Defect Elimination | Principles, Steps, and Framework

Defect elimination plays a significant role in a stellar maintenance program. Although the concept seems simple in theory, it can be more challenging in practice. In a nutshell, the process works to eliminate defects causing downtime, production losses, and waste. The complicating factor, however, is people are involved. Finding a way for the whole organization to rally around the idea of defect elimination will be the key driver to long-term success.

A defect is anything that erodes value, reduces production, creates waste, or compromises employee health, safety, or environmental performance. Think of them as not only bugs that are attacking equipment, but also attacking processes and practices throughout the organization.

In this article, we'll share a blueprint for creating a defect elimination process at your organization.

Defect Categories

Defects can be separated into five broad categories:

- **Defects from raw materials**. Raw materials include anything necessary for production, depending on the industry. For example, a paper mill might find a nail in a log causing damage to the equipment during processing.
- **Operational discipline**. Normal wear and tear falls into this category as well as excessive wear and tear coming from how equipment is operated. A lack of skills or training may contribute to operational discipline defects.
- **Workmanship**. Although missing skills or tools fall into this category, more importantly, it's the expectation that faster repairs are better than correct repairs. Consistent quality workmanship should be the expectation.
- **Quality materials**. Defects coming from vendor parts affect material quality. However, problems occurring during transportation or storage of materials would also fall into this category.
- **Design**. Defects from design include anything design-related within equipment, processes, and practices that don't meet current business needs. For example, a facility that was designed perfectly 20 years ago and no longer meets new business needs has defects from design. Design for operability and maintainability are also included in this category.

Difference Between Planned Maintenance and Defect Elimination

The main difference between planned maintenance and defect elimination is the focus of the effort. The first looks at how frequently a piece of equipment or process needs inspection, lubrication, replacement, or some other type of maintenance work and schedules that accordingly. The latter asks the question, why is the breakdown happening in the first place, and can we eliminate the cause of the issue?

For example, a refinery was having trouble with product specifications because they had a control valve with a positioner that failed frequently. The frustration with the frequent failure and resulting specification problems initially drove the team to study how frequently this event was occurring, which was about every 90 days.

The company implemented planned maintenance to improve the situation, preordering the parts and kitting them so the replacement could be done during scheduled downtime at 90-day intervals. The planned maintenance was incredibly effective at improving work efficiency, reducing maintenance costs, and preventing product quality problems.

A couple of years later, a small cross-functional team with a defect elimination mindset started looking for the sources of the defect. The team contacted the part vendor and learned that 90 days was a very short lifespan for this particular instrument. After examining the instrument's specifications, they then visited the field to see the part in action. The team noticed the positioner was located on an uninsulated hot oil line, and they knew from their conversations with the vendor the part had temperature limitations.

The temperature was above the continuous operating limit of the instrument, but below the maximum limit that would cause failure, which resulted in the short lifespan. The team insulated the surrounding pipe to prevent the heat from getting to the positioner. As a result, the latest positioner has not needed replacement for more than three years.

Replacing malfunctioning positioner on control valve

Eliminating the source of the defect: excessive heat

Framework for an Effective Defect Elimination Process

When most businesses tackle maintenance and reliability issues, they usually dedicate significant resources to address the largest problems. Although this is logical in many ways, the important thing to remember is this means very few resources are dedicated to the small issues, which cumulatively, equal or exceed those major efforts. Defect elimination targets fixing those small issues throughout an organization.

Here's a basic framework to create an effective defect elimination process:

- **Find a defect.** The key to this first step is to allow your employees to identify a defect they want to eliminate, not assign one to them. This is important because the ultimate goal is to create a culture where everyone is looking for defects to eliminate. This empowerment from the beginning will help create that culture.
- **Verify defects are within boundaries.** Empowering employees within a set boundary space will encourage more freedom. This can mean within a particular production line or process or within a certain department. Instead of constraining employees, boundaries provide more freedom within an allotted space.
- **Establish a team.** Instead of assigning people to a defect elimination team, recruit three to six people from cross-functional areas who are empowered to take action. Try to build a team with individuals who have the power to remove defects as well as those who can prevent defects in the first place.
- **Prevent defects from reoccurring**. Instead of just performing a traditional repair, the team may need to be trained to look for defect sources to prevent its future recurrence.
- **Eliminate defect**. Be sure the team doesn't become a recommendation team, but is empowered to take action. They may need additional help to eliminate the defect, but they should be intimately involved in the process.
- **Document success**. Upon completion, it's important to document the success in a simple-to-share format with before and after pictures.
- **Calculate and track the savings**. At some point, someone's going to want to make sure the effort and the money being put into this process is paying dividends. Since all of these projects are small, be sure your tracking system doesn't overwhelm the size of these projects. A simple spreadsheet can do the job.
- **Tell the stories of the defect elimination teams.** Everybody wants to know the numbers, but what they're actually going to remember are the stories that go along with them. Gather details as well as data.

Three Ways Management Can Provide Support

Like most company-wide initiatives, top-down support is necessary to get the ball rolling for a defect elimination process to be successful. However, in order to achieve true engagement (and not just malicious compliance), the idea has to build momentum over time on its own. Three things management can do to encourage that momentum include:

> **Inspiration**. Management needs to inspire employees to improve and take action. Employees need to understand why it's important at this moment in time and why they should care. The inspiration needs to be personal, sincere, and emotionally significant.
> **Structure**. Management needs to set clear boundaries including what's acceptable to work on as well as defining and communicating a simple process to participate.
> **Support**. Management needs to explain how to launch teams, fund these small ideas, track progress, and share success.

An Organizational Practice Field

The Manufacturing Game® was designed to show how all of the best practices fit together and to give a clear understanding of what needs to happen to improve. It deals with the integration of real-life production and maintenance functionality including high-priority factors such as Health, Safety, and Environmental considerations and a "Don't Just Fix It, Improve It" (DJFI) approach to reducing the amount of work needing to be done.

When George Mahoney, Program Manager and Business Optimization Lead for Procurement at Merck, heard about this game, he was quickly sold.

> "We had some ups, and we had some downs, but we ended up winning a national award for being the best at defect elimination," Mahoney said. "A mantra created by our mechanics was 'let's get the bugs out.' As we dug deeper into it, we realized the defect elimination game was 'the how.'"

A Better Day at Work

For Mahoney, he wanted to give everyone a better day at work by having more control over their day. Defect elimination really targeted those little things that bothered individual employees—and then gave them the power to fix them.

> "If they're able to have a better day at work, maybe they'll have a better day with their family afterward or have an easier ride home," Mahoney explained. "Even if it's just a better day at work, we still win. A happy mechanic is a more productive mechanic."

Small Wins Develop Habits

By starting with the smallest jobs possible, a company can gain momentum, develop behaviors and habits, and change company culture. Here are some examples Mahoney shared.

> **Adding a Water Separator**
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> A mechanic was working in a chilled water building where leaky seals were a problem, and water was destroying bearings. This mechanic recommended a water separator, so he could see when water was getting in as well as prolong the life of the bearing by periodically draining out the water. The mechanic could then change the bearings when he wanted instead of waiting for a catastrophic failure. Although this very simple solution didn't eliminate the problem, it did buy time and gave that mechanic control.
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> **Installing a Barometric Damper**
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> Mechanics who frequently fixed roof-based fan motors in the winter noticed some motors were spinning from wind blowing in the opposite direction. This required the motor having to overcome that momentum, which led to prematurely wearing off the bearings. The suggestion to install a barometric damper came up. Since these only open when the fans kick on, the problem was solved.
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> **Door Handle Extension and Signage**
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> A door designed for a hospital was being used incorrectly, resulting in personal injury or broken door cams. Someone suggested adding an extension on the handle and a bullseye sign saying, "Hit it here," which solved the problem.

Don't Just Fix It, Improve It

Organizations who implement a DJFI mentality often see significant improvements in their organizations because they encourage a culture shift, a different mindset. Some managers worry that mechanics who are given free reign to submit work orders or improve things on their own will take their focus off their work.

> "However, if you improve only 1% of your corrective maintenance work orders, you're going to have a monumental impact," Mahoney said. Be sure you measure that 1% to see if that's the case in your organization; in one example, an organization experienced a 30% reduction in materials and labor costs because not only did technicians improve things, but they stopped breaking them in the first place.

Creating an Elite Underground Team

Although teams are common in the business world, creating a fun spin on a defect elimination team can make a significant difference in how the concept is embraced.

> "We created the Shadow Network," Mahoney explained. "It was an underground network. We didn't tell anyone that they were on this team; we basically had a group of people who knew someone who knew someone who could get things done."

The Shadow Network was a group of go-getters who could help the cause of defect elimination**.**

> "Our first rule was we had to make it exclusive, so members would feel special being part of the group," Mahoney said. "The next thing was we kind of made it interesting by the way we communicated with them. Finally, we kept things simple and small."

Conclusion: A Good Infection

Once the momentum builds for defect elimination, it's difficult to stop.

> "Every time we held one of these defect elimination sessions, I made it my personal business to go out and look at those projects, every single one of them," Mahoney said. "People were so proud of what they did, it was almost impossible not to go look at them."

Once a group plays the game and completes some small projects, the momentum will spread like a good infection.

> "We found that every time we played a new game, our defect elimination doubled," Mahoney added. The game reminded people to take on another small defect elimination project and continued to amplify overall results. "One of the keys to success was continually reinforcing it and giving positive feedback."

FAQs

How Did You Find the Data for Defect Elimination Projects?
Although some people would tap into a computerized maintenance management system (CMMS) and find the biggest programs, the program works best when you simply ask people what bothers them most and give them the freedom to eliminate or repair it.

It's important to review things like the number of projects completed or money saved on a weekly basis. Data from completed work orders that are marked DJFI can be used to validate and quantify completed projects.

Also, the game works well if a management group provides the focus or boundaries such as safety problems, quality issues, or saving energy, or provides a "top ten" list that can serve as an example and prompt. The key is you're letting people pick things they're passionate about, because ultimately, it's not about making one defect go away, it's about changing the culture to a defect elimination culture.

How Did You Scale This Across Multiple Sites Within Your Organization?
It's important to share results, not only in terms of numbers, but by example. Take other members of a department to a site where defect elimination occurred and share the successes in person. When the passionate person who made the change can share the excitement with others, it can be infectious.

We encourage companies to ask leadership for a small chance to try the program because it requires very little upfront cost and investment. Showing results can help obtain the management team to encourage scaling up from there.

What Was Your Biggest Lesson Learned From Implementing Defect Elimination?
Mahoney explained he learned to shift his focus from equipment to people.

> "I was so frustrated; I felt like I was screaming into a tunnel and no one was listening," he said. "But until you care about the people, until you care about how they work, the conditions they're in, what they care about, nothing works. No program will work if you forget about the people who are operating and running the equipment."

How Did You Calculate Cost Savings and Avoidance by Successfully Implementing a Defect Elimination Project?
Cost savings were either calculated simply by comparing how many times a piece of equipment used to fail vs. how often it failed now, or using a sophisticated tool that was validated by multiple third-parties as an effective way to quantify cost savings. Some things could be quantified by using CMMS data as well.

How Do You Cascade Lessons Learned to Other Personnel?
Although each defect elimination team is a small group, the efforts should be company-wide and even include key contractors and vendors. In addition, each group should be cross-functional, which would touch different departments with each effort.

> "We used our Shadow Network meetings to spread the successes," Mahoney said. "We would show a picture of a defect we eliminated, and ask that group if there was anywhere else in the company where we could do the same thing. It was one way we amplified the results of our lessons learned.
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> "In the end, it's this socio-technical network, where now people across the organization are working together," he added. "They have eliminated all these silos, and they've fixed this piece of equipment or that process. It's really not about sharing lessons learned with everybody else; it's about changing behaviors so employees stop breaking equipment and feel empowered to fix it."

Watch the Video Presentation here:
https://app.livestorm.co/upkeep/implementing-a-defect-elimination-process