RIO TINTO
ENERGY AMERICA

Implementation of a Multi-Site Engineered Maintenance Program

Tom Moriarty, President, Alidade MER

Mark Gilbertson, Director Asset Management,
Rio Tinto Energy America

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

Who we are….

- Rio Tinto Energy America is a wholly owned subsidiary of Rio Tinto plc. Rio Tinto one of the world's largest mining companies.

- Rio Tinto Energy America is a significant producer of low-sulfur steam coal, with operations in Colorado, Montana, and in Wyoming.

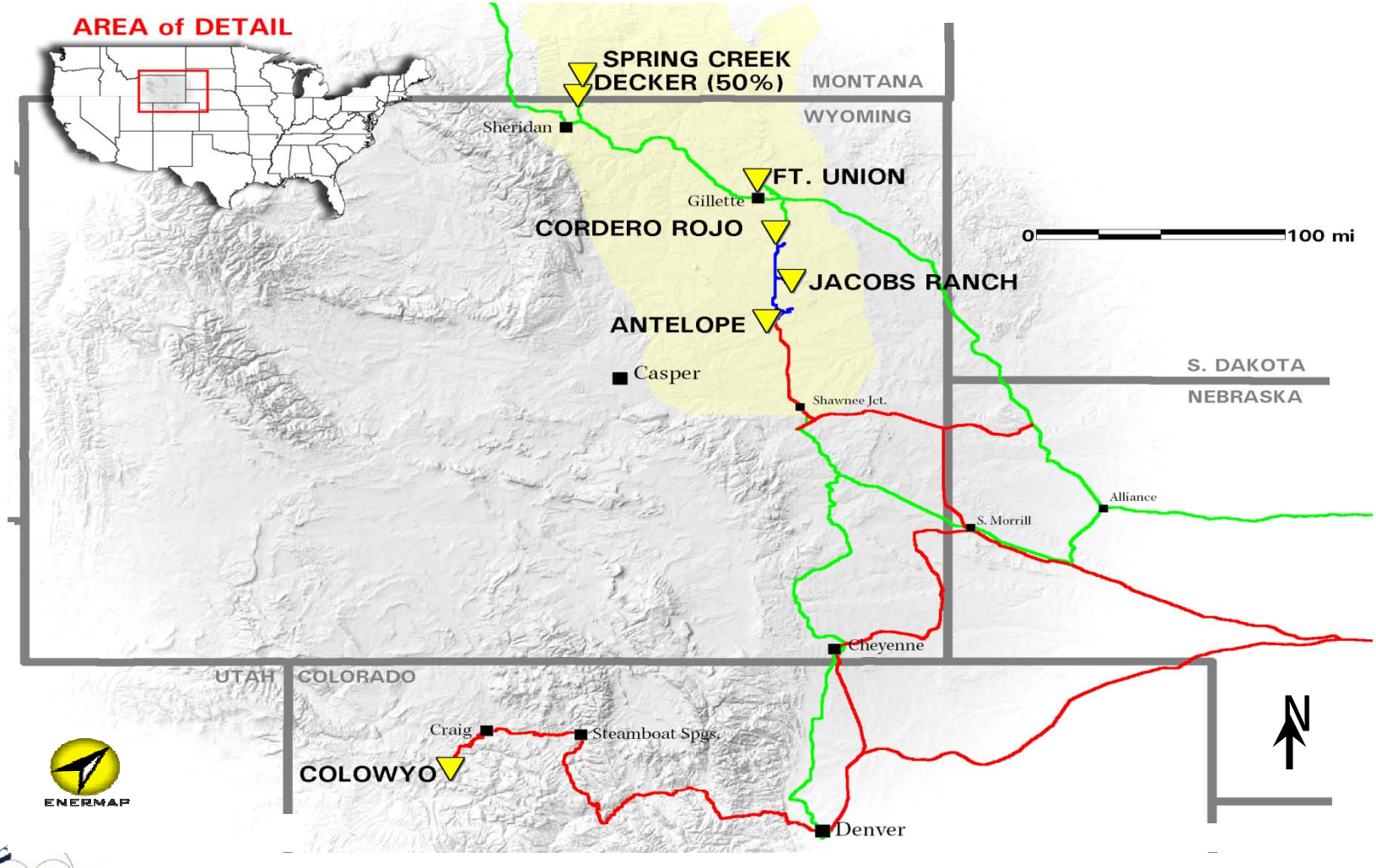
- The open pit mining methods employed are very equipment intensive; assets are expensive and reliability of assets is critical to our success.

- Alidade MER, Inc. is a management, engineering and reliability (MER) focuses professional services firm providing insight, advice and support to leaders of people and managers of assets.

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

And where we are…



ALIDADE M.E.R

RIO TINTO ENERGY AMERICA

Specific Operations

- Colowyo Mine
  - operates 3 draglines, a large shovel, a large excavator, and a number of front-end loaders.
  - coal haulage, and some overburden haulage, is accomplished with 240 ton trucks.
  - invests 6,500 man-hours' technical labor in maintenance of the Komatsu 830E truck fleet.
- Antelope Mine
  - operates one large dragline in overburden stripping and five shovels that load either overburden or coal, as well as two large front end loaders.
  - Antelope operates 36 trucks, all of them 240 ton Komatsu 830E.
  - 40,000 man-hours labor are planned for maintenance and repair of the fleet.

ALIDADE M.E.R

RIO TINTO ENERGY AMERICA

Specific Operations

- Jacobs Ranch Mine
  - one dragline and with four large shovels;
  - coal is primarily loaded with four smaller shovels;
  - haulage is accomplished with 42 trucks, 34 of which are Komatsu 830Es.
  - consume 38,000 man-hours of technical labor to maintain the fleet.
- Cordero-Rojo Mine
  - uses three large draglines, supported by three 60 ton class shovels
  - coal is primarily loaded by smaller shovels.
  - haulage fleet is made up of 38 Komatsu 830E trucks,
  - require some 42,000 man-hours annual technical labor to maintain.
- Spring Creek Mine
  - a fleet of 8 new Komatsu 830E AC drive trucks, utilized in coal haulage.
  - we predict 8,800 man-hours annual labor to adequately inspect and maintain the fleet.

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

Typical Configuration of a Mining Truck

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

Opportunity Analysis

- Asset value; approx. $370mm US replacement value.
- Production capacity of +/- 430mm units tons
- Technical labor requirements exceed 125,000 man-hours annually and are supplemented by contract labor when necessary.
- Facility and infrastructure considerations: Large shops, large cranes, large tooling are required for many services.
- Proper scheduling and utilization of the infrastructure reduces the costs and improves efficiency of these factors.

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

FMECA / PMO Process

- FMECA
  - Failure Modes Effects and Criticality Analysis
- PMO
  - Planned Maintenance Optimization
- Beyond FMECA & PMO
  - Task Writing and Implementation

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

FMECA

- Preparation
  - The setting; away from distractions
  - Team mix; operations, maintainers, engineering
  - Facilitator; focused on process, ask grounding questions
  - Scheduling; not more than two consecutive weeks
  - Time for process training and pilot sub-system

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

FMECA Process

- System Description & Boundaries
- Sub-System Description & Boundaries
- System and Sub-System Functional Descriptions
- Descriptions of Significant Functional Failures
  - Likely to occur, would occur if no PMs,
  - Major safety/regulatory issue
- Significant Failure Modes, Causes and Effects
- Criticality and Probability
  - Safety, Regulatory, Production Impact, Corrective Action
  - Weightings and scales to speed analysis
  - Used to prioritize failure causes for PMO/resource allocation

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

FMECA Tips for Success

- Team member selection
  - Respected among peers (not necessarily gray beards)
  - Able to engage, and explain & champion changes
- Measure the progress
  - Available Time vs. Number of Sub-Systems Completed
- Issue clarification
  - Bring sub-teams together to discuss/resolve issues
- Consistency
  - Facilitator must be focused
  - Teams must be kept on track

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

PMO

- PMO Training
- Detectability (FMECA or PMO)
  - Provides indication of potential task types
- Target Range Selection
  - High safety and regulatory impacts must be done
  - Depends on your resources!
  - Severity x Probability; sort, organize for analysis
  - Highest priority failure causes matched w/ resources
- Pilot PMO and Sub-Team PMO

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

PMO

- Detectability
  - Identifies planned tasks to be evaluated
- Estimate Task Resource Requirement
  - Frequency, labor, matls, contractors, downtime
- Estimate No-Task Run-to-Failure Impact
  - Frequency, labor, matls, contractors, downtime
  - Collateral damage, idle workforce, clean-up, etc.
- Ratio of Task Cost to No-Task Cost
  - If > or = 1.00 task is acceptable
  - if < 1.00 check estimates, change task or RTF

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

PMO Tips

- Team member selection
  - Respected among peers (not necessarily gray beards)
  - Able to engage, and explain & champion changes
- Target Range Selection
  - Start with 25% to 33% of Significant Failure Causes
- Measure the progress
  - Available Time vs. Number of Tasks
- State assumptions
  - Be clear on the assumptions for estimates & impacts
  - FMECA and PMO are “living documents”

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

Task Writing

- Breaths life into task selections
- Standardize format
- Circulate to key stakeholders for concurrence
- Make improvements / corrections
- Implement
- Measure

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

Gap Analysis

- Some services not performed at all sites
- Varied frequencies
- Standards and “pass/fail” criteria lacking in most cases
- No standard time estimates for specific tasks
- Some tasks redundant (performed by more than one work group)
- Inappropriate task assignment; technicians performing work during machine downtime that the operator is qualified to perform during normal operation.
- Inadequate planning information; had not established PF curve estimates for condition standards
- Tasks not properly ordered relative to location on machine and task type.

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

Improvement Process

- Several techniques and suppliers interviewed, Alidade MER selected as process consultant.
- Selected team from all properties and all disciplines; planners, operators, operations trainers, mechanics, inspectors, electricians, reliability techs. Team members rotated through the workshops as their particular areas were addressed.
- Total of 18 team members with an average daily team of 8 to 10 personnel.
- 24 systems, 1350 failure modes identified; 1116 analyzed.
- Total time for FMECA was 14 days
- PMO focused on top 30% (330 failures) and was completed with same team in 8 days

ALIDADE M.E.R

RIO TINTO ENERGY AMERICA

Results of Implementation

- Average time to perform annual inspections and routine service reduced from 287 to 157 downtime hours.
- Additional time (approx. 10 hours/month) is dedicated to repair services that are identified at prior inspections.
- Accurate inspections allow accurate planning; the correct parts, the correct service information, the correct tooling, and the correct technical skills.
- Maintenance personnel (technicians, supervisors, planners), as well as operators, accept the system easily because they or their co-workers were involved in designing it.

100% PM schedule compliance last quarter!

ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA

Results of Implementation

- 1.2% overall availability improvement compared to same period last year
- Total maintenance downtime reduction of 13% compared to same period last year
- Process has been duplicated on large dragline; results are complete and optimized tasks are being rolled out at this time.
- Plans to continue adoption and refinement of application of this methodology across all major fleets.

ALIDADE M.E.R

RIO TINTO ENERGY AMERICA

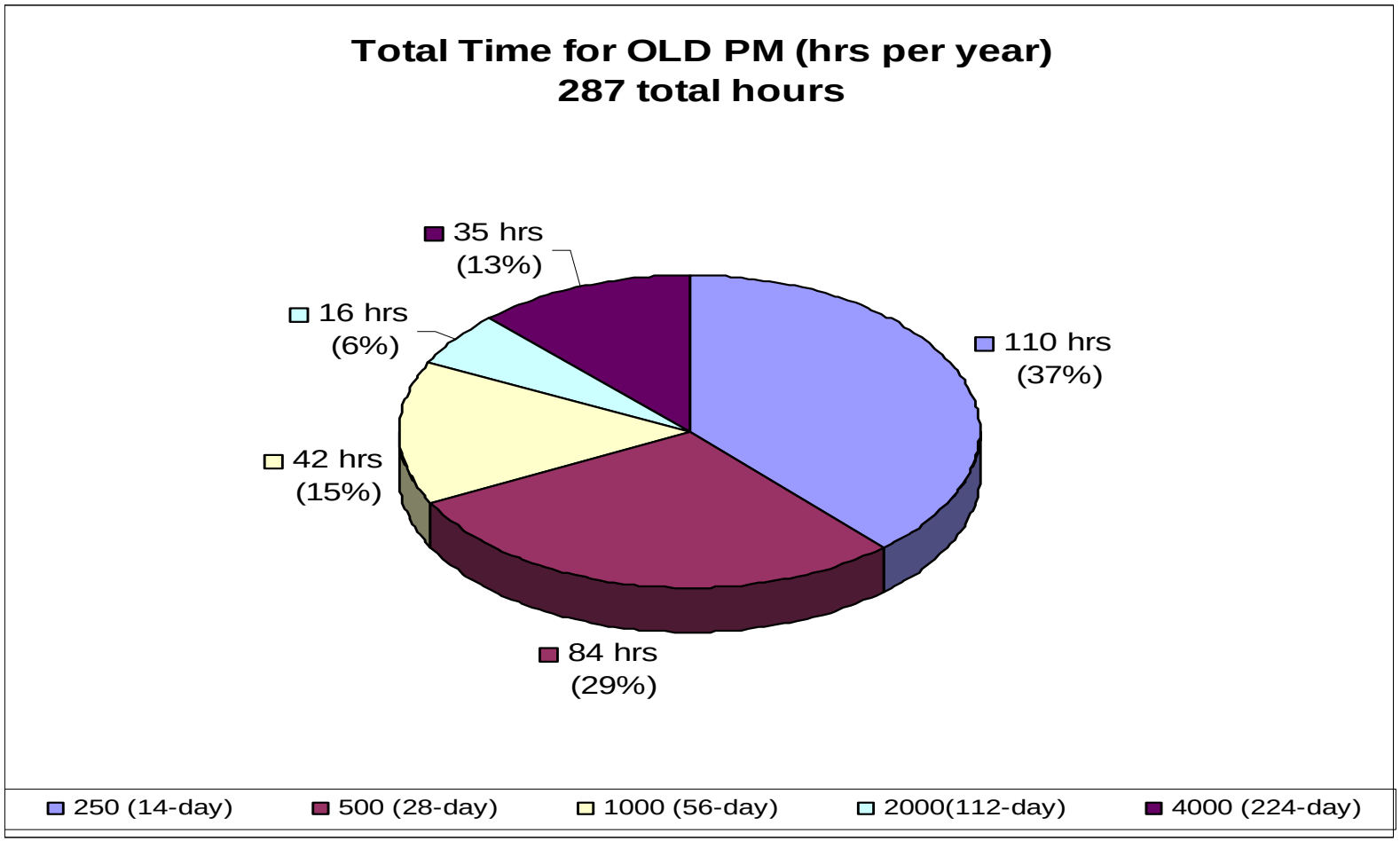
Tabulated Results

PM	Annual times	Mechanic Hours	Welder Hours	Electrical Hours	Old PM Avg Time (hr)	New PM Avg Time (hr)	Total Time for OLD PM (hr per year)	Total Time for NEW PM (hr per year)
250 (14-day)	11	8	0	2	10	2.67	110	29
500 (28-day)	6	8	2	4	14	10.79	84	65
1000 (56-day)	3	8	2	4	14	10.79	42	32
2000(112-day)	1	10	2	4	16	16.48	16	16
4000 (224-day)	1	24	6	5	35	14.46	35	14
						Total	**287**	**157**

% Difference New vs. Old = 45.2%

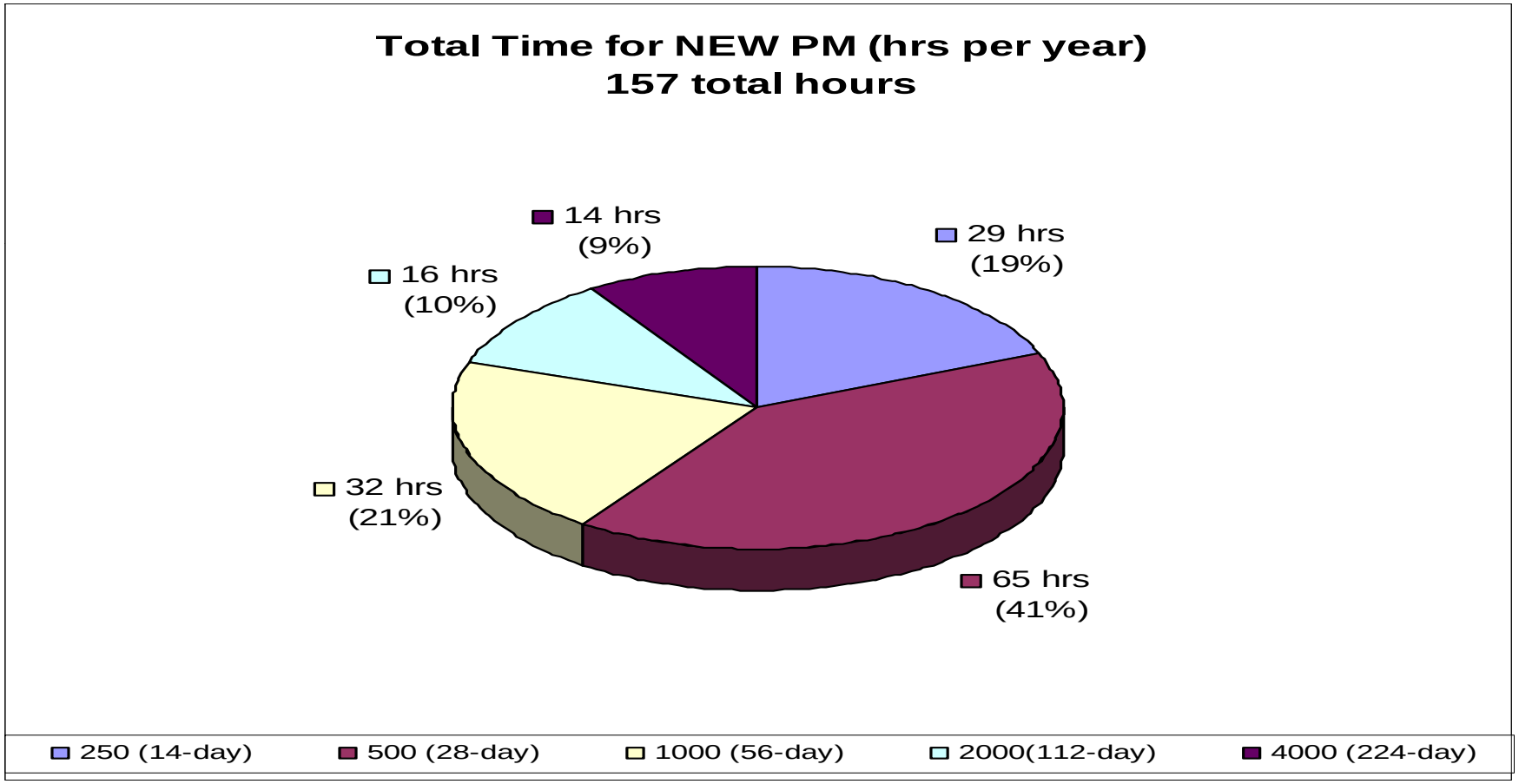
ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA



ALIDADE M.E.R

RIO TINTO
ENERGY AMERICA



ALIDADE M.E.R

Thank you…

- Tom Moriarty, PE, CMRP
  - President, Alidade MER, Inc.
  - Office: (321) 773-3356
  - Cell: (321) 961-4306
  - Email: tjmpe@alidade-mer.com

- Mark Gilbertson,
  - Director of Asset Management, Rio Tinto Energy America
  - Office: (307) 685-6188
  - Email: Mark.Gilbertson@riotinto.com

ALIDADE M.E.R