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FINAL REPORT
PRODUCTION TEST NO. 105-1-MR
POISON COLUMN CONTROL DURING
REACTOR OPERATION

Received by OST

NOV 23 1952

BY

R. D. SCHILLING AND K. W. HESS

REACTOR SECTION
MANUFACTURING DEPARTMENT

JULY 24, 1952

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FINAL REPORT
PRODUCTION TEST NO. 105-1-MR
POISON COLUMN CONTROL DURING REACTOR OPERATION

By

R. D. Schilling and K. W. Hess

Process Unit
Reactor Section

July 24, 1952 ©

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FINAL REPORT
PRODUCTION TEST NO. 105-1-MR
POISON COLUMN CONTROL DURING REACTOR OPERATION

INTRODUCTION

The lack of control rod capacity in the reactors with nine rods is causing significant production losses. The present control system, which functioned satisfactorily at a 300 MW equilibrium power level, is unable to counteract the larger startup reactivity transient effects at the current high power levels. This lack of strength causes the power level to be restricted during startup. The control system is also not flexible enough to prevent outages for the discharge of temporary poison.⁽¹⁾

A method of obtaining the required supplementary control strength and flexibility has been conceived⁽²⁾ and equipment developed for this purpose. The purpose of this test⁽³⁾ was to demonstrate the operational feasibility of the special front and rear face equipment which was designed to permit the routine charging and discharging of poison slugs at selected process tubes during periods of reactor operation. This report presents the data, results and conclusions obtained from the trial use of this equipment.

SUMMARY

The poison column control equipment was used successfully on three occasions to charge a 45 slug Pb-Cd poison column within one hour after reactor startup and to discharge the poison during operation at power levels of 250, 300 and 414 MW. The supplemental control strength of the poison column was between 13 and 21 inhours.

-
- (1) Document, HW-24817, "Poison Column Control During Reactor Operation", R. D. Schilling - K. W. Hess
 - (2) Document HW-21638, "Poison Addition During Pile Operation", 7-13-51, C. W. Botsford
 - (3) Document HW-23906, "P.T. No. 105-1-MR, Poison Column Control During Reactor Operation", 5-16-52, R. D. Schilling

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There were no reactor control difficulties associated with the use of this equipment.

The method of poison control involves charging standard lead-cadmium slugs into a process tube at full header pressure and under full water flow. This is accomplished by the use of a pressure-lock charging cylinder and a valve on the inlet nozzle. The discharge of the poison slugs is accomplished at a low tube water flow by remotely opening a valve on the rear nozzle and displacing the poison column out of the tube with a dummy loading. The displacement dummies are then washed out of the tube with a high water flow rate. The basis for this method of discharging slugs during reactor operation is the fact that the quantity of water required to cool a poison column is considerably less than the flow rate at which these slugs will flush out of an open tube.

Some minor mechanical difficulties encountered in the operation of the charging cylinder have been rectified. The demonstration has shown that this type of equipment and method do offer a satisfactory method of obtaining additional flexibility and strength of reactivity control.

DISCUSSION

Basis

The ability to charge and discharge poison in selected tubes during reactor operation can result in significant production increases. These increases can be achieved through the following means:

1. Control of Local Hot Spots

The power level of a reactor must be restricted when any tube in the reactor is operating at its limiting power generation value. The effective elimination of local hot spots would allow a maximum number of tubes to approach the limiting production rate. In addition to controlling local high temperature regions, the temperature of cooler, low production areas may be increased by adjustments to poison tubes during operation.

2. Poison Adjustment to Permit Optimum Rod Configuration

The maldistribution of heat generation caused by undesirable rod configurations could be alleviated and a more desirable rod pattern obtained. Although the loadings in flattening tubes may be adjusted during normal outages, shutdowns for the express purpose of adjusting poison have resulted in approximately 12 hours of outage time during the six months from September, 1951 through February, 1952.

3. Discharge of Temporary Poison Without Shutting Down the Reactor

During the six months from September, 1951 through February, 1952 a total of approximately 80 hours of outage time was required to discharge temporary poison columns. This outage time represents approximately 0.3% total production.

4. Discharge of Regular Poison to Extend Scram Recovery Time and Reduce Minimum Downtime

The reactivity transients could be partially controlled by pushing poison tubes during an outage and then reloading them after startup as the xenon burnout increases.

5. Faster Rise to Full Power Level

Significant production losses are being sustained at B, D, DR and F reactors due to insufficient control strength in the horizontal rod system during the reactivity transient following startup. The added control strength offered by adjustable poison columns will permit these reactors to maintain a power level consistent with graphite and/or tube temperature limitations during the non-equilibrium period.

It is estimated that the addition of 120 inhours of variable control in these reactors will permit high power level startups which will result in a 3.2% increase in production based on an average of two cold startups per month at each of these reactors.

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EQUIPMENT DESCRIPTION

A method of charging any current type of slug and discharging poison and dummies at any previously selected process tube during reactor operation has been developed.

Slugs may be added to the selected tubes through a pressure lock device on the front nozzle and may be discharged by flushing or by displacement. Water flow is used to seat the charge.

A sketch of the equipment taken from the Production Test⁽²⁾ is shown in Figure 1, appended. It consists of modified front and rear nozzles, a hydraulic charging tube and a remote control station for operating the rear nozzle valve. The nozzles each contain a ball valve which will permit the passage of slugs when open and provide an effective seal against tube pressure when closed. The valve is a standard 2" Rockwood Sprinkler Co., screwed bond type and contains a steel ball mounted in a two piece aluminum body. The rear nozzle valve is hydraulically operated by a double acting cylinder. This cylinder is controlled from the most accessible sample room. The charging of slugs is accomplished by attaching the charging tube, which will stand tube inlet pressures, to the lug ring on the inlet nozzle valve, sealing the charging tube with the screw lock, opening the inlet nozzle valve and charging the slugs from the charging tube into the process channel by means of the hydraulically operated piston. Discharge is accomplished by opening the rear nozzle valve remotely from the sample room control station and displacing the column with a dummy loading.

The basis for this method of poison column control is that the water flow required to cool a process tube loaded with lead-cadmium poison is significantly lower than the amount required to wash these slugs from an open tube. This fact permits opening the rear end of a poison tube during reactor operation and requires a controlled displacement of the poison slugs for discharge.

This equipment may be applied to the charging and discharging of uranium columns following the evaluation and solution to two problems. The first of these is the cocking of uranium slugs charged by water flow. Cocking may be undesirable from heat transfer considerations. This is being investigated and it is felt that a satisfactory solution will be found. The second problem, associated with discharging uranium while operating, results from the fact that the flow required to cool a heavy metal column is nearly the same as the quantity which will wash these slugs from an open tube. Several solutions to this problem are being investigated.

RESULTS

In this test, the equipment was used on one tube to determine its operational limitations and to evaluate the problems associated with charging and discharging poison during reactor operation.

The equipment was mounted on tube 1277-B and was successfully used for poison addition and discharge on three occasions. In each test, a downstream dummy pattern, a full loading of forty-five lead-cadmium poison slugs and two solid aluminum dummies were charged approximately one hour after reactor activation. The discharge was accomplished after reactor reactivity turn-around at different reactor power levels on each test. In the initial test, the discharge was accomplished at a 250 MW level by a displacement of the poison pieces through the entire length of the tube. During the second and third tests, the power level was 300 and 415 MW respectively and the poison pieces were displaced only through the active portion of the reactor and then were washed out with the high water flow of the flushing operation.

Complete operating data were taken for a fifteen minute period before and after poison adjustments as well as during the actual test. These data consist of all control rod positions, temperatures of the test tube, the average temperature of the eight surrounding tubes, a standard tube and the bulk effluent temperature, power level and operational comments. The data, in

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the Appendix, show that the reactor was as closely controlled during the periods of poison adjustment, as during normal operation prior and subsequent to the test periods.

The following comments summarize the observed results obtained during the test.

1. Mechanical Operation

Only minor difficulties occurred in the use of the equipment.

Rear - From two to five minutes delay occurred in the initial opening of the rear ball valve during each of the three discharge operations. No delay occurred in closing the valve. The lag in the opening cycle was due to the presence of air in the cylinder, low water pressure and small control lines. No other difficulty occurred with the rear nozzle installation.

Front - No difficulty occurred with the front ball valve. The fittings on the auxiliary water supply line developed water leaks after several uses and were re-seated. The piston in the charge cylinder became hard to withdraw due to a lack of lubrication on the "O" ring.

2. Time Required for Charge-Discharge Operations

Approximately one-half hour front elevator time was required to accomplish each operation. The actual elapsed time required for pile poison changes averaged thirteen minutes for charging and ten minutes for discharging.

3. Tube Temperature Effects

The effluent temperature of the test tube varied approximately four degrees during a majority of the poison column adjustments and the average effluent temperature from the eight surrounding tubes varied about 5°C from the temperature of the standard. The temperature changes showed the poisoning effect of the column. As poison was charged into the tube, the temperature of the surrounding eight tubes dropped from the standard; conversely, as the poison was discharged,

the temperature of the surrounding tubes converged on that of the standard. These effects are shown in Figure 2. The temperature rise of the test tube indicated an ample supply of cooling water at the design value of 7.5 gpm.

4. Pressures

The panellit pressure of the test tube varied from 7 to 94 psi during the discharging operations and from 28 to 225 psi during the charging operations. These variations were expected, and were the result of the tube loading changes and opening the rear valve. They show that the poison tube panellit reading is of no value during operation of the equipment. Flow changes in the test tube did not affect the panellit pressure of adjacent tubes.

5. Power Level

Only minor power level variations occurred during and following the poison column adjustments and were easily controlled. No heat cycling resulted from these variations. During each test a different operator, who relatively unfamiliar with the test operation, was controlling the reactor. Operating experience with this method will probably reduce these minor power level variations.

6. Control Strength

The inhour value of the poison column at the time of charging was between 8.5 and 18 inhours, and at the time of discharging was between 13 and 21 inhours. This latter range is the best indication of the control strength of the column because of the inherent difficulties in calculating reactivity effects immediately following startup. The power level and relative reactivity variations during the time of poison charging and discharging are shown in Figure 3. The lack of a definite drop in the rod control of Charge II was probably obscured by the normal control difficulties of a "P" column startup.

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The difficulties encountered were all of a minor mechanical nature and for the most part have been rectified. The particular cylinder used to actuate the rear nozzle valve was designed for air operation. The substitution of a cylinder designed for water service and the use of a higher pressure would speed the opening of the rear nozzle. The use of an oil medium may be advantageous.

It is concluded from the results of these tests that the equipment and poison control method offer a satisfactory means for obtaining supplementary reactor control.

Robert D Schilling
R. D. Schilling

K. William Hess
K. W. Hess

RDS:KWH:mb

FIGURE 1

NO.		REV. BY		APPD. BY		DEPT.		DATE		DWG. NO.		DRAWING TITLE	
REVISIONS										REFERENCE DRAWINGS			
SCALE:										U.S. ATOMIC ENERGY COMMISSION			
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APPROVALS										GENERAL ELECTRIC			
DIV.										SPECIAL POISON CONTROL EQUIPMENT			
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APPENDIX

POISON CHARGING - TEST I

5-28-52

TIME AM	Total Time	LOADING		TEMPERATURES		PRES- SURE 1277 Panellet	POWER LEVEL L and N	CONTROL STRENGTH		OPERATION REMARKS
		Slugs	Cycle	8 Tube Average	973 Std.			Rod IH	Calculated IH	
5:53	0	0	1	48	49	33	300	163	127	Rear valve opened - Flushing dummies
5:59	6	AP*	2	48	50	65	289	244		Rear valve closed
6:00	7		3							Inlet temp. 14.1°C
01	8									
02	9									
03	10									
04	11									
05	12									
06	13									
07	14									
08	15									
09	16									
10	17									
11	18									
12	19									
13	20									
14	21									
15	22									
16	23									
17	24									
18	25									
19	26									
20	27									
21	28									
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24	31									
25	32									
26	33									
27	34									
28	35									
29	36									
30	37									
31	38									
32	39									
33	40									
34	41									
35	42									
36	43									
37	44									
38	45									
39	46									
40	47									
41	48									
42	49									
43	50									
44	51									
45	52									

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POISON DISCHARGING - TEST I

Swing 5-28-52

TIME	LOADING		TEMPERATURES		PRES- SURE LEVEL	CONTROL STRENGTH			OPERATION REMARKS
	Total Time	Slug Cycle	Total Time	Average Std.		L and N	Rod Position	Calculated IH	
11 30	-8		18.0	31.8	57	250	A 2 B in 14		
33	-5		17.2		57	250	4-5 out 12		
36	-2						5-40 11	304.5	
38	0	2-AP	34.0	32.2	40	251	7.8 in 9) 200 11-		Rear Valve Opened
39	-1		34.2	32.2	30	252	125 11		Hit Charge
40	2								
41	3		34.2	32.2	30	252	125 11		
42	4		34.2	32.2	30	252	125 11		
43	5		34.2	32.2	30	252	125 11		
44	6		35.0	32.2	27	231	100 12	303.9	22
45	7		35.0	32.2	27	248	" 12		
46	8		36.0	32.2	27	250	160 16		First P on Rear
47	9		36.0	32.2	27	251	90 24	303.4	14
48	10		37.8	36.0	25	251	30 29		
49	11		39.8	38.6	22	251	30 29		
50	12		39.8	38.6	19	251	30 29		
51	13		39.8	38.6	17	251	30 29		
52	14		39.8	38.6	14	254	in 32		
53	15		39.8	38.6	12	248	4) 2" in-out 29		
54	16		39.8	38.6	9	250	33.5 29	302.8	0
55	17	2-AP	39.8	38.6	7	250	33.5 29		All P Out
56	18	1-SA	39.8	38.6	7	250	33.5 29		Open Pigtail Valve
57	19		39.8	38.6	7	250	33.5 29		All Perfs Out
58	20		39.8	38.6	7	250	33.5 29		Pigtail Closed - Rear Closed
59	21		39.8	38.6	7	250	33.5 29		Flow Restriction Dummies -
12 00	22	2-SA	12.0	37.9	60	253	25.0 29.5		Pigtail open
01	23	2-SA	11.8	37.6	90	248	15 30	302.3	
02	24		11.8	37.2	88	244	20 30		
03	25		11.8	37.2	90	244	20 30		
04	26								
05	27		14.0	37.5	94	245	26.2 29	301.7	Pigtail closed
06	28		14.0	38.3	31	245	26.2 29	at 07	
07	29		14.0	39.0		245	26.2 29		
08	30		14.0	39.0	31		26.2 29		
09	31		14.0	39.0			26.2 29		
10	32		14.0	39.0			26.2 29		
11	33		14.0	39.0			26.2 29		
12	34		14.0	39.0			26.2 29		
13	35		14.0	39.0			26.2 29		
14	36		14.0	39.0			26.2 29		
15	37		14.0	39.0			26.2 29		
16	38		14.0	39.0			26.2 29		
17	39		14.0	39.0			26.2 29		
18	40		14.0	39.0			26.2 29		
19	41		14.0	39.0			26.2 29		
20	42		14.0	39.0			26.2 29		

POISON INHOURS TAKEN FROM PLOT

POISON CHARGING - TEST II

Swing 8-27-52

TIME	LOADING		TEMPERATURES			PRES-SURE	POWER LEVEL	CONTROL STRENGTH			OPERATION REMARKS
	Time Total	Time Cycle	Total Slug	1277 Test	8 Tube Avg	Std. Dev					
8:48	0	AP	1	16.2	48.4	-4.2	44.2	390	300.0	A-2, 8, 9 In	Pigtail Open
8:57	0	AP	1	17.0	48.8	-3.3	43.5	358	284.0	B at 137-241	Flow 37,000 gpm
8:58	1			17.1	45.0	-5.7	39.3	73		B-51/7-220.3	Min. 45°C
8:59	2	2.3		17.1	45.0	5.0	40.7	87	287.0	B-1597-230.3	
9:00	3			17.1	51.0	-5.0	46.1	87			
9:1	4			17.2	55.9	-6.6	47.8	83	312.0	B-102.1	
9:2	5	5.6		17.1	54.5	-6.5	48.0	83			
9:3	6			17.1	53.6	-6.6	44.2	83	318.0	B-24.7	
9:4	7			17.1	51.7	-6.6	44.8	83	312.0	B-24.7	
9:5	8			17.1	50.1	-6.1	44.0	85	376	B-147-212.6	
9:6	9			17.1	50.0	-5.0	44.0	85			
9:7	10	AP	8	17.2	48.0	-5.8	42.1	85	380	7-212.0	
9:8	11	P	8	17.2	47.8	-5.8	42.0	85	387	7-210.0	
9:9	12		10	17.2	48.4	-5.6	43.8	85	381	7-204.5	
9:10	13		11	17.2	48.2	-5.3	43.9	85	384	7-228.2	
9:11	14		12	17.3	49.1	-5.2	43.9	85	371	7-207.8	
9:12	15		13	17.4	47.5	-5.1	43.8	113	394	7-228.4	
9:13	16		14	17.4	45.3	-4.2	41.1	134	300	7-186.5	
9:14	17		15	17.4	45.3	-3.8	43.3	134	285	7-186.5	
9:15	18		16	17.4	48.2	-2.9	43.3	176	310	7-204.3	
9:16	19		17	17.8	48.2	-3.3	40.7	176	372	7-208.5	
9:17	20		18	18.0	44.0	-1.6	38.8	181	364	302.5	Pigtail Valve Closed at 9:27:50
9:18	21		19	18.0	41.6	-1.1	40.5	181	302.5	7-180.0	
9:19	22		20	18.0	43.6	-0.8	42.8	215	385	300	
9:20	23		21	18.4	42.3	-1.3	41.0	215	385	300	
9:21	24	SA	22	18.4	41.2	-1.0	40.2	225	385	301.5	
9:22	25		23	18.6	41.2	-1.0	40.2	225	302.5	7-186.2	
9:23	26		24	18.3	39.3	-1.2	38.2	223	302.5	7-186.2	
9:24	27	SA	25	18.3	39.3	-1.2	38.2	223	302.5	7-186.2	
9:25	28		26	18.6	41.7	-3.3	41.2	223	302.5	7-186.2	
9:26	29		27	18.6	42.9	-1.1	41.8	223	302.5	7-186.2	
9:27	30		28	22.0	41.0	-1.0	40.0	53	302.5	7-180.0	
9:28	31		29	22.2	40.9	-0.4	40.5		300	7-164.7	
9:29	32		30	22.5	40.5	0.0	40.5		300	162.0	
9:30	33		31						300	162.0	
9:31	34		32						300	153.5	
9:32	35		33						301.5	148.0	
9:33	36		34						142.6	232	
9:34	37		35						280	232	
9:35	38		36								
9:36	39		37								
9:37	40		38								
9:38	41		39								
9:39	42		40								
9:40	43		41								
9:41	44		42								
9:42	45		43								
9:43	46		44								
9:44	47		45								
9:45	48		46								
9:46	49		47								
9:47	50		48								
9:48	51		49								
9:49	52		50								

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POISON DISCHARGING - TEST II

G. Aveyard 6-28-52

TIME	LOADING			TEMPERATURES			PRES-SURE	POWER LEVEL	CONTROL STRENGTH				OPERATION REMARKS
	Time	Total	Slug	1277	8 Tube	Std.			Land	Calculated	Rod	Polson	
	AM	Time	Slug	Test	Average	-Avg.	Panellet	Calv.	Land	Position	ΔIH	IH	
3:21	0			23.0	38.9	-0.4	25.5	52	450	300	6-238.5	0	A, 2, B, 7, 8 in; 4.5, 8 out;
3:22	1								450	300	238.2	0	Rear valve opened at
3:24	3								440	300	242.6	-1	3:27.30
3:26	5								435	300	242.6	-1	Flow 36,900 gpm
3:28	7	AP		41.2	38.8	-0.6	38.2		435	300	242.6	-1	Eff. 48.0°C
3:29	8	2-AP	1		38.9	-0.6	28.3		435	299	250	-1	
3:30	9	2	4		39.0	+0.7	38.7		435	301	250	-1	
3:31	10				39.0	+0.6	38.6		430	300.5	250	-1	
3:32	11				39.0	+0.5	38.5		430	299	252.5	-1	
3:33	12				40.2	+0.2	38.2		430	298	8-273.1	+2	8 at 252.5 inches
3:34	13				39.0	+0.3	38.3		445	299.5	257.5	+3	
3:35	14				39.0	-0.2	38.9		430	291	210	+8	
3:36	15				39.2	+0.1	38.3		430	285	213.5	+8	
3:37	16				39.6	0	38.6		430	288	219.5	+7	
3:38	17				40.1	-0.2	38.9		440	288	230.5	+8	
3:39	18				40.9	-0.5	40.4		440	293	6-242.3	+8	
3:40	19				43.0	-1.8	41.2		440	285	243.3	+8	
3:41	20				43.6	-2.6	41.0		440	295	260	+5	
3:42	21				43.6	-3.2	40.4		440	285	244.2	+2	
3:43	22				44.2	-3.4	40.8		435	285	6/270	+4	
3:44	23				44.2	-4.2	41.0		435	285	9/254.2	+4	
3:45	24				45.9	-4.5	41.4		435	295	6-273.0	+4	
3:46	25				45.9	-4.5	41.4		435	295	281	+3	
3:47	26				46.2	-4.1	42.1		435	295	298	+2	
3:48	27				46.0	-4.0	42.0		430	298	OUT	+1	
3:49	28												
3:50	29												
3:51	30												
3:52	31												
3:53	32												
3:54	33												
3:55	34												
3:56	35												
3:57	36												
3:58	37												
3:59	38												
4:00	39												
4:01	40												
4:02	41												
4:03	42												
4:04	43												
4:05	44												
4:06	45												

Open Rear Ball Valve to
Flush Closed Rear Ball Valve
Charge two SA Flow Restrict-
tion Dummies

Day 6-28-52

DECLASSIFIED

POISON DISCHARGING - TEST III

Day 6-29-52

TIME		LOADING		TEMPERATURES				POWER LEVEL	CONTROL STRENGTH			OPERATION REMARKS		
Time	Total	Time	Slug	8 Tube	Std. Average	Std. Avg.	Effu-ent	Calv.	Land	N	Rod	Position	Rod Calcu- ΔBH lated ΔIH	Poison ΔH
11:03				49.8	5.2	55.0	58.9	1030	414		8-57.0	0	0	A. 2 in. 5 out. B-55 5. 4-265 7. 6-130. 7-158. 9-197
05				50.0	5.0	55.0		1030	413		58.0	0		
07				50.0	5.0	55.0		1035	414		60.0	-1		Flow 37.040 gpm.
09				50.0	5.0	55.0		1035	414		61.2	-1		
11				50.0	5.0	55.0		1030	414		62.0	-1		Eff 59.0
12				50.0	5.0	55.0		1035	414		65.0	-1.5		
13				50.1	5.1	55.2		1035	414		66.0	-2		From plot
14				50.3	4.9	55.2		1030	414		66.0	-2		
15				50.3	4.8	55.1		1035	414		69.0	-2		21
16				50.3	4.8	55.1		1035	414		70.0	-2		
17				50.3	4.8	55.1		1035	414		70.0	-2		-3
18				50.3	4.8	55.1		1035	414		72.0	-3		
19				50.3	4.8	55.1		1035	414		74.0	-3		16
20				50.3	4.8	55.1		1035	414		69.0	-2		
21				50.3	4.8	55.1		1035	414		69.0	-2		7
22				50.3	4.8	55.1		1035	414		69.0	-2		
23				50.3	4.8	55.1		1035	414		69.0	-2		16
24				50.3	4.8	55.1		1035	414		69.0	-2		
25				50.3	4.8	55.1		1035	414		69.0	-2		16
26				50.3	4.8	55.1		1035	414		69.0	-2		
27				50.3	4.8	55.1		1035	414		69.0	-2		16
28				50.3	4.8	55.1		1035	414		69.0	-2		
29				50.3	4.8	55.1		1035	414		69.0	-2		16
30				50.3	4.8	55.1		1035	414		69.0	-2		
31				50.3	4.8	55.1		1035	414		69.0	-2		16
32				50.3	4.8	55.1		1035	414		69.0	-2		
33				50.3	4.8	55.1		1035	414		69.0	-2		16
34				50.3	4.8	55.1		1035	414		69.0	-2		
35				50.3	4.8	55.1		1035	414		69.0	-2		16
36				50.3	4.8	55.1		1035	414		69.0	-2		
37				50.3	4.8	55.1		1035	414		69.0	-2		16
38				50.3	4.8	55.1		1035	414		69.0	-2		
39				50.3	4.8	55.1		1035	414		69.0	-2		16
40				50.3	4.8	55.1		1035	414		69.0	-2		
41				50.3	4.8	55.1		1035	414		69.0	-2		16
42				50.3	4.8	55.1		1035	414		69.0	-2		
43				50.3	4.8	55.1		1035	414		69.0	-2		16
44				50.3	4.8	55.1		1035	414		69.0	-2		
45				50.3	4.8	55.1		1035	414		69.0	-2		16
46				50.3	4.8	55.1		1035	414		69.0	-2		
47				50.3	4.8	55.1		1035	414		69.0	-2		16
48				50.3	4.8	55.1		1035	414		69.0	-2		
49				50.3	4.8	55.1		1035	414		69.0	-2		16
50				50.3	4.8	55.1		1035	414		69.0	-2		
51				50.3	4.8	55.1		1035	414		69.0	-2		16
52				50.3	4.8	55.1		1035	414		69.0	-2		
53				50.3	4.8	55.1		1035	414		69.0	-2		16
54				50.3	4.8	55.1		1035	414		69.0	-2		
55				50.3	4.8	55.1		1035	414		69.0	-2		16
56				50.3	4.8	55.1		1035	414		69.0	-2		
57				50.3	4.8	55.1		1035	414		69.0	-2		16
58				50.3	4.8	55.1		1035	414		69.0	-2		
59				50.3	4.8	55.1		1035	414		69.0	-2		16
60				50.3	4.8	55.1		1035	414		69.0	-2		

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END

**DATE
FILMED**

3 / 24 / 93