The Perils of Efficiency

Impacts of an Unexpected Closure of the Poe Lock

Analysis performed by the
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Office of Cyber and Infrastructure Analysis
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Presented August 16, 2016 at Resilience Week, Chicago, IL

Iron Ore-Steel-Automobile Manufacturing Supply Chain

- One of the most consequential supply chains in the United States has a potential single point of failure.
- A six-month disruption could cost $1.1 trillion and 11 million jobs.
- Optimization for efficiency has resulted in loss of resilience, an example of self-organized criticality.

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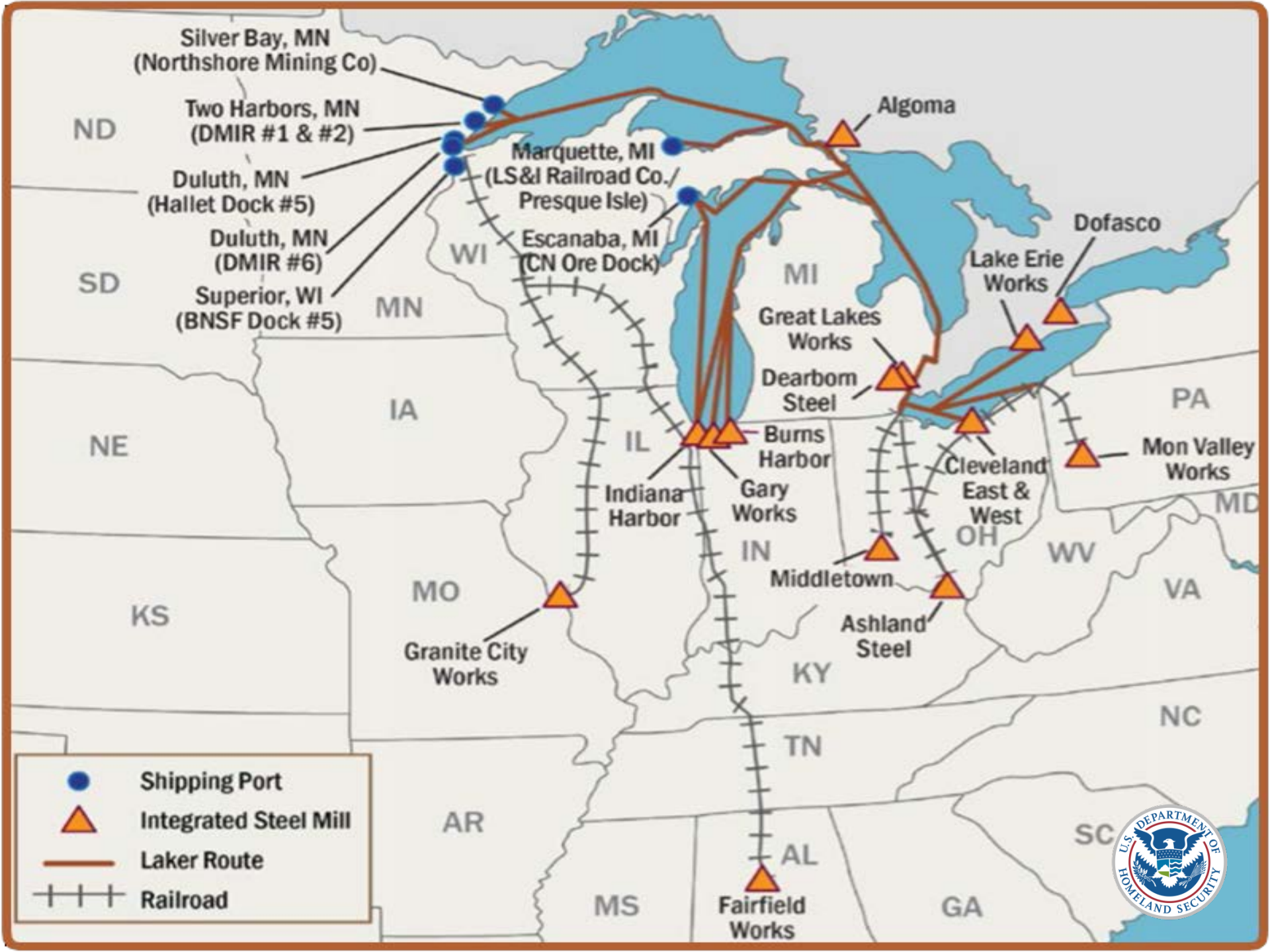
Silver Bay, MN
(Northshore Mining Co)
Two Harbors, MN
(DMIR #1 & #2)
Duluth, MN
(Hallet Dock #5)
Duluth, MN
(DMIR #6)
Superior, WI
(BNSF Dock #5)
Marquette, MI
(LS&I Railroad Co./
Presque Isle)
Escanaba, MI
(CN Ore Dock)
Algoma
Dofasco
Lake Erie
Works
Great Lakes
Works
Dearborn
Steel
Burns
Harbor
Indiana
Harbor
Gary
Works
Cleveland
East &
West
Mon Valley
Works
Middletown
Ashland
Steel
Granite City
Works
Fairfield
Works
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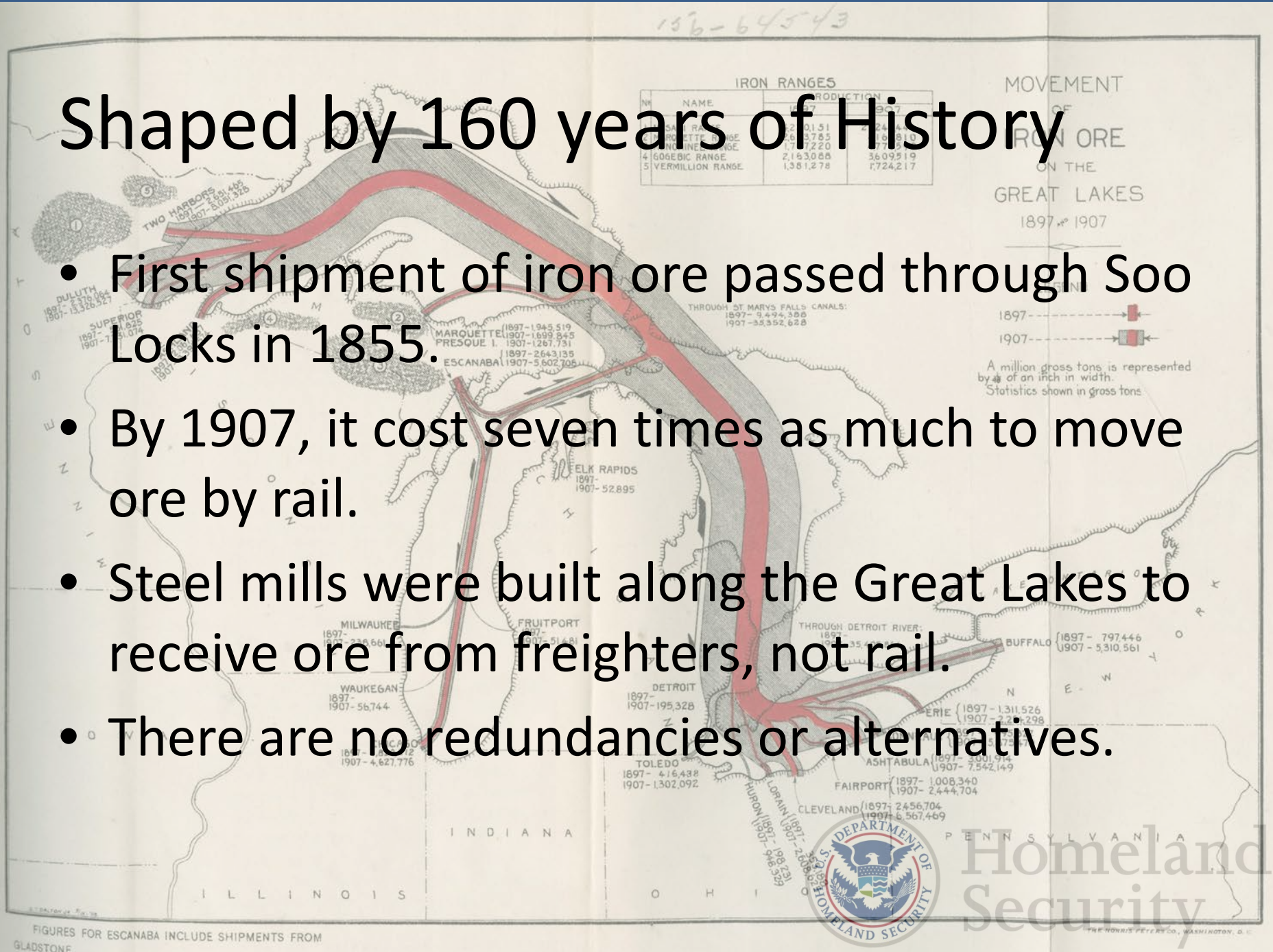
NC
SC
AR
MS
AL
GA
Shipping Port
Integrated Steel Mill
Laker Route
Railroad
U.S. DEPARTMENT OF HOMELAND SECURITY

Shaped by 160 years of History

- First shipment of iron ore passed through Soo Locks in 1855.
- By 1907, it cost seven times as much to move ore by rail.
- Steel mills were built along the Great Lakes to receive ore from freighters, not rail.
- There are no redundancies or alternatives.



Iron Ore Mining

…actually, it's taconite.

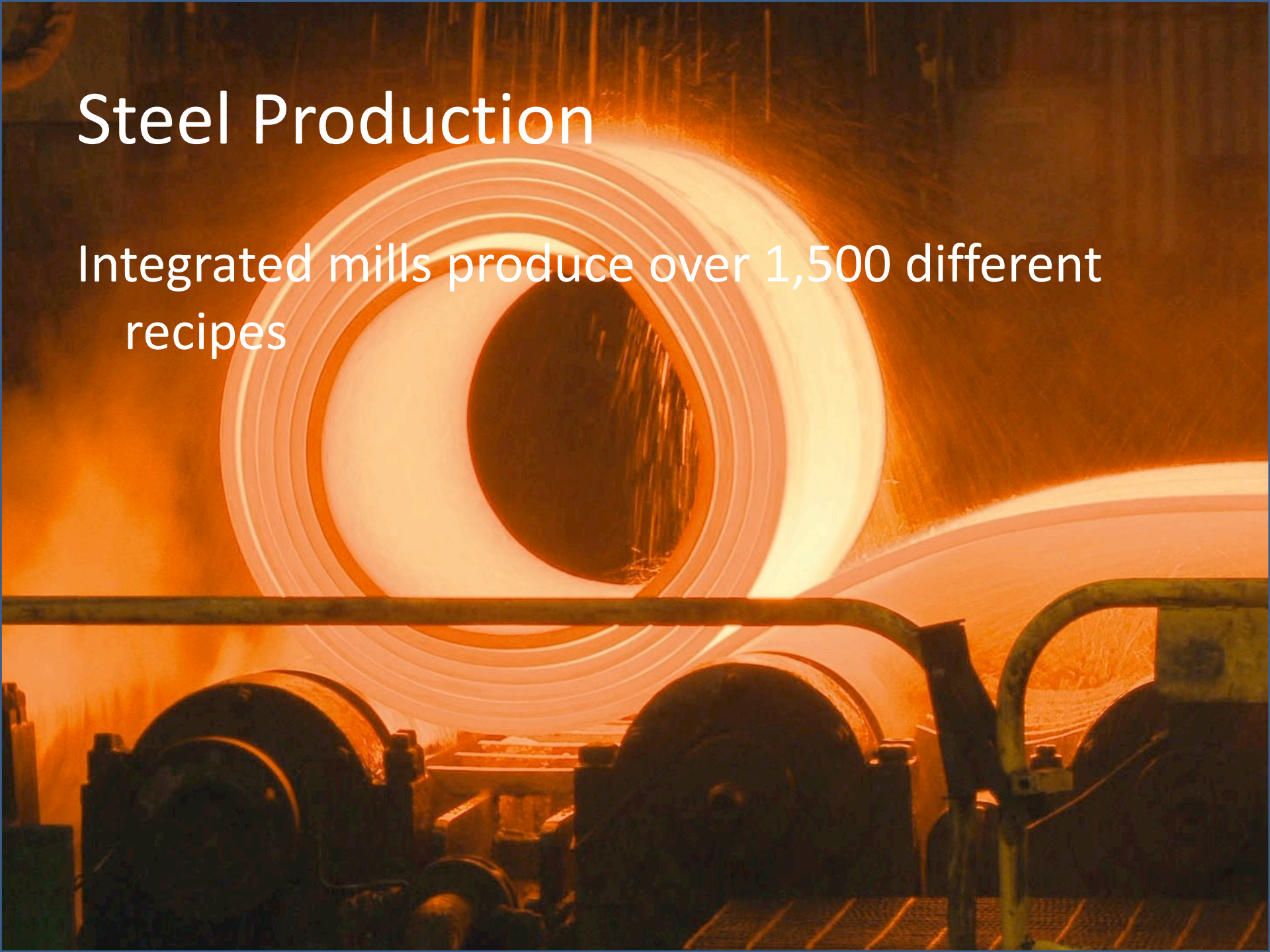
Iron Ore Shipping

Soo Locks


Canadian Lock
Whitefish Island
U.S. Hydro Plant
Closed locks
Poe Lock
MacArthur Lock

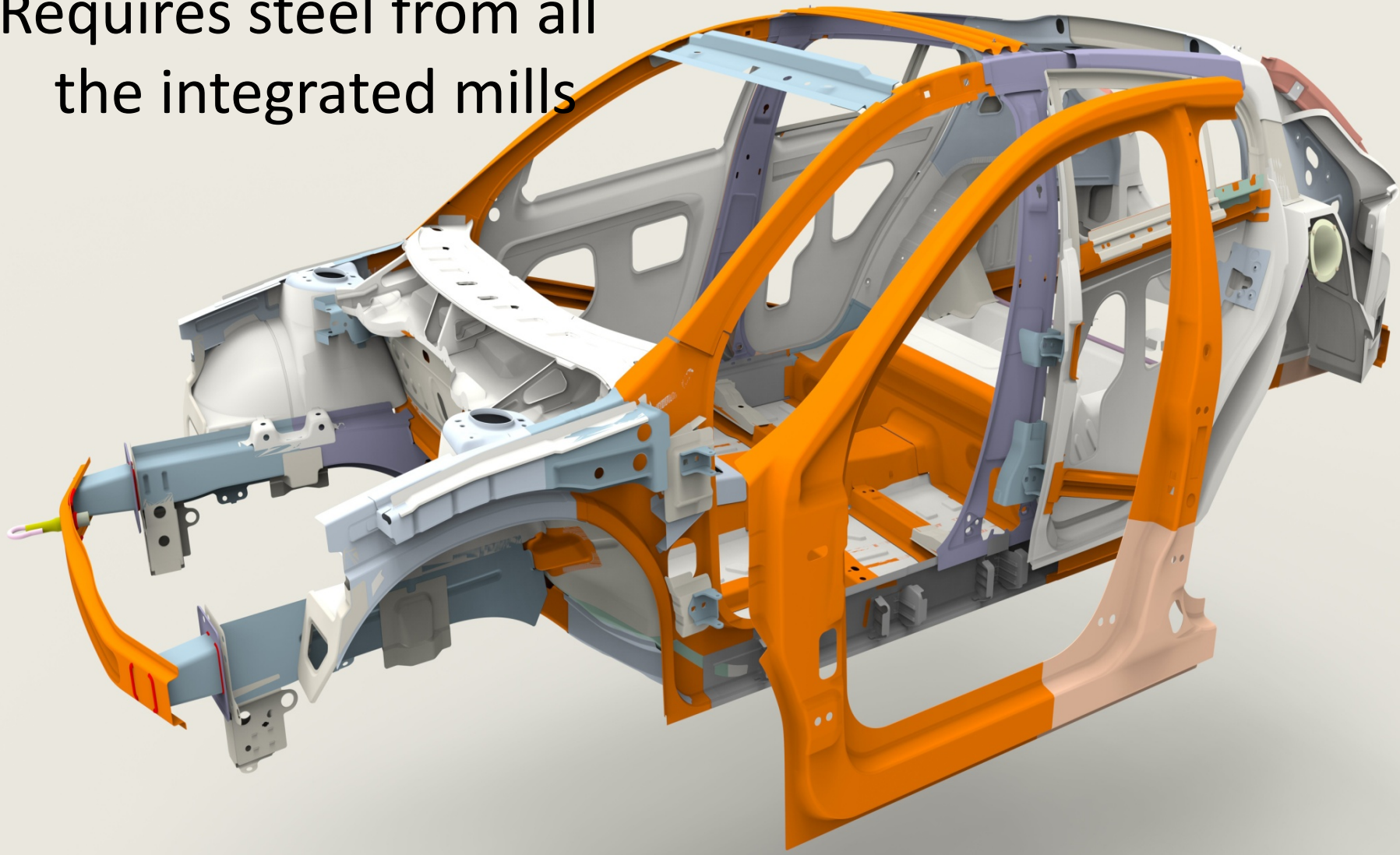
Steel Production

Integrated mills produce over 1,500 different recipes



Auto Manufacturing

Requires steel from all the integrated mills



Possible Scenario Timeline

MAR

- March 25: Poe Lock remains closed at the end of winter for 6-month period
- At least 78% of mining capacity will shutter immediately.

APR

- By April 15: Great Lakes steel mills likely close 75% of U.S. capacity
- Remaining steel goes to the construction, steel center, and tubular markets.

MAY

- By May 15: Domestic automobile, farm, construction and mining equipment, and appliance operations forced to curtail operations.

SEP

- End of September: Poe Lock re-opens
- Blast furnaces and coke batteries must be inspected for damage due to shutdown.
- Given the 4 months remaining until the winter closure, much of the initial re-stocking will be directed at building up winter inventory.

DEC

- Mid-December: Steel production re-starts.

APR

- Early April: Automobile production re-starts.

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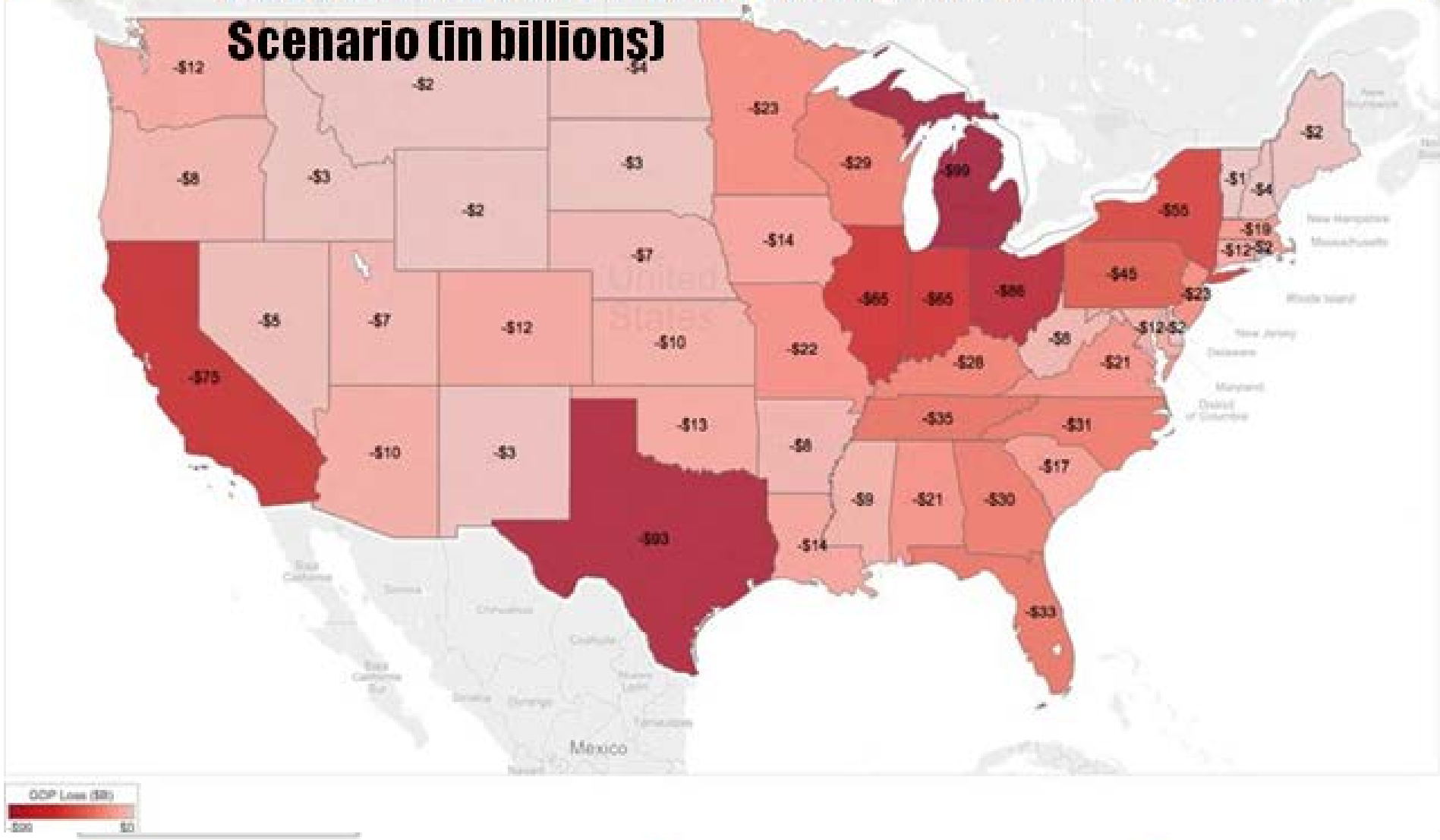
Impacts

A Loss of Gross Domestic Product Attributable to the Scenario (in billions)



Are there Alternatives?

- Building a Twin to the Poe Lock
- Moving Iron Ore by Rail
- Moving Iron Ore by Truck
- Shipping through the Port Of Escanaba
- Lightering
- Importing Foreign Iron Ore
- Importing Foreign Steel
- Producing Aluminum Cars
- Increasing Stockpiles

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Twin Lock

USACE has an unfunded plan to build a second Poe-sized lock using both closed locks.


Port
Railyard

Takeaways

- Inherent tradeoffs exist between economic drivers and resilience.
- Stakeholders know their own processes and requirements but may not understand the supply chain as a whole.
- Single, localized failure can create risks for dependent systems that span multiple jurisdictions and industries.
- Risk analysis is the starting point for mitigation.

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Modern Passenger Boat Coming Out of Poe Lock, Sault Ste. Marie, Mich.

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