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U. S. DEPARTMENT OF ENERGY

UNIVERSITY REACTOR INSTRUMENTATION PROGRAM

(GRANT No De-FG02-91ID13083)

FINAL REPORT

DISCLAIMER

INTRODUCTION

The University of Massachusetts Lowell Research Reactor has received a total of $115,723.00 from the Department of Energy (DOE) Instrumentation Program (DOE Grant No. DE-FG02-91ID13083) and $40,000 in matching funds from the University of Massachusetts Lowell administration.

The University of Massachusetts Lowell Research Reactor has been serving the University and surrounding communities since it first achieved criticality in May 1974. The principle purpose of the facility is to provide a multidisciplinary research and training center for the University of Massachusetts Lowell and other New England academic institutions. The facility promotes student and industrial research, in addition to providing education and training for nuclear scientists, technicians, and engineers.

The 1MW thermal reactor contains a variety of experimental facilities which, along with a 0.4 megacurie cobalt source, effectively supports the research and educational programs of many university departments including Biology, Chemistry, Nuclear and Plastics Engineering, Radiological Sciences, Physics, and other campuses of the University of Massachusetts system.

Although the main focus of the facility is on intra-university research, use by those outside the university is fully welcomed and highly encouraged.

INSTRUMENTATION UPGRADES

Prior to the DOE Instrumentation funding, the University of Massachusetts Lowell Research Reactor had been operating with essentially the same type of electronic components since criticality. The two systems that required immediate attention and were targeted for upgrades are described below.

Radiation and Effluent Monitoring System

The University of Lowell Research Reactor uses a radiation monitoring system to alert personnel to unexpected and high radiation levels within containment. The system consists of a stack effluent monitor, two constant air monitors and fourteen local area monitors to measure gross radiation levels. One neutron detector in the system monitors for direct fission product releases.

The stack effluent monitor purchased and installed in 1993, replaced a system that was over twenty-five years old. This equipment is essential to the operation of the reactor since the constant surveillance of stack effluents and local radiation monitoring of key areas is necessary to show compliance with Nuclear Regulatory Commission limitation on radiaonuclide emissions to unrestricted areas. The NMC Digital Continuuous Air Monitor is a stand-alone, 3-channel unit. The three channels are for particulate, iodine and noble gas detection. At this time the system functions as a stand alone, local monitor. Additional modifications will be necessary in the future to provide for remote monitoring and reception of alarm signals into the control room.

The equipment to replace the radiation monitoring system was ordered from Nuclear Research Corp in 1995. The equipment was ordered to meet the facility's requirement of single failure criterion specified in 10CFR50, Appendix A for loss of signal, loss of power or instrument failure. The special order resulted in a two year delay. The final shipment of equipment arrived at the Lowell reactor in July, 1997. The digital solid state radiation monitoring system is fully compatible with the existing system, so it will be installed in segments. Present plans are to complete installation by the end of 1997. A list of the equipment purchased is listed in Appendix 1.

Nuclear Instrumentation

The second system targeted for equipment upgrades using the DOE grant monies and matching university funds was the reactor power measuring channels. This equipment was ordered from General Atomics in 1995. The equipment arrived at the facility in a damaged and inoperable condition due to improper shipping and handling. The equipment was shipped back to General Atomics; the process of repairing the instruments has taken over a year and half. At this time, all the equipment is on site and functional. The status of the instrumentation is listed as a "work in progress" as the detailed testing and installation planning progresses.

The nuclear instrumentation purchase includes 2 linear power channels, (one of which contains a power level flux controller), and a logarithmic power/reactor period channel. The automatic power level controller maintains the reactor at a preselected power level. The units forming the channel include the power schedule set switch, the power schedule indicator and a servo-amplifier.

The logarithmic and period channels monitor the power level of the reactor and the rate at which power is changing. The logarithmic power channel can measure reactor power over a range of approximately .1 watt to 10^6 watts. An amplifier differentiates this logarithmic signal to give the reactor period. The linear power and period channels are major components

of the reactor safety system and are used to meet the requirement of the facility's Technical Specifications.

CONCLUSION

Modern equipment is essential for the continued operation of the reactor facility. The use of old equipment has resulted in long down times for the facility since replacement parts are scarce for such outdated equipment. Academically, training engineers and scientists with modern technology is far more effective than using vintage vaccuum-tube technology.

Appendix 1

Radiation and Effluent Monitoring System

quantitity	description	unit $	total $	
Nuclear Measurement Corp.				
1	Monitor, Effluent, stack and gas plug	$39,643.37	$39,643.37	
				$39,643.37
Nuclear Research Corp.				
6	ADM-606-bit Ratemeters	$2,945	$17,070.00	
1	NP-100 Neutron probe BF3 counter	$2,250.00	$2,250.00	
2	IP-100 Ion Chamber Detector	$1,295.00	$2,590.00	
9	GP-100 Wide Range Gamma Probes	$ 995.00	$8,955.00	
3	GP-100c Wide Range Probes w/ check sources	$1,335.00	$4,005.00	
3	AX 300a, Local Alarm Indicators	$1,000.00	$3,000.00	
2	19" NIM BIN Chassis	$2,500.00	$4,500.00	
2	preamplfiers for 500V detector	$2,000.00	$4,000.00	
				$46,370.00

Nuclear Instrumentation

quantitity	description	unit $	total $	
General Atomics				
2	Linear Power Channel(NLI-1000) &			
1	Logarithmic Power and Reactor Period Channel (NLI-1000) (package price)		$59,700.00	
1	Power Level Controller (NFC-1000)		$ 4,700.00	
				$64,400.00
Omega Instruments				
	Upgrades for temperature Monitoring		$1,532.00	
				$1,532.00
Oxford Instruments				
	Ratemeter, Log/Linear		$1,298.81	
				$1,298.81
Miscellanous supplies (cables, fixtures, hardware)				$1,465.43
	TOTAL			$154,709.11
	University matching funds	(subtract)		$ 40,000.00
	Remaining balance	(add)		$ 1,013.39
	Grant amount			**$115,723.00**