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MAKING BAD ACTOR ELIMINATION PROGRAMS WORK

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INTRODUCTION

Most plants have pieces of equipment that are chronic problems. In some operations, machinery problems can be a leading cause of outages, while in others, solids handling equipment problems, aggressive corrosion of pressure equipment, erosion of parts or power failures are the issue. Problems can often be traced back to a lack of procedures, poor employee morale, or a lack of training. These problems impact profitability due to the frequency of outages, unexpected cost of repairs, and cost of lost production.

Studies have shown the cost of unplanned and emergency work increases 3 to 9 times more than the cost of planned work (Campbell, 2001) (Strawn) (O'Brien). A typically reasonable and conservative figure used in cost/benefit calculations is 4 times the cost. Primarily, this increase is due to pulling people off planned jobs to address emergencies, lack of a plan when equipment crashes unexpectedly, lack of spare parts, overtime or premium pay for repair shop space, and sub-optimal sequencing of work.

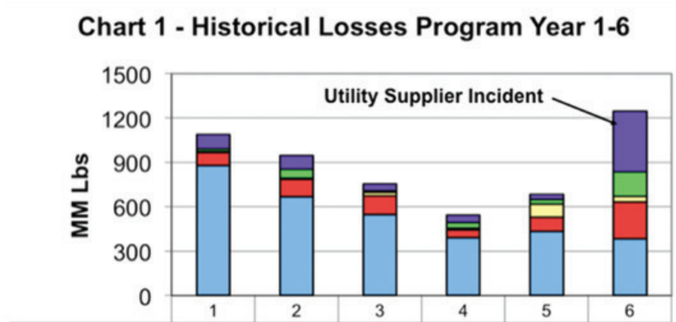
Process and personal safety are also major considerations in a plant with chronic equipment issues. Frequent failures can result in the release of process materials, fires, personnel exposure to hazardous chemicals, and each maintenance activity comes with certain risks. These risks increase when equipment fails unexpectedly and there is pressure to restore operations.

These problems can also negatively impact employee morale due to interruptions of planned work, pressure to improve the situation, and frustration that another evening or weekend is disrupted once again repairing the same piece of equipment. We term these equipment items "Bad Actors."

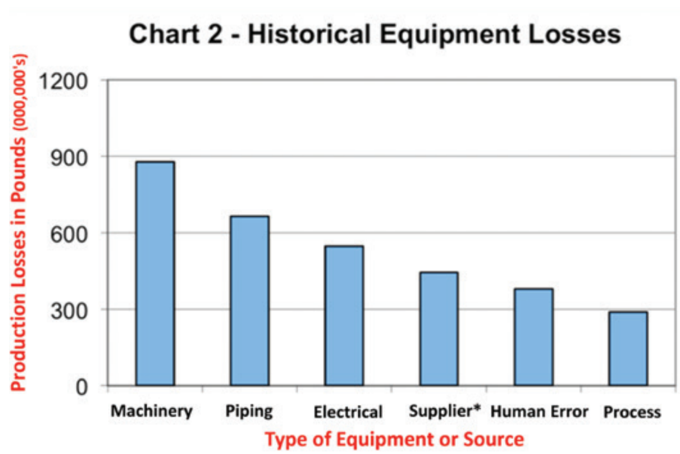
In this article, the first in a series of articles on improving plant reliability programs through improvements in culture, programs, and equipment performance, I focus on Bad Actor Elimination.

BAD ACTOR ELIMINATION

It is critical that a plant takes some specific actions to eliminate "Bad Actors." The first step is to identify which pieces of equipment are routinely impacting safety, production, and cost. Early in the program, simply interviewing the operations and maintenance personnel in a plant will likely identify the top "Bad Actors." However, to truly get an accurate handle on this situation, data is required. The computerized maintenance management system (CMMS) should be a key element in this process. Queries of maintenance costs and number of outages by equipment type first should be developed to identify classes of equipment that are problems. Also cost of production loss should be developed or estimated. Data then can be graphed on three Pareto charts showing frequency of outage, cost of repairs, and production loss. Then a drill-down should be constructed to determine which specific equipment tag numbers are the worst performers. By performing this exercise and displaying the results on a series of Pareto charts, the plant management will be able to assess very clearly if they have a problem with, say, a specific pump service—or if the entire pump program is an issue.



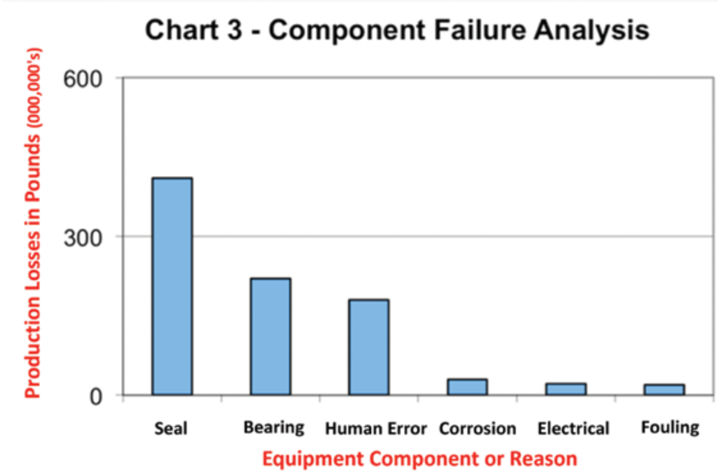
	1	2	3	4	5	6
Supplier	96	91	44	48	36	412
Other	20	62	11	39	32	166
Human Factor	6	7	27	13	90	40
Process	89	121	125	52	93	245
Equipment Failure	878	665	547	391	434	385

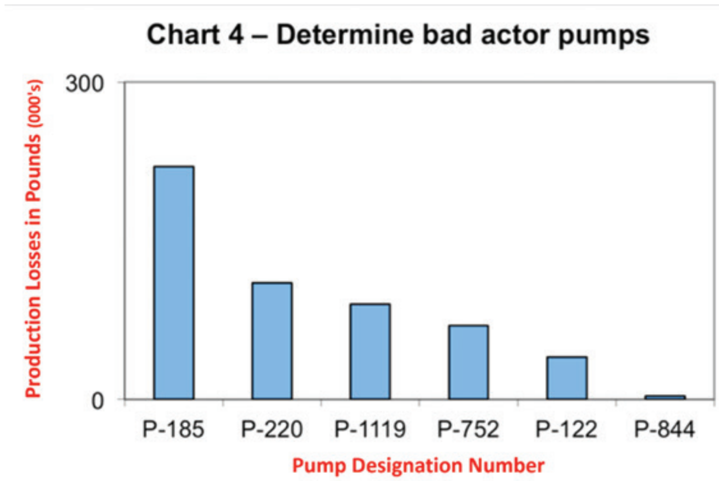


Examples of how Pareto Charts can be used to identify Bad Actors are shown below. Charts similar to these can be used for analysis of any class of equipment that may be causing problems; then drill-down charts can identify problem components or specific equipment tag numbers.

Chart 1 shows overall historical losses for a manufacturing company. The chart emphasizes how a single incident can dominate the results for annual reliability performance.

Next, **Chart 2** shows a breakdown of Losses by Equipment Type Failure. In this example Machinery failure was the highest loss category and a key focus area for reliability improvement. The chart is based on millions of pounds of product loss. Additional





charts could identify frequency of these failures and total dollar losses for production and maintenance expense.

Additional breakdowns of the failures can reveal the types of components that are failing. An example is shown in **Chart 3**.

In addition, specific pieces of equipment that are Bad Actors can be identified through this process. **Chart 4** is an example of this exercise.

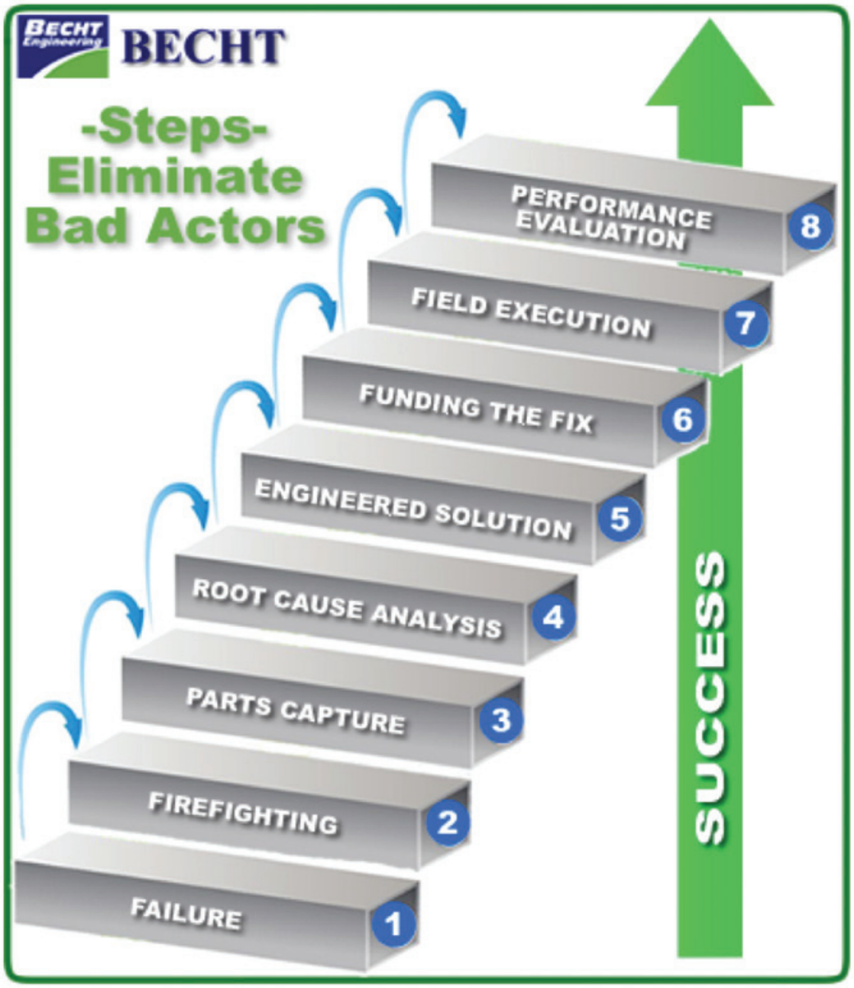
As a result of the graphical representations, management should be able to recognize opportunities for improvement in reduced maintenance costs and added production. The next step in the process is to identify the root cause of the problem. Subsequently, an evaluation of the cost of the remedy and likelihood of success by implementing the solution can be performed.

A case study of how this process can be effective in reducing outages, improving reliability and enhancing safety involves an evaluation of a major olefin producer's corrosion-under-insulation program.

This particular operating company had been suffering significant production losses, fires and spills due to corrosion-under-insulation. At the time, the company was using API inspection methods and focusing on internal corrosion and damage mechanisms. In many services in olefins plants, the product is relatively clean and there is little concern about internal corrosion. By utilizing Pareto analysis, the company determined that over 90 percent of the leaks were caused by external corrosion. The company altered the focus from internal to external corrosion, identified areas most vulnerable to CUI, and attacked the problem in a prioritized, long-term program. Result - leaks, outages and fires were reduced significantly.

Root Cause Analysis (RCA) is an effective tool in the Bad Actor elimination process; however, this alone does not solve the problem or improve equipment performance. There are several steps prior to and beyond the RCA that must be executed in order to achieve equipment performance improvement. A building block process to achieve this success is illustrated below:

This 8-step process to eliminate Bad Actors includes a number of elements subsequent to **1.** Equipment Failure. A **2.** Firefighting



(triage) step may be needed to restore production. At the same time the failed **3.** Parts should be Captured in the "as failed" condition to preserve evidence of the failure and to assist the next step, **4.** Root Cause Analysis. The RCA can utilize a number of methods. The key to a good RCA is to have a broad, knowledgeable team and the right data on the failure. The next steps are to **5.** Engineer a Solution, **6.** Fund the Effort and **7.** Execute the Work. An **8.** Evaluation of the success of the fix should be performed. It is critically important to get the problem solved the first time to demonstrate the process is effective and gain credibility for the program. In some cases, spending a bit more for a sure solution is better than trying to shave cost by implementing a marginal solution.

Many plants fail to realize there will be no improvement in equipment performance until the seventh step in this sequence, proper and effective Field Execution, is achieved. In fact, if the seventh step is not effectively executed, the efforts up to that point will result in additional costs for analysis, engineering, preparing funding requests, and other waste due to a poor fix. Many plants get caught in a "do loop" ahead of field execution of the solution. These loops may include pure firefighting where the plant is in a fail-fix-fail recycle loop. Other plants may have sound root cause analysis but fail to get to the engineered solution, funding, or field execution. These plants will have significant difficulty addressing and eliminating chronic equipment issues.

The last step in the process, Performance Evaluation, is key to determine the effectiveness of the solution—especially if the solution is to be applied to an entire class of equipment. Moreover, this is vitally important if the root cause analysis identifies human factors or procedures as the problem. Evaluation of the effectiveness of training and change management is also an important step. ■

For more information on this subject or the author, please email us at inquiries@inspectioneering.com.

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Rick Hoffman joined Becht Engineering in June, 2009 as a Senior Engineering Advisor. He has more than 39 years of experience in engineering, reliability management and maintenance in the refining, petrochemical and synthetic fuels industries. Prior to joining Becht Engineering he was the Director, Specialty Engineering for LyondellBasell Industries. In this role he had worldwide responsibility for corporate technical support, mechanical engineering and maintenance for more than 40 chemical plants and two refineries. He was also responsible for capital project support, setting the strategic direction for Lyondell maintenance.