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OAK RIDGE NATIONAL LABORATORY

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FROM: J. P. Gill and T. E. Cole

Previous Progress Reports:

ORNL-CF-54-6-55	ORNL-CF-54-11-110	ORNL-CF-55-4-185	ORNL-CF-55-12-158
ORNL-CF-54-7-138	ORNL-CF-54-12-213	ORNL-CF-55-5-192	ORNL-CF-56-2-158
ORNL-CF-54-8-163	ORNL-CF-55-1-186	ORNL-CF-55-7-100	ORNL-CF-56-5-190
ORNL-CF-54-9-234	ORNL-CF-55-2-187	ORNL-CF-55-8-155	ORNL-CF-56-8-199
ORNL-CF-54-10-164	ORNL-CF-55-3-224	ORNL-CF-55-10-137	

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GENERAL

Construction of the reactor building, reactor structure and process water system is approximately 80% complete and the Construction Contractor estimates turn-over to ORNL by March 1, 1957.

Purchase and fabrication of equipment to be installed by ORNL with regard to the reactor, reactor controls and process water system instrumentation are approximately 75% complete.

Present schedules indicate that the facility should be ready for critical experiments by June 1st, with full power operation approximately three months later.

The request for additional project funds for the expansion of building facilities (air conditioning, elevator, hot cell, additional laboratory space, etc.,) amounting to \$515,000 has been approved by the Atomic Energy Commission within the past month. Drawings and specifications are now being prepared by the Engineering Department in order that the necessary materials and equipment can be ordered in advance so that the work can proceed simultaneously with the installation of the reactor equipment by ORNL. The present Construction Contractor will not be involved in this phase of the work.

The cost of inspection on the ORR Project, principally with regard to the construction contract, is costing considerably more money than was originally estimated. It is now believed that an additional \$75,000 will be required to complete the ORNL portion of the work.

Included in this report is a list of the actual and estimated costs for each phase of the work involved in the project as of October 1st. The total of \$1,399,744 is \$65,744 above the \$1,334,000 now assigned to ORNL.

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CONSTRUCTION

Considerable progress has been made in the past few months on the construction end of the project. The building has been completely enclosed, all floors have been poured, and the building crane has been put into operation.

The reactor pool floor and the base of the main biological shield have been completed to the level of the first floor. The latter constituted a major accomplishment in that it involved locating accurately the aluminum bottom plug liner and the successful placing of a large segment of the barytes concrete shield by the Pre-Pak method.

Field crews of the Chicago Bridge and Iron Company arrived on the job in the early part of October and have completed approximately 60% of the erection of the aluminum pool liner. They have been able to continue almost independently of the other phases of the structure construction, and apparently have had little difficulty in maintaining good quality in the aluminum welding.

Earlier difficulties have been overcome in the welding of the large diameter aluminum piping of the process water system. Except for the time element we can now look forward to a satisfactory installation. Part of this improvement has been due to a reorganization of the subcontractors' working force and the decision by ORNL to make more extensive use of radiography in the ORNL inspection. The fact that radiography is being used on welds that according to the Specifications would normally be inspected only by the dye-penetrant method has added considerably to the weld quality by allowing detection of hidden faults in the weld joints. The inspection costs to ORNL for this additional radiography have been justified by the number of flaws detected.

Since all of the 18-inch and 36-inch pipe had been radiographed during the shop fabrication and it was understood that this part of the system was to meet rigid inspection requirements this portion of the installation is now proceeding satisfactorily with little repair work required. That portion of the 24-inch diameter pipe to be installed in locations that did not require radiography according to the Specifications was shop fabricated in sections with apparently no quality control except for dye-penetrant checking and as a result is requiring approximately 75% repair work as determined by our field radiography. Since the subcontractor has had difficulty in finding qualified welders for this work, a large portion of the 24-inch diameter pipe is now being reshipped to New Orleans for repair. The ORNL inspectors and the general contractor are in agreement on the quality of welding required and the responsibility for repair without cost to ORNL is understood to be the Contractors. Previous experience with the Contractor leads us to be suspicious of statements from him regarding his willingness to assume the responsibility for this repair; however, there seems to be no question regarding the necessity for repair and the work is being done as rapidly as could be expected under the circumstances. If the Contractor chooses to file a claim for additional money on this part of the work it will not delay the job.

REACTOR COMPONENT FABRICATION AND PROCUREMENT

All mechanical components necessary for the installation of the reactor are now on hand with the exception of the reactor vessel, the shim rods and the live fuel elements. The dummy fuel elements necessary for initial hydraulic tests have been completed. The shim-safety rods will be finished by January 1st. Delivery of the reactor vessel is expected sometime in February.

Fabrication of the reactor vessel, except for the schedule, has proceeded quite satisfactorily within the past few months and is now approximately 60% complete. Some difficult portions of the work, particularly with regard to the welding and rifle-drilling of the lattice housing, have been accomplished. The upper and lower tank sections along with the cover plates are essentially complete. Other formed and machined items which along with the lattice housing form the center tank section are ready for welding. The completed lower assembly should be ready for final machining at the Portsmouth Naval Yard in the latter part of December. Since the ORR Building will not be available for the installation of the reactor equipment until the early part of March, it is believed that the late delivery of the vessel will not constitute a serious delay in the project.

In order to minimize the reactor component installation period with respect to alignment and assembly difficulties and to familiarize the operating personnel with the design features and servicing procedures, a preassembly of core components and mechanical controls is now in progress in Building 3001. Steel and aluminum structural frameworks will simulate the critical locations incorporated in the reactor structure and the reactor vessel. A short tank section gasketed to the bottom plug assembly will be filled with water and it is planned to test, demonstrate and establish servicing information on the mechanical controls. This assembly should be completed by the end of December.

A model of the reactor pool and shielding ($1/2$ inch = 1 foot) is on display in Building 3001 and a second model ($1\ 1/2$ inches = 1 foot) of the reactor and experimental facilities along with adjacent portions of the structure is nearing completion and should be ready for display by the early part of January.

EXPERIMENTAL FACILITIES

Detailed drawings and 95% of the material required for the fabrication of the north and south large facility plugs were sent to the Paducah Works at the end of October. Delivery is scheduled for March, 1957.

The design of experiments by the Engineering Department for the Homogeneous Reactor Project and the Chemical Technology Division resulted in last minute changes reincorporating the conventional shielding steps in each of the ten-inch diameter experimental holes, for both plugs.

A common design for all of the six-inch diameter beam hole plugs has been worked out with the experimenters and the Reactor Operations Department and fabrication drawings are now in progress. The design provides for a combination beam hole plug and collimator; the collimator tapers from the lattice terminating with a section two inches square at a distance thirty inches from the outer end of the plugs. At this point the area is increased to a four-inch square opening approximately 16 inches long, then to a five-inch square section about 16 inches long; these larger sections along with the full volume of the cubicle are available for experimental equipment and shielding associated with beam type work. The 4" and 5" square sections will be provided with an iron plug for initial use. Changes can be made in equipment installation at the outer end of the plug during shutdown, by flooding the front end of the plug and the armulus with water. The same plug design is used at each facility, and they are interchangeable.

The detail design for all of the equipment required for the north facility experiments is proceeding quite rapidly and equipment should be ready shortly after the reactor is operated at full power.

So far no known plans have been made for any ANP experiments in the south facility.

Several other groups planning experiments in the ORR are now beginning design of their experimental equipment. It is requested that these groups review their plans in detail with J. A. Cox of the Reactor Operations Department in order to minimize interference with other experimenters and the reactor operations requirements. This is a particularly important point as the number of experiments planned is large and it will be necessary to carefully plan the installations. Failure to clear preliminary plans through the Reactor Operations Department may result in having to redesign equipment to avoid interference.

REACTOR CONTROLS & INSTRUMENTATION

All of the reactor control cubicles and panels have arrived from the Taylor Instrument Company. Additional wiring and re-wiring not a part of the contract with Taylor Instrument Company is now taking place in Building 3551. R. Toucey is in charge of the instrumentation installation; R. Hartman is in charge of the electrical installation.

The servo limit switches and associated drives are now being detailed by A. M. Tripp of the Engineering Department; the basic design has been completed and approval by the project staff has been obtained.

A set of drawings for the wiring of the rod drives is now under consideration so that the rod drives can be fully mocked-up in Building 3001.

An inexpensive hand-and-foot counter utilizing the ORNL Quintector is being packaged by C. Waggoner of the Instrumentation and Controls Division. The drawings for this design should be ready within two weeks for project approval.

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The Modern Sound Company auxiliary intercom components have arrived from Pittsburgh, Pennsylvania, and have been evaluated. It appears that these devices will be used in the O.R.R. intercom installation.

L. Chase of the Instrument Application Department is producing detailed installation drawings for the cooling-system instrumentation. A number of these drawings are being circulated for comment and approval.

Thermocouples have been installed around the reactor bottom plug liner; their position coordinates have been recorded and record photographs have been made. This information is being forwarded to F. T. Binford of the Reactor Operation Group; at such time as the thermocouple installation is complete a report will be written containing this "as-built" information for future use.

Modular hardware for experiment tie-in to the reactor control system is being designed by J. Stribling's group and a memorandum is being prepared by S. H. Hanauer covering use of the tie-in.

Thirty-six thousand feet of 5/c wire cable has arrived from the U. S. Rubber Company and this wire is now stored in Building 4500.

To date, approximately 70% of the devices for reactor control and cooling system has been purchased or is on order. Only a few major items remain to be purchased; e.g., intercom, single-wire and 2-wire cable.

REACTOR PHYSICS

Gamma heating studies of the reactor have been completed except for examination of the heating problems in special equipment such as sample holders and experimental equipment. Problems of this type are being handled as they arise. ORNL-CF-56-11-36 gives a comparison between calculated and measured gamma-ray heating in the Bulk Shielding Facility.

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This work should serve as a guide to the calculation of gamma heating effects in the ORR or other similar reactors and should be of considerable help in planning experiments.

A major effort covering the computation of the flux distribution and the critical mass of the reactor under various conditions has been started. The method employs the 3G3R Code of Bate, Einstein and Kinney together with the RSP Code of Nelson. It is anticipated that initial results on a cold-clean symmetric model will be available by December 1st. This work has been delayed an unreasonable period of time due to lack of available manpower to prosecute this phase of the work. At present this work is being done by the ORR Project at the expense of advance planning for the installation and testing phase of the work.

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ORR Project
ORNL Accounts & Expenditures
October 1, 1956

Account No.	Description	Cost or Estimated Cost	June	July	August	Sept.	Total to Date
x3900-15	Preliminary Design	99,657					99,657
x3900-1900-2	A-E Services - Part I	71,736					71,736
*3900-1900-3	Inst. and Controls Design	60,000	1,092	1,208	2,262	2,163	47,800
x3900-1900-4	A-E Design Criteria	23,709					23,709
x3900-1900-5	5 MW Cooling System Design	15,536					15,536
x3900-1900-6	Utilities & Site Design	14,320					14,320
*3900-1900-7	Reactor Design	100,000	1,711	1,401	1,531	1,204	93,188
x3900-1900-8	Controls Development	27,686	793				27,686
*3900-1900-9	Controls Purchases	108,900	883	34,001	5,912	3,320	54,033
*3900-1900-10	Instrumentation Purchase	23,500	1,921	85	765	2,665	13,963
x3900-1900-12	20 MW Cooling System	33,080					33,080
x3900-1900-13	A-E Services - Part II	24,362					24,362
x3900-1900-14	Reproduction for Contract Dwg. & Specs	5,269					5,269
*3900-1900-15	Site and Utilities Preparation	6,425			655		6,885
*3900-1900-17	Inspection of Construction	65,000	1,550	3,520	3,655	5,183	51,769
*3900-1900-18	Utilities and Site Construction	42,125	178	1,296	5,042	172	25,966
*3900-1900-19	Beryllium Reflector Purchase	100,000	23	1,301	3,043	2,851	95,426
*3900-1900-20	Reactor Unit Purchases	200,000	10,962	35,064	12,626	5,639	86,445
*3900-1900-21	A-E Service - Part III	27,000	113**	1,390	270**	560	23,301
*3900-1900-22	Reactor Controls Installation	41,000					
*3900-1900-23	Cooling System Inst. Installation	15,000				8	8
x3900-1900-24	Lead Shields - Fabrication	11,500	1,903	2,511	2,275	1,102	10,323
x3900-1900-25	Lower Bearings and Support Plate	7,000	975	892	66	69	6,590
x3900-1900-26	Lead Brick	1,739					1,739
x3900-1900-27	Mechanical Controls Fabrication	75,000	9,078	3,868**	2,191	15	71,542
x3900-1900-28	Upper Grid Mechanism Fabrication	20,000	6,309	5,477	4,067	1,074	19,511
*3900-1900-29	Large Facilities Purchase	42,000	1,034	799	8		1,872
x3900-1900-30	Fuel Element (Dummy)	10,000	1,077	1,043	2,636	1,091	7,393
*3900-1900-31	Design of Bldg. Decontam. System	5,000		414	129	38	580
*3900-1900-32	Material to Contractor	5,000	1,044	1,149	131	71	2,394
*3900-1900-33	Test Field Welding	3,200			941	600	1,546
3900-1900	Reactor Assembly & Installation	50,000					
3900-1900	Beam Hole Components	20,000					
3900-1900	Rabbit Tube Installation	10,000					
3900-1900	Installation of Bldg. Decontam. System	35,000					
		1,399,744	40,420	83,583	47,665	27,825	937,629

x Work Completed - Account Closed

* Work in Progress - Account Open

** Credit to Account

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