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DOUGLAS UNITED NUCLEAR MONTHLY REPORT

JUNE 1971

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DOUGLAS UNITED NUCLEAR

MONTHLY REPORT

JUNE 1971

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SUMMARYN REACTOR PLANT OPERATION

N Reactor remained shut down, and the maintenance program directed toward startup in July was continued.

FUEL FABRICATIONProduction Statistics - Tons

Billets extruded	39.0
Finished fuel produced	7.5

Rework and first-run short end pieces only were processed. Output was as planned.

TECHNICAL ACTIVITIES

Coolant was discontinued in the process channels on the left side of N Reactor for about 14 hours to permit repairs on the CV-3-1 check valve. The feasibility of performing maintenance in this manner on primary loop components that cannot otherwise be isolated was established by production test in May.

Measurements of N process tubes indicate a tube elongation apparently proportional to cumulative exposure. Future work will be directed toward determining the effect of elongation on operation.

GENERAL

The transfers of DUN operated facilities and related project and fund request activities to ARHCO, BNW and WADCO, were essentially completed on June 30. The Company force was reduced 71 employees as a result of the transfers.

There were no disabling injuries and no radiation exposures exceeded operational control.

Charles D. Harrington
President

N REACTOR PLANT OPERATIONSPRODUCTIONGeneral

Reactor production (largely fuel grade Pu), power level and related statistics are tabulated below. Input production and time operated efficiency (TOE) for the past six months are shown on the following chart:

Statistical Summary

Electrical Generation (KMW)	- WPPSS	0
	- 184-N	0.31
Fuel Charge (Tons)	- 94 Metal	331.09
	- 125 Metal	64.68
	- Natural Uranium	0.37
		<u>396.14</u>
Fuel Oil Usage (bbl.)		9,670

OPERATING EXPERIENCEReactor Loading

The 27 tubes discharged last month and left empty for tube examination were re-charged to complete the scheduled reactor loading changes. Five tubes of PT 94 Mk-IV-AA material scheduled for discharge were left in the reactor for the next operating period at the request of the AEC who wish to consider them for a long term irradiation study. The reactor loading at month end is shown on the front face map on page B-4.

Reactor Outages

The reactor was shut down the entire month in continuation of the January 28 outage. A plant maintenance program was in progress throughout the month with startup scheduled for July. At month end the repair activities were drawing to a close and special systems tests were in progress to demonstrate readiness of the plant for startup. Total outage hours for the month were 720.

Equipment ExperiencePrimary Loop

J. A. Jones forces completed V-11 and V-12 valve repairs on June 25. A total of 88 reconditioned V-12 valves and 18 spool pieces were installed during the outage. Four additional leaks not requiring valve removal were repaired. The total leaks repaired involving V-12 valves is 110. A total of 229 V-11 valves was repacked with Grafoil during the outage. Technical analysis of the data on remaining leaks in the V-11 and V-12 areas indicates an accumulated leakage of less than one gallon per minute at these locations.

Other primary loop leak repairs were continued during the month by N Plant Maintenance forces. At month end 107 leaks had been repaired and 17 known leaks remained to be repaired. The leak maintenance will continue toward the goal to have all miscellaneous leaks repaired by plant startup in July. A notable achievement during the month was the repair of the CV-3-1 valve bonnet leak. This leak has existed for many years and required removing primary coolant flow from the left side of the reactor to effect repairs. Testing showed that left side reactor heat could be satisfactorily removed through the graphite cooling system, thus making it possible to stop left side primary cooling long enough to repair the CV-3-1 valve.

Demineralized Water Plant

The degasifier for the demineralized water plant was removed from service for internal inspection and repair of the rubber lining. The plant continued to make good quality water at a reduced rate during the three weeks the degasifier was unavailable by removing oxygen using a hydrazine-activated carbon treatment method that was developed especially for this job. The damaged liner area in the degasifier was repaired by an outside vendor, but all work in connection with removing and returning the vessel to service was performed by N Plant Maintenance forces.

Ball Safety System

The five ball channels reported previously to have liner block separations were resleeved during the month. This completes the resleeving program at this time, and all ball channels were in operating condition at month end.

Graphite Heat Exchanger

The No. 3 heat exchanger was received during the week of June 21, following repair and retubing at 189-F. It has been set in place in the auxiliary cell in the 109 Building and installation was in progress at month end. It is expected that raw water piping connections can be completed prior to startup and that the remainder of the installation can be completed as time is available during subsequent outages.

Boilers

An "all boiler" outage was taken on June 28 for steam and feedwater repairs to equipment common to all boilers. At month end, the boilers are all operating and preparations for boiler load tests early in July are in progress. A leak in a roof tube of CE-1 boiler was repaired.

Process Tube Temperature Monitor

At month end all but four unreadable temperature detectors have been restored to service. During the outage, 182 repairs have been made to date.

Equipment Modifications

The following equipment modifications were completed:

DC-3092, "Flow Monitor Transducer Calibration Facility Modification." Modifications were made to speed up calibration work by changing the required demineralized water source from an accumulator system to the existing 200 psig demineralized water supply.

DC-3119, "Primary Pump Seal Water Versus Pump Suction Transmitter Replacement System No. 415.33." More reliable transmitters were provided for AP instrumentation in the six 109-N cells.

DC-3157, "IWV-253 Valve Positioners Pressure Change - 109-N." This change provides improved pressurizer level control following a reactor scram.

DC-3159, "Electrical Deactivation of ECS Valves V-19, V-23-1, V-23-2, V-28-1, and V-28-2." These valves are no longer required to be electrically controlled and were electrically deactivated to remove several potential ground sources, thus reducing the possibility of unscheduled reactor outages.

MDC-N-69-67, "Mechanical Control Board and Battery Charger Load Circuit Revision." Modifications corrected wiring deficiencies.

MDC-N-70-74, "Regulated Air Supply for Panels No. 1 and No. 2 - CE Boilers." Precision air regulators were provided in the instrument air system to give more stable boiler control.

MDC-N-70-88, "Mixing Station for Boiler Fuel Oil Additives." Equipment and piping were installed to permit supplying additives to fuel oil in efforts to reduce tube fireside scale and acid corrosion in the standby boilers.

MDC-N-71-2, "RTD Communications." Improved communications systems were provided between the various locations where process tube temperature monitor work is performed in order to reduce radiation exposure.

MDC-N-71-15, "Fuel Oil Pressure Annunciator CE-1 and CE-2." Wiring and circuitry were modified to make these boiler system annunciators operable.

Loading Pattern - N Reactor

34	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	34	
33							EV	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E							33	
32						E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	13	13	G	E	E	E	E	E	E						32	
31						E	E	E	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	E	E	E					31	
30					E	E	E	X	X	X	X	X	X	X	X	X	X	18	X	18	X	X	X	X	X	X	X	E	E	E					30	
29				E	E	E	X	X	94	X	18	G	GA	18	G	G	G	G	G	G	G	G	G	G	G	G	X	X	X	X	E	E	E		29	
28		E	GA	E	X	X	X	G	GA	GA	GA	GA	GA	G	G	GA	G	18	GA	G	GA	GA	GA	GA	GA	X	X	X	E	E	E	E		28		
27	E	E	E	X	X	X	X	GA	G	GA	GA	GA	GA	GA	GA	GA	G	13	13	G	GA	GA	GA	GA	G	G	X	X	X	E	E	E	E		27	
26	E	E	X	94	X	G	G	G	G	G	G	G	G	G	G	GB	G	G	G	G	G	G	G	GA	G	G	X	X	94	X	X	G	E		26	
25	E	E	X	X	X	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	X	10	X	G	G		25	
24	E	E	X	X	X	G	G	G	36	G	G	G	G	G	G	G	G	G	G	G	18	18	G	G	G	G	G	G	X	X	X	E		24		
23	E	E	X	X	X	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	X	X	X	E	G		23	
22	GA	E	X	X	X	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	GA	GC	G	G	G	G	G	X	X	X	E	G		22		
21	E	E	X	X	X	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	X	X	X	E	GA		21		
20	E	E	X	X	X	G	G	G	G	G	G	G	G	G	G	G	18	G	G	G	FB	G	G	G	G	G	G	X	X	X	E	GA		20		
19	E	E	X	X	X	G	18	G	G	G	G	G	G	G	G	G	G	18	G	G	G	G	G	G	G	G	FB	X	X	X	E	E		19		
18	E	E	94	X	X	G	G	G	G	G	G	G	G	GA	G	G	G	G	G	G	G	G	G	G	G	G	G	X	X	X	E	GA		18		
17	E	E	X	X	X	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	X	X	X	E	EV		17		
16	E	E	X	X	X	G		N	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	X	X	X	E	EV		16		
15	EV	E	X	X	X	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	X	X	X	E	EV		15		
14	E	E	94	X	X	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	X	X	X	E	E		14		
13	EV	E	X	X	X	GA	G	G	G	GA	G	G	GA	G	G	G	G	G	GA	G	G	G	GA	G	GA	G	G	X	X	X	E	EV		13		
12	G	X	X	X	X	G	G	G	G	G	G	G	G	GA	G	G	GA	GB	G	G	G	18	G	G	G	G	G	X	X	X	E	EV		12		
11	EV	E	X	X	X	G	G	G	36	G	G	G	G	G	G	36	GA	GA	G	G	G	GA	G	G	GA	36	G	G	X	X	X	E	EV	ES	11	
10	E	EV	X	X	X	G	G	G	GA	GA	GA	GA	GA	GA	GA	GA	GA	GA	G	18	GA	GA	GA	GA	GA	G	G	X	X	X	E	EV		10		
09	ES	E	X	X	X	X	G	GA	GA	G	G	GA	G	G	G	G	G	G	G	G	G	GA	GA	G	G	G	X	X	X	E	E		09			
08	E	E	EV	X	X	X	GA	GA	G	G	G	GA	AS	G	G	G	GA	AS	AS	G	G	AS	G	AS	AS	AS	GA	X	18	X	EV	E	E	08		
07		ES	EV	EV	X	X	X	X	G	G	G	G	G	G	G	G	G	G	G	G	G	G	AS	G	AS	G	X	X	X	X	E	ES	E		07	
06		E	EV	EV	X	X	X	X	G	G	G	G	G	G	G	G	G	18	G	G	G	G	G	GA	18	X	X	X	EV	ES	E			06		
05			E	EV	EV	X	X	X	X	X	X	G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	E	EV	E		05	
04				ES	E	EV	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	E	EV	ES	E		04
03					E	E	BC	E	G	E	E	E	E	E	E	E	E	EV	E	E	E	36	36	36	EV	E	EV	ES	E						03	
02					E	E	E	E	E	E	BC	G	BC	BC	BC	BC	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E		02	
01																																			01	
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74		

Fuel Code	No. Tubes	Description	PT-NR No.	No. Tubes	Description
E, ES	166	Mk-IC (94 Metal - Fringe)	94	5	Mk-IVAA Demonstration
F	2	Mk-IV (94 Metal - High U-236)	113	4	Evaluation of the End
G	571	Mk-IV (94 Metal - Central & Fringe)			Spider Inner Support
N	1	Mk-1B (Natural U)			System
X	230	Mk-1A & Mk-IV (125 & 94 Metal)	136	8	Mk-IV Non-bonded End
					Closures
	970	Total	118	16	Mk-IV Performance Test
	34	Total PT		1	Graphite Sample Channel
	1004	Grand Total			
				34	Total PTs

FUEL FABRICATIONPRODUCTION

Input Production - Tons 39.0

Percent of Forecast 130.1

Output Production

Finished Assemblies

Tons Output 7.5

Percent of Forecast 44.4

Uranium Utilization - %

B09 78.9

X09 --

Month-End Inventories - Tons

Bare Uranium Billets 91

Finished Fuel 245

OPERATING EXPERIENCE

The low level throughput consisted of rework fuels and first-run short end pieces. Defective rates were higher than normal, which is usual when processing short end pieces.

PROCESS ASSISTANCE AND CONTROL

Billet assembly problems were recently encountered when the outside diameter on inner copper sleeves for Mark B billets was found to be on the high side of specifications and the center hole diameter on end plates was on the low side, resulting in an excessive interference fit between the sleeves and the end plates. Etching the sleeves for an increased amount of time to reduce the outside diameter temporarily relieves the problem. Fifty percent of 3,000 sleeves in inventory have outside diameters on the high side of specifications.

An alternate method is to reduce the sleeve OD by magnetic forces. This arrangement uses a compression coil which sets up magnetic forces opposite to those generated in the workpiece (copper sleeve), thus compressing the end of the sleeve. By adjusting the energy delivered to the compression coil the amount of deformation of the workpiece can be controlled. Approximately 120 sleeves have been successfully sized for current production usage. No assembly problems were encountered with the magneformed sleeves.

TRANSFER OF DUN FACILITIES TO OTHER AEC-RL CONTRACTORS

The transfer of DUN facilities scheduled to go to other contractors was essentially complete by July 1. Included were inventories of essential materials, equipment,

blueprints, operating procedures and other similar information. The following summarizes the major facilities and services transferred:

300 Utilities - to WADCO

The 300 Area Utility Services consisting of steam generation and distribution, water system river pumps, filter plant and distribution lines, compressed air and distribution, sanitary and process sewer collection and disposition, emergency electrical generation, and all of the associated buildings and equipment.

Central Service Facility - To BNW

The analytical laboratory and central maintenance offices were transferred. The machine shop and instrument and electrical shops were vacated.

Machine Shop - To ARHCO

Eight major machine tools were transferred to ARHCO and moved to 200-West shops. Machine shop service to DUN will be mainly supplied by ARHCO.

300 Area Trash Collection and Disposal - To ARHCO

The responsibility for 300 Area trash collection and disposal was transferred to ARHCO, including all collection equipment, 301 garage and equipment storage.

100 Area Export Water System - To ARHCO

The 100 Area export water system operation supplying water to 200, 100-D and 100-F Areas was transferred, including all the buildings and facilities.

Attendant with the transfer of the utility services was the transfer of related project and fund request activities as follows:

DAP 536 - No. 2 Boiler Replacement for Increased Steam Generating Capacity

Demolition of the existing boiler is essentially complete. Bumstead-Woolford, Seattle, has been awarded the contract for the new 100,000 #/hr. oil-fired boiler.

Vendor design effort is expected to be completed July 1. Boiler delivery, subject to approval, is anticipated in August and installation may be completed in November and December, 1971.

DAP 541 - Boiler Feedwater System Additions (500,000 #/hr) Deaerator

This project authorized \$174,000 for 500,000 #/hr deaerator and related work. Invitations to bid have been issued and responses are due month end. J. A. Jones has been assigned installation responsibility.

DAP 543 - Smoke Density Monitors - 384 Building

This project authorized \$50,000 for smoke density monitors on three powerhouse stacks. Installation work is in progress. Some equipment on order is not on site. Completion date is scheduled for November 1971.

DAP 550 - Steam Distribution System Additions - 300 Area

A project proposal requesting \$130,000 for about 1300/ft of 10-inch steam line and about the same length of four-inch condensate return line was forwarded to AEC on May 18.

The work proposed would provide looped service to the Biology facility and other facilities in the southeast section of 300 Area.

Design Criteria are in preliminary form. AEC-RL has determined that this work cannot be funded this fiscal year.

DCP 548 - Sanitary Sewer System Additions - Southeast Section 300 Area

A \$49,000 Request for Directive has been with AEC-RL since December 2, 1970. Consideration of the proposal has apparently been deferred pending the CH₂M report and recommendations for sewage treatment. The AEC has determined that this project cannot be funded this fiscal year.

Fuel Oil Storage Bunker Addition

Development of a proposal to increase existing capacity by 150,000 gallons, at an estimated cost of \$90,000 is in progress. The work would maintain the current seven-day supply when the new #2 boiler is placed in service. This work cannot be funded this fiscal year.

Fencing Contaminated Burial Site and Burning Pit

Funds have been requested for the Burial Site only; however, the funding situation has caused approval to be deferred.

The Fuels Section force has been reduced by 71 as a result of the above transfers. Those in excess of the receiving contractors' needs and of DUN's requirements have been or will be laid-off.

100-KE & K PLANT DEACTIVATION STATUS

As of June 30, all work required to deactivate K Plant has been completed, except for those facilities required to be left in service for the storage and shipment of fuel elements from the storage basins and for the Corrosion Test Facilities in 105-KE and 1706-KE which are operated for BNW.

Project work required to protect equipment in K Plant from moisture condensate and for fire protection after the remaining facilities have been deactivated is approximately 45 percent completed. The six effluent retention basins have been drained, walls washed down, and approximately two feet of earth placed in the bottom of the basins, and all inlet and exit piping has been sealed with blanks. The KE crib and trench have also been covered with earth. All material stored at the Burial Ground has been disposed of, and the burial trenches have been covered.

TECHNICAL ACTIVITIESN REACTOR OPERABILITY PROGRAMPT-NR-271 - Primary Loop Coolant Shut-Off Testing and CV-3-1 Repair

PT-NR-271 was performed during the weekend of May 22-23, for the purpose of generating test data necessary to form the basis to allow extended (24 hours or greater) reactor primary loop coolant shut-off time. This test then established the feasibility of performing required maintenance on various primary loop components that cannot otherwise be isolated.

The information obtained from PT-NR-271 was immediately utilized to repair the seal plate of CV-3-1. A supplement to PT-NR-271 was written and the check valve repaired on June 2.

Coolant was stagnated in the process channels on the left side of the reactor core for about 21 hours during the initial test, and for about 14 hours during the check valve repair. Some of the conclusions obtained from the test are summarized in the following paragraphs.

1. Observed Temperature Transients

Special thermocouples were inserted in the center fuel channel of three process tubes to monitor the actual temperature transients in a typical high power fuel column. In addition, two thermocouple train assemblies previously installed in the core were monitored. Predicted versus maximum observed temperatures are summarized below:

Tube No.	Predicted Steady-State Temp. F	Maximum Temp. F	Test		CV-3-1 Repair
			Observed Maximum Temp. F	Approximate Steady-State Temp. F	Approximate Steady-State Temp. F
1748*	142		136	129	120
2249*	134		141	118	123
2750*	136		151	147	114
1443**	-		~ 77	74	70
1843**	-		~ 77	77	67

* At center of fuel column

** At outlet of fuel column

A steady-state temperature was not attained during the test, and the temperature transients reached a maximum and declined steadily. This phenomenon is attributed to the onset of natural convection within each channel and connector, as was evidenced by ATTM system maps taken during the test.

As noted in the table of results, the approximate steady-state temperatures observed during the CV-3-1 repair were lower than those observed during the test. The difference is probably due to the onset of a small amount of forced circulation through the reactor core which resulted from the isolation procedure used.

2. Hydrogen Detection

Prior to performing the test, some concern was expressed with respect to the radiolysis of water to H_2 and O_2 and the potential accumulation of H_2 in areas around the primary piping vents, high spots in the piping, in areas around CV-3-1, and in Zone 1. No hydrogen was detected during the test or CV-3-1 repair.

FUEL PERFORMANCE PROGRAM

Disposition of High Exposure Mark IV and Mark IVAA Fuel

The disposition of ten high exposure Mark IV and Mark IVAA fuel columns charged under PT-94 and PT-107 is summarized in the following table. As directed by the AEC, five Mark IV columns were discharged before reaching their authorized exposure. Five additional Mark IVAA columns were retained for an additional irradiation period.

TABLE I

Disposition of High Exposure Mark IV and Mark IVAA Fuel

PT-NR-94 - Mark IV Demonstration

<u>Tube No.</u>	<u>Fuel Type</u>	<u>Present Exposure, MWD/T</u>	<u>Authorized Exposure MWD/T (by PT)</u>	<u>Disposition</u>
2359	Mark IV	~ 5445	6000	Discharged 6/21
1443	Mark IV AA	~ 2550	6000)	
1843	Mark IV AA	2560	2700)	
2644	Mark IV AA	1965	2500)	
2670	Mark IV AA	2035	2500)	
2948	Mark IV AA	2120	2500)	
				Retained for one irradiation period

PT-NR-107 - Central Zone Loading of Mark IV Fuel

2154	Mark IV	3530	5000)	Discharged 6/21
2160	Mark IV	3520	6000)	
2452	Mark IV	3760	4000)	
2460	Mark IV	3580	5000)	

Column 3262 charged under PT-NR-113, "Evaluation of End Spider Inner Support System," was discharged June 21, and is being held for examination to evaluate the end spider support system.

PLANT LIFE PROGRAM

Steam Generator Tubes

Scanning electron microscopic (SEM) examination of the secondary side of samples of steam generator 6B Inconel-600 tubing has shown no indication of corrosive attack under the tube supports when the samples were examined in the filmed condition. The examination will be repeated after the film has been removed.

Ball Channel Renovation

On June 7 the removal of the top three ball channel liner blocks in channels 43, 52, 53, 56, and 63 was initiated, starting with channel 52. The plan was to resleeve these channels to the top of the fourth block with new, more flexible graphite sleeves to correct existing open block junctions and eliminate inadvertent loss of balls into the graphite stack. All channel renovation and resleeving work was completed on June 17.

The major portion of the work involved development and testing of tooling for removal of the vertically "cracked" third block in channel 52. Removal of this cracked block was extremely difficult due to channel separations in the reactor front-to-rear direction, which allowed the halves of the block to "float" and wedge in the channel. Removal efforts on channel 52 started on June 7 and resleeving was completed on June 14. The remaining four channels were all completed on June 17 with no problem.

Design and fabrication of special tooling to reseal blocks 4, 5, 6, 7, and 8 in channels 53 and 56 has been initiated.

Control Rod Corrosion

Comparative spectrographic analysis and a search of original purchase orders has verified that the N control rod aluminum seal section tubing is actually 6063 aluminum alloy, rather than the 6061 alloy that the tubing drawing, H-1-28018, specified. Verification that the seal section tubing and the tip section boron carbide containing aluminum extrusions are the same alloy reinforces the concern that the extensive pitting observed on the seal section tubing may also be present on the tip section extrusions.

Design criteria and a project proposal were submitted to AEC-RL early in June with the aim of obtaining FY 1971 funds for conversion of the present single pass coolant system to a recirculating system utilizing high purity water. The estimated total project cost is \$235,000. Benefits to be obtained from the project are 1) a reduction of control rod replacement costs and improved operating continuity by avoiding reactor outages due to rod leaks, and 2) a reduction in chemical and radioisotopic pollution of the environs affected by the single-pass coolant effluent.

Reactor Layaway Technology

Corrosion coupons placed in loops KER-2 and 3 in 1964 to provide information of the long-term corrosion characteristics of several materials in a stagnant deionized water-hydrazine-lithium hydroxide environment at room temperature have been examined.

Carbon steel coupons exposed to the layaway solution in KER-2 showed weight loss equivalent to a penetration of 0.01 mils/year. Carbon steel coupons in KER-3 had been subjected to aerated filtered water for approximately ten days in 1970. As a consequence, the weight loss of the carbon steel coupons in KER-3 was about five times the weight loss of the coupons from KER-2 with five to ten times the surface film.

The tests clearly demonstrated the effectiveness of the pH 10-11 lithium hydroxide, 500 ppm hydrazine solution for long-term layup of carbon steel systems.

Process Tube Surveillance

Process tube 3059 was removed from N Reactor in May as part of a continuing surveillance program to examine radiation effects on N tubes. After a new tube had been cut to the prescribed length and inserted, it was observed that the nozzle would not fit with the connector Grayloc coupling. A comparative measurement was then made of the length of tube 3054 which had been in-reactor since original startup. It was found to be approximately one inch longer than the originally installed length of 53 feet. This measurement suggested that the tubes in the reactor since startup had elongated rather than the newly installed tube mistakenly cut an inch too short. A measurement program was initiated to determine the extent of tube elongation.

The lengths of 122 tubes were indirectly measured by measuring the distance from the face of the front gas thimble to the rear of the front nozzle thread boss. Since the gas thimble is bolted to the front shield while the nozzle is fixed to the tube, this measurement when compared to the original dimensions was an indication of tube elongation. It was found that many high flux tubes had apparently elongated 0.8-0.9 inch. It was not certain at that time whether this represented the total length increase since any outward movement of either front or rear shield would reduce the apparent tube length increase. Subsequent measurements of the overall front-to-rear nozzle distances made through four tubes suggests that some outward shield movement has occurred and that overall tube elongation is actually 0.1-0.2 inches greater, i.e., approximately one inch. Variation in tube elongation was noted and was found to be related to the method by which the tubes were fabricated. The 30 percent cold-work tubes made by Harvey Aluminum Company (approximately 92 percent of reactor tubes) showed up to one inch elongation while the 18 percent cold-work Harvey tubes (2 percent of reactor tubes) showed 0.5-0.7 inch elongation and the 18 percent cold-work tubes made by Chase Brass (6 percent of reactor tubes) had elongated only 0.3-0.5 inch. In all cases, the elongation was approximately proportional to the cumulative tube exposure, i.e., fringe tubes of a tube group elongated less than central zone tubes in the same grouping.

The significance of the length change from an operational viewpoint is under study. A potential problem is associated with the four keys in the front nozzle which ride in keyways inside the gas thimble to prevent the nozzle and tube from rotating. An axial clearance of 1.75 inches was originally provided and was ample to accommodate the 0.8-0.9 inch of thermal expansion normally resulting from operation. Because of the additional 0.8-1 inch elongation from tube elongation, axial clearance between the keys and the gas seal packing between the nozzle and thimble has apparently been used up so that at operating temperature the four keys are probably butting against the gas packing ring in some cases. Any additional elongation will transfer load to the 0.034 inch wall thimble and to the front shield. A key question, therefore, is the mechanism of the observed elongation. If elongation is due to irradiation-induced creep, the pressure load will gradually be transferred from the tube to the thimble and shield and the creep rate would be expected to drop as the axial stress in the tube drops. However, if the elongation is due to a swelling phenomenon (independent of stress), significantly higher

stresses could be involved, similar to those associated with attempting to restrain thermal expansion. To date the exact cause of the observed elongation is not known; however, the length increase observed can be predicted utilizing an expression for the creep strain of internally-pressurized Zircaloy tubes developed from in-reactor test data by Watkins and Wood of UKAEA.¹

Future work involves taking additional reactor measurements to 1) determine the extent of front and rear shield movement, 2) evaluate tube elongation mechanisms by measuring thimble strains, and 3) determine whether differential process tube lengths has reduced the spacings between some inlet connectors. The first two of these require the development of equipment and techniques so only the third is scheduled for completion this outage..

N Graphite Surveillance

Two process tube vertical height traverses were completed to determine front-to-rear profiles at the bottom of the stack. Preliminary analyses of the data show channel 0358 has subsided about 0.50 inch and channel 0357 has risen about 0.25 inch. The 0357 measurements confirm the 0.25-0.50 inch rise measured in a side-to-side traverse channel at the bottom of the stack in May. Lifting of the bottom of the stack while the top subsides was anticipated as a result of the keyed structure of the stack.

DECONTAMINATION PROGRAM

A report, DUN-7674, "Radiation Levels - V-12 Pipe Spaces," has been prepared and issued. The results of this analysis have shown the incentive for developing an external decontamination technique which could be applied to the reactor pipe spaces. Radiation levels in excess of 1000 mrem/hr were experienced by pipefitters in V-12 leak repairs with a total exposure of 153 rem for 110 leak repairs in V-12 pipe spaces. Of these radiation levels, approximately 150-250 mR/hr were from internally deposited radioactivity.

Planning has been initiated to provide a method and equipment to decontaminate the external surfaces of the pipe spaces and a program plan has been drawn up. This includes the following:

- Evaluation of the effectiveness of several decontaminants to be done off-reactor on valves removed from the reactor.
- Analysis of system components which may be exposed to decontamination solutions, to determine the degree to which they will be involved in a mass decontamination effort.
- A program to determine short- and long-term corrosion effects of the decontamination chemicals on the materials present in the PCL system.

¹TRGR-1757, "The Significance of Irradiation-Induced Creep on Reactor Performance of a Zircaloy-2 Pressure Tube," B. Watkins and D. S. Wood, 1968.

- Study of waste disposal problems.
- Design of equipment and system for chemical decontamination as dictated by the results of the above.

To provide specific data for evaluation of effectiveness of various reagents, a program for decontamination tests to be performed on V-12 valves which have been removed from the reactor has been established. This would provide the following information:

- Reduction in dose rate from valve after typical exterior spray application.
- Reduction in dose rate from valve after exterior bath decontamination.
- Reduction in dose rate from valve after A and B porting interior decontamination.
- Reduction in dose rate from valve after A, B, and C porting interior decontamination.

Fabrication of fixtures to hold the valves during these tests will permit establishment of standardized locations from which the exposure rate reading will be taken, thereby ensuring consistent results.

OPERATIONAL SUPPORT PROGRAM

The Design Criteria, "Protection of Equipment, 109-N Building," which describe the operational and technical requirements of the capital funded modification required in 109-N to improve the Zone III ventilation, are ready for transmittal to the AEC. This work is now planned to be accomplished prior to the summer months of 1972.

In addition to the capital funded work, expense funded work is planned to be performed prior to the startup of N Reactor in 1971 so that some improvements in the 109 ventilation system will be achieved this summer in order to effect some reduction in the basement temperature. This work consists primarily of 1) increasing the fan speeds on the Zone III supply exhaust ventilation fans, and 2) removing the reheat coil from the basement air duct, and increasing the water spray capacity for the Zone III air washer.

Project DCP-528, 100-N Area Fire Protection Improvements

At the request of the AEC, the Factory Mutual Research Corporation inspected the N Reactor facilities and prepared an extensive report evaluating the fire protection status of the facilities and recommending a number of improvements.

The scope of the subject project has been revised based on the Factory Mutual Research Corporation recommendations and an indicated fund limitation of about \$340,000. The revised scope includes the following:

105 Building

- a. Application of fire retarding mastic coating on bundled cables and cable trays in critical locations.
- b. Installation of fire stops in cable or cable tray penetrations through walls.

109 Building

- a. Installation of water spray system at the mezzanine end of the steam generator cells.
- b. Application of fire retarding mastic coating on bundled cables and cable trays in critical areas.

117 Building

Provisions of a wet pipe sprinkler system for the cell diversion door hydraulic power pack and main floor areas.

The design criteria and project proposal have been transmitted to AEC-RL for approval and allocation of FY 1971 funds.

NUCLEAR SAFETY ASSURANCE PROGRAMProcess Standards Auditing

Nuclear Safety Audit - Fuels - A nuclear safety audit of the fuels manufacturing area was completed. No standards violations or infractions of nuclear safety procedures were noted.

Nuclear Safety Audit - N Reactor - Auditing of the shutdown N Reactor and support facilities continued. A special audit has been completed which involved checking the Equipment Maintenance Standards records and Process Operation's startup check sheets to ensure that equipment testing is being done according to the scope and frequency of the Operating Safety Limits document. This special audit revealed no violations of the testing requirements.

The audit of the N Reactor and support facilities involved the following systems and specifics.

1. Emergency Cooling Backup Status
2. Electrical System Bus Status
3. Primary Cooling System Bus Status
 - a. Primary Coolant Temperature
 - b. Process Tube Temperatures
4. Secondary System Pumping Status

- a. Steam Generators in Use
 - b. Dump Condensors in Use
 - c. Raw Water Temperature to Dump Condensors
5. Circulating Raw Water Pump Status
 6. Graphite Cooling Status
 7. Horizontal Control Rod Status, Rod Out of Service
 8. Flux Monitoring System Status
 9. Diesel Oil Storage Tank Inventory
 10. Coolant Water Storage Tank Inventories and Temperatures
 11. Boiler Status

Project DCE-539 - Nuclear Flux Monitor System

The N Reactor nuclear flux monitoring system consists of three subsystems, each of which covers a specific range of flux. These are

- Startup Range Subsystem
- Intermediate Range Subsystem
- Power Range Subsystem

Less than optimum performance and excessive maintenance costs prompted the decision to upgrade the system. The proposed work is required to improve the operational reliability and maintainability of these systems. This work will reduce spurious malfunctions which have an effect on operating continuity and reduce the related system maintenance and the corresponding personnel radiation exposure. In addition, the replacement system design will comply with the IEEE Criteria 279 for Nuclear Power Plant Protection Systems which is currently being used as a guide in the licensing of nuclear power plants.

The scope of work consists of making replacements and modifications to the startup range (subcritical), intermediate-range, and power range instrumentation system components and associated signal-receiving process instrumentation. New electronic equipment and detectors will be used in the three subsystems.

After the January 28 announcement of the planned reactor shutdowns, work was stopped on all projects and fund authorizations were cancelled. Funds for this project were reinstated on June 1 and work has been resumed. As of month end detail design is estimated at 75 percent complete.

WASTE MANAGEMENT

100-N Ventilation Stack Monitor

To provide quantitative data on radioactive gaseous effluent releases would require monitoring of airborne and gaseous effluents from N Reactor. Original monitoring equipment in the 117 exhaust air filter building samples only the Zone I and Zone II exhaust for routine condition. The bulk of the exhaust air is from Zone III and is not filtered or sampled. The existing sampling equipment does not operate satisfactorily because of the excessive moisture in the Zone I exhaust.

A project was scoped to provide an extensive monitoring system for both routine and all conceivable accident conditions. The system envisioned with remote readout is completely automatic. The project was originally part of the Effluent Control Project, but was removed because of funding problems. Subsequently, a separate project proposal was prepared but was not implemented because of lack of funds. An alternate and less extensive sampling system has been developed to provide for routine monitoring of gaseous radionuclide releases to the environment. The proposed system would provide qualitative and quantitative data on the release of radionoble gases, radioiodines, radioparticulates, and tritium oxide. Although the system is primarily effective for routine monitoring during normal reactor operation, it would inherently incorporate certain features with limited capability for accident analysis and evaluation.

The air sample would be passed through a particulate and charcoal filter cartridge which is periodically taken to the laboratory for analysis. The sample exhaust from the filter cartridge would be cooled to condense out the moisture together with any tritium oxide. The resulting condensate would also be periodically analyzed in the laboratory. In addition to this, an ion chamber would be located in the base of the exhaust ventilation stack to provide information on radionoble gases. Exhaust air flow measurements would also be taken to help evaluate the analytical results.

Design of the simplified monitor system is complete and construction is about 10% complete. Existing equipment from shutdown facilities is being utilized extensively.

TECHNICAL ACTIVITIES - FUELS

Zircaloy Cladding Fabrication

Eleven billets were extruded to produce outer Zircaloy clad shells for Mark IV outer billet extrusions. The billets, pierced nearly two years ago, were OD sleeved with .030-inch thick copper-silicon material, while the ID surface was flame sprayed with a .010-.015 inch layer of copper. Different front end configurations were used to determine their effect on extruded surfaces as follows:

- A .030-inch thick end plate welded to the OD sleeve - on three billets.
- A 1-1/4-inch "spun" end to form a one-piece sleeve and end plate - on three billets.
- A 1/2-inch "spun" end placed between two thin end plates. One end plate was placed inside the can and one outside. A weld on the ID joined the plates together - on five billets.

At the time the billets were pierced it was anticipated that a .065-inch thick copper silicon ID sleeve would be used for extrusion. Flame spraying a thin copper layer on the ID surface is considerably more economical but results in a loose billet to mandrel clearance. Previously, when the copper ID layer was used a 1/4-inch copper silicon ring was also used on occasions in the belief that the ring prevented chips from the graphite cutoff from penetrating into the rear of the extruded tube due to loose billet-to-mandrel clearance. To confirm the value of the ring, three billets were extruded without the ring.

It appears that the defect length is 8-10 inches long on the three extrusions without the ring and about two inches with the ring. The rear defect lengths, as well as the front lengths, will be compared when the copper is removed.

The optimum conditions from analysis of these extrusions will be utilized on subsequent outer clad fabrications.

Extrusion Tool Reliability

Specific written procedures for the inspection and reinspection of all extrusion tooling, excepting containers and liners, have been in effect for quite some time and have proven highly satisfactory. Recent problems with excessive container and liner growth indicate that similar more specific control procedures would be worthwhile for liners and containers.

A number of factors bear on liner life and also on potential tool failures. Included are the honing of the liner ID, surface preparation following honing, and surface preparation of new liners and lubrication during extrusion.

Liner life and tool failures are also affected by excessive temperature and overstressing due to extreme extrusion pressure. Maximum extrusion pressures are established and changed from time to time depending on tool type and sizes and specific tool conditions. All of these factors are being reviewed and analyzed to establish optimum procedures for overall coordination of tool rework, tooling set-up, and extrusion parameters.

ADMINISTRATION - GENERALDECLASSIFICATION OF N REACTOR DOCUMENTS

The downgrading of N Reactor documents to Confidential and Unclassified was started with review priority being given to those potentially usable for the BPA study.

EMPLOYMENT SURVEY

DUN personnel totals and employee allocations as of June 30 and May 31 are shown in Appendix B.

UNION RELATIONS

On June 21 the membership of the Hanford Atomic Metal Trades Council accepted a proposed 9-month contract extension. The terms of the extension were:

1. A wage increase of \$12.00 per week.
2. Agreement by the Company to enter into Appendix "A" discussions within 60 days.
3. Commencement of interim discussions on or after November 1, in preparation for 1972 contract negotiations.

The extension agreement will expire on March 30, 1972.

SAFETY

No personnel radiation exposure exceeded operational control.

Month-end safety statistics were:

Disabling injuries - June	0
- CY to date	0
Days since last disabling injury	357
Man-hours since last disabling injury	2,300,000

APPENDIX APROJECT STATUS SUMMARY - REACTOR FACILITIESAUTHORIZED PROJECTS

<u>Number & Title</u>	<u>Authorized Funds - \$</u>	<u>Percent Complete</u>		<u>Remarks</u>
		<u>Design</u>	<u>Construction</u>	
<u>Single-Pass Reactors</u>				
DAP-549, Rev. 1, Deactivation of KE Reactor and 100-K Area	160,000	80	45	Installation of the new water lines for fire protection has been completed and the lines tested. Title I comment drawings have been issued by Vitro for the electric heat installation. Detail design is nearing completion on the No. 3 KE boiler control modification.
<u>N Reactor</u>				
GCP-411, Rev. 3, Effluent Control Program - 100-N Area	1,960,000	93	96	Work resumed June 15. Design proceeding on diesel fire protection. Dump tank instrumentation design complete. ATP on spray diesel jacket cooling completed June 22.
DCE-519, Rev. 4, Replacement of Bridge Crane and Hoist System with New Crane System - 105-N Storage Basin Area	465,000	100	95	Sixty-ton crane interlock installation essentially complete.
DCP-528, Rev. 1, Fire Protection System Improvements - 100-N	30,000	33	0	Revised project proposal based on AEC-RL request completed. Submitted to AEC-RL.

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AUTHORIZED PROJECTS

<u>Number & Title</u>	<u>Authorized Funds - \$</u>	<u>Percent Complete</u> <u>Design</u> <u>Construction</u>	<u>Remarks</u>
DCE-539, Upgrade Flux Monitor System - N Reactor	335,000	75 0	Purchase Orders have been reopened for procurement of the control room panels and hardware. Delivery is scheduled for late July.
DAE-540, Smoke Density Monitors for DUN-Operated Facilities - 100-Areas	55,000	100 0	All work stopped January 28, pending decision on N Reactor operation. Proposal revised to include N only. Submitted to AEC-RL June 3, 1971.
DCP-542, High Pressure Injection System Improvements - N Plant	138,000	0 0	All work stopped January 28, pending decision on N Reactor operation. Scope being reviewed for three-year campaign.
DAP-547, Permanent Markers for Buried Wastes in Ter- minated 100-D, 100-F and 100-H Sites	28,000	8 0	Design is under way.

PROJECT PROPOSALS AWAITING AUTHORIZATION

<u>Number & Title</u>	<u>Funds Requested</u>	<u>Date to AEC-RL</u>
DCP-527, Graphite Cooling & Fog Spray Improvements 100-N	\$ 97,000	5/9/69
DCP-528, Rev. 2, Fire Protection System Improve- ments - 100-N	344,000	2/18/71
DCP-529, Gravity Drainage System and Disposal Basin for 100-N Area	200,000	7/9/69

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PROJECT PROPOSALS AWAITING AUTHORIZATION

<u>Number & Title</u>	<u>Funds Requested</u>	<u>Date to AEC-RL</u>
DAP-530, Upgraded Electrical Services & Lighting 1100-N and 1101-N Buildings	78,000	8/12/69
DCP-538, Heat and Ventilation System Improvement 105-N and 109-N Buildings	330,000	5/18/70
DAE-540, Rev. 1, Smoke Density Monitors for DUN- Operated Facilities, 100 Areas	38,000 (Reduced Total)	6/3/71
DCE-551, Training Mock-Up for V-12 Replacements, 185-D Building	49,500	6/1/71
DCE-552, Control Rod Coolant Recirculation Facilities, N Reactor	235,000	6/10/71

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PROJECT PROPOSALS RETURNED BY AEC-RL

None

PROJECT PROPOSAL PREPARATION

<u>Number & Title</u>	<u>Design Criteria</u>	<u>Project Proposal</u>
Export Water System Backup - 182-D (for 200 Areas)	Completed	Completed - Held by sponsor (ARHCO) pending mode of operation.
Stack Monitoring Improvements - 100-N Plant	Completed	Prepared. An AR, however, has been approved to cover routine stack monitoring improvements portion of item. This item therefore will drop from this report.

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DUN-7591

PROJECT PROPOSAL PREPARATION

<u>Number & Title</u>	<u>Design Criteria</u>	<u>Project Proposal</u>
Protection of Equipment, 109-N Building	Completed	Completed
DCP-528, Rev. 3, Fire Protection System Improvements, 100-N Area	Completed	Completed
DCE-519, Rev. 5, Replacement of Bridge Crane and Hoist System with New Crane System, 105-N Storage Basin Area	In preparation	In preparation
DAP-547, Rev. 1, Permanent Markers for Buried Wastes in Terminated 100-D, 100-F, and 100-H Sites	Completed	Activity Started

APPENDIX BEMPLOYMENT SUMMARY
(with employee allocations)

	<u>6/30/71</u>	<u>5/31/71</u>
<u>CONTRACT PERSONNEL</u>		
<u>02 Programs</u>		
Douglas United Nuclear	794	900
Assisting Other Contractors	<u>9</u>	<u>9</u>
Total - 02	803	909
<u>Other Programs Under AEC Contract</u>		
Assisting Other Contractors and WPPSS	34	36
Special Irradiations	<u>6</u>	<u>7</u>
Total - Other Programs	40	43
<u>Total Contract Personnel</u>	<u>843</u>	<u>952</u>
<u>COMMERCIAL ACTIVITIES PERSONNEL</u>	<u>18</u>	<u>23</u>
<u>TOTAL FORCE</u>	861	975