TOTAL RELIABILITY SYSTEMS

An Experience-Based Work Process for
Building and Integrating
Total Productive Maintenance (TPM) System Wide

WELCOME

Thanks for choosing to attend this Whitewater Strategies sponsored workshop on developing Total Reliability Systems within high performance teams. Building effective systems, processes, and teams are tough jobs. But the effort and frustration pay big dividends for those brave enough and patient enough to persevere.

To really appreciate the power of this workshop, a lot will be required of you. You, and the other workshop attendees, are going to be encouraged to push yourselves and try new and different things. In order to be effective, this workshop requires hard work, tenacity, and willingness to have fun. If you put forth the effort, this will be one of the most rewarding educational experiences of your life.

The workshop facilitators have been selected and developed to assist and support you as you discover the principles and concepts of Total Reliability and build your own processes for achieving and sustaining high performance.

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WORKSHOP PURPOSE

The biggest challenge facing American industry today is successfully coping in a world wide competitive climate. Although there are many recipes to be found, sustained higher levels of team and organizational performance are rarely achieved in practice. A major cause of failing to "put words to action" is a lack of opportunity for many to be able to experience hands-on activity in a learning and developing environment.

This workshop has been designed to provide individuals with a practical understanding of Total Productive Maintenance concepts coupled with a Socio-Technical Systems (STS) approach. Together, these systems support the accomplishment of core business expectations. We call it TOTAL RELIABILITY SYSTEMS™ (TRS) and it allows participants to "live" the principles for insuring equipment effectiveness in a team focused environment.

PURPOSE

The purpose of this workshop is to build an understanding of Total Reliability Systems (TRS) and build a process that enables your work group to consistently use the tools taught by TRS within your work-group. Building processes within your team is just as important as learning the technical skills of TRS.

OBJECTIVES

- Understand the components of Total Reliability Systems (TRS).
- Develop a master plan for implementing TRS within your workgroup.
- Understand how to measure Overall Equipment Effectiveness (OEE).
- Experience being part of a successful team and contributing to that team's success.
- Understand the seven Core Processes and how they relate to TRS.
- Learn by doing and by sharing your understandings with others.
- Experiment, apply new learnings, and build new skills for effective working.
- Experience the four areas of TRS:
    - *Clean and Inspect* — Cleaning to enable inspection of equipment to take place.
    - *Inspect and Detect* — Inspecting to detect equipment problems.
    - *Detect to Correct* — Detecting to find the equipment problems and fixing them.
    - *Correct to Perfect* — Correcting the "root cause" for problem elimination and developing a learning organization.

WORKSHOP PRINCIPLES

This workshop is designed to explore system reliability while understanding and maintaining three key principles of high performance:

Open System — High performance organizations exist in an "open system" and build effective processes to respond to all demands of that system.

Learning — High performance organizations understand how individuals learn and create an environment which encourages learning through exploration, experience, and continual improvement.

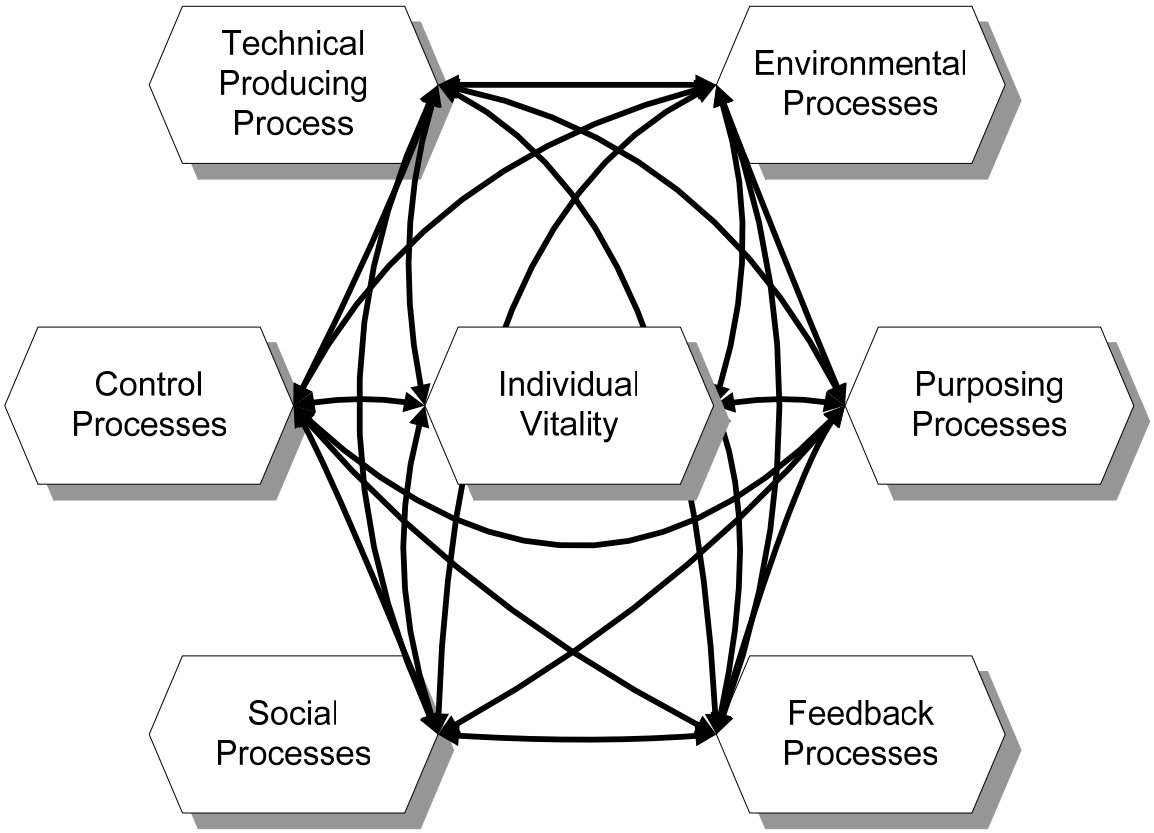
Accountability — High performance organizations account for their results to the larger system. These results are usually displayed using numbers.

OPEN SYSTEMS AND TOTAL RELIABILITY

WORKSHOP CONCEPTS

Total Reliability Systems (TRS) provides us a new way to look at the activities which are commonly known as Total Productive Maintenance (TPM), Autonomous Maintenance (AM), Visual Factory, etc.... This workshop is designed to help us gain these skills while working within an Open Systems—Socio-Technical model. For many, a simple definition of the Open Systems—Socio-Technical model is the equivalent of working in a true team structure. This model (below) will represent the organization, or team, in which we work. The model also includes the elements which must work together in order for the organization to effectively meet its overall purpose.

MODEL: BASIC INTERDEPENDENT ELEMENTS OF STS



LEARNING APPROACH

"I Hear and I Forget
I See and I Remember
I Do and I Understand."

–Old Chinese Proverb

"Training Won't Work,
A Tool Approach Can't Work,
Copying Doesn't Work Either."

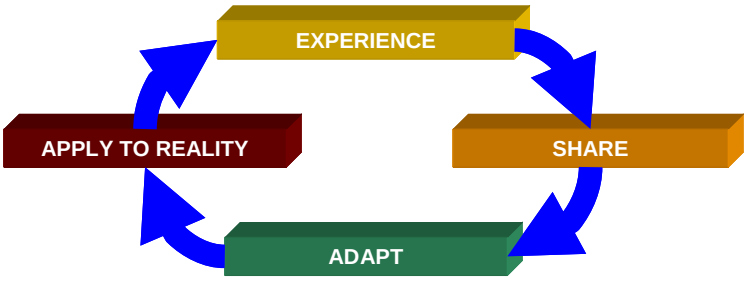
–John J. Sherwood

"Adults learn best when they
take charge of their own learning."

–Warren Bennis

A PROCESS FOR LEARNING FROM EXPERIENCE

At the beginning of the workshop, participants "join" a team whose primary purpose to build effective reliability processes through learning, understanding, and living the principles of TPM. As teams, each group will explore various tasks using the experiential learning model below.



is

EXPERIENCING:

Learning begins with experiencing. Become involved in an activity; acting, behaving, performing, observing, seeing. Take action—do something. Experience is the basis for learning.

SHARING:

Following the experience itself, it is vital for individuals to share *their* reactions and observations with others who have either experienced or observed the same activity.

ADAPTING:

Flowing naturally from the *discussing* step is the need to develop principles or extract generalizations from the experience. Here, we state learning in a way that helps all of us further define, clarify, and elaborate them.

APPLYING:

The final step in the cycle is the application of the principles and learnings derived from the experience. The process is *not* complete until the new learning or discovery is used and put into action. Applying, of course, becomes an "experience" in itself, and with new experiences, the cycle begins again.

During the workshop, each team will work together on various process tasks, *experiencing* the activity and building skills and processes. Following each task, the entire group will meet together to *share* information, *discuss* and provide feedback to each other on the effectiveness of the processes each team used. The individual teams will then have an opportunity to *adapt* their processes and *apply* these learnings to a new task or *experience.*

This process builds throughout the workshop and concludes with each team sharing an overall set of Key Learnings and Action Plans with the rest of the participants. This is completed through use of what we call an "Activity Board" and a short presentation incorporating the activity board.

SYSTEM ACCOUNTABILITY

All organizations live in competition with others. In order for organizations to be "High Performing," they must continually measure themselves against the expectations of their customers, their own expectations, and the requirements of their environment. They must use these measurements to continually improve their results in order to survive as an organization.

For your learning organization to become High Performing and gain the most from this workshop experience, we have designed a process to continually assess and measure the results of your learning. As each team shares their results and learning with the rest of the participants, the other teams will compare and assess their results with the results from the other teams. At the conclusion of each sharing period, your team will evaluate the performance of themselves and each other team on a scale of 1-10 and provide some specific feedback to help them with their next presentation. Only one rule applies to the distribution of the ratings, and that is:

- No team can receive the same rating value.

Your team will be allowed a few minutes at the end of the presentations to discuss, evaluate, and prepare feedback for each group. You may wish to ask yourself questions like the following in evaluating the learning products:

- Did they meet our expectations?
- Were they thorough?
- What did they do that was different?
- What did they learn that we missed?
- What will I remember most?
- Was it the right
    - size (quantity),
    - material (quality)
    - feeling (impact)?

IN-HOUSE WORKSHOPS

We, at Whitewater Strategies, Inc.., wish to assist you in your efforts to develop effective processes and high performing teams within your organization. Total Reliability Systems™ can play a key role in these efforts.

Companies sponsoring participants and desiring to include this workshop as part of their internal development strategy can do so by:

- Identifying internal company resources who have attended a TRS workshop and who can assist as co-trainers.
- Providing the opportunity for these internal resources to "staff" a TRS workshop and gain experience.
- Develop a plan with Whitewater Strategies to use the materials, workshop design, internal resources, and TRS in an in-house setting.

The written materials in this manual were designed and developed through the collaborative efforts of D. Felten, K. Simmons, D. Simmons, and R. Boland. Any reproduction of the workshop design or materials contained in this workbook is prohibited. Although we desire and encourage you to use these materials, ANY use of the materials or workshop design requires prior written permission from Whitewater Strategies, Inc. In this way, we can maintain the integrity of the materials and insure the responsible application of the design.

Please direct requests to use these materials, develop in-house workshops, explore the other workshops available through STS International, Inc., or any other questions to:

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GETTING STARTED

Team and Workshop Expectations

Exercise 1

THEORY INPUT

Effective teams are not born or mandated, they develop. In order for individuals to become a team, members must identify and agree on a common purpose. This will involve giving your own personal opinions, thinking for yourself and your team, and providing energy to get the job done.

TEAM OUTPUTS

As individuals, build your understanding and knowledge of each other. To do this, have each team member prepare an autobiography that fully describes who they are. They may choose to use the format of "Nine Squares" on page 13, or some other framework. Plan to speak for five minutes to the other members of your sub-group about such things as:

- Who you are, what you do
- Personal qualities/skill
- Strengths
- Pet irritants/peeves
- Workshop expectations
- Accomplishments
- Interests, values
- Developmental needs
- Aspirations
- Workshop fears

As a sub-group:

Prepare a consensus listing of workshop expectations and workshop fears.

- Identify key responsibilities of your team within the plant.
- Identify the key things you would change if you were "King for a Day."
- Based on this listing, write a purpose statement for your sub-group that attains the expectations and overcomes the fears.
- Develop a name and logo for your sub-group that depicts who you are and what your team hopes to attain.
- Be prepared to share your outcomes and what you learned with the other teams in an insightful and impactful manner.

NINE SQUARES

An Exercise for Getting Acquainted

Instructions: Have each team member take a page of flipchart paper and fill-in the nine squares with graphics (pictures, charts, lines, etc.) that describe three things that turn me on, three things that turn me off, and three things I need/want to learn.

What turns me on			
What turns me off			
What I need/want to learn			

When everyone is finished, have each member post their chart on the wall and explain the meaning of their pictures.

Ask any clarifying questions you need to ask. Be sure you understand and get to know your members.

TOTAL RELIABILITY SYSTEMS (TRS) =

Total Productive Maintenance (TPM) + Socio-Technical Systems (STS)

THEORY INPUT

Total Productive Maintenance is a key element in creating world class system reliability. It does not stand alone, but requires getting an effective mix of employees, skills, and equipment knowledge then developing processes that achieve total control of equipment losses. This people and process development is referred to as a Socio-Technical System. For TRS to endure and be effective, a change in the social system (culture) of the organization must occur. The first step in developing these processes is creating an understanding of the key elements and activities of TRS.

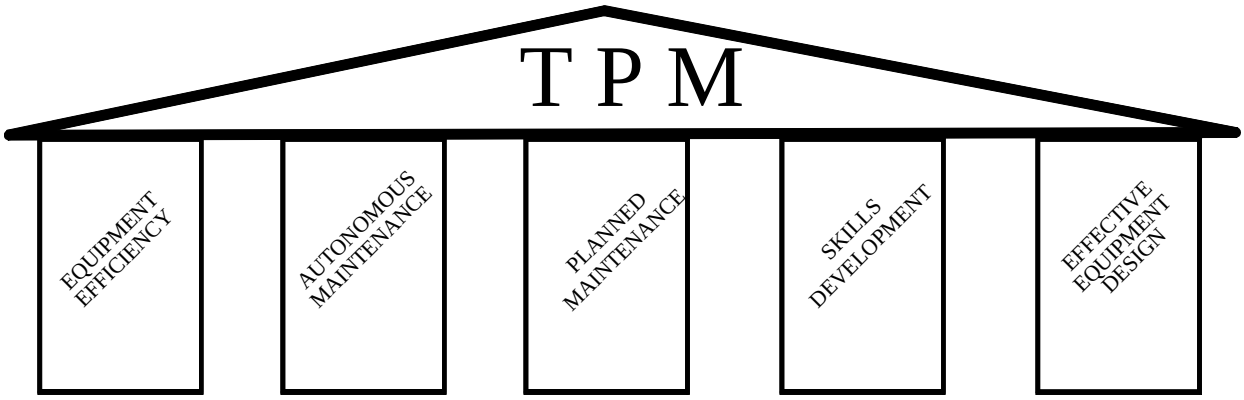
TASK OBJECTIVES

Explore with your team the components and principles of TRS while beginning to identify the specific goals and objectives which TRS will help your group achieve.

DESIRED OUTCOMES

- Draw the TRS Toolbox to the best of your team's memory and list as many tools in each of the drawers that you can.
- Develop a list of specific reliability issues you hope to resolve through this workshop.
- List what poor machine conditions cause, especially as it relates to your facility.
- Determine who is responsible for equipment upkeep at this present time, and who should be responsible in the future.
- Brainstorm all resources which could be available to help your team with the TRS effort.
- Develop a list of benefits available from the integration of TRS as part of your high performance system.
- Be prepared to share your outcomes and what you learned with the other teams in an insightful and impactful manner.

5 PILLARS OF TPM



Total Productive Maintenance (TPM) is supported by five key process elements. Applied together with an effective system design, these pillars promote the overall system reliability and provide focus and understanding to the employees who have responsibility for overall productivity of the system. These Pillars are:

Equipment Efficiency

- Implementing improvement activities designed to increase overall equipment effectiveness.

Autonomous Maintenance

- Establish a system of autonomous maintenance to be performed by cross-functional teams.

Planned Maintenance

- Establish a system for insuring scheduled preventive and predictive maintenance.

Skills Development

- Establish processes to assess training needs and insure the continued development of individual skills.

Effective Equipment Design

- Establish a system for designing, specifying, selecting and previewing equipment to insure that the best operating and maintaining options are built into the equipment prior to delivery and installation.

GOALS OF TRS

- "No" Accidents
- "No" Unplanned Downtime
- "No" Defects
- "No" Speed Losses
- "No" Customer Service Shortages
- Reduced Operating Cost
- Maximum Equipment Life

In order for these pillars to become part of a company-wide total reliability program, it is also necessary to develop the following:

- A Culture which integrates the goals of TRS
- A "Preventive System" preventing all kinds of losses based on actual equipment in the workplace (zero defects, breakdowns, accidents, incorrect speed of operation).
- A process to involve all employees and organizational areas. (i.e. production, sales, administration, purchase, accounts, etc.)

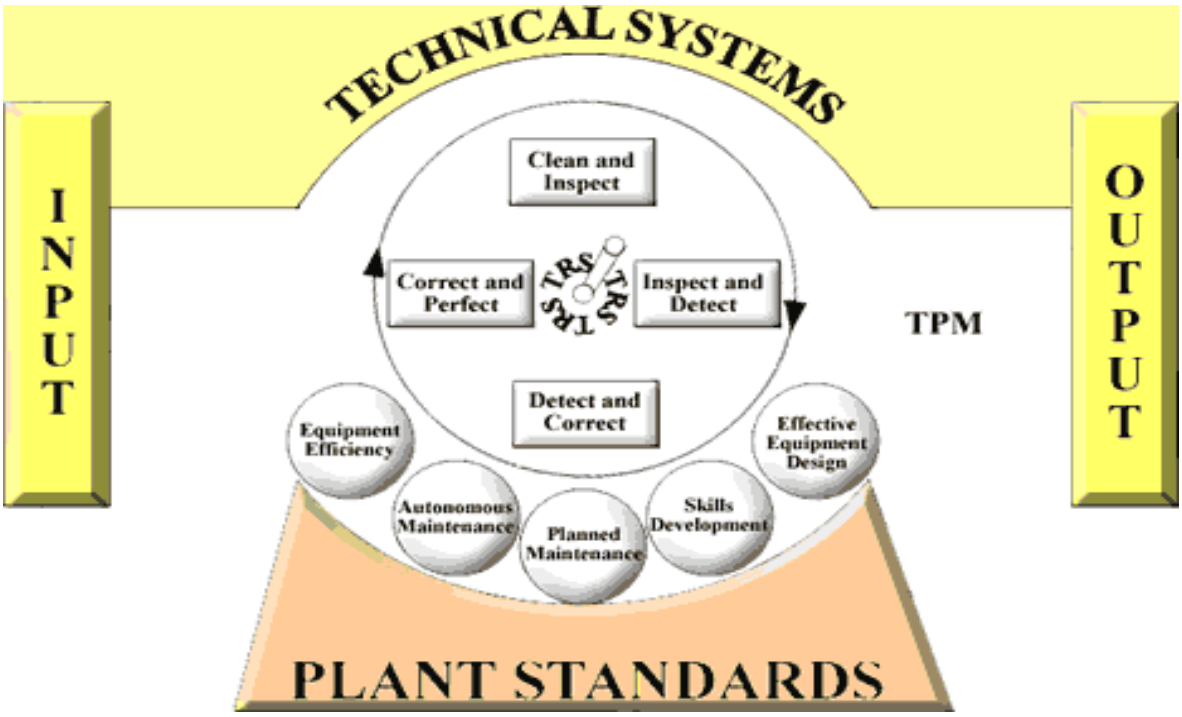
STRATEGIES AND BENEFITS

Beyond the pillars and core integration activities—TRS implementation is based on the completion of several specific activities. These activities are focused on the accomplishment of a series of goals toward significant strategic results. Each of these are noted below:

TRS Process Activities

- Planning the introduction of TRS—Team / Equipment selection and timing
- Overall equipment effectiveness tracking
- Plant standards agreement
- TRS Workshop training
- Predictive Maintenance: Developing systems for maintenance tracking
- Skills assessment and development of systems for skills enhancement
- Master plan development and execution of plan
- Machine procurement and commissioning:
- TRS process from design to installation
- Supplier program of improvement to support your TRS process

TRS Tool-Box



Total Reliability Systems (TRS) is housed in four areas. These areas are the "drawers" of the TRS Toolbox. Within these drawers are tools. These tools will be explained in more detail throughout the manual. The drawers are housed in a frame which holds all activity together. This frame is the development and implementation of the Socio-Technical System design. Holding up this framework are the toolbox wheels which consist of the "7 core processes" on one side and the "5 pillars of TPM" on the other. Completing the toolbox is the common "handle" of the agreement of plant standards. When fit together, these components promote the overall system reliability and provide focus and understanding to the employees who have responsibility for the productivity of the system. The drawers, and tools found in each of these drawers, are explained briefly below:

1. Clean and Inspect

The first step, or drawer, of the TRS Toolbox is to initially *Clean AND Inspect* the equipment. The word "and" is very important. "And" signifies that the processes of cleaning and inspection are completed simultaneously. Cleaning is not done only for the sake of making the equipment look better (which it does). Cleaning is completed in order for the "cleaner" to inspect the machinery and locate conditions which appear abnormal. Therefore, while cleaning, inspection is completed. During this initial phase, the tools within the clean and inspect drawer should be forged and used. These tools are cleaning, inspection, and lubrication standards. Standards are used to define what needs to be done in using and caring for the equipment. Development and use of these tools are described later in the manual.

2. Inspect and Detect

The second drawer of the TRS Toolbox is to *Inspect AND Detect* equipment abnormalities and determine if those abnormalities need to be corrected. Again, "and" is very important because the activities, *Inspect and Detect*, should happen simultaneously. Inspection of the equipment should be completed to identify equipment issues. These equipment issues should be documented using some form of "abnormality tracking". Abnormality tracking is another tool within the *Inspect and Detect* toolbox drawer. Further discovery can be made by establishing and tracking the Overall Equipment Effectiveness (OEE) indicator. The OEE is another tool within the *Inspect and Detect* drawer. Through use of the OEE, equipment downtime, scheduling issues and quality problems are discovered. These areas, along with others, are another tool within the *Inspect and Detect* drawer, called "The Dirty Half Dozen." The remaining tools left within the *Inspect and Detect* drawer are "the 5 why's" and use of a "planned maintenance" system.

3. Detect to Correct

Through the *Inspect and Detect* process, equipment and operation issues are discovered. These issues are then addressed using the third drawer of the TRS toolbox. This drawer is named *Detect to Correct.* Tools found within this drawer include improvement projects, operator operating standards (OOS),contamination elimination, visual controls and use of a preventative maintenance system. All of these tools are used to correct problems which have been previously discovered. Visual controls enhance the ability to properly operate and maintain the equipment.

4. Correct to Perfect

Perfection is then sought using the fourth drawer of the TRS toolbox. Tools found in this drawer include one point lessons, establishing a predictive maintenance plan, assessing and developing the skills of the facilities personnel. Also operational difficulties are identified through using speed trap detection. Arguably, the most important tool within this drawer is development and implementation of a TRS master plan. This master plan charts a course for all TRS activity to follow.

RESULTS OF TRS

EQUIPMENT

Higher Operating Efficiencies
Fewer Failures
Consistent Setting Adjustment
Better Access
Easier to Monitor and Adjust
Continuously Monitored

TEAMS

Cooperation
Removed Barriers
Renewed Commitment
Ownership of Problem & Solutions
Improved Communications

COMPANY

Cleaner, More Orderly Facility
More Competitive in World Class Organizations
Improved Moral and Product Support

PRODUCTS

Higher Quality
Improved Throughput
Reduced Waste
Greater Consistency

INDIVIDUAL

Increased Skills
Ownership in Process
Deeper Understanding of Operation and Variance Control

EFFECTIVE MACHINE MANAGEMENT

Effective Machine Management is based on the philosophy that the team responsible for producing outputs using specific equipment should also be primarily responsible for its cleanliness, upkeep, and overall reliability. Effective Machine Management involves operators, maintenance personnel, if separate from the operation personnel, engineering, and leadership to expose hidden defects and to prevent breakdowns before they occur. In order for your machinery to run effectively, and continue running, it is important to determine which tools of the TRS Toolbox will be most effective and useful to your machinery. This requires a thorough understanding of these tools and agreement amongst your team mates regarding which tools to use at what point.

These tools build within the operating and maintenance processes the knowledge and ability necessary to keep your machinery reliable and defect free. For it to be most effective, it requires a team which is multi-skilled in many of both operating and technical areas. It also expects them to know when and where to seek out more expert advice and service when it is required. Other sources of information to call upon can include equipment manuals, equipment manufacturers and technicians, the Internet and public libraries, other outside vendors and internal plant and company resources. Remember that there are many sources of information when looking for answers to equipment questions.

If care is not given to the machinery you operate, breakdowns will naturally occur. A breakdown is the tip of the iceberg, the visible part. It is easy to see and everyone knows when it occurs. But there are deeper and less visible losses and failures just below the surface. They may present themselves as poor machine conditions such as:

Leaks (Oil, Air, fluids, etc.),
Wear, Play, Slackness, Missing Covers,
Surface Damage, Cracking
Adherence of Raw Materials
Missing Bolts, Frayed wiring,
Corrosion, Deformation,
Dust, Dirt,
Overheating, Vibration, Noise

POOR MACHINE CONDITIONS CAUSE:

- Loss of Efficiency due to:
  - Poor placement of fixtures and gauges
  - Increased Breakdowns
  - Slow Startups after a Problem
  - Poor Morale

- Poor Work Environment
  - Machine Parts are Missing

- Quality Problems

- Safety Problems:

  - Fire Hazards
  - Near Accidents
  - Personal Injuries
  - Property damage

CLEAN AND INSPECT

THEORY INPUT

In order to stop problems before they cause equipment malfunction or breakdown, it is essential to be able to continually assess the condition of the equipment. To do this, we need to have the equipment clean, visible, and know what to look for.

When we CLEAN the equipment, we get it into a near "new" condition. Through making improvements, our goal is to eventually make the equipment "better than new". Cleaning makes it very easy to see where the abnormalities have come from—whether from the equipment, or from us, the operators. With that in mind, we are prepared to begin a program of systematically INSPECTING and eliminating the sources of contamination. INSPECTING relies heavily on our ability to make the equipment Visible and Accessible, two key components to readily CLEANING the conditions in the future and INSPECTING their sources. As you clean, try to determine how you might make changes to make the equipment more visible in the future.

We must insure that whatever work is completed is done in a safe manner. Before beginning work on the equipment, make absolutely sure that the equipment has been "locked-out and tagged-out." If you are unclear about these procedures, get someone who absolutely knows about rendering the equipment inoperative. The "lock-out, tag-out" procedures are for YOUR safety and the safety of your TEAMMATES.

TASK OBJECTIVES

You and your team are to explore the principles of CLEAN and INSPECT and prepare your equipment by thoroughly cleaning and begin inspecting it.

DESIRED OUTCOMES

- Gain a clear understanding of the principles of CLEAN and INSPECT.
- Gain an understanding of the condition of your equipment by assessing it prior to cleaning and again afterwards. Photographs of equipment before cleaning assists this understanding.
- Gather the materials and products necessary to safely and efficiently clean all aspects of the machinery.
- Understand the areas of the machine where the greatest abnormal conditions exist.
- Be prepared to share your outcomes and what you learned with the other teams in an insightful and impactful manner.

CLEAN AND INSPECT

CLEAN AND INSPECT—the first step in the TRS Process is designed to accomplish the following:

- Provide the team with a clear understanding of the condition of the machine.
- Clean the machine to a degree that makes the equipment as clean as it was when it was new.
- Gain a clear understanding of areas where the condition of the machine is abnormal. These abnormalities include:
  - Dirt/Contamination
  - Broken Parts
  - Missing Parts
  - Insecure Parts
  - Broken/Unreadable Indicators or Gauges
  - Features Not Fitting Together
  - Lost Parts
  - Wear
  - Oil/Air Leaks
  - Coolants Spillages
  - ETC.
- During this process the participants:
  - Are initially surprised with the findings.
  - Are able to go beyond viewing only superficial abnormalities of the machine and get to the deeper, more hidden abnormalities.
  - Find that the number of abnormalities found increases dramatically during the thorough cleaning and inspection process.

CLEANING GUIDELINES

_____1. Photograph your equipment before and after you clean it. This provides you a visual record which will be part of DETECT.

_____2. Lockout/ and tag out the equipment following company procedures.

_____3. Systematically clean each part of the equipment using the checklist below. As you clean, remember: CLEANING IS A FORM OF INSPECTION. Document each abnormal condition you find.
Note: An "abnormal condition" can be a broken bolt, a leak, or worn or damaged part; it can also be a very dirty part. Ask yourself::
WHY did this happen?
WHAT other problems could it cause?
HOW can I prevent it from recurring?

_____4. Correct problems or situations now—if you have the materials and skills. Otherwise document them and work with your team to insure they are prioritized, scheduled and completed properly.

_____5. Record cleaning tasks completed for future reference and fine tuning.

_____6. When the equipment is running again, observe how abnormal conditions reappear. Calculate how long it will take to return the machine to the condition you achieved at the end of initial cleaning.

MACHINE CHASSIS—CHECK FOR:

Dirt, dust, excess oil, sludge, chips, spatter, or other foreign matter—

_____ Moving, rotating parts

_____ Locator or product contact parts, mounting surfaces, positioning parts, etc.

_____ Frames, beds, oil pan interior/exterior, conveyors, transfer lines, feeders, chutes, rubber rollers, etc.

_____ Reference pins, surfaces, crank plate, back electrodes, bars

_____ Braking apparatus, locking mechanisms, nozzles, paint hoses

_____ Guide surfaces, fixtures, gauges, dies, cylinders, tank interior/exteriors, cables, or other devices installed on equipment

_____ Loose or missing nuts, bolts, etc.

_____ Play in moving parts, fixture mountings, etc.

_____ Unnecessary objects on body of machine

_____ Is equipment firmly seated?

LUBRICATION SYSTEM—CHECK FOR:

_____ Dirt, dust, sludge, on lubricators, grease cups, lubricating devices, etc.

_____ Proper lubricant levels and drip feed

_____ Covers on all lubricating supply vessels

_____ Dirt and grease on lube lines

_____ Leaks and seepage

_____ Oil not reaching all intended lubrication points

_____ Malfunctioning devices

AUXILIARY DEVICES—CHECK FOR:

Damage and dirt, dust, excess oil, grease, chips, sealer, paint residue, etc. on—

_____ Air cylinders, solenoid valves, mist separator, transformer

_____ Limit switches, micro-switches, proximity switches, photoelectric sensors

_____ Motors, belts, gear boxes, welding transformer, pumps, propeller shafts, couplings, cover, etc.

_____ Face plates and surfaces of instruments, meters, displays, switches, control boxes (inside/out)

_____ Wiring, piping

_____ Loose or missing nuts, bolts, etc.

_____ Leaks—oil, water, air, gas, steam

_____ Buzzing or other abnormal sounds in solenoids and motors

_____ Burned out indicator lamps

AREA AROUND EQUIPMENT—CHECK FOR:

_____ Tools and supplies in location/missing/damaged

_____ Bolts, nuts, tools, etc. on or around equipment

_____ Dirty, illegible, hard-to-see name plates and labels

_____ Transparent covers, windows, view plates, and other safety shields dirty, dusty, or fogged

_____ Dirty, tangled wiring, leaking pipes

_____ Dropped parts, work pieces, etc.

_____ Defective work pieces left lying around

_____ Conforming and non-conforming products and scrap not kept separate

_____ Extraneous clutter, trash, and outdated notices

ESTABLISHING STANDARDS

During CLEANING and INSPECTING, standards need to be established in the following areas:

- Cleaning
- Inspection
- Lubrication

As CLEANING and INSPECTING progress, the group becomes aware of deterioration that has occurred over a period of neglect. Standards are required to re-establish effective control of equipment operation. Upon initial completion of these standards and their effective implementation, future improvements will be necessary as additional issues are discovered. Ownership of the process by the teams is essential for effective continued operation.

Cleaning:	Forms part of inspection and provides for effective control of the machine. (See CLEANING GUIDELINES PAGE)
Inspection:	Work to defined standards and assure compliance (check lists shift to shift, etc.).
Lubrication:	To ensure minimal wear and correct operation (over lubrication can be as bad as under lubrication).

STANDARDS

At this stage, the teams will develop standards based on:

- Findings of CLEAN and INSPECT
- Historical data of machine performance
- Operational experience of teams
- Input from engineering or other technical expertise when needed

GUIDELINES FOR DEVELOPING STANDARDS

Standards should clearly and understandably:

- Identify any items to be cleaned, inspected, or lubricated.
- Explain the criteria for judging whether action must be taken.
- Prescribe the normal corrective action to be taken.
- List tasks in a logical, efficient sequence.
- Identify for future improvement any tasks that remain difficult or time-consuming.

In preparing Lubrication Standards—you must additionally specify:

- Lubrication site
- Type and amount of lubricant
- Lubrication method and tools
- Interval
- Who is responsible for carrying out which lubrication tasks
- Use colored coding system for amount of grease and time interval between each application.

LUBRICATION STANDARDS/ GUIDELINES

Effective procedures for cleaning, inspecting, and lubricating equipment can be developed when:

- *The people doing the work understand its importance and set their own standards.*
- *The equipment has been improved to make cleaning and oiling easier.*
- *The time required for these activities is an official part of the daily schedule.*

BASIC LUBRICATION ACTIVITIES

_____1. Identify lubrication sites (oil caps, grease fittings, etc.) And lubricant level check sites to be included in routine cleaning and inspection tasks.
_____2. Document any problems found on abnormality summary sheet and follow up.
_____3. Make sure oil levels are visible; mark upper and lower limits.
_____4. Label lubrication sites and provide instruction (oil type, interval).
_____5. Make sure necessary lubricants are adequately stocked, conveniently located, well-organized, and clearly marked.
_____6. Locate lubrication tools near where they are used, then organize and label clearly.
_____7. Establish appropriate target lubrication times and intervals and document actual time spent.
_____8. When lubrication tasks cannot be completed in the time specified, develop and test ways to shorten the time.

PREPARING BASIC LUBRICATION STANDARDS

For each piece of equipment prepare lubrication standards that document and describe lubrication tasks and inspection items.

_____1. Specify lubrication site, type and amount of lubricant, lubrication method and tools.
_____2. Specify who should carry out lubrication tasks and how often.
_____3. Identify items to be checked during lubrication and action to be taken.
_____4. List tasks in a logical, efficient sequence.
_____5. Make sure standards are clear and easy to understand by everyone.

PREPARING BASIC CLEANING, LUBRICATION, AND INSPECTION MANUAL

_____1. Review and revise current (provisional) sequence and timing of cleaning and inspection tasks in light of DETECT improvements. Incorporate any new tasks or inspection items, including new lubrication tasks.
_____2. Prepare separate standards for each piece of equipment or area:
  _____Clarify assignments; e.g., who is responsible
  _____List tasks in a logical, efficient sequence
  _____Specify types of cleaning and lubrication and areas to be treated
  _____Identify cleaning and lubrication methods and tools
  _____Identify sites to be inspected during cleaning and lubrication
    *visual inspection *touch inspection*inspection and cleaning tool
  _____Specify inspection criteria and corrective action to be taken
_____3. Make sure standards are clear and easily understood by everyone.
_____4. Test revised procedures and compare times against established targets. When tasks cannot be completed in the times specified, develop and test ways to shorten the time.
_____5. Incorporate inspection items to prevent specific quality or machine failures on a continuing basis as they are identified.

GENERAL STANDARD EXAMPLE

Team/Process	Machine	Date	Page ___ of ___

Diagram

Change Approval Who Date	Step #	Task Completely describe: where, what to do, what to inspect for, tools and material to use	How often to be done	Time to complete

Approval: Who Date	Second Original located at: Date	Removed date

INSPECT AND DETECT

THEORY INPUT

When we CLEAN AND INSPECT the equipment, we get it into a near "new" condition which makes it very easy to see where the abnormalities have come from—whether from the equipment, or from us, the operators.

With that in mind, we are prepared to begin a program of systematically INSPECTING AND DETECTING and eliminating the sources of contamination. DETECTING relies heavily on our ability to make the equipment Visible and Accessible, two key components to readily INSPECTING the conditions in the future and DETECTING their sources.

TASK OBJECTIVES

To observe the equipment after operation, document sources of contamination, improve visibility and accessibility equipment and plan future improvements.

DESIRED OUTCOMES

- Build total team awareness of where contamination has come from in the past.
- Identify areas where visibility is poor or impossible.
- Identify areas where accessibility is poor or near impossible.
- Identify ways and processes to reduce or eliminate sources of contamination.
- Create a plan to prioritize, schedule and complete improvements to the equipment and area.
- Understand how to find root causes using "Why."
- Be prepared to share your outcomes and what you learned with the other teams in an insightful and impactful manner.

INSPECT AND DETECT

INSPECT AND DETECT has the following key objectives:

- Prevent deterioration by locating and stopping the spread of contaminants at their source and facilitating preventative checks.
- Make cleaning and inspections more thorough and less time-consuming and operation of equipment easier. Tools to be used in this process include visual factory and visual controls.
- Discover operational issues which can be scheduled and fixed at a later date through the use of planned maintenance.
- Encourage operators to use their creativity to find equipment issues and control the equipment's environmental conditions.
- Apply use of the 80/20 rule. This insures that the main issues are prioritized and worked on first before less significant issues are addressed.

INSPECT AND DETECT process Steps:

- During cleaning and inspection record details of existing issues.
- Identify areas of concern on the equipment (Tag, Label...).
- Prioritize defects and conditions (80/20 rule...).

INSPECT AND DETECT—Key Points

- Develop pro-active not reactive solutions.
- Teams are powerful when they work together.
- No improvement is as powerful as a measurable and recorded improvement.
- Methodology—low cost vs. high cost.

ABNORMALITY TRACKING

Date Team Equip

#	Condition Observed	Description of Work to be Done	Who	Target	Complete
1					
2					
3					
4					
5					
6					
7					
8					

THE DIRTY HALF DOZEN"

Availability	1. Equipment Failures 2. Set-Up/Adjustments
Performance	3. Minor Stoppages 4. Reduced Speed/Feed
Quality Rate	5. Product Defects 6. Reduced Yield

THE 5 WHYS

Why? Why? Why? Why? Why?

A SEARCH PROCESS FOR BUILDING A COMMON UNDERSTANDING AND DETERMINING THE ROOT CAUSE

Whenever you want to build common understanding in a group or determine a root cause to a problem which you are experiencing, ask the Five Whys. Begin by initially exploring why you are here, why you are doing what you are doing, or why do you want what you want. Then by following-up the initial discussion with the Five Probing Whys.

I. Why Is That Important To You?
II. Why Is That Important To You?
III. Why Is That Important To You?
IV. Why Is That Important To You?
V. Why Is That Important To You?

This same process of asking "Why" can be applied to DETECTING the root cause of the equipment issue. Try using this process on an existing equipment issue you have discovered. See if you can find the root cause of the problem. A root cause is usually found when you repeat the same answer to the "why" question twice.

STARTER QUESTIONS

- How many felt this exercise was goofy, way-out, dumb, etc.?
    - Share those thoughts and the reasons why. You may wish to probe again.

- What were the common themes at the end of the last why?

5 WHYS EXAMPLES

Problem—
Oil is leaking into an electrical control cabinet.

Q -Why is the oil leaking into the cabinet?
A - The door won't close and seal tight.

Q -Why won't the door seal?
A - The door is bent.

Q -Why is the door bent?
A - The scrap buggy runs into the door and bends it.

Q -Why does the scrap buggy run into the door?
A - There is nothing to keep it away from the door.

Solution:

Fabricate stop and bolt to floor in front of cabinet. This will keep the scrap buggy from being able to contact the door.

Problem—
Oil is leaking onto the floor by the cabinet.

Q -Why is the oil leaking on the floor?
A -It is running down the cabinet and onto the floor.

Q -Why is the oil on the cabinet?
A -The oil is leaking from above (2nd floor)

Q -Why is the oil coming from the 2nd floor?
A -A large gear reducer is leaking in Process Department.

Solution:

Replace the seals in the gear reducer in process department.

OVERALL EQUIPMENT EFFECTIVENESS (OEE)

The OEE or Overall Equipment Effectiveness is a Measure of equipment reliability and productiveness, from the machine's "point of view." Using this method allows a team to see how effectively their equipment is performing, where its problems are, and how poor scheduling or quality impacts output.

The OEE includes three basic measures:

- AVAILABILITY (A)
- PERFORMANCE (P)
- QUALITY (Q)

The equation used is:

$$OEE = (A)(P)(Q)$$

For example: If Availability for a piece of equipment is 95%, the Performance is 85% and the Quality is 93%; then the Overall Equipment Effectiveness (OEE) is:

$$OEE = (95\%)(85\%)(93\%) = 75\%$$

Some terminology we must know to understand and interpret the OEE measure:

- Availability—The Operating time divided by the Scheduled Run Time, expressed as a percentage of the actual time the machine was available and ran.
    - [Operating Time/Scheduled Time]
- Scheduled Time—The total time the machine is expected or scheduled to operate. The time is less any lunch, break, scheduled PM, or scheduled shut down.
    - [Total Time in Shift–Scheduled Down time]
- Operating Time—The actual time the machine ran. This is the scheduled time less major breakdowns, setup, and adjustments. [Scheduled Time–Down Time]
- Performance—The actual machine output expressed as a percentage of the total designed or expected output. [Actual Output / Designed Output during Operating Time]
- Quality—The total acceptable/quality product produced expressed as a percentage of the actual machine output.

To better illustrate OEE, we'll look through a more complete example with the following parameters:

Gen. Data:	1–8 hour shift, (480 minutes)
	Lunch and breaks require 50 minutes
	Scheduled PM requires 30 minutes
	Designed output is 500 units/minute
	Total possible production time: 480 - (50 + 30) = 400 min.
	Total possible output: 500 un./min. x 400 min. = 200,000 un.
Quality Info:	Produced 160,000 units
	150,000 acceptable production
	10,000 rejects
Unscheduled Info:	Two major breakdowns total 40 minutes
	Setup took 20 minutes
	Total Unscheduled Downtime = 60 min.
	Operating time: 400 min. - 60 min. = 340 min.
	Availability 340 min. / 400 min. = .85%
	Performance (160,000/340min.) / 500 un/min = .94%
	Quality 150,000/160,000 = 94%
EE	Overall Equipment Effectiveness ..... (

From the Availability percentage, we learn how major breakdowns and setups affected our total schedule run. From the Performance Percentage, we learn the rate at which our equipment operated during our running time. Minor stoppages and reduced speeds affect this number. The Quality component is defined as the ratio of good quality units to produced units. This ratio gives us an indication of how the quality of our process is affecting overall equipment effectiveness.

OEE COMPUTATION FORM

Line _____ Equipment

Week Of

					Check Day	M	T	W	T	F	S	S
AVAILABILITY	Total Operating Time/Shift								1			
		Breaks		a								
		Lunch		b								
		Scheduled Maintenance		c								
		Other		d								
	Scheduled Down Time(a+b+c+d)								2			
	Scheduled Run Time (#1 - #2)								3			
		Breakdowns	#	e								
		Setups	#	f								
		Adjustments	#	g								
	Downtime Losses (e+f+g)								4			
	Operating Time (#3 - #4)								5			
	AVAILABILITY (#5 / #3) x 100%								6			
PERFORMANCE	Output During Operating Time								7			
	Actual Output Rate (#7 / #5)		Units/min=	8								
	Maximum Design Rate		Units/min=	9								
	Maximum Design Possible Output (#9 x #5)								10			
	PERFORMANCE RATE (#7 / # 10)								11			
QUALITY	Total Units Produced (Same as #7)								12			
	Total Rejected Units								13			
	Total Good Units (#12 - #13)								14			
	QUALITY RATE (#14 / #12)								15			
OVERALL EQUIPMENT EFFECTIVENESS (#6 X #11 X #15)												

DETECT TO CORRECT

_____1. Review documentation from initial cleaning (sources of dirt, dust, leaks, spattering, etc)
_____2. Document all areas that are inaccessible, hard-to-clean, or hard-to-inspect.
_____3. Brainstorm and list actions you can take to control or eliminate each source of dirt and every leak, for example:
- Eliminate sources of dirt entirely
- Control or localize the spread of dust, chips, or lubricant
- Shield areas from contamination
- Speed up flow of cutting oil to reduce accumulation of debris
- Minimize area through which cutting oil flows
- Repair leaks, reducing lubricant volume to stop overflows
- Eliminate need for oil pans

_____4. Brainstorm and list actions you can take to make cleaning and inspecting easier and to reduce the time involved, for example:
- Design special cleaning tools
- Reposition equipment for access
- Install windows
- Make cover removal and replacement easier
- Install more oil gauges
- Change location of lubrication inlets
- Change lubrication method
- Simplify piping or wiring layout
- Keep access ways tidy and unobstructed
- Re-organize tasks to reduce time and balance daily and weekly work
- Extend lubrication intervals

_____5. Review the cost, safety, and environmental impact of every improvement proposed.
_____6. Prioritize repairs or corrective actions and decide;
- What is needed.
- Who has the assignment to insure it is completed.
- When should it be done.
- What other resources are necessary to complete the improvement.

_____7. Implement simple, safe, and cost-free ideas right away. Test the effectiveness of other ideas through simulation and temporary fixtures and document the results. When necessary enlist additional resources from outside the team to review your results and help implement your improvements.
_____8. Monitor through the ASSESS and DETECT process to continually identify problems and improve the equipment.
_____9. Measure your efforts (time, cost, downtime...) Set objectives for improvements in the future.
_____10. Measure effectiveness of your improvements using the Overall Equipment Effectiveness (OEE).
_____11. Share your results and creative improvements with others through your activity board, Improvement Bulletins, and plant wide meetings.

IMPROVEMENT PROJECT

- Shares an idea visually and graphically
    - Usually a drawing to show detail
    - Explains the idea for improvement
    - Shows a before and after condition
    - Used for communication to bring about a redesign

IMPROVEMENT PROJECT WORKSHEET

Project:	1. Machine 2. Date: 3. Team #
Conditions Before:	Conditions After:

Details and Drawing

OPERATOR OPERATING STANDARD

An Operator Operating Standard (OOS) is an agreement on how a specific machine, or set of machines, will be operated. This Standard is constructed through a meeting of all those who run the machinery. Discussion about all related settings and modes of operation take place. Consensus is then reached on how the machinery should be ran and the agreement is put on paper. Some groups elect to have each member sign the OOS, signifying his/her understanding and agreement of how the machinery will be operated in the future.

Examples of what items are put on an OOS:

- Equipment speed
- Pressure settings
- Adjustment settings
- Changeover settings
- Temperature
- Time periods
- Digital readout settings
- Methods of operation
- Training or testing required before operation of specific machinery
- Documentation requirements of operator

The OOS can take on many forms, depending on the need of agreement at the time. Operator Operating Standards promote critical group thinking to reach agreement on the best practice to operate machinery in harmony within the work group once the standard has been set. The purpose of the OOS is to produce a consistent product through consistent operation.

When these standards are not adhered too, it is up to the group which established the Standards to call it to the one's attention who is not maintaining proper control. One common saying used to make this connection can be:

FOLLOW THE OOS YOU SILLY GOOSE!

VISUAL CONTROLS

MAKE SYSTEM VISUAL

Prime objectives necessary for effective application of VISUAL CONTROL:

- Information related to operational performance should be on or near the equipment.
- Have essential visual controls/diagrams on equipment.
- New team members will need essential information for reference purposes to operate equipment effectively.
- The goal is to get the appropriate information or standard as close to the point of use as possible.

VISUAL CONTROLS

It is important that fasteners (bolts, rivets, etc.) are easy to observe and check without needing to re-torque the fastener to see if it has moved or loosened. The key is to mark the fastener after installation. Remember:

Registration Marks

- Why
  - Help us recognize potential problems immediately
- When
  - After assembly of torque test
- Where
  - Anywhere fasteners may become loose and cause a problem
  - High vibration areas
  - Where loose fasteners may create a safety problem

Use of Lexan in place of metal guards

- Why
  - Help us recognize potential problems immediately
- When
  - As soon as possible
- Where
  - Anywhere there are moving parts and Lexan is a strong enough barrier for the application

o

CORRECT TO PERFECT

THEORY INPUT

CORRECT TO PERFECT in Total Reliability Systems is the same as for an organizational system in that it provides the standards, commitments, and processes necessary to reduce variances from standard. If our objective with equipment is to ensure that they are 100% reliable in meeting the overall plant production needs, then CORRECT TO PERFECT helps us build processes, guidelines, and plans to achieve that objective.

TASK OBJECTIVES

You and your team will build an understanding of CORRECT TO PERFECT.

DESIRED OUTCOMES

- Understand the Four Types of Maintenance.
- Understand how to look for and find speed traps.
- Understand how to apply the 80/20 rule.
- Be prepared to share your outcomes and what you learned with the other teams in an insightful and impactful manner.

CORRECT TO PERFECT

CORRECT has the following key objectives:

- Improve equipment operation and ease of use through improvements and redesigns.
- Reach agreement on the method of operation for equipment and document using an operator's operating standard.
- Begin a preventative maintenance program with the tracking to move to a predictive maintenance plan.
- Eliminate machine speed deficiencies.

CORRECT process Steps:

- Insure that detection of issues is completed and documented.
- Insure 80/20 rule has been applied to sort priorities.
- Select top needs for immediate changes.
- Explore ideas as team for improvement.
- Select most probable solution.
- Try ideas (simulate) and record results.
- Repeat to continuously improve process.

CORRECT—Key Points

- Develop pro-active not reactive solutions.
- Teams are powerful when they work together.
- No improvement is as powerful as a measurable and recorded improvement.
- Methodology—low cost vs. high cost.
- Work to fail to succeed.

TARGETS FOR CORRECT TO PERFECT

Teams are encouraged to design solutions to typical process problems of contamination and inaccessible areas such as:

Equipment Areas:

- Guards
- Chutes
- Covers (see through)
- Conveyors
- Vacuum Systems
- Deflectors
- Air Deflectors
- Stops
- Proximity/Micro Switches
- Brushes
- Distribution Pipes, etc.
- Key Parts That Are Hard Or Impossible To Inspect
- Features which become dirty immediately following cleaning
- Unseen areas
- Gauges—condition indicators
- Micro-switches
- Gears—bearing—drive systems
- Areas which affect machine performance
- Inaccessible areas

Process/Guideline Areas

- Time Consuming actions
- Material Handling
- Employee Attitudes/behavior
- Roles and Responsibilities
- Skill Development

FOUR TYPES OF MAINTENANCE

Maintenance should not be defined as a department. According to Webster's dictionary it defines the word maintenance as being " the upkeep of property or equipment." Individuals can posses maintenance skills and abilities, departments can't. TRS carries the concept further by defining when the maintenance, or upkeep, takes place. The timing of maintenance is critical to an operation. Timing of maintenance determines if an operation will continue to run in an efficient, cost effective manner. Below are the definitions of the FOUR TYPES OF MAINTENANCE.

BREAKDOWN MAINTENANCE

Repair activity only takes place after the machinery has ceased to be able to manufacture a quality product in a timely fashion. This type of maintenance robs the operation of valuable production time. Instead of the machinery producing products, it sits idle while repairs are made. Often, repairs are made to "get by," leaving the problem to surface again in the future. Sometime this is caused due to lack of parts available at short notice. It can be argued that this type of "maintenance" may not be maintenance at all since the activity is not focused on upkeep before a breakdown, but rather on repair after the breakdown occurs.

PLANNED MAINTENANCE

Upkeep activity takes place after a problem is detected. Planned maintenance is better than breakdown maintenance in that the machinery can continue to run and plans are laid to fix the discovered problem before a breakdown happens. Sometime these plans cut into production time that was previously scheduled, depending on the severity of the pending issue. Parts availability is less of an issue than with breakdown maintenance since there is more time to react on getting the parts procured.

PREVENTATIVE MAINTENANCE

Upkeep activity takes place on a regularly scheduled basis. There is no production loss associated with this upkeep activity since the time is scheduled specifically for maintenance activity. Parts are available at most times since the period that the equipment is to be worked on is known.

PREDICTIVE MAINTENANCE

Upkeep activity takes place on a scheduled basis. However, the difference between preventative and predictive maintenance is what drives setting the time period as to when the upkeep activity takes place. Preventative maintenance sets the upkeep time period on somewhat of an arbitrary fashion. No history has been tracked to discover how long a part's life span will be. Predictive maintenance uses a tracking system to determine how long a part will last and then a schedule is set to change the part before its life expectancy expires. Part availability is maximized since the life expectancy of the part is known.

SOME METHODS FOR PERFECTING

Developing Learning Opportunities

- One Point lessons
  - Short visual lesson or explanation
  - Contained on one page
  - Supported with drawings
  - Explains one point or subject
  - Can be understood fully within ten minutes
- Cutaway models
- Improvement blueprints

Resources... just a few

- The buddy system
- Maintenance planner
- PM updater

. THE 80/20 RULE

Separating the "Vital Few" from the "Trivial Many"

THE 80/20 RULE

The Pareto Principle suggests that 20% of the activities in which we are involved generate 80% of our results. The corollary to that is that 80% of our time is spent in activities which generate only 20% of the results. If we effectively prioritize our efforts, we will spend out time on those problems and activities which give us the biggest bang for our effort—that is the 20% which will get the 80% results. Pareto shows us where to concentrate our limited resources to best effect.

TRS APPLICATION

As we INSPECT and DETECT equipment abnormalities—we will identify many problems and actions required. Of these—there are 20% (1 in 5) which will improve our processes by 80%. Our initial efforts should be on these—the others can be improved later.

PERFECT

THEORY INPUT

We have now cleaned the equipment, improved initial areas of concern (DETECT), developed plans and standards, and now need to develop the knowledge, skills, abilities, physical controls, visual controls, and culture to PERFECT our reliability over the long haul. This phase focuses on developing our people throughout the team and organization to better see, understand, control, and improve our technical production.

TASK OBJECTIVES

With your team, develop a framework for identifying what knowledge, skills, and abilities are required in order to maximize the reliability of the equipment, review and assess the skills of team members, and develop a plan to provide development where needed. Develop learning opportunities which can immediately begin educating others.

DESIRED OUTCOMES

- Identify all skills necessary to effectively complete all activities and standards.
- Assess each team member's skills and competencies.
- Develop materials and checklists necessary to provide—hands-on, experiential learning for team members.
- Develop a plan for learning with priorities, schedules, resources needed, and responsibilities identified.
- Develop and understand the concept of developing learning opportunities.
- Develop an action plan for the next month of activities.
- Be prepared to share your outcomes and what you learned with the other teams in an insightful and impactful manner.

PERFECT

Developing Ability and Control

In order to incorporate the first five steps of TRS into the everyday culture and habits of the team and organization, developmental learning must occur on a regular basis. This learning includes:

!Team Members cross-training and gaining multiple skills.

- Operators gaining Maintenance Skills.
- Maintenance skilled members learning more about equipment operation.
- Building a base of required—common skills which all team members have.

- Team Members continuing to gain "high-end" or "highly technical" training, based on their background, to insure depth of skills on the team.

- Engineers/ planners/ supervisors/ coaches all learning to operate and maintain equipment to broaden their understanding and capability within the team.

- This developmental learning includes, but is not limited to:

- Lubrication
- Basic Maintenance
- Pneumatics
- Hydraulics
- Welding
- Pressing
- Drive Systems
- Motors
- Gearbox Systems
- Electrical Functions
- Scheduling
- Operating
- etc...

SKILLS ASSESSMENT GRID

Equipment Skills	Team Member Names								

Indicate Skill Level :1 - Safe Operation / 2 - Proficient / 3 - Qualified to train others

BUILDING A PLAN

After exploring the concepts and tool for using TRS, we need to build a plan or road map which will allow our team to implement and use these tools on a continuing basis. It is important that we build this plan with all team members present and that it represents the team's consensus on the goals and methods for accomplishing TRS.

The action plan involves three major parts which rely on much of the work you have done up until now:

Identify the TRS playing field. (Scope of work or areas of responsibility.) This includes:

- Decide which equipment and areas our team is responsible for.
- List all regular TRS activities which must be accomplished and how often they must be performed.
- Identify all areas of improvement that have been discussed during the workshop.
- Identify possible actions which could be taken to make the improvements.
- Identify skills we have and those we must learn to effectively handle the work we have defined.

Set short term goals and ways to measure our progress.

- Identify the most important work to be performed first (80/20 rule).
- Set date targets and assign responsibilities to team members. Identify what needs to be done, who should do it, and when it should be accomplished.
- Identify resources (people, equipment, tools, parts, etc.) which are necessary in order to accomplish the goals.
- Identify approvals which might be necessary or required to proceed.

Do it and Account for your accomplishment.

- Remember the saying: "plan your work–then work your plan."
- Remember the power of pictures, before and after, and show off your achievements.
- Keep a record of performance before and after the changes.
- Identify the next set of goals and objectives
- Meet as a team to assess progress and measure the results of the work.

There is no "magic formula" to making the plan effective but we do have a few suggestions:

- Keep it Simple and Straight-forward (KISS).
- Focus on the "Critical Few" (Pareto Principle—20% of the problems account for 80% of the results).
- Set Goals together, with the team.
- Measure it yourself, when it's happening. After-the-fact measures rarely give you the information quick enough to adapt, integrate, and attain.
- Depend on each other and set regular, focused follow-up.