF THE TECHNOLOGY OF RADIATION PROCESSING OF FOODS

I. Introduction:

Research on the radiation processing of foods commenced over ten years ago. Within the past six years a full-scale development program has been concentrated in the United States on this new concept in food technology. Work on radiation processed foods in other countries has also been initiated and is being pursued actively. Major effort in the United States has been supported by the Government, primarily the Department of Defense, through contractual research projects at universities, research institutes, and private companies. Current selected information on radiation processed foods technology can be found in the previously mentioned report on the MIT International Conference on the Preservation of Foods by Ionizing Radiation. A comprehensive survey of the field through 1957 is contained in the U. S. Army Quartermaster Corps publication entitled, "Radiation Preservation of Food",* However, the rate of accumulation of information in this subject area has increased sharply since the latter book was published. Therefore it is necessary to consult the recent scientific journals for the most important new information.

II. Results from Experimental Investigations:

The comprehensive research and development program on radiation processing of food has revealed some products having potential for commercialization. Radiation sterilization of some meats, such as beef, still poses major problems but other items, such as chicken, fish and pork products, show

* Available as Report No. PB 151 493 from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Price \$5.00

promise as completely sterile products. Generally, however, sub-sterilization offers more immediate promise since effects on quality (flavor, texture and color) are minimized and the processing costs more nearly approach those of conventional processing methods. The sub-sterilization of marine products, chicken and some selected fruit products, such as strawberries, to extend shelf life appears promising.

III. Present Product Status:

A. Meats:

1. Beef:

Radiation sterilized beef frequently has an off-flavor. The United States Army is intensively investigating the formation of off-flavor, in beef and methods to overcome it as sterilized beef is a prime objective of the Army. Modest doses of radiation can be used to delay microbial spoilage of cuts of beef stored at 35°F. thus extending shelf life from about 5 days to perhaps 6 weeks.

2. Chicken:

Sterilizing doses produced minimal changes in taste and odor. Radiation sterilized chicken is slightly more pink in appearance than unirradiated chicken. Chicken irradiated with sub-sterilization doses and held at 35°F. has its shelf life extended to 30 days or more compared with 10 days for untreated chicken and retains acceptable taste and odor.

3. Pork:

a. Roast Pork - Experiments conducted by the Army demonstrated that pre-heated or roasted pork that is subsequently radiation sterilized is better in quality than heat-processed canned pork. The texture and flavor of radiation processed brown-an-serve pork is highly acceptable.

b. Sausage - The flavor of some formulations of pork sausage is little affected by radiation processing. Shelf life of sausages given one megarad and held at 35°F. is more than six weeks compared with two weeks for control sausages.

c. Bacon - The Army has reported good results on bacon with respect to acceptability at sterilization doses.

B. Marine Products:

Fishery products are promising for commercial radiation processing. Four-fold increases in refrigerated shelf life after sub-sterilization doses are found. The radiation processing of fish and shell fish, such as halibut, ocean perch, cod, shrimp, crab meat and lobster are perhaps the most promising for commercialization, since the flavor, odor, color and texture of these radiation processed products are likely to meet with consumer acceptance. Many fishery products are quite perishable and a four-fold increase in shelf life under refrigeration would be of significant benefit to the consumer and to the fishing industry.

C. Vegetables:

Sterilization of fresh vegetables has not been developed. Fair results have been obtained with sub-sterilization treatment of several vegetables, such as carrots and asparagus. The spoilage of vegetables, such as asparagus, due to rot and fungi may be controlled with sub-sterilization doses.

D. Fruits:

Sub-sterilization processing of fruits, such as strawberries, citrus fruits, grapes and peaches, may offer promise for commercialization. The low dose treatment of these fruit items can control

spoilage due to rhizopus, gray mold and brown rot, respectively. Shelf life extension for transcontinental shipment of a high spoilage item, such as strawberries, could be highly beneficial to the consumer and the grower. With respect to tropical fruits, such as papayas and mangoes, most serious problem of marketing is disinfestation of various fruit flies. It appears that low dose treatment of fruits can solve this problem.

E. Grains:

Radiation treatment has been investigated for the disinfestation of grain. Questions which have not been well answered in this regard include comparison between cost of chemical and radiation disinfestation, prevention of reinfestation and the problem of multiple radiation treatment, if required. Radiation disinfestation of grain or grain products may find commercial applications.

F. Sprout Inhibition:

Prevention of sprouting in tubers particularly potatoes, as a result of radiation treatment has been amply demonstrated. Radiation treatment makes it possible to inhibit sprouting for long periods under commercial conditions. There are problems to be overcome in subsequent decay prevention.

IV. Wholesomeness and Safety Clearance

A most comprehensive program to test the nutritional and toxicological safety of irradiated food has been conducted by the Department of the Army (Office of The Surgeon General). This program exceeds any animal feeding program that has ever been conducted on processed foods. The plans for the tests have been developed in close liaison

with the Food and Drug Administration. It is our understanding that three to five more years would be required to complete and analyze feeding studies. Research in this area is intended to determine whether irradiated foods are safe and wholesome.

Much concern developed recently on the problem of induced radioactivity when it was observed that short lived radioactive isotopes with low activity could be measured in foods treated with high energy electrons. Fortunately, however, experimental evidence indicates that low energy gamma sources such as cobalt-60 and cesium-137, or X-rays of comparable low energy, as would be expected, do not produce detectable activity in foods. The Food and Drug Administration will of course require documentary evidence on the safety of these sources for food processing.

V. Packaging:

Experimental studies to date have been directed largely at satisfactory packaging materials for sterilization processing. Considerable work remains to be done in studying satisfactory packaging materials for sub-sterilization processing. Such containers must not only be capable of preventing microbial recontamination, but also of permitting transmission of respiratory gasses. In addition, it must be determined what types of chemical by-products result from the packaging material since minute amounts of extractable substances produced during irradiation could result in undesirable effects in the food.

VI. Radiation Facilities:

Radiation sources currently used for the radiation processing of foods program are generally inadequate in size and characteristics, and are usually located at distances from both the source of food supply and the research laboratory. The principal existing gamma sources consist

of reactor fuel elements of various types used under dissimilar conditions of exposure at sites far removed from food processing laboratories. Progress is being limited by the need for additional gamma irradiators or low energy X-ray machines to develop the best and most economic conditions for radiation processing of a wide variety of food products.

VII. Economics:

Economics of radiation processing are presently based on laboratory studies and calculations rather than on experience under pilot plant conditions. Cost estimates for sterilization treatment have been on the order of a few cents per pound whereas the estimated cost for sub-sterilization processing has generally been on the order of a few tenths of a cent per pound. Reliable cost information will not become available until quasi-commercial plants are built.

PART "B"

RECOMMENDED NATIONAL CIVILIAN RADIATION PROCESSED FOODS PROGRAM

I. Program Description

To conduct research and development, economic, marketing, and consumer acceptance studies, and feasibility demonstrations during the next 5 years necessary to establish the commercial practicality of civilian applications of radiation processed foods that would accelerate their introduction into the economy. The immediate objective would be to concentrate on a small number of selected food products which appear to promise early technical feasibility and market acceptance.

II. Basic Assumptions

- A. The most immediate civilian application of radiation to preserve foods, both from a technical and economic point of view, is low dose treatment to extend shelf life of perishable foods, including meat, fish, vegetables and fruits.
- B. Establishing the wholesomeness and safety of radiation processed foods will for some years be largely a Government responsibility since industry would not undertake both high capital costs for radiation processing plants and expensive long term wholesomeness costs. Short term wholesomeness tests could be expected of industry on individual items, having particular commercial attractiveness.

- C. The Army wholesomeness and safety program at sterilizing and sub-sterilizing doses will be completed and will contribute information toward clearance for these foods as well as additional foods irradiated to lower sub-sterilization doses; however, a modest amount of supplemental work may be necessary to obtain clearance for foods of interest in the civilian program.
- D. The provisions of Public Law 85-929, September 6, 1958, which amended the Federal Food, Drug, and Cosmetic Act, must be met as regards the use of radiation as a food additive. Since radioactivity under some circumstances is carcinogenic, radiation processing of food which will induce measurable radioactivity in the food will not be permitted under the present law.
- E. Public acceptance of radiation processed foods must be demonstrated. Even though a number of food items may have been given FDA clearance by high dose tests, animal and human volunteer feeding studies with specific low dose treated foods may be required for psychological reasons.
- F. Establishment of the commercial success of a few radiation processed foods will prompt industry to extend independently the technology throughout the broad spectrum of food products.
- G. Individual Federal Agencies will continue to conduct long range fundamental research programs on radiation effects on food. The Army program will continue and will supply much fundamental data of this kind which would otherwise have to be developed under the civilian program.

III. Program Administration

- A. The Interdepartmental Committee will provide over-all guidance and recommendations in program policy, direction and budget. It will function principally as a coordinating committee rather than an operating committee.
- B. Program administration would be conducted by one designated Agency on behalf of the Interdepartmental Committee and its member Agencies. This is to include program budgeting, contracting, and reporting. It is proposed that AEC be the operating Agency because (1) much of the food process development work required involves radiation source technology and radiation engineering, and (2) the radiation processed foods program would be a principal facet of the Nations' Atoms-For-Peace program.
- C. The Interdepartmental Committee would function by:
1. Reviewing and making recommendations concerning the over-all program as presented annually by the operating Agency, including the proposed budget request to Congress.

NOTE: This would not preclude any Agency pursuing activities with its own funds independently of the Interdepartmental Committee, and does not imply Interdepartmental Committee control of Agency research and development program.
 2. Receiving periodic reports and evaluations from the operating Agency on the status of the program.
 3. Meeting at least semi-annually to consider policies, programs, and procedures and issue such public statements as may be considered desirable.

4. Establishing a Program Coordination Committee of the most directly participating Agencies to meet as necessary at the call of the operating Agency to consider specific problems as they arise.

D. The operating Agency will function by:

1. Preparing the over-all program and budget for review and recommendation by the Interdepartmental Committee and making the budget request to Congress.
2. Consulting the member Agencies on proposed programs and projects including cost and justifications, for inclusion in the over-all program.
3. Receiving proposals from private organizations and reviewing them where necessary with an appropriate member Agency.
4. Making agreements and contracting with member Agencies and others for conduct of work.
5. Reviewing and evaluating reports, etc., from contractors and others with appropriate member Agencies and other experts in the field as well as assuring the availability of such reports and evaluations to member Agencies, industry, the public, and foreign countries as appropriate.
6. Establish and consult as necessary with a committee of the National Research Council on civilian radiation preservation of food regarding broad program policy and objectives.

IV. Program Objectives

- A. To further the national Atoms-For-Peace and War-On-Hunger programs, assume U. S. world leadership in the radiation processing of foods, and provide technical assistance in this field to developing countries.
- B. To identify potential civilian applications of radiation processed foods which would have substantial technical, economic, or other significance in food production, processing, distribution, marketing, or consumption.
- C. For selected food products conduct research and development work necessary to establish the technical and commercial feasibility of radiation processing.
- D. To supplement Army wholesomeness and safety studies as necessary to obtain FDA clearance for the above referenced selected food products and to conduct continuing wholesomeness studies on radiation processed foods of interest in the civilian economy.
- E. Through suitable Government and private facilities, and with adequate "promotions," to test market for these selected radiation processed food products.
- F. To conduct studies of basic nutritional and organoleptic factors on the biochemical level to compare radiation processed foods with foods processed by other methods, specifically to compare fresh, frozen and irradiated foods after typical consumer storage and cooking procedures.

V. Cooperation with Industry

A policy of maximum cooperation with industry will be followed. Extensive use should be made of "radiation study agreements" in which for a given phase of work the government supplies the service of irradiation of the food, and industry performs the remaining parts of the investigation. Results from the investigations are then made available to all those who are cooperating in the program.

In this way it is expected that industry will make most of its contributions in investigations in the areas of shelf life extension, packaging, consumer acceptability testing, and marketing analyses. The government would be expected to support the major work in the areas of fundamental research, microbiology, food chemistry, and causes of organoleptic changes, etc., provide irradiation services, develop economic and safe radiation process technology and conduct basic wholesomeness testing.

VI. Facility Requirements

In view of the combined needs of the military and civilian programs, a national radiation processed foods research and development center would materially accelerate progress. Certain specialized radiation facilities for food processing, e.g., research irradiators and mobile food irradiators also will be necessary to achieve the foregoing program objectives. Attachment 1 sets forth in detail proposed facilities for radiation processed foods research and their estimated

construction costs, as well as, alternative facility recommendations depending upon action on the Army program.

VII. Problems Foreseen

- A. Due to the budgeting cycle, it would not be expected adequate operating funds will be available for the civilian radiation processed foods program before FY 1962.
- B. Assuming the Army arrives at a decision or other arrangements are made to proceed promptly with construction of a research and development radiation center for food processing, it would not be available for use before FY 1962. If the center must await the customary budgeting process, it would not be available for use until FY 1964. Thus two years can be saved if the center can be undertaken promptly.

VIII. Initial Activities

- A. Survey all research and development work to date to analyze and collect data relevant to the civilian program.
- B. Conduct studies described in IV B above.
- C. In selected cases, identify scope and cost of research and development program needed and initiate preliminary experimental work.
- D. Design mobile irradiators consisting of high intensity Cobalt 60 sources and/or x-ray sources of comparable energy.
- E. Analyze status and timing of Army wholesomeness program and establish close and continuing liaison with this activity.

NOTE: "B" and "C" above have already been done in the case of fish by MIT under contract with AEC. A full report will soon be available.

IX. Budget Estimates

Assumptions:

1. Eight food items to be developed.
2. Man years charged at total cost of \$25,000 each.
3. The estimates are made on the basis of Cobalt 60 as the radiation source. It might be desirable to use low-energy electron accelerators as the radiation source for some of the irradiators envisioned. In this event, the cost estimate will be comparable to the Cobalt 60 source estimate.

Operating Costs:

	<u>FY '60</u>	<u>FY '61</u>	<u>FY '62</u>	<u>FY '63</u>
Initial Activities	200,000			
Equipment				
Research Irradiators (4)	200,000			
Mobile Irradiators (2)		400,000		
Food Chemistry		50,000	200,000	200,000
Microbiology		100,000	400,000	400,000
Product Development		100,000	400,000	400,000
Nuclear Effects		25,000	25,000	25,000
Process Engineering			25,000	50,000
Packaging Development		25,000	50,000	75,000
National Center Operation			50,000	150,000
Commodity Procurement and shipping		10,000	35,000	50,000
Irradiation Services		180,000	200,000	250,000
Supplementary Wholesomeness		<u>30,000</u>	<u>60,000</u>	<u>90,000</u>
	400,000	920,000	1,445,000	1,690,000

Construction:*

	<u>FY '60</u>	<u>FY '61</u>	<u>FY '62</u>	<u>FY '63</u>
National Center			1,400,000**	
Marine Products Irradiator			500,000***	

* Alternative recommendations depending upon action on the Army program are set forth in Attachment 1.

** Not required if Army funds presently held by AEC for a gamma facility are available to build a center to which civilian program has access. Assumes Cobalt 60 at Army price.

*** Not required if National Center built in a suitable location either by Army as above, or by civilian program.

ATTACHMENT 1

IRRADIATION FACILITIES FOR A NATIONAL CIVILIAN RADIATION PROCESSED FOODS PROGRAM

I. Introduction

Irradiation facilities for the conduct of research and process development for a national civilian radiation processed foods program are discussed. The construction of several specialized facilities is proposed. These facilities would also be available for use by the Department of Defense, other Government departments and industry and be operated under the broad guidance of the Interdepartmental Committee.

II. Need for Facilities

- A. Existing radiation sources used to irradiate food are inadequate in size and characteristics, and are generally located at some distance both from the source of food supply and the laboratory which is supervising research and development efforts. To provide proper process control of the radiation processing experiments, the irradiation sources should be located close to the source of food supply and the research laboratory. Much of the food now being irradiated in the research program is frozen or refrigerated for extended periods prior to irradiation resulting in the introduction of undesirable conditions.
- B. Irradiators are needed to develop and demonstrate the best and most economic methods of food radiation processing under a wide variety of product conditions. It is to be emphasized that the development work to be carried out is on both the techniques of radiation processing of foods and the quality of the resulting product.
- C. Fixed facilities will meet some of the existing requirements. Certain food studies, however, must be carried out using fresh harvested or

fresh processed local varieties of food. Mobile Food Irradiation Units with approximately 100,000 curies of cobalt 60 or the equivalent X-rays from a low energy electron accelerator will fulfill this need. The value of these units would be enhanced through their being shared by several users. This is feasible since peak demands and program requirements relative to various food items will vary throughout the year and from one area of the country to another. The cobalt 60 irradiation units could be mounted on special trucks or flat cars providing adequate shielding of the source during transport. These units would be staffed by trained personnel for effective and safe utilization. The Mobile Irradiators would be administered from a home base which would also provide the operational personnel for the units. Additionally, several small scale research irradiators with approximately 10,000 curies of cobalt 60 or the equivalent X-rays from a low energy electron accelerator each will be required to investigate fundamental research problems such as the biochemical effects in radiation processed foods and the origin and control of organoleptic factors (see Appendix "A").

- D. These facilities would retain focus on the United States as a leader in the field of food irradiation. They would provide a visible and substantial contribution to technical assistance for less developed countries. This would be done by performing research and development processing in food preservation applicable to these less developed countries and by acting as the training centers for personnel from foreign countries.

III. Types of Irradiation Facilities

A. Research Irradiators

Four research irradiators are proposed for conduct of fundamental studies necessary for developing radiation processed foods. Interest

has been expressed for two each of these irradiators for the Department of Agriculture and Department of Interior.

B. Mobile Irradiators

1. For fruits, vegetables, and grains

A mobile irradiator is proposed for use by the Department of Agriculture in the continental U. S. for studying shelf-life extension of fruits and vegetables and disinfestation of grain.

2. For tropical fruits

A mobile irradiator is proposed for use by the Department of Agriculture in Hawaii to study the disinfestation of tropical fruits.

C. Fixed Irradiators

1. For marine products

A marine products processing irradiator is proposed for use by the Department of Interior and should be located near an important east coast fishing port. Note that need for this irradiator would be eliminated if the National Center were built in a suitable geographic area since it could be utilized in part for this purpose.

2. A National Center

Among the facilities should be one having sufficient flexibility to investigate those radiation process variables that the program thus far has demonstrated to be of importance.

Such a National Center would:

- a. Permit study of microbiological safety, depth dose uniformity, and dose rate effects.

- b. Permit study of civilian applications for low dose treatment of meat products.
- c. provide adequate process control to assure reproducibility of end product.
- d. Provide a supply of radiation processed foods for testing acceptance, palatability, and storage characteristics.
- e. Promote interest and participation of industry in radiation processing of foods.
- f. Develop process specifications and quality control factors.
- g. Study radiation effects on containers.
- h. Give indications of costs, to include capital, operating, and cost per pound for radiation processing of foods.

Cobalt 60 Complex - Cobalt 60 has been selected as the principal radiation source for the National Center because of its properties of being neutron-free, readily reproducible, and reliable. The proposed cobalt 60 irradiator is capable of processing in excess of 500 megarad pounds per hour of food. The uniquely flexible source is designed to solve process development problems relating to microbiological safety, depth dose uniformity, product quality control, variable dwell time and evaluation of products using variable source and conveyor configurations. This irradiator requires about one million curies of cobalt 60, a cave with a water pool storage facility, labyrinth entrance, and a simple flexible conveyor. The estimated total cost of the facility is \$1.1 million including cobalt 60 and 10% over-all cost contingency. It will also be desirable to examine the suitability of low energy electron accelerators for the radiation processing of foods.

Supporting Food Preparation, Laboratory and Office Building - The building proposed to support food research and process development requirements contains approximately 10,000 square feet. Food preparation will be performed with institutional type equipment requiring manual operation. A suitable refrigeration area will be provided. The laboratory area will provide for chemical quality control tests, microbiological tests, dosimetry tests and taste acceptance tests. If the Army builds facilities which are adequate for a National Center, the Interdepartmental Committee and the operating Agency should seek an arrangement for access to it.

IV. Alternative Recommendations Depending Upon Action on Dept. of Army Program

In this report it has been assumed that the Army program will continue as proposed by the Quartermaster Corps and that it would require at least partial use of facilities comparable to the National Center. Should these assumptions prove incorrect, it is to be noted that

1. The food throughput of the National Center for low dose sub-sterilization treatment would be far in excess of the near term civilian program requirements,
2. The immediate civilian program requirements could be met by research and mobile irradiators and
3. The Atomic Energy Commission presently has under construction a radiation engineering facility at Brookhaven National Laboratory, which with some modification, could meet the product and process development objectives envisioned for the National Center relative to the civilian program, including the limited amount of product irradiations foreseen. (see Appendix "B")

If the Army does not build an irradiation facility for its own use, and in addition cannot justify sharing the use of a National Center to furnish radiation services for its program, then it is recommended that construction of the Center be deferred. In addition to the mobile and research irradiators previously mentioned, it is recommended that a marine products irradiator be established as identified on page 24 of the report. In these circumstances, the operating budget estimates would require reconsideration.

V. Cost Estimate for Irradiation Process Research Facilities

	<u>Plan Including National Center</u>	<u>Alternate Plan</u>
Fixed Research Irradiators (4)	200,000	200,000
Mobile Irradiators (2)	400,000	400,000
Fruits, vegetables, grain	200,000	
Tropical fruits	200,000	
National Center*	<u>1,400,000</u>	
Marine Products Irradiator 550,000**	2,000,000	<u>550,000</u> 1,150,000

* Assumes cobalt 60 could be provided at Army price. Not required if Army funds presently held by AEC for a gamma facility are available to build a center to which the civilian program has access.

** This irradiator would be needed only if the National Center were not built or was constructed in an unsuitable location.

VI. Schedule

It is estimated that approximately 18 to 24 months would be required to design, construct and test operate the fixed irradiators.

APPENDIX "A"

IMPORTANCE OF BASIC RESEARCH STUDIES IN FOOD
SCIENCE (CHEMISTRY AND MICROBIOLOGY) IN THE
RADIATION PROCESSED FOODS PROGRAM

To evaluate the ultimate potential of irradiation in the processing of foods, basic chemical and microbiological research studies are needed to provide information not now available designed to circumvent off-flavor and odors that develop in foods such as beef. It may also be possible to decrease, through bacteriological studies, the dosage required to achieve specific preservation objectives. Significant advances cannot be made until such data are available for products of such great importance as meats with the use of sterilizing dosages. These research areas need significant attention, not only to assist in achieving the technological objectives described, but also as a part of the government's role in support of basic science in the over-all Atoms-for-Peace program. Scientists and other leaders in all countries have looked to the United States for leadership in basic science relating to the potential peace time use of atomic energy and it is essential that the United States continue to provide this leadership. Full evaluation of the potentials of irradiation in food processing cannot be made without the basic research studies in food science in the areas outlined above. Valid information cannot be obtained from these studies unless the research organizations have available adequate research facilities.

APPENDIX "B"

HIGH INTENSITY RADIATION DEVELOPMENT LABORATORY

The HIRDL to be constructed at Brookhaven National Laboratory, will serve for research and development on the use of high intensity radioisotope sources. This facility will be capable of safely handling 1,000,000 curies of cobalt 60 and much greater quantities of cesium 137. Initially the laboratory will be loaded with 500,000 curies of cobalt 60.

The building will contain small research laboratories and two large hot cells with remote handling equipment and a canal. One of these hot cells, the Experiment Preparation Cell, will receive radiation sources directly from either nuclear reactors or fission product separation plants. It will be used to handle, clad, weld and safety test source containers. The sources are then transferred via the canal to the second hot cell, the Experiment Irradiation Cell.

In the Experiment Irradiation Cell, detailed measurements will be made of the radiation fields created using various geometric arrangements of the fabricated radioisotope sources. Experiments will include irradiation of different target materials representative of commercial items such as food, drugs and chemicals, that might be treated in a large irradiator.

The program with this new facility will include experimental studies of factors affecting the design of large irradiators, such as radiation dose delivered at different points within a target, source dimensions, target dimensions, optimum source and cladding dimensions, optimum design of high efficiency irradiators, heat generation and dissipation in high level sources, and radiation damage to source materials.

Work of this facility will provide sufficient experimental and engineering data to permit private groups to design high level irradiators

for particular commercial operations.

Additional facilities necessary at Brookhaven to meet requirements for a food program would be food preparation storage, handling and transportation facilities, and also laboratory space and equipment for evaluation of foods prior to and after irradiation. Throughput capacity would be several hundred pounds per hour at moderate dose treatment (0.5 megarad). The facility could handle packages approximately 16" x 20" x 6".

The HIRDL is expected to have undergone trial runs and be available for product irradiation about July, 1962.

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APPENDIX "C"

DESCRIPTION OF MAJOR PROGRAM ELEMENTS

1. Initial Activities. To intelligently pursue the radiation processed foods program, it is necessary to undertake certain initial activities. These include (a) collection and analysis of Army research and development work to date relevant to the civilian program; (b) identification of specific food products promising technical, economic or marketing advantages through radiation processing and research and development work required to develop them, and (c) design of irradiators.

2. Food Chemistry. Radiation causes various chemical, vitamin, nutritional and organoleptic (odor, color, taste, texture) changes in food. Studies are required to identify precisely the nature and extent of these changes.

3. Microbiology. Spoilage by microorganisms is often the prime cause of rapid spoilage of foods. The purpose of radiation processed is to destroy or inhibit these microorganisms. This requires study of radiation resistance of numerous spoilage microorganisms common to food stuffs, so as to determine radiation dosage for their growth inhibition.

4. Preservation Factors. It is necessary to be able to routinely and reproducibly obtain acceptable radiation processed food products. This requires study of the effect of variation in irradiation conditions such as total dose, humidity, irradiation time, etc., on acceptability of a product.

5. Nuclear Effects. Use of radiation for food processing entails study of unique factors not encountered in conventional food processing. These include possible effects on food depending upon the rate at which the radiation is delivered, investigation

Appendix "C"

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to assure absence of induced radioactivity in food, and evaluating systems for precisely measuring radiation dosage delivered to the food.

6. Process Engineering. This involves establishing radiation processing facility design criteria to accommodate irradiation conditions imposed by food chemistry, microbiology, preservation factors and nuclear effects studies.

7. Packaging Development. This involves development of food packaging materials that are radiation resistant, do not transmit toxic additives to the food, and are suitable for marketing purposes.

8. Commodity Procurement and Shipping. This involves obtaining and transportation of foods required to carry out the foregoing research and development.

9. Irradiation Services. A number of private organizations have cooperated in the Army food program by evaluating irradiated foods without charge. It is expected similar arrangements can be made in the civilian program. This item thus reflects cost of irradiating foods which are thereafter evaluated by private groups without charge.

10. Supplementary Wholesomeness. The Army has been conducting and is expected to complete a definitive wholesomeness and safety program on radiation sterilized food. Although this program will contribute information of value for low dose radiation processed foods, additional wholesomeness and safety studies will be required to obtain FDA clearance for foods of interest in the civilian program.

Appendix "C"

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APPENDIX "D"

Fiscal Plan for the Radiation Processed Foods Program

	<u>FY '60</u>	<u>FY '61</u>
Initial Activities and Studies.	75,000	100,000
Research Irradiators (1 each year).	40,000	40,000
Food Chemistry		
Microbiology		
Supplementary Wholesomeness)	--	200,000
Preservation Factors.	--	50,000
Nuclear Effects.	--	25,000
Packaging Development.	--	25,000
Commodity Procurement.	--	10,000
Irradiation Services.	--	50,000
	<u>115,000</u>	<u>500,000</u>

Appendix "D"

Materials

January 14, 1960

MEMORANDUM FOR THE CHIEF ENGINE AND GENERAL MANAGER

Subject: NATIONAL PROGRAM FOR RESEARCH IN RADIATION PRESERVATION OF FOOD

Attached for your information is a copy of the ASD testimony for JCAE hearing, scheduled for 10:00 a.m. and 2:00 p.m. today, on the National program for Research on Radiation Preservation of Food.

W. B. McNeal
Secretary

Attachment
As noted above

RECEIVED
U.S. Atomic Energy Commission
Office of the Secretary

JAN 14 1960
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1-14-60

AEC TESTIMONY FOR JCAE HEARING ON THE NATIONAL PROGRAM
FOR RESEARCH ON RADIATION PRESERVATION OF FOOD

Brief History of Role of AEC in the Program

1. As you know, the Atomic Energy Commission has had an early and continuing interest in the possibilities of radiation preservation of foods. As pointed out in previous hearings before this Committee, ionizing radiation gives promise of being an important large scale application of the peaceful atom. Since the production, processing and distribution of food is the largest industry in the world, a new development which gives promise of improvement in food availability and in the food economy would have important, world-wide consequences.

2. During early 1950, the Atomic Energy Commission began seriously to look for ways to utilize advantageously the vast amount of waste fission products accumulating from nuclear reactor operations. The potential of certain fission products, such as Cesium 137, a long-life gamma ray emitting radioisotope, looked very promising. Under the general supervision of the Atomic Energy Commission, a series of research contracts were initiated to investigate the possibilities. The contractors included the Massachusetts Institute of Technology, University of Michigan, Food Research Institute, Columbia University, American Meat Institute Foundation, Stanford Research Institute, Brookhaven National Laboratory, National Canners Association, and the Vitro Corporation.

3. To stimulate interest in the field, the Commission provided kilocurie Cobalt-60 gamma sources for small-scale research irradiators. The first recipients were several of the above-named institutions and the University of Chicago. The Commission has continued to produce radioisotope radiation sources and to develop gamma source technology to meet the increasing needs for advancing irradiation technology.

4. As early as 1951 the Army Quartermaster Corps began to sponsor a small amount of research in radiation preservation of food related to specific Army needs. Army activities in this field increased rapidly over the next few years. By the time of the April 1954 hearings of your Subcommittee on Research and Development relative to the use of isotopes in agriculture, the Subcommittee was informed of the impending transfer of primary responsibility to the Army Quartermaster Corps. Because of continued expressions of interest in radiation preservation of food by many members of the Joint Committee, a public hearing was held on the over-all progress and potentials of the program on May 9, 1955. At that session the possibility of broadening the scope of the Army project to include civilian interests and to get it progressing as rapidly as possible was discussed.

5. In August 1955, following the Joint Committee hearing, a plan was devised to place the program on a national basis. Following approval of the plan by the Secretary of the Army and the

Secretary of Defense, the broader program on radiation processed food was launched on November 22, 1955. A full review of the current state of the art and program plans was presented by Department of Defense representatives before the Atomic Energy Commission. The Defense Department expressed optimism over the eventual success of the program. The need for a more broadly based effort was brought out, with particular reference to the Commission's continued assistance in the nuclear and radiation aspects of the program. Specifically at that time the need was expressed for a very large gamma-ray source for pilot-plant scale irradiation of food and assistance requested on the design, funding and construction of a suitable gamma-ray producing reactor.

6. The food irradiation reactor was one of two radiation sources proposed for the planned food processing pilot-plant. The reactor, 24 Mev linear accelerator and a food processing plant, constituted the main components of the U.S. Army Ionizing Radiation Center planned for Stockton, California.

7. The Commission agreed in December of 1955 to fill the Army requirement for the food irradiation reactor and place a \$3,000,000 item in its fiscal year 1957 budget for this purpose. To fund for the development of the non-nuclear portion of the USAIRC, the Department of Army programmed \$4,500,000.

8. Prior to letting the contract for design and construction of the Food Irradiation Reactor a full reevaluation was carried out on the desirability of proceeding with the reactor as the gamma radiation source. This reevaluation included consideration of technical difficulties being experienced due to the corrosive properties of the indium sulfate loop proposed for the reactor and the recognition that a Cobalt-60 facility appeared to offer a more practical source of gamma radiation. Because of the substantial nature of the corrosion problem and the determination that a Cobalt-60 irradiation facility was a cheaper and more readily available gamma radiation source, the reactor project was cancelled by the Department of Defense. In turn, the Commission was requested to design, construct and test operate a Cobalt-60 high intensity food irradiator as the gamma radiation source for the Stockton facility, using Army funds.

9. In early 1958, the Assistant Secretary of Defense for Research and Engineering provided performance specifications for the Cobalt-60 facility and requested a cost estimate. Subsequently, \$2,500,000 was transferred to AEC from the Army for the project. In July 1958, AEC contracted with the Curtiss-Wright Corporation for the design, construction, and test operation of the High Intensity Food Irradiator, as the facility was called. Approximately \$400,000 has been spent to date on research and development and design phases of the project. In accordance with recommendations

of the Quartermaster Corps, the HIFI contract has been continued with minimal effort, but including continuation of design studies.

10. Irradiation facilities at the Materials Testing Reactor, the Argonne National Laboratory, and the Commission's Savannah River plant have been the chief AEC sources utilized to date by the Department of Army in the food program. Additionally, the Commission has produced the radiation sources for the food irradiation work being conducted by the Department of Army at its installation at Dugway, Utah.

11. Thus the Commission's principal technical role in the national radiation preservation of food program, since this program has been administered by the Department of Army, has been the development of suitable radiation sources and irradiation facilities.

12. Shortly after the Army on October 22, 1959, announced the deferral of its Radiation Center, the General Manager authorized the AEC representative on the Interdepartmental Committee on Radiation Preservation of Food to suggest that the Committee formulate a national civilian program on radiation processing of food. The suggestion was adopted and an ad hoc panel was established to develop such a program and to recommend individual agency responsibilities. On January 7, 1960, the ad hoc panel made a preliminary report. This will be considered by the Interdepartmental Committee on January 26, 1960. If supported by the Committee,

the program will then be referred to each member agency, including the Commission and the Department of Defense, for consideration.

13. In conclusion, from the very beginning of government support of research on radiation processed food the Commission has maintained an interest in fostering, encouraging and developing the national program on radiation preservation of food. We continue to believe that a coordinated national program can be carried through with likelihood of success and that the domestic and international benefits would be substantial.

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Office Memorandum • UNITED STATES GOVERNMENT

TO : File

DATE: January 13, 1960

FROM : W. B. McCool, Secretary *W. B. McCool*

SUBJECT: COMMISSION DECISION ON AEC 719/30 - JCAE HEARING ON FOOD IRRADIATION

SYMBOL: SECY:RVW

1. At Meeting 1582 on January 11, 1960, the Commission briefly discussed AEC 719/30, but deferred further consideration until the noon hour.

2. On the afternoon of January 11 we were informed by the General Manager's office that during the noon hour on January 11, 1960, the Commission:

Approved, as revised, the testimony set forth in AEC 719/30, for the JCAE Hearing on the National Program for Research and Radiation Preservation of Food.

cc: General Manager
Deputy General Manager
Asst. Gen. Mgr. for Adm.
General Counsel
Director, Isotopes Development

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14560

DATE:

INDEX: Materials 12

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TO:

FROM:

SUMMARY: AEC 994/6 - INFORMAL AEC-JCAE STAFF MEETING
This meeting with the JCAE was to discuss the isotopes program, the food irradiation program was briefly discussed.

FILED: Isotopes Program 3 Distribution and Transfer

INDEXER: date of paper: 1-12-60

REMARKS:

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U. S. ATOMIC ENERGY COMMISSION

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1582th AEC 2. AEC 719/30 - JCAE Hearing on Food Irradiation

Meeting
1-11-60
~~SECRET~~

RLS

The General Manager introduced a proposed Commission statement to be presented at the JCAE Hearing on Food Irradiation scheduled for January 14, 1960.

Mr. Graham expressed skepticism about the food irradiation program, noting that serious questions had been raised in the preceeding months about cancer producing agents in foods, and he said it seemed difficult to justify food irradiation on economic grounds when freezing is relatively inexpensive. Mr. Floberg said he believed a basic scientific program was needed in order to better understand the effects of ionized radiation on food.

The Commissioners adjourned the meeting at this point, stating that they would continue their discussion of AEC 719/30 during the noon hour. **

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1-11-60

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January 10, 1960

AEC 719/30

COPY NO. 51

ATOMIC ENERGY COMMISSION

JCAE HEARING OF FOOD IRRADIATION

Note by the Secretary

The General Manager has recommended that the attached report by the Director of Isotopes Development be circulated for discussion and for review of the proposed statement to be presented at the JCAE hearing on Food Irradiation on January 14, 1960.

W. B. McCool
Secretary

ALL
719
30

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ATOMIC ENERGY COMMISSION

JCAE HEARING OF FOOD IRRADIATION

Report to the General Manager by the
Director, Office of Isotopes Development

1. The Joint Committee on Atomic Energy has called an open hearing on food irradiation for Thursday, January 14, 1960. The Army and AEC have been requested to provide principal witnesses and to have prepared statements to present.

2. Members of the AEC and JCAE staff have discussed the general scope and agenda of the hearings. The JCAE staff plans that Army witnesses will lead off the hearing. During questioning of the Army witnesses, AEC witnesses may be called upon to comment on Army testimony. Dr. Aebersold will then read the AEC prepared statement (Appendix "A") and answer questions. Dr. Schilling, Deputy Director, Division of Biology & Medicine, will be present to answer questions asked of AEC concerning health aspects of food irradiation. A few industrial witnesses will then be called.

3. It is anticipated that the hearing will be concerned principally with (1) the Army's decision to defer construction of the U.S. Army Ionizing Radiation Center (USAIRC), Sharpe General Depot, Stockton, California, and (2) the reduced food irradiation program now under consideration by the Army. It is to be anticipated that AEC witnesses will be questioned concerning the AEC's role and attitude toward the Army actions. Appendix "B" sets forth specific types of questions that it is anticipated will be asked and proposed replies thereto.

4. In addition to the Army matters, it is quite likely that AEC witnesses will be asked to testify concerning what sort of

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civilian radiation processed food program should be carried out and what role the AEC should play in it. Due to the formative stage of plans for such a program, it is proposed that, if possible, AEC witnesses avoid discussing such plans and particularly avoid committing the AEC to a program at this time. The JCAE staff has indicated a willingness to accept replies to this effect on the basis that a later hearing might be called to discuss the civilian program. However, since JCAE members, despite the staff attitude, may press AEC witnesses for AEC plans for a food radiation program, it is desirable that the Commission consider present plans and provide guidance to the witnesses.

5. Shortly after the Army on October 22, 1959, announced the deferral of its Radiation Center, the General Manager authorized the AEC representative on the Interdepartmental Committee on Radiation Preservation of Food to suggest that the Committee formulate a national civilian program on radiation processing of food. The suggestion was adopted and an ad hoc panel, chaired by Dr. Aebersold, was established to develop such a program and to recommend individual agency responsibilities. On January 7, 1960, the ad hoc panel made a preliminary report. This will be considered by the Interdepartmental Committee on January 26, 1960. If supported by the Committee, the program will then be referred to each member agency and department for consideration. An outline of the proposed program follows:

a. The program would concentrate upon low-dose treatment to extend shelf life of perishable foods, including meat, fish, vegetables, and fruits, as the most immediate civilian application of radiation to preserve foods, both from a technical and economic point of view. (Note: To date nearly the total Army program has been on high dose sterilizing treatment to preserve food for long term storage without refrigeration. The proposed civilian program assumes that the Army will continue to study high dose effects.)

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b. The program is based on the assumption that through development of radiation processing techniques for a few types of food, proof of their wholesomeness, and by establishing their commercial success, industry will be prompted to extend independently the technology throughout a broad spectrum of food.

c. Program administration, including budgeting, contracting, and reporting, would be carried out by one agency -- the Atomic Energy Commission -- with the Interdepartmental Committee coordinating the program interests of all member agencies. It is proposed that the AEC be the operating agency because (1) much of the food process development work required involves radiation source technology and radiation engineering, and (2) the radiation processed food program would be a principal facet of the nation's Atoms-for-Peace program.

d. Operating fund levels for the proposed program are as follows:

	<u>FY 1960</u>	<u>FY 1961</u>	<u>FY 1962</u>	<u>FY 1963</u>	<u>FY 1964</u>	<u>FY 1965</u>
(millions)	\$.4	\$.9	\$ 1.5	\$ 1.7	\$ 1.7	\$ 1.7

The program calls for early construction of food construction facilities estimated to cost \$1.4 million to support research and development efforts. These construction funds will not be required if Army funds currently available for the deferred Stockton radiation center can be used to build a National Radiation Processed Food Research and Development Center which would be shared by both the civilian and Army programs.

7. The Director of Isotopes Development considers the foregoing proposed civilian radiation processed food program to be a sound one, subject to further study of the facilities required to meet both the civilian and military needs and final ascertainment of the DOD program. However, the Commission, in considering the proposed program and the role in it proposed for the AEC, should be aware of the following fiscal problems:

a. The Director of Isotopes Development states that funds available for the Isotopes Development Program in FY 1960 are fully committed. Further, in FY 1961 such funding could be accomplished only by drastic curtailment or elimination of other major program activities.

It should be noted that in its final action on the AEC's fiscal year 1960 budget estimates, the Congress noted in its Conference Report that the amount allowed for the Isotope Development Program was \$4 million. Although there

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is sufficient appropriations available through underruns in other programs to fund the proposed increase of \$400,000 for Isotopes Development in 1960, it would necessitate a request to the Appropriations Committee to secure their approval for increasing this program by the required amount.

b. With respect to the increase required for fiscal year 1961, it would have to be met from the \$4.5 million presently budgeted for the Isotopes Development Program, or, if the Commission determined that the base program was of such high priority that the food radiation increase could not be accommodated, it would require a decrease in some other program in order to provide the funds. Since the 1961 budget is already in print, it would appear that such an adjustment, if determined upon, should be transmitted to the Congress after the President's budget has gone forward.

LIST OF ENCLOSURES

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APPENDIX "A"

AEC TESTIMONY FOR JCAE HEARING ON THE NATIONAL PROGRAM
FOR RESEARCH ON RADIATION PRESERVATION OF FOOD

Brief History of Role of AEC in the Program

1. As you know, the Atomic Energy Commission has had an early and continuing interest in the possibilities of radiation preservation of foods. As pointed out in previous hearings before this Committee, ionizing radiation gives promise of being an important large scale application of the peaceful atom. Since the production, processing and distribution of food is the largest industry in the world, a new development which gives promise of improvement in food availability and in the food economy would have important, world-wide consequences.

2. During early 1950, the Atomic Energy Commission began seriously to look for ways to utilize advantageously the vast amount of waste fission products accumulating from nuclear reactor operations. The potential of certain fission products, such as Cesium 137, a long-life gamma ray emitting radioisotope, looked very promising. Under the general supervision of the Atomic Energy Commission, a series of research contracts were initiated to investigate the possibilities. The contractors included the Massachusetts Institute of Technology, University of Michigan, Food Research Institute, Columbia University, American Meat Institute Foundation, Stanford Research Institute, Brookhaven National Laboratory, National Canners Association, and the Vitro Corporation.

3. To stimulate interest in the field, the Commission provided kilocurie Cobalt-60 gamma sources for small-scale research

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irradiators. The first recipients were several of the above-named institutions and the University of Chicago. The Commission has continued to produce radionuclide radiation sources and to develop gamma source technology to meet the increasing needs for advancing irradiation technology.

4. As early as 1951 the Army Quartermaster Corps began to sponsor a small amount of research in radiation preservation of food related to specific army needs. Army activities in this field increased rapidly over the next few years. By the time of the April 1954 hearings of your Subcommittee on Research and Development relative to the use of isotopes in agriculture, the Subcommittee was informed of the impending transfer of primary responsibility to the Army Quartermaster Corps. Because of continued expressions of interest in radiation preservation of food by many members of the Joint Committee, a public hearing was held on the over-all progress and potentials of the program on May 9, 1955. At that session the Subcommittee on Research and Development requested the Army to broaden the scope of its project to include civilian interests and to get it progressing as rapidly as possible.

5. In August 1955, as the result of the formally expressed desires of the Joint Committee, a plan was devised to place the program on a national basis. Following approval of the national plan by the Secretary of the Army and the Secretary of Defense, the national program on food irradiation was launched on November 22, 1955, by a full review of the current state of the art and program plans presented by Department of Defense representatives before the Atomic Energy Commission. The Defense Department expressed optimism over the eventual success of the program. The need for a more broadly based effort was brought out, with

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particular reference to the Commission's continued assistance in the nuclear and radiation aspects of the program. Specifically at that time the need was expressed for a very large gamma-ray source for pilot-plant scale irradiation of food and assistance requested on the design, funding and construction of a suitable gamma-ray producing reactor.

6. The food irradiation reactor was one of two radiation sources proposed for the planned food processing pilot plant. The reactor, 24 Mev linear accelerator and a food processing plant, constituted the main components of the U.S. Army Ionizing Radiation Center planned for Stockton, California.

7. The Commission agreed in December of 1955 to fill the Army requirement for the food irradiation reactor and place a \$3,000,000 item in its fiscal year 1957 budget for this purpose. To fund for the development of the non-nuclear portion of the USAIRC, the Department of Army programmed \$4,860,000.

8. Prior to letting the contract for design and construction of the Food Irradiation Reactor a full reevaluation was carried out on the desirability of proceeding with the reactor as the gamma radiation source. This reevaluation included consideration of technical difficulties being experienced due to the corrosive properties of the indium sulfate loop proposed for the reactor and the recognition that a Cobalt-60 facility appeared to offer a more practical source of gamma radiation. Because of the substantial nature of the corrosion problem and the determination that a Cobalt-60 irradiation facility was a cheaper and more readily available gamma radiation source, the reactor project was cancelled by the Department of Defense. In turn, the Commission was requested to design, construct and test operate a Cobalt-60 high intensity food irradiator as the gamma radiation source for the Stockton facility, using Army funds.

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9. In early 1958, the Assistant Secretary of Defense for Research and Engineering provided performance specifications for the Cobalt-60 facility and requested a cost estimate. Subsequently, \$2,500,000 was transferred to AEC from the Army for the project. In July 1958, AEC contracted with the Curtiss-Wright Corporation for the design, construction, and test operation of the High Intensity Food Irradiator, as the facility was called. Approximately \$350,000 has been spent to date on research and development and design phases of the project. In accordance with recommendations of the Quartermaster Corps, the HIFI contract has been continued with minimal effort, but including continuation of design studies.

10. Irradiation facilities at the Materials Testing Reactor, the Argonne National Laboratory, and the Commission's Savannah River plant have been the chief AEC sources utilized to date by the Department of Army in the food program. Additionally, the Commission has produced the radiation sources for the food irradiation work being conducted by the Department of Army at its installation at Dugway, Utah.

11. Thus the Commission's principal technical role in the national radiation preservation of food program, since this program has been administered by the Department of Army, has been the development of suitable radiation sources and irradiation facilities.

12. Shortly after the Army on October 22, 1959, announced the deferral of its Radiation Center, the General Manager authorized the AEC representative on the Interdepartmental Committee on Radiation Preservation of Food to suggest that the Committee formulate a national civilian program on radiation processing of food. The suggestion was adopted and an ad hoc panel, chaired by

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Dr. Paul C. Aebersold, Director of the AEC's Office of Isotopes Development, was established to develop such a program and to recommend individual agency responsibilities. On January 7, 1960, the ad hoc panel made a preliminary report. This will be considered by the Interdepartmental Committee on January 26, 1960. If supported by the Committee, the program will then be referred to each member agency and department for consideration.

13. As soon as the Interdepartmental Committee has formally made its recommendations on a national civilian program for radiation processing of food, the proposed program will be studied by the Commission as well as by the other agencies involved, including the Department of Defense. The Commission will then forward to the Joint Committee the proposed program of the Interdepartmental Committee and will furnish the Commission's comments thereon as soon as possible.

14. In conclusion, from the very beginning of government support of research on food irradiation the Commission has maintained an active role in fostering, encouraging and developing the national program on food irradiation. We continue to believe that an aggressive, coordinated national program can be carried through with likelihood of success and that the domestic and international benefits would be very great indeed.

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APPENDIX "B"

ANTICIPATED QUESTIONS AND PROPOSED ANSWERS

1. Q Was the AEC consulted by the Army in advance of the latter's decision to defer construction of the Army Radiation Center?

A Neither the Commission nor its staff were consulted on the Army's decision to defer construction of the Army Radiation Center. By letter of October 20, 1959, from the Quartermaster General, the Commission was formally notified of this decision. A few days prior to this the AEC received and commented upon a proposed press release on the decision.

2. Q Did AEC concur in the proposed press release?

A AEC did not concur in the proposed press release on the ground that it contained statements indicating that the decision was being made, at least in part, on the basis of results from the Army wholesomeness program indicating toxicity in food due to irradiation. On the basis of information developed by the Army wholesomeness program and which had been seen by AEC staff, such a conclusion would not be warranted.

The proposed release was then revised by the Army and was concurred in by AEC.

3. Q Does AEC concur in the Army's decision to defer construction of the Army Radiation Center?

A AEC has not attempted to evaluate the Army's decision, since the Army has based its decision in major part on military logistical considerations. AEC staff had given informal advice to the Army prior to the decision, recommending that the facility would be more useful if designed for experimental work rather than as a pilot-plant. The Commission does believe that facilities for development of techniques for radiation processing of food are needed by the country.

4. Q What is the technical opinion of the AEC of the adequacy of the Army's wholesomeness program and of the findings to date of that program?

A The Army's wholesomeness program was designed by the Department of the Army, Office of the Surgeon General, with the full cooperation of the Federal Drug Administration to establish the suitability of irradiated food for unrestricted use for human consumption of the military and civilian population.

The AEC considers that the Army's wholesomeness program in general was well conceived and is a very valuable program. Being a program of long duration to be carried out with limited funds, it is only to be expected that certain experiments, in retrospect, may be deemed to be of doubtful validity. Also, it was recognized from the outset that all

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desirable parallel control experiments could be performed within available funds. On the basis of results which the AEC has seen to date, it would seem that the general results of the program should accomplish its original objective.

5. Q What is the technical opinion of the AEC as to the significance of certain adverse biological and physiological abnormalities observed in some experiments under this program?

A On the basis of results of the program which the AEC has seen, it does not appear that certain adverse physiological effects observed in experimental animals are the result of the consumption of irradiated foods per se. It is to be specifically noted that:

- (a) Physiological effects observed occurred in an extremely limited number of animals and are not statistically meaningful.
- (b) Considerable question exists regarding the scientific adequacy of some experiments conducted where these effects were observed in terms of animal tests and control groups maintained, diets established, etc.
- (c) The adverse physiological effects being observed would not be uncharacteristic in animals maintained on a diet largely made up of boiled meat, for example, where the heat from the cooking process breaks down vitamins and other essential dietary constituents.

6. Q Describe the civilian food irradiation program which the AEC considers to be needed.

A As pointed out in our opening statement, the Interdepartmental Committee on Radiation Preservation of Food is currently developing a recommended national civilian program for radiation processing of food. Such a program will be referred to the Commission as well as to the other member agencies and departments in the near future. It would be premature for the Commission to comment on such a program until it has had the opportunity to consider the Committee's recommendations. When the Committee's report is received, the Commission will transmit a copy to the Joint Committee and provide Commission's comments thereon as soon as possible.

7. Q Describe the experimental irradiation facilities which the AEC believes should be constructed.

A It is our understanding that the national civilian program for radiation processing of food now being developed by the Interdepartmental Committee on Radiation Preservation of Food will include recommendations as to experimental facilities needed. It would be premature for the Commission to comment on such facilities until it has had the opportunity to consider the Committee's recommendations. When the Committee's report is received, the Commission will transmit a copy to the Joint Committee and provide Commission's comments thereon as soon as possible.

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8. Q In General Luedecke's letter to Mr. Ramey dated November 19, 1959, it is stated that "It is our opinion that the most significant civilian application of radiation to preserve food, both from a technical and economic viewpoint, is low dose treatment to extend shelf life of perishable foods." And later . . . "We believe that serious consideration should be given to reorientation of the National Program for Irradiation Preservation of Food with a focus on low dose treatment."

Why does the AEC believe that the civilian program should concentrate on low dose food preservation?

- A In making the above statements, the AEC assumes that the Army's program which emphasizes high dose food preservation will be continued.

Emphasis in the civilian program should be on low dose treatment to extend shelf life of perishable foods because in the United States, and a large portion of the world, food losses are most substantial in the chain of supply between the producer and consumer. Extension of shelf life for a few days or weeks would be of significant consumer and economic importance.

Furthermore, certain radiation effects on food not relating to wholesomeness for consumption are greatly reduced in low dose treatment as compared to high dose treatment. By this we mean such factors as change in taste, color and texture of the food which can have significant psychological effect on a civilian consumer making a decision to purchase.

It is believed that low dose irradiated food can be successfully introduced into the economy at a much earlier date than foods preserved through high level treatment.

Material - 12

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JAN 4 1960
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January 4, 1960

MEMORANDUM FOR: THE GENERAL MANAGER

With reference to your memorandum of December 29^{*} on the subject of a national civilian program for radiation preservation of food, I am glad to learn that an ad hoc Interdepartmental Committee has been established to consider the course of action to be followed by the Federal Government in furthering the development of food preservation through radiation.

From my discussions in Albuquerque, I would expect the Joint Committee to go into this matter early in the year. I think they will suggest that the AEC take on the problem in one of its laboratories, and I am inclined to believe Sumner Anderson will press for assignment to Los Alamos. I think we should be prepared with our position by the middle of January.

I believe this is of sufficient importance to warrant bringing to the Commission's attention in a formal paper.

(Signed) John A. McCone

John A. McCone

RECORDED

* Filed in letter

1-10



UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

DEC 29 1954

MEMORANDUM FOR CHAIRMAN MALONE

SUBJECT: U. S. CIVILIAN RADIATION PRESERVATION OF FOOD PROGRAM

By your memorandum of December 14, my recommendations have been requested concerning the AEC position in regard to the radiation preservation of foods program and the steps we should take to implement such a program, in light of the recent Army actions deferring the Ionizing Radiation Center.

I believe that the Commission has a definite interest in the development of technology for radiation preservation of foods. The most immediate interest is in civilian application of radiation to preserve food both from a technical and economic viewpoint by low dose treatment to extend shelf life of perishable foods. Emphasis to date under the Department of Army program has been on high dose sterilization treatment for long term storage without refrigeration.

It would appear that a number of government agencies have similar interests in developing a national civilian program for radiation preservation of food with a focus on low dose treatment. I authorized our representative to the Interdepartmental Committee on Radiation Preservation of Food to present the need for such a national program at the November meeting of the Committee. An ad hoc subcommittee was appointed by the Interdepartmental Committee to develop elements of a national civilian radiation preservation of foods program. This will include recommendations concerning individual agency responsibilities. The program is to be prepared by January 15 for consideration of the Interdepartmental Committee by February 1. This should provide a sound mechanism for more clearly defining an appropriate role for the AEC with respect to radiation preservation of foods. I will keep the Commission advised concerning the Interdepartmental Committee's actions.

Until we are able to more clearly define what the AEC's role should be, I believe it would be premature to decide upon the part that any AEC laboratory should play in the program.

See memo dated 1-4-55 to the DM from Malone

12/29

With respect to the radiation program plans of the Army, I have circulated for the information of the Commission as ABC 719/29, a letter to Mr. Hasey of the JOAE discussing the current status of the Army's program and our comments thereon.

A. L. Ludecke

General Manager

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AEC 719/29

December 14, 1959

COPY NO. 48

ATOMIC ENERGY COMMISSION

JCAE REQUEST FOR INFORMATION ON U.S. RADIATION
PRESERVATION OF FOOD PROGRAM

Note by the Secretary

The General Manager has requested that the attached letter to the Joint Committee on Atomic Energy be circulated for the information of the Commission.

W. B. McCool
Secretary

AEC
719
29

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UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D. C.

November 19, 1959

Mr. James T. Ramey
Executive Director
Joint Committee on Atomic Energy
Congress of the United States

Dear Mr. Ramey:

This responds to your letters of October 27 and 28, 1959, in which you request comments by the Commission on

(1) the recent action by the Department of the Army to defer construction of the U. S. Army Ionizing Radiation Center, Stockton, California, with particular reference to the stated scientific basis for this action,

(2) the disposition of the \$3,000,000 in AEC funds involved in AEC-DOD projects 57-c-6, Food Irradiation Facility, and

(3) the Commission's plans for the food irradiation program following the deferral of the Stockton project.

The following remarks are presented in response to the specific questions raised by you.

1. The Department of the Army arrived at its decision for deferral of the Radiation Center without prior consultation with the AEC. Based upon the Commission's knowledge in this matter, however, the Department of the Army's decision was predicated upon the fact that:

a. Certain physiological problems have not yielded to solution in the laboratory. These include the questions of possible effects of radiation-preserved foods on fertility, vision, and the cardio-vascular system.

b. A current need exists for critical re-evaluation of present economic justification of radiation-preserved food within the military establishment to show precisely how strategic and tactical advantages will accrue to the Army from the use of radiation-preserved food.

2. With respect to possible adverse physiological effects of radiation-preserved food, the weight of present evidence indicates that any such effects observed to date in experimental animals are not the result of the consumption of the irradiated food per se. It is to be specifically noted that:

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a. Physiological effects observed occurred in an extremely limited number of animals and are not statistically meaningful.

b. Considerable question exists regarding the scientific adequacy of many experiments conducted in terms of animal tests and control groups maintained, diets established, etc.

c. The adverse physiological effects being observed would not be uncharacteristic in animals maintained on a diet largely made up of boiled meat, for example, where the heat from the cooking process breaks down vitamins and other essential dietary constituents.

3. The Commission has been advised by the Army Quartermaster Corps that it is to proceed with the Cobalt-60 High Intensity Food Irradiator project which the Army funded as follows:

a. The contract which the Commission has with the Curtiss-Wright Corporation to design, construct and test-operate the HIFI be continued with minimal effort.

b. Cobalt-60 production by AEC for the HIFI be deferred until the radiation source requirements for the revised program are determined.

c. The design phases of the HIFI work now in progress be continued pending a review of source requirements.

In the meantime, the Army is re-determining need for and type of radiation facility required to support the redefined research program for radiation preservation of food now being developed. The Army Quartermaster Corps has requested the Commission to provide recommendations by November 10, 1959, on a modified gamma radiation facility to support the food research program.

4. Project 57-c-6, Food Irradiation Reactor (FIR), was abandoned because the Department of Defense favored a Cobalt-60 food irradiation facility to be funded entirely by that Department. This project was rescinded by Public Law 85-590, dated August 4, 1958. Reference is also made to the letter of March 18, 1958, from the Chairman, AEC, to the Chairman, JCAE, regarding the project. Funds appropriated to the AEC were reflected in the carry-over available for application to the FY 1959 requirements.

5. It is our opinion that the most significant civilian application of radiation to preserve food, both from a technical and economic viewpoint, is low dose treatment to extend shelf life of perishable foods. In the U.S. and a large portion of the world, food losses are most substantial in the chain of supply between the producer and consumer. Emphasis under the Army program has been on high dose sterilizing treatment for long-term storage without refrigeration.

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Accordingly, we believe that the national program for radiation preservation of food should be reoriented with a focus on low dose treatment. The Commission staff plans to take the initiative in presenting this viewpoint to the Interdepartmental Committee on Radiation Preservation of Food at its meeting on November 24, 1959. The objective would be to develop within the framework of the Interdepartmental Committee elements of a revised national program and individual Agency responsibilities.

Sincerely yours,

/s/ A. R. Luedcke

General Manager

McC 12. Wash. Bureau - Dispatch

A. E. Lando, General Manager

AUG 7 1959

A. A. Wells, Director
Division of International Affairs

INTERNATIONAL SYMPOSIUM ON THE RADIATION PRESERVATION OF FOODS

The first jointly sponsored U.S. - IAEA conference was held at the Massachusetts Institute of Technology from July 27 through July 30, 1959 in implementation of Chairman McCone's offer at the International Agency's last General Conference amounting to "joint sponsorship with the Agency of specialized symposia, seminars and short training courses in specific fields of isotope applications." The symposium was considered to be an outstanding success by the participating scientists from 24 countries and the IAEA.

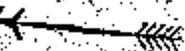
The keynote address was delivered by the Honorable H. S. McCoy, (Department of Commerce) Chairman of the Interdepartmental Committee on Radiation Preservation of Food. Other speakers included Dr. Henry Haldeman, IAEA Deputy Director General; Dr. Paul Abersold of the AEC; Dr. Ralph Ekin, Office of the Quartermaster General; Dr. Paul Gessner of the Chase Manhattan Bank; Dr. Bernard Frotter of MIT; and 31 other scientists, of whom 25 were from foreign countries throughout the world.

The basic purposes of the conference were twofold:

First, to present a clear picture of the work being done on radiation preservation of foods and of the future prospects in this field, and second, to consider the possible application of this process to the problems of the less developed countries, whether they be countries having food shortages or countries producing potentially exportable surpluses.

The conference proceedings, including complete texts of all papers and statements presented, are being prepared by MIT; and copies will be made available to the AEC, IAEA and all participants.

It is suggested that this memorandum be made available to the Commission.

cc: IAEA 

U.S. ATOMIC ENERGY COMMISSION
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Memorandum

TO : Paul G. Abersold, Director
Office of Isotopes Development

DATE: June 12, 1959

FROM : W. B. McCool, Secretary

SUBJECT: COMMISSION DECISION ON AEC 773/5 - RADIATION PROCESSING FACILITY
AT THE SODIUM GRAPHITE REACTOR, HALLAM, NEBRASKA

SYMBOL: SECY:ANE

1. This memorandum supersedes our memorandum dated June 9, 1959, subject as above.

2. This will confirm our telephone notification on June 9, 1959, that at Meeting 1518 on June 8 the Commission:

a. Determined that construction at this time of a radiation processing facility at the Sodium Graphite Reactor, Hallam, Nebraska should not be supported;

b. Noted that the support of construction of a radiation processing production facility at the Sodium Graphite Reactor, Hallam, Nebraska will be considered again when and if the appropriate conditions in paragraph 5 of AEC 773/5 are satisfied;

c. Noted that the construction of an experimental radiation processing or source engineering facility at Hallam will be considered in the future if research and development requirements become evident in these areas which could be accommodated by such a facility;

d. Noted that the present construction authorization for the Hallam Reactor includes design features which will permit future installation of a radiation processing facility or an experimental facility, and that this capability will be maintained;

e. Noted that it is not deemed necessary to advise the JCAE of this action; and

f. Noted that no news release will be issued.

3. The General Manager has directed you to take the action necessary to implement this decision. Copies of pertinent correspondence should be provided the Office of the Secretary.

cc: General Manager
Asst. Gen. Mgr. for Adm.
Asst. Gen. Mgr. for R&ID
General Counsel
Director, Reactor Development
D. C. Office

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Copy filed: JRA-b - Consumers

6-12-59

DATE:

INDEX: MATERIALS-12-Waste Processing and Disposal

~~INDEX-50-Sodium-graphite-Reactor-Department~~

TO:

FROM:

SUMMARY: AEC 773/5; RADIATION PROCESSING FACILITY AT THE SODIUM GRAPHITE REACTOR, HALLAM, NEBRASKA. To consider construction of a Radiation Processing Facility at the Sodium Graphite Reactor, Hallam, Nebraska. In June, 1958, AEC contracted with Atomic International for a feasibility study and preliminary design for an irradiation facility for the CPPD sodium graphite reactor. At Mtg. 1421 on 10-31-58, the Comm. requested recommendations concerning AEC support of such a Sodium 24 radiation processing facility at Hallam.

FILED:

INDEXER: IR&A-6-Consumers Public Power District

REMARKS: date of paper: 6-4-59

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DOE NSI DECLASSIFICATION REVIEW E.O. 12958
BY: SP E.A.P.M. 6-30-99 DOE/NSI-23

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U. S. ATOMIC ENERGY COMMISSION
CORRESPONDENCE REFERENCE FORM

6-4-59

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Office Memorandum • UNITED STATES GOVERNMENT

TO : Frank K. Pittman, Director
Division of Reactor Development

DATE February 10, 1959

FROM : W. B. McCool, Secretary

SUBJECT: COMMISSION DECISION ON AEC 152/113 - PROGRAM FOR IMPLEMENTATION OF
NUCLEAR POWER PROGRAM OBJECTIVES

SYMBOL: SECY:AHE

1. At Meeting 1467 on February 6, 1959, the Commission:

Approved, as revised, the program outlined in AEC 152/113 for implementation of Nuclear Power Program objectives set forth in AEC 496/55 which was approved at Meeting 1466 on February 6, 1959.

2. You will recall that during the discussion of AEC 152/113 the Commissioners requested a report on the effects of sodium coolant on valves, pumps, and other equipment now under inspection as part of the SEANOLF sodium cooled reactor.

3. In addition the Commissioners requested a review of the Hallen and Chugach contracts to determine the possibility of changing the reactor design to a water or an organic system, or delaying the project to improve the sodium design. The Commissioners had no objection to staff meetings with Hallen and Chugach representatives.

4. The General Manager has directed that you take the action necessary to implement this decision and to meet the requests in paragraphs 2. and 3. above. Copies of pertinent correspondence should be provided the Office of the Secretary. If you wish, we will circulate to the Commissioners an information paper on the results of the SEANOLF reactor study.

cc: General Manager
Asst. Gen. Mgr. for Adm.
General Counsel
Controller
D. C. Office ←

Copies filed:

Reactor Div. 1 (original)

MA 9-6 - Nuclear Powered Submarines

Materials for Waste Processing

RA 1-5D-SRE

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2-10-59

5-19-59

Dear Mr. Cole:

As you will recall, in my statement at Vienna last September, I emphasized our interest in the Agency's program of training, research and application in the field of radioisotopes. I stated this government's willingness to cooperate with this effort through joint support with the Agency of specialized symposia, seminars and short training courses.

We are now arranging to contribute to the support of an international conference on the preservation of foods by ionizing radiation to be held at the Massachusetts Institute of Technology, Cambridge, Massachusetts, during the period July 22-31, 1959. The objectives of the conference are to disseminate scientific knowledge and techniques in the field of radiation preservation of foods, and to discuss the practical means of establishing and utilizing this knowledge and these techniques to an economic advantage in various parts of the world.

I understand that, in the near future, the Massachusetts Institute of Technology will approach the Agency concerning participation in this conference. I sincerely hope that the Agency will be able to cooperate in this important undertaking.

Sincerely yours,

Chairman

The Honorable Sterling Cole
Director General
International Atomic Energy Agency
Vienna, Austria

cc: Mr. Gardner, IAS
Mr. Sauerwald, IIA
Mr. [unclear]

Chairman
[unclear]

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AEC 719/26

December 8, 1958

COPY NO. 32

ATOMIC ENERGY COMMISSION

PRESERVATION OF FOODSTUFF

Note by the Secretary

The attached letter from the Director, ICA, is circulated for the information of the Commission. The attachment has been referred to the Division of Reactor Development.

W. B. McCool
Secretary

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INTERNATIONAL COOPERATION ADMINISTRATION
WASHINGTON

OFFICE OF
THE DIRECTOR

November 26, 1958

MEMORANDUM FOR: The Honorable John A. McCone
Chairman, Atomic Energy Commission

The Honorable J. R. Killian, Jr.
Special Assistant to the President
for Science and Technology

SUBJECT: Preservation of Foodstuff

It is expected that in the near future, ICA will meet with the Department of Agriculture to discuss ways and means whereby we might reduce the cost of transporting and preserving the surplus agricultural commodities which are anticipated to be available for shipment overseas during the next few years.

I think that I have mentioned to you before that the value of these commodities might run into several billion dollars.

I think it would be most helpful if the AEC and Dr. Killian could each provide us with one or more experts on this subject. Their mission would be to indicate to us what possibilities there are in achieving some sort of a miniaturization of the commodities themselves and placing them in a condition proof from insects, rot, deterioration, et cetera.

/s/ J. H. Smith, Jr.

J. H. Smith, Jr.

AEC

Materials-12-

UNITED STATES
ATOMIC ENERGY COMMISSION
Washington 25, D. C.

No. A-315
Tel. HAZelwood 7-7831
Ext. 3446

FOR IMMEDIATE RELEASE
(Wednesday, November 26, 1958)

AEC SEEKS EXPRESSIONS OF INDUSTRIAL INTEREST
IN COOPERATIVE ESTABLISHMENT OF GAMMA IRRADIATOR

The Atomic Energy Commission is seeking expressions of interest by private firms and organizations in undertaking, with Commission assistance, the design, construction and operation of a Gamma Process Development Irradiator for research and development on industrial applications of high-level radiation.

This project is part of the Commission's program for encouraging development and application of technology by which the economic value of high-level radiation sources - such as Cobalt 60, fission byproducts and radiation from specially designed reactors - can be realized in industrial manufacturing processes.

The Gamma Process Development Irradiator would be designed for the equivalent of two million curies of Cobalt 60. It would have maximum flexibility for accommodating radiation sources of different kinds and of varying sizes and shapes for high-level irradiation (megarads) of solids, liquids and gases.

Cost of the facility is estimated to be \$1,600,000, exclusive of the cost of the radiation source.

In accordance with its policy of encouraging widespread private participation in the development and use of atomic energy, the Commission wishes to determine whether single companies or groups of companies would privately finance, design, construct and operate the irradiator. In support of the project the Commission would consider providing

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up to one million curies of Cobalt 60 without charge, or other reasonable proposals for Commission assistance. In these circumstances it would be necessary that the irradiator be available a substantial part of the time for use by other private organizations at reasonable fees, and that the owner work out satisfactory patent arrangements with these users. It would also be required that complete plans, specifications and cost data, both construction and operating, be available for public distribution, and that technology developed on irradiation techniques, as distinguished from radiation effects, be made public.

Interested organizations should write to the Director, Office of Isotopes Development, Atomic Energy Commission, Washington 25, D. C. by December 31, 1958. To the extent possible, a statement as to the nature and extent of Commission support desired, if any, should be included.

Following receipt and evaluation of replies, the Commission will consider whether an invitation to submit formal proposals is warranted.

Staff members of the Office of Isotopes Development are available to interested organizations for preliminary discussion looking to submission of letters.

Mattini 5-72
~~OFFICIAL USE ONLY~~*Yellow***Office Memorandum • UNITED STATES GOVERNMENT**TO : Frank K. Pittman, Director
Division of Reactor DevelopmentNovember 3, 1958
DATE:

FROM : W. B. McCool, Secretary

SUBJECT: FOOD IRRADIATION FACILITY FOR CONSUMERS REACTOR
SYMBOL: SSCY:RVW

1. At Meeting 1421 on October 31, 1958, the Commissioners discussed a proposal by Chauncey Starr to construct, in connection with the Consumers sodium reactor, a food irradiation facility for processing four hundred tons of food daily. They requested further information on this suggested facility, including cost figures for transporting food to the reactor site for processing. They also requested a staff recommendation on whether the project deserved AEC financial support.

2. The General Manager has directed that you prepare this report for circulation to the Commission.

cc: General Manager
Asst. Gen. Mgr. for Adm.
Asst. Gen. Mgr. for R&ID
General Counsel
Controller
D. C. Office

~~OFFICIAL USE ONLY~~*Copy file 1401-50-SRE**PA-6 Consumers Public Power District**11-3-58*

*Attachments - 12
W. notes Processing*

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August 6, 1958

COPY NO. _____

ATOMIC ENERGY COMMISSION

REPORT ON SEVENTH MEETING OF INTERDEPARTMENTAL
COMMITTEE ON RADIATION PRESERVATION OF FOOD

Note by the Secretary

The attached letter from the retiring Chairman, Inter-
departmental Committee on Radiation Preservation of Food, is
circulated for the information of the Commission. The attach-
ment has been referred to the Office of Industrial Development.

W. B. McCool
Secretary

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DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C.

August 1, 1958

Honorable John A. McCone
Chairman, Atomic Energy Commission

Dear Mr. McCone:

This is to inform you that the Interdepartmental Committee on Radiation Preservation of Food, on the occasion of its seventh meeting, held on July 31, 1958, elected as its Chairman, Mr. H. B. McCoy, Administrator, Business and Defense Services Administration, Department of Commerce.

This action reflects those concepts prevailing at the time of the Committee organization as well as the opinion of the Committee that, in the past two years, the food irradiation process has developed to a point where it is desirable that the chairmanship be assumed by an agency more closely concerned with the commercialization of the process.

I wish to thank you for the support given by your representatives during the period of my chairmanship and to assure you of the Army's firm resolve to continue its present vigorous efforts to promote the technology for the application of this preservation process.

For your information I am including a copy of my remarks, as presented at the meeting, reviewing the activities of our member agencies during my tenure of office.

Sincerely yours,

/s/

W. H. Martin
Director of Research and Development

1 Incl
Remarks

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STATEMENT OF ACHIEVEMENT

BY

Dr. William H. Martin
Retiring Chairman
Interdepartmental Committee on Radiation
Preservation of Food

On May 15, 1956, this Committee was formed to coordinate the Government effort in the development of this new technology, to provide motivation and broad guidance for the Program, and ultimately to facilitate the commercialization of the process. Today, over two years later, my term of office as first Chairman will conclude. This is the seventh meeting of the Committee. We have added two members, most recently the Small Business Administration, and organized a system of subcommittees that represents the interests of the various departments. In addition to their separate activities, there have been two plenary sessions of the subcommittees. Some of these groups have been more active than others, but all have contributed to the Committee's major function, that of coordinating Government activity in this field.

On this occasion, it is proper to briefly review the activities of the various member agencies of our Committee and also to point out the increasing outside interest in this new technology. Before doing this, however, I wish to state that there is much occasion for optimism and much has been accomplished towards the day when "ray-preserved" foods will appear as part of the Army ration and on the market for civilian consumption.

INTERNAL ACTIVITY

A most interesting recent development has been the signing of a contract between the Atomic Energy Commission and the Curtiss-Wright Corporation, on July 17, 1958, for a 2,000,000 curie cobalt 60 radiator; the necessary funds, \$2,500,000, were provided by the Department of Defense. This facility has replaced the previously planned reactor and assures a source of gamma energy for the U.S. Army Ionizing Radiation Center. The technical skill and management of the Atomic Energy Commission have been invaluable in this instance.

In addition to these funds, the Army will commit \$3,200,000 in FY 1959 for the Pilot Plant building which will be erected at Stockton, California. I mention this to emphasize partly the continuing contribution of the Army. Furthermore, the Army will maintain the contractual research and development program at approximately the million dollar level as in previous years. This program, as you know, involves contract programs funded by the Army and those "No-Cost" contracts generally with industry, the expenses of which are largely carried by the company concerned. The generous interest of industry in this "No-Cost" operation has been encouraging.

I think that the Troop Acceptability Tests at Fort Lee, Virginia, are another excellent yard stick of accomplishment.

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To date, both bacon and pork loin have been fed with good results and more foods will be fed before the end of the year. The following sixteen foods have been cleared, so far, by the Office of The Surgeon General, Department of the Army, for feeding under the conditions of these tests. After completion of these tests, the "long-term" wholesomeness studies will be initiated.

Bacon	Peaches	Sweet Potatoes	Tuna
Chicken	Fruit Compote	Cole Slaw	Shrimp
Chicken Stew	Oranges (including	Carrots	Cod Fish
Pork Loin	orange juice)	Corn	
	Pineapple Jam	Green Beans	

In addition to all this, there have been numerous exhibits and talks, sponsored in different instances by practically all our member agencies. Material has been supplied to a representative of the Voice of America for overseas broadcasts and a motion picture, introducing "ray-preserved" foods in popular style, tailored to fit the needs of Army troops, is now available for distribution. Material has also been furnished Army educational centers for class instruction. The Department of State and other agencies have made overseas distribution of similar information.

The subcommittee on Economic and Market Analysis, with its chairmanship provided by the Department of Commerce, has, in conjunction with the Harvard Graduate School of Business, made an economic study of the place of irradiated foods in the future economy. This study is the most advanced of its kind and will be made available to industry.

Over 30 publications have been made available to the interested public by the Department of Commerce. Through their office and otherwise, over 900 copies of the first Committee report and 200 copies of the Summary Report of the Second Technical Points of Contact Conference have been distributed. A 500-page Monograph on Radiation Preservation of Food will be available for sale to the public this fall.

Without attempting to list all the activities of the Department of Commerce, we must still make special reference to the work of the National Bureau of Standards in the field of dosimetry and dosimetric standards. We wish them well in their pending request for \$1,500,000 for a high energy electron accelerator for their work in this field.

The efforts of the personnel of the Department of Health, Education and Welfare to establish satisfactory health physics procedures for radiated food installations, both in terms of standards and methods of measurements, and in cooperation with State officials, should be noted. Mention should also be made of the thought and effort of Department of Agriculture personnel concerning the inspection procedures and standards to be applied to the production of irradiated foods as they come into commercial production.

Agriculture's Commodity Development Program, in the field of fruits, vegetables, meats and eggs; and Department of

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Interior's program relative to fish preservation, have indicated the interest of these agencies.

OUTSIDE ACTIVITY

Outside activity is increasing. While this is a difficult area to assess, signs of independent industry interest can be discussed. Recently a full-page advertisement of American Can Company appeared in Food Technology for June 1958, pointing out future potentialities. A forward looking article by E. W. Chester of J. A. Ward, Inc., New York, assessing the economic future of the process from the standpoint of industry interest, appeared in the June 1958 issue of Food Engineering. Initial plans have been prepared by Radiation Corporation of California, a subsidiary of Anaheim Cold Storage, for a pilot plant for the radiation preservation of food; and the Reliable Packing Company of Chicago, has installed a pilot cobalt 60 source. These are only a few selected surface indications of independent industry interest that, it is hoped, will greatly increase in the next few years.

Nor has international interest been lacking. Various meetings, wholly or partially connected with irradiated food, have been held. The European Contact Group of the Food and Agricultural Organization (ECG-FAO) sponsored a meeting on the "Uses of Isotopes and Radiation in Agricultural Research" at Wageningen, Netherlands, 10-14 December 1956. This group has recently completed a planning meeting (29-30 April 1958, Rome, Italy) for a fall conference on the "Use of Ionizing Radiations for Food Preservation," to be held in Harwell, England, 17-22 November 1958. The British held a symposium in Cambridge, England, on "Processing of Foods with Ionizing Radiations," 26-27 September 1957. The United Nations Educational, Scientific and Cultural Organization (UNESCO) held an "International Conference on Radioisotopes in Scientific Research," in Paris, France, 9-20 September 1957. The European Productivity Agency, Organization for European Economic Cooperation (EPA-OEEC), in cooperation with the International Cooperation Agency (ICA), sponsored a 6-month's project on "The Use of Atomic Energy and Its By-Products in the Production, Marketing and Distribution of Agricultural Products," in which top scientists from the 17-member European countries and associate members of Canada and the United States participated. This project culminated in a meeting held in Paris, France, 21-25 July 1958, for the purpose of reporting, coordinating, and summarizing the activities of the individual participating scientists.

Plans are being formulated by personnel of the Atomic Energy Commission for an international conference, including perhaps 30-40 foreign scientists, to be held in 1959 and also for the establishment of a school for such people. Committee member agencies have cooperated fully and have encouraged these opportunities to present the accomplishments and leadership of this country in this developing technology in the atomic energy field and have provided representation.

Furthermore, there has been encouraging signs from the interest expressed at various technical meetings throughout

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the country. At the 1956 Institute of Food Technologists meeting, held at Pittsburgh, Pa., 8 papers solely concerned with irradiated foods were presented. At their May 25-29, 1958, meeting in Chicago, Ill., 30 papers directly and wholly concerned with this subject were presented and numerous others made some reference to it.

CONCLUSION

In conclusion, may I wish the new Chairman well. His selection follows our original thought to choose, when appropriate, a Chairman from an agency closer to the industrialization of the radiation preservation of food process. I have already gone on record as to the continuing concern of the Army with the need for and the desirability of industrializing this process. I am enthusiastically anticipating the opportunity to support and work with Mr. McCoy, our new Chairman.

AEC

Materials-12. Wright

UNITED STATES
ATOMIC ENERGY COMMISSION
Washington 25, D. C.

No. A-188
Tel. Hazelwood 7-7831
Ext. 3446

FOR IMMEDIATE RELEASE
(Wednesday, July 23, 1958)

AEC SIGNS \$1.6 MILLION CONTRACT WITH CURTISS-WRIGHT
FOR GAMMA RAY FOOD IRRADIATOR FOR U.S. ARMY

The Atomic Energy Commission has signed a contract with the Curtiss-Wright Corporation to develop, design, construct, and test operate a major gamma irradiation facility to be built as part of the U.S. Army Ionizing Radiation Center at Lathrop, California. The facility will be known as the High Intensity Food Irradiator (HI-FI) and is expected to be ready for operation about mid-1960.

The HI-FI's source of radiation will be about two million curies of Cobalt-60 to be produced at the Savannah River Plant, and supplied to the contractor by the Commission. With the exception of the Cobalt-60, the cost of the project is estimated at \$1,605,000, including a fee of \$80,000 for the contractor.

As depicted by the Curtiss-Wright proposal, several thousand strips of radioactive cobalt will be assembled into two radiation plaques. These will be installed within an irradiation chamber where the temperature may be controlled over a wide range. Thick concrete walls will separate the chamber from the rest of the facility. Personnel will be able to enter the chamber safely when the plaques are lowered into a water-filled canal in the chamber floor. A conveyor system will be installed to permit continual operation of the facility.

To make the HI-FI an independent unit, the complete facility will also include locker rooms, a health physics laboratory, control room, a maintenance area, and a crane for handling the heavy lead and steel casks which will be used to ship the Cobalt-60 from the Savannah River Plant to the USAIRC.

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The HI-FI will be one of the two radiation sources to be incorporated into the USAIRC, the remainder of which is being built by the Army Engineers. The other source will be an electron linear accelerator now being built for the Army by Varian Associates of Palo Alto, California.

In addition, the Center will have offices, laboratories, and a versatile food processing plant capable of handling a variety of foods under different conditions. The Center will become the major production facility of the Quartermaster's Radiation Preservation of Foods Project, which was established in 1953 to determine the feasibility and means of using ionizing radiation to process foods.

(NOTE TO EDITORS & CORRESPONDENTS: This announcement is being issued simultaneously by the San Francisco Operations Office.)

AEC

PLB 25-SRE

Bill Jenkins
B-421

UNITED STATES
ATOMIC ENERGY COMMISSION
Washington 25, D. C.

No. A-176
Tel. HAZELWOOD 7-7831
Ext. 3446

FOR IMMEDIATE RELEASE
(Tuesday, July 8, 1958)

AEC CONTRACTS FOR STUDY OF SODIUM REACTOR COOLANT
AS POSSIBLE SOURCE OF HIGH-LEVEL RADIATION

The Atomic Energy Commission has contracted with Atomics International Division of North American Aviation for a feasibility study on use of the sodium reactor coolant at the Hallam Nuclear Power Facility as a high-level radiation source for industrial processing. The agreement is on a cost-type basis with a fixed ceiling of \$76,000.

The study will investigate the technical feasibility of using the radioactive sodium coolant for industrial radiation processing and of integrating such a radiation processing plant with the nuclear power facility being built at Hallam, Nebraska. Included will be a preliminary design study for the radiation processing plant.

The 75,000 net electric kilowatt facility at Hallam is being built by the Commission and the Consumers Public Power District under the Commission's Power Demonstration Reactor Program. Consumers will operate the plant upon its completion, expected in late 1961. Full power operation is expected in late 1962. Research and development work for the project is being done by Atomics International, under contract to the Commission.