

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

July 9, 1993

NRC INFORMATION NOTICE 93-51: REPETITIVE OVERSPEED TRIPPING OF TURBINE-DRIVEN
AUXILIARY FEEDWATER PUMPS

Addressees

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the problem of repetitive tripping of turbine-driven auxiliary feedwater pumps (TDAFWPs) at the South Texas Project Electric Generating Station. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

On December 27, 1992, Houston Lighting & Power Company (the licensee) performed a monthly surveillance test on its Unit 1 TDAFWP. After receiving a start signal, the pump immediately tripped on an overspeed condition. The operators repeated the surveillance test after a successful local manual start. On this attempt the pump successfully started, and the licensee subsequently considered the pump operable.

On January 23, 1993, Unit 2 tripped from 100-percent power on low water level in one of the steam generators. The trip occurred because electro-hydraulic control oil to the steam generator main feedwater pump turbine was lost. The Unit 2 TDAFWP started on demand and was later secured when no longer required. After the pump was secured, problems occurred when operators attempted to relatch MOV-514 (the TDAFWP trip/throttle valve) from the control room. (See Figure 1.) The pump was declared inoperable. The licensee conducted a significant amount of troubleshooting and testing on the TDAFWP to resolve the MOV-514 relatch problem and another speed control problem that was identified during the testing. After the operability surveillance test was completed successfully, the TDAFWP was declared operable and the unit was restarted on January 25, 1993.

On January 28, 1993, the Unit 1 TDAFWP was tested as part of a routine monthly surveillance. When started, the TDAFWP immediately tripped on an overspeed condition and was subsequently declared inoperable. From January 28 through

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January 30, 1993, the licensee undertook an extensive testing and troubleshooting effort to determine the cause of the problem with the TDAFWP. Numerous pump starts were completed. Several problems (overspeed tripping, lack of speed control, oscillations, and inability to maintain rated full-load, steady-state speed) were identified. On January 30, 1993, the Unit 1 TDAFWP was declared operable following extensive maintenance activities and the successful completion of the surveillance test.

On February 1, 1993, the Unit 1 TDAFWP was tested again at the direction of the Unit 1 operations manager in order to ensure operability, considering the numerous problems encountered previously. After receiving a start signal, the pump tripped on an overspeed condition and was declared inoperable.

On February 3, 1993, Unit 2 was operating at 100-percent power. Two steam-driven steam generator main feedwater pumps and one electric startup feedwater pump were providing feed flow to the steam generators. The startup feedwater pump tripped when the pump lubricating oil duplex strainers were being shifted. Operators began to manually ramp down power but were unable to avoid the low steam generator level. The operators subsequently initiated a manual reactor trip before receiving an automatic reactor protection system trip signal on low steam generator level. Following the plant trip, the Unit 2 TDAFWP received an automatic signal to supply water to the steam generators. The pump started but immediately tripped on an overspeed condition.

On February 4, 1993, Unit 1 commenced a shutdown to place the reactor in the mode required by the Technical Specifications because the TDAFWP had not been restored to an operable condition within the outage time allowed by the Technical Specifications.

Further details can be found in License Event Report 50-498/93-007 and NRC Inspection Reports 50-498; 50-499/93-05 and 50-498; 50-499/93-07.

Discussion

Although the licensee did not identify the root cause of the Unit 1 TDAFWP overspeed trips, the proximate cause was determined to be the intrusion of water into the TDAFWP turbine that adversely affected its performance. However, this cause was effectively masked for several surveillance tests because the surveillance test program established to satisfy the operability requirements of the Technical Specifications was not sufficiently rigorous to assure that the testing was performed under suitable environmental conditions. The TDAFWP was not returned to its normal standby condition before each of the TDAFWP surveillance tests performed on December 27, 1992, and January 30, 1993. Because of this, the pump was not tested in its normal standby condition and degraded conditions affecting operability were not revealed.

The licensee determined that the root cause of the February 3, 1993, Unit 2 TDAFWP overspeed trip was an incorrect valve lineup in conjunction with an inoperable or degraded steam trap. The valves and the steam trap are located in the drain line from the steam admission line. (See Figure 1.) The TDAFWP overspeed trip was caused by excessive condensate buildup in the steam supply line upstream of the trip/throttle valve (MOV-514 in Figure 1). The excessive condensate had accumulated because the steam trap bypass valve, MS-517, was incorrectly positioned (closed) and the steam trap had degraded to such an extent that it was no longer capable of passing condensate to the condenser.

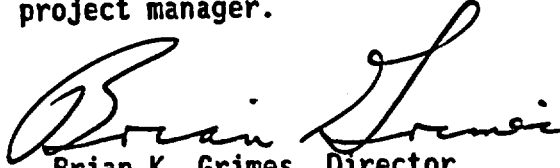
The licensee took the following corrective actions related to the hardware modifications for both units:

- The trip/throttle valves and governors were sent to the respective vendors for complete refurbishment and testing. The gearing arrangement of the trip/throttle valve was modified to ensure slower stroke time, thus enabling a more positive governor response.
- The TDAFWP drain system was modified to remove the steam traps in the steamline drain system, replacing them with a spool piece. Also, the trip/throttle valve high-pressure steam leakoff was separated from the turbine casing drain line and rerouted to the sump to prevent possible intrusion of steam into the turbine casing. (See Figure 2.)

Related Generic Communications

- NRC Information Notice 86-14, Supplement 2, "Overspeed Trips of AFW, HPCI, and RCIC Turbines," dated August 26, 1991.
- NRC Information Notice 88-09, "Reduced Reliability of Steam-Driven Auxiliary Feedwater Pumps Caused by Instability of Woodward PG-PL Type Governors," dated March 18, 1988.
- IE Information Notice 86-14, Supplement 1, "Overspeed Trips of AFW, HPCI, and RCIC Turbines," dated December 17, 1986.
- IE Information Notice 86-14, "PWR Auxiliary Feedwater Pump Turbine Control Problems," dated March 10, 1986.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.



Brian K. Grimes, Director
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Office of Nuclear Reactor Regulation

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(817) 860-8141

William D. Johnson, RIV
(817) 860-8148

Peter C. Wen, NRR
(301) 504-2832

Attachments:

1. Figure 1, Existing South Texas Project
TDAFWP Steam Supply and Exhaust System
2. Figure 2, Modified South Texas Project
TDAFWP Steam Supply and Exhaust System
3. List of Recently Issued NRC Information Notices

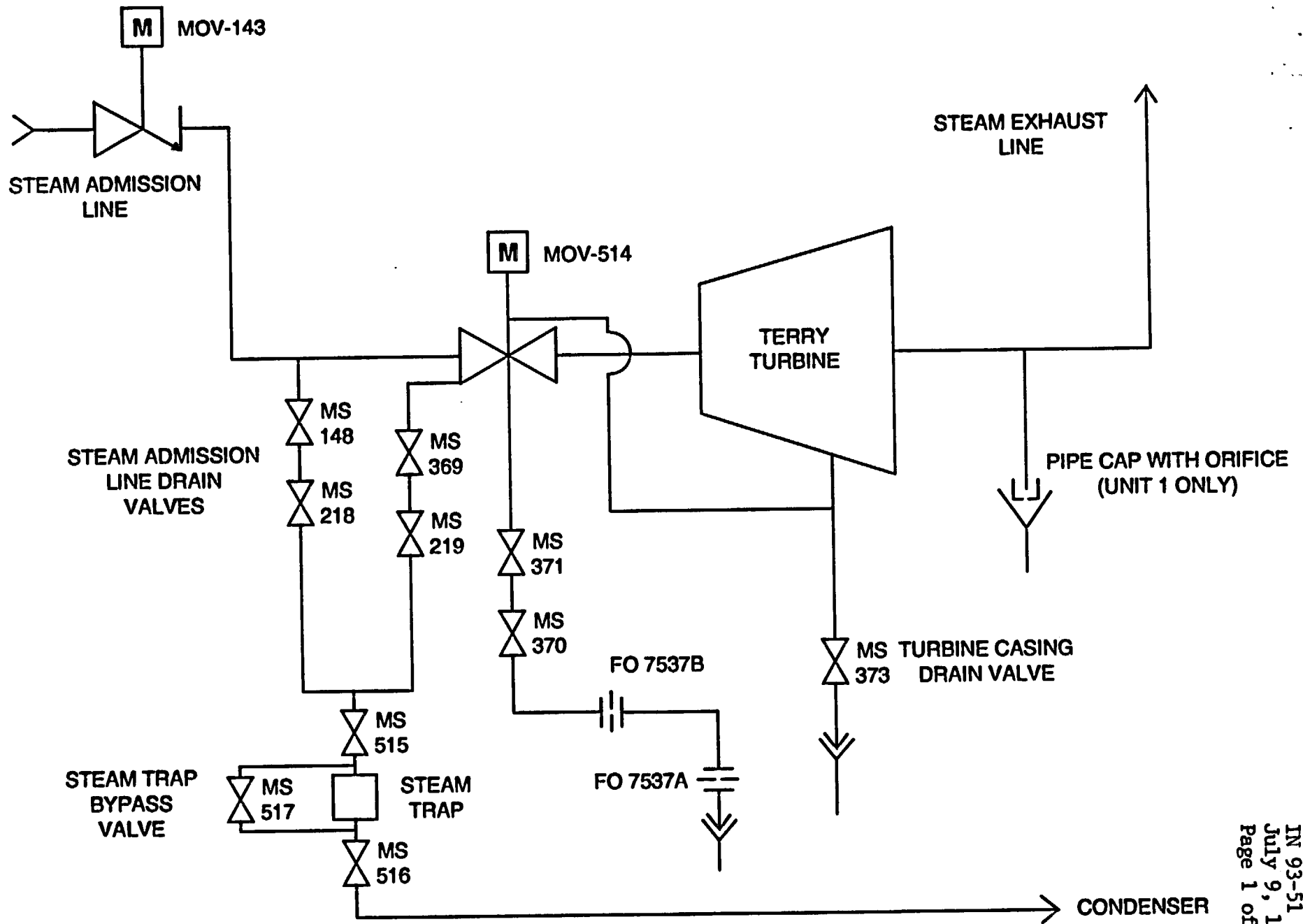


FIGURE 1
TDAFWP STEAM SUPPLY AND EXHAUST SYSTEM (UNMODIFIED)

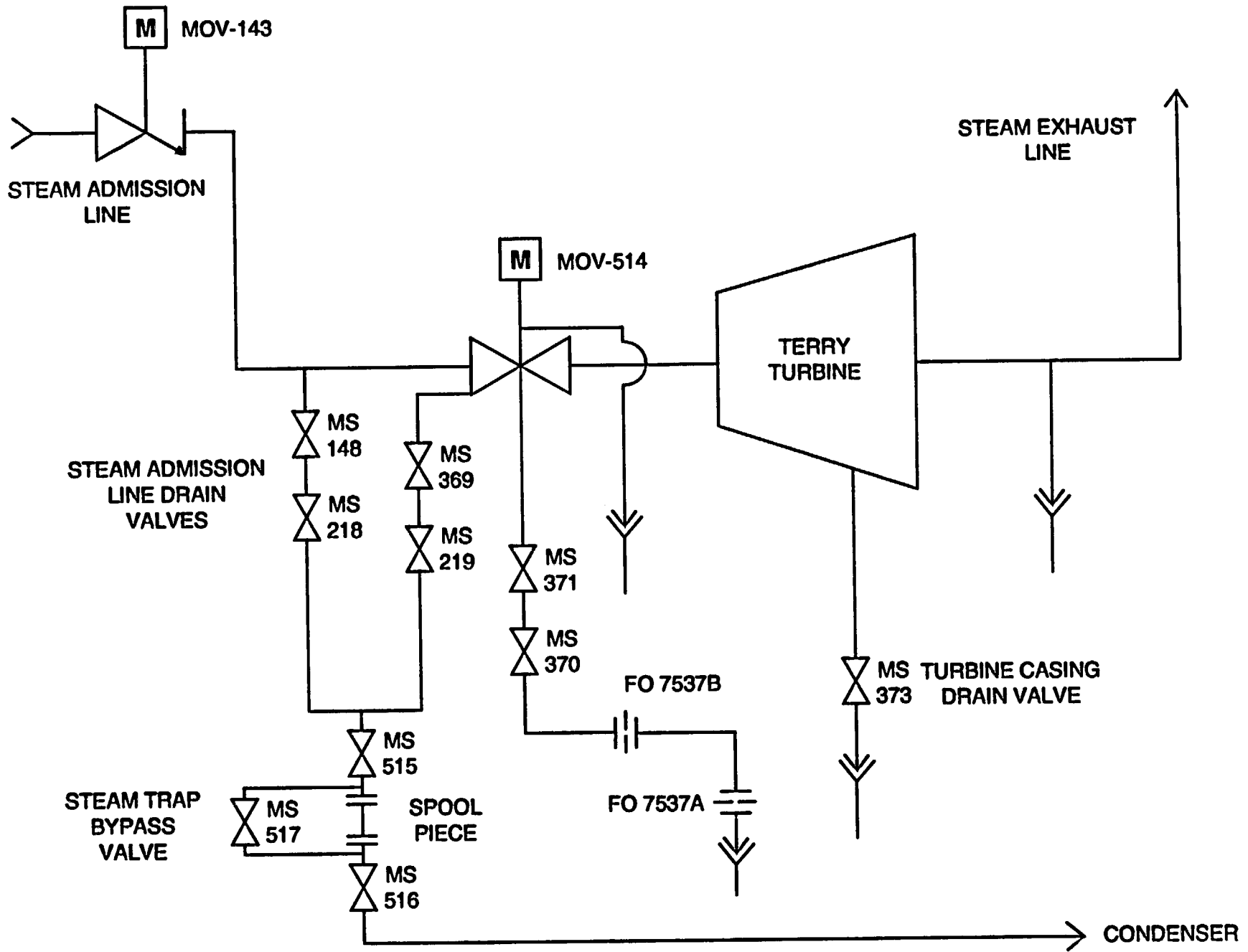


FIGURE 2
TDAFWP STEAM SUPPLY AND EXHAUST SYSTEM (MODIFIED)

LIST OF RECENTLY ISSUED
 NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-50	Extended Storage of Sealed Sources	07/08/93	All licensees authorized to possess sealed sources.
93-49	Improper Integration of Software into Operating Practices	07/08/93	All holders of OLs or CPs for nuclear power reactors.
93-48	Failure of Turbine-Driven Main Feedwater Pump to Trip Because of Contaminated Oil	7/6/93	All holders of OLs or CPs for nuclear power reactors.
92-06, Supp. 1	Reliability of ATWS Mitigation Systems and Other NRC-Required Equipment not Controlled by Plant Technical Specification	07/01/93	All holders of OLs or CPs for nuclear power reactors.
93-47	Unrecognized Loss of Control Room Annunciators	06/18/93	All holders of OLs or CPs for nuclear power reactors.
93-46	Potential Problem with Westinghouse Rod Control System and Inadvertent Withdrawal of A Single Rod Control Cluster Assembly	6/10/93	All holders of OLs or CPs for Westinghouse (W)-designed nuclear power reactors.
93-45	Degradation of Shutdown Cooling System Performance	06/16/93	All holders of OLs or CPs for nuclear power reactors.
93-44	Operational Challenges During A Dual-Unit Transient	06/15/93	All holders of OLs or CPs for nuclear power reactors.
93-43	Use of Inappropriate Lubrication Oils in Safety-Related Applications	06/10/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
 CP = Construction Permit

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***SEE PREVIOUS CONCURRENCE**

OFFICE	*OGCB:DORS	*DRP:RIV	*TECH ED.	*SC:DRP:RIV	*D:DRP:RIV
NAME	PCWen/vsb	MASatorius	MFMejac	WDJohnson	ABBeach
DATE	06/01/93	06/02/93	06/02/93	06/04/93	06/04/93
*PM:PDV:NRR	*C:SPLB:DSSA:NRR	*D:DSSA:NRR	*C:OGCB:DORS:NRR	D:DORS:NRR	
LEKokajko	CEMcCracken	ACThadani	GHMarcus	BKGrimes	
06/08/93	06/09/93	06/10/93	06/16/93	07/ / 93	

DOCUMENT NAME: 93-51.IN

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DATE	06/01/93	06/02/93	06/02/93	06/04/93	06/04/93
*PM:PDV:NRR	*C:SPLB:DSSA:NRR	*D:DSSA:NRR	C:OGCB:DORS:NRR	D:DORS:NRR	
LEKokajko	CEMcCracken	ACThadani	GHMarcus <i>GHM</i>	<i>SK</i> Grimes	
06/08/93	06/09/93	06/10/93	06/16/93	06/25/93	

DOCUMENT NAME: INTDAFWP.WP

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DATE	06/01/93	06/02/93	06/02/93	06/04/93	06/04/93
PM:PDV:NRR	BC:SPLB:ESSA?NRR	329 A:ESSA:NRR	BC:OGCB:DORS:NRR	D:DORS:NRR	
LEKokajko	CEMcCracken	ACThadani	GHMarcus	BKGrimes	
06/8/93	06/9/93	06/10/93	06/ /93	06/ /93	

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 June xx, 1993
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NAME	PCWen/vsb	MASatorius	MFMeJac	WDJohnson	ABBeach
DATE	05/01/93	05/1/93	06/02/93	06/4/93	06/4/93
RE:PLB:DSSA:NRR	D:DSSA:NRR	BC:OGCB:DORS:NRR	D:DORS:NRR		
CCMcCracken	ACThadani	GHMarcus	BKGrimes		
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DATE	06/1/93	06/ /93	06/2/93	06/ /93	06/ /93
BC:SPLB:DSSA:NRR	D:DSSA:NRR	BC:OGCB:DORS:NRR	D:DORS:NRR		
CEMcCracken	ACThadani	GHMarcus	BKGrimes		
06/ /93	06/ /93	06/ /93	06/ /93		

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