

The University of Missouri Research Reactor,

Its Fuel and Productivity

by

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An informal paper presented at the
International Meeting of Research Reactor Fuel
Designers, Developers, and Fabricators

Argonne National Laboratory

Nov. 8-9, 1978

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Summary

The U.S. Department of State and U.S. Department of Energy have initiated a program to reduce the quantity of highly enriched U-235 used in the 141 research reactor in the U.S. and abroad, those research reactors to which the U.S. supplies fuel. This program calls for maintaining the "present capability and fuel costs" of these reactors but reducing the enrichment from 93% to 45% or to 8-20% by increasing the weight % loading of the fuel elements. The higher wt % loading will be achieved through a fuel development program.

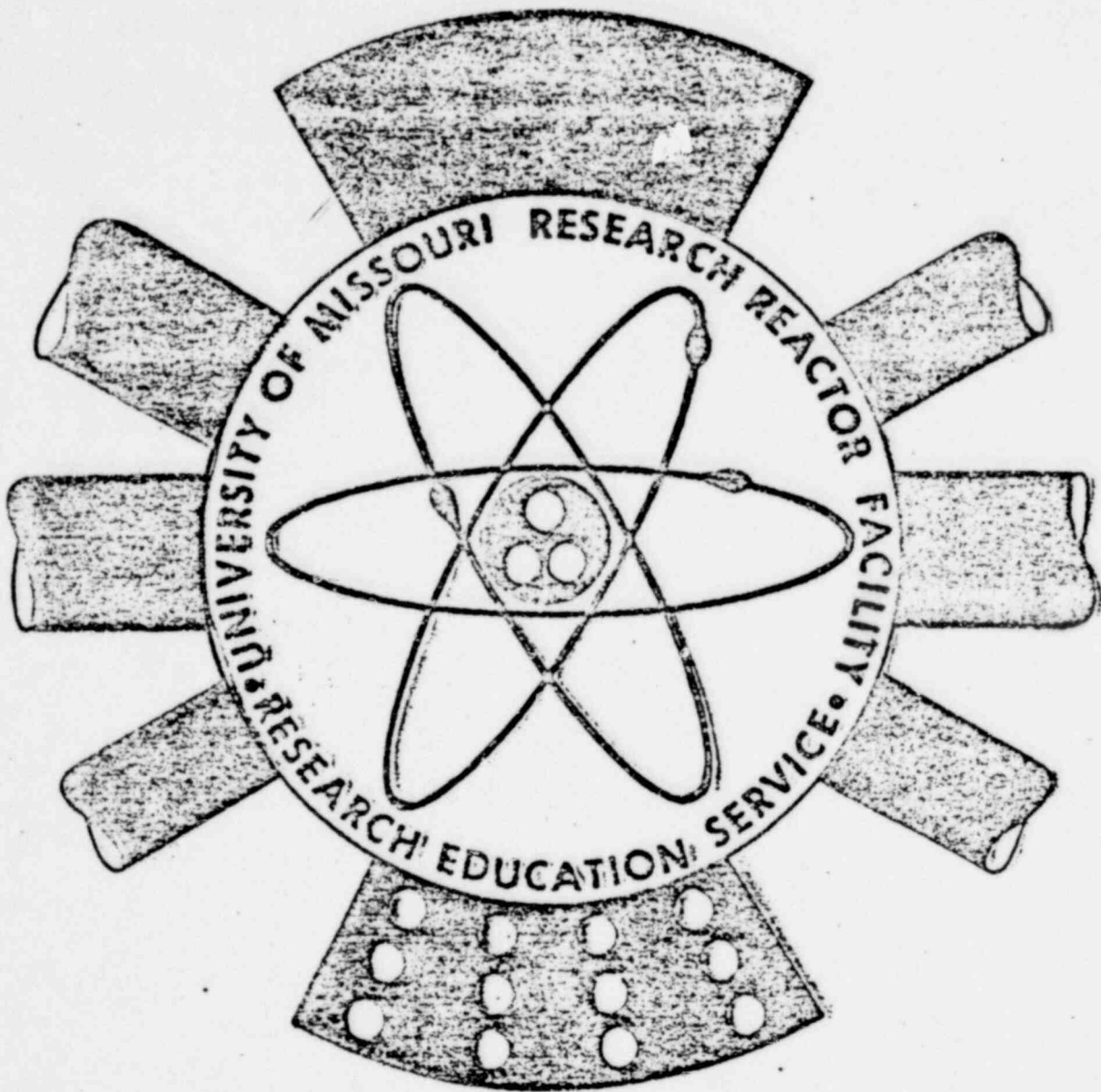
We support the U.S. effort of fuel development leading in increased research capabilities and reduced fuel costs. These are forward steps in productivity.

We support the program to reduce the use of highly enriched U-235 for those reactors that can achieve this and do not have the desire to increase their capabilities.

But for those reactors that can increase their capabilities and desire to do so we believe the U.S. program should be directed so that the U.S. can recover a lead position in this field of basic research and so that these research reactors can increase productivity and help the U.S. recover economically.

Slides 2, 3, 4 summarize the contribution to education research and service of the University of Missouri Research Reactor, MURR. These contributions are helping to offset the impact on the U.S. economy of research from other countries. Slide 5,6,7 describe the MURR and its fuel. Fuel developments have allowed the MURR to keep the cost/MWD of fuel constant until the last orders were saddled with much larger costs from security and administration. Slides 8,9,10, and 11 outlines the slipping position of U.S. research reactors as compared to the rest of the world. Slide 12 lists some of the opportunities that the U.S. has missed because of the hold-the-line-attitude. Slide 13 shows that the MURR could not decrease its U-235 enrichment and maintain present capabilities and costs. On the other hand slide 14,15, 16, and 17 shows how MURR could cut fuel fabrication costs and reduce by 40% the U-235 in inventory if fuel development leads to a 60 wt % loaded fuel at 93% enrichment and we are allowed to use this development. Slide 18 shows the upgrade and increased capabilities MURR could achieve with fuel development of 93% U-235 and removal of the arbitrary institutional limits.

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I. Background on MURR

Slide 1 Logo

The University of Missouri Research Reactor, MURR, is the highest flux steady state reactor at a USA university. Its purpose is to produce neutron and gamma radiation and to use this radiation for research, education and service.

Slide 2, 3, 4 MURR Productivity

Slides 2, 3, and 4 list the summarized accomplishments of the MURR during school year 1977-1978 in the areas of educations, research and service.

The MURR was among the last of the high flux research reactors designed and built in the USA. It was designed to take maximum advantage of technical capacities to reach maximum flux density. Design includes the use of 93% enriched uranium and maximum wt % loading available at the time of design.

Slide 5 Horizontal Cross Section of MURR Core

Slide 5 is a horizontal section through the core of the reactor showing the flux trap, the annulus of 8 fuel elements, the pressure vessel, control rods, irradiation facilities and beam tubes. At 10 MW the peak thermal neutron flux in the trap is 6×10^{14} n/cm² sec and at the beam tubes 1.2×10^{14} n/cm² sec.

Slide 6 Characteristics of MURR Fuel - November 1978

Slide 6 lists the characteristics of the present fuel of MURR.

Slide 7 Cost History of MURR Fuel Elements (Fabrication only)

Slide 7 lists the costs for fabricating MURR elements. Core one was bought in 1965 while core 20 was bought in 1977. One notes that while the cost of elements has almost doubled from cores 1 to 20, we have been able to hold the cost/MWD almost constant by applying advancing technology such as the UA1_x and 150 MWD/element burn-up. This is a prime example of increasing productivity. The 50% increase from cores 20 to 23

SLIDE 2

EDUCATION

SUPPORTED BY MURR - JULY 1977 - JUNE 1978

- TOURS FOR 3,256
- SPEAKERS FOR 52 SEMINARS, COLLOQUIA, AND TALKS
- LECTURES FOR 35 CLASS HOURS
- 7 INSTRUCTORS FOR 24 CREDIT HOURS OF COURSES
- 2 INTERNATIONAL CONFERENCES

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SLIDE 3

RESEARCH

SUPPORTED BY MURR - JULY 1977 - JUNE 1978

- SUPPORTED THE RESEARCH OF 108 FACULTY AND 76 GRADUATE STUDENTS FROM 31 DEPARTMENTS OF THE UNIVERSITY OF MISSOURI AND 14 OTHER UNIVERSITIES
- SUPPORTED THE RESEARCH LEADING TO 52 JOURNAL AND PROCEEDINGS PUBLICATIONS FROM THE UNIVERSITY OF MISSOURI AND OTHER UNIVERSITIES
- SUPPORTED RESEARCH LEADING TO 41 PAPERS PRESENTED AT PROFESSIONAL MEETINGS
- SUPPORTED RESEARCH LEADING TO THE GRANTING OF 4 PH.D DEGREES AND 8 MASTERS DEGREES
- PROVIDED THE FINANCIAL SUPPORT FOR 8 FACULTY (8 FTE), 21 GRADUATE STUDENTS (14 FTE) AND 16 UNDERGRADUATE STUDENTS (14.5 FTE)
- SECURED RESEARCH EQUIPMENT WORTH \$119,000 BY GIFTS, LOANS, AND GRANTS AND WORTH \$137,000 BY PURCHASES FROM MURR FUNDS
- SUPPORTED 61 GRANTS AND CONTRACTS TOTALING \$7,521,638
- SUPPLIED 166 SHIPMENTS OF 39 DIFFERENT ISOTOPES
- MADE 262 NEUTRON RADIOGRAPHS FOR 8 STUDENTS AND FACULTY FROM 4 DEPARTMENTS
- ANALYZED ABOUT 4900 SAMPLES USING NEUTRON ACTIVATION ANALYSIS
- PROVIDED EXPERT TESTIMONY IN 7 COURT CASES

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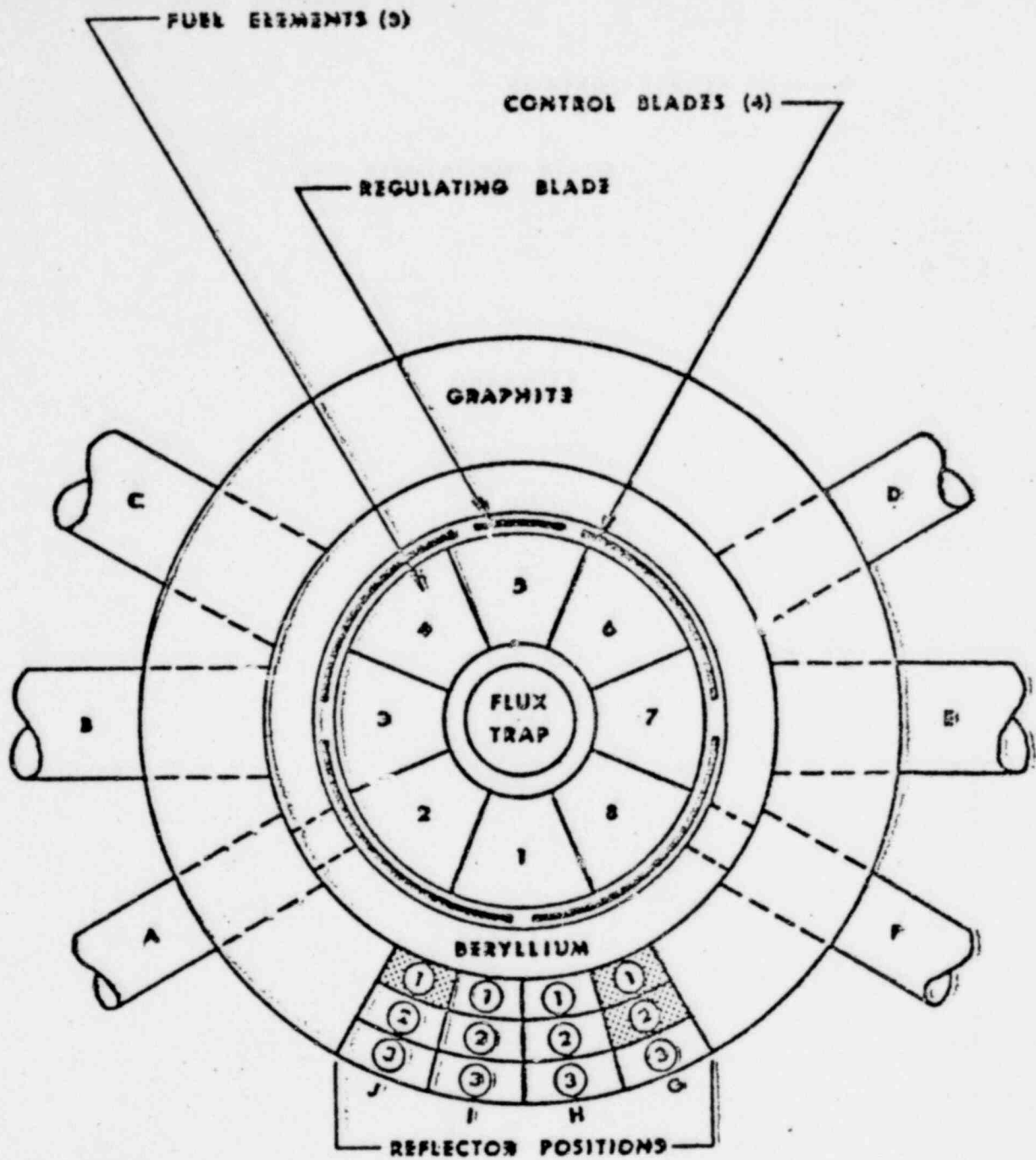
SLIDE 4

SERVICE

PROVIDED BY MURR - JULY 1977 - JUNE 1978

- PROVIDED SERVICE TO 6 OTHER UNIVERSITIES WITHIN THE STATE OF MISSOURI AND 26 OUTSIDE OF MISSOURI
- PROVIDES SERVICE TO 27 STATE AND FEDERAL AGENCIES
- SUPPORTED 14 RESEARCH PROJECTS DIRECTLY RELATED TO MISSOURI
- SUPPORTED 3 RESEARCH PROJECTS DIRECTLY RELATED TO ENERGY CONSERVATION AND DEVELOPMENT
- SUPPORTED 4 MISSOURI INDUSTRIES AND 47 OUT-OF-STATE INDUSTRIES

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DENOTES PNEUMATIC TUBE POSITION

FLUX TRAP, BEAMPORT AND REFLECTOR
EXPERIMENTAL FACILITIES
(Not to Scale)



SLIDE 6

CHARACTERISTICS OF MURR FUEL - NOV 1978

ELEMENTS/CORE	8
WEIGHT U/EL	775 GMS
WEIGHT U/CORE	6.2 KG
U ENRICHMENT	93%
WEIGHT % U	41%
TYPE	U A L _x PLATES
# PLATES/ELEMENT	24
FUEL LIFE	150 MWD / ELEMENT
CORE LIFE	ABOUT 4 MONTHS
MAX. FISSION DENSITY	1.8×10^{21} F/CC
POWER DENSITY	300 KW / LITER

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SLIDE 7

COST HISTORY OF MURR FUEL ELEMENTS
(FABRICATION ONLY)

<u>CORE</u>	<u>\$ COST/ELEMENT</u>	<u>COST/MWD</u>
URANIUM - ALUMINUM ALLOY		
I	\$ 5450	\$ 75
II, III	5500	81
IV, V	5300	77
VI	6250	90
URANIUM - ALUMINIDE INTERMETALLIC		
VII, VIII	4500	50
IX, X, XI	5200	53
XII, XIII, XIV	5200	52
XV, XVI, XVII	7750	78 (99 MWD/EL)
		52 (150 MWD/EL)
XVIII, XIX, XX	9500	60
XXI, XXII, XXIII	~14000	93

is almost all due to the increased cost of security and administration.

II. Background of Recent Research Reactor Development

To appreciate the need for increases in capabilities of US research reactors, one needs to compare the state of research reactor development in the USA for the last 10 years as compared to the rest of the world. First the need for neutrons and neutron research has been clearly and positively stated in the recent study by the USA National Academy of Science.

"Neutron Research on Condensed Matter: A Study of the Facilities and Scientific Opportunities in the United States" National Academy of Science (1977)

The first research reactors were built in the USA and the USA had a commanding lead through the 1950's. But the next slides show what happened when the US attitude shifted to one of hold-the-line and make-do-with-present-capabilities.

Slide 8 Research Reactors in USA Oct 1978

These are the research reactors now left in the USA. One notes that two have been downgraded in operating time till they are almost impotent. Only modest upgrading has been achieved because of the difficulty of overcoming NRC restrictions and lack of a positive attitude. One notes that no new research reactors have gone critical in the USA since 1967. One notes that the power levels are quantized - 2, 5, 10, 40, 100 MW. This quantization is caused by institutional limits, not technical limits.

Slide 9 Research Reactors Shut Down in USA 1965-1978

Slide 9 shows the research reactors that have been shut down in the USA. One notes that we have shut down about half our peak capability. How does this USA experience compare to the rest of the world?

SLIDE 8

RESEARCH REACTORS* OPERATING IN U.S.A. OCTOBER 1978

<u>REACTOR</u>	<u>POWER (MW)/OPERATING SCHEDULE (%)</u>	<u>FIRST CRITICAL</u>	<u>RECENT UPGRADE/DATE</u>
CP-5	5 / 20	1953	↓ 20% SEPTEMBER 1978
OMEGA-WEST	8 / 20	1957	↓ 20%
ORR	30 / 90	1958	
MITR	5 / 90	1958	↑ 1978
UNCR	5 / 90	1961	
SUNY (BUFFALO)	2 / 90	1961	
FORD	2 / 70	1963	
RHODE ISLAND	2 / 90	1964	
HFBR	40 / 90	1965	↑ 60 MW/1979 -COLD SOURCE
HFIR	100 / 90	1965	
MURR	10 / 90	1966	↑ 10 MW/1974 -150 HR/WK
NBSR	10 / 90	1967	↑ 20 MW/1979 -COLD SOURCE

*REACTORS THAT HAVE FLUXES AND OPERATING SCHEDULES SUCH THAT THEY DO OR COULD DO GOOD NEUTRON DIFFRACTION - THIS WAS USED AS A LOWER LIMIT TO SEPARATE THOSE REACTORS THAT DO MORE RESEARCH FROM THOSE REACTORS THAT ARE MORE ORIENTED TOWARD TEACHING AND TRAINING

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S.LIDE 9

RESEARCH REACTORS SHUT DOWN IN U.S.A. 1965 - 1978

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<u>REACTOR</u>	<u>POWER</u>	<u>DATE SHUTDOWN</u>	<u>DEGRADE</u>
BGRR	20	1969	
MTR	40	1970	COULD STILL BE THIRD BEST IN U.S.
NRR	1	1970	
K-WEST	?	1970	ONLY "HOT SOURCE" IN U.S.
AMRR	5	1970	
BRR	2	1974	
NASA	60	1974	
IRL	5	1975	
PUERTO RICO	2	1976	
LPTR	3	1978	
ALRR	5	1978	
CP-5	5		20%
OMEGA WEST	8		20%
GTRR	5		20%
GETR	50	1977	TEMPORARY
LLL	2	1978	"SHUT DOWN"

Slide 10 Research Reactors in England, France and Germany

Slide 10 shows the research reactors in three developed countries that have about the same population as the USA. The ILL, which went critical in 1972, has surpassed the USA reactors in research and has shifted the center of neutron scattering to Europe. The ILL is backed up by a set of medium flux research reactors. One notes that two are due to be shut down but a new reactor is being built to replace Saclay. One notes that most have been upgraded to their technical limits, not some administrative limit. One might argue that the score is now equal if this was the end of the story, but it isn't.

Slide 11 Research Reactors Under Construction (1980 - World Wide)

Slide 11 shows that the rest of the world is building new and replacement reactors, while the USA is building none. The net result of all this is slide 12.

Slide 12 Missed Opportunities by USA

The bottom line is that the USA has slipped into a secondary position in this kind of research and development because the USA has not kept up in reactor development and fuel development and because we have not used all our technical capabilities to provide maximum research capability.

III. Possible MURR Fuel Changes

Having shown that we are getting behind in research, let me now turn back to the purpose of this meeting, namely changes in fuel. The MURR has not done a detailed study, but from our knowledge of our present fuel behaviour we can make some estimates.

Slide 13 Summary Data - U-235 Loading - MURR

Slide 13 is a summary of the criticality conditions of MURR. The MURR needs a core holding 2.5 Kg U-235 to go critical, 4.5 Kg to override Xenon at 10 MW but with a very short cycle, and 6.2 Kg to have a reasonable life of about 120 days for each core.

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SLIDE 10

RESEARCH REACTORS IN THE THREE MEMBER COUNTRIES*

		<u>POWER (MW)</u>
GEESTHACHT		5
HAHN MEITNER INSTITUTE, BERLIN		5-↑10 MW 1980
JÜLICH (DIDO)		23
KARLSRUHE		44 ↓ 1980
HARWELL	DIDO	25
	PLUTO	25
CENG	SILOÉ	35
	MÉLUSINE	8-↑12 MW 1980
SACLAY (EL3)		20 ↓
ILL		57

*ENGLAND, FRANCE, GERMANY - SAME POPULATION AS U.S.

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SLIDE 11

RESEARCH REACTORS UNDER CONSTRUCTION (1978) - WORLD WIDE

- *1BR-11 PULSED REACTOR, DUBNA, U.S.S.R.
4 MW THERMAL AVERAGE, 5×10^{16} n/cm² PEAK PULSE FLUX
1979 COMPLETION
- *SACLAY RESEARCH REACTOR, FRANCE
14 MW, DEDICATED LENS FACILITY, MID-1979 OPERATION
- *LENINGRAD RESEARCH REACTOR, U.S.S.R.
100 MW, 3×10^{15} n/cm²sec FLUX, 1980 OPERATION
- *TROMBAY RESEARCH - ISOTOPE PRODUCTION REACTOR, INDIA
100 MW, RELATIVE LOW FLUX 10^{14} n/cm²sec
- *SWIERK RESEARCH REACTOR, POLAND
30 MW
- *KYOTO RESEARCH REACTOR, JAPAN
30 MW, 1981 COMPLETION
- *IRAQ - 30 MW FOUNDATION POURED
- *GHANA - 8 MW UNDER CONSTRUCTION
- *AUSTRALIA IS CONSIDERING BUILDING A NEW REACTOR
- *WEST GERMANY HAS COMPLETED STUDY AND IS CONSIDERING CONSTRUCTION
- *NO NEW RESEARCH REACTORS SERIOUSLY CONSIDERED FOR U.S.A.

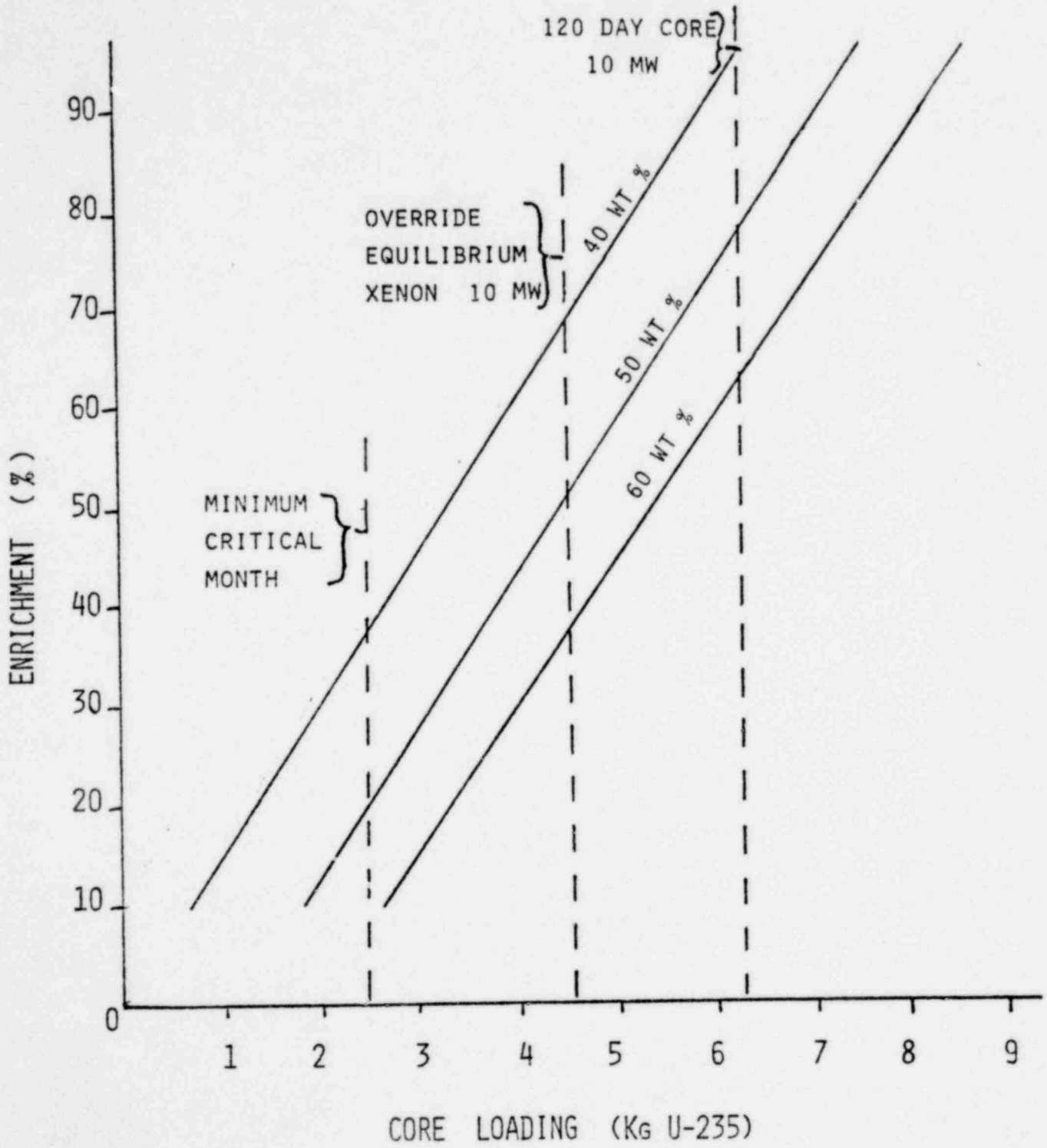
SLIDE 12

MISSED OPPORTUNITIES BY U.S.A. IN RESEARCH REACTORS

	<u>U.S.A.</u>	<u>OTHERS</u>
• RESEARCH	1/3	2/3
• NEW REACTORS	0	8
• REACTOR ϕ t UPGRADE	+10% - 50%	EXTENSIVE
• FLUX TAILORING (COLD/HOT SOURCES)	0/0	7/2
• SMALL ANGLE NEUTRON SCATTERING SPECTROMETERS	2	8
• BACK SCATTERING SPECTROMETERS	0	SEVERAL
• ISOTOPE PRODUCTION	DECREASING	INCREASING
• SILICON SEMICONDUCTOR PRODUCTION	1	20
• DOLLAR SAVINGS	LITTLE	

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CORE LOADING - MURR



SLIDE 13

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SLIDE 13 ALTERNATE

SUMMARY DATA - U-235 LOADING
UNIVERSITY OF MISSOURI RESEARCH REACTOR (MURR)

CURRENT TECHNOLOGY - 40 WEIGHT % U

<u>ENRICHMENT LEVEL</u>	<u>WEIGHT U-235 (KG)</u>
10%	0.665
20%	1.33

MINIMUM CRITICAL MASS - MURR - 2.5 KG U-235

50%	3.325
-----	-------

OPERATION AT 10 MW REQUIRES 4.5 KG U-235
TO OVERRIDE EQUILIBRIUM XENON

93%	6.2
70%	4.65

A 50 WEIGHT PERCENT LOADING CAPABILITY IMPLIES THAT A 75%
ENRICHMENT WOULD BE REQUIRED TO MAINTAIN 6.2 KG U-235.

A 60 WEIGHT PERCENT LOADING CAPABILITY IMPLIES THAT A 64%
ENRICHMENT WOULD BE REQUIRED TO MAINTAIN 6.2 KG U-235.

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Slide 14 & 15 Fuel Cycle Costs - Fabrication Only

Slide 14 and 15 show the cost of fuel fabrication for 93% enriched and 70% enriched fuel at 40 wt %. To drop to 70% enrichment, MURR fuel cost would jump to \$6,000,000/yr, a ridiculous and unacceptable number.

If we now leave the base of existing capability and consider technical development and higher wt % loadings. Slides 14 and 15 show some of the possibilities. With 60% loading we could cut our cost/MWD to below what it was in 1965. Now that is using technical development to produce real productivity.

There is another real advantage in a higher wt % loadings at 93% enrichment.

Slide 16 & 17 Annual Fuel Inventory

Slide 16 and 17 show our estimates of U-235 that now must be held in inventory for MURR to have a confident supply of fuel. This includes U-235 in fabrication, fresh fuel in storage, in use, and spent fuel awaiting shipment. One notes that by going to 60 wt % and 93% enrichment there is only 60% as much U-235 being held or in transit. The right hand axis shows an estimate of the cost of fuel inventories. Once again using 93% enriched and 60 wt % provides a real cost savings, thus increased productivity.

But while cost savings are important, we believe there is a more important goal. That goal is the one that true science always strives for and it is a goal that in the past the USA has strived for. That goal is increased capabilities. The 10 MW power limit of MURR is an institutional limit. The MURR is now capable of increasing power to 15 MW with only minor engineering changes and no significant change in level of safety. And the MURR could be increased to 25 MW with moderate engineering changes and safety systems additions. These upgrades could be achieved if 60 wt %, 93% enriched fuel were provided.

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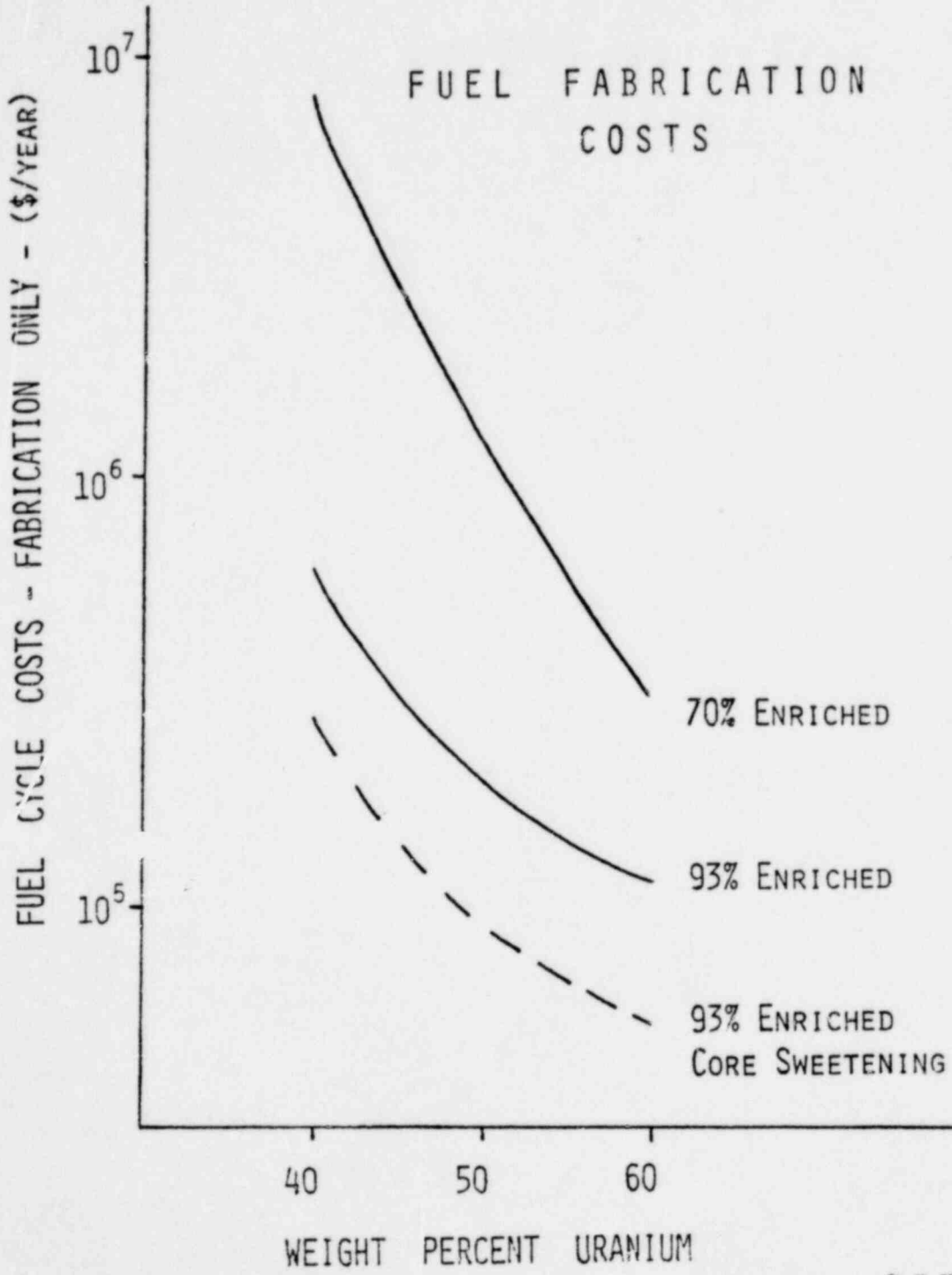
SLIDE 14

FUEL CYCLE COSTS - FABRICATION ONLY

<u>ENRICHMENT LEVEL (%)</u>	<u>U-235 CONTENT (WT %)</u>	<u>USABLE MWD 10 MW, 1 HOUR RESTART (NO CORE SWEETENING)</u>	<u>COST/USABLE MWD</u>	<u>ANNUAL COSTS</u>
93%	6.2 Kg (40%)	550	\$200	\$600,000
93%	6.2 Kg (40%)	1200 (WITH CORE SWEETENING)	\$90	\$270,000
70%	4.67 Kg (40%)	50	\$2200	\$6,600,000
93%	7.5 Kg (50%)	1700	\$65	\$195,000
70%	5.8 Kg (50%)	300	\$380	\$1,140,000
93%	9.3 Kg (60%)	2800	\$40	\$120,000
70%	7.0 Kg (60%)	1200	\$90	\$270,000
50%	5.0 Kg (60%)	-0-		
20%	2.0 Kg (60%)	-0-		

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SLIDE 15



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SLIDE 16

UNIVERSITY OF MISSOURI RESEARCH REACTOR
 ANNUAL FUEL INVENTORY REQUIREMENTS
 (150 HOUR/WEEK, 10 MW POWER, 93% ENRICHMENT)

CURRENT 6.2 KG CORE

	<u>REQUIREMENT</u>	<u>NUMBER CORES</u>	<u>KG-235</u>
OFF	{ 1 YEAR IN FABRICATION 2 YEARS "FRESH" IN STORAGE	3	18.6
SITE		6	37.2
ON	{ 1 YEAR IN USE 1 YEAR AWAITING SPENT FUEL SHIPMENT	3	18.6
SITE		3	18.6
		<u>TOTALS</u>	<u>93</u>

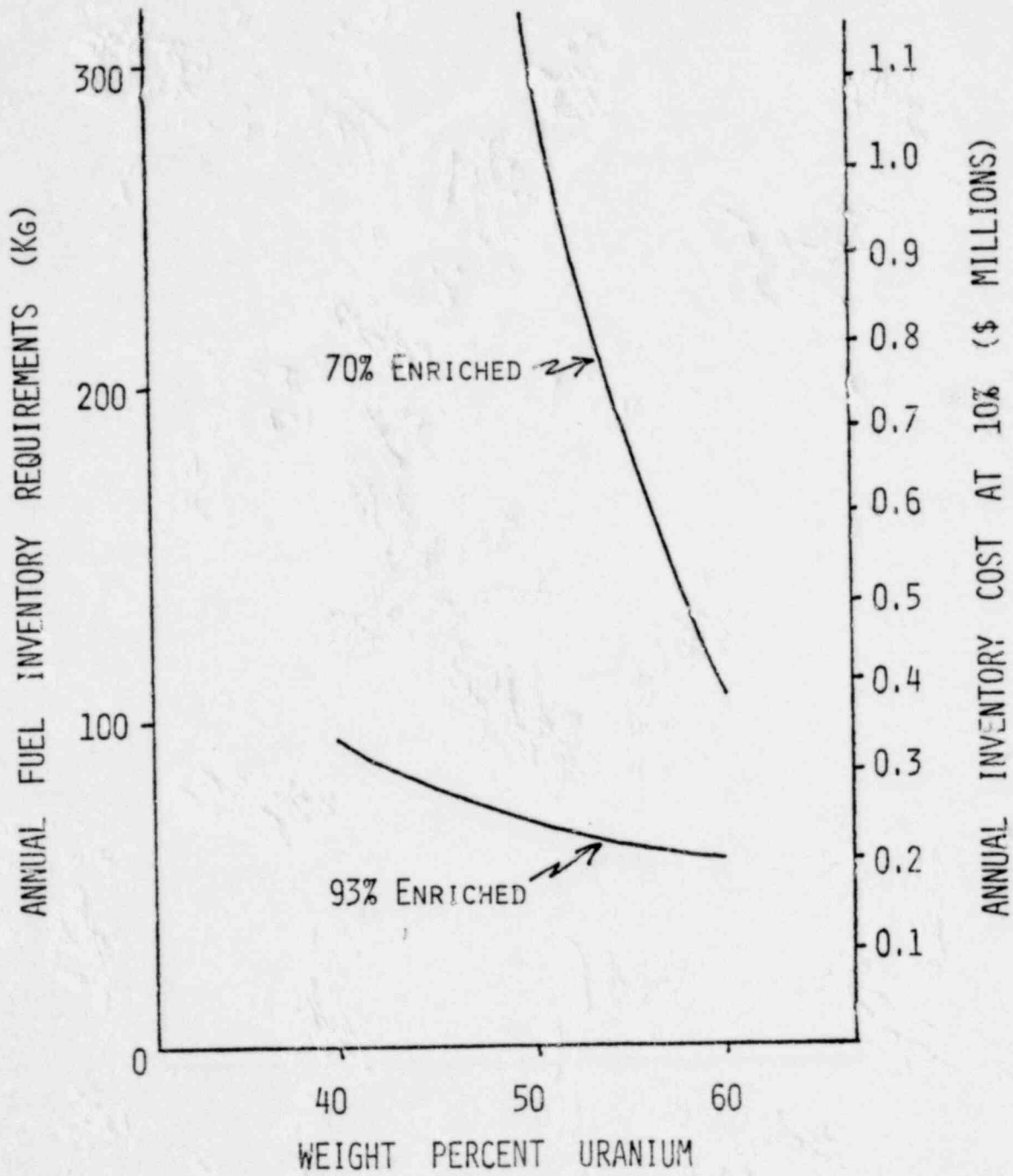
60 WT %, 9.3 KG

OFF	{ 1 YEAR IN FABRICATION 2 YEARS "FRESH" IN STORAGE	1.2	11.2
SITE		2.4	22.4
ON	{ 1 YEAR IN USE 1 YEAR AWAITING SPEND FUEL SHIPMENT	1.2	11.2
SITE		1.2	11.2
		<u>TOTALS</u>	<u>56</u>

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SLIDE 17

U-235 INVENTORY REQUIREMENTS



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Slide 18 Possible MURR Upgrade

Slide 18 summarizes what gains and capabilities of productivity could be gained at MURR with fuel development leading to 60 wt % loading and 93% enrichment. These are the kinds of upgrades that reactors outside the USA have been making and it is how the USA should be developing. It is unscientific and not in past tradition of the USA to freeze into a base of present capabilities. It will kill research and development.

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SLIDE 18

POSSIBLE MURR UPGRADES

60 WEIGHT % - 93% ENRICHED

INCREASED POWER LEVELS	UP TO 25 MW
INCREASED FLUX IN TRAPS	UP TO 1.75×10^{15} n/cm ² sec
INCREASED FLUX IN BEAMS (INCREASED POWER)	UP TO 3×10^{14} n/cm ² sec
INCREASED FLUX IN BEAMS (CORE SHORTENING)	
10 MW	1.5×10^{14} n/cm ² sec
25 MW	3.9×10^{14} n/cm ² sec
LESS 93% ENRICHED URANIUM IN INVENTORY AND IN TRANSIT	60% REDUCTION
COST SAVINGS (FUEL FABRICATION 10 MW)	\$200,000/YEAR
(FUEL FABRICATION 25 MW)	\$500,000/YEAR
(INVENTORY 10 MW)	\$140,000/YEAR

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GRADUATE RESEARCH ASSISTANTS

Randy Alkire	101	2-3331	443-2035
Bobbin Annfar	224	2-4211	449-1788
Bob Cobran		2-3331	
Morris Crow			
Gary Hughes			
A.S. Hanna			
Bob Koeppe	101	2-3331	449-2325
Sue Langhorst	225	2-6692	474-7383
Tom Lindley	257	2-3331	882-5705
T.F. Lui	101	2-4211	443-6172
Frank Morris		2-3331	449-1037
Allan Pringle	101	2-3331	443-0696
Steve Talent			
Song-Lin Chung			442-6536
Hsien-Tang			
John Korsah			474-6647
John Lindsay	246	2-4011	
Jeff Simmons	282	2-6525	
Reynold Wang			
Bill Cokeler			442-0494
Lynn Tomason			

STUDENT ASSISTANTS

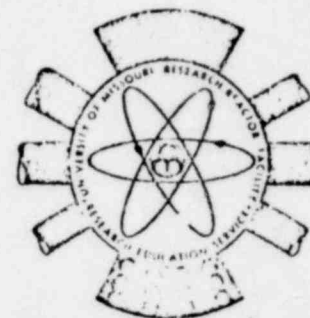
David Bain	246	2-4011	442-6501
David Lay	260	2-3331	474-4933
Terry Lee			882-8664
McClellan Grote	269	2-4211	445-4798
Bernard Bochner			
Steve Schlegel			

- + FACULTY MEMBERS -University
- + FACULTY MEMBERS -Stephens College
- * FULL TIME STAFF/PART-TIME STUDENT

ROOM NUMBERS AND PHONE NUMBERS ARE WHAT WE HAVE ON RECORD
 CHANGES WILL BE MADE ON THE NEXT EDITION



MURR DIRECTORY



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RESEARCH REACTOR FACILITY STAFF

DIRECTOR'S OFFICE

+ DIRECTOR, R. Brusler
 + ASSOC. DIRECTOR, D. Alger
 + CH. SEC., J. Marchand
 SEC. STENO
 FIN. ASST., R. Bonney
 + RES. ASST., M. Meyer
 + RES. ASST., S. Horner
 + RES. ASST., G. Thompson
 + RES. ASST., G. Larson
 RES. LIBRARIAN, P. McConnell

HEALTH PHYSICS

EGC, H.P., G. Olson
 H.P. TECH., J. Taylor
 H.P. TECH., R. Doro
 H.P. TECH., S. Stewart

OPERATIONS

* REACTOR MGR., C. McKibben
 REACTOR ENG., W. Zank
 * REACTOR PHYS., P. McGinty
 REACTOR PHYS., C. Edwards
 DEPUTY MGR., D. Card
 DEPUTY CLERK, D. Williams
 SECRETARY, V. Sharp
 SHIFT SUPER., L. Walker
 SHIFT SUPER., H. Iritschler
 SHIFT SUPER., B. Bezenek
 SHIFT SUPER., M. Spease
 * SR. REACTOR OP., M. Meyer
 * SR. REACTOR OP., Fullerton
 * SR. REACTOR OP., J. Tunick
 * SR. REACTOR OP., R. McCann
 * SR. REACTOR OP., P. Fernandez
 * SR. REACTOR OP., C. Anderson
 * SR. REACTOR OP., S. Hughes
 * SR. REACTOR OP., J. Berstler
 * SR. REACTOR OP., R. Jansson
 * SR. REACTOR OP., R. Swank
 * SR. REACTOR OP., V. Jones
 * SR. REACTOR OP., S. Stierwalt

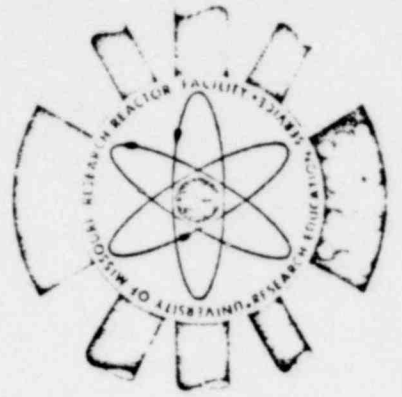
REACTOR SERVICES	ROOM	OFFICE	HOME
SERVICE ENGR., S. Gunn	246	2-4011	443-2145
ELEC. TECH., K. Armbruster	246	2-4011	445-6085
RES. TECH., A. Meyer	246	2-4011	874-3482
LAB ASST., C. Elliott	246	2-4011	474-4061
LAB ASST., R. Jordan	246	2-4011	445-3634
ELECTRONIC SHOP			
CH. RES. ELEC. TECH., V. Zager	282	2-6525	474-2407
RES. ELEC. TECH., T. Seeger	282	2-6525	474-7187
MACHINE SHOP			
CH. RES. ENGR. TECH., M. Evans	271	2-6416	698-2450
SR. RES. ENGR. TECH., D. Peeler	271	2-6416	698-3450
RES. ENGR. TECH., R. Womack	271	2-6416	386-2450
RESEARCH AND APPLICATIONS			
SR. RES. SCI., G. Ehrhardt	243	2-3331	449-3355
+ GR. LEADER, B. Yelton	101c	2-3331	443-6126
+ SR. RES. SCI., J. Meese	261b	2-3331	445-5019
+ SR. RES. SCI., J. Schlapper	256	2-3331	445-4724
+ SR. RES. SCI., R. Berliner	260	2-3331	445-1365
RES. SCI., D. Mildner	101	2-3331	443-5504
+ VISITING PROF., H. Anderson	241	2-3331	449-6874
+ VISITING PROF., D. Troutner	101	2-3331	449-2154
+ VISITING PROF., M. Chandrasekhar	258	2-3331	
SR. SEC., M. Seewooster	261a	2-3331	443-2324
NUCLEAR ANALYSIS PROGRAM			
+ PROG. DIRECTOR, J. Vogt	226	2-7229	442-7121
SR. RES. SCI., S. Morris	217	2-6521	442-5295
SR. RES. SCI., D. James	229	2-6748	445-2631
FORENSIC CHEMIST, T. Baxter	228	2-6692	449-5042
* SR. RES. SPEC., J. Carni	227	2-6692	443-5401
* SR. RES. SPEC., C. Graham	225	2-6692	874-1372
SR. RES. LAB TECH., V. Spate	217	2-6521	657-9450
SR. RES. LAB TECH., S. Crowson	217	2-6521	449-5047
SEC. STENO, J. Smith	222	2-7220	443-1793
SR. RES. SCI., M. Glascock	217	2-6361	445-6137

REACTOR SERVICES	ROOM	OFFICE	HOME
SERVICE ENGR., S. Gunn	208	2-4211	445-6580
ELEC. TECH., K. Armbruster	206	2-4211	445-4775
RES. TECH., A. Meyer	205	2-4211	442-4342
LAB ASST., C. Elliott	205	2-4211	474-4525
LAB ASST., R. Jordan	261c	2-4211	445-3701
ELECTRONIC SHOP	NE	2-3550	445-3115
CH. RES. ELEC. TECH., V. Zager	PHYSICS	2-7742	442-8849
RES. ELEC. TECH., T. Seeger	PHYSICS	2-6210	445-2189
MACHINE SHOP	EE	2-2484	
	DRC	2-3527	
RESEARCH AND APPLICATIONS			
SR. RES. SCI., G. Ehrhardt	260	2-4211	693-5971
+ GR. LEADER, B. Yelton	269	2-4211	
+ SR. RES. SCI., J. Meese	269	2-4211	474-7380
+ SR. RES. SCI., J. Schlapper	269	2-4211	474-8326
+ SR. RES. SCI., R. Berliner	275	2-4011	442-6728
RES. SCI., D. Mildner	275	2-4011	474-8350
+ VISITING PROF., H. Anderson	402	2-4011	443-5452
+ VISITING PROF., D. Troutner	275	2-4011	443-7529
+ VISITING PROF., M. Chandrasekhar	275	2-4011	
SR. SEC., M. Seewooster	275	2-4011	442-5580
NUCLEAR ANALYSIS PROGRAM			
+ PROG. DIRECTOR, J. Vogt	402	2-4011	449-4241
SR. RES. SCI., S. Morris	402	2-4013	474-6214
SR. RES. SCI., D. James	302	2-4013	445-5680
FORENSIC CHEMIST, T. Baxter	302	2-4013	874-3955
* SR. RES. SPEC., J. Carni	302	2-4013	474-7368
* SR. RES. SPEC., C. Graham	302	2-4013	442-0657
SR. RES. LAB TECH., V. Spate	302	2-4013	474-4174
SR. RES. LAB TECH., S. Crowson	302	2-4013	443-5955
SEC. STENO, J. Smith	302	2-4013	445-7322
SR. RES. SCI., M. Glascock	302	2-4013	696-5506
	302	2-4013	445-1603
	302	2-4013	443-6005
	302	2-4013	474-6036
	302	2-4013	474-8387
	302	2-4013	696-3454
	302	2-4013	449-7904

2036 061



**UNIVERSITY OF MISSOURI
RESEARCH REACTOR (MURR)
ANNUAL REPORT
JULY 1977 - JUNE 1978**



2036 062

7908310 516

MURR IS THE UNIVERSITY OF MISSOURI RESEARCH REACTOR FACILITY

MURR IS A SOURCE OF NEUTRON AND GAMMA RADIATION

MURR IS THE HIGHEST FLUX AND HIGHEST POWER STEADY STATE REACTOR

AT A U. S. UNIVERSITY

MURR'S PURPOSE IS TO SUPPORT EDUCATION, RESEARCH, AND SERVICE

2036 063

EDUCATION

SUPPORTED BY MURR - JULY 1977 - JUNE 1978

- TOURS FOR 3,256
- SPEAKERS FOR 52 SEMINARS, COLLOQUIA, AND TALKS
- LECTURES FOR 34 CLASS HOURS
- 7 INSTRUCTORS FOR 24 CREDIT HOURS OF COURSES
- 2 INTERNATIONAL CONFERENCES

2036 064

MURR TOURS - JULY 1977 - JUNE 1978

UNIVERSITY OF MISSOURI STUDENTS	903
SECONDARY SCHOOLS (HIGH SCHOOLS, JR. HIGH, ETC.)	1,096
OTHER UNIVERSITIES	203
WALK-IN (PUBLIC IN PRIVATE TOURS)	773
PROFESSIONAL ORGANIZATIONS	<u>281</u>
TOTAL TOURS GIVEN	3,256*

*35 FOREIGN COUNTRIES WERE REPRESENTED:

Argentina	Egypt	Iraq	Norway	Sweden
Austria	France	Italy	Pakistan	Thailand
Belgium	Ghana	Japan	Panama	Turkey
Burma	Holland	Lebanon	Peru	Union of South Africa
Canada	India	Libya	Phillipines	Vietnam
Denmark	Indonesia	Nepal	Republic of China	West Germany
England	Iran	Nigeria	Saudi Arabia	

2036 065

SEMINARS, COLLOQUIA, TALKS BY MURR STAFF - JULY 1977 - JUNE 1978

DATE	SPEAKER	TITLE OF TALK	PRESENTED
7/77	M. Kay, D. McKown	Current Research in NAA and RIA	New Chemistry Graduate Students
7/28/77	J. Meese	Silicon Detector Compensation by Nuclear Transmutation	Air Force Materials Lab, Wright-Patterson AFB, Ohio
8/10/77	W. Yelon	Research and Applications at MURR	Studsвик, Sweden
8/24/77	W. Yelon	Research Support at MURR	Stockholm, Sweden
9/77	D. James	Coal Residue Leaching Studies	UMC-Chemistry
9/77	G. Schlapper	Security at the MURR	UMC Police
9/4/77	W. Yelon	Neutron Studies of $Y_6(FeMn_{1-x})_{23}$	Kjeller, Norway
9/28/77	F. Hansen	Neutron Scattering from Non-Crystalline Materials	UMC-Physics
10/5/77 10/12/77	F. Hansen	Problems in Adhering Reliable Pair-Distribution Functions for Non-Crystalline Materials	UMC-Physics
10/6/77	R. Brugger	Possible Research Projects at MURR	UMC-Nuclear Engineering
10/6/77	G. Schlapper	Neutron Tomography at MURR	UMC-Nuclear Engineering
10/21/77	D. McKown	NAA Research Opportunities at MURR	UMC-Chemistry
10/21/77	M. Kay	Biomedical Research Opportunities at MURR	UMC-Chemistry
10/27/77	J. Meese	Transmutation Doping in Semiconductors - A New Reactor Technology	UMC-Nuclear Engineering
11/18/77	D. Mildner	Moderator Design for Pulsed Neutron Sources	Univ. of Michigan-Nuclear Engineering

<u>DATE</u>	<u>SPEAKER</u>	<u>TITLE OF TALK</u>	<u>PRESENTED</u>
11/28/77	D. Mildner	Small Angle Neutron Scattering Instrumentation - Conventional and Time-of-Flight	Argonne National Laboratory Solid State Science
12/77	R. Berliner	The Design of the Small Angle Neutron Scattering Instrument at MURR	National Bureau of Standards
12/4/77	W. Yelon	Neutron Studies of Ferrous Halides	GM, Warren, Michigan
1/78	M. Kay	Current Research in Radioisotopes	UMC-Biology Majors Assoc.
1/78	D. Alger	MURR Research Related to Agriculture	UMC-Agriculture Faculty Dinner
1/78	D. Alger	Research Interests	UMC-Nuclear Engineering
1/17/78	R. Brugger	Safety of Nuclear Energy	UMC-Civil Engineering
1/19/78	R. Brugger	Safety of Nuclear Energy	Columbia Rotary Club
2/78	M. Kay	MURR as Part of the Comprehensive Cancer Research Center	Cancer Research Center
2/78	M. Kay	Isotope Production and Research at MURR	Nuclear Medical Technology Students, Research Medical Center, Kansas City
2/1/78	R. Brugger	Safety of Nuclear Energy	Pacaderm Club
2/2/78	J. Meese	Neutron Transmutation Doping of Silicon	UMR-Physics
2/2/78	S. Morris	The Analysis of Biomedical Samples by Neutron Activation Analysis	UMC-Chemistry
3/78	F. Tsang	Neutron Filtered Beams at MURR	National Bureau of Standards

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<u>DATE</u>	<u>SPEAKER</u>	<u>TITLE OF TALK</u>	<u>PRESENTED</u>
3/6/78	T. Blewitt	Radiation Effects in Solids	UMR-Nuclear Engineering
3/17/78	F. Hansen	Band Structure Model for Hindered Rotation in Molecules and for Liquids	UMC-Physics
3/22/78	W. Yelon	Neutron Studies of Ferrous Halides	Rice University, Houston, Texas
3/27/78	R. Brugger	Use of Filtered Beams for Doppler Effect Studies and Neutron Tomography	UMR-Nuclear Engineering
3/31/78	D. McKown	NAA of Geological Materials	U. S. Geological Survey- Denver, Colorado
4/78	F. Tsang	Doppler Effect Measurements of ^{238}U	UMC-Nuclear Engineering Seminar
4/78	R. Brugger	Research and Applications at MURR	EG&G Seminar
4/78	R. Brugger	Safety of Nuclear Energy	Lions Club
4/12/78	W. Yelon	Multi-Use Gamma Facility	Los Alamos Scientific Laboratory
4/22/78	R. Brugger	MURR-New Facilities and Nuclear Physics Experiments	UMC-Physics Review
4/22/78	W. Yelon	Neutron Scattering Studies of Solids	UMC-Physics Review
4/29/78	A. Pringle	A Small Angle Neutron Scattering Experiment at MURR	Missouri Academy of Science , Joplin, Missouri
4/29/78	R. Brugger	Research and Applications at the University of Missouri Research Reactor	Missouri Academy of Science, Joplin, Missouri
5/1/78	F. Hansen	Band Structure Model for Hindered Rotation in Molecules and for Liquids	UMC-Physics
5/5/78	D. Mildner	Neutron Scattering and Biological Applications	UMKC-Chemistry
5/10/78	D. Mildner	SANS Facility at MURR	UMC-Physics

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<u>DATE</u>	<u>SPEAKER</u>	<u>TITLE OF TALK</u>	<u>PRESENTED</u>
5/12/78	R. Brugger	Doppler Effect Measurements of ^{238}U	LASL Physics Seminar
5/15/78	D. McKown	Size Fractionization of Trace Elements on Airborne Particulates: NAA Studies	Washington State Univ.-Chemistry
6/1/78	W. Yelon	The MURR Gamma Ray Facility	ILL, Grenoble, France
6/6/78	W. Yelon	Neutron Scattering Facilities at MURR	ILL, Grenoble, France
6/7/78	W. Yelon	Neutron Studies of Rare Earth Magnets	CNRS, Grenoble, France
6/7/78	J. Meese	Neutron Transmutation Doping and Radiation Damage in Silicon	Argonne Natl. Lab-Materials Science Division
6/9/78	W. Yelon	Neutron Scattering Facilities at MURR	CEN, Saclay, France

690 9306

COURSE LECTURES PRESENTED BY MURR STAFF - JULY 1977 - JUNE 1978

<u>DATE</u>	<u>LECTURER</u>	<u>COURSE, TITLE OR SUBJECT OF LECTURE</u>	<u>UNIVERSITY & DEPARTMENT</u>
8/77	M. Kay	Chemistry 461 - Advanced Radiochemistry	UMC-Chemistry
9/13/77	M. Kay	Panel Discussion on Trace Element Analysis and Sampling	UMMC-Pathology
9/15/77	M. Kay	Radiation Biology 328-MURR and Nuclear Medicine and Research	UMC-Chemistry
10/77	M. Kay	Radiation Pharmacology 324	UMC-Chemistry
10/17-31/77	D. McKown	Biochemistry 310-Neutron Activation Analysis	UMC-Chemistry/Biochemistry
10/17-31/77	D. McKown	Biochemistry 310-Lab-Neutron Activation Analysis	UMC-Chemistry/Biochemistry
3/20-21/78	D. McKown	Physics 307-Gamma-ray Spectroscopy	UMC-Physics
4/19/78	D. James	Isotope Applications: NAA Facilities at MURR	UMC-Agronomy
4/20/78	D. McKown	Agronomy 401-Radioisotope Methods	UMC-Agronomy
4/25/78	S. Morris	Nuclear Engineering 305-Neutron Activation Analysis	UMC-Nuclear Engineering
4/27/78	D. McKown	Geology 210-Neutron Activation Analysis	Southwest Missouri State-Geology
5/78	J. Meese	Statistical Mechanics Class-Semiconductor Statistics	UMC-Physics
5/5/78	D. Mildner	Neutron Scattering and Biological Applications	UMKC-Chemistry

2036 070

COURSES & LABS TAUGHT BY MURR STAFF - JULY 1977 - JUNE 1978

<u>STAFF MEMBER</u>	<u>COURSE TITLE AND NUMBER</u>	<u>COURSE HOURS</u>	<u>NUMBER OF STUDENTS</u>
M. Kay	Chemistry 568-Radiochemistry - University of Missouri-Kansas City	2	22
M. Kay	Chemistry 568-Radiochemistry Lab - University of Missouri-Kansas City	1	12
S. Morris	Forensic Laboratory Techniques - Northeast Missouri State University	3	20
D. McKown/M. Kay	Chemistry 461-Advanced Nuclear Chemistry	3	6
D. McKown/M. Kay	Chemistry 361-Radiochemistry	3	17
R. Brugger	Training Session at MURR-Philosophies of Research Reactor Operations	1	8
J. Meese	Electrical Engineering 401-Solid State Theory	3	9
J. Meese	Physics 311-Optics	3	3
J. Meese	Physics 311-Optics Lab	1	3
D. Alger	Training Session at MURR - Philosophies of Research Reactor Operations	1	8
T. Blewitt	Physics 473, Nuclear Engineering 401 - Radiation Effects in Solids	3	12

2036 071

CONFERENCES SPONSORED BY MURR

<u>DATE</u>	<u>CHAIRMAN</u>	<u>CONFERENCE</u>	<u>NUMBER OF ATTENDANTS</u>
4/23-26/78	J. Meese*	Second International Conference on Trans- mutation Doping in Semiconductors, University of Missouri-Columbia	114

VICE CHAIRMEN

R. Berliner

S. Gunn

10/10-14/77	J. Vogt	Third International Conference on Nuclear Methods in Environmental and Energy Research, University of Missouri-Columbia	126
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2036 072

RESEARCH

SUPPORTED BY MURR - JULY 1977 - JUNE 1978

- SUPPORTED THE RESEARCH OF 108 FACULTY AND 76 GRADUATE STUDENTS FROM 31 DEPARTMENTS OF THE UNIVERSITY OF MISSOURI AND 14 OTHER UNIVERSITIES
- SUPPORTED THE RESEARCH LEADING TO 52 JOURNAL AND PROCEEDINGS PUBLICATIONS FROM THE UNIVERSITY OF MISSOURI AND OTHER UNIVERSITIES
- SUPPORTED RESEARCH LEADING TO 41 PAPERS PRESENTED AT PROFESSIONAL MEETINGS
- SUPPORTED RESEARCH LEADING TO THE GRANTING OF 4 PH.D. DEGREES AND 8 MASTERS DEGREES
- PROVIDED THE FINANCIAL SUPPORT FOR 8 FACULTY (8 FTE), 21 GRADUATE STUDENTS (14 FTE) AND 16 UNDERGRADUATE STUDENTS (14.5 FTE)
- SECURED RESEARCH EQUIPMENT WORTH \$119,000 BY GIFTS, LOANS, AND GRANTS AND WORTH \$187,000 BY PURCHASES FROM MURR FUNDS
- SUPPORTED 61 GRANTS AND CONTRACTS TOTALING \$7,521,638
- SUPPLIED 166 SHIPMENTS OF 39 DIFFERENT ISOTOPES
- MADE 262 NEUTRON RADIOGRAPHS FOR 8 STUDENTS AND FACULTY FROM 4 DEPARTMENTS
- ANALYZED ABOUT 4900 SAMPLES USING NEUTRON ACTIVATION ANALYSIS
- PROVIDED EXPERT TESTIMONY IN 7 COURT CASES

2036 073

MURR SUPPORTED RESEARCH - JULY 1977 - JUNE 1978

<u>UNIVERSITY & DEPARTMENT</u>	<u>FACULTY/MURR STAFF</u>	<u>STUDENTS</u>	<u>TITLE OR BRIEF DESCRIPTION OF RESEARCH</u>
UMC-Physics, Chemistry	Danner, Kim		Molecular Dynamics of Hydrogenous Solids
Univ of Michigan, UMC-Physics	King, Werner/Mildner	Pringle	Small Angle Scattering
Univ of Michigan- Nuclear Engineering, UMC-Physics	King, Werner/Berliner, Mildner, Yelon, Brugger	Pringle Koepp Butterfield Ball	Fabrication and Testing of the Small Angle Neutron Spectrometer Detector Array
UMC-Nuclear Engineering	/Vogt	Acobyan	Trace Element Studies of Lung Tissue as Related to Pulmonary Diseases
UMC-Nuclear Engineering	/Vogt, James, McKown	Asprer	Study of Selenium in Phillipine Foods
UMC-Reproductive Biology	Fahim/Vogt		Trace Elements in Crystals from Bladders and Kidneys
Internatl. Atomic Energy Agency & World Health Organization	Parr/Vogt, James, Carni		Trace Elements in Human Milk
UMC-Chemistry	Loeppky/Vogt, James, Graham	Smith	Study of Carcinogens in Public Drinking Water Supplies in Missouri
Internatl. Marine Lab. of Monaco	Fukai/Vogt, James		Interlaboratory Studies of Fish Tissue
UMC-Agronomy	Matches, Martz/Vogt	Anderson	Cerium and Chromium as Tracers in Studies of Digestibility in Ruminants
UMC-Archaeology	Brock/Vogt		Human Bone Studies Related to Southwest Missouri

2036 074

UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
UMC-Bioengineering	Larsen/Schlapper, Brugger	Keller, Milan, David	The Development of Neutron-Gamma Tomography for Non-Destructive Testing
UMC-Nuclear Engineering	Loyalka/Schlapper	Hwang, Golshani, Hussain	Employment of the SCALE Program for Licensing of Spent Fuel Shipping Casks
UMC-Archaeology	R. Benfer, A. Benfer/ Vogt		Studies of Ancient Human Bone from Peru
UMR-Nuclear Engineering	Sanders/Schlapper	Punyakumleard	Utilization of MURR Waste Heat
Amoco Research Center	Wennerberg/Hansen, Mildner		Structure of Amoco Active Carbon
UMC-Physics UMR-Physics	Taub, Alldredge/ Hansen		Theoretical Calculation of the Dynamics and Ori- entation and Position of Hydrocarbons Absorbed on a Graphitized Carbon Powder Using Either Empirical Potentials or a Hartree Fock Scheme in the Mindo 3 Approximation
UMC-Nuclear Engineering	/Brugger	Tsang	Development of a Sc Filtered Beam with Better Signal to Background Ratios
UMC-Nuclear Engineering	meyer, Miller/ Brugger		Design of a Filtered Beam to Yield Neutron Flux Distributions Similar to Those Formed in Fusion Reactors
UMca-MURR	/Brugger		Use of the LAMPF-NNR to Measure the Transmission as a Function of Neutron Energy for Si Single Crystal Filters
UMca-MURR	/Alger, Brugger		Development of a Method to Distinguish ^{10}B From Natural Boron in Epoxy Mixes

2036 075

UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
Brookhaven Instruments	Wood/Meese, Gunn, Berliner, Alger		Precision Neutron Irradiation System for Transmutation Doping
Ortec	Hyder/Meese		Transmutation Compensated Si-Particle Detectors
Rockwell Internatl.	Austerman/Meese, McKown		Transmutation Compensated Extrinsic IR Detector Arrays
Sandia Natl. Lab	Stein/Meese		Optical Absorption of NTD-Si
UMC-Nuclear Eng., Electrical Eng.	Larson/Brugger, Schlapper	Koeppel	Neutron/Gamma Tomography Development as a Tissue and Body Scanning Method
UMC-Plant Pathology	Sehgal/Mildner		Structure of Southern Bean Mosaic Virus
General Motors-Physics	Keem/Mildner		Structural Studies of Minerals and Glasses
UMC-Physics	Cowan/Meese	Haifa	EPR of NTD-Si
UMC-Physics	Chandrasekar/Meese	Lindley	Advance Techniques for Detector Compensation by Transmutation Compensation
UMR-Physics	Hale/Meese	Katz	EPR of NTD-Si
UMC-Electrical Engineering	Charlson/Meese	Glairon	Resistivity Fluctuations in NTD-Si
Univ of Chicago- Physics	Fritzsche/Meese	Vesaghi	Transmutation Doping of GaAs
Univ of Southern Illinois at Edwards- ville-Physics	Baldwin/Meese		Electron Microscopy of NTD-Si

2036 076

<u>UNIVERSITY & DEPARTMENT</u>	<u>FACULTY/MURR STAFF</u>	<u>STUDENTS</u>	<u>TITLE OR BRIEF DESCRIPTION OF RESEARCH</u>
UMC-Human Nutrition, Food and Food Science Management	Dowdy/James		Trace Element Nutrition Studies
UMca - ETSRC	Lichte/James		Evaluation of Hair Washing Techniques Prior to Analysis
UMC-Forestry	Settergren/McKown	Tennyson	Bromide Ion Tracer and Post Sampling NAA for Evaluation of Irrigation Waste Water Movement
UMC-Nuclear Engineering	Meyer/McKown	Reed	Size Fractionization of Trace Elements on Air Pollution Particulates
Univ. of Kentucky- Chemistry	Ehmann/McKown	Strobe	Analysis of Lunar Rocks Using NAA
UMC-Chemistry	Manahan/McKown	Shaw	INAA of Shale Oils, Tars, and Waxes
UMC-Animal Husbandry	Martz/McKown	Weiss	INAA of Cerium and Chromium Stable Element Nutritional Markers
UMC-Archaeology	Rowlett/McKown	Garrison	NAA Characterization of Ancient Coinage Manufacture
UMC-Anthropology	Wood/McKown	Tippett	NAA Characterization of Pottery Sherds
UMC-Archaeology	Rowlett/McKown	Ives	Trace Element Characterization of Prehistoric Chert Sources
UMC-Chemistry	Manahan/McKown	Ting	Evaluation of Trace Element Behavior During Coal Pyrolysis
UMC-Chemistry	Harris/McKown	Saremi	Evaluation of Low Energy Photons for INAA
UMC-Chemistry	Manahan/McKown & James	Graham	Trace Element Chemistry During Coal Hydrogenation

2036 077

UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
UMC-Forestry	McGinnes/McKown	Smith	INAA of Walnut Wood Samples
Univ of Chicago- Geochemistry	Davis/McKown & James		NAA of Meteoritic Inclusions
Southwest Missouri State-Geology	Mantei/McKown		Elemental Association in Mineral-Bearing Rocks: Geochemical Prospecting Studies
UMC-Forestry	McGinnes/McKown	Cutter	NAA Study of Chemical Changes in Wood During Charcoaling
UMR-Chemistry	Manuel/McKown	Ballard, Oliver	NAA Measurement of Isotopic Anomalies in Mete- oritic Materials
Univ of Kentucky- Chemistry	Ehmann & Bruckner/ McKown		Evaluation of Boron Carbide Epithermal Irradiation Containers and INAA of Coal
Indiana Univ- Environmental Studies	Siddigi/McKown	Hudson	Measurements of Trace Element Pollutants in Waste Water Sediments Using NAA
Southeast Missouri State-Chemistry	Bahn/Morris		The Analysis of Bioenvironmental Samples for As and Se by NAA; A Study of the Effect of a Coal- Fired Power Plant in a Rural Area
UMC-Chemistry Stephen's-Chemistry UMMC	Koirttyohann, H. Anderson Nolph, W. Anderson/ Morris, Kay		Analysis of Dialysates for Trace Elements via NAA. Samples have been generated in clinical studies evaluating continuous ambulatory peritoneal dialysis (CAPD)
UMC-Chemistry	Murmann/Morris	Giese	Oxygen-18 Exchange Studies in a Complex Vanadium Oxyanion Using 49V
UMC-Nuclear Engineering	Miller/Morris	Korsah	Development and Evaluation of Charcoal Filter Standards to be Used in the Determination of Radio- Iodine Gaseous Effluent Concentrations

2036 078

UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
UMC-Chemistry	Koirttyohann/James	Carni O'Halloran	Use of ^{58}Fe as a Stable Isotope Tracer for Iron Absorption Studies
UMC-Child Health	Woodruff/James	Carni	Iron Utilization in Anemic Infants
UMC-Civil Engineering	Novak/James	Clevenger	Recovery of Metals from Electroplating Wastes
UMC-Nuclear Engineering	Miller/Kay, Moore		Nuclear Medical Patient Dose Rate Studies in Phantoms
UMR-Chemistry	Ballard/Kay		Use of Co-60 to Produce Gem Quality Smoky Quartz from Clear Arkansas Quartz Crystals
UMC-Chemistry	Troutner/Kay	Gilmer	Use of Stable Ca Tracers to Study Ca Balance in Pituitary Dwarfism
UMC-Agronomy	Graham/Kay	Zibilske	Used Co-60 Facility to Sterilize Soil Samples
UMC-Chemistry	Troutner/Kay	Riggs	Te-123 as a Nuclear Medical Calibration Standard and Cross Section for Production Reaction
UMC-Chemistry	Troutner/Kay	May	Trace Elements in Infant Formulae
Stephen's College	Anderson/Kay	Redman	Preparation of Cr-51 EDTA for Use in Heart Tissue Culture
UMC-Agronomy	Larson/Kay	Cooper	Irradiation of Seeds in Co-60 Facility for Class Project
UMC-Physics	Shupp/Kay, Moore		18 Sources Prepared for Electron-Shake-Off Experiments
UMC-Civil Engineering	O'Connor/Kay	Thiem Badorek	Halogens in Finished Water from Treatment Plant by NAA

2036 079

UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
UMC-Anthropology	Rowlett/Kay	Garrison	Co-60 Irradiation of Archeology Samples and α -Counting of Samples
UMC-Anthropology	Rowlett/Kay	Johansen	Co-60 Irradiation of Archeological Pottery and Ceramic Samples for TLD Dating
UMR-Chemistry	Stoffer/Kay		Radiation Polymerization of Silicone and Starch Polymers Using Co-60
UMC-Chemistry, UMMC, VAH-Nuclear Medicine	Troutner, Holmes, Logan/ Kay, Moore		Preparation of a ^{113}Sn - ^{113}In Generator for Human Use
UMC-Chemistry, UMMC, VAH-Nuclear Medicine	Troutner, Holmes, Logan/ Kay, Moore		New Nuclear Medical Scanning Agents
UMMC-Nephrology	Nolph/Morris, Kay, Moore		Trace Elements in Continuous Ambulatory Peritoneal Dialysis (Preliminary Data for Proposal)
UMMC-Nephrology, Dermatology	P. Anderson, H. Anderson, Nolph/Morris, Kay, Moore		Trace Element Behavior in Psoriasis Patients Undergoing Peritoneal Dialysis
Scripps Inst. of Oceanography, UCSD	Desaedeleer/Kay, Moore		Irradiation of Rock Samples for Studies on Vapor Pressure of Trace Metals
UMMC-Medicine, VAH	Ivey/Kay, Moore		Cr-51 for Oral Human Use in Studies of Drug Absorption from the Stomach
Washington Univ	Westerburg/Kay		Preparation of Separated Isotope Sources for Nuclear Spectroscopy
UCLA Med School	Crevey, Rau, Bridge/Kay, Moore		Preparation of Very Pure Na-24 and K-42 for Ion Transport Studies in Human Heart Tissue Cultures

2036 080

UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
UMC-Nuclear Engineering	Bull/Morris	Langhorst	Quantitative Evaluation of ^3H Release From MURR and Identification of Individual Contributing Sources
UMca-MURR	/Morris		Sampling, Effect of Storage, and Rapid Analysis of Drinking Water for Selenium by INAA
Purdue-Food Science and Nutrition	Liu/Morris		Studies to Further Illuminate the Dietary Requirement and Useful Chemical Form of Chromium
UMC-Chemistry	Kaiser/Morris, Baxter		Analysis of Evidence Samples in Criminal Cases via NAA
General Motors	Keem, Lee/Yelon		Magnetic Structure of NdCo_{17} and NdFe_{17}
UMR-Chemistry	Long/Mildner		Magnetic Structure of Bis-Pyridine Dichlorides
General Atomic	Whittemore/Yelon		Precipitation of High Temperature Stainless Steel Alloys
Purdue-Chemistry	Honig/Yelon, Werner		Charge Density Waves in V_2O_3
Purdue-Physics	Overhauser, Collella, Werner/Staudenmann, Yelon		Neutron Interferometry
ILL-CNRS Grenoble	Vettier/Yelon		Phonon Dispersion in FeClBr and FeBr_2
Purdue	Collella/Werner		Debye Waller Factor in KCl
Brookhaven UMC-Physics	Passell Taub, Danner/Mildner	Talent	Adsorbed Hydrocarbon Films
Purdue, GM	Honig, Keem/Yelon		Phonons in V_2O_3 and the Metal-Insulator Transition
UMC-Chemistry	Schlemper/Mildner	Hsu Hussain	Neutron Diffraction Studies of Short Hydrogen Bonds

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<u>UNIVERSITY & DEPARTMENT</u>	<u>FACULTY/MURR STALL</u>	<u>STUDENTS</u>	<u>TITLE OR BRIEF DESCRIPTION OF RESEARCH</u>
UMC-Chemistry	Schlemper, Malin		Electron Density of Nitroprusside Ions
UMR-Chemistry	/Yelon	Alkire	Elastic Gamma Ray Scattering
UMC-Physics	Schupp/Yelon		Inelastic Gamma Ray Scattering
UMC-Physics	/Werner	Kim	Neutron Interferometry
UMC-Physics	/Tompson, Yelon	McCarthy	Inelastic Scattering Studies of $Pb_xSn_{1-x}Te$ Alloys
Idaho State Univ.- Physics, UMca-MURR	McMurry/Hansen		Calculation of Neutron Transition Intensities for Excitations of the Hindered Urethyl-Rotor in 4-Methyl-Pyridine
Idaho State Univ.- Physics, UMca-MURR	McMurry/Hansen		The Use of Relative Rotations and Translations of Molecules or Groups of Atoms as Coordinates for Crystal Potentials
UMca-MURR	/Hansen, Brugger		Development of a Profile Analysis of Neutron Time- of-Flight Spectra Data
UMca-MURR	/Hansen		A New Computational Method for Obtaining Reliable Pair Distribution Functions of Non-Crystalline Materials from Diffraction Data
UMca-MURR	Pederseu, Carneiro/ Hansen		Development of a Self-Consistent Method for Cor- recting Inelastic Neutron Scattering Data for Multiple Scattering Using the Experimental Dy- namic Structure Factor $S(H,W)$
UMR-Chemistry	James/Yelon	Hardman	Magnetic and Crystallographic Ordering in Re_6 $Re_6(Fe_xMn_{1-x})_{23}$ Alloys
UMKC-Geology	Coveney/Yelon		Mineralogenesis in Quartz
Iowa State- Chemistry	Jacobsen/Yelon	Fuller	ZrBrD and Related Compounds Absorption in Hydrogen

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UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
UMC-Physics	Gurmen/Tompson, Yelon		CeB ₆ and Other Hexaborides
UMC-Physics UMR-Ceramic Eng.	Ownby/Tompson, Mildner		¹¹ Bp-Structure
Univ of Pittsburgh	Malik, Wallace/Yelon		Magnetic Structure and Hydrogen Positions in Th ₆ Mn ₂₃ D ₃₀
General Motors	Keem, Croat/Yelon		Magnetic Structure of TbFe ₃ and ErFe ₃
Washington Univ- Biological Chemistry	Banaszak/Mildner		Structure of Crystalline Xenopus Yolk Lipoprotein
UMR-Chemistry	Long/Mildner		One-Dimensional Magnetic Ordering of Transition Metal Bispyridine Dichlorides
UMKC-Chemistry	Schmitz/Mildner		Conformational Studies of Chromatin
UMKC-Chemistry	Cheng/Mildner		Calcium with Sodium Salt of Nitrilotriacetic Acid
UMC -Electrical Engineering	Charlson/Meese	Glairon Charlson	Transistor Gain Trimming on I ² L Integrated Circuits by Transmutation Doping
UMC-Chemical Engineering	Retzloff/Mildner		Catalyst La _{0.9} (Sr/Th) _{0.1} CO ₃
UMC-Electrical Engineering	Charlson/Meese	Glairon	Isochronal Annealing of NTD-Si
UMC-Electrical Engineering	Charlson/Meese	Richardson	Photoconductivity Null Apparatus

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UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
UMC-Mechanical Engineering	Creighton/Meese	Morris	Corrosion Fatigue Characterization of Reactor Pressure Vessel Steels
UMC-Mechanical Engineering, Physics, Nuclear Engineering	Hoepfner, Blawitt/ Meese	Morris Sweigert	Fatigue of Neutron Irradiated Ni
UMC-Nuclear Engineering	/Brugger	Tsang	Doppler Effect Measurements of ^{238}U as a Metal and as U_3O_8
UMC-Nuclear Engineering	/Brugger	Tsang	Doppler Effect Measurements of Sn in the Gray, White and Liquid Phases
UMC-Nuclear Engineering	Bull/Alger, Brugger	Julian	New Fuel Design for MURR
UMC-Nuclear Engineering	/Brugger	Hanna	Development of a Neutron Beam for Prompt Gamma NAA
UMC-Nuclear Engineering	/Brugger		Implosion of Pellets Containing ^{238}U or Transceramic Elements: An Alternate Fuel Cycle & Waste Burner
Purdue-Physics	Grabowski, Ramdas/ Meese	Jagannath	Phosphorus Transition Optical Line Widths in Trans- mutation Doped Si
UMC-Nuclear Engineering	/Alger	Liu	Characterization of Neutron Radiographic Imaging Systems
UMC-Nuclear Engineering	Bull/Alger	Panhuis	Development of Real-Time Imaging Systems for Neutron Radiography
UMR-School of Mines	/Alger	Woolsey	Measurement of Moisture Distribution in Shale

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UNIVERSITY & DEPARTMENT	FACULTY/MURR STAFF	STUDENTS	TITLE OR BRIEF DESCRIPTION OF RESEARCH
UMMC-Medicine	Mullen/Kay	H. Lite D. Wilson	Co-60 Irradiation of Mice to Suppress Their Immune Response System
UMMC-Medicine	Mullen, Cooperstock/Kay, Moore		Laboratory Space, Technical Assistance, and Waste Handling for I-125 Labeling of Proteins, Hormones, and Other Organic Structures for Radioimmunoassay Studies
UMMC-Physiology	Jones/Kay, Moore	Myer Warden Lui Heidlage	Hypertensive Mechanism and Vascular Ion Transport
UMC-Biochemistry	Luckey/Kay		Demonstration of Radiation Hormesis in Protista and Mice

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PUBLICATIONS FROM USE OF MURR - JULY 1977 - JUNE 1978

<u>AUTHOR</u>	<u>TITLE</u>	<u>JOURNAL</u> / <u>STATUS</u>	<u>CAMPUS/DEPARTMENT</u>
F. Hansen	A Computer Program for Calculation of Reliable Pair-Distribution Functions of Non-Crystalline Materials from Limited Diffraction Data	Computer Physics / Accepted	UMca - MURR
H. McMurry, F. Hansen	The Use of Relative Rotations and Translations as Coordinates for Crystal Potentials, Part I Theoretical	Journal of Chemical Physics / Submitted	UMca - MURR
H. McMurry, F. Hansen	The Use of Relative Rotations and Translations as Coordinates for Crystal Potentials in Hexamethylenetetramine and Trigonal Selenium, Part II, Applications	Journal of Chemical Physics / Submitted	UMca - MURR
W. Yelon, J. Keem	Elastic Constants of V_2O_3 in the Insulating Phase	Solid State Comm. / Submitted	UMca - MURR
W. James, K. Hardman, W. Yelon, B. Kebe	Structural and Magnetic Properties of $Y_6(Fe_{1-x}Mn_x)_{23}$	Journal de Physique / Accepted	UMR - Material Res. UMca - MURR
V. Liu, J. Morris	Relative Chromium Response as an Indicator of Chromium Status	Amer. Journal of Clinical Nutrition / Published June 1978	UMC - Human Nutrition UMca - MURR
D. McKown & J. Morris	A Rapid Method for Measuring Selenium in Biological Materials	J. Radioanalytical Chemistry 43, 409, 1978 (Invited)	UMca - MURR
R. Murmann & K. Giese (J. Morris acknowledged)	Mechanism of Oxygen-18 Exchange Between Water and the Vanadium (V) Oxyanion: $V_{10}O_{28}^{6-}$	Inorganic Chemistry, 17 1160 (1978)	
A. Jones, R. Sander, D. Kampschmidt	The Effect of Norepinephrine on Aortic K-42 Turnover during deoxycorticosterone Acetate Hypertension and Antihypertensive Therapy in the Rat	Circulation Research / In Press	UMMC - Physiology

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<u>AUTHOR</u>	<u>TITLE</u>	<u>JOURNAL</u>	<u>STATUS</u>	<u>CAMPUS/DEPARTMENT</u>
B. Royer, R. Brugger	Development of an ^{238}U Filtered Beam of 186 eV Neutrons	Nuc. Sci. & Engr.	Published	UMC-Nuclear Engineering, UMca - MURR
H. Taub, H. Danner, Y. Sharma, H. McMurry, R. Brugger	Intramolecular and Surface Vibrat- ory Modes of Butane Absorbed on Graphite Observed by Inelastic Neutron Scattering	Phys. Rev. Letters <u>39</u> 215 (1977)	Published	UMC-Physics, UMca - MURR
H. Taub	Application of Neutron Scattering to the Study of the Structure and Dynamics of Short-Chain Hydrocarbons Absorbed on Small Particles	Inelastic Electron Tunneling Spectro- scopy, ed. by T. Wolfram Springer Series in Solid State Science, Vol. 4, 170 (1978)	Published	UMC-Physics
H. Taub, H. Danner, Y. Sharma, H. McMurry, R. Brugger	Neutron Scattering Study of the Structure and Dynamics of Bu- tane Absorbed on Graphite	Surface Science <u>76</u> , 50 (1978)	Published	UMC-Physics
B. Boland, D. Mildner, G. Stirling, L. Bunce, R. Sinclair, C. Windsor	High Energy Vibratory Spectro- scopy on a Pulsed Neutron Source	Nucl. Instr. & Meth.	To Be Published	Rutherford-NBRU, UMca - MURR, Harwell-Material Physics
H. Danner, H. Kim, Y. Sharma	Low Frequency Skeletal Vibrations in Solid n-Alkyl Bromides by Neutron Inelastic Scattering	J. Chem. Phys.	Being Revised	UMC-Physics, Chemistry

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AUTHOR	TITLE	JOURNAL	STATUS	CAMPUS/DEPARTMENT
P. Lieu, D. McKown, A. McGinnes	Radial Distribution of Six Inorganic Elements in Black Walnut Wood: Effects of Extractions on their Content	Wood Science	Submitted	UMC - Forestry UMca - MURR
D. Slocum, A. McGinnes, D. McKown	Elemental Analysis of Oak and Hickory Charcoal Using NAA	Wood Science	Submitted	UMC - Forestry UMca - MURR
D. McKown & J. Morris	Selenium Analysis Methodology and Applications	Proceedings: 11th Annual Conf. on Trace Substances in Environmental Health	Published	UMca - MURR
L. Tennyson, C. Settergren, D. McKown	Pre-irrigation Assessment of Percolate Water Movement at Effluent Irrigation Sites	J. Environ. Quality	Submitted	UMC - Forestry UMca - MURR
D. James, M. Janghorbani, T. Baxter	Leachability of Neutron Irradiated Fly Ash	Anal. Chem. 49, 1994 (1977)	Published	UMca - MURR MIT
E. Schlemper, C. Fair	A Short, Highly Asymmetrical Intramolecular Hydrogen Bond: A Neutron Diffraction Study of $(Pt(C_5H_{11}N_2O)_2H) + Cl^- \cdot 3.5 H_2O$	Acta Cryst. B33, 2482-2489 (1977)	Published	UMC - Chemistry
C. Fair, E. Schlemper	A Neutron Diffraction Study of Anhydrous Ethylenediamine D-Tartrate	Acta Cryst. B33, 1337-1341 (1977)	Published	UMC - Chemistry
C. Fair, E. Schlemper	A Neutron Diffraction Study of the Short Hydrogen Bond in a Tetradentate α -Amine Oxime Complex of Nickel (II)	Acta Cryst. B34, 436-442 (1978)	Published	UMC - Chemistry
C. Julian, et al.	Technological and Economic Assessment of Use of Highly-Enriched Uranium in Research Reactors	Argonne Natl. Lab. Tech. Memorandum, RSS-TM-3	Published	UMC - Nuclear Engineering

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AUTHOR	TITLE	JOURNAL	STATUS	CAMPUS/DEPARTMENT
D. Mildner, B. Boland, R. Sinclair, C. Windsor, L. Bunce, J. Clarke	A Cooled Polyethylene Moderator on a Pulsed Neutron Source	Nucl. Instr. & Meth. 152 437-446 (1978)	Published	UMca - MURR, Rutherford-NBRU, Harwell-Material Physics, Univ. Kent-Physics
M. Kay, D. Hutcheson, D. Luckey, et. al	Fate of Rare Earth Oxide Dietary Marker in Rats and Pigs	J. Nucl. Med. and Biology	In Review	UMca - MURR, UMC-Biochemistry
A. Jones, L. Miller	Ion Transport in Tonic and Phasic Vascular Smooth Muscles and Changes During Hypertension	Blood Vessels	In Press	UMMC-Physiology
H. Braley-Mullen	Antigen Requirements for Induction of B-Memory Cells	Cellular Immunology	Published	UMC-Medicine
H. Braley-Mullen	Selective Suppression of Primary IgM Responses by Induction of Low Dose Paralysis to Type III Pneumococcal Polysaccharide	Cellular Immunology	Published	UMC-Medicine
H. Braley-Mullen	Conversion of Type III Pneumococcal Polysaccharide Low Responders to High Responders by Immunization with a Thymus-Dependent form of Antigen	Cellular Immunology	Published	UMC-Medicine
H. Braley-Mullen	Secondary IgG Responses to Type 3 Pneumococcal Polysaccharide	European Journal of Immunology	Published	UMC-Medicine

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AUTHOR	TITLE	JOURNAL	STATUS	CAMPUS/DEPARTMENT
D. Mildner	Small Angle Scattering on a Pulsed Neutron Source	Nucl. Instr. & Meth. <u>151</u> 29-39 (1978)	Published	UMca - MURR, Rutherford Lab-NBRU
C. Windsor, R. Heenan, B. Boland, D. Mildner	A Constant Q Spectrometer for Pulsed Neutron Sources	Nucl. Instr. & Meth. <u>151</u> 477-488 (1978)	Published	Harwell-Material Physics, Reading Univ.-Chemistry, Rutherford Lab-NBRU, UMca-MURR
R. Berliner, J. King, D. Mildner	An Inexpensive Method for Testing Position Sensitive Particle Detectors	Nucl. Instr. & Meth. <u>152</u> 431-435 (1978)	Published	UMca - MURR, Univ. of Michigan-Nuclear Engineering
Staff/MURR	University of Missouri Research Reactor Facility	Brochure Published by MURR Staff	Published	UMca - MURR
D. Mildner, C. Windsor	Small Angle Scattering on the Harwell Linac	Nucl. Instr. & Meth.	Submitted	UMca - MURR, Rutherford Lab-NBRU, Harwell-Material Physics
J. Meese	Kinetics of Externally Stimulated Interstitia Release Followed by Vacancy-Interstitia Annihilation	Phys. Rev. <u>16</u> 5466 (1977)	Published	UMca - MURR
W. Richardson, J. Meese	Photoconductivity Null Apparatus for the Determination of Minority Carrier Lifetime	Rev. of Sci. Instr. <u>49</u> 329 (1978)	Published	UMC-Electrical Engineering, UMca - MURR
N. Divis/Editor	Questions & Answers About the Research Reactor Facility, 3rd Edition	Brochure	Published by MURR	UMca - MURR
F. Tsang, R. Brugger	The Differential Cross Section of ²³⁸ U at 144 keV	Nucl. Sci. & Engr.	Published	UMC-Nuclear Engineering, UMca - MURR

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AUTHOR	TITLE	JOURNAL	STATUS	CAMPUS/DEPARTMENT
W. Miller, W. Meyer	The Effect of the Aymuthal Angle on Fast-Neutron Concrete Albedos	Journal Nucl.Science & Eng.	Published	UMC - Nuclear Engr.
F. Hansen	A Computer Program for Normal- ization and Instrumental Correct- ion of Neutron Diffraction Data on Non-Crystalline Materials to Obtain the Static Structure Factor	Computer Physics Communication	Accepted	UMca - MURR
F. Hansen	A Computer Program for Calculation of Parameters Necessary for the Computation of Reliable Pair Distribution Functions of Non-Crystalline Materials from Limited Diffraction Data	Computer Physics Communication	Accepted	UMca - MURR
S. Werner	Applications of Pulsed Neutrons from a Spallation Source	IEEE Transactions on Nuclear Science NS-24, No.3, 981 (1977)	Published	UMC - Physics
C. Morgan, H.Jackson S. Werner	Calculated Cross Sections for Elastic Scattering of Neutrons From Vortex Rings in Liq.He ⁴	Phys.Rev.B.	To be Published	UMC - Physics
S. Werner, J.Staudemann, R. Colell, A. Overhouser	Gravitational and Rotational Effects on the Neutron Phase	Press Conference Series, Oxford Univ. Press	To be Published	UMC - Physics
G. Ford, S. Werner	Scattering of Electromagnetic Waves by a Gyrotropic Sphere	Physics Review	Submitted	UMC - Physics
D. Mildner, J. Carpenter, C. Pelizzari	Multiple Scattering Correction to Neutron Diffraction Data of Isotropic Systems Using Optimized Monte Carlo Techniques	Acta Cryst. <u>A33</u> 954-961 (1977)	Published	UMca - MURR Argonne Natl Lab Univ. of Michigan-N.E.
D. Mildner & J. Carpenter	An Optimized Monte Carlo Simulation for Diffraction Experiments Using Pulsed Neutron Sources	Acta Cryst. <u>A33</u> 962-967 (1977)	Published	UMca - MURR Rutherford Lab-NBRU Argonne National Lab.
D. Mildner	Small Angle Neutron Scattering with Azimuthal Symmetry	Nucl. Instr. & Meth. <u>150</u> 357-359 (1978)	Published	UMca - MURR Rutherford Lab-NBRU

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AUTHOR	TITLE	JOURNAL	STATUS	CAMPUS/DEPARTMENT
H. Braley-Mullen	Secondary IgG Responses to Type III Pneumococcal Polysaccharide	Journal of Immunology	Published	UMC-Medicine
W. Daughton, B. Defacio	Soliton Modulation Widths for $Pb_{1-x}Sn_xTe$ TO-Phonons	Phys. Lett. <u>62A</u> , 203(1977)	Published	UMC-Physics
W. Daughton, C. Tompson, E. Gurnien	Lattice Instability and Phonon Lifetimes in $Pb_{1-x}Sn_xTe$ Alloys	J. Phys. C: Solid State Phys. <u>11</u> , 1573 (1978)	Published	UMC-Physics
W. Daughton, B. Defacio	Lattice Instability and Phonon Lifetimes in $Pb_{1-x}Sn_xTe$ Alloys-Part II	J. Phys. C: Solid State Phys.	Accepted	UMC-Physics

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PAPERS PRESENTED FROM THE USE OF MURR - JULY 1977 - JUNE 1978

AUTHOR	TITLE	CONFERENCE	CAMPUS/DEPARTMENT
S. Morris, L. Bahn	The Analysis of Environmental Impact for Arsenic and Selenium	Missouri Academy of Science Annual Meeting, April 1978	UMca-MURR, SEMSU-Chemistry
L. Bahn, S. Morris	Effects of Coal Burning on Arsenic and Selenium Concentrations in the Environment	Missouri Academy of Science Annual Meeting, April 1978	SEMSU-Chemistry, UMca-MURR
L. Bahn, S. Morris	The Distribution of Arsenic in Soil, Vegetation and Drinking Water in an Area Surrounding a Coal Fired Electric Generating Plant	Southwest Regional ACS Meeting, Little Rock, AR, Sept. 1977	SEMSU-Chemistry, UMca-MURR
D. James, J. Vogt	Automated Determination of Essential Trace Elements in Milk by Neutron Activation	Coordinated Research Program on Comparative Methods for the Study of Trace Elements in Human Nutrition	UMca-MURR
J. Vogt, R. Acobyann	Lustramental NAA of Trace Elements in Blood and Lung Tissue from Patients with Pulmonary Diseases	International Union of Pure and Applied Chemistry Congress, Tokyo, Japan	UMca-MURR, UMC-Nuclear Engineering
R. Stone, D. Hines, D. McKown, S. Gunn	Detection and Identification of Potential Impurities Activated by Neutron Irradiation of Czocharalski Silicon	Second International Conference on Neutron Transmutation Doping of Semiconductors, Columbia, MO, April 1978	Monsanto, Inc., UMca-MURR
H. Danner, H. Kim, Y. Sharma	Neutron Spectroscopic Analysis of the Low Frequency Intramolecular Vibrations in the n-Alkyl Bromides and the n-Alkyl Dibromides	XXIII Symposium on Molecular Spectroscopy, June 12-16, 1978, Ohio State U., Columbus, OH	UMC-Physics, Chemistry
G. Larsen, G. Schlapper	Neutron Cross-Sectional Imagery at MURR	Comp. Conference, San Francisco	UMC-Bioengineering

AUTHOR	TITLE	CONFERENCE	CAMPUS/DEPARTMENT
H. Taub, H. Danner, Y. Sharma, H. McMurry, R. Brugger	Neutron Scattering Study of the Structure and Dynamics of Butane Absorbed on Graphite	IV Rolla Conference on Surface Properties of Materials, Aug. 1977	UMC-Physics
H. Taub, H. Danner, Y. Sharma, H. McMurry, R. Brugger	Neutron Scattering Study of the Structure and Dynamics of Hydrocarbon Molecules Absorbed on Graphite	Midwest Solid State Conference, October 7-8, 1977	UMC-Physics
H. Taub	Neutron Scattering Studies of the Structure and Dynamics of Absorbed Hydrocarbon Films	Conference of UM Physics Dept., UMSL, May 20, 1978	UMC-Physics
J. Meese	The NTD Process - A New Reactor Technology	Second International Conference on Neutron Transmutation Doping of Semiconductors	UMca-MURR
B. Stone, D. Hines, S. Gunn, D. McKown	Detection and Identification of Potential Impurities Activated by Neutron Irradiation of Czochralski Silicon	Second International Conference on Neutron Transmutation Doping of Semiconductors	Monsanto Corporation, UMca-MURR
P. Glairon, J. Meese	Isochronal Annealing of Resistivity in Float Zone and Czochralski NTD-Silicon	Second International Conference on Neutron Transmutation Doping of Semiconductors	UMC-Electrical Engineering, UMca-MURR
L. Katz, E. Hale	ESR in Neutron Transmutation Doped Silicon	Second International Conference on Neutron Transmutation Doping of Semiconductors	UMR-Physics
J. Meese, P. Glairon	Resistivity Fluctuations in Highly Compensated NTD-Silicon	Second International Conference on Neutron Transmutation Doping of Semiconductors	UMca-MURR, UMC-Electrical Engineering

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AUTHOR	TITLE	CONFERENCE	CAMPUS/DEPARTMENT
R. Berliner, S. Wood	A Computer Controlled NTD-Silicon Irradiation System for the MURR	Second International Conference on Neutron Transmutation Doping of Semiconductors	Brookhaven Instruments, UMca-MURR
P. Glairon, E. Caine, E.J. Charlson, E.M. Charlson	Transistor Gain Trimming in I ² L Integrated Circuits Using the NTD Process	Second International Conference on Neutron Transmutation Doping of Semiconductors	UMC-Electrical Engineering, UMca-MURR
P. Glairon, J. Meese	Isochronal Annealing of Neutron Transmutation Doped Silicon	March 1978 Meeting of American Physical Society	UMC-Electrical Engineering, UMca-MURR
P. Glairon, J. Meese	Resistivity Fluctuations in Neutron Transmutation Doped Silicon	March 1978 Meeting of American Physical Society	UMC-Electrical Engineering, UMca-MURR
P. Glairon, W. Richardson	Silicon Doping by Neutron Transmutation	April 1978 Missouri Academy of Science	UMC-Electrical Engineering, UMca-MURR
S. Werner	Applications of Pulsed Neutrons from a Spallation Source	1977 Particle Accelerator Conference, Chicago, IL	UMC-Physics
D. Mildner, C. Windsor	A Filter Method for Small Angle Scattering on a Pulsed Neutron Source	APS Meeting, Washington, D.C., March 1978	UMca-MURR, Rutherford Lab- NBRU, Harwell-Material Physics
R. Berliner, D. Mildner, R. Brugger, J. King, S. Werner, W. Yelon, A. Pringle	Design and Preliminary Test of a Large Area Position Sensitive Neutron Detector	APS Meeting, Washington, D.C., March 1978	UMca-MURR, UMC-Physics, Univ. of Michigan-Nuclear Engineering

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E. Schlemper, B. Hsu	Studies of Electron Density in Short Hydrogen Bonds: Room Temperature X-ray and Neutron Diffraction Study of the Hydrogen Maleale Ion	Gordon Research Conference, Plymouth, NH, June 1978	UMC-Chemistry
E. Schlemper, B. Hsu	Studies of Electron Density in Short Hydrogen Bonds: Room Temperature X-ray and Neutron Diffraction Study of the Hydrogen Maleale Ion	American Crystallographic Assoc., Winter Meeting, Norman, OK, March 1978	UMC-Chemistry
A. Camp	Optimization of UMC Research Reactor Fuel Cycle	ANS, San Diego	UMR-Nuclear Engineering
W. Miller	UNFBENS: On-Line Real-Time Spectrum Unfolding for Benjamin Detectors	ANS, San Diego	UMC-Nuclear Engineering
W. Miller	On-Line Calculation of Experimental Neutron Spectra Uncertainties	ANS, San Diego	UMC-Nuclear Engineering
W. Yelon	The University of Missouri Gamma Ray Facility	Workshop on Intense Capture Gamma Source, ILL, Grenoble, June 1978	UMca-MURR
W. James, K. Hardman, R. Lemaire, W. Yelon	The Magnetic Structure of $Y_6(Fe_{1-x}Mn_x)_{23}$	XIII Rare Earth Conference, Wheeling, WV, October 1977	UMR-Material Research Center, Chemistry, UMca-MURR
S. Gunn, J. Meese, D. Alger	High Precision Irradiation Techniques for NTD Processing at UMC Research Reactor	Second International Conference on Neutron Transmutation Doping of Semiconductors	UMca-MURR

AUTHOR	TITLE	CONFERENCE	CAMPUS/DEPARTMENT
D. Mildner	UMC Research Reactor Small Angle Neutron Scattering Facility	Workshop on Small Angle Scattering of Neutrons by Polymers and Biological Systems, Washington, D. C., March 1978	UMca-MURR
R. Brugger	Regulations and Research Reactors	ANS Winter Meeting, San Francisco	UMca-MURR
F. Tsang	Doppler Effect Measurements of ^{238}U	Midwestern ANS Student Meeting, April 1978	UMC-Nuclear Engineering, UMca-MURR
H. Camp, R. Sanders	Optimization of the UMC Research Reactor Fuel Cycle	ANS Summer Meeting, San Diego, June 1978	UMR-Nuclear Engineering
S. Werner	Neutron Sagnac Effect	Physics Dept., Univ. of Dortmund, West Germany, July 1977	UMC-Physics
S. Werner	Gravitational and Rotational Effects on the Neutron Phase	International Conference on Neutron Interferometry, ILL, Grenoble, France, June 1978	UMC-Physics
A. Pringle	A Small Angle Neutron Scattering Spectrometer at MURR	Missouri Academy of Science, April 1978	UMC-Physics, UMca-MURR
R. Brugger	Research and Applications at the MURR	Missouri Academy of Science, April 1978	UMca-MURR
R. Brugger	Possibility of Doppler Effect Spectroscopy	Midwest Solid State Conference, April 8, 1978	UMca-MURR

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THESES COMPLETED RELATED TO MURR - JULY 1977 - JUNE 1978

<u>STUDENT</u>	<u>DEGREE</u>	<u>CAMPUS/DEPARTMENT</u>	<u>ADVISOR</u>	<u>MURR INTERFACE</u>	<u>TITLE</u>
R. Acobyan	Ph.D.	UMC - Nuclear Engr.	J. Vogt	J. Vogt	Neutron Activation Analysis of Trace Elements in Human Lung
G. Schlapper	Ph.D.	UMC - Nuclear Engr.	S. Bull	-	Midi-Maxi Interaction in the Interpretation of Nuclear Medicine Procedures
B. Strobe	Ph.D.	Univ. of Kentucky	Ehmann	D. McKown	Trace Element Distribution in Lunar Core Samples Using NAA
L. Tennyson	Ph.D.	UMC - Forestry	A. McGinnes	D. McKown	Subsurface Hydrology and Ion Solution Chemistry Related to Effluent Disposal Sites in the Missouri Ozarks
A. Camp	M.S.	UMR - Nuclear Engr.	R. Sanders	J. Schlapper	Optimization of the MURR Fuel Cycle
P. Glairon	M.S.	UMC - Elec. Engr.	J. Charlson	J. Meese	Neutron Transmutation Doping of Semiconductors
J. Gilmer	M.S.	UMC - Chemistry	D. Troutner	M. Kay	Calcium Balance Studies in Pituitary Dwarfism Using Stable Tracers and Neutron Activation Analysis
M. Monzyk	M.S.	UMC - Chemistry	D. Troutner	M. Kay	Standard Independent Yields of Ba-139 and La-147 from Thermal Neutron Fission of Cf-249
E. Noel	M.S.	UMC - Nuclear Engr.	W. Miller	S. Gunn	Preliminary Design of Sample Monitor System

<u>STUDENT</u>	<u>DEGREE</u>	<u>CAMPUS/DEPARTMENT</u>	<u>ADVISOR</u>	<u>MURR INTERFACE</u>	<u>TITLE</u>
C. Riggs	M.S.	UMC - Chemistry	D. Troutner	M. Kay	Te-123m A New Nuclear Medicine Calibration Standard
L. Woolsey	M.S.	UMR - School of Mines	Aughenbaugh	D. Alger	Water Distribution in Shale
M. Reed	M.S.	UMC - Nuclear Engr.	W. Meyer	D. McKown	Selenium Airborne Particle Emissions from Coal-Fired Electric Generating Plants

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FACULTY AND STUDENTS FUNDED BY MURR - JULY 1977 - JUNE 1978

<u>NAME</u>	<u>CAMPUS/DEPARTMENT</u>	<u>F.T.E.</u>	<u>POSITION</u>
R. Brugger	UMC - Physics /Nuclear Engr.	1	Professor
D. Alger	UMC - Nuclear Engineering	1	Assistant Professor
M. Kay	UMC - Chemistry	1	Assistant Professor
J. Meese	UMC - Physics	1	Assistant Professor
D. McKown	UMC - Chemistry	1	Assistant Professor
J. Vogt	UMC - Nuclear Engineering	1	Associate Professor
W. Yelon	UMC - Physics	1	Assistant Professor
T. Blewitt	UMC - Nuclear Engineering, Physics	1	Visiting Professor
G. Asprer	UMC - Nuclear Engineering	1/2	Graduate Student
P. Glairon	UMC - Electrical Engineering	1/2	Graduate Student
T. Baxter	UMC - Business Administration	1	Graduate Student
C. Graham	UMC - Chemistry	1	Graduate Student
G. Schiapper	UMC - Nuclear Engineering	1	Graduate Student
D. McGinty	UMC - Nuclear Engineering	1	Graduate Student
C. McKibben	UMC - Nuclear Engineering	1	Graduate Student
R. Alkire	UMR - Chemistry	1/2	Graduate Student
C. Butterfield	UMC - Physics	1/2	Graduate Student
G. David	UMC - Mechanical	1/2	Graduate Student
M. Golshani	UMC - Nuclear Engineering	1/2	Graduate Student
C. Kim	UMC - Physics	1/2	Graduate Student
J. Lindsay	UMC - Nuclear Engineering	1/2	Graduate Student
T. Liu	UMC - Nuclear Engineering	1/2	Graduate Student
J. Milan	UMC - Nuclear Engineering	1/2	Graduate Student

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A. Punyakumleard	UMR - Nuclear Engineering	1/2	Graduate Student
C. Riggs	UMC - Chemistry	1/2	Graduate Student
M. May	UMC - Chemistry	1/4	Graduate Student
R. Koeppe	UMC - Physics	3/4	Graduate Student
A. Pringle	UMC - Physics	1/2	Graduate Student
S. Talent	UMC - Physics	1/2	Graduate Student
D. Sprague	UMC - Undeclared	1	Graduate Student
C. Anderson	UMC - Elec. Engr.	1	Undergraduate Student
J. Berstler	UMC - Engineering	1	Undergraduate Student
P. Fernandez	UMC - Mechanical Engr.	1	Undergraduate Student
M. Fullerton	UMC - Mechanical Engr.	1	Undergraduate Student
R. Janssen	UMC - Engineering	1	Undergraduate Student
R. McCann	UMC - Electrical Engr.	1	Undergraduate Student
W. Meyer	UMC - Electrical Engr.	1	Undergraduate Student
T. Seeger	UMC - Electrical Engr.	1	Undergraduate Student
R. Swank	UMC - Mechanical Engr.	1	Undergraduate Student
J. Tunink	UMC - Engineering	1	Undergraduate Student
O. Montgomery	Stephens College - Political Sci.	1	Undergraduate Student
D. Bain	UMC - Electrical Engr.	1	Undergraduate Student
E. Ball	UMC - Electrical Engr.	1	Undergraduate Student
T. Kovacs	UMC - Agriculture	1/2	Undergraduate Student
R. Lindley	UMC - Physics	1/2	Undergraduate Student
S. Crowson	Stephens College - Premed.	1/2	Undergraduate Student

RESEARCH EQUIPMENT PROCURED BY MURR - JULY 1977 - JUNE 1978

DESCRIPTION	SOURCE OF FUNDS	(STATUS)	ESTIMATED VALUE & SOURCE	
			MURR	OUTSIDE
MEK 6800 D2 Microprocessor Evaluation Kit	MURR	(delivered)	\$ 300	
1 - SWTPC M ₆₈₀₀ Micro-Computer	SANS (NSF)	(delivered)		\$ 600
150 - Charge Sensitive Preamplifiers	SANS (NSF)	(fabricated in house)		\$ 45,000
50 - Gas-filled Linear Position Sensitive Detectors	SANS (NSF)	(delivered)		\$ 25,500
3 - Computer Interfaces (3XE, 2XE, 3XC)		(fabricated in house)	\$ 3,000	
7 - PDP 11/03 Computers				
3XE	MURR	(delivered)	\$ 3,500	
2XE	MURR	(delivered)	\$ 3,500	
Interferometer	NSF	(delivered)		\$ 3,500
STD	MURR	(delivered)	\$ 3,500	
MUGS (3XC)	NSF	(delivered)		\$ 3,500
SANS	NSF	(delivered)		\$ 3,500
MUGS	NSF	(delivered)		\$ 3,500
6 - Dec Writers				
Interferometer	NSF	(delivered)		\$ 1,350
MUGS (3XC)	NSF	(delivered)		\$ 1,350
STD (two)	MURR	(delivered)	\$ 2,700	
Computer Terminal	MURR	(delivered)	\$ 1,350	
MUGS	NSF	(delivered)		\$ 1,350
50 - Dual Amplifier-ACD Boards	SANS (NSF)	(on order)		\$ 17,500
Misc. Computer Accessories for 11/40				
Memory	MURR	(delivered)	\$ 3,000	
Floppy Disks	NSF	(delivered)		\$ 3,500
Hard Disks	MURR	(on order)	\$ 8,000	

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DESCRIPTION	SOURCE OF FUNDS	(STATUS)	ESTIMATED VALUE & SOURCE		
			MURR	OUTSIDE	
Silicon Transmutation Control System	MURR	(delivered)	\$ 10,000	\$ 10,000	
Germanium Detector	MUGS	NSF	(delivered)	\$ 9,000	\$ 9,000
Electronics	MUGS	NSF	(under construction)	\$ 5,000	\$ 5,000
Source Shield Cask	MUGS	NSF	(built)	\$ 3,000	\$ 3,000
Rotor	MUGS	NSF	(built)	\$ 2,000	\$ 2,000
Full Circle	MUGS	NSF	(built)	\$ 5,000	\$ 10,000
3XC Spectrometer		MURR-Physics		\$ 10,000	\$ 20,000
Detector Box-Shield	3XC	MURR	(installed)	\$ 1,000	\$ 2,000
Displex (Taub)		Research Corporation	(delivered)	\$ 10,000	\$ 10,000
Beam Tube Liner & Collimator E		MURR	(installed)	\$ 1,000	
Si Filter, Beam Port E		Monsanto-MURR	(installed)	\$ 1,000	\$ 3,000
Detector Box-Shield	3XC	MURR	(installed)	\$ 5,000	
Graphite Crystals	SANS	NSF Grant	(delivered)		\$ 2,025
Upper Flight Tube and Detector Housing	SANS	NSF Grant	(under construction)		\$ 5,000
2 - Vacuum Pumps	SANS	NSF Grant	(delivered)		\$ 1,300
HV Power Supply	SANS	NSF Grant	(delivered)		\$ 1,020
Silicon Wafers	SANS	Monsanto Gift			

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DESCRIPTION	SOURCE OF FUNDS	(STATUS)	ESTIMATED VALUE & SOURCE	
			MURR	OUTSIDE
Ultrasonic Cleaner	MURR		\$ 186	
Audio Frequency Generator	MURR		\$ 26	
Portable Oscilloscope	MURR		\$ 318	
Fatigue Experiment Electronics Parts	MURR		\$ 200	
Temperature Controller	MURR		\$ 104	
Fatigue Load Frame	UMC-Mechanical Engineering			\$ 400
Microprocessor and Interface for Tomography data acquisition	Missouri Service Funds(fabricated in house)			
LiF (ZnS) Converter Screen	MURR	(delivered)	\$ 300	
Gold Metal Foil Converter	MURR	(delivered)	\$ 250	
Screens				
New Collimator and Aperture for Neutron Radiography	MURR	(in operation)	\$ 3,000	
Nuclear Data 6620 Pulse Height Analysis System	MURR-MCCJ	(delivered)	\$ 43,000	\$ 9,000
Searle Analytic Liquid Scintillation System	MURR	(delivered)	\$ 11,100	
beam Tube for Beam Port , Shielding and Beam Collimator for Prompt Gamma Neutron Activation Analysis	MURR	(partially built)	\$ 2,000	
		TOTALS	\$118,924	\$187,395

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GRANTS AND CONTRACTS SUPPORTED BY MURR - JULY 1977 - JUNE 1978

<u>PRINCIPAL INVESTIGATOR/ MURR INTERFACE</u>	<u>GRANT TITLE</u>	<u>AGENCY</u>	<u>AMOUNT</u>	<u>STATUS/PERIOD</u>
/J. Meese	Advanced Techniques for Transmutation Compensation of Extrinsic Silicon Detectors, Contract F33615-76-R-5230	Air Force	\$119,995	Funded 2/78-2/80
/J. Meese	Proposal for Conf. Support-Second Internatl. Conf. on Neutron Transmutation Doping in Semiconductors, Contract N0014-78-G-0012	Office of Naval Res., AF Office of Scientific Res.	6,000	Funded 1/78-10/78
D. Creighton, D. Hoepfner/ J. Meese	Corrosion Fatigue Characterization of Reactor Pressure Vessel Steels	Electric Power Res. Institute	998,647	Rejected
K. Schmitz/D. Mildner	Are Half-Nucleosomes Formed in Induced Conformational Transitions in Chromatin Core Particles?: A Small Angle Neutron Scattering Study	NSF	126,283	Pending
G. Long/D. Mildner	One Dimensional Magnetic Ordering of Transition Metal Bispyridine Dichlorides	NSF		To be submitted
/D. Mildner	Conducting Experiments Using a Small Angle Neutron Scattering Spectrometer	NSF		To be submitted
J. Keem/D. Mildner	Structural Studies of Minerals and Glasses	NSF		To be written
O. Sehgal/D. Mildner	Structure of Southern Beam Mosaic Virus	NSF		To be written
/W. Yelon	Missouri Univ. Gamma Spectrometer	NSF	63,100	Funded 3/77-8/78
/W. Yelon	Missouri Univ. Gamma Spectrometer (renewal)	NSF	39,440	Funded 5/78-10/79
S. Werner/W. Yelon	The Metal Insulator Transition in Transition Metal Sesquioxides	NSF	62,299	Funded 8/78

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<u>PRINCIPAL INVESTIGATOR/ MURR INTERFACE</u>	<u>GRANT TITLE</u>	<u>AGENCY</u>	<u>AMOUNT</u>	<u>STATUS/PERIOD</u>
W. Liu/S. Morris	The Role of Chromium Nutrition in Serum Lipid Metabolism	American Heart Assoc.	\$ 25,000	Pending
S. Koirtyohann/D. James	Application of Stable Isotopes and Neutron Activation to the Study of Iron Absorption in Human Subjects	USDA	\$ 95,000	Funded 9/77-9/78
C. Woodruff/D. James	Efficiency of Food Iron Utilization by Infants	NIH	\$273,304	Rejected, to be resubmitted
S. Koirtyohann/D. James	Development of a Sampling and Analytical Design for Effluent Characterization at an MHD Facility	MERDI	\$ 24,953	Funded 6/77-9/77
T. Clevenger/D. James	Characterization of Trace Element Profiles from Small MHD Plants	MERDI	\$ 21,811	Funded 1/78-3/78
T. Clevenger/D. James	Method Development and Analysis for Trace Elements in Samples from Small MHD Plants	MERDI	\$ 19,044	Pending
D. James	Trace Element Balances in Human Nutrition	USDA	\$152,705	Pending
J. Novak/D. James	Recovery of Metals from Electroplating Wastes	USAF	\$123,845	Funded 6/77-10/78
/J. Vogt	Third International Conference on Nuclear Methods in Environmental and Energy Research	ERDA	\$ 3,448	Funded 9/77-2/78
F. Lichte/D. James, J. Carni, J. Vogt	Analysis for Trace Elements in Human Tissues	NIH	\$ 72,517	Funded 6/76-9/77

<u>PRINCIPAL INVESTIGATOR/ MURR INTERFACE</u>	<u>GRANT TITLE</u>	<u>AGENCY</u>	<u>AMOUNT</u>	<u>STATUS/ PERIOD</u>
H. Taub/	Neutron Scattering Study of the Structure and Dynamics of Adsorbed Hydrocarbons	Research Corp.	\$ 4,000	Funded 6/77-6/78
H. Taub, H. Danner/	Neutron Scattering Study of the Structure and Dynamics of Simple Hydrocarbons Adsorbed on Chemically Inert and Catalytically Active Substrates	NSF	\$178,705	Not selected for funding 5/78, to be resubmitted 9/78
R. Brugger	Doppler Effect Measurements	NSF	\$ 42,000	Funded 5/77-10/79
/J. Vogt, D. James, S. Morris, D. McKown	Regional Neutron Activation Analysis Instrumentation Facility	NSF	\$1,601,258	Pending
H. Mullen/M. Kay	Cellular Mechanisms Regulating Antibody Production	NIH	\$ 20,460	Continuation awaiting approval 5/78-4/79
H. Mullen/M. Kay	Cellular and Genetic Regulation of Auto-immune Disease	NIH	\$ 38,084	Funded 5/78-4/79
A. Jones/M. Kay	Study of Altered Ion Transport Properties of Vascular Smooth Muscle Associated with Hypertension	USPHS Heart-Lung Assoc.	\$350,000	Funded through 1982
M. Kay	Trace-Element Exposure from Human Milk and Formulae	NIH	\$168,572	In review
Dr. Forker/M. Kay	Mechanisms of Bile Formation	NIH	\$250,000	Funded through 8/79
Dr. Cooperstock/M. Kay	Pathogenesis of Neonatal Endotoxemia	NIH	\$ 30,000	Funded 7/78-6/79
K. Ivey/M. Kay	Absorption of Drugs from the Stomach	VA	NA	Funded 7/78-6/79

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PRINCIPAL INVESTIGATOR/ MURR INTERFACE	GRANT TITLE	AGENCY	AMOUNT	STATUS/PERIOD
D. Troutner/D. McKown, S. Morris, H. Kay	Undergraduate Research Participation Pro- posal	NSF	\$14,000	Rejected
S. Manahan/D. McKown	Cleaning Coal with Coal	USDI- OWRR	\$10,500	Funded
E. McGinnes/D. McKown	Relative Abilities of Trees in Different Black Walnut Families to Heal Wounds	USDA	\$40,000	Funded 9/76-12/79
C. Settergren/D. McKown	Forest Hydrology Project	McIntire/ Stennes	\$ 7,500	Funded to 12/77
S. Manahan/D. McKown	Cleaning Coal with Coal	DOE	\$20,000	Submitted
/S. Morris	Region III Criminalistics Laboratory	MCCJ	\$28,750	Funded
/S. Morris	Region III Criminalistics Laboratory	MCCJ	\$ 5,268	Funded
Erlin-Himes Assoc./ S. Morris	Neutron Activation Analysis	Erlin- Himes	\$ 1,500	Funded
Mallinckrodt/S. Morris	Neutron Activation Analysis	M/N	\$ 1,200	Funded
American Add-Mixtures	Radioassay Contract	AAM	\$ 1,500	Funded
Mallinckrodt/S. Morris	Radiopharmaceutical Assay Service	M/N	\$ 1,000	Funded
Monsanto/S. Morris	Silicon Radioassay Service	Monsanto	\$ 1,000	Funded
Procter & Gamble/S. Morris	Neutron Activation Analysis	P&G	\$ 250	Funded
V. Liu/S. Morris	A Pilot Study for Using Hair as a Biopsy Material for Chromium Nutritional Status	NIH	\$30,000	Pending

<u>PRINCIPAL INVESTIGATOR/ MURR INTERFACE</u>	<u>GRANT TITLE</u>	<u>AGENCY</u>	<u>AMOUNT</u>	<u>STATUS/PERIOD</u>
/G. Schlapper	Fuel Cycle Support	DOE		Funded 1978-83
/R. Brugger, G. Schlapper	Fuel Fabricator	DOE	\$200,000	Funded 1978-79
W. Miller/G. Schlapper	Three-Dimensional Emission Tomography	NSF	\$ 32,000	Funded 1977-79
E. Schlemper	Study of Short Hydrogen Bonds	NSF	\$ 40,000	Funded 1977-79
H. Anderson/M. Kay	Local Course Improvement Grant	NSF	\$ 7,200	Rejected
W. Yelon/S. Werner	A Regional Center for Neutron and Gamma Ray Scattering	NSF	\$1,979,000	Submitted
J. King/R. Brugger, S. Werner, W. Yelon	Small Angle Neutron Scattering	NSF	\$ 81,000	Funded 8/77-10/78
Vettier/W. Yelon	Studies of Magnons and Phonons in $Fe(Cl_xBr_{1-x})_2$	NATO	\$ 5,100	Funded 8/77
	Magnetic and Crystallographic Structure of Transition Metal - Rare Earth Magnets	ONR-NSF	\$ 70,000	Submitted
James-Lemaire/W. Yelon	Rare Earth Magnets	NSF	\$ 23,000	Funded 5/77-5/78
/C. Tompson	Neutron Scattering from $^{125}SnTe$	NSF		To be renewed
H. Taub/	Study of the Structure and Dynamics of Simple Hydrocarbons Adsorbed on Graphite by Neutron Scattering	Research Corp.	\$ 10,000	Funded 6/77-6/78
H. Taub/	Study of the Structure and Dynamics of Simple Hydrocarbons Adsorbed on Graphite by Neutron Scattering	UMC Research Council	\$ 1,400	Funded 6/77-6/78

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<u>PRINCIPAL INVESTIGATOR/ MURR INTERFACE</u>	<u>GRANT TITLE</u>	<u>AGENCY</u>	<u>AMOUNT</u>	<u>STATUS/PERIOD</u>
J. Pierce/D. James, C. Graham, J. Carni	Chemical Research on Heavy Metals in Bio- logical Materials	USDI	\$145,775	Funded 8/72-12/78
J. Pierce, T. Clevenger/ J. Vogt, D. James, J. Carni, C. Graham	Analytical Sources for Special Measurement Problems	NIOSH	\$ 53,131	Funded 4/77-4/78
		TOTAL	<u>\$7,521,638</u>	

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RADIOISOTOPES SUPPLIED BY MURR - JULY 1977 - JUNE 1978

Special preparation:

Three tritium enriched $\text{Cu}(\text{NO}_3)_2 \cdot 5\text{H}_2\text{O}$ sources for G. Schupp, UMC Physics

Routine Production:

166 shipments to UMC and UMMC users

Isotopes produced were:

Antimony-122	Copper-64	Scandium-46
Antimony-124	Europium-154	Silver-110m
Arsenic-76	Germanium-71	Sodium-22
Barium-131	Gold-198	Strontium-85
Bromine-82	Iodine-125	Tellurium-123m
Cadmium-115m	Lanthanum-140	Tellurium-129
Cerium-141	Mercury-197	Terbium-160
Cerium-143	Mercury-203	Tin-113m
Cerium-144	Molybdenum-99	Tin-119m
Cesium-137	Neodymium-147	Tritium (H-3)
Cobalt-57	Phosphorus-32	Ytterbium-169
Cobalt-60	Potassium-42	Zinc-65
Chromium-51	Rubidium-86	Zinc-69m

Class Use:

Professor L. Bahn (SEMO-Chemistry)	10 isotopes
Professor D. Troutner (UMC-Chemistry)	12 isotopes
Professor G. Schupp (UMC-Physics)	2 isotopes

Produced for Animal, Human, or Tissue Culture Study:

Isotopes:	
Arsenic-76	Potassium-42
Chromium-51	Sodium-24
Lanthanum-140	Terbium-160

21 Tl-201 samples were analyzed in support of a new drug application to the FDA

NEUTRON RADIOGRAPHS MADE AT MURR - JULY 1977 - JUNE 1978 *

<u>FACULTY/STUDENT</u>	<u>CAMPUS/DEPARTMENT</u>	<u>SUBJECT</u>
D. Alger/T. Liu	UMca-MURR, UMC-Nuclear Eng.	Evaluation of Beam Constituents and Sensitivity Levels of Various Screen-Film Combinations for Neutron Radiographic Facility
D. Alger/T. Liu	UMca-MURR, UMC-Nuclear Eng.	Measurements of Modulation Transfer Functions of Neutron Radiographic Imaging Systems
D. Alger/T. Liu	UMca-MURR, UMC-Nuclear Eng.	Determination of L/D of Neutron Radiographic Facility
R. Brugger/S. Hanna	UMca-MURR, UMC-Nuclear Eng.	Determination of Beam Location for Beam Port A
D. Alger/T. Liu	UMca-MURR	Quality Control Service Work and Component Evaluation
L. Woolsey	UMR-Geological Engineering	Determination of Water Distribution in Shale Using Neutron Radiography
C. Tompson	UMC-Physics	Beam Port E Collimator Evaluation
S. Werner	UMC-Physics	Radiograph of Neutron Detectors
R. Brugger/J. Brugger	UMca-MURR	Radiograph of Plants

* Total radiographs made - 262

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MURR USE FOR NEUTRON ACTIVATION ANALYSIS - JULY 1977 - JUNE 1978

IRRADIATIONS:

Pneumatic Tube : 2526 irradiations
In-pool : 108 irradiations

MEASUREMENTS:

Approximately 4900 individual element measurements

RADIONUCLIDES DETECTED:

Na-24
Mg-27
Al-28
Si-31
S-37
Cl-38
K-42
Ca-49
Sc-46
V-52
Cr-51
Mn-56

Fe-59
Co-60m
Co-60
Ni-65
Cu-66
Zn-69m
As-76
Se-75
Se-77m
Br-82
Br-80

Rb-82
As-110
In-116
Sb-122
I-128
Ba-139
La-140
Ce-141
Sm-153
Eu-152
Hg-203

NAA PROCEDURES DEVELOPED FOR:

Lung Tissue
Misc. Foods
Drinking & Waste Water
Hair
Airborne Particulates
Lunar Rocks
Shale Oils
Feces

Ancient Corns
Pottery Sherds
Chert
Coal Combustion Products
Wood
Meteorites
Rocks
Blood Serum

MURR EXPERT WITNESS TESTIMONY INVOLVING EVIDENCE ANALYZED BY NEUTRON
ACTIVATION ANALYSIS WAS PRESENTED BY J. STEVEN MORRIS AND
TERRY BAXTER IN THE FOLLOWING CASES:

COOPER COUNTY CIRCUIT COURT	JULY 6, 1977
ST. LOUIS COUNTY CIRCUIT COURT	JULY 28, 1977
BOONE COUNTY MAGISTRATE COURT	AUGUST 11, 1977
ST. LOUIS COUNTY CIRCUIT COURT	OCTOBER 21, 1977
BUTLER COUNTY CIRCUIT COURT	NOVEMBER 6, 1977
COLE COUNTY CIRCUIT COURT	MAY 10, 1978
BOONE COUNTY CIRCUIT COURT	MAY 31, 1978

SERVICE

PROVIDED BY MURR - JULY 1977 - JUNE 1978

- PROVIDED SERVICE TO 6 OTHER UNIVERSITIES WITHIN THE STATE OF MISSOURI AND 26 OUTSIDE OF MISSOURI
- PROVIDED SERVICE TO 27 STATE AND FEDERAL AGENCIES
- SUPPORTED 14 RESEARCH PROJECTS DIRECTLY RELATED TO MISSOURI
- SUPPORTED 3 RESEARCH PROJECTS DIRECTLY RELATED TO ENERGY CONSERVATION AND DEVELOPMENT
- SUPPORTED 4 MISSOURI INDUSTRIES AND 47 OUT-OF-STATE INDUSTRIES

OTHER EDUCATIONAL INSTITUTIONS SUPPORTED BY MURR - JULY 1977 - JUNE 1978

M. D. ANDERSON HOSPITAL
CALIFORNIA INSTITUTE OF TECHNOLOGY
UNIVERSITY OF CALIFORNIA - LOS ANGELES
UNIVERSITY OF CALIFORNIA - SAN DIEGO
UNIVERSITY OF CHICAGO
UNIVERSITY OF CINCINNATI
UNIVERSITY COLLEGE OF SWANSEA, WALES, UK
IDAHO STATE UNIVERSITY
UNIVERSITY OF ILLINOIS
INDIANA STATE UNIVERSITY
UNIVERSITY OF INDIANA
IOWA STATE UNIVERSITY
UNIVERSITY OF KENTUCKY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
MEDICAL SCHOOL - UNIVERSITY OF CHICAGO
UNIVERSITY OF MIAMI
*MISSOURI SOUTHERN STATE UNIVERSITY
UNIVERSITY OF NORTH CAROLINA
*NORTHEAST MISSOURI STATE UNIVERSITY
NEW JERSEY DENTAL SCHOOL
UNIVERSITY OF OKLAHOMA
OKLAHOMA STATE UNIVERSITY

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UNIVERSITY OF PITTSBURGH

PURDUE UNIVERSITY

RANDOLPH MACON COLLEGE

RUTGERS

SCRIPPS INSTITUTION OF OCEANOGRAPHY

*SOUTHEAST MISSOURI STATE UNIVERSITY

*SOUTHWEST MISSOURI STATE UNIVERSITY

*STEPHENS COLLEGE

STANFORD

*WASHINGTON UNIVERSITY

*MISSOURI BASED

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STATE AND FEDERAL AGENCIES SUPPORTED BY MURR - JULY 1977 - JUNE 1978

AMES LAB - IOWA STATE

AIR FORCE MATERIALS LAB, WRIGHT PATTERSON AIR FORCE BASE

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

AIR FORCE WEAPONS LAB, KIRKLAND AIR FORCE BASE

ARGONNE NATIONAL LABORATORY

CANADIAN CENTRE FOR MINERAL AND ENERGY TECHNOLOGY

CENTER FOR DISEASE CONTROL, U. S. DEPARTMENT OF HEW

CHICAGO METROPOLITAN SANITARY DISTRICT

DEPARTMENT OF JUSTICE

*ELLIS FISCHER STATE CANCER HOSPITAL

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, DOE

ENVIRONMENTAL PROTECTION AGENCY, EPA

*FISH PESTICIDE LABORATORY, COLUMBIA, MO

*HARRY S. TRUMAN VETERANS ADMINISTRATION HOSPITAL, COLUMBIA, MO

IOWA CITY VETERANS ADMINISTRATION HOSPITAL

LOS ALAMOS SCIENTIFIC LABORATORY

*MISSOURI COUNCIL ON CRIMINAL JUSTICE

NATIONAL BUREAU OF STANDARDS

NATIONAL HEART AND LUNG INSTITUTE

NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH

NATIONAL INSTITUTES OF HEALTH

OFFICE OF NAVAL RESEARCH

OAK RIDGE NATIONAL LABORATORY
PATUXENT WILDLIFE RESEARCH CENTER, USDI
SANDIA NATIONAL LABORATORY
USDA HUMAN NUTRITION LABORATORY, GRAND FORKS, ND
USDA VITAMIN MINERAL NUTRITION LABORATORY, BELTSVILLE, MD

*MISSOURI BASED

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MURR RESEARCH RELATED TO ENERGY CONSERVATION - JULY 1977 - JUNE 1978

- Study to heat MURR building with MURR waste heat to demonstrate energy conservation and use of low temperature water.
- NAA research for evaluating trace element profiles for MHD (magnetohydrodynamic) coal combustion.
- NAA research and methods development for elemental analysis of coals and coal products.

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MURR RESEARCH DIRECTLY RELATED TO MISSOURI - JULY 1977 - JUNE 1978

- Evaluate hydrologic behavior of common Ozark terrain related to forest and irrigation for timber crop improvement (NAA).
- Study discoloration defects in black walnut (Missouri's No. 1 timber crop) to improve tree management and harvest methods (NAA).
- Study chemical parameters related to charring conditions and charcoal yield. Charcoal is a major outlet for Missouri hardwood (NAA).
- Determine the extent and effects of selenium deficiency in Missouri livestock to improve feed supplement programs (NAA).
- Evaluate "clean fuel" conversion technology which would increase the use of high impurity Missouri coal (NAA).
- Assess the precious metal ore resources in the lead belt ore field structure of Missouri (NAA).
- Study environmental effects of coal combustion in Missouri power plants (NAA).
- Establish the prehistoric habitation sites and and quarrying areas in the Missouri Crescent Hills region.
- Studies of trace chemical elements in human bones from the Truman Dam area of Southwest Missouri.
- Studies of trace elements in Missouri drinking water and possible relations to cancer.
- Study of potentially harmful pollutants from mining operations in the Missouri lead belt (ETSRC-NAA).
- Evaluation of available selenium in Missouri drinking water supplies (NAA).
- Evaluation of the environmental effects of a coal-fired power plant in a rural Missouri area.
- Neutron Transmutation Doping of Semiconductors Research supports the Semiconductor Division of Monsanto Corporation, St. Peters, MO, a Missouri industry.

KOMATSU ELECTRONIC METALS

*MISSOURI BASED

WISCONSIN ELECTRIC

W. R. GRACE AND COMPANY

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SUMMARY OF HEALTH PHYSICS SUPPORT OF MURR - JULY 1977 - JUNE 1978

IN SUPPORT OF ACTIVITIES AT MURR REACTOR HEALTH PHYSICS:

- MET ALL HEALTH PHYSICS REQUIREMENTS FOR OPERATION OF REACTOR.
- CERTIFIED 200 SHIPMENTS OF RADIOISOTOPES TO UNIVERSITY OF MISSOURI USERS.
- CERTIFIED 857 SHIPMENTS OF RADIOISOTOPES TO UNIVERSITIES, LABORATORIES,, AND COMPANIES NOT PART OF THE UNIVERSITY OF MISSOURI.
- PREPARED AND CERTIFIED FOR SHIPMENT 1155 CUBIC FEET OF RADIOACTIVE WASTE TO DISPOSAL FACILITIES.
- PROVIDED PERSONNEL MONITORING FOR 130 PERSONS, AN INCREASE OF 10% OVER THE PREVIOUS YEAR.
- PROVIDED SAFETY ANALYSIS PLANNING FOR FIVE MAJOR PROJECTS AT MURR.
- PROVIDED SUMMER EMPLOYMENT FOR TWO UNDERGRADUATE STUDENTS.
- PROVIDED GUIDANCE FOR TWO GRADUATE STUDENTS WORKING ON REACTOR HEALTH PHYSICS PROJECTS.

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REACTOR OPERATIONS*

SUMMARY - JULY 1977 - JUNE 1978

- THE MURR INCREASED ITS OPERATING SCHEDULE TO 7 DAYS PER WEEK (GREATER THAN 150 HOURS PER WEEK) ON SEPTEMBER 1, 1977. THE PREVIOUS OPERATING SCHEDULE WAS 5 DAYS PER WEEK (90-100 HOURS PER WEEK). THERE WERE NO MAJOR INTERRUPTIONS TO THE OPERATING SCHEDULE.

TOTAL HOURS OPERATED	7375.7
TOTAL HOURS AT FULL POWER	7351.5
TOTAL INTEGRATED POWER	3064.74 MWD

- SEVEN MODIFICATIONS WERE MADE TO THE REACTOR OR REACTOR PLANT. THESE INCREASED THE RELIABILITY OF THE REACTOR.
- NEW TESTS AND EXPERIMENTS THAT WERE INSERTED INTO THE REACTOR INCLUDED THE OPENING OF BEAM PORTS C AND E, AND A MAJOR REVISION TO THE THERMAL COLUMN.
- 5 NEW FUEL ELEMENTS WERE RECEIVED AND 14 SPENT FUEL ELEMENTS WERE SHIPPED.
- ALL RADIOACTIVE RELEASES WERE BELOW THE LIMITS SET BY THE NUCLEAR REGULATORY COMMISSION.

* FOR DETAILS SEE "REACTOR OPERATIONS ANNUAL REPORT 1977 - 1978"