



# Maintenance – Roadmap to Reliability

Proposed contents and module for in-house training



Phase 1: Restoration and Addressing the Basics



Phase 2: Addressing Design Weaknesses



Phase 3: Improving the Maintenance Task through RCM



Phase 4: Predict Equipment Lifetime

## Reasons why you need to attend this training

- **LEARN** how to start-up and organize the Maintenance pillar and understand the most important preparations needed to improve the reliability of industry's assets and equipment.
- **PROVIDE** a crystal clear direction and roadmap for maintenance on how the highest reliability of your equipment and assets in your industry
- **LEARN** what support operators needs from Maintenance.
- **LEARN** the details on how to integrate RCM (Reliability-Centered Maintenance) into the higher Phases/ Steps of Planned Maintenance. Find out if TPM and RCM contradict or complement each other.
- **DISCOVER** how to reduce unplanned breakdowns in your plant.
- **LEARN** how to implement Planned Maintenance right the first time and avoid costly mistakes and seeing what works and not.
- **LEARN** how to prepare and develop the Maintenance "MASTER PLAN".
- **LEARN** what it takes to implement Planned Maintenance right the first time.
- **LEARN** how your industry can save on cost on doing Maintenance
- **FINALLY** ask yourself, is my plant ready for the Planned Maintenance experience?



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## Package Includes:

- Morning / Afternoon meals and Lunch
- Complete Handouts on the course
- 1 complimentary copy of MRR book
- Exercises and Handouts on MRR
- Case Study on Planned Maintenance
- Certificate of completion
- MRR book (372 pages)

## Who Should Attend:

- Operations and Maintenance Managers
- TPM Office, Facilitators and Coordinators
- Facilities Managers
- Preventive/Predictive Maintenance Group
- Reliability Engineers and Managers
- Top Management and Decision Makers
- Continuous Improvement Groups
- People involves in doing Maintenance

## Feedback:

- *The thoughts and education of the training are taught clearly. It is a very important help for me and Sanyo if we are going to apply to apply the knowledge we learned. Mr. Rolly Angeles is a very inspiring person. His training is very well facilitated. Arigato Gosaimasu! From Vivian Grace Garcia / Technical Staff*
- *A very comprehensive topic discussion was imparted The strategies and effective way of performing this type of maintenance was highly appreciated by all participants. From Jennifer Joy Siongco/Staff*
- *Facilitator is well adept on the subject matter.. Mr. Angeles is very good in presenting the subject matter as well as his knowledge regarding the subject. With respect to his experience, there is no doubt that Mr. Angeles is one of the best person around to teach the Planned maintenance concept. From Jeson Solis*
- *The facilitator is good & familiar/expert with Planned Maintenance. It help us enlighten our knowledge in TPM and maintenance tasks. The subject is highly recommended to all maintenance personnel at any industry. From Joel Tomanan / Sr. Engineer*
- *The facilitator has a very good presentation and experience on the topics. I gained a lot of ideas and knowledge on how to plan for my machines to prevent breakdown. I am confident enough to train my subordinates with this kind of system. Thank you very much! From Conrado Alapit Jr./ Engineer*



**Planned Maintenance Master Class, Sanyo Semiconductor, July 2007**

*There are many things I have learned through the years driving TPM in an industry I used to work for that are not written in TPM books, but the most valuable lesson I have learned through my TPM experience is that doing Maintenance is not about improving the equipment but rather it is improving the people that maintain the equipment, once the people improve the same goes with the equipment. . . Rolly Angeles*



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## About MRR

- This course covers a strategy for maintenance people to achieve a high reliability of their equipment and assets through the principles of Planned Maintenance Four Phases to Zero unplanned breakdown strategy.
- Phase 1 deals with Stabilizing MTBF, main activity involved here is restoration by establishing Equipment Basic Equipment Condition.
- Phase 2 deals with Addressing Equipment Weaknesses in Design and addressing them to prolong the lifespan of parts.
- Phase 3 and 4 of Planned Maintenance deals with developing a Maintenance Tasks Selection Diagram in order to classify which parts will fall on the different maintenance tasks available. This is where Reliability Centered Maintenance can be used.
- Phase 4 if Planned Maintenance is about Predicting Failures through a system known as Condition-Based Maintenance and the use of Diagnostic tools to monitor condition of parts

## MRR Objective:

- Provide a detailed and structured approach through the application of TPM's Planned Maintenance
- Realize the importance of establishing basic equipment condition in our equipment
- Provide an understanding on what Planned Maintenance is and what it wants to achieve
- Learn how to implement the four phases of Planned Maintenance as well as understand the 6 failure patterns and how it affects us in our day to day maintenance activities

## About the Resource Speaker

**Rolly**, is a seasoned international reliability and maintenance consultant with 29 year of solid experience in the field. He had been invited in different countries and have conducted reliability and maintenance trainings as well as consultation on United Arab Emirates, India, Malaysia, Indonesia, Thailand, Nigeria, China, South Africa, Botswana, Bangladesh and Brunei. His portfolio of maintenance trainings include Maintenance Management courses on TPM, Lubrication, Tribology, Condition-Based Maintenance, RCM, RCFA, Planned Maintenance, World Class Maintenance Management, The Twelve Disciplines, Oil Contamination Control, Maintenance Indices and KPI's, Maintenance Management System and much more. Rolly previously worked with Amkor Technology Phils., as a TPM Senior Engineer, an industry engaged in the manufacture of IC products and spearheaded their TPM Planned Maintenance organization compose of maintenance managers and engineers. He was responsible for the dramatic reduction of unplanned breakdowns in their TPM Journey as well as RCM implementation on their Facilities AHU and as well as their sub-station equipment. His last working experience at Lepanto Mining is where he started developing these maintenance trainings. Rolly is currently working as an independent reliability and maintenance consultant and will be soon releasing his 2<sup>nd</sup> book Maintenance – Roadmap to Reliability.

## MRR Course Briefer:

This training covers the 4 Phases of implementing a Plant wide Planned Maintenance structured approach. The first two phases will provide us a detailed approach on how to reduce the breakdowns in our equipment while the remaining two phases covers on how to provide a sound and robust approach to improve the way we maintenance our equipment.

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## Maintenance – Roadmap to Reliability Day 1

- 8:00 – 8:30 - Coffee and Registration
- 8:30 – 9:00 - Welcome and Introduction of resource speaker
- Take MRR Pre-post IQ Quiz
- 9:00 - 10:00 - Introduction : Changing The Maintenance Culture
- Domino Effect of Being Reactive
- Can Maintenance Really Eliminate Equipment Breakdowns and Failures
- 1000 - 1015 - Morning Break / Meals
- 1015 - 1200 - **Module 1 : Maintenance – Roadmap to Reliability Overview**
- Planned Maintenance Defined
- 4 Phases of Planned Maintenance
- The 2 sides of Failure
- The Concept of Planned Maintenance Activities
- MRR Preparatory Stage
- How Maintenance is Being Approached By Industries
- Having a Clear Concept on What Constitute a Breakdown and Not
- Knowing MTBF, MTTF and MTTR
- Understanding what MRR wants to achieve
- 1200 - 1300 - Lunch
- 1300 - 1500 - **Module 2 : Phase 0 – MRR Preparatory Stage**
- Understanding The Need for An Effective Maintenance Structure
- Establishing the Maintenance Vision and Mission
- Importance of Conducting Machine Ranking
- Developing a Master Plan for Maintenance
- MRR Phase 0 Details Step by Step Roadmap of Activities
- 1500 - 1515 - Afternoon Break / Meal
- 1500 - 1700 - **Module 3 : Phase 1 - Stabilize MTBF**
- The Need To Restore and Address the Basics on Our Equipment
- 3 Basic Activities on Planned Maintenance Phase 1
- Maintenance Guidance and Support for Operators
- Function Loss and Function Reduction Breakdown
- What Phase 1 will Achieve – 60 to 80% Reduction in Unplanned Breakdown
- Horizontal Replication of Phase 1 Activities
- Detailed Step by Step Roadmap of Activities for Phase 1
- 1700 - End of Day 1



Included in the package

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## Maintenance – Roadmap to Reliability Day 2

- 8:00 – 8:30 - Coffee and Recap of Day 1
- 0830 - 1000 - **Module 4 : MRR Phase 2 Addressing Design Weakness**
  - Concept of Phase 2 – Every Equipment Has Its Weaknesses In Design
  - How to Addressing Equipment Design Weaknesses
  - Analytical and Problem Solving Techniques for Maintenance
  - Investigating Equipment Failures Through Root Cause Failure Analysis
  - Step by Step Detailed Roadmap of Activities for Phase 2
- 1000 - 1015 - Morning Break / Meals
- 1015 - 1200 - Understanding Different Types of Wear Perform Exercise on Wear Abrasive, Adhesive, Erosive, Fatigue and Corrosive Wear
  - Understand How To Control These Types of Wear
  - Take Quiz on Different Types of Wear
  - Case Study on Phase 2
- 1200 - 1300 - Lunch
- 1300 - 1500 - **Module 5 : MRR Phase 3 Periodically Restore Deterioration**
  - Common Belief on Maintenance – Does All Parts Wear Out
  - Understanding Infant, Random and Age Related Failures
  - Understanding Reliability-Centered Maintenance
  - Preparing the RCM Information Worksheet
  - Understanding the RCM Decision Diagram or Algorithm
- 1500 - 1515 - Afternoon Break / Meal
- 1515 - 1700 - Hidden and Evident Failures
  - Understanding the Consequences of Failure Environmental, Safety, Operational and Non-Operational Consequences
  - Failure Consequences Exercise
- 1700 - End of Day 2



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## Maintenance – Roadmap to Reliability Day 3

- 0800 - 1000
  - Recap of Day 2
  - **Module 6 : PM Phase 4 Predict Equipment Lifetime**
  - Understanding the Concept of Predictive Maintenance
  - P-F Curve Explained
  - Integrating RCM into the TPM Planned Maintenance Structure
  - Understanding the Different Maintenance Tasks Available
  - Deriving the Maintenance Tasks for Equipment
  - Phase 3 and 4 Roadmap of Activities
- 1000 - 1015
  - Morning Break / Meals
- 1015 - 1200
  - Understanding Reactive, Preventive, Predictive and Proactive Maintenance
  - **MRR WORKSHOP 1 Workshop on Maintenance Tasks**
- 1200 - 1300
  - Lunch
- 1300 - 1400
  - **MRR WORKSHOP 2 : Planned Maintenance Board Game**
- 1500 - 1515
  - Afternoon Break / Meal
- 1515 - 1600
  - Actual Case Study: JIPM Planned Maintenance Success Story
- 1600 - 1630
  - Take Post Quiz on MRR
  - Check Pre-Post Quiz on MRR
- 1630 - 1700
  - Starting an Improvement Reliability
  - Awarding of Certificates
  - Summary and Closing
- 1700
  - End of Seminar



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# **Maintenance – Roadmap to Reliability**

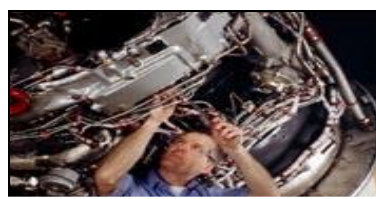
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## **MRR Testimonies and Feedback:**

- Very alive, energetic and informative. Lots of resources like the Rolling Stones, powerpoints. Facilitator is an expert. Application of layman's term for non technician people. There are recognition (giving chocolates) and comparison on pre and posts exams. From Maureen Tating, Human Resources, Technical Documentation Specialists, Transition Optical
- The speaker catches the audience attention. He shows confidence and very knowledgeable of the topic. From Adrian Gamboa, Senior Control Engineer, Transition Optical
- Has a very good presentation by the use of visual aids and illustrations. Discussed clearly the context of each subject/topic. Relates the topic based on actual experience. Catches the audience attention through jokes that are related to the topic. From Jeffrey Gawat, Technology Engineering Technician, Transition Optical
- This will assist Botash to always remember that operators and engineering must stop blaming each other whenever a major breakdown occur and should work together to improve the lifetime of the assets. From Gabedi Abofilwe, Senior Planning, Engineering
- Good course content, training aids, technical knowledge, instructor effectiveness were excellent. It does not teach you about work environment only but how to approach life. From Norma Moeketsi, Maintenance Planner, Engineering Reliability, Botash Ash
- Very relevant with our situation. This training will help a lot if we change. Operators becoming engineering partners instead of being customers. From Madeswi, P.P. Engineering, Botswana Ash
- Review of basic concept to successful maintenance. Sharing of facilitators personal experience, setting up the program and final results achieved after many years of implementation. Emphasis placed on ownership of maintenance activities by engineering/maintenance and operations. View that the two are partners as opposed to customers service provider relationship. From Godfrey Nilala, Superintendent Wellfield, Botswana Ash
- The trainer is very relevant to the operation. It can improve the business results if implemented well by the organization. The objectives were very clear. Visual aids helps better understanding. It promotes lot of interaction and helps the team to have a common understanding of the subject. It is more practical. From Modise Meera, Divisional Engineer, Botswana Ash
- A very course aimed at providing the necessary skills in developing and maintain world class maintenance strategy. Could be the only solution for organization in very competitive market with a high maintenance costs life Botswana Ash. From Thabane Malasa. Divisional Engineer

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## MRR Testimonies and Feedback:

- In depth understanding about how to reduce reactive maintenance and lessen breakdowns and increase cost savings. It taught us that to improve, it takes planning and understanding what you have in place that change does not happen overnight. The instructor is knowledgeable in the subject it will work best for us if he reviews our progress within short intervals. From Hance Bale, Maintenance Specialists, Botswana Ash
- Plant maintenance is a shared responsibility between operators and maintenance personnel. Operations and maintenance people must be friends at work towards the same goal. Lubrication is very important to prolong the lifespan of equipment. Management must commit as well as give support to the workforce. From Ezekiel Sondani, Foreman, Botswana Ash
- Got a very clear understanding about PM. Presentation is very good and easy to understand. Materials got from the trainer is very useful and helpful for further procedure to start PM. This training is helpful to me to start my PM with confidence and much more clarity towards my objectives. From Sathveer Potlupi, PIPAVAV, Gujarat, India
- It is very much noticeable that Mr. Rolly Angeles had gone through the basic maintenance experience and had given his heart to his job. He knows the subject deeply. From Gopal Chunhun. PIPAVAV, Gujarat India
- I am very inspired to my duty and role about maintenance. This is a very good training about maintenance and about the maintenance people. From Piyush Adroja, PIPAVAV, Gujarat, India
- Trainer was very knowledgeable, majority of the members, almost all from maintenance team have attended. One thing sure is about the training is all maintenance people will sing the same song or at least will know the song which we are talking or explaining about. From Sri Balaji, PIPAVAV, Gujarat, India
- With a good knowledge contents, it was really new things that I've learned. As a G.E.T. it was my first training within my first month, I didn't know how it was practically, but still I understood most of the things that Mr Rolly learned. But the main things are the forms that you have provided us. From Anand Mehta, PIPAVAV, Gujarat,
- This training is able to show the path that how we can implement TPM in our organization in an effective manner. We also enjoy the whole training due to Mr. Rolly's friendly nature and deep knowledge about the training source. From Ajeet Singh, PIPAVAV, Gujarat, India
- Good points about this training are all inspiring videos, all examples given by Rolly, way of presentation, reality about maintenance, all the sheet, forms on MTBF, how to implement Planned Maintenance in our plant. Also respect about maintenance and its people and also give inspiration and increase the moral of maintenance people. Thanks, I get this opportunity in my life. From Mihir Upadhyay, Gujarat, India

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## Review on Maintenance Roadmap to Reliability Book

First I want to thank you Sir Rolly for giving me this very rare opportunity to comment in a book and have my comment in print. At first I was wondering where would this book leads me? Your quote “changing a system means changing a culture” captured my attention. So as I read, I already knew I need to finish reading this book. I can relate to most of what was illustrated, stated and example in this book. They’re all true and happening. A reality. I dreamed of having a kind of maintenance organization such as those described. My only worry is that I am not in the position to implement such. It is true that this kind of approach should be top to bottom, no support from upper management means you’ll end up to nothing. I am a maintenance guy and proud to be one. But it is great to know somebody that dedicates too much time and adhere to improve the lives of maintenance people like Rolly Angeles. From Darwin Abragante, Level 2 Thermographer, Analog Devices Gen. Trias, Inc.

This book is easy to read (take it from a guy who is a selective reader) and the flow of thought is smooth – relatable; to maintenance, production and quality people. The book provides general and specific inputs that should be considered in preparing a maintenance roadmap for an organization. The author, who is a maintenance guy, a facilitator and a trainer shares his vast experience in the actual maintenance task, implementation of maintenance strategy and analysis on maintenance management issues. This book has a good established link from the initial book that Rolly released. The way the book was written is just like having Rolly in front of you, explaining with passion the different topics about maintenance strategy – book well written. The TPM-PM implementation and TPM lessons shared by Rolly gives the reader of this book a glimpse – guidance on what needs to be done plus the pitfalls that need to be avoided. As each organization forms and develops its own maintenance culture, this book is a good reference to have. From Charles D. Mendoza, Sr. Quality Improvement Engineer / TQM/TPM, STMicroelectronics Inc.

The unique strength that Rolly Angeles brings to this book is that he has had significant expertise in implementing both TPM and RCM and so can bring these two methodologies together seamlessly. There are very few people who have had experience in both approaches. All this technical stuff that gets me excited might not mean much to many of you. Luckily Rolly keeps things interesting with his engaging stories, his personal insights and his fast pace all of which keep things moving along. I love the words of wisdom at the start of each chapter and the multiple choice questions at the end of each chapter that check you have understood what you have read. From Peter Todd Reliability Engineer, SIRF Roundtable, www.sirfrt.com.au

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