

2008 European Dry Bulk Shipping Market

Outlook Conference

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Ciragan Palace Kempinsky, Istanbul Turkey



Safe Handling and Carriage:

HOT BRIQUETTED IRON (HBI)

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Transportation Committee

Hot Briquetted Iron Association (HBIA)

- Introduction
- Definitions & Characteristics: HBI vs. DRI
- Safe Handling & Carriage
- Worldwide DRI & HBI
- Safety Indexes for HBI
- Meet the HBIA
- Conclusions
- References & Contacts

- Hot Briquetted Iron is a source of metallics for the production of high quality iron and steel
- It is shipped in bulk
- It is classified as DRI (A) under the IMO BC Code
- It has been produced for 30 years
- Its compacted structure makes it safe for sea carriage
- Nearly **90** million tonnes of HBI have been shipped safely worldwide: over **39** million from Venezuela only (major exporter)
- It is a growing commodity
- The HBIA offers expertise on the safe handling and carriage of this product

What is HBI?



➤ Iron Ore



➤ Direct Reduction of Iron



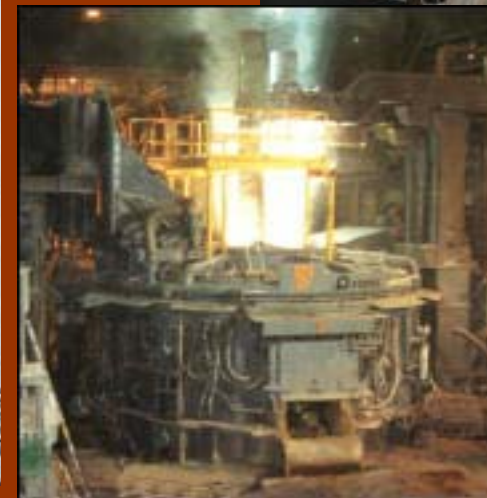
➤ Hot Briquetting



➤ Soft-loading



➤ Shipping: DRI (A) as per IMO guidelines



➤ Steelmaking: HQ steels



HBI : Safe Handling & Carriage

- **Direct Reduced Iron (DRI)** - The product of iron oxide pellets and/or lump ores or fines that have been reduced (i.e., oxygen removed) without reaching the molten stage. IMO classifies this product as DRI (B) Pellets, Lumps, and Cold Molded Briquettes.
- **Hot Briquetted Iron (HBI)** - A form of DRI that has been compacted at a temperature greater than 650° C at the time of compaction and has a density greater than 5.0 grams per cubic centimeter (g/cm³). IMO classifies this product as DRI (A) Hot Molded Briquettes.

- **Weight:** 0.5 to 1.5 kg (1.0-3.5 lbs)
- **Apparent Density:** $>5.0 \text{ g/cm}^3$ ($>310 \text{ lbs/ft}^3$)
- **Bulk Density:** 2.50-3.30 metric tons/m³ (156-206 lbs/ft³)
- **Size:**
 - ✓ Length = 90-130 mm (3.5-5.0 in)
 - ✓ Width = 48-110 mm (1.9-4.5 in)
 - ✓ Thickness = 20-50 mm (0.75-2.0 in)
- **Fines (under 4 mm):** less than 5%



HBI : Safe Handling & Carriage

- **Less reactive with water (reoxidation)**
- **Higher thermal & electrical conductivity**
- **Less fines generation**
- **Safer to handle and store in all types of weather**
- **Safer for ocean and inland transport**
- **Easier to handle with scrap handling equipment**

- Pellets and lump [DRI (B)] was shipped beginning in 1970s
- Many accidents: self-heating of DRI (B)
- It was a response from the industry towards safe carriage to solve DRI (B) self-heating
- By briquetting:
 - ✓ Less porous
 - ✓ Less surface area exposed for re-oxidation
 - ✓ Higher thermal conductivity to release heat
 - ✓ Safer for carriage
- HBI was born in mid-1970s and classified in IMO BC Code as DRI (A)

Physical Comparison between HBI and DRI Pellets

HBI



DRI



DRI (A)

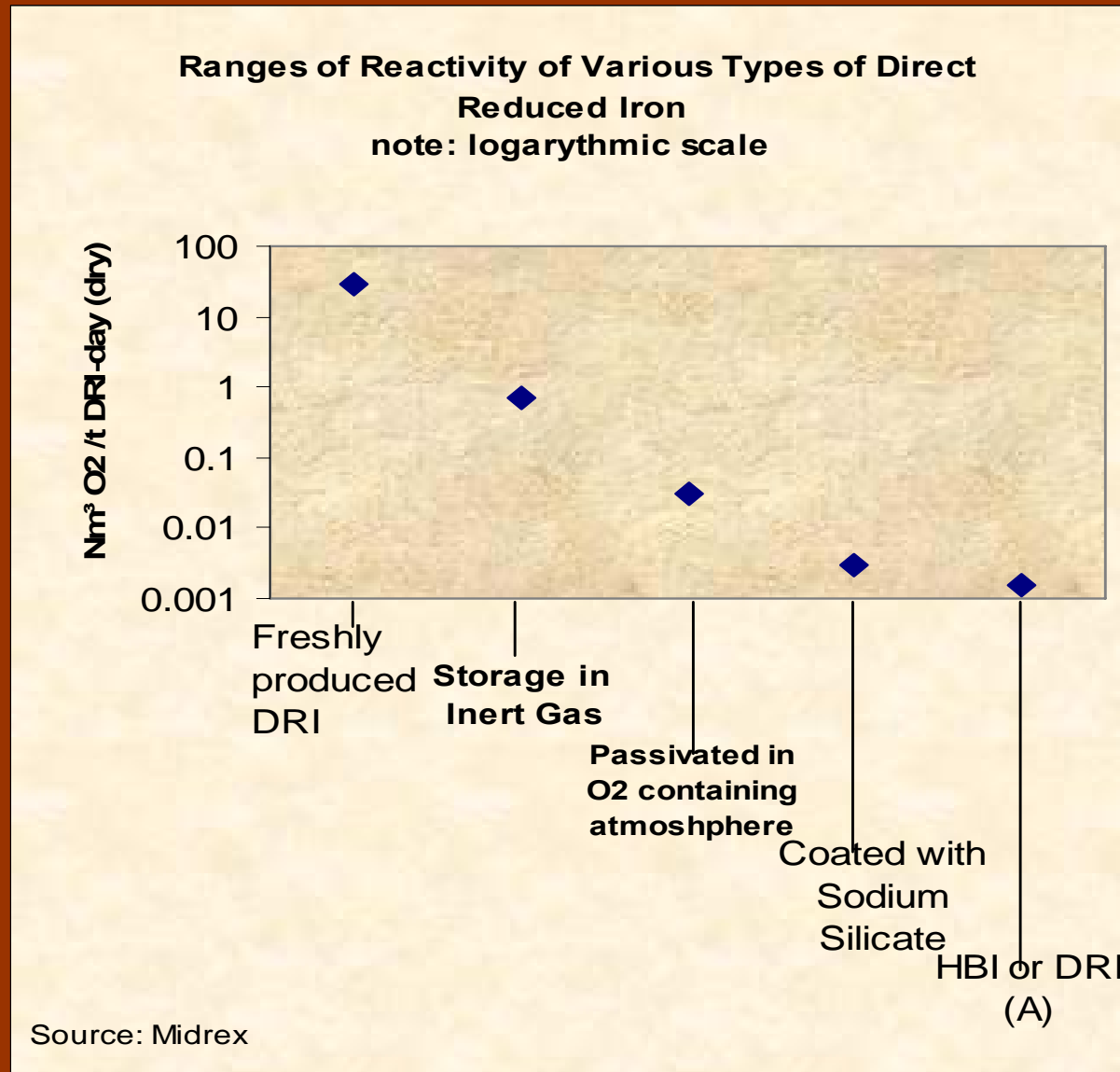
DRI (B)

HBI : Safe Handling & Carriage

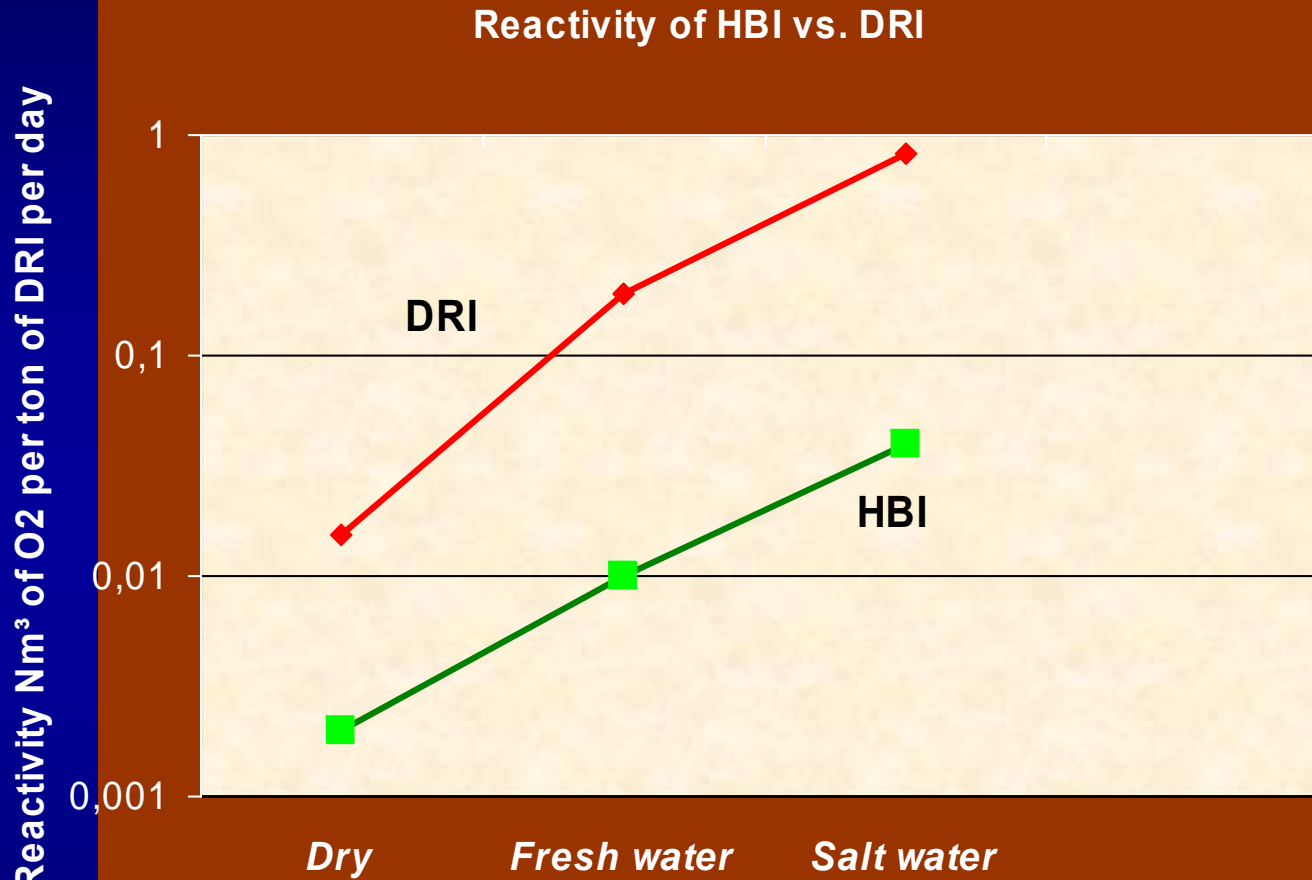


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HBI : Safe Handling & Carriage



HBI : Safe Handling & Carriage



The Y-axis of this graph is logarithmic.
Reactivity at the top of this graph is 10,000 times greater than reactivity at the bottom.

Source: MIDREX

HBI : Safe Handling & Carriage

Safe Handling & Sea Carriage of HBI

HBI : Safe Handling & Carriage

Most Important Characteristics of HBI as Compared to DRI (B)

- **Minimum risk of overheating and hydrogen generation during transport and handling**
- **HBI density minimizes water pick-up**
 - ✓ **75% less than DRI**
- **Open air storage at the producers, carriers, loading & discharging terminals and users site does not cause problems**
- **Handling similar to scrap and little production of fines during handling**
- **Best handled by conveyor belt system & soft loading systems**
- **High apparent and bulk densities facilitate bulk handling**

HBI : Safe Handling & Carriage

As per IMO BC Code, HBI is classified as MHB:

- Oxygen depletion in enclosed spaces
- Self-heating
- Hydrogen generation if in contact with water - explosive mixture in concentration over 4% by volume (100% LEL)
- Dust generation

- **As per BC Code**
 - ✓ Density: greater than 5.0 g/cm³
 - ✓ Temperature below 65°C
 - ✓ Fines (under 4mm): 5% max.
- **Surface ventilation (NATURAL)**
- **No special precautions such as inerting of cargo holds**
- **Non-combustible or has a low fire risk**
- **Golden rule: Do not allow HBI get in contact with seawater**

- **Dry bulk carriers: single-decker, handy-size, handy-max., supra-max, or Panamax; strengthened for heavy cargoes.**
- **Hatchcovers to be of twin-fold type, hydraulically or mechanically operated. Hatchcovers to be of watertight construction.**
- **Fitted with natural ventilation**
- **Classed by a world recognized Classification Society**
- **Suitable for the carriage of bulk cargoes under Appendix B of the BC Code**

- **Check the weather (avoid loading in heavy rain)**
- **Sample and monitor cargo temperature (should be < 65° C)**
- **Inform Captain of cargo description and handling and shipping guidelines**
- **Inspect cargo and vessel for compliance with IMO BC Code**

- Test that cargo holds are watertight
- Verify holds are clean and dry; free of residues from previous cargoes
- Inspect hatch covers and other entryways



- **Strainer plates on bilge wells to be sift-proof**
- **Electrical cables and fittings on deck should be in good conditions**
- **Radar, RDF scanner and other delicate equipment should be protected against dust and fines.**

- Review written loading plan and sequence
- Open active hold and open others slightly
- Load hold evenly
- Use soft loading device if available to reduce breakage
- Monitor temperature in hold and cargo pile
- Close and secure hold



- **Smoking, burning, welding, cutting and other sources of ignition should not be allowed**
- **Keep holds closed and free of seawater**



- Ensure surface ventilation is effective
(NATURAL)
- Monitor holds LEL ($\leq 25\%$) and cargo temperature ($\leq 65^{\circ}\text{C}$)
- Check bulkheads in adjacent holds for heating
- Use oxygen monitor to check hold or cargo compartment if entry is necessary

- It is advisable to check for LEL before opening cargo holds
- Verify cargo temperature inside cargo holds
- Measure O₂ before entering any cargo spaces
- Radar, RDF scanner and other delicate equipment should be protected against dust
- Unloading under all weather conditions is acceptable

The following suggested emergency procedures are based on the Best Available Practice (BAP) with this product.

Emergency Procedures I

Procedures If Temperatures Rise above 65°C:

- **INFORM THE SHIPPER IMMEDIATELY AND LOOK FOR ADVICE.**
- Monitor temperature with more frequency in holds and adjacent bulkheads and evaluate its tendency.
- Check whether there was any ingress of water in cargo holds
 - ✓ If there was ingress of sea water, the effect will only be noticed after 16-24 hrs.
 - ✓ The temperature would increase and then should stabilize
- Check for steaming of cargo
 - ✓ If so the natural ventilation should be kept open at all times
- **DO NOT USE WATER TO COOL DOWN THE CARGO**
- If weather permits and gear available, spread out the cargo inside the hold as much as possible.
- If temperatures of the cargo reaches and surpasses 120 °C, preparation to jettison or discharge the cargo at the nearest safe and suitable port should be conducted.

Precautions if concentration of LEL over 25% (1% hydrogen):

- **INFORM THE SHIPPER IMMEDIATELY AND LOOK FOR ADVICE.**
- **KEEP THE NATURAL SURFACE VENTILATION OPEN AT ALL TIMES**
- **Monitor LEL in the holds continuously until level drops to less than 25 %.**
- **Avoid any possible ignition source on the vicinity.**

DO NOT USE EITHER FRESH WATER OR SEAWATER TO COOL DOWN HOT MATERIAL

- Be prepared to jettison cargo if very high temperatures (over 120 °C) are recorded, or make arrangements to get to the nearest safe and suitable port for discharging the hot cargo.
- Consider the solutions with the following priorities as follows:
 - unload the troubled cargo at nearest port
 - jettison of cargo
 - As the last resort flood the hold with water (keeping integrity of ship)

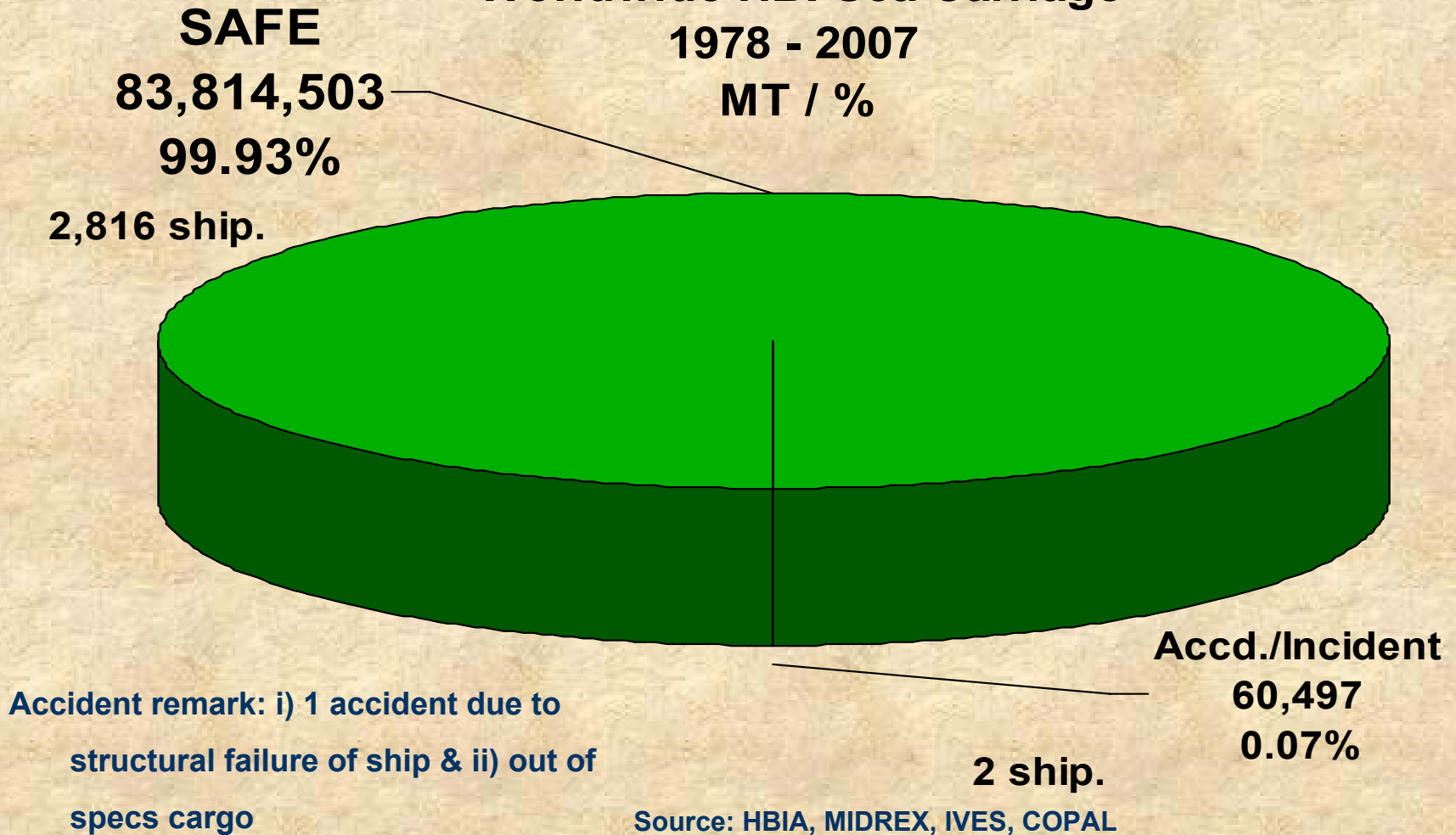
- If the proper precautions are followed, i.e.,
 - Density: greater than 5.0 g/cm³
 - Temperature below 65°C at time of loading
 - Fines (under 4mm): 5% max.
 - No water
 - Surface natural ventilation in place
 - As per IMO guidelines
 - Shippers' additional loading/carrying/unloading procedures
- The result is a **SAFE CARRIAGE** as demonstrated by actual **experience...**

- **Approx. 89.68 million tonnes of HBI have been shipped worldwide (1978 -2007)**
- **Approx. 83.88 million tonnes have been by water (sea & inland)**
- **39.27 million tonnes have been shipped from Venezuela alone**
- **Results...**



HBI : Safe Handling & Carriage

Safety Index Worldwide HBI Sea Carriage 1978 - 2007 MT / %

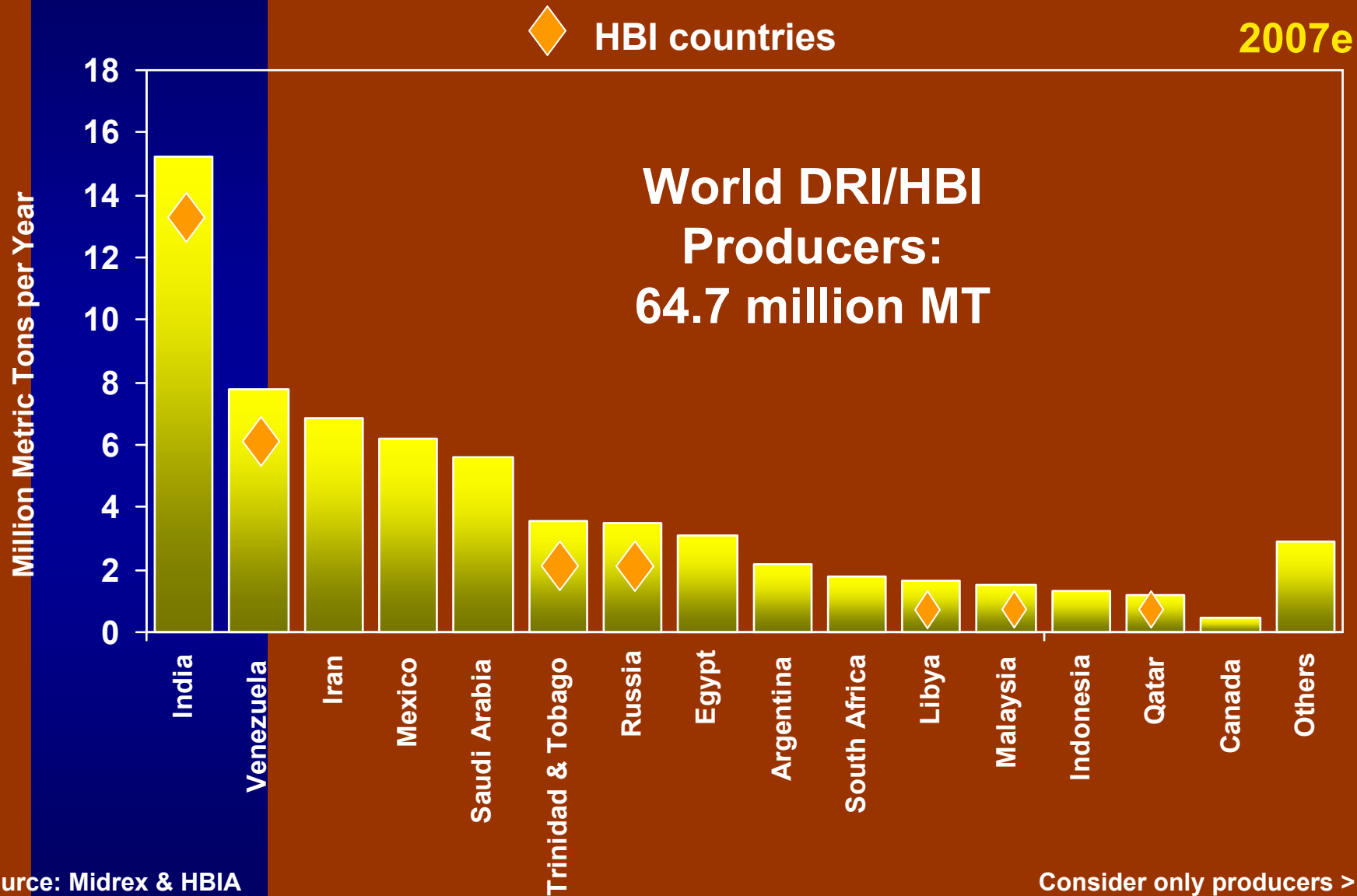




Worldwide DRI/HBI Production & Market

HBI : Safe Handling & Carriage

World DRI/HBI Producers

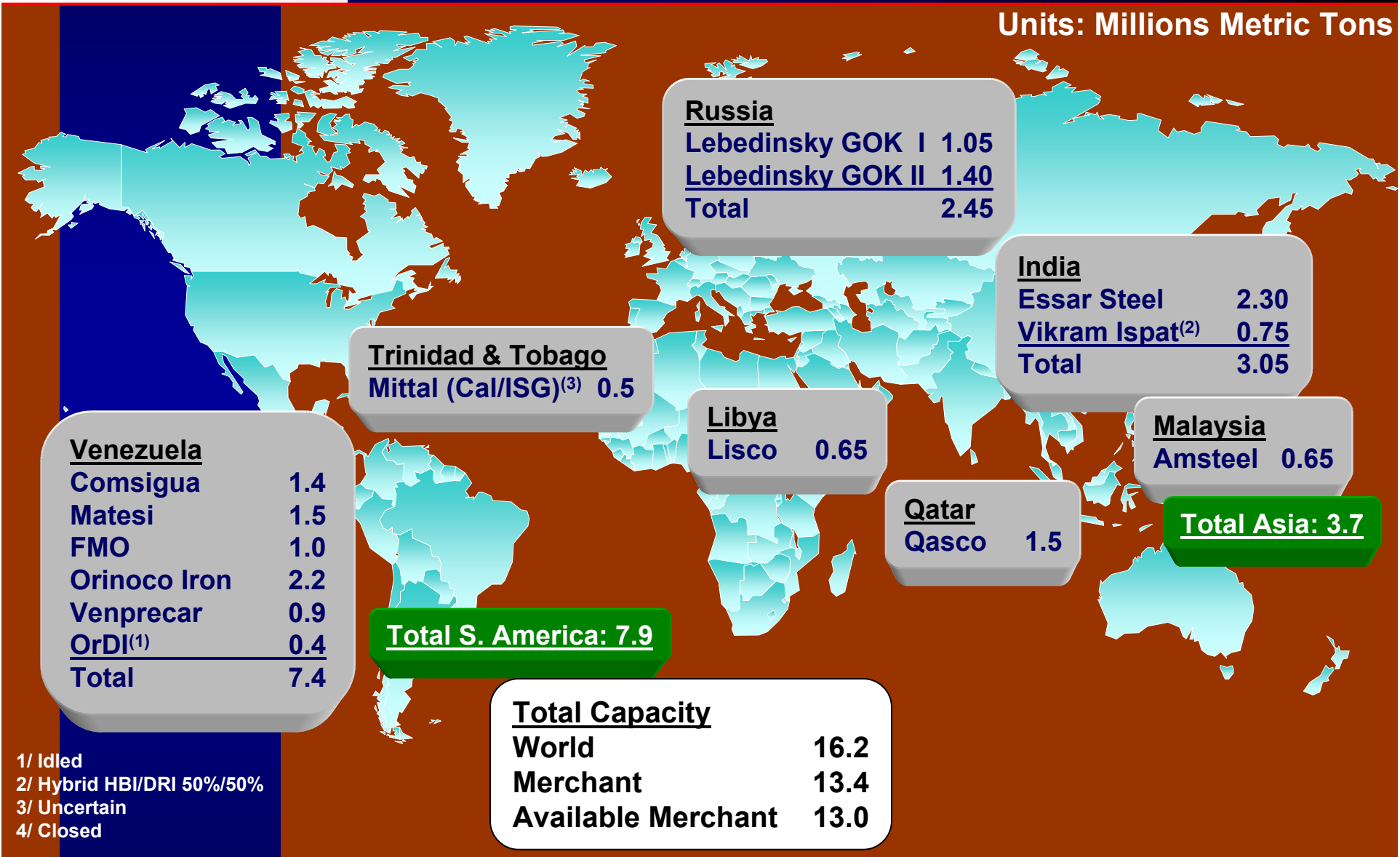


Source: Midrex & HBIA

Consider only producers > 0.5 Mt/yr

HBI : Safe Handling & Carriage

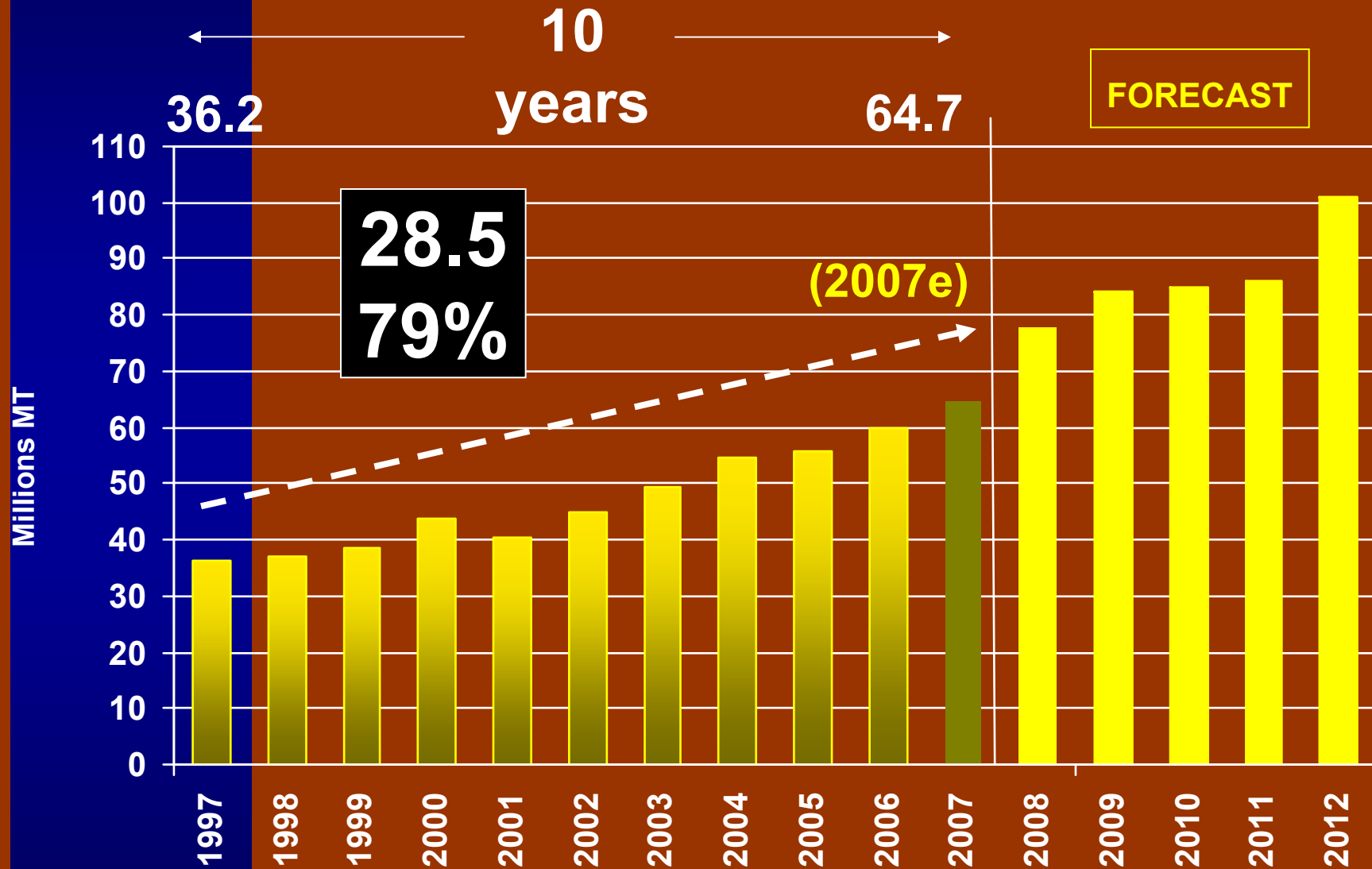
Units: Millions Metric Tons



1/ Idled
2/ Hybrid HBI/DRI 50%/50%
3/ Uncertain
4/ Closed

HBI : Safe Handling & Carriage

Growth in DRI/HBI Output



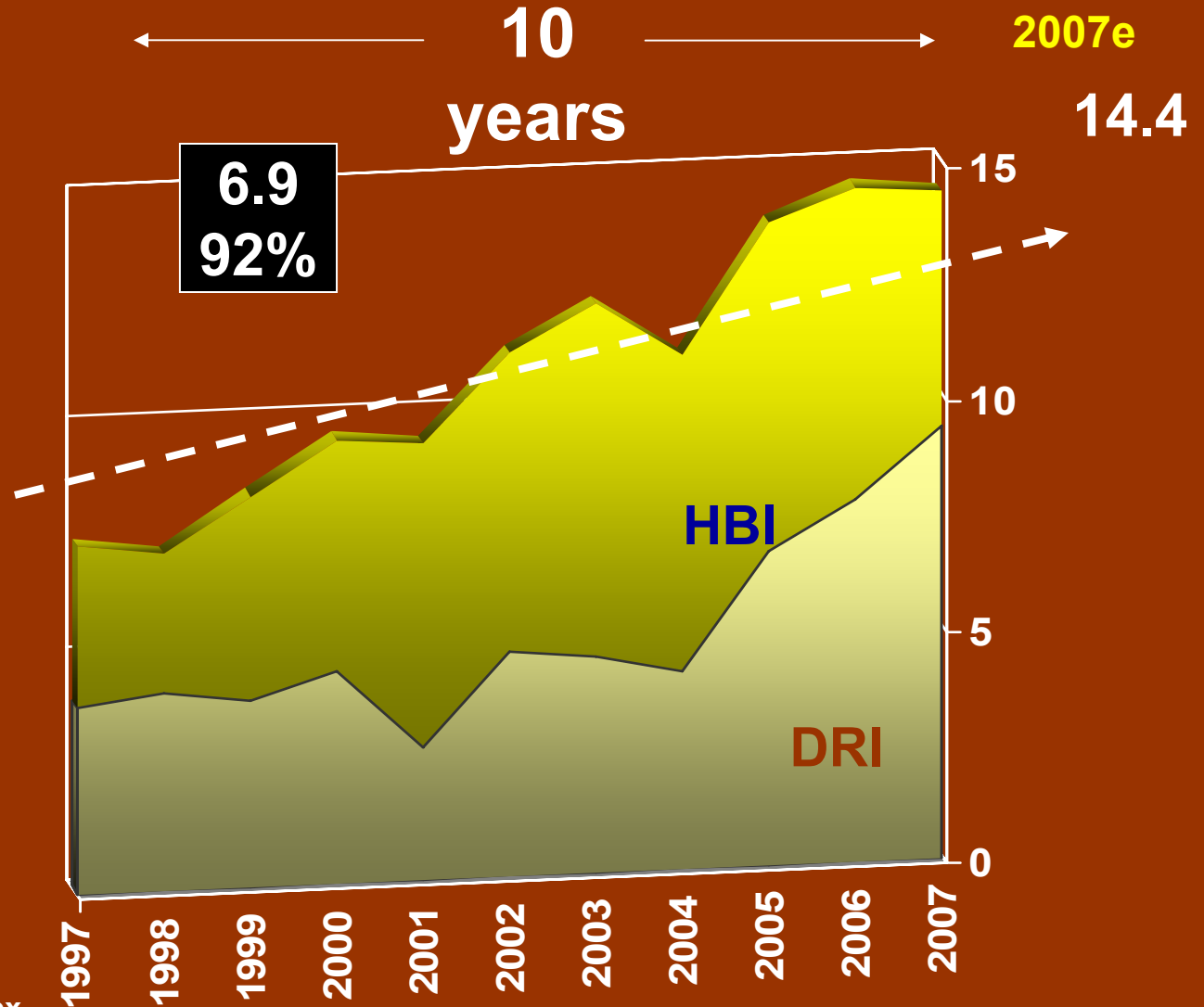
Source: Midrex, HBIA

HBI : Safe Handling & Carriage

Growth in Shipments

Millions MT

7.5



Source: Midrex

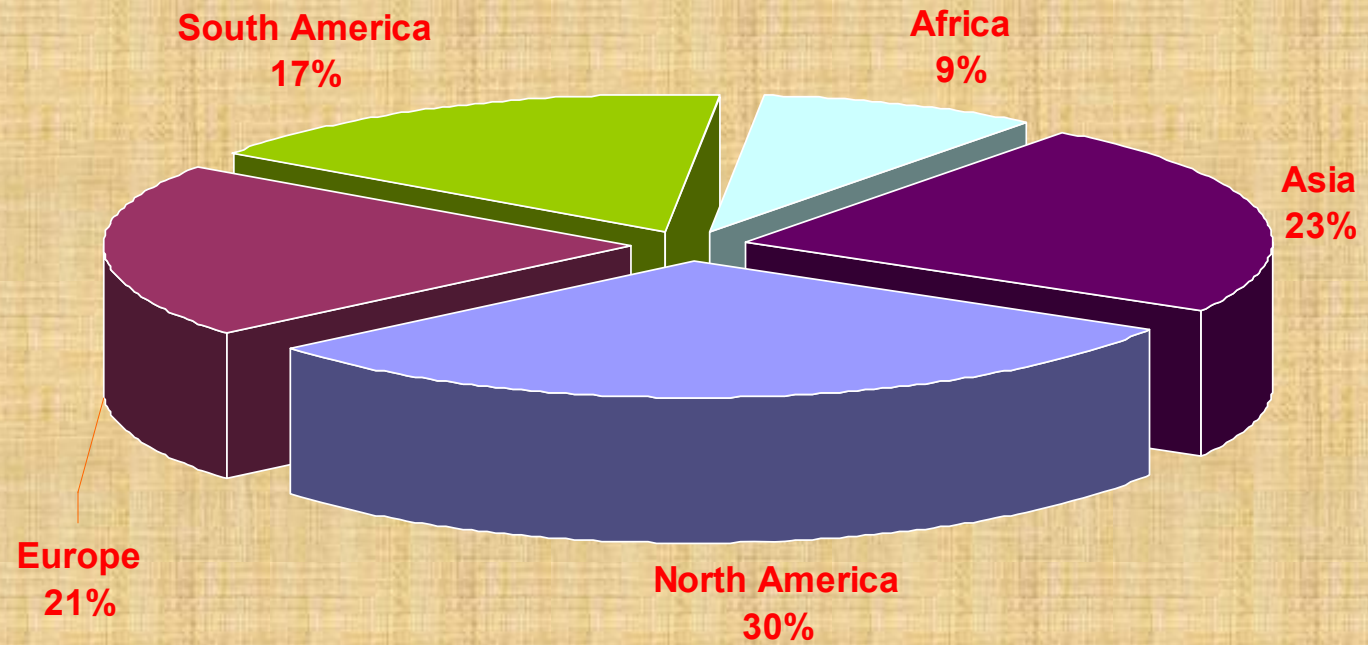
HBI : Safe Handling & Carriage

Where does HBI go?



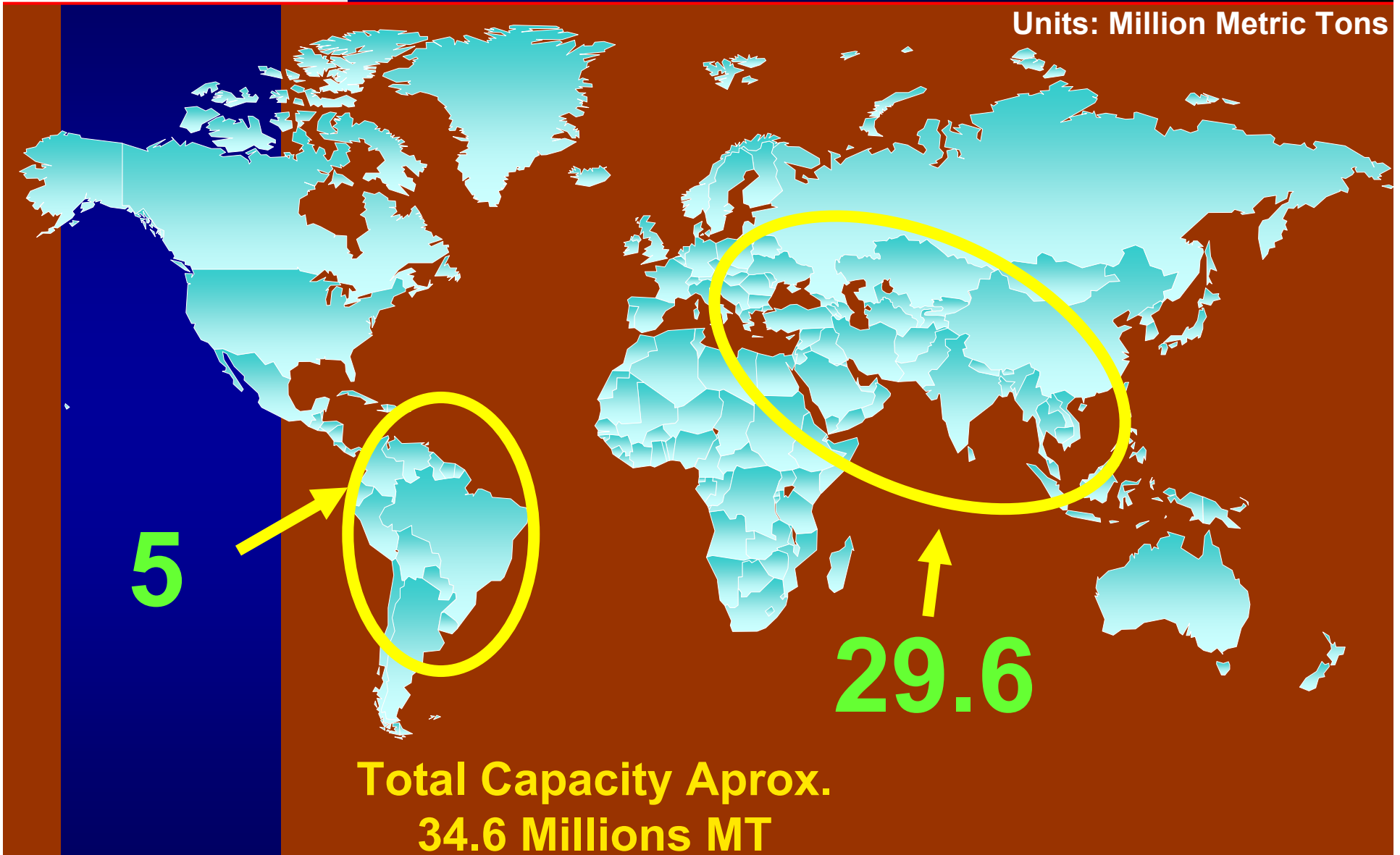
HBI : Safe Handling & Carriage

2007e



HBI : Safe Handling & Carriage

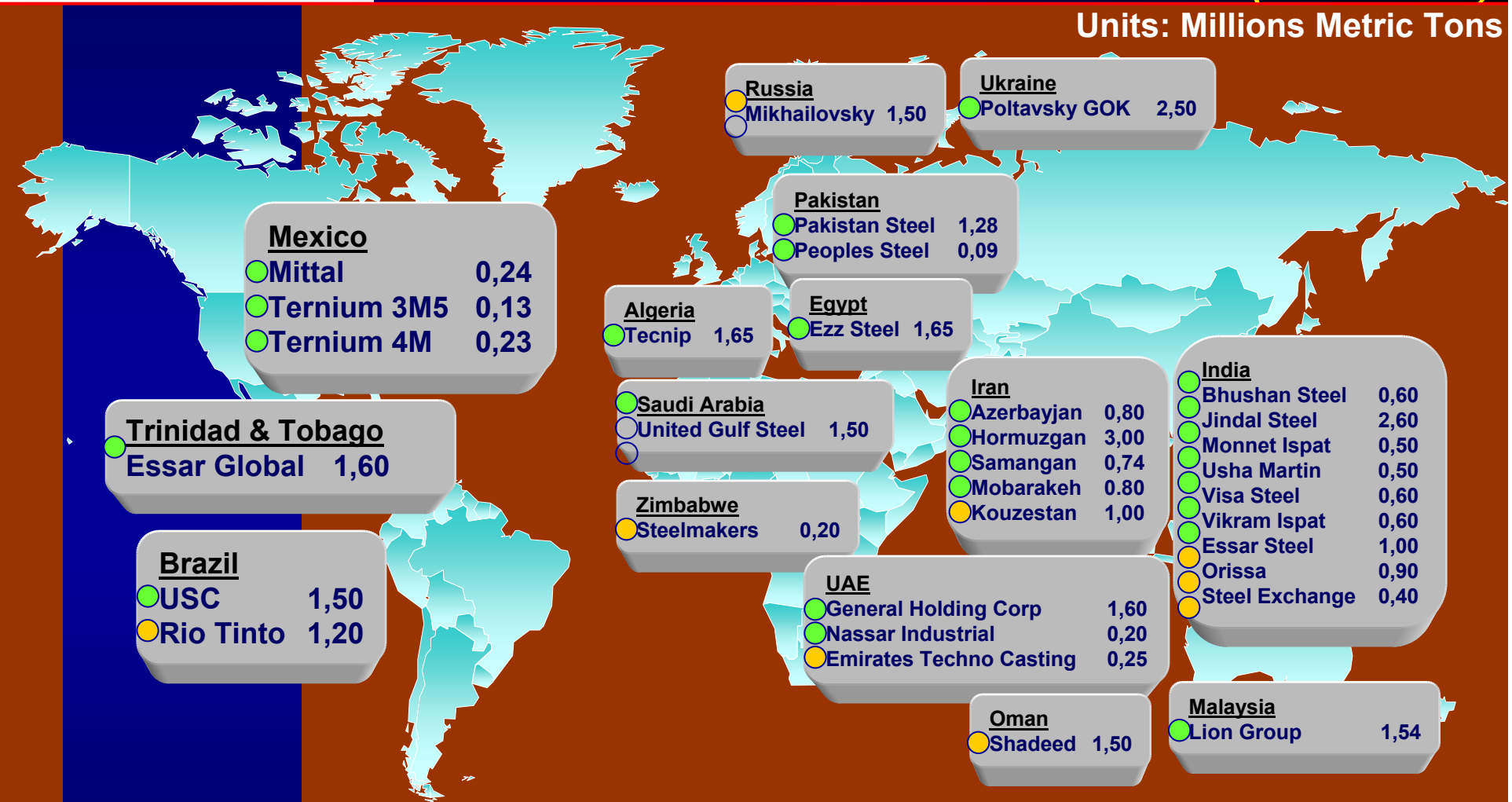
Units: Million Metric Tons



HBI : Safe Handling & Carriage

New DRI/HBI Plants (Gas Based)

Units: Millions Metric Tons



**Total Capacity Aprox.
34.6 Millions MT**

Captive Plants ●
Captive/Merchant Plants ●

Meet the HBIA



HBI : Safe Handling & Carriage

**To promote hot briquetted iron (HBI)
as a preferred source of high quality,
merchant iron units and to assist the
global steel industry in the effective
use of HBI**

**To inform ship owners and charterers,
terminal operators, metallics traders,
and users of HBI of the methods for
safely handling, shipping, and storing
HBI and other direct reduction
products**



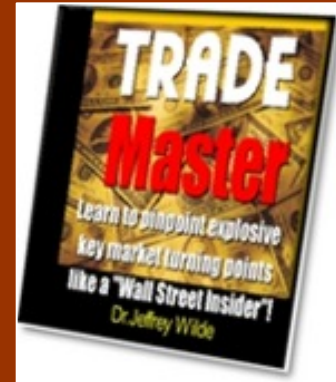
Producers



Associates



Traders



Special Members





Promotion



Transportation



Technical



HBI : Safe Handling & Carriage

Producers

- Comsigua
- CVG FMO
- Lebedinsky Mining & Dressing Plant
- MATESI
- Orinoco Iron
- Venprecar
- Vikram Ispat

Capacity: 10.2 Million MT

Associates

- Cleveland-Cliffs Inc.
- Compañía Operadora del Puerto de Palúa (COPAL)
- Kobe Steel Ltd.
- Köppern Ghbh & Co. KG
- LKAB
- Midrex Technologies, Inc.
- Outotec
- Phoenix Bulk Carriers
- Progress Rail Services
- Quebec Cartier Mining Company
- Samarco Mineração S.A.
- Ship Management & Transport
- Siemens VAI Metals Technologies GmbH & Co.
- Tenova (HYL)
- Torvald Klaveness Group
- Vale
- Icap Hyde & Co.

Traders

- **BHP-Billiton Marketing Asia Pte Ltd.**
- **Commodities & Minerals Enterprise Ltd.**
- **David J. Joseph Company**
- **Duferco S.A.**
- **National Materials Trading Corp.**
- **Sims Group Global Trade Corp.**
- **Sojitz Corp. of America**
- **Stemcor UK Limited**
- **Tube City IMS Corporation**

Special Members

➤ **Ralph Smailer**

➤ **Roy Whipp**

- Supply more than 90% of all DR plants in the world
- Production capacity more than **10** million tons
- Nearly **90** million tons of HBI shipped safely
- Pioneered soft loading method and equipment
- HBI shipments ranging from 20,000-60,000 tons

- **HBI is a bulk metallic commodity and it is safe for carriage because of its physical characteristics and proper precautions taken for shipping as per IMO guidelines and shippers advices.**
- **HBI was the response from the industry on safety to overcome the self-heating problems of DRI.**
- **Nearly 90 million tonnes of HBI have been shipped worldwide in the last thirty years; over 39 million tonnes only from Venezuela (major exporter).**

- **99.93%** of the tonnage have been carried safely.
- It is a growing commodity as world demand increases for clean iron units.
- **The HBIA:**
 - ✓ vast experience, expertise and advice on the safe handling & sea carriage of HBI and other DRI products.

For further information, please contact:

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HBIA

<http://www.hbia.org/>

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**Thank you for your
attention**

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