Mel Price – Auxiliary Lock Downstream
Miter Gate Repair

One Corps Serving the Armed Forces and the Nation
Mel Price Accident
3 October 2004

What Happened?

Why Did It Happen?
Mel Price Accident

What Happened?
Gate Leafs Forced Downstream From Normal Mitered Position

One Corps Serving the Armed Forces and the Nation
Gate Leafs Forced Downstream From Normal Mitered Position
Mel Price Accident

Damage Summary
Damage to Gate Anchorages

One Corps Serving the Armed Forces and the Nation
Damage to Gate Anchorages
Damage to Gate Anchorages
Failed Operating Struts
Diagonal Failure

One Corps Serving the Armed Forces and the Nation
Damage to Miter End of Leafs

One Corps Serving the Armed Forces and the Nation
Pintle Socket Sheared Off

One Corps Serving the Armed Forces and the Nation
Pintle Ball Retainer Sheared Off
Bottom Seal Damaged
Mel Price Accident

Why Did It Happen?
Gate Operating Arm

Failure Tube

10.20.2004 09:29

One Corps Serving the Armed Forces and the Nation
Operating Arm Failure Tube

Failure Bolts

MITER GATE STRUT ASSEMBLY MK231/1-1

One Corps Serving the Armed Forces and the Nation
Failure Tube

Failure Bolt

Fractured Strut

One Corps Serving the Armed Forces and the Nation
Normal Miter Block Position

One Corps Serving the Armed Forces and the Nation
One Corps Serving the Armed Forces and the Nation

Gate Control Stations

Central Control House

Local Control House
Switches on Machinery Rack

One Corps Serving the Armed Forces and the Nation
Modification of PLC Logic

One Corps Serving the Armed Forces and the Nation
Miter Gate Sill

One Corps Serving the Armed Forces and the Nation
Miter Gate Sill

- Miter End
- Of Leaf
- Bottom Seal
- Gate Stop
- Top of Sill

One Corps Serving the Armed Forces and the Nation
Investigation Report
Findings

• Increased hydraulic system relief pressures and fracture of the strut failure tube failure bolts.
• Leaves not mitered.
• PLC programming incorrectly indicated that the downstream gate was mitered (closed).
• No operator verification of miter or intervention.
• Filling of lock chamber with the downstream gate leaves not in miter.
• Appreciable unbalanced head on the unmitered downstream gate leaves.
• Catastrophic failure – miter gate leaves move past miter.

One Corps Serving the Armed Forces and the Nation
Actions Taken By MVS
Based on Report Recommendations

1. Standard Operator Procedures and Training
2. Programming Ladder Logic Control
3. Additional Miter Gate Switch
4. Policy on Changes and Inter-Office Coordination
5. Relief Valve Gages and Mechanical Linkages
All-Discipline Team

One Corps Serving the Armed Forces and the Nation
Concentrate On Critical Activities

One Corps Serving the Armed Forces and the Nation
Variety of Contract Instruments

Best Value
AE IDIQ
MIPR
Purchase Order
Lump Sum Contract
Credit Card

One Corps Serving the Armed Forces and the Nation
Team Visits

Engineers conferring with Contractor

Diagonal Stressing Team

One Corps Serving the Armed Forces and the Nation
What We Did Right

- All-Discipline Team
- Communicate, Communicate, Communicate
- Concentrated On Critical Activities
- Hired Contract Employee To Schedule Service Base And Contractor Work
- Contingency Planning
- Used Any and All Contract Options
- Team Project Visits To See Progress
- Kept Exec Office Involved
- Risk reduction measures to keep the main lock operating.
Gate Repairs
Gate Repairs

Pulling Gate
Position of Leafs After Accident
Removing Illinois Leaf

Rock Island District

Crane “Hercules”
Placing Illinois Leaf on Spare Gate Barge

One Corps Serving the Armed Forces and the Nation
Guy Cables Installed

One Corps Serving the Armed Forces and the Nation
Guy Cables Installed

One Corps Serving the Armed Forces and the Nation
Both Leafs Secured on Spare Gate Barge

One Corps Serving the Armed Forces and the Nation
Damage Inspection

One Corps Serving the Armed Forces and the Nation
Surveying Damaged Gate

One Corps Serving the Armed Forces and the Nation
Survey Results – Illinois Leaf

2.21’ max deflection

0.5’

1’

1.5’

2’

FLOW
MISSISSIPPI RIVER
What Do We Do Now?
Panel of Experts

- Retired construction and operations personnel from USACE (Similar Failure At Bankhead)
- Steel structures engineering experts from various universities
- Heat straightening expert
- Structural engineers from other USACE offices
- St. Louis District structural engineers, lock operations personnel and Rivers Project Office personnel
Conclusions From Panel of Experts

- Gate could be repaired
- Repair would be quicker than replacement
- Heat straightening could be used
- Leafs should be layed down for repairs
Gate Repairs

Laying Leafs Down
Original Lifting Beam For Vertical Lifting Only

One Corps Serving the Armed Forces and the Nation
Redesigned Lifting Beam

One Corps Serving the Armed Forces and the Nation
Lifting Beam In “Green Monster” Test Rack

One Corps Serving the Armed Forces and the Nation
Installing Lifting Beam
Turning Feet for Gate Laydown

One Corps Serving the Armed Forces and the Nation
Removing Guy Cables

One Corps Serving the Armed Forces and the Nation
Shreve Moving Leaf For Lay Down

“Louisville” District Crane “Shreve”

One Corps Serving the Armed Forces and the Nation
Aligning Turning Feet on Support Stands

One Corps Serving the Armed Forces and the Nation
In Position for Laydown

Crane Barge Sewell Winch Used to Initiate Rotation

One Corps Serving the Armed Forces and the Nation
Rotation on Turning Feet

One Corps Serving the Armed Forces and the Nation
Shreve Setting Leaf Horizontal

One Corps Serving the Armed Forces and the Nation
Gate on Support Stands

One Corps Serving the Armed Forces and the Nation
Gate Leafs in Horizontal Position

One Corps Serving the Armed Forces and the Nation
Leaf Supported In Deflected Position

Approx. 18°
Enclosure on Delong Barge at Service Base

One Corps Serving the Armed Forces and the Nation
Gate Repairs

Heat Straightening
Heat Straightening Crew

One Corps Serving the Armed Forces and the Nation
Heat Straightening

Vee Heats

One Corps Serving the Armed Forces and the Nation
Spot Heats
Heat Straightening Diagonals
Diaphragms Before Heat Straightening

One Corps Serving the Armed Forces and the Nation
Diaphragm After Heat Straightening
Support Condition For Checking Straightness

Single Support On Top Girder

Two Support Columns On Bottom Girder
Gate Repairs

Structural Repairs
Revised Strut Arms and New Pintle Sockets

No Failure Bolts

One Corps Serving the Armed Forces and the Nation
Machining Strut Arm at Service Base

One Corps Serving the Armed Forces and the Nation
Fabrication Work at Service Base

One Corps Serving the Armed Forces and the Nation
Welding Strut Arm at Service Base

One Corps Serving the Armed Forces and the Nation
Modified Bottom End of Diagonal

One Corps Serving the Armed Forces and the Nation
Modified Bottom Diagonal Gussets

One Corps Serving the Armed Forces and the Nation
Modified Bottom End of Diagonal

One Corps Serving the Armed Forces and the Nation
Castings Supplied By Rock Island Arsenal

Anchor Bars
And Gudgeon Barrels

Pintle Sockets

One Corps Serving the Armed Forces and the Nation
Gate Stops on Miter Gate Sill

One Corps Serving the Armed Forces and the Nation
Lifting Repaired Leafs Vertical
Installing Lifting Device
Shreve Lifting Leaf Vertical

One Corps Serving the Armed Forces and the Nation
Shreve Lifting Leaf Vertical

One Corps Serving the Armed Forces and the Nation
Leafs In Toaster for Transport to Lock
Reinstalling Gate
One Corps Serving the Armed Forces and the Nation

Repaired Illinois Leaf in Place
Welding & Boring Gudgeon Pin Plates

One Corps Serving the Armed Forces and the Nation
Welding & Boring Gudgeon Pin Plates
Installing Missouri Leaf

One Corps Serving the Armed Forces and the Nation
Repaired Gate Leafs in Place

One Corps Serving the Armed Forces and the Nation
Repaired Gate Leafs in Place

One Corps Serving the Armed Forces and the Nation
July 2005 - Auxiliary Lock Back In Service

One Corps Serving the Armed Forces and the Nation
Thank You !!!

One Corps Serving the Armed Forces and the Nation