

MINE HEALTH AND SAFETY

Twenty Years On

A second look

Presentation to MineSafe 2016, 31 August

May Hermanus

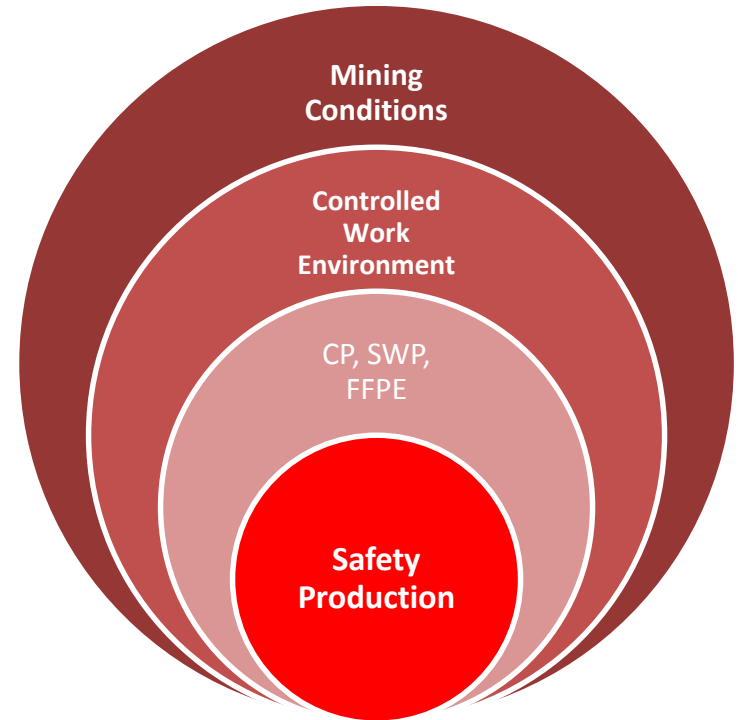
Outline

- Why take a “second look”
- Continued Importance of the Mining Sector
- OHS Then and Now
 - MHSA Intent and Tools
 - Methods, Initiatives and Interventions & the Outcomes
 - Performance in perspective
- Looking forward

OHS Performance Revisited

- Meaningful expansion of the analytical lens of OHS performance / improved understanding of risk & RM options
 - Locate OHS outcomes and efforts in a larger context (current framework limited)
 - Ore body characteristics (mineralisation, geology, extent)
 - Extraction (mining method)
 - Equipment, people, work methods and environment
 - Improvements in RM tools and methods
 - What does the OH data say?
- Implications / meaning of OHS indicators and trends?
- What does our interpretation mean for current and future priorities?

OHS as An Emergent Property

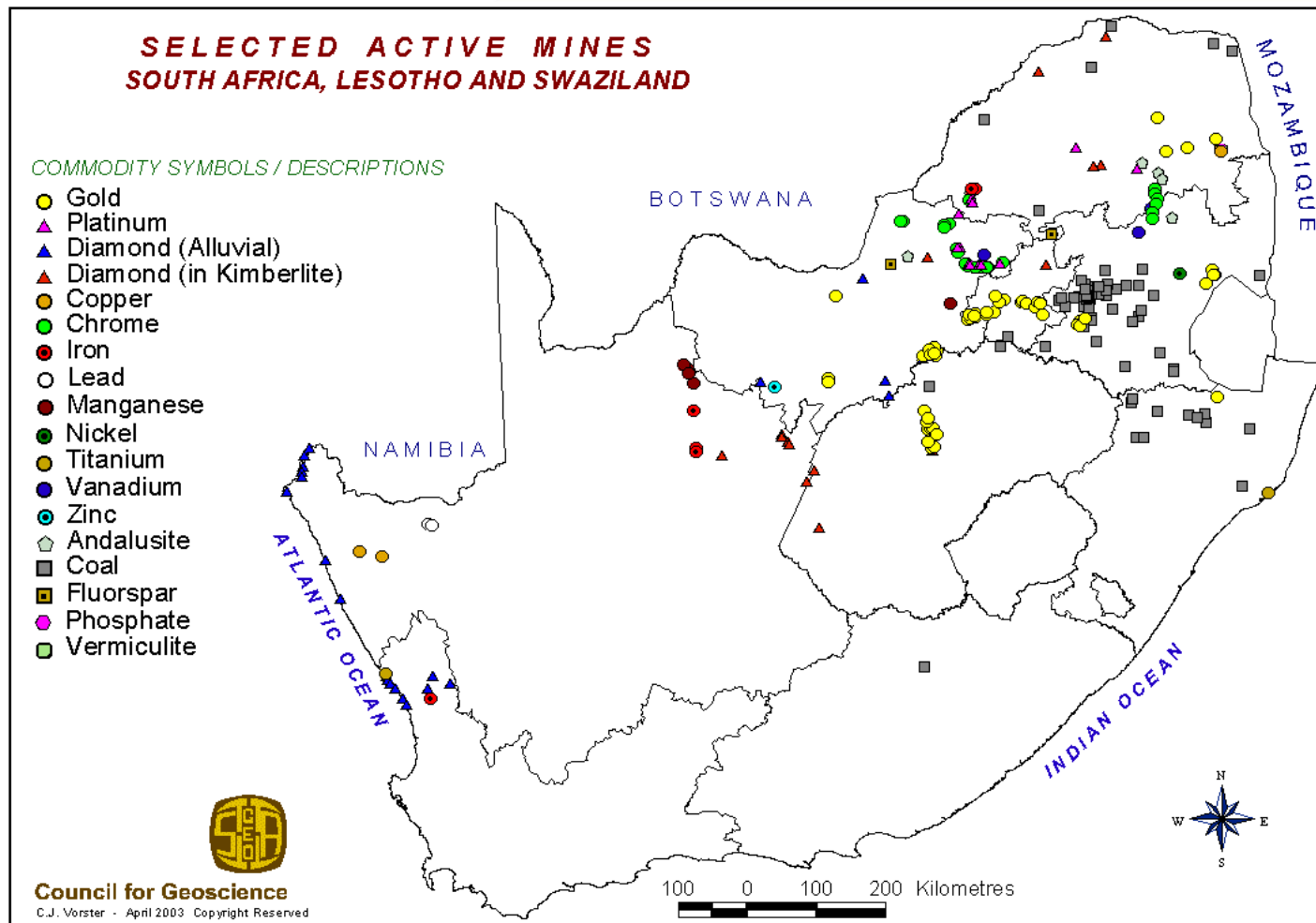


Context: Mineral Wealth

- Mineral Wealth in Abundance
- Reserves USD 2.5 trillion
(www.south africa.info and CGS)
- World Number #1 in:
 - PGMs (87.7%)
 - Chromium (72.4%)
 - Manganese (80%)
 - Titanium (65%)
 - Gold (12.7%)

Mineral	Unit	Reserves		
		Mass	%World	Rank
Chromium Ore	Mt	5500	72.4	1
Gold	t	6000	12.7	1
Manganese Ore	Mt	4000	80	1
PGMs	t	70000	87.7	1
Titanium-incl. BC	Mt	400	65	1
Fluorspar	Mt	80	17	2
Titanium Minerals	Mt	71	9.8	2
Vanadium	kt	12000	32	2
Vermiculite	Mt	80	40	2
Zirconium	Mt	14	25	2
Antimony	kt	350	16.7	3
Phosphate Rock	Mt	2500	5.3	4
Uranium	kt	435	8	4
Coal	Mt	30408	7.4	6
Copper	Mt	13	2.4	6
Lead	kt	3000	2.1	6
Nickel	Mt	3.7	5.2	8
Zinc	Mt	15	3.3	8
Iron Ore	Mt	1500	0.8	13
Alumino-silicates	Mt	51	*	*
Iron Ore - incl. BC	Mt	25000	~10	*

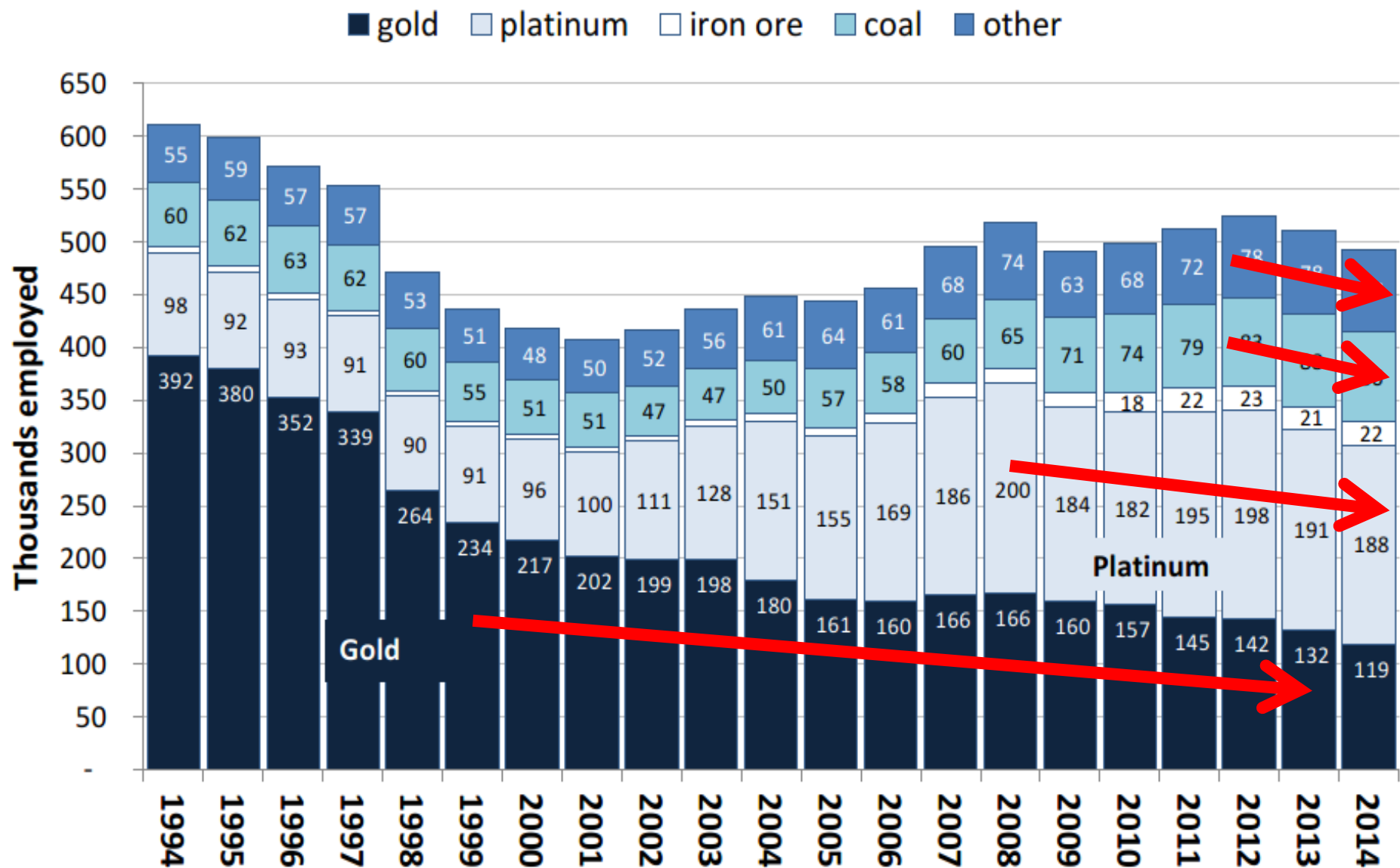
Context: Location of Major Mines



Context: Social Contribution

- Historically high contribution to GDP – 7% direct and 10% indirect (induced)
- Skewed development
- Very labour intensive - one miner supports 12-15 dependents
- The NDP calls for increasing employment and growth in country, but mining is increasingly mechanised
- Mining (moreover the minerals value chain) has a critical role to play in the development of the country

Employment Trends



Employment when MHSA was launched

Commodity	1987	1995/1996	2013/14
Gold	~600000	382646	131 591
PGM	~100000	~110000	191 261
Coal	~120000	63260	87 768
Iron Ore		< 10000	21 145
Diamonds	~20000		13 547
All	827827	571427	448 909

Observations

- The mining industry is constantly in flux
- Employment distribution between the commodities has changed, and continues to change
- Risk profile of the sector also changing
- How does this affect OHS outcomes? As:
 - Overall, formal employment levels decline
 - Rate of decline different for different commodities
- How does the mining OHS community respond to:
 - New strategies for extending life of the mining sector
 - Increasing concerns about public health and safety
 - Informal mining

The MHSA – What did it aim to address and How?

What

- Very high levels of death, injury, occupational diseases & ill health
- Absence of workers' voices (concerns, framing problems, in decision-making)
- Absence of accurate and comprehensive OHS data
- Dedicated act and enforcers

How

- *Forums for government, employers and workers to come together to assess state of OHS, deliberate on policy needs and interventions (representation / consultation)*
 - *Resourced by information sharing, knowledge and training*
- *Clarity on accountability for OHS*
- *RM mechanisms. Risks to be assessed, treated in order of priority*
- *Increased policy and analytical capability*

Interventions

- Risk Management frameworks, approaches and tools
- Milestones
- MOSH
- Broken Window Regulatory Policy
- Culture Framework
- Skills planning including OHS Representative Training

Improved in RM Methodology

- Initial confusion about how to go about this. Framing / frameworks, quantitative methods, overly simple methods and more coherent and sophisticated RM methodology over time
 - Worker / work representative roles?
- GEN 105 – Assessing Mining Employees Risk to Lost Time Accidents (Measure Consequences/ Not possible to measure consequence (latency or confusion with lifestyle factors)).
- SIMRAC GUIDE – Frequency Matrix and Severity Matrix
- GMIRM and ISO 31000

a) Creates value

- b) Integral part of organizational processes
- c) Part of decision making
- d) Explicitly addresses uncertainty
- e) Systematic, structured and timely
- f) Based on the best available information
- g) Tailored
- h) Takes human and cultural factors into account
- i) Transparent and inclusive
- j) Dynamic, iterative and responsive to change
- k) Facilitates continual improvement and enhancement of the organization

**Principles for managing risk
(Clause 3)**

4.2
Mandate
and
commitment

4.3
Design of
framework
for managing risk

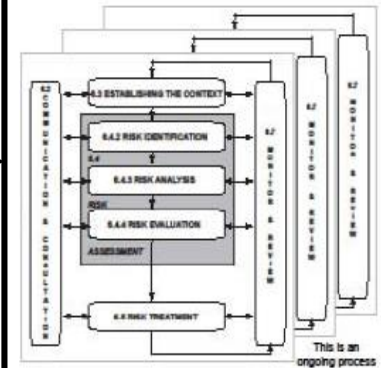
4.6
Continual
improvement
of the
framework

4.5
Monitoring
and review
of the
framework

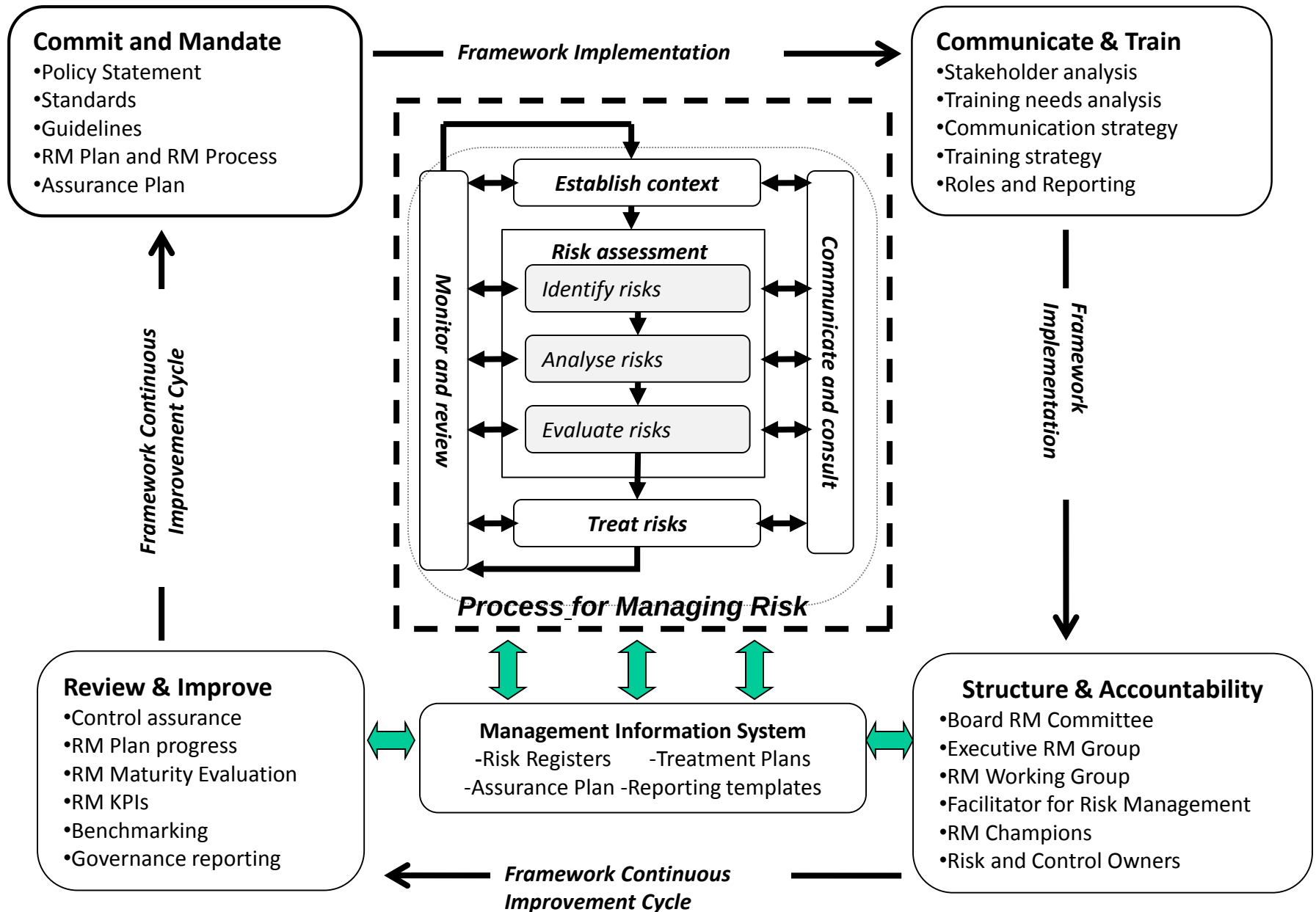
4.4
Implementing
risk
management

**Framework for
managing risk
(Clause 4)**

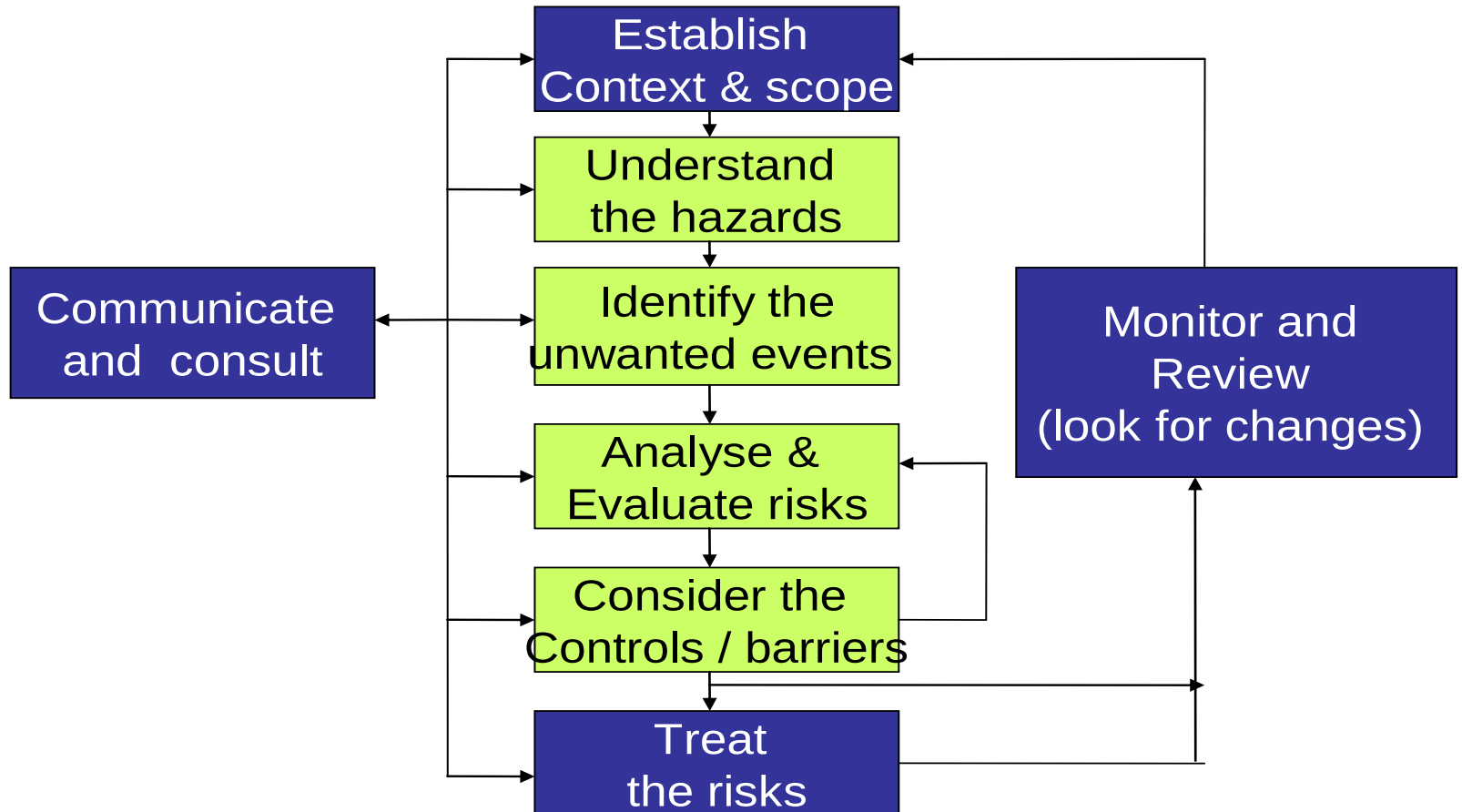
ISO Overview
3 main clauses
plus terminology from
ISO Guide 73



**Process for managing
risk
(Clause 5)**



Minerals Industry Risk Management Process (modified version of AS4360:2004)



Milestones

Industry Target: Zero fatalities and injuries

Milestones by 2013:

- **In the Gold Sector:** To meet the safety performance levels equivalent to current international benchmarks for other underground metalliferous mines at the least;
- **In the Other (Non-gold) Sectors*:** Consistent and continuous improvement and achievement of current international benchmarks at least.
- **Annual Milestone:** To achieve international benchmarks, an annual milestone reduction of 20% was agreed to by stakeholders.

Milestones Occupational Health

Target: Elimination of silicosis

- **Milestones:** By December 2008, 95% of all exposure measurement results will be below the occupational exposure limit for respirable crystalline silica of 0.1mg/m³ (these results are individual readings and not average results).
- After December 2013, using present diagnostic techniques, no new cases of silicosis will occur amongst previously unexposed individuals (Previously unexposed individual = individuals unexposed prior to 2008, i.e. equivalent to a new person entering the industry at 2008).

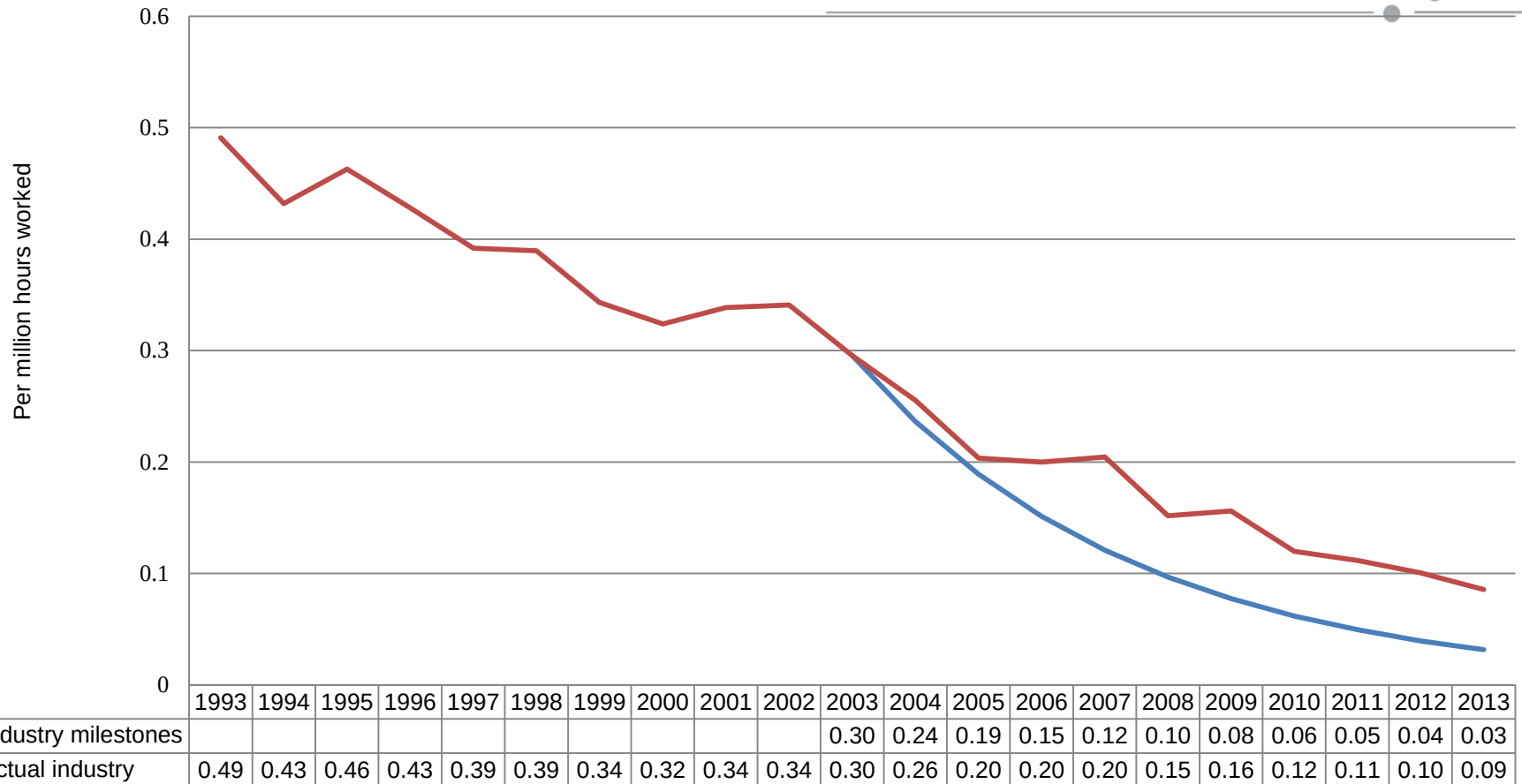
Target: Elimination of noise induced hearing loss (NIHL)

- **The present noise exposure limit specified in regulation is 85dB(A)**
- **Milestones:** After December 2008, the hearing conservation programme implemented by industry must ensure that there is no deterioration in hearing greater than 10% amongst occupationally exposed individuals.
- By December 2013, the total noise emitted by all equipment installed in any workplace must not exceed a sound pressure level of 110dB(A) at any location in that workplace (includes individual pieces of equipment).

Milestones 2014

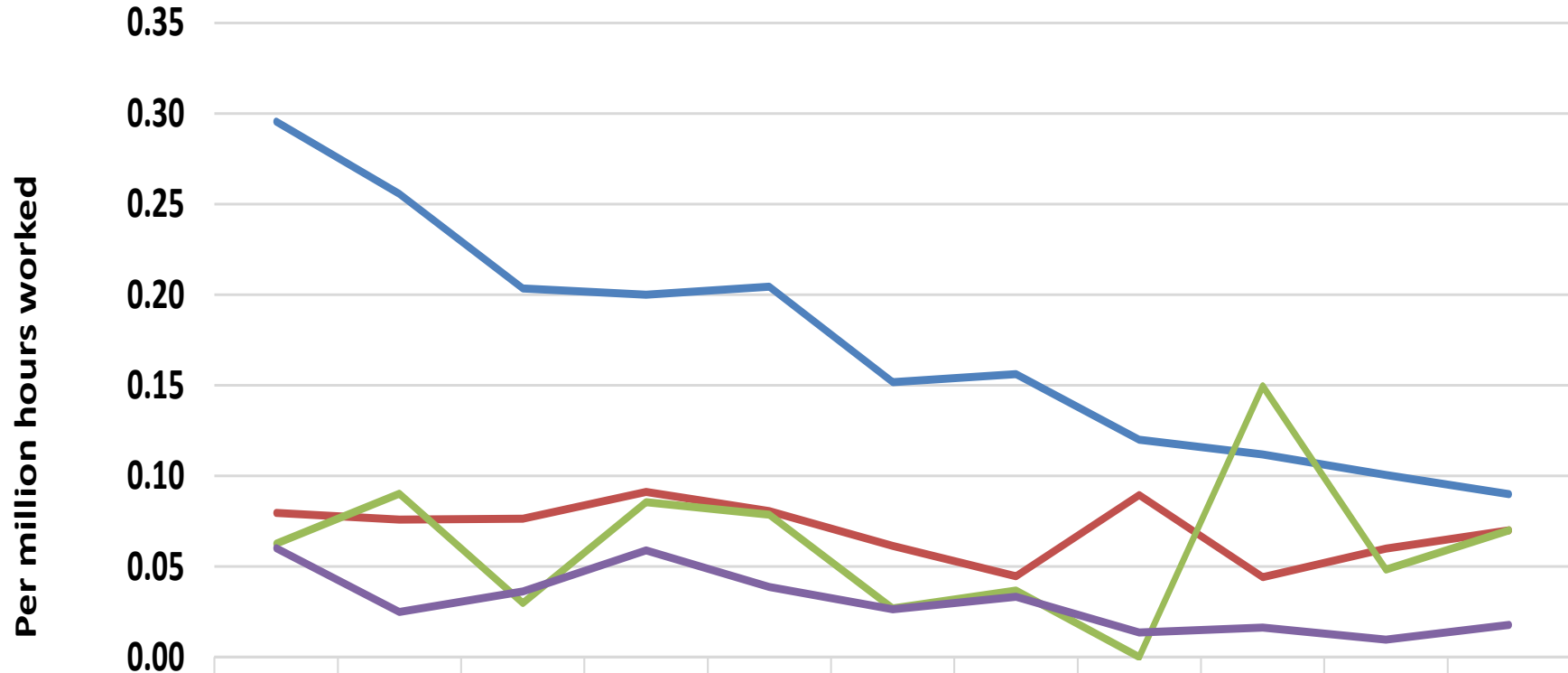
- Continued commitment to zero harm (safety, health including TB) *Zero fatalities by 2020 (20% $\geq$ per year); 0.005 mg/m³ silica; $\leq$ 107dBA; TB $\leq$ National Average.*
 - Eliminate exposure to high level OHS risks
 - HIV-AIDS/ TB Action plan
- Culture Transformation
 - Bonus system impacts, Risk Management, Leadership, Leading Practice
 - Elimination of discrimination, upskilling, socio-economic opportunities
 - Implement framework, improve tripartite relations, ensure implementation of summit commitments

OHS Performance - Industry fatality rate performance against safety milestones, 1993 – 2013



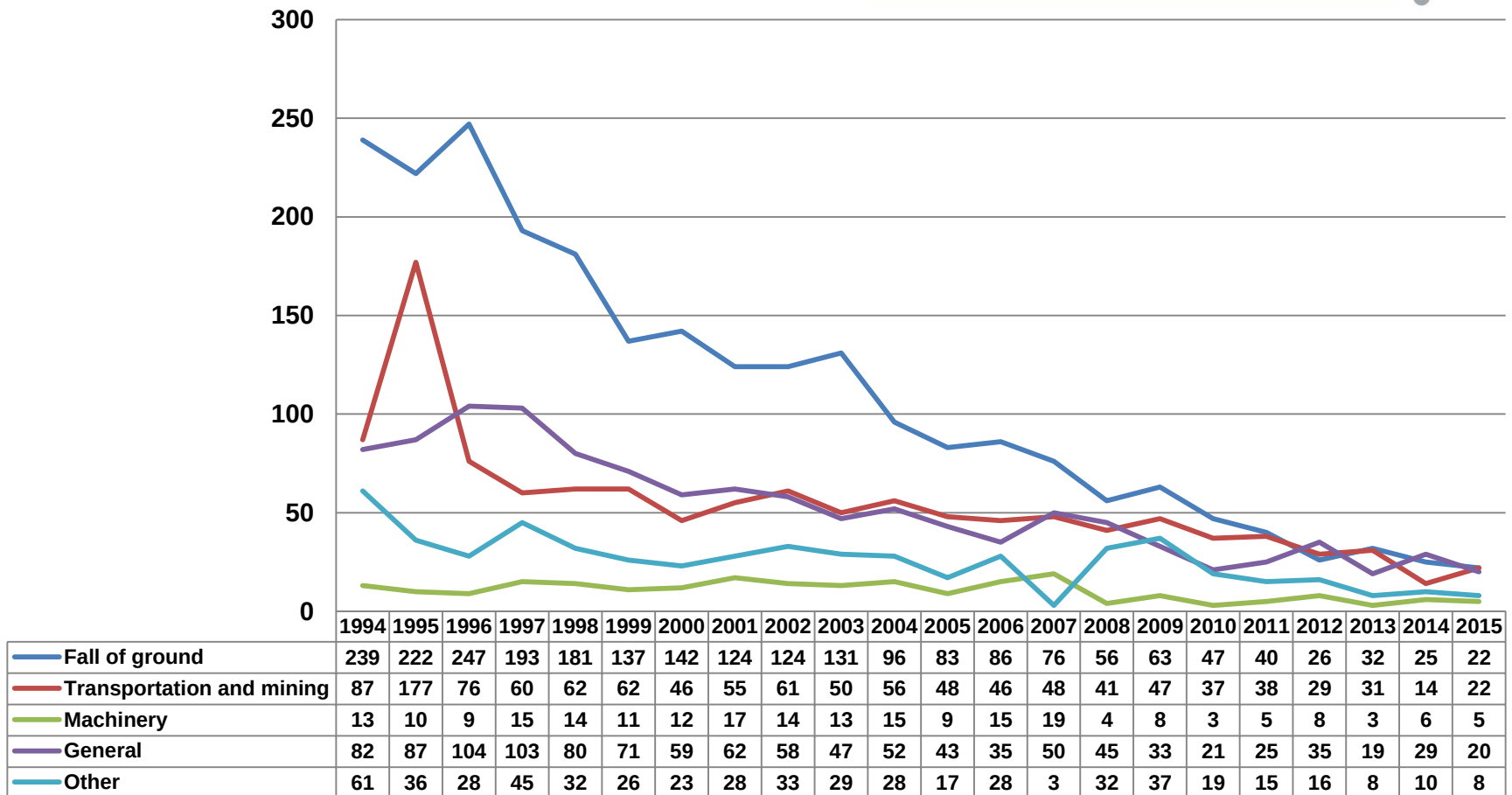
Industry achieved annual reduction target FOUR times in the last 10 years.

OHS Performance: Fatality Rates



	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
South Africa	0.30	0.26	0.20	0.20	0.20	0.15	0.16	0.12	0.11	0.10	0.09
USA	0.08	0.08	0.08	0.09	0.08	0.06	0.04	0.09	0.04	0.06	0.07
Canada (Ontario)	0.06	0.09	0.03	0.09	0.08	0.03	0.04	0.00	0.15	0.05	0.07
Australia	0.06	0.02	0.04	0.06	0.04	0.03	0.03	0.01	0.02	0.01	0.02

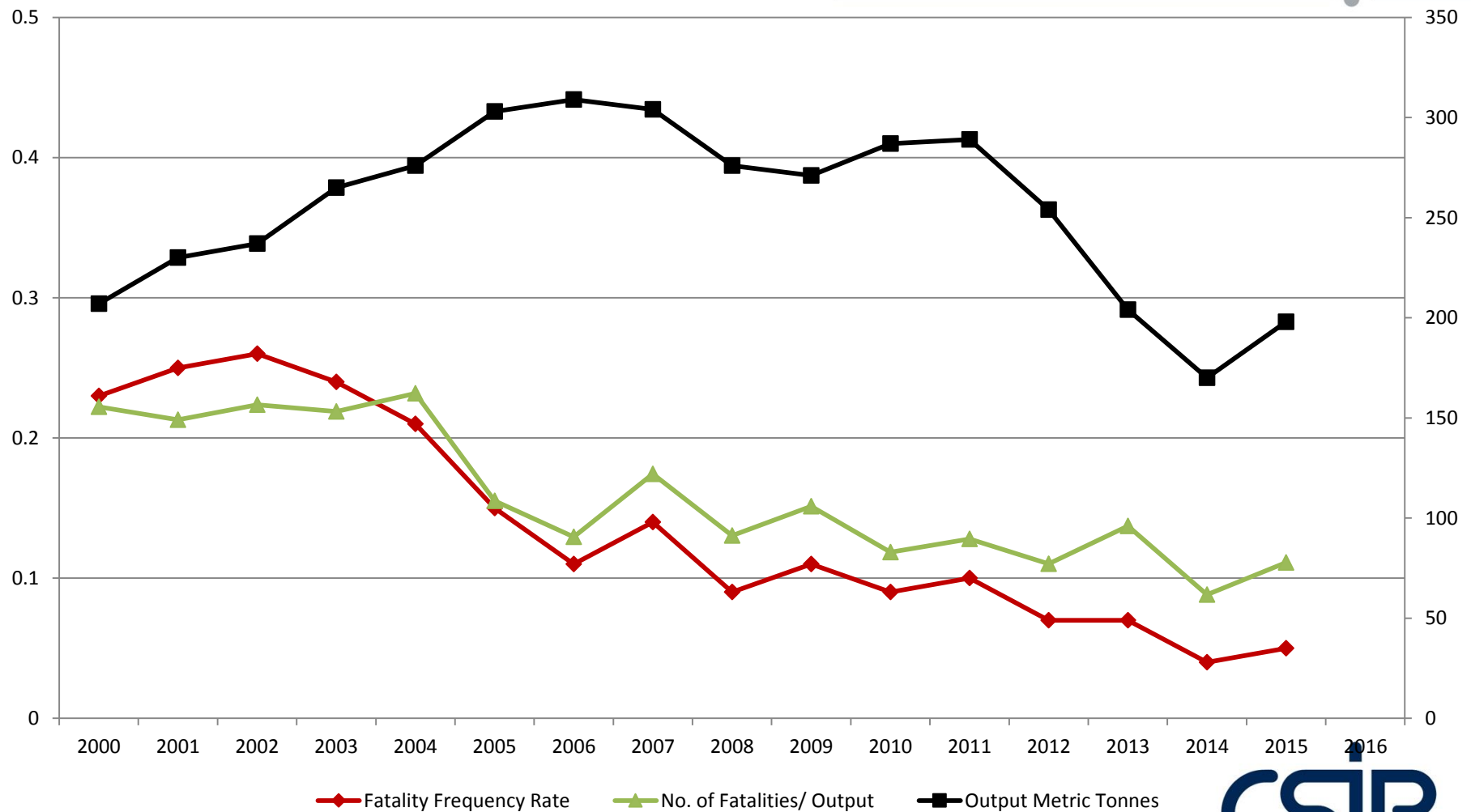
OHS Performance: “Causes” of Fatalities



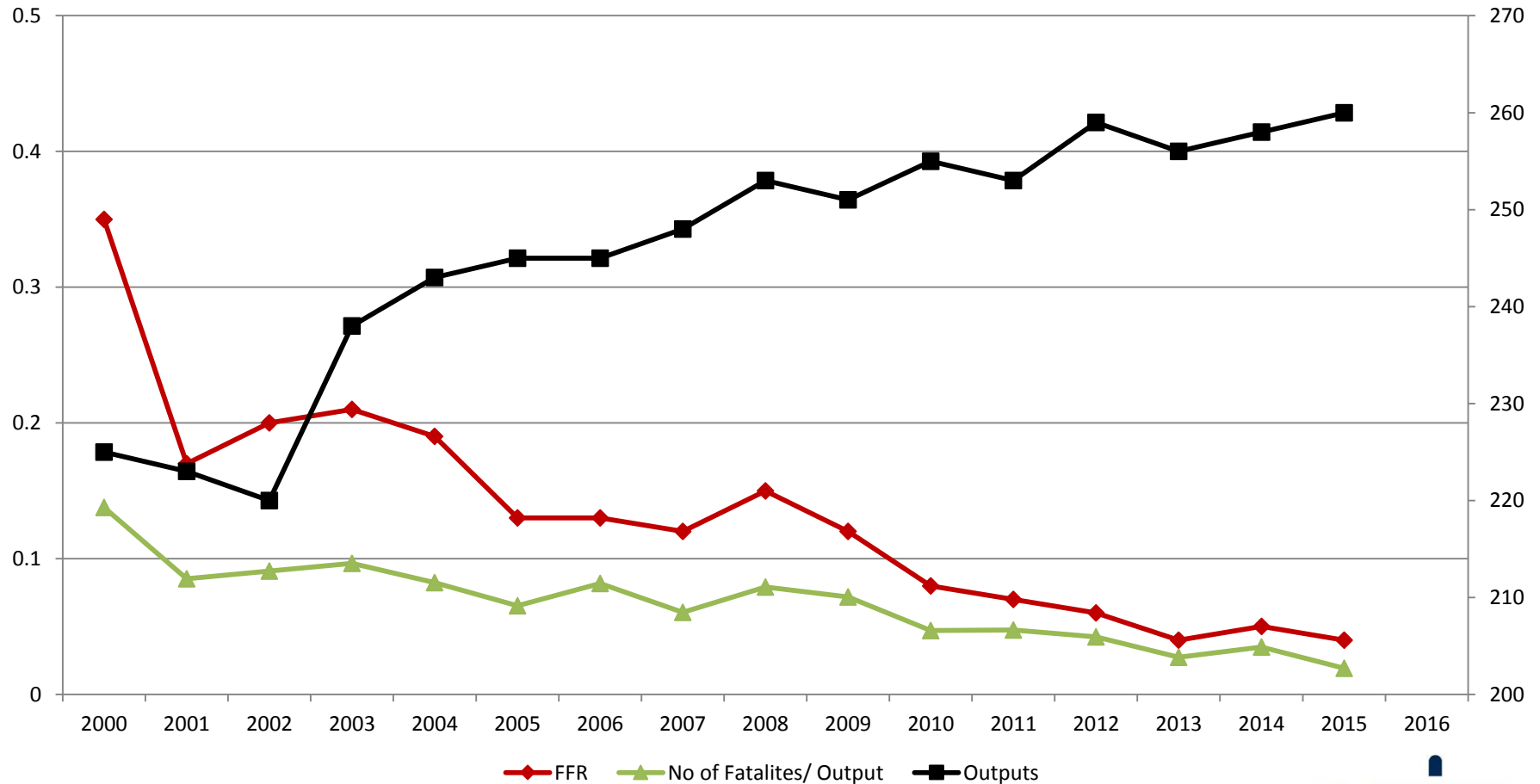
Gold FFR and Output (metric tonnes)



Platinum FFR and Output (metric tonne)



Coal FFR and Output (million tonnes)



Safety Indicators

- Number of fatalities in gold approached that of platinum sector down 2003-2013 (~ 120 to ~40)
- Coal 23 miners died in 2003 compared to 11 deaths 2013
- *Netting and bolting with new drilling technology*
- *Ongoing investment in understanding and mitigating rock bursts*
 - *Mining methods, backfilling, hydraulic support, bracket and stabilising pillars*
- *Machine ergonomics, collision avoidance technologies*

Health Indicators

- **NIHL**

- Cases: 6679 in 2003 to 1189 in 2013 (Gold mining 5783 in 2003 to 471 in 2013)
- Audiogram database
- Engineering solutions (work in progress, quiet rock drill)

- **Silicosis**

- Disease identification, surveillance monitoring (Gold 2042 to 1164 in period 2003 to 2013)
- Reduction of airborne respirable dust (nearly 95% $< 0.10\text{mg/m}^3$)

- **HIV/ TB**

- 2004 (Thibela project), linked silicosis exposure, TB, and HIV-AIDS vulnerability
- Gold mining (platinum presence)
- Mine / sector level actions and SA action plan
- HIV (TB): 64% voluntary testing (73%), Incidence 9%, (1%) ARV ~ 14% (97% of?) Co-infection 81%

MOSH

Adoption process focuses identifying, documenting, demonstrating and facilitating widespread adoption of leading practices with significant impact potential

- **Rockfalls**
 - Entry examination and making-safe procedure
 - Nets with bolts
 - Trigger Action Response Plan (follows recognition of FOG hazards)
- **Transport and Machinery** – Proximity detection devices
- **NIHL** – Effective Hearing Protection, engineering
- **Respirable Dust**
 - **Fogger** /mist-spray systems to capture airborne respirable dust at key locations
 - **Footwall/sidewall treatment** - Wetting of footwalls and sidewalls with water
 - **Multi-stage filtration system (MSFS)** - 3 stage system to remove harmful dust

Broken Window Enforcement Policy

- *A broken windows enforcement policy* is about pursuing even the of smallest infractions aggressively to “create an atmosphere of order and lawfulness, thereby preventing more serious crimes from happening”. (Wilson and Kelling 1982)

Heavy-handed stoppages at mines hit output by [Allan Seccombe](#), 16 August 2016, 05:40 (Bday)

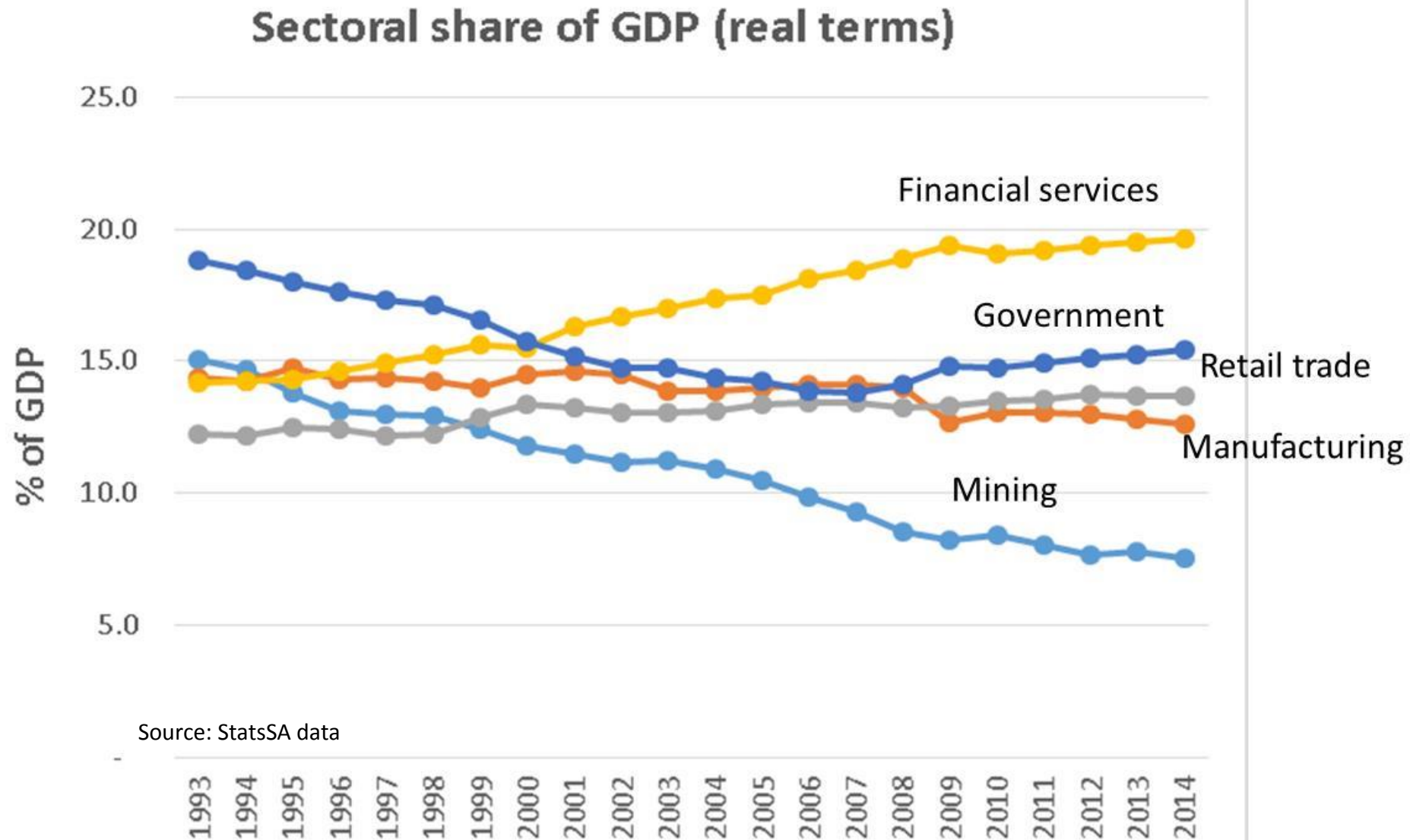
Cost R834m in first half 2016

South Africa's government hit back at mining companies that criticized the frequency of safety stoppages, saying that the health of workers takes priority over profit.

Looking Back to Look Forward

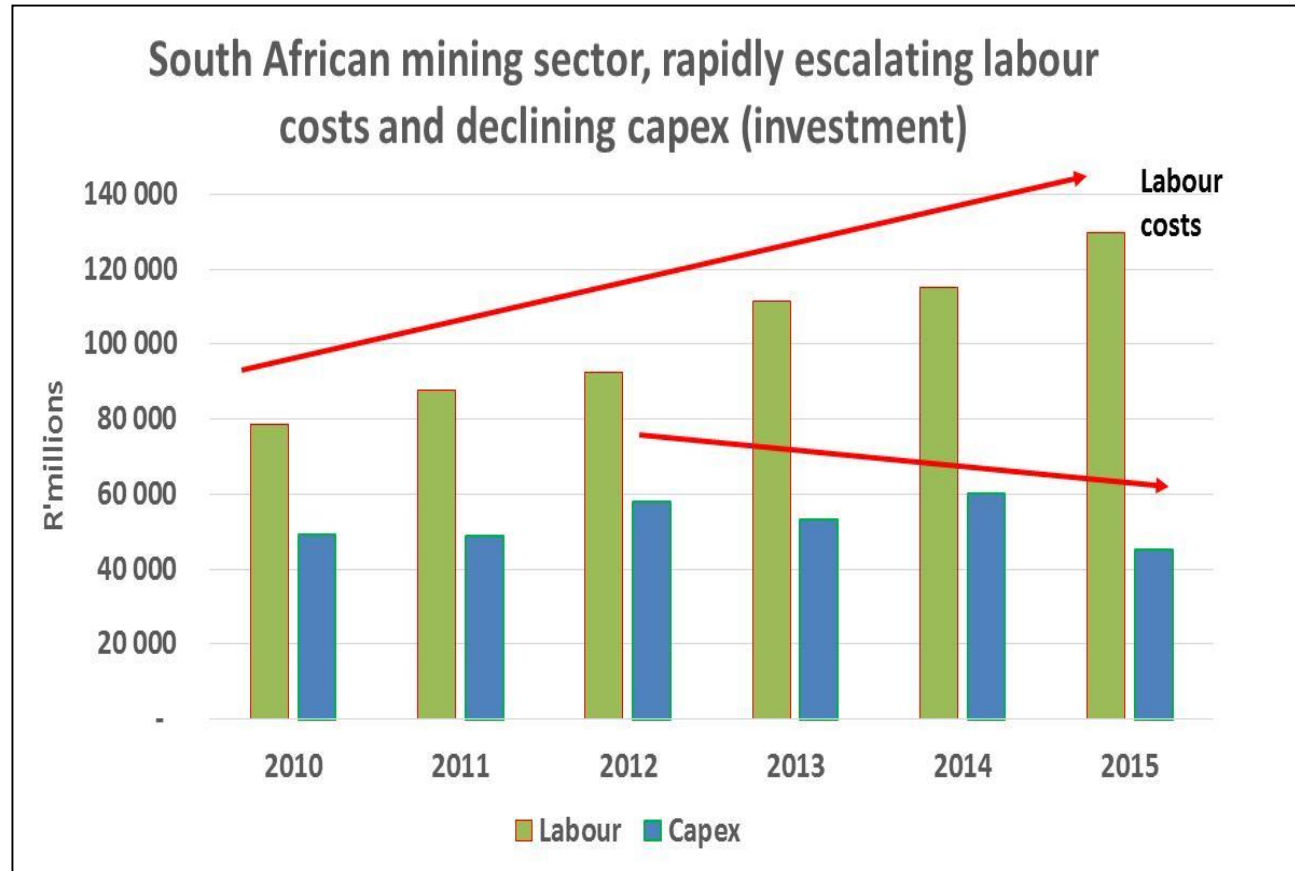
- Data to hand indicates marked improvement
- Which initiatives worked where, why, to what degree?
 - Major driver/s: decline in gold? Initiatives and interventions?
- Relevance and resourcing of initiatives
 - For the present
 - For the future (context changing)
 - Already OHS goals referencing industry level concerns
- Implications
 - For OHS research
 - For regulation
 - For workers (unions and safety reps)

Context: Contribution to GDP



Economic issues in Mining

- Input Costs have risen
- Cost of electricity has trebled
- Employment costs have increased
- For gold, mining conditions are more challenging
- Similarly for platinum mines
- Coal mining future uncertain



Sector Prospects

- No change in mining methods: Gold and platinum mining ceases in 2033 and 2029 respectively
- With mechanised and continuous mining: Gold and platinum mining life extended to 2044 and 2042 respectively
- What does the mean for health and safety?
 - Changing risk profile
 - Requirement to address current and future challenges
 - Planning for different skills sets (MQA)

Planning in Progress

- Mining cluster rather than mining sector
 - Advancing the cluster through R&D and establishment of manufacturing capability
- Employment in the cluster rather than in mining per se
- Beneficiation choices
- Post-mining landscapes
- Livelihoods communities
- Sustainable communities / society

R&D in Plans Summary

Advancing the cluster through R&D in Mining and Manufacturing

Mining R&D Programme

Mining Manufacturing Development Programme

Initiatives proposed

- Focus on operations
- Increase transformed mining R&D capacity
- Enhance Mining Manufacturing Capability
- Define institutional arrangements and funding for R&D and Manufacturing
- Strengthen infrastructural capability for R&D and Manufacturing

Value Propositions

Will unlock un-mineable resources safely

- Large percentage of current resources cannot be mined.

Revitalising and localise mining R&D (transformation, skills & competencies)

- Local R&D is very fragmented being done elsewhere as well as Mining OEMs' R&D is done globally .

Increase manufacturing's contribution to GDP in line with IPAP and 9-Point plan

- Manufacturing of Mining Equipment in SA is very limited with large level of imports

CELEBRATING
70 Years
Ideas that work

CSIR
our future through science

END
Thank you!!

