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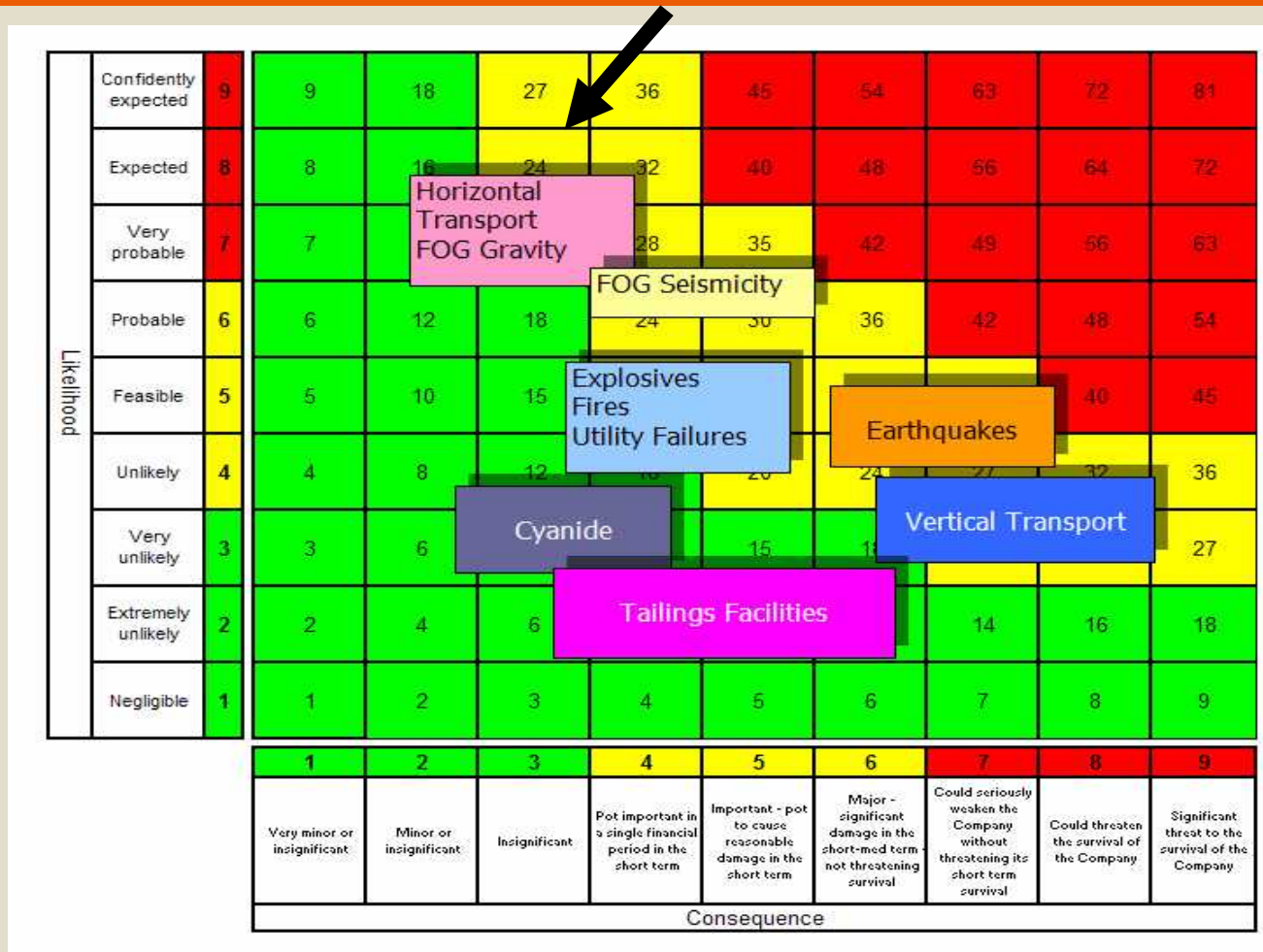
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# Risk Management in Underground Rail Transport in Gold Mining

July 2006

IAIN MENZIES  
HEAD OF ENGINEERING  
Africa Underground Region

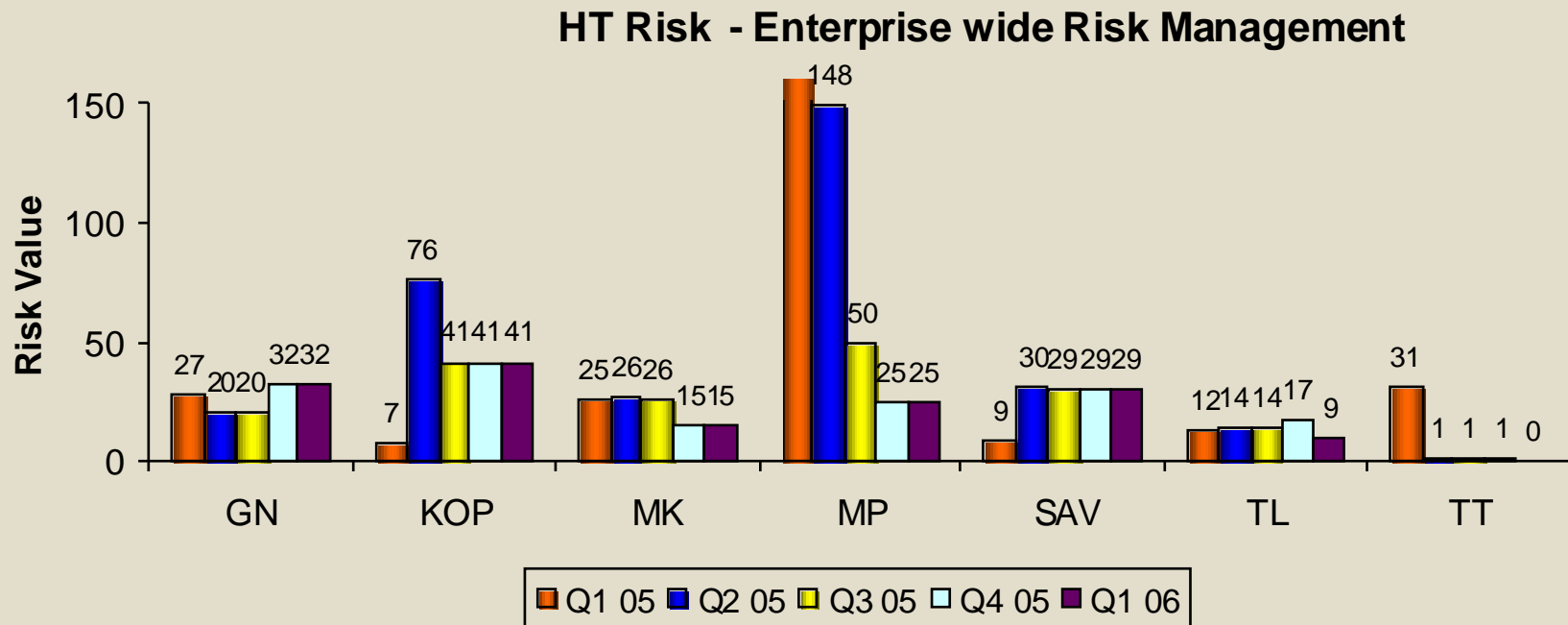
# Risk – Peril Category Position – All Operations



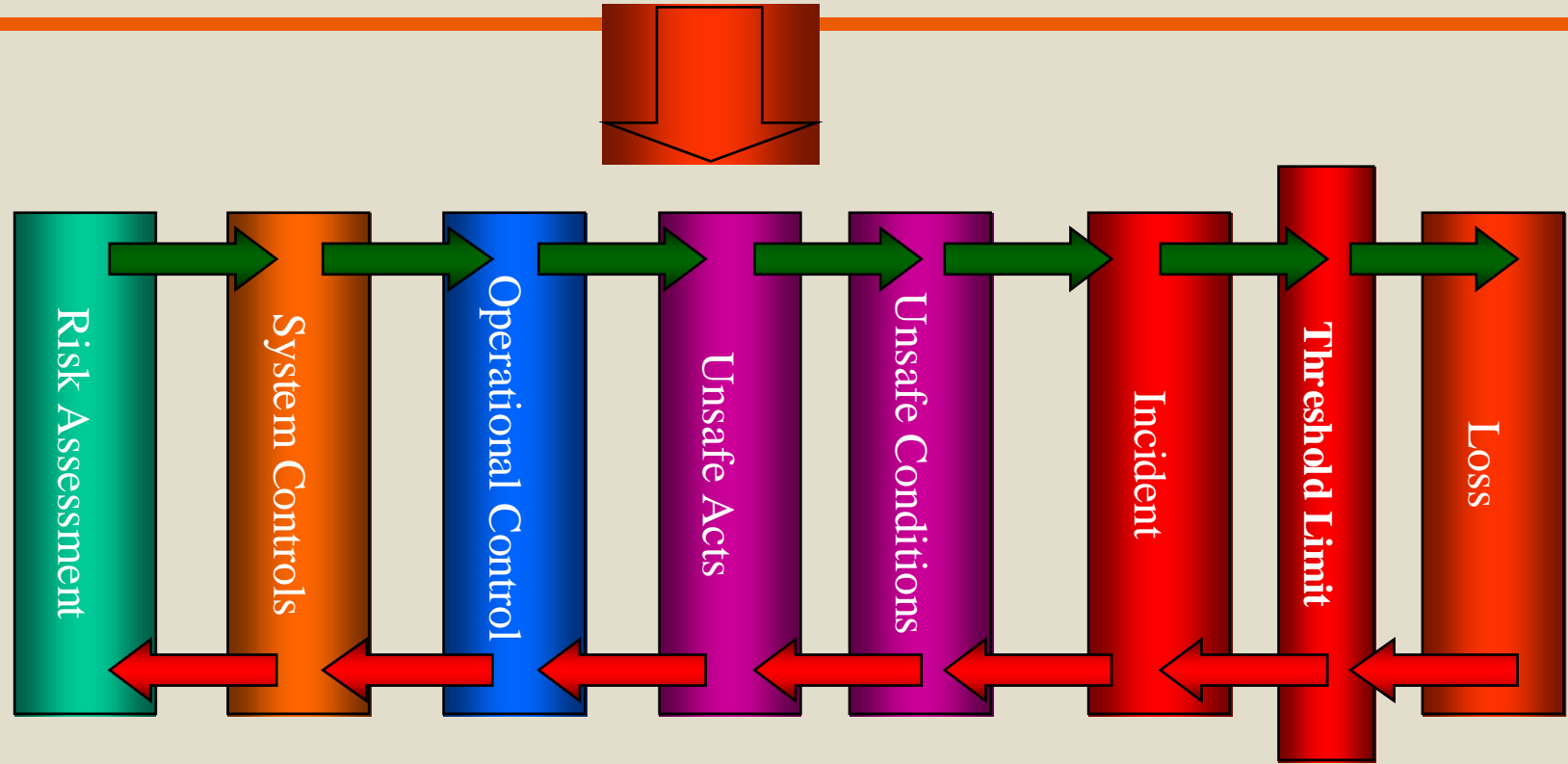
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Enterprise-wide Risk Management Matrix

# HT Risk – Enterprise Wide Risk Management



# The Loss Causation Model



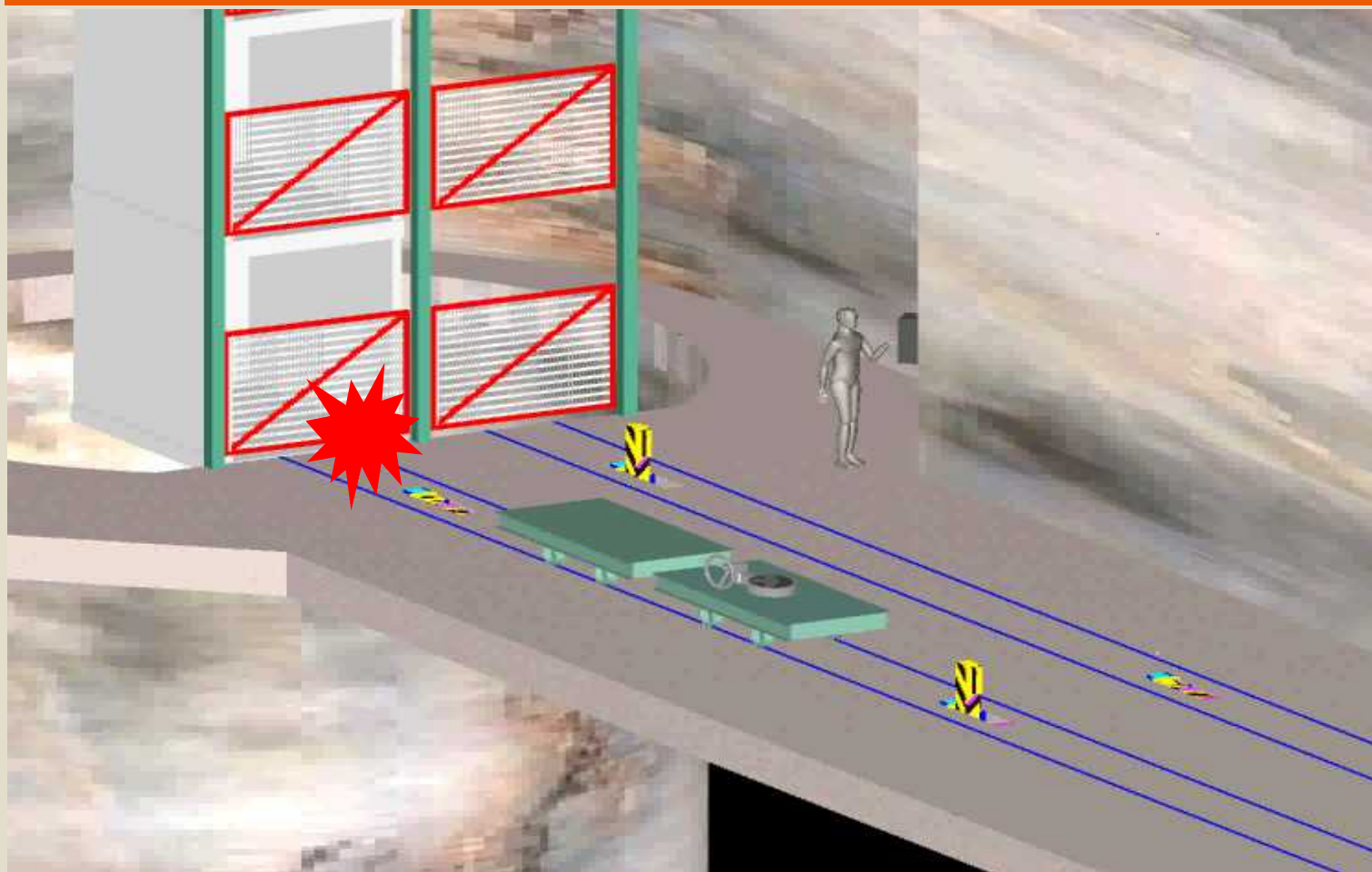
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## U/G Horizontal Transport Fatalities

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2000	2001	2002	2003
8	3	7	3

# Vertical Shaft Incident



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# Vertical Shaft Incident

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**Stop the shaft!**

**What?**

**Why?**

**Team Investigation**

**Design review**

**Risk assessment**

**Fix**

**Monitor**

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# Horizontal transport Incident

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# Horizontal transport Incident

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**Loco team re-rails without proper equipment ...**










**No management investigation**

# Time Frame

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- HT Task Teams 2001/2002
- 2003 Safety Strategic Session
- 2003 Strategic Plan for HT Safety
- 2004 Strategic Plan for HT & VT Safety
- 2005 Strategic Plan for continuation of Transport Safety
- 2006 Continuation of Transport Safety Initiatives

## 2003 HT STRATEGIC ISSUES

1	Technical & Progress – Iain Menzies	
2	Operational Guidance – Mike O'Hare	
3	Appoint Eng. Manager as custodian of HT supported by senior operational line officials	
4	Review baseline risk assessments	
5	Conduct issue based risk assessments	
6	Action plan to address issues	
7	Internal / External audits – to be conducted	
8	OESH Person to be appointed for HT	
9	Develop a set of non-negotiable golden rules for HT	

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# Overall Thrust

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- Long Term Action Plans
- Short Term Initiatives



# HT HIGH LEVEL SAFETY INITIATIVES

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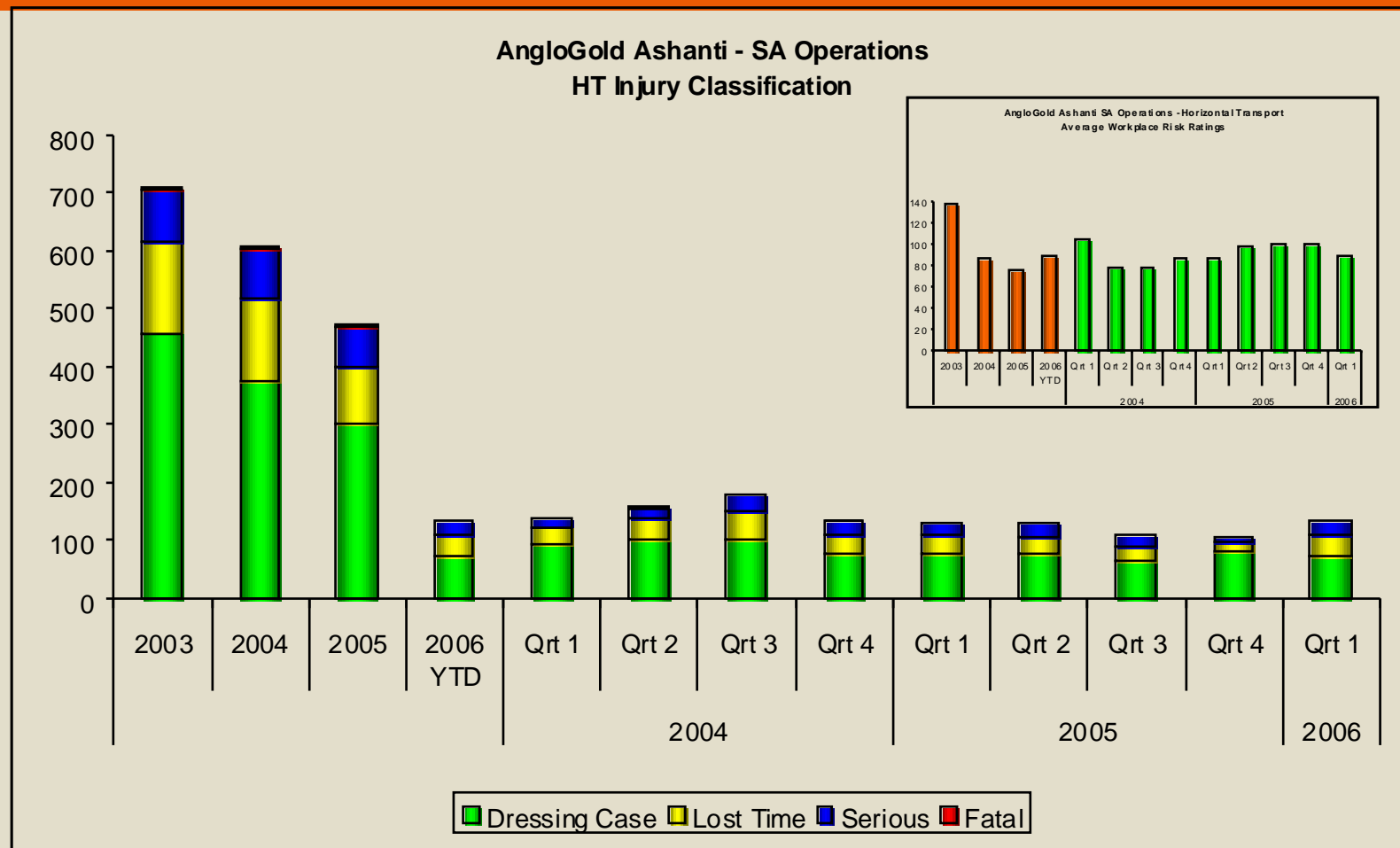
- HT Audits – 18 monthly by Audit department, 9 month follow up. 
- HT User Group meetings
- Mine based HT Task Group
- HT Guidelines and Standards in place and reviewed continuously.
- Updated mine overseers COP's for Engineering.
- M/O and S/O Engineering awareness training.
- Track work upgrading R7.7m over last 3 years, R10,8 for next 3 years.
- Audit of all stope box fronts.
- Issued HT Golden Rules. 
- HT action logs (general guideline developed)
- Appointment of dedicated HT OESH persons.
- Derailment reporting. 
- HT Safety competition. 
- Mobile equipment driver selection criteria.
- Track work C.O.W. appointments.
- Section Risk Ratings. 
- Review and action all major accidents
- Improved maintenance techniques

# HT HIGH LEVEL SAFETY INITIATIVES CONT.

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- Track work maintenance training course.
- Standard (correctly designed) stope box front.
- Pneumatic control of stope chutes.
- Stope box front mud rush simulator.
- Contractors check list.
- Design work on rolling stock suspension systems.
- New era loco programme 109 out of 426 
- Six monthly safety workshop.
- Video camera installation at strategic points.
- Industrial Engineering simulations
- Centre of gravity tramming
- Large Locos/spans – reduction of fleet
- Vent door design improvements.
- Quarterly Business Unit feed back to Head of Engineering
- Enhanced Reporting. 
- Process based organization.

# HT Incident – Injury Classification (compare incidents with Risk Profile)



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## Horizontal Transport Fatalities

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2000	2001	2002	2003	2004	2005	2006
8	3	7	3	1	2	0



# Golden Rules of Trammimg

When last have you been for a refresher training



Valid Driver Permit

Do You Fill in Your Pre-Use Checklist Daily



Checklist

## Horizontal Transport

Do You Stand Clear From The Tracks When a Loco Approach



DRIVER TO SLOW DOWN AND OPERATE SIREN

Do You Adhere To All Traffic Rules



## 5 Golden Rules

Do You Report All Derailments And Incidents



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# Engineering HT & VT Competition - 2005

HORIZONTAL TRANSPORT					VERTICAL TRANSPORT				
Best Improvement					Best Improvement				
	2004	2005	% Var	Pos		2004	2005	% Var	Pos
TAUTONA	2.73	1.18	-56.8%	1	KOPANANG	1.39	0.29	-79.4%	1
SAVUKA	1.95	1.19	-38.8%	2	MPONENG	0.32	0.07	-78.1%	2
KOPANANG	1.45	1.07	-26.3%	3	SAVUKA	0.73	0.51	-30.1%	3
MOAB KHOTSONG	1.51	1.95	28.6%	4	TAUTONA	0.62	0.44	-29.2%	4
MPONENG	0.24	0.35	46.1%	5	TAU LEKOA	0.10	0.10	7.8%	5
GREAT NOLIGWA	2.78	1.21	-56.6%	6	MOAB KHOTSONG	0.22	0.32	50.0%	6
TAU LEKOA	1.33	1.54	15.5%	7	GREAT NOLIGWA	0.26	0.49	88.0%	7

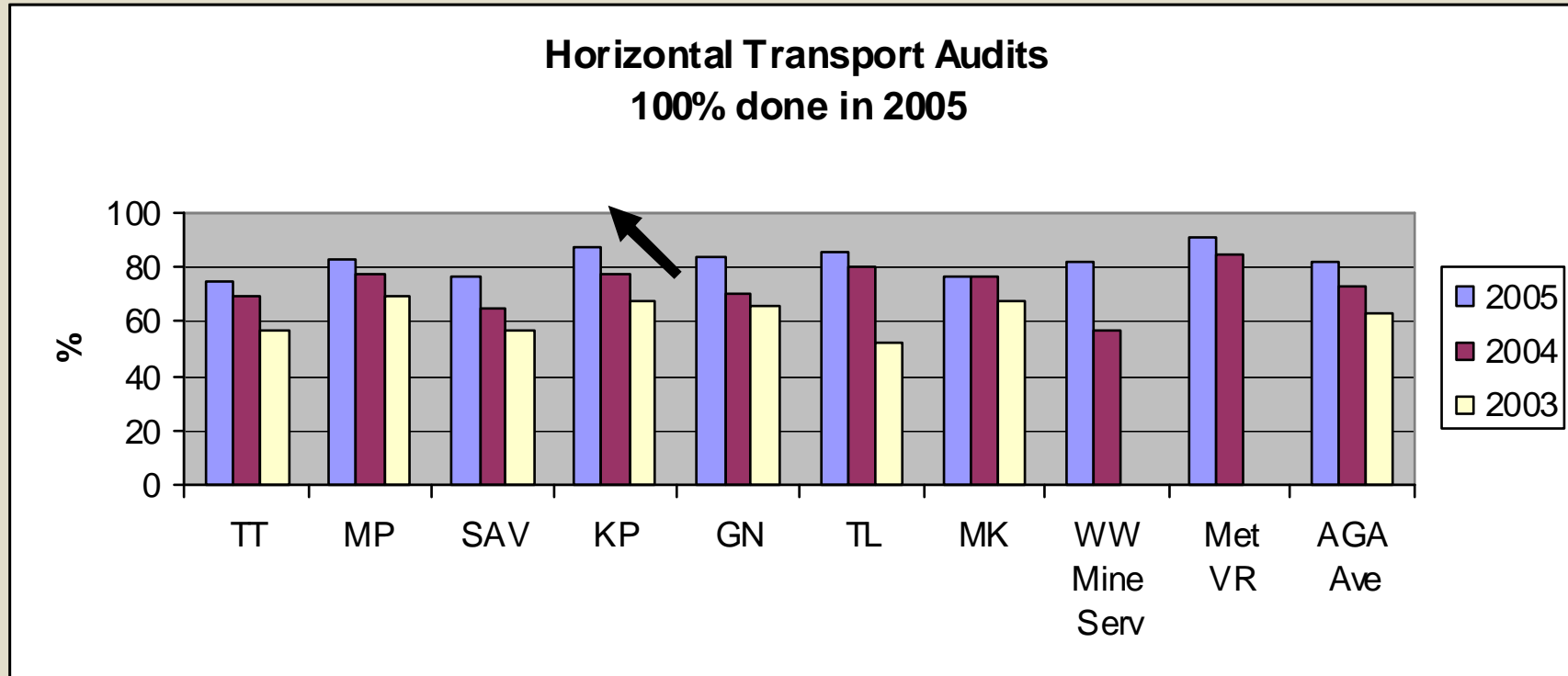
OVERALL TRANSPORT					OVERALL TRANSPORT		
Best Overall Improvement					Best LTIFR for 2005		
	2004	2005	% Var	Pos		2005	Pos
KOPANANG	2.85	1.36	-52.3%	1	MPONENG	0.42	1
TAUTONA	3.36	1.62	-51.7%	2	KOPANANG	1.36	2
SAVUKA	2.68	1.70	-36.5%	3	TAUTONA	1.62	3
MPONENG	0.56	0.42	-24.8%	4	SAVUKA	1.70	4
MOAB KHOTSONG	1.73	2.27	31.3%	5	MOAB KHOTSONG	2.27	5
GREAT NOLIGWA	3.05	1.70	-44.2%	6	TAU LEKOA	1.64	6
TAU LEKOA	1.43	1.64	14.9%	7	GREAT NOLIGWA	1.70	7

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# Horizontal Transport Audits



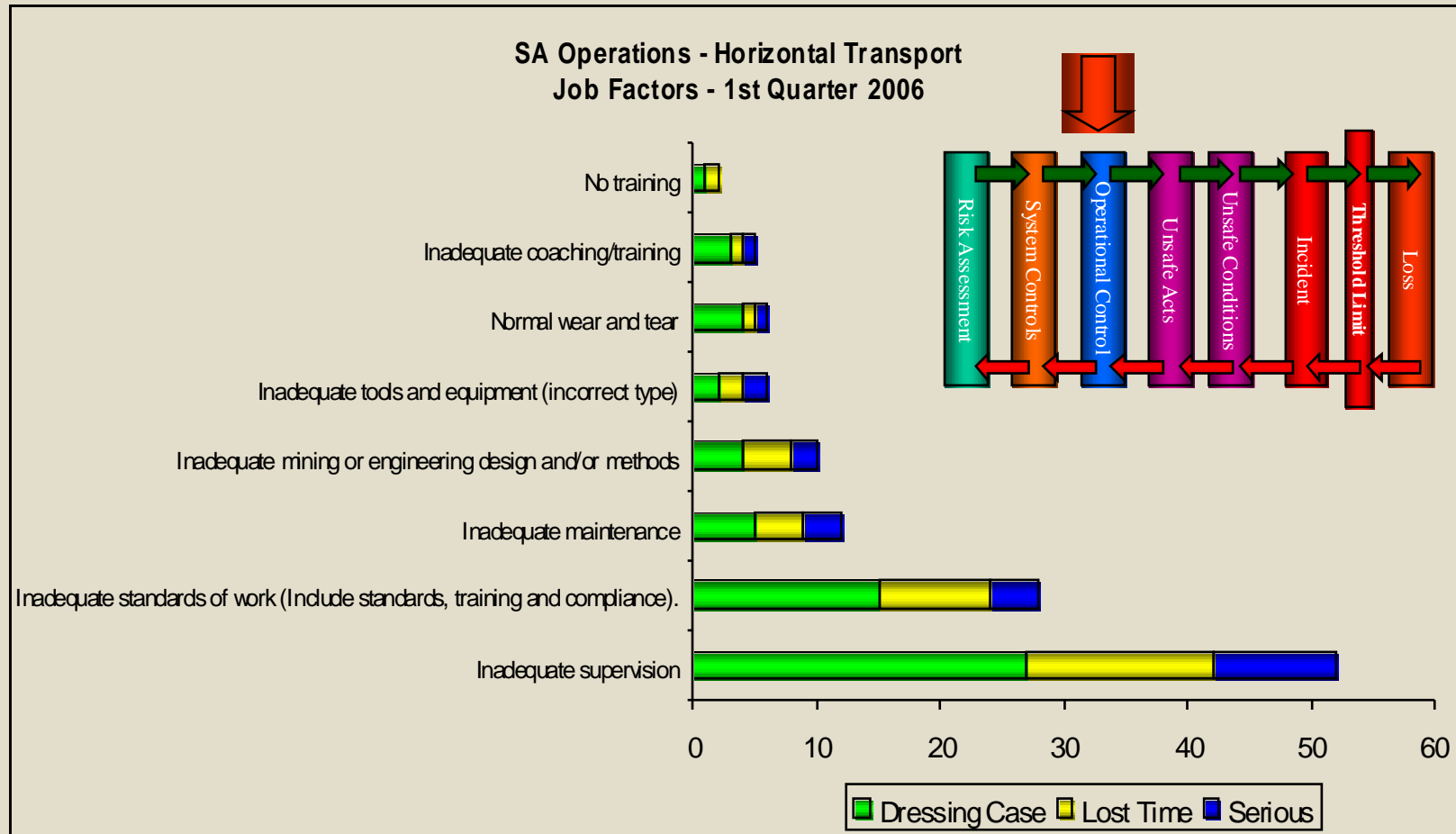
# HT Risk Profiles

(a)



# HT Incidents – Job Factor Failures

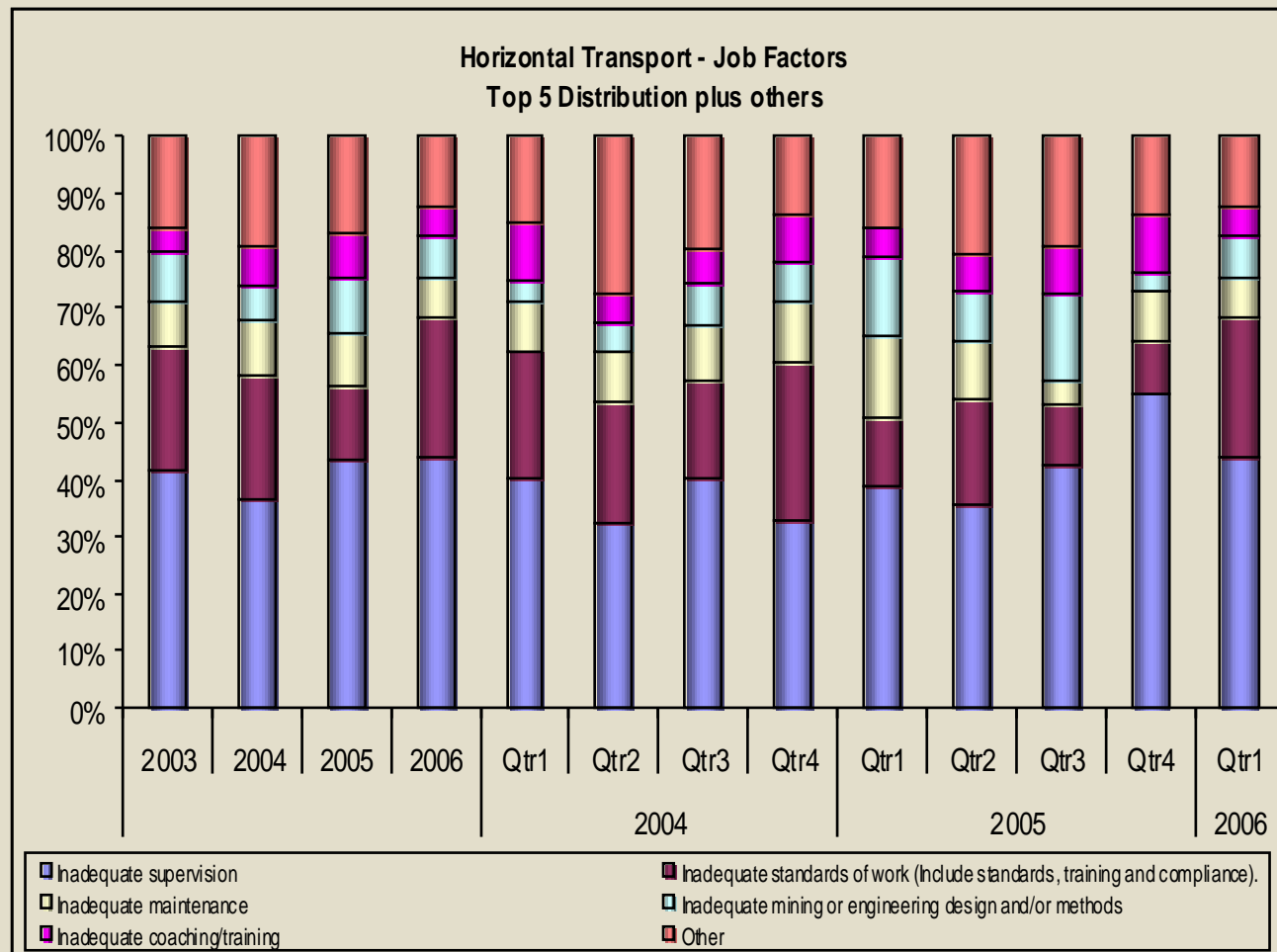
(c)



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# HT Incidents – Job Factor Failures

(d)

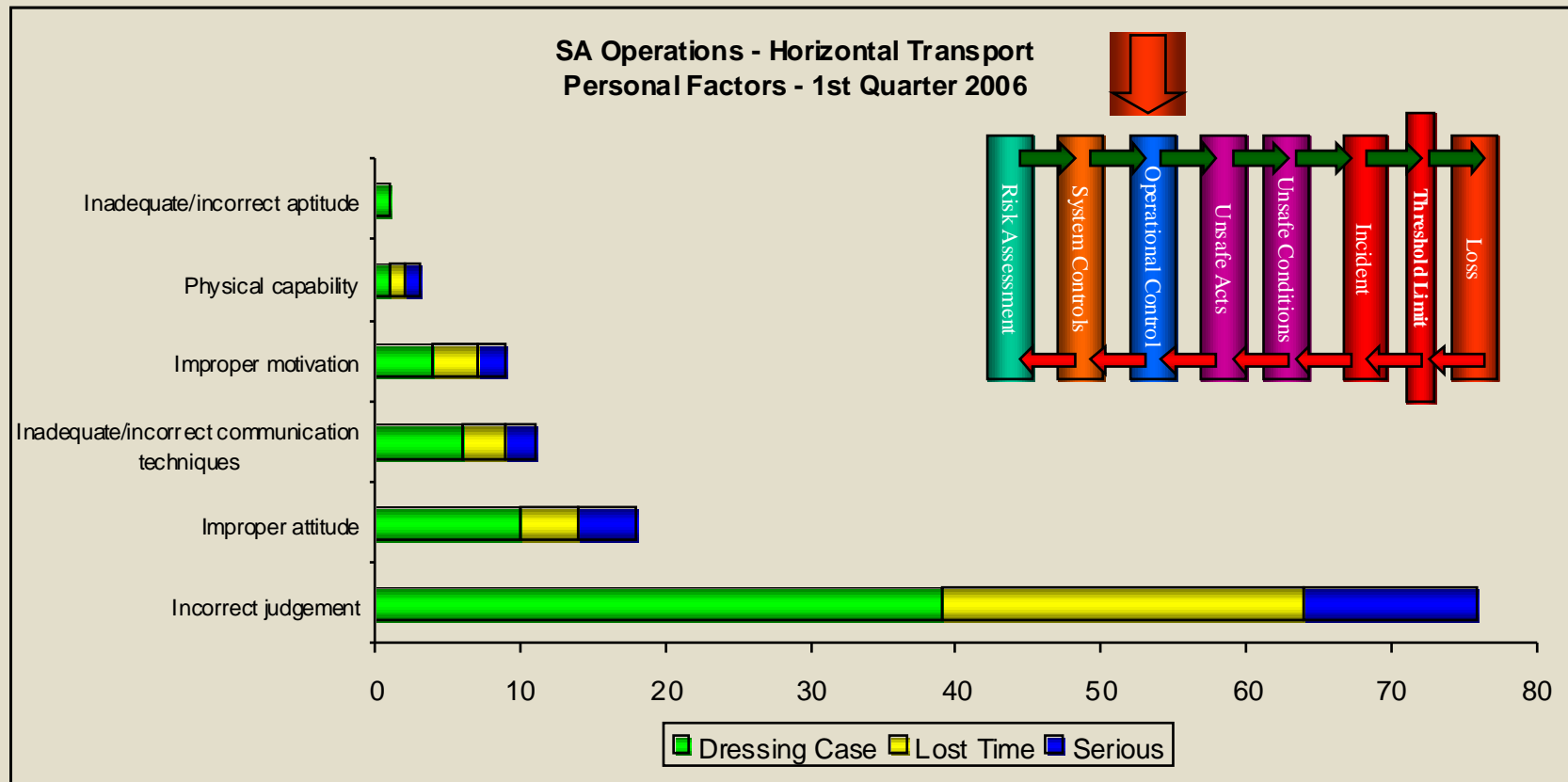


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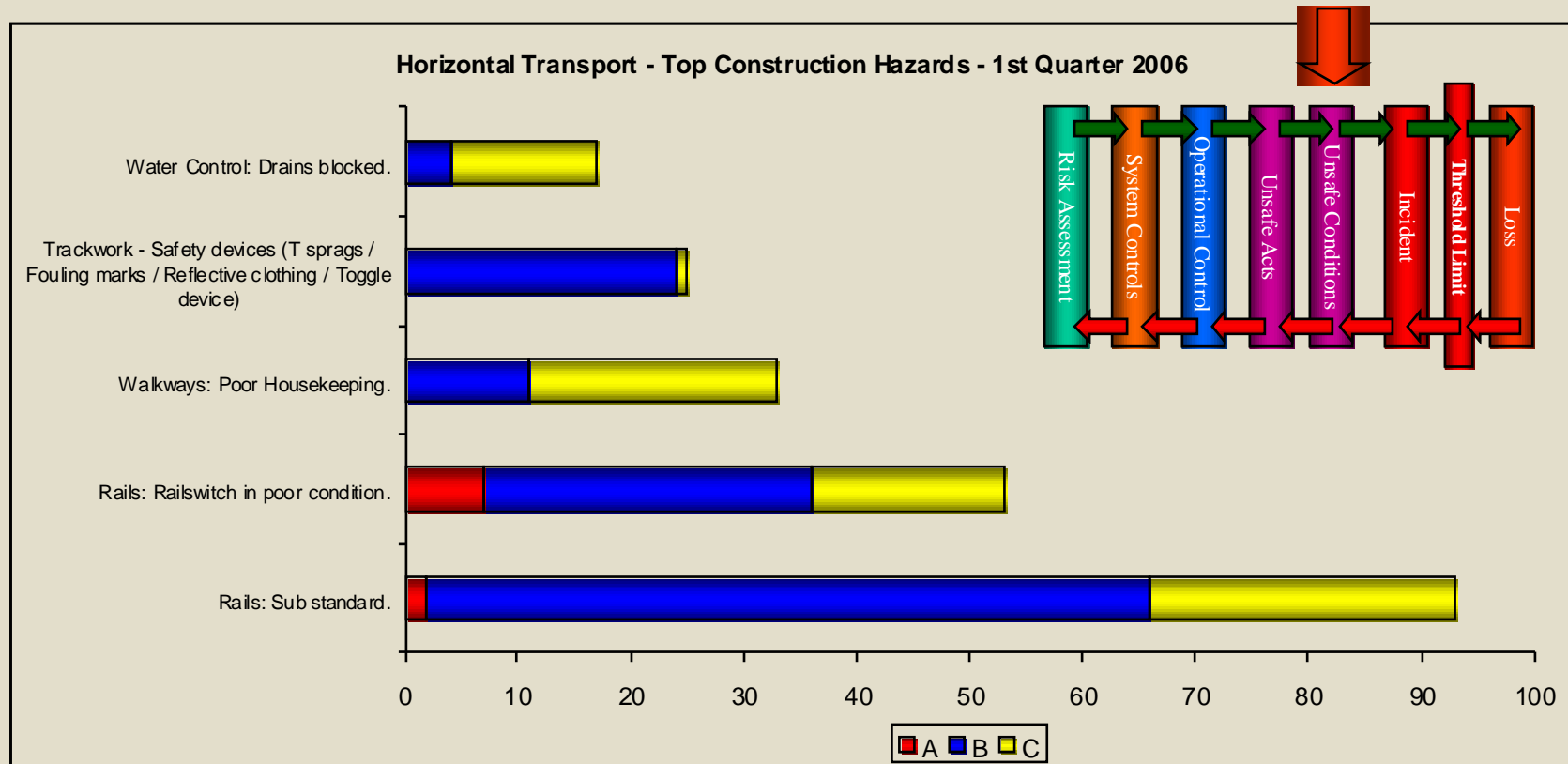
# HT Incidents – Personal Factor Failures

(e)

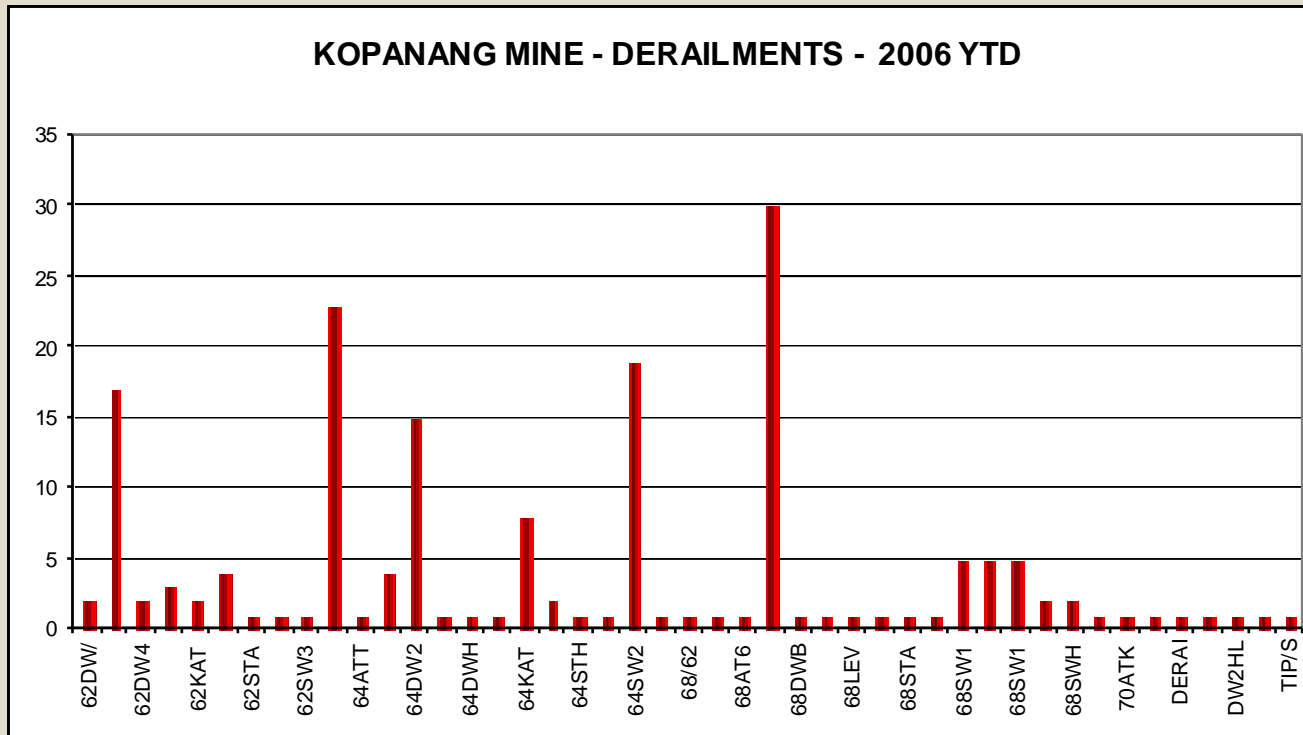


# HT Incidents – Construction Hazards

(f)



# Derailments at Kopanang - 2006 YTD



# Derailment Register - Kopanang

## De-Railments

Date	Loco No	Level / Tip	Time Derailed	Time Rerailed	Time Lost	Rigger called			Remarks	SWITCH / RAIL CONDITION
						Time Called	Time Arrived	Name		
4/01/2006	392	62SE3/HLGE	09:25	10:38	01:13				LOCO 392	RAIL CONDITION
4/01/2006	428	64KATLEHOTIP	05:15	09:26	04:11	06:30	06:30		1 HOPPER	
5/01/2006	421	64SW2/21	09:15	09:30	00:15				2 FULL MAT. CARS	SWITCH CONDITION
5/01/2006	723	64DW2/16N	11:00	12:05	01:05				LOCO 723	SWITCH CONDITION
5/01/2006	380	64DW2HLGE	00:55	01:10	00:15				4 FULL HOPPERS	RAIL CONDITION
5/01/2006	764	64DW2HLGE	02:52	4:15:00	01:23				2 FULL HOPPERS	RAIL CONDITION
6/01/2006	695	62DW/SWSPLIT	11:00	11:22	00:22				LOCO 695	
06/01/2006	723	64DW2HLE	17:55	19:15	01:20				LOCO AND 2 HOPPERS	RAIL CONDITION
9/01/2006	723	64DW1/HLGE	02:00	5:00:00	03:00				1 FULL HOPPER	RAIL CONDITION
9/01/2006	724	64DW213X/C	18:50	20:30:00	01:40				4 FULL HOPPERS	RAIL CONDITION



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