



717290

1231
etc-

UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE OPERATIONS
P.O. BOX E
OAK RIDGE, TENNESSEE 37830

*Classified
Bill McVey*

AREA CODE 615
TELEPHONE 483-8611

BEST COPY AVAILABLE

SEP 19 1972

Lab Reports
FILE *SM7B Reprocessing*

L. R. Rogers, Director, Directorate of Regulatory Standards, Headquarters
THRU: Milton Shaw, Director, Div. of Reactor Development & Technology, HQ

ORNL PROPOSAL FOR STUDY OF EFFLUENT GUIDES FOR NUCLEAR FUEL CYCLE

In response to a request from K. G. Stayer, ORNL has transmitted by the enclosed September 11 letter a program and budget proposal for the development of technical bases for establishing "as low as practical" guides for radioactive effluents of the nuclear fuel cycle. The ORNL proposal is being transmitted to you for consideration of support under Program 30. The proposal is transmitted through DRDT to provide concurrence and/or comments in view of interface with on-going DRDT activities at ORNL.

Based on our review of the ORNL proposal program and staffing plans, we feel the proposed work can be readily accomplished at ORNL and without adverse effect on currently assigned RDT programs. The proposed program appears to meet the indicated requirements of Regulatory for assistance in this area and we hope it will be possible to reach an early decision on your support of the proposed work.

Original Signed by
Joseph A. Lenhard

Joseph A. Lenhard, Director
Research and Technical Support Division

ORR:WDA

Enclosure:
ORNL ltr dtd 9-11-72, w/proposal (3)

cc w/encl:
K. G. Stayer, HQ
J. H. Hill
D. F. Cope, RDT-OSR(ORNL) ←

REPOSITORY *Oak Ridge Operations*
COLLECTION *Records Holding Area*
BOX No. *Documents 44-94*
A-49-6 1 of 4
7544 Bldg. 2714-H
FOLDER *04-40-40-01 Fuel Recycle*
EBR Reprocessing

1115981

OAK RIDGE NATIONAL LABORATORY

OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION



POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

OFFICE OF THE DIRECTOR

September 11, 1972

U. S. Atomic Energy Commission
Post Office Box E
Oak Ridge, Tennessee 37830

Attention: Mr. J. A. Lenhard
Research & Technical Support Division

Gentlemen:

Subject: Proposal for Developing a Technical Basis for Effluent Guides
for the Nuclear Fuel Cycle

Oak Ridge National Laboratory was asked by Keith G. Steyer, Chief, Fuels and Materials Standards Branch of the Directorate of Regulatory Standards, to submit a proposal to develop the technical basis for establishing as low as practical guides for the nuclear fuel cycle. This was to include a technical assessment of effluent treatment methods, environmental impact assessment, and effluent processing cost analysis. As a result of this request, representatives of ORNL met with representatives of Regulatory on July 6, 1972, at Bethesda, Maryland, to discuss this problem. Following this discussion, the enclosed proposal was prepared and discussed with Regulatory.

There are several aspects of the proposed program that should be noted. Much of the background information that will be used in this assessment was and is being developed under RDT programs. For example, methods for control of iodine, tritium, and krypton releases are under development under the LMFBR and HTGR spent fuel processing programs, and a study has been made to define the experimental work necessary to reduce all radioactive effluents from chemical processing plants to near zero. Also, under subcontract with NFS and Allied-Gulf, studies are being made to ascertain the application of advanced effluent control methods to present and future LWR fuel processing plants.

This latter study may involve a sensitive point. The results of these studies by commercial fuel reprocessing firms may be used by Regulatory to determine future release limits for these firms. However, it is understood that the general results of these studies will be made public.

The personnel to be used on this program involve only two who are now engaged in RDT programs. A. L. Lotts is involved with the Thorium Utilization Program and would be diverted about 20% of his time to oversee the

1115982

September 11, 1972

fuel fabrication portion of this proposed study. R. E. Blanco now devotes 30% of his time to laboratory-scale LMFBR fuel processing. This is a reduction from full time in FY-1971 and 50% in FY-1972 due to the changing emphasis in the processing program from laboratory- to engineering-scale work. Blanco will be assigned one-half time to the proposed program which will not interfere with his RDT duties.

If you concur in ORNL's performing the proposed task for Regulatory, we would appreciate your transmitting the enclosed proposal to Mr. L. R. Rogers, Directorate of Regulatory Standards.

We also request that concurrence for ORNL participation be obtained from RDT because of our heavy commitment to experimental work for RDT in this area.

We will be happy to supply any additional information you require.

Sincerely yours,



Alvin M. Weinberg
Director

AMW:DEF:il

cc: F. L. Culler (3)
D. E. Ferguson (4)
J. H. Frye, Jr. (3)
R. J. Hart, AEC-CRO (2)
R. F. Hibbs, UCC-ND (2)
J. H. Hill, AEC-CRO (2)
R. A. McNees (2)
Milton Shaw, AEC-Wash. (3)
D. B. Trauger (2)

Enclosure

1115983

OAK RIDGE NATIONAL LABORATORY

OPERATED BY

UNION CARBIDE CORPORATION • NUCLEAR DIVISION

Contract No. W7405-eng-26

PROGRAM AND BUDGET PROPOSAL

30 Regulation
PROGRAM

1. CONTRACTOR UNION CARBIDE CORPORATION NUCLEAR DIVISION		CONTRACT NO. W7405-eng-26		TASK NO.	
2. PROJECT TITLE Environmental Assessment of the Nuclear Fuel Cycle				189 NO.	
3. BUDGET ACTIVITY NO. 30 20 25 03 0		4. DATE PREPARED July 14, 1972		03	
5. METHOD OF REPORTING <input type="checkbox"/> MONTHLY <input type="checkbox"/> OPEN LITERATURE <input type="checkbox"/> QUARTERLY <input checked="" type="checkbox"/> TOPICAL <input type="checkbox"/> SEMI ANNUAL <input type="checkbox"/> OTHER (Specify) <input checked="" type="checkbox"/> ANNUAL		6. WORKING LOCATION: OAK RIDGE, TENNESSEE <input checked="" type="checkbox"/> X-10 SITE <input type="checkbox"/> ORGDP SITE <input type="checkbox"/> Y-12 SITE <input type="checkbox"/> OTHER (Specify) <input type="checkbox"/> MELTON VALLEY			
7. PERSON IN CHARGE R. E. Blanco and D. J. Nelson		8. PROJECT TERM FROM: July 1972 TO: Continuing			
PRINCIPAL INVESTIGATOR(S) A. L. Lotts R. C. Dahlman J. W. Poston A. D. Ryon S. V. Kaye B. C. Finney M. J. Bell		<input checked="" type="checkbox"/> NEW WORK <input type="checkbox"/> ESTABLISHED PROGRAM			
9. MAN YEARS		FY 19		FY 19 73	
a) SCIENTIFIC				5.0	
b) OTHER TECHNICAL					
TOTAL				5.0	
10. FUNDING					
OPERATING COSTS:					
a) DIRECT SALARIES				120,000	
b) MATERIALS & SERVICES				15,000	
c) SUBCONTRACTS					
d) INDIRECT EXPENSES				115,000	
TOTAL OPERATING COSTS				250,000	
OBLIGATIONS FOR CAPITAL EQUIPMENT NOT RELATED TO CONSTRUCTION					
11. REACTOR CONCEPT			12. MATERIALS		

1115984

13. DATES AND TITLES OF PUBLICATIONS:

Siting of Fuel Reprocessing Plants and Waste Management Facilities, ORNL-4451 (July 1970).

R. E. Blanco et al., Radiological Impact Study - Part I: Cost of Radioactive Waste Treatment at Light Water Nuclear Power Plants (May 20, 1972).

14. SCOPE:

This project has the objective of preparing generic environmental impact and cost-benefit reports for all of the operations of the nuclear fuel cycle except power production. This information will be useful to the U.S. AEC in formulating "As Low As Practicable" regulations for application to nuclear fuel cycle industries and waste repositories. The project encompasses mining, milling, refining, conversion, enrichment, fuel preparation, fuel fabrication, reprocessing, refabrication, shipping, and waste repositories. It considers sources of effluents that result from nonroutine and accident conditions as well as those from normal plant operation. Containment and recovery systems will be considered that cover a wide range of emission limits below current regulations for noxious gases, liquids, and particulates. Recovery systems for airborne or liquid effluents will contain provisions for producing effluents and residues that are suitable for recycle or shipment and disposal. Systems for solid wastes will be evaluated from the point of view of (1) minimizing waste generation, (2) procedures for decontamination to reduce the hazard potential of the waste, (3) technical limits and break-even costs for recycle, and (4) methods of post-generation volume reduction.

The project will be conducted by engineers and environmental scientists who are experienced in fuel cycle engineering and assessment of the environmental impact of fuel cycle facilities and nuclear power reactors. The engineering aspect of the problem will involve a comprehensive evaluation of systems for effluent control, containment, and waste management in the fuel cycle, and the development of incremental costs and "source terms" for noxious effluents of systems that cover the range from present practice to the foreseeable limits of available technology. The environmental science aspect to the problem will entail the compilation of basic data on the behavior of appropriate radionuclides and other noxious materials in the environment, quantitative estimation of the radiation dose to man and damage to the environment through the variety of pathways in terrestrial and aquatic systems, and comparison of the risks and benefits of nuclear fuel cycle operations with related industries and other types of fuel cycles for energy production.

The environmental behavior of radionuclides and noxious materials and their impact on man and the environment is frequently dependent upon the specific site where releases occur. Environmental factors to be considered include soil type, biota, climatological conditions, atmospheric dispersion, occurrence of aquatic habitats and population densities. The potential exists for a wide spectrum of conditions but with a knowledge of source terms provided in the engineering assessment it may be possible to provide a series of limiting conditions from the environmental standpoint. Environmental conditions at existing sites used in various aspects of the fuel cycle will be used in developing criteria related to environmental impacts. Existing data obtained from environmental monitoring and from published sources will be used in the present evaluations. The systematic approach to this problem will pinpoint areas where research is needed and other, on-going research programs can effectively focus investigations on mission problems.

The scope of this multiple study program is extensive and it is expected to require several years for

14. SCOPE: (Cont'd)

completion. In some cases, all the required information is not available at present. For example, the movement of plutonium in the environment or the data from existing subcontracts on effluent control as funded by RDT. However, additional information will become available in the near future. The general plan for assessing the environmental impact will be the same for each of the industries in the nuclear fuel cycle. This plan is outlined as follows using fuel reprocessing plants as an example. The Nuclear Fuel Services (NFS) plant has been in operation for several years and the Midwest Fuel Reprocessing Plant and the Barnwell Nuclear Fuel Plant are expected to initiate operations in late 1972 and 1974, respectively.

- (1) Assess the gaseous, liquid, and solid waste treatment systems at the three reprocessing plants to determine similarities or marked discrepancies. Characterize a model (generic) plant (or plants) based on this information. (Assessment of a larger number of installations may be required for other industries.)
- (2) Survey and analyze the ecological implications at the three sites in an effort to define impacts that could form the basis for a generic environmental statement at a model plant. The development of a suitable method for averaging the diverse environmental conditions at various sites is expected to be a major problem.
- (3) Prepare a set of conceptual flowsheets for treating waste effluents from the model plant which illustrate the effect of increased efficiency and cost for waste treatment. Case 1 of each set will represent the base cost, zero or minimal waste treatment system and the cases with higher numbers will represent early, current, and advanced, complex treatment systems.
- (4) Calculate the source term for each case, i.e., the amount of radioactive or other noxious material released to the environment.
- (5) Determine the impacts of the effluents on the environment for each case.
- (6) Estimate the cost of the waste effluent treatment systems.
- (7) Compare the costs of waste effluent treatment with the impacts of the effluents on the environment. This comparison will form the basis for determining the meaning of "as low as practicable" for regulatory purposes.
- (8) Basic engineering and environmental data will be compiled as required for the studies. Portions of this information will be issued as separate reports.

15. RELATIONSHIP TO OTHER PROJECTS:

This project is related to an ORNL project funded by the Division of Regulation (Budget Activity No. 30 20 25 03 0) for preparation of generic reports and draft environmental statements on light water power reactors. It is related to ORNL projects funded by the Division of Reactor Development and Technology (Budget Activity Nos. 04 40 04 01 1 and 04 01 51 01 1) that have an objective of developing advanced effluent control technology for the reprocessing of LWR, LMFBR, and HTGR fuels. The project is also related to the ORNL activities funded by the Division of Waste

15. RELATIONSHIP TO OTHER PROJECTS: (Cont'd)

Management and Transportation (Budget Activity No. 01 04 01 02 6) for development of repositories for radioactive waste and the shipping of nuclear materials. The project is more generally related to several other ORNL activities in fuel cycle technology, nuclear safety and environmental impact, some of which are funded by the Division of Biomedical and Environmental Research.

16. TECHNICAL ACCOMPLISHMENTS IN FY 1972:

This is a new project.

17. EXPECTED RESULTS IN FY 1973:

We expect to complete first drafts of generic environmental and cost-benefit reports for the LWR fuel reprocessing industry and the uranium mining, milling, and refining industries. We will prepare substantial portions of a report for the plutonium fuel fabrication industry. We will collect data and prepare initial studies to scope the problem of environmental assessment for the other fuel cycle operations including: (1) mining, milling, and refining of thorium; (2) uranium conversion; (3) uranium enrichment; (4) preparation and fabrication of enriched uranium LWR, HTGR, and plutonium LMFBR fuels; (5) reprocessing and refabrication of HTGR and other advanced fuels; (6) federal and commercial repositories and burial grounds for radioactive wastes; and (7) shipping of all types of materials in the nuclear fuel cycle.

The environmental impact and cost-benefit assessment for the LWR fuel reprocessing industry will be based upon the NFS, MFRP, and BNFP plants and current studies of advanced plant concepts that are funded by RDT. The engineering aspect will rely on existing subcontracts (funded by RDT through ORNL) with Nuclear Fuel Services and Allied Gulf for study of advanced concepts for effluent control. The environmental assessment will include consideration of the local and worldwide impact of such materials as ^{85}Kr , ^3H , ^{131}I , ^{129}I , and particulates of mixed fission products and actinides.

The studies of the uranium mining, milling, and refining industries will include an assessment of the adaptation of existing milling processes for removal of radium and a variety of schemes for management of tailings and other types of waste. The environmental studies will include an assessment of the exposure pathways for uranium and all of its daughters together with noxious chemical effluents.

The engineering assessments of plutonium fuel fabrication will rely on development work in plutonium fuel fabrication, the experience and plans of commercial fuel fabrication, applicable experience from AEC sites, and work at ORNL and HEDL that is directed toward minimizing the volumes and treatment of plutonium contaminated solid wastes. We will assess available data on the exposure pathways for dispersed plutonium, realizing that much of the needed data on the behavior of plutonium in certain types of terrestrial and aquatic systems is not yet available.

The engineering assessments of the thorium--uranium-233 fuel cycle will rely on development work at ORNL in the refabrication of HTGR and LWBR fuels, the reprocessing of thorium fuels, and the purification of uranium-233 along with experience gained as the national storage center for uranium-233. Additional data is available from other AEC sites and from private industry.

1115987

17. EXPECTED RESULTS IN FY 1973: (Continued)

Brief progress reports will be prepared on a monthly basis.

18. EXPECTED PROGRESS IN FY 1974:

We will revise and complete environmental impact and cost benefit reports for LWR fuel reprocessing; uranium mining, milling, and refining; and plutonium fuel fabrication. We will complete draft reports on two or three other fuel cycle operations based upon the most pressing need for information. These operations will conceivably involve nuclear materials shipping and the preparation and reprocessing of HTGR fuels. The program will continue into FY 1975 to complete the environmental assessment of the nuclear fuel cycle.

19. DESCRIPTION, JUSTIFICATION, AND COSTS OF MAJOR MATERIAL, SUBCONTRACTS, TECHNICAL SERVICES, AND CAPITAL EQUIPMENT OBLIGATIONS:

<u>Description and Justification</u>	<u>Cost Estimates</u>		
	<u>FY 1972</u>	<u>FY 1973</u>	<u>FY 1974</u>
Technical Services			
Computer Services		15,000	15,000

20. PROPOSED OBLIGATIONS FOR RELATED CONSTRUCTION PROJECTS, IF ANY: None

1115988