Conveyor Failure
Roller Bearing Failures

Analysis Name: Conveyor Rollers

Principal Analyst: Ron Hughes

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PROACT® ROOT CAUSE ANALYSIS (RCA)
PROCESS DESCRIPTION

The following Root Cause Analysis (RCA) was conducted to help us determine the "true" root causes of the event analyzed. This PROACT® RCA analysis technique has been field-proven for over thirty years and replicates the tasks involved in any investigative occupation. The analysis was conducted to determine the physical, human and latent root causes associated with the event at hand.

Below is a quick overview of the RCA process used to determine our facility's "Significant Few" events:

1. PReserve Event Data - Outline the measures taken to collect the 5-P's (Parts, Position, People, Paper and Paradigms)
2. Order the Analysis Team - Delineates the formation of the team and its associated structure
3. Analyze the Event Data - The use of a disciplined, logical thought process to draw accurate and comprehensive conclusions based on facts
4. Communicate Findings and Recommendations - The effective and efficient means of getting RCA recommendations implemented through proper communication
5. Tracking for Bottom-Line Results - Ensuring the sustainability of successful outcomes by monitoring performance of implemented recommendations

Preserve

PReserve Event Data

As in any investigative occupation, it is a REQUIREMENT that data (evidence) be collected from the scene and preserved in such a fashion as is appropriate for further analysis. As with the detective at a crime scene, the area is roped off and the scene preserved for the professionals who will come in and collect the necessary data.

PROACT® utilizes a data collection technique called the 5-P's. The 5-P's stand for the following five (5) data categories:

1. Parts – Physical or tangible evidence. Examples include process equipment, diagnostic equipment, fluid samples, etc.
2. Paper – Documentation. Examples include procedures, specifications, records, policies, test results, literature searches, etc.
3. Positional - Elements of time and space. Examples include times of occurrences, location of occurrences, frequency of occurrences, etc.
4. People - People sought to be interviewed regarding an event. Examples include management, administration, witnesses, engineers, hourly personnel, purchasing, etc.
5. Paradigms - People's belief systems that contribute to decision errors. "Cost reduction is #1", "It's the manufacturer's fault", "Poor design", etc.

Data Collection

Category	Data	Strategy	Team Member	Date	Completed	Hours
Parts	Failed Roller Bearings	Obtain from maintenance and bring to analysis team for examination.	Ron Hughes	10/24/2002	Yes	0.5
Parts	Lubrication Samples	Obtain from maintenance and send out for analysis. Bring analysis results to team for review and examination.	Steve Webb	10/24/2002	Yes	0.2
Paper	Conveyor Specifications	Obtain from Document Control and bring to team for review and analysis.	Steve Webb	10/24/2002	Yes	0.5
Paper	Conveyor System Drawings	Obtain from Engineering and bring to team for review and analysis.	Steve Webb	10/24/2002	Yes	0.5
Paper	Maintenance Histories	Obtain maintenance histories for the maintenance department manager and bring to team for review and analysis.	Mike Gaddis	10/24/2002	Yes	1
People	Operator/ Maintenance Staff Interviews	Identify and interview all personnel who have worked on, or maintained, the conveyors and bring completed questionnaires back to team for review and analysis.	Wes Stepherson	10/24/2002	Yes	4
Paper	Tribologist Report	Send out samples of failed roller bearings for analysis of lubricants.	Hugh Rentschler	10/24/2002	Yes	2
Paradigm	Interviews with Oilers	Review interview sheets and discuss with analysis team to uncover existing paradigms concerning plant lubrications practices.	Ron Hughes	10/24/2002	Yes	2
Paper	Lubrication Procedures	Obtain a copy of lubrication procedures from Document Control and bring to team for review and analysis.	Wes Stepherson	10/24/2002	Yes	0.2
Paper	Review CMMS for MTBF	Make a correlation analysis of failures to time of occurrence and bring to team for review and analysis.	Hugh Rentschler	10/24/2002	Yes	4

Category	Data	Strategy	Team Member	Date	Completed	Hours
Paper	Material Data Sheets	Obtain the MDS for the lubricants used on conveyor rollers from Document Control and bring to team for review and analysis.	Mike Gaddis	10/24/2002	Yes	0.1
Paper	Training Records of Oilers	Obtain from Training Department and bring to team for review and analysis.	Wes Stepherson	10/24/2002	Yes	0.2
Paper	Lubrication Specifications	Obtain from Engineering and bring to team for review and analysis.	Mike Gaddis	10/24/2002	Yes	0.2
Paper	Metallurgical Report on Roller Bearings	Send out failed roller bearings to metallurgical lad for examination and bring the results to the team for review and analysis.	Hugh Rentschler	10/24/2002	Yes	1
Paper	Production Logs	Obtain from Production Supervisor and bring to team for analysis of how roller bearing failures have affected production quotas.	Hugh Rentschler	10/24/2002	Yes	0.2
Paper	Pictures of Failed Bearings and Conveyor System	Take pictures of failed bearings and the Conveyor System and bring to the analysis team.	Wes Stepherson	10/24/2002	Yes	4

Data Collection File Links

Category	Data	Team Member	Location	Name
Parts	Failed Roller Bearings	Ron Hughes	C:\Program Files\RCI\PROACT3\FileLinks\5	bearing1.jpg
Paper	Pictures of Failed Bearings and Conveyor System	Wes Stepherson	C:\Program Files\RCI\Bridge\FileLinks\5	IM000648.jpg
Paper	Pictures of Failed Bearings and Conveyor System	Wes Stepherson	C:\Program Files\RCI\Bridge\FileLinks\5	bearing5.jpg

Order

Ordering the Analysis Team

Another prerequisite to the PROACT® RCA approach is that an appropriate team be formed for the analysis at hand. Such an effort involves the following:

1. Providing an unbiased team facilitator - Assigning a person to lead the analysis who has nothing to gain or lose by the outcome; an expert in the facilitation of the PROACT® RCA methodology.
2. Amassing a team of cross-functional members - Ensuring that the team itself is not biased with one perspective; allowing team members to be experts as well as objective observers.
3. Establishing a Team Charter (Terminal Objective) for the analysis - Gaining consensus on a one (1) paragraph statement that outlines the reason the team is together.
4. Establishing Critical Success Factors (CSF's) - Establishing CSF's that outline how the team will know when they have been successful.

Team Members
Principal Analyst: Ron Hughes

Name	Company	Title	Phone	Email	Read	Read/Write	Delete

Charter

To identify the root causes of the recurring conveyor roller failures in the cutsize system. This includes identifying deficiencies in or lack of management systems. Appropriate recommendations for root causes will be communicated to management for rapid resolution.

Critical Success Factors

1 - A cross-functional section of plant personnel/experts will participate in the analysis

2 - A disciplined RCA approach will be utilized

3 - A measurement process will be used to track the progress of approved recommendations

4 - All analysis hypotheses will be verified or disproven

5 - Management agrees to fairly evaluate the analysis team's findings and recommendations

6 - No one will be disciplined for honest mistakes

Dates

Ananlysis Start Date:	**5/2/2003**
Expected Completion Date:	**5/2/2003**

Comments

Conveyor rollers have been experiencing numerous failures, from apparent lock ups, in increasing numbers during the past year. Currently, the MTBF is approximately 2.5 weeks.

The following interim fixes have been attempted without success:

Roller bearings have been changed out from standard to heavy duty.
Several differenct types of lubricants have been tried without any noticeable difference in MTBF.
Lubrication intervals have been stepped up from bi-weekly to weekly.
All automatic lubrication systems have been shut off and bearings lubricated manually.

Analyze

Analyze the Event Data

Any undesirable outcome is a result of a series of "cause-and-effect" relationships. The data collected in the 5-P's section of this report will ultimately serve as proof (evidence) as to what actually did or did not occur.

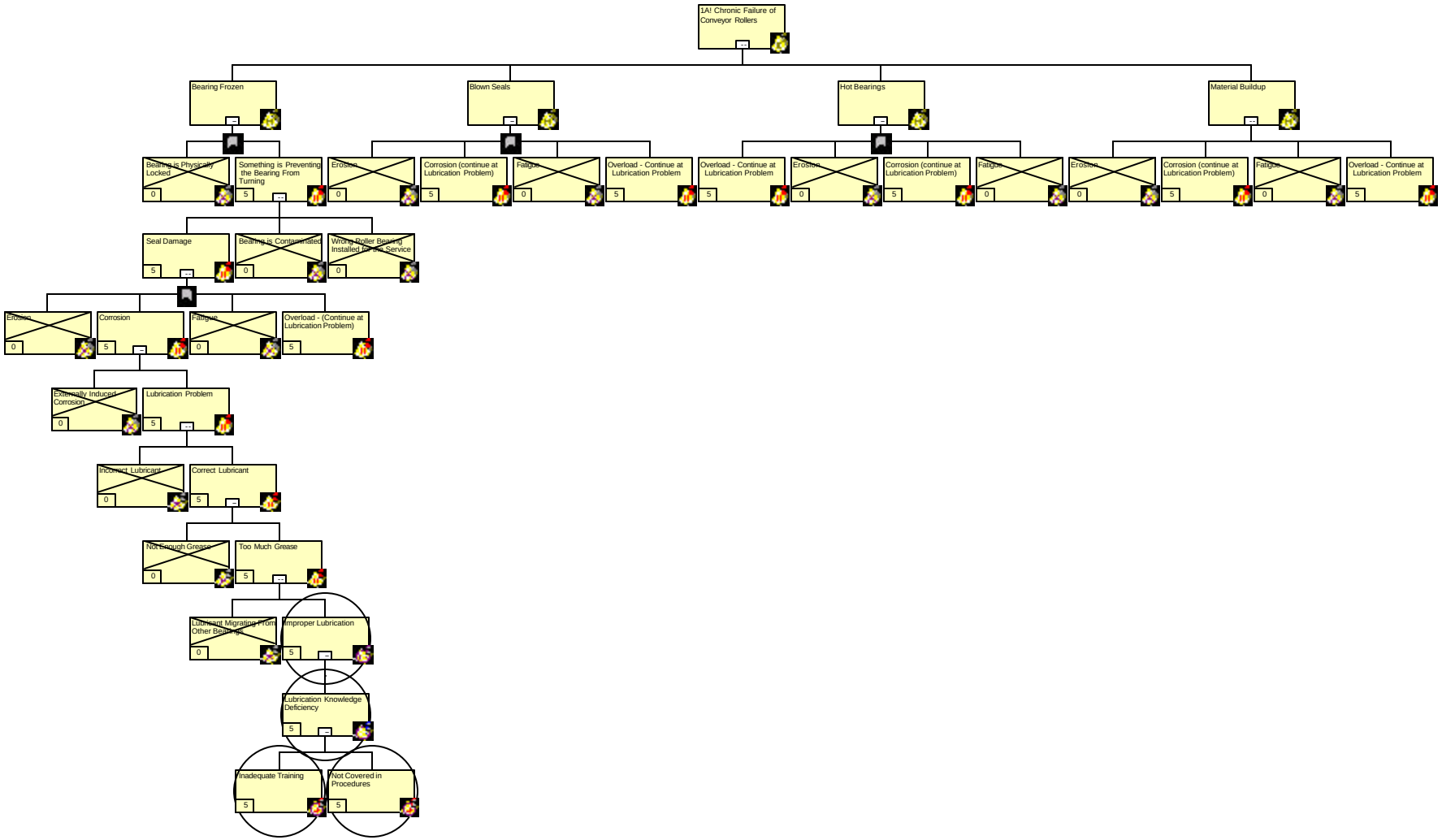
A logic tree will be used in the PROACT® RCA approach to graphically express the "cause-and-effect" relationships discussed earlier. In this approach, the top two levels of blocks represent the Event (Level 1) and the Modes (Level 2). From level to level represents a "cause-and-effect" relationship. These levels specifically represent the "undesirable outcomes" that did occur (facts only)!

From the MODE level, we do not know why they have occurred, just that they did. From this point we become hypothetical and repeatedly ask the question "How Can?".

As hypotheses are developed in this fashion, we use our 5-P's data to verify what is true and what is not true. In this fashion, facts lead our analyses not assumptions. This process is reiterated until we start to uncover the real root causes; the reasons that people make decision errors that lead to undesirable outcome.

Root causes originate from flawed systems in which people depend on to make informed decisions. We call these Latent Root Causes or Organizational Root Causes. Flawed organizational systems lead to poor decisions being made by well-intentioned individuals. We call these the Human Root Causes. Decision errors lead to Physical Root Causes, or events or conditions that are visible.

Only when we uncover the Latent Roots or Organizational System Roots are we actually conducting a "real" ROOT CAUSE analysis.


1A! Chronic Failure of Conveyor Rollers
Bearing Frozen
Blown Seals
Hot Bearings
Material Buildup
Bearing is Physically Locked
0
Something is Preventing the Bearing From Turning
5
Erosion
0
Corrosion (continue at Lubrication Problem)
5
Fatigue
0
Overload - Continue at Lubrication Problem
5
Overload - Continue at Lubrication Problem
5
Erosion
0
Corrosion (continue at Lubrication Problem)
5
Fatigue
0
Erosion
0
Corrosion (continue at Lubrication Problem)
5
Fatigue
0
Overload - Continue at Lubrication Problem
5
Seal Damage
5
Bearing is Contaminated
0
Wrong Roller Bearing Installed for the Service
0
Erosion
0
Corrosion
5
Fatigue
0
Overload - (Continue at Lubrication Problem)
5
Externally Induced Corrosion
0
Lubrication Problem
5
Incorrect Lubricant
0
Correct Lubricant
5
Not Enough Grease
0
Too Much Grease
5
Lubricant Migrating From Other Bearings
0
Improper Lubrication
5
Lubrication Knowledge Deficiency
5
Inadequate Training
5
Not Covered in Procedures
5

Verification Logs

Hypothesis	Team Member	Verification Method	Outcome
Bearing is Contaminated	Steve Webb	Visually inspect failed conveyor roller bearing seals for evidence of contamination.	Although there is excessive grease in the bearings there is no evidence of any type of contamination that could have contributed to the incident being investigated.
Bearing is Contaminated	Steve Webb	Visual inspection of the bearing for evidence of contamination.	There is no evidence of bearing contamination.
Bearing is Physically Locked	Steve Webb	Visually inspect failed conveyor roller bearings.	Bearings are not physically locked. However, they are not turning as easily as they should.
Bearing is Physically Locked	Mike Gaddis	Visually inspect failed bearings of the conveyor rollers for evidence of being physically locked up.	Bearings are not physically locked up. However, they are not turning as easily as they should be.
Correct Lubricant	Steve Webb	Send a sample of the lubricant out for analysis.	Tribogolist report indicates that the correct lubricant is being used.
Corrosion	Hugh Rentschler	Send failed bearing(s) out for metallurigical analysis.	The metallurgical report indicates the presence of corrosion in the seal area of the bearing.
Corrosion (continue at Lubrication Problem)	Steve Webb	Send bearing out for metallurgical analysis.	The analysis showed that the bearing seals were blown due to too much grease being injected into the bearing seal area. This also accounts for the evidence of corrosion found in this same area.
Corrosion (continue at Lubrication Problem)	Hugh Rentschler	Send bearing out for metallurgical analysis.	The analysis showed that the bearing seals were blown due to too much grease being injected into the bearing seal area. This also accounts for the evidence of corrosion found in this same area.
Erosion	Hugh Rentschler	Send failed bearing(s) out for metallurgical analysis.	Metallurgical reports shows no indication of erosion within the bearing.

Hypothesis	Team Member	Verification Method	Outcome
Erosion	Hugh Rentschler	Send bearing out for metallurgical analysis.	Metallurgical reports shows no indication of erosion within the bearing.
Erosion	Steve Webb	Send failed conveyor roller bearings out for metallurgical examination.	Metallurgical reports shows no indication of erosion within the bearing.
Externally Induced Corrosion	Mike Gaddis	Visually inspect the bearing lubrication for evidence of debris or other forms of externally induced corrosion.	No evidence of externally induced corrosion is apparent in the lubricant.
Fatigue	Hugh Rentschler	Send failed bearing(s) out for metallurigical analysis.	The metallurgical report indicates no evidence of fatigue in the bearing or roller.
Fatigue	Steve Webb	Send bearing out for metallurgical analysis.	There is no evidence of fatigue contributing to the incident being investigated.
Fatigue	Hugh Rentschler	Send bearing out for metallurgical analysis.	There is no evidence of fatigue contributing to the incident being investigated.
Improper Lubrication	Wes Stepherson	Send bearing out for metallurgical and tribology analysis.	Tribologist report shows that the correct type of lubricant is being used. However, metallurgical report indicates that there is too much grease in the bearing.
Inadequate Training	Hugh Rentschler	Review oil training records and training programs on lubrication.	The only training that the oilers receive is OJT. This training was monitored and showed several inadequacies. Only what equipment is lubricated was givern. Nothing on types and techniques of lubrication.
Incorrect Lubricant	Steve Webb	Send a sample of the bearing lubricant out for analysis.	Tribogolist report indicates that the correct lubricant is being used.
Lubricant Migrating From Other Bearings	Mike Gaddis	Visually inspect converyors for evidence of migrating lubricants.	Ther is no physical evidence that the lubricants are migrating beyond there immediate area.

Hypothesis	Team Member	Verification Method	Outcome
Lubrication Knowledge Deficiency	Ron Hughes	Interview oils to ascertain knowledge levels.	Interviews reveal that oilers do not understand the dangers associated with over lubrication. In addition, other basic lubrication principles such as types and uses of lubricants are not understood by the oilers. There is a good understand of different lubricantion techniques.
Lubrication Problem	Mike Gaddis	Review metallurgical report for evidence of a lubrication problem.	The report indicates corrosion in the seal area due to excessive amounts of grease in the bearing.
Lubrication Problem	Mike Gaddis	Visual inpection of failied bearings.	There appears to be too much grease in the bearing seal area.
Not Covered in Procedures	Hugh Rentschler	Review plant lubrication procedures and compare with equipment requirements.	The procedures indicated that the equipment must be lubricated but does not cover the type of lubricant to be used, the amount and techniques of lubrication and cautions concerning equipment and personnel safety during lubrication.
Not Enough Grease	Hugh Rentschler	Send failed roller bearing out for metallurgical and tribology analysis.	Tribologist report shows that the correct type of lubricant is being used. However, metallurgical report indicates that there is too much grease in the bearing.
Overload - Continue at Lubrication Problem	Hugh Rentschler	Send failed bearing(s) out for metallurigical analysis.	The analysis showed that the bearing seals were blown due to too much grease being injected into the bearing seal area. This also accounts for the evidence of corrosion found in this same area.
Seal Damage	Steve Webb	Visually inspect converyor roller bearing seals.	Many of the bearings have blown seals . This appears to be the result of over-lubrication of the bearings as many have excessive grease buildup in the seal area.
Seal Damage	Mike Gaddis	Visually inspect bearing seals for evidence of damage.	The seals are blown indicating some form of overload in the sealing area.

Hypothesis	Team Member	Verification Method	Outcome
Something is Preventing the Bearing From Turning	Ron Hughes	Visually inspect failed conveyor roller bearings.	Bearings are not physically locked. However, they are not turning as easily as they should.
Something is Preventing the Bearing from Turning	Mike Gaddis	Visually inspect conveyor roller bearings for evidence that something is preventing them from turning as they should.	The bearings tend to bind as a result of over-greasing.
Too Much Grease	Hugh Rentschler	Send failed roller bearing out for metallurgical and tribology analysis.	Tribologist report shows that the correct type of lubricant is being used. However, metallurgical report indicates that there is too much grease in the bearing.
Wrong Roller Bearing Installed for the Service	Wes Stepherson	Review Roller/Bearing Specifications to see if what is installed is correct and appropriate for the service.	The bearings that are installed are per plant specifications.
Wrong Roller Bearing Installed for Service	Wes Stepherson	Review Roller/Bearing Specifications to see if what is installed is correct and appropriated for the sevice it is being used for.	What is installed is per specification and well within the limitations for what they are being used.

Verification File Links

Hypothesis	Team Member	Location	Name
Corrosion	Hugh Rentschler	C:\Program Files\RCI\Bridge\FileLinks\5	Spalded Roller Ball.gif
Overload - Continue at Lubrication Problem	Hugh Rentschler	C:\Program Files\RCI\Bridge\FileLinks\5	Damaged Outer Race.gif
Seal Damage	Mike Gaddis	C:\Program Files\RCI\Bridge\FileLinks\5	bearing5.jpg
Something is Preventing the Bearing from Turning	Mike Gaddis	C:\Program Files\RCI\Bridge\FileLinks\5	After Repair_Before Repair.gif

Communicate

Communicate Findings and Recommendations

As with this report, an effective means of communication is necessary to get RCA recommendations approved and implemented. This primarily involves communicating the conclusions of the RCA and the recommendations as a result of the RCA.

The elements of this section are intended to communicate the summary of the findings of the RCA for management, as well as the detailed recommendations made by the RCA team members for resolution of the causes identified.

A RCA cannot be successful without the approval and implementation of the analysis recommendations.

Event Summary

During the past several months the plant has been experiencing an inordinate amount of conveyor problems that have been directly tied to roller bearings. As a interim step, roller bearing lubrication intervals have been increased from once every two weeks to one a week.

Summary of Findings

Chronic conveyor roller bearing problems have been experienced from the following failure modes; blown seals, bearing frozen and hot bearings. The analysis has revealed that the failure modes can be directly attributed to existing plant lubrication practices. Identified root causes show that roller bearings have been over lubricated because plant oilers did not understand the dangers of over lubrication. In addition, latent issues dealing with inadequate training and procedures have been identified.

PROACT® Description

PROACT® is a methodology developed by Reliability Center, Inc. (RCI) to help users analyze their organization's most costly problems. The term PROACT® is an acronym for PReserving Failure Data, Ordering the Analysis, Analyzing the Data, Communicating Findings and Recommendations and Tracking for Results.

Executive Summary Recommendations

Root Cause	Type	Recommendation	Responsible	Estimated Completion Date	Completed
Not Covered in Procedures	Latent	Revise maintenance procedures	Ron Hughes	10/24/2002	No
Inadequate Training	Latent	Set up training on lubrication practices and techniques for oilers.	Hugh Rentschler	10/24/2002	No
Lubrication Knowledge Deficiency	Human	Retrain oils on lubrication practices.	Hugh Rentschler	10/24/2002	No
Improper Lubrication	Physical	Clean and re grease conveyor roller bearings.	Mike Gaddis	10/24/2002	No

Detailed Recommendations

Root Cause	Type	Recommendation	Completed
Not Covered in Procedures	Latent	Revise all maintenance procedures to include the lubrication requirements for facility equipment; including, lubrication types, amounts, techniques and frequency of lubrication. Procedures should contain the appropriate warnings, cautions and notes to insure both personnel and equipment safety and reliability.	No
Inadequate Training	Latent	During OJT, educate oilers on the dangers of over lubrication and the techniques used to ensure proper lubrication. Establish a formalized training program to include lubrication practices, techniques and precautions. Set up testing requirements to measure job performance and knowledge levels.	No
Lubrication Knowledge Deficiency	Human	Write and implement a lubrication training program for facility oilers.	No
Improper Lubrication	Physical	During next outage, have the conveyor roller bearings cleaned and re packed with grease (Parker Lubri-Plate 20-20) lithium base grease.	No

Acknowledgements

Company	Position	Contributor	Expertise
SKG Bearings	Engineer	Brian Smith	Bearings.

Analysis-At-A-Glance

Analysis-At-A-Glance

For the benefit of those that must oversee Root Cause Analysis (RCA) activities from the business perspective, this Analysis-At-A-Glance section provides such information.

In the PROACT® Root Cause Analysis process, there are three points where tasks are assigned to team members, they in:

1. data collection,
2. hypothesis verifications and,
3. the development and implement of recommendations.

At each of these points the analyst is afforded the opportunity to input the number of man-hours it took them to complete the task and to add any other associated costs to complete the task.

Analysis-At-A-Glance is the section where all of this information is brought together in a meaningful fashion. This is the location of where the estimated Return-On-Investment's (ROI-Year 1) reside for both the individual recommendations and the analysis as a whole. The detailed cost breakdowns are also available upon request in this section.

Preserve Costs

Preserve Task	Team Member	Description	Total
Parts: Failed Roller Bearings	Ron Hughes	Manhours(0.5)	$50.00
Parts: Lubrication Samples	Steve Webb	Manhours(0.2)	$18.00
Paper: Conveyor Specifications	Steve Webb	Manhours(0.5)	$45.00
Paper: Conveyor System Drawings	Steve Webb	Manhours(0.5)	$45.00
Paper: Maintenance Histories	Mike Gaddis	Manhours(1)	$60.00
People: Operator/Maintenance Staff Interviews	Wes Stepherson	Manhours(4)	$280.00
Paper: Tribologist Report	Hugh Rentschler	Tribology Report	$2,000.00
Paper: Tribologist Report	Hugh Rentschler	Manhours(2)	$160.00
Paradigm: Interviews with Oilers	Ron Hughes	Manhours(2)	$500.00
Paper: Lubrication Procedures	Wes Stepherson	Manhours(0.2)	$14.00
Paper: Review CMMS for MTBF	Hugh Rentschler	Manhours(4)	$320.00
Paper: Material Data Sheets	Mike Gaddis	Manhours(0.1)	$6.00
Paper: Training Records of Oilers	Wes Stepherson	Manhours(0.2)	$14.00
Paper: Lubrication Specifications	Mike Gaddis	Manhours(0.2)	$12.00
Paper: Metallurgical Report on Roller Bearings	Hugh Rentschler	Manhours(1)	$80.00
Paper: Metallurgical Report on Roller Bearings	Hugh Rentschler	Metallurgical Report	$2,500.00
Paper: Production Logs	Hugh Rentschler	Manhours(0.2)	$16.00
Paper: Pictures of Failed Bearings and Conveyor System	Wes Stepherson	Manhours(4)	$280.00
			$6,400.00

Verification Costs

Verification Task	Team Member	Description	Total
Visually inspect failed bearings of the conveyor rollers for evidence of being physically locked up.	Mike Gaddis	Manhours(1)	$60.00
Visually inspect conveyor roller bearings for evidence that something is preventing them from turning as they should.	Mike Gaddis	Manhours(1)	$60.00
Visual inspection of the bearing for evidence of contamination.	Steve Webb	Manhours(1)	$90.00
Review Roller/Bearing Specifications to see if what is installed is correct and appropriated for the sevice it is being used for.	Wes Stepherson	Manhours(1)	$70.00
Visually inspect bearing seals for evidence of damage.	Mike Gaddis	Manhours(.1)	$6.00
Send failed bearing(s) out for metallurgical analysis.	Hugh Rentschler	Manhours(.2)	$16.00
Send failed bearing(s) out for metallurigical analysis.	Hugh Rentschler	Manhours(0)	$.00
Send failed bearing(s) out for metallurigical analysis.	Hugh Rentschler	Manhours(.1)	$8.00
Send failed bearing(s) out for metallurigical analysis.	Hugh Rentschler	Manhours(.2)	$16.00
Visually inspect the bearing lubrication for evidence of debris or other forms of externally induced corrosion.	Mike Gaddis	Manhours(.5)	$30.00

Verification Task	Team Member	Description	Total
Visual inpection of failied bearings.	Mike Gaddis	Manhours(.1)	$6.00
Review metallurgical report for evidence of a lubrication problem.	Mike Gaddis	Manhours(.2)	$12.00
Send bearing out for metallurgical analysis.	Hugh Rentschler	Manhours(.1)	$8.00
Send bearing out for metallurgical analysis.	Steve Webb	Manhours(0.1)	$9.00
Send bearing out for metallurgical analysis.	Hugh Rentschler	Manhours(.1)	$8.00
Send bearing out for metallurgical analysis.	Hugh Rentschler	Manhours(.1)	$8.00
Send bearing out for metallurgical analysis.	Hugh Rentschler	Manhours(.1)	$8.00
Send failed conveyor roller bearings out for metallurgical examination.	Steve Webb	Manhours(0.1)	$9.00
Send bearing out for metallurgical analysis.	Steve Webb	Manhours(0.1)	$9.00
Send bearing out for metallurgical analysis.	Steve Webb	Manhours(0.1)	$9.00
Send a sample of the bearing lubricant out for analysis.	Steve Webb	Manhours(.2)	$18.00
Send a sample of the lubricant out for analysis.	Steve Webb	Manhours(.2)	$18.00
Send failed roller bearing out for metallurgical and tribology analysis.	Hugh Rentschler	Manhours(.2)	$16.00
Send failed roller bearing out for metallurgical and tribology analysis.	Hugh Rentschler	Manhours(.2)	$16.00
Visually inspect converyors for evidence of migrating lubricants.	Mike Gaddis	Manhours(1)	$60.00

Verification Task	Team Member	Description	Total
Send bearing out for metallurgical and tribology analysis.	Wes Stepherson	Manhours(1)	$70.00
Interview oils to ascertain knowledge levels.	Ron Hughes	Manhours(4)	$1,000.00
Review oil training records and training programs on lubrication.	Hugh Rentschler	Manhours(4)	$320.00
Review plant lubrication procedures and compare with equipment requirements.	Hugh Rentschler	Manhours(4)	$320.00
Send failed conveyor roller bearing out for metallurgical examination.	Ron Hughes	Manhours(0.5)	$.00
Send failed conveyor roller bearings out for metallurgical examination.	Mike Gaddis	Manhours(.5)	$30.00
Review existing equipment lubrication procedures to see if they are adequate to meet plant requirements.	Hugh Rentschler	Manhours(5)	$400.00
Review existing lubrication training program and materials to ascertain adequacy.	Ron Hughes	Manhours(3)	$.00
Interview oilers to ascertain lubrication knowledge levels.	Ron Hughes	Manhours(4)	$.00
Send failed conveyor roller bearings out for analysis.	Ron Hughes	Manhours(0.5)	$50.00
Visually inspect conveyors of evidence of migrating lubricants.	Steve Webb	Manhours(.5)	$45.00
Visually inspect bearings to determine if they were lubricated properly.	Steve Webb	Manhours(.5)	$45.00
Visually inspect bearings to determine if they were lubricated properly.	Steve Webb	Manhours(.5)	$45.00

Verification Task	Team Member	Description	Total
Send sample of the lubricant out for analysis and compare with existing lubrication requirements.	Mike Gaddis	Manhours(.5)	$30.00
Send sample of the lubricant out for analysis and compare with existing lubrication requirements.	Mike Gaddis	Manhours(.5)	$30.00
Visually inspect failed conveyor roller bearings for evidence of a lubrication problem.	Ron Hughes	Manhours(.5)	$.00
Send sample of the lubricant out for analysis.	Ron Hughes	Manhours(.5)	$.00
Visually inspect the lubricant for evidence of corrosion.	Ron Hughes	Manhours(.5)	$.00
Send failed conveyor roller bearings out for metallurgical examination.	Mike Gaddis	Manhours(.5)	$30.00
Send failed conveyor roller bearings out for metallurgical examination.	Mike Gaddis	Manhours(.5)	$30.00
Visually inspect converyor roller bearing seals.	Steve Webb	Manhours(.5)	$45.00
Visually inspect failed conveyor roller bearings.	Steve Webb	Manhours(.5)	$45.00
Visually inspect failed conveyor roller bearings.	Ron Hughes	Manhours(0.5)	$.00
Visually inspect failed conveyor roller bearing seals for evidence of contamination.	Steve Webb	Manhours(.5)	$45.00
Review Roller/Bearing Specifications to see if what is installed is correct and appropriate for the service.	Wes Stepherson	Manhours(2)	$140.00
Send failed conveyor roller bearings out for metallurgical examination.	Steve Webb	Manhours(.5)	$45.00

Verification Task	Team Member	Description	Total
Send failed conveyor roller bearings out for metallurgical examination.	Steve Webb	Manhours(.5)	$45.00
Send failed conveyor roller bearings out for metallurgical examination.	Steve Webb	Manhours(.5)	$45.00
Send failed conveyor roller bearings out for metallurgical examination.	Ron Hughes	Manhours(1)	$100.00
Send failed conveyor roller bearings out for metallurgical examination.	Steve Webb	Manhours(.1)	$9.00
Send failed conveyor roller bearings out for metallurgical examination.	Steve Webb	Manhours(.1)	$9.00
Send failed conveyor roller bearings out for metallurgical examination.	Steve Webb	Manhours(.1)	$9.00
Send failed conveyor roller bearings out for metallurgical examination.	Steve Webb	Manhours(.1)	$9.00
			$3,561.00

Recommendation Costs

Related Cause	Team Member	Description	Total
Not Covered in Procedures	Ron Hughes	Manhours(40)	$2,800.00
Inadequate Training	Hugh Rentschler	Manhours(80)	$6,400.00
Lubrication Knowledge Deficiency	Hugh Rentschler	Manhours(120)	$9,600.00
Improper Lubrication	Mike Gaddis	Manhours(100)	$6,000.00
			$24,800.00

PROACT® RCA Analysis-At-A-Glance Overview

ANALYSIS AND TEAM DATA

Analysis Name:	Conveyor Rollers
Principal Analyst:	Ron Hughes
Team Members:	members not found
Team Charter:	To identify the root causes of the recurring conveyor roller failures in the cutsize system. This includes identifying deficiencies in or lack of management systems. Appropriate recommendations for root causes will be communicated to management for rapid resolution.
Critical Success Factors:	- A cross-functional section of plant personnel/experts will participate in the analysis - A disciplined RCA approach will be utilized - A measurement process will be used to track the progress of approved recommendations - All analysis hypotheses will be verified or disproven - Management agrees to fairly evaluate the analysis team's findings and recommendations - No one will be disciplined for honest mistakes
Start Date:	5/2/2003
Estimated Completion Date:	5/2/2003
Estimated Cost of Event:	$500,000.00

STATUS OF PRESERVE

Number of Data Collection Tasks Assigned:	16
Number of Data Collection Tasks Complete:	16
% of Data Collection Tasks Completed:	100%

STATUS OF ANALYZE

Number of Hypotheses:	32
Number of Verifications Assigned:	58
Number of Verifications Completed:	58
% of Verifications Completed:	100%

STATUS OF COMMUNICATE

Number of Root Causes Identified:	4
Number of Recommendations Proposed:	4
Number of Recommendations Approved:	3
% of Recommendations Approved:	75%

NUMBER OF RECOMMENDATIONS

Approved:	3	75%
In-Process:	3	100%
Completed:	0	No Data

ESTIMATED RETURN-ON-INVESTMENT (Year 1)

Estimated Cost of Event/Benefit Derived if Eliminated:	$500,000.00
Cost of Root Cause Analysis and Recommendations:	$34,796.00 (see Details)
Estimated Return on Investment (Year 1) (%):	1437%

Process Flow Diagram - Designed Process

Process Flow Diagram - Process That Occurred

Process Flow Diagram - Proposed Modified Process

Executive Summary: Root Cause Action Plan

Root Cause	Suggested Resolution/ Action Plan	Metric to Track	Responsible	Estimated Completion Date	Approved	In-Process	Complete
Not Covered in Procedures	Revise maintenance procedures		Ron Hughes	10/24/2002			
Inadequate Training	Set up training on lubrication practices and techniques for oilers.		Hugh Rentschler	10/24/2002	v	v	
Lubrication Knowledge Deficiency	Retrain oils on lubrication practices.		Hugh Rentschler	10/24/2002	v	v	
Improper Lubrication	Clean and re grease conveyor roller bearings.		Mike Gaddis	10/24/2002	v	v	

Executive Summary: Estimated Return-On-Investment (Year 1)

Est. % of Annual Loss	Root Causes Identified	Annual Losses (Potential Benefit)	Sum of Recommendations	Estimated ROI (Year 1)
%	Not Covered in Procedures	$.00	$2,800.00	%
%	Inadequate Training	$.00	$6,400.00	%
%	Lubrication Knowledge Deficiency	$.00	$9,600.00	%
%	Improper Lubrication	$.00	$6,000.00	%