# Notice!

- This file is a ‘disabled’ file. It is not complete. Slides have been left out and other info is lacking. I have posted this file for general information.

- This file in its entirety is available for US$50 in Microsoft’s Powerpoint format.

- E-mail me for details.

- marc@qs9000.com

# The 8-D Methodology

-

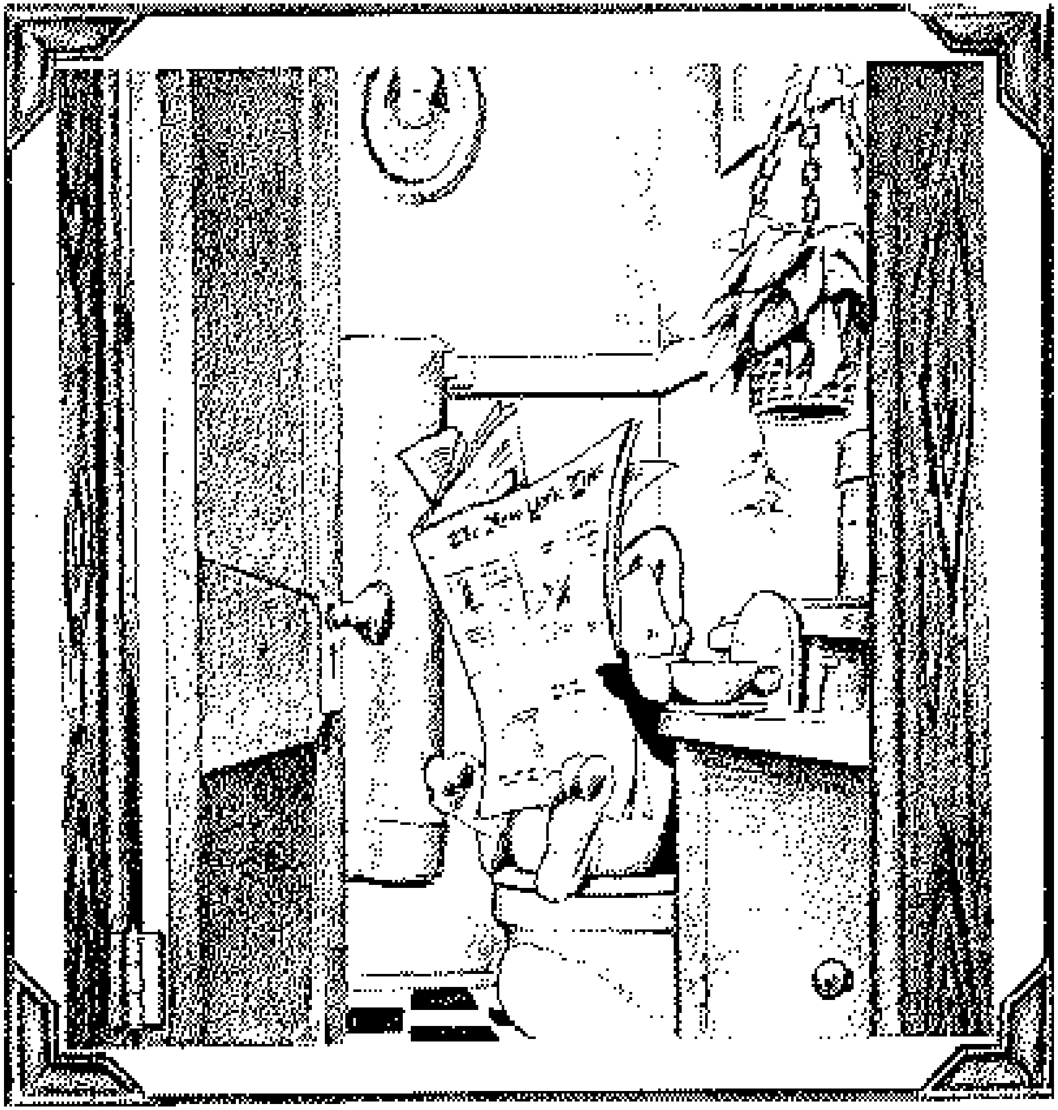
A Philosophy

and

A Part Of

Continuous Improvement

# Don’t Let This Happen To YOU!

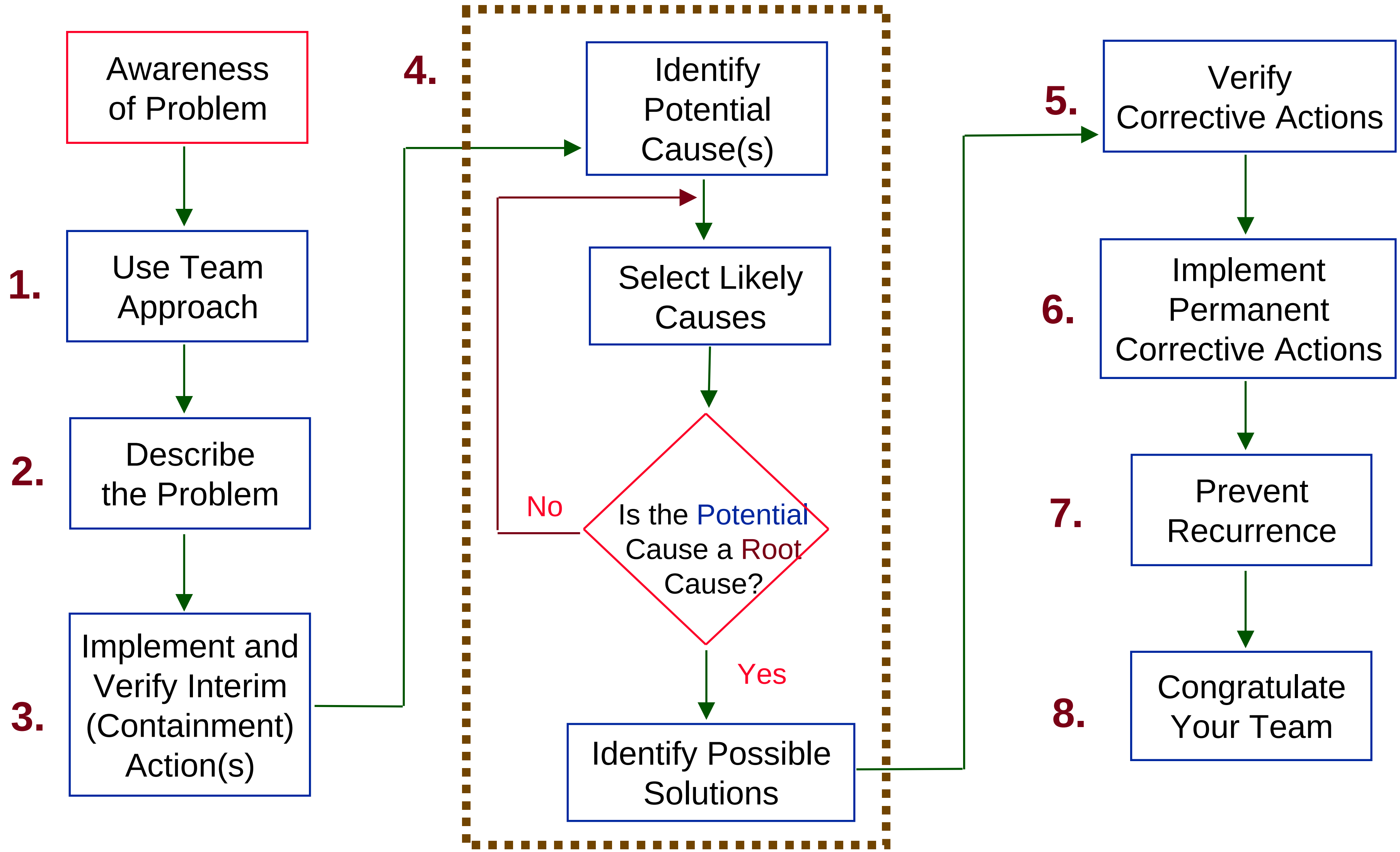


# 8 Discipline

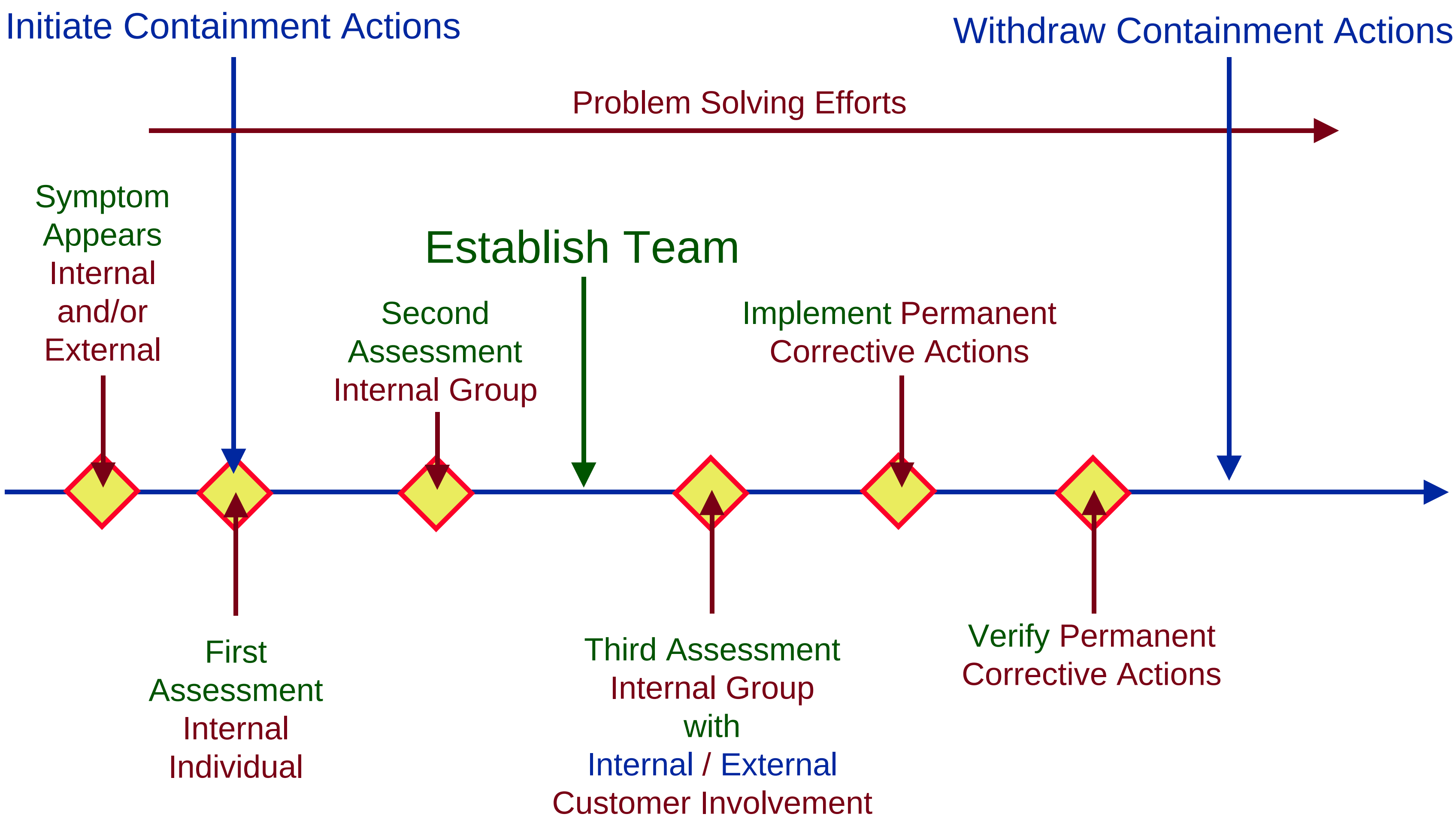
-

# A Problem Solving Methodology

# The 8-D System



# Typical Process Time Line




This process can stop or loop back upon its self at any point in the process.

# Process Variation

- **All variation is caused**. There are specific reasons why your weight fluctuates every day, why sales go up, and why Maria performs better than Robert. Management must recognize that variations in production or quality within manufacturing or service processes can be viewed as "special cause" variations, which are best removed by team members operating the process and "common cause" variations, which require management action to change some inherent feature of the process. There are four main types of causes.
- **Common** causes are the myriad of **ever-present** factors (e.g., process inputs or conditions) that contribute in varying degrees to relatively small, apparently random shifts in outcomes day after day, week after week, month after month. The collective effect of all common causes is often referred to as **system variation** because it defines the amount of variation inherent in the system.
- **Special** causes are factors that **sporadically** induce variation over and above that inherent in the system. Frequently, special cause variation appears as an extreme point or some specific, identifiable pattern in data. Special causes are often referred to as **assignable** causes because the variation they produce can be tracked down and assigned to an identifiable source. (In contrast, it is usually difficult, if not impossible, to link common cause variation to any particular source.) Special Cause variation results from events which are occurring outside the process. For example, a relatively major change in temperature or humidity could cause significant variation (points outside control limits) in the process.

# Causes of Variation

## Common Causes

- When all variation in a system is due to common causes, the result is a stable system said to be in statistical control. The practical value of having a stable system is that the process output is predictable within a range or band. For example, if a stable order entry system handles 30 to 60 orders a day, it will rarely slip to fewer than 30 or rise to more than 60.

## Special Causes

- If some variation is due to special causes, the system is said to be unstable since you cannot predict when the next special cause will strike and, therefore, cannot predict the range of variation. If a system is unstable and subject to special cause variation, its capability might sporadically (and unpredictably) drop sharply below or rise sharply.

# Process Variation

- **Tampering** is additional variation caused by unnecessary adjustments made in an attempt to compensate for common cause variation.
- Tampering with a process occurs when we respond to variation In the process (such as by “adjusting” the process) when the process has not shifted. In other words, it is when we treat variation due to common causes as variation due to special causes. This is also called “responding to a false alarm,” since a false alarm is when we think that the process has shifted when it really hasn’t.
- In practice, tampering generally occurs when we attempt to control the process to limits that are within the natural control limits defined by common cause variation. We try to control the process to specifications, or goals. These limits are defined externally to the process, rather than being based on the statistics of the process.
- Rather than using the suggested control limits defined at ±3 standard deviations from the center line, we instead choose to use limits that are tighter (or narrower) than these (sometimes called Warning Limits). We might do this based on the faulty notion that this will improve the performance of the chart, since it is more likely that subgroups will plot outside of these limits. For example, using limits defined at ±2 standard deviations from the center line would produce narrower control limits than the ±3 standard deviation limits. However, you can use probability theory to show that the chance of being outside of a ±3 standard deviation control limit for a Normally-distributed statistic is .27% if the process has not shifted. On average, you would see a false alarm associated with these limits once every 370 subgroups (=1/.0027). Using ±2 standard deviation control limits, the chance of being outside the limits when the process has not shifted is 4.6%, corresponding to false alarms every 22 subgroups!

# Process Variation

- **Deming showed how tampering actually increases variation.** It can easily be seen that when we react to these false alarms, we take action on the process by shifting its location. Over time, this results in process output that varies much more than if the process had just been left alone.
- **Structural** variation is regular, systematic changes in output. Typical examples include seasonal patterns and long-term trends.

- The strategy for special causes is simple: Get timely data. Investigate immediately when the data signals a special cause is/was present. Find out what was different or special about that point. Seek to prevent bad causes from recurring. Seek to keep good causes happening.
- The strategy for improving a common cause system is more subtle. In a common cause situation, all the data are relevant, not just the most recent or offending figure. If you have data each month for the past two years, you will need to look at all of that data.

# Process Variation

- Distinguishing between the four types of causes is critical because the appropriate managerial actions are quite different for each. Without this distinction, management will never be able to tell real improvement from mere adjustment of the process or tampering. In practice, the most important difference to grasp first is the difference between special cause variation and common cause variation.

# Analysis vs Action

The ‘disciplines’ which make up the 8-D process are divided into **Analysis** and **Action** steps.

## Analysis Steps

- Δ D2 Problem Description Analysis - A method to organize information about the Symptom into a Problem Description through the use of repeated WHYs.
- Δ D4 Root Cause Analysis - A process to arrive at Root cause paths.

## Action Steps

- Δ D3 Containment - An interim Verified action that will prevent the Symptom from reaching the customer.
- Δ D5 Choose Corrective Action - The best corrective action which, when implemented in D6, permanently eliminates the Root Cause of the problem.
- Δ D6 Implement Corrective Action - The best corrective action from D5 that is introduced into the process and Validated over time.
- Δ D7 System Preventive Action - Actions which address the system that allowed the problem to occur.

# Problem vs Symptom

- **At this point it is important to distinguish between a problem and a symptom.** A symptom, for example, could be a split in a seam.
- Generally, there are a series of problems associated with a process that causes a symptom (in this case the seam split). A symptom often illustrates a ‘gap’ between the desired quality (of the seam) and its actual quality. The seam split because of a problem in the process.
- Every company has its own internal system for appraising symptoms and problems. Sometimes a symptom occurs where 1 person can evaluate the problem and address it. Other times the symptom is significant and requires a team to investigate and remove the cause.

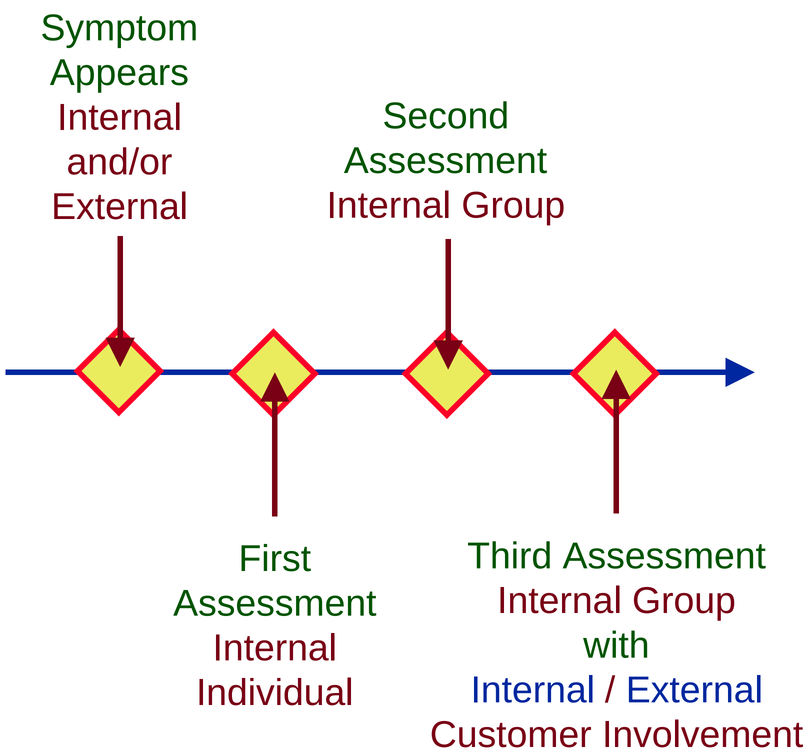
# When An 8-D Is Necessary

- Using 'Good Judgment' is the first step in deciding when to start an 8-D. Often, however, an 8-D is a customer requirement in response to a problem.
- Ideally, a Measurable will indicate when an 8-D should be started. When an undesirable trend in a process develops, corrective action can be taken to reduce the cause of the variation before a symptom occurs in the process and escapes to the customer.
- If the undesirable trend triggers questions, a decision must be made whether the symptom can be fixed by an individual or whether the symptom requires further analysis. Further analysis typically indicates it's time to assemble an 8-D problem solving team.
- Often, an indication that an 8-D is necessary results from feedback from the customer that there is a concern with the product. That concern shows up as a **Symptom** that has been detected by the customer.

# When An 8-D Is Necessary

- At this point, each of you (in your thoughts) is wanting the instructor to provide a black & white explanation of when a formal 8-D is required. Unfortunately, the answer is that the only time an 8-D is 'required' is when a customer requires it.
- Each company provides an internal threshold. It is typically somewhat subjective. There is no 'absolute' in so far as when or how far. Many companies use a Review Board. But - each has it's own path.

# When An 8-D Is Necessary




There are typically several assessment points in a company's evaluation of a symptom.

Each assessment is a decision point - first by one or more individuals, then by 'official' groups.

At each point, 'reason' is used to decide whether a 'full' 8-D is necessary.

# Verification vs. Validation

**Verification** and **Validation** are often not well understood. Verification and Validation work together as a sort of 'before' (Verification) and 'after' (Validation) proof.

- **Verification** provides 'insurance' at a point in time that the action will do what it is intended to do without causing another problem. **Predictive.**
- **Validation** provides **measurable** 'evidence' over time that the action worked properly.

**PAYNTER CHART**
(Third Shift)

| | NUMBER OF WORKERS AFFECTED: | | | | | | |
|---|---|---|---|---|---|---|---|
| PROBLEMS: | JUL. | AUG. | SEP. | OCT. | NOV. | DEC. | TOTAL |
| TRAFFIC JAM ON E-WAY | 90 | 84▲ | 4 | 3☆ | 0● | | 181 |
| BUSES LATE | 30 | 30 | 9 | 8 | 30 | | 107 |
| CONSTRUCTION | 17 | 16 | 17 | 8 | 0 | | 58 |
| NOT ENOUGH PARKING | 9 | 10 | 20 | 21 | 9 | | 69 |
| BAD WEATHER | 4 | 0 | 0 | 0 | 21 | | 25 |
| TOTAL: | 150 | 140 | 50 | 40 | 60 | | 440 |

▲ — Containment Action: Change Shift Starting Times.
☆ — Corrective Action: Open Second Entrance, Change Shift Starting Times Back to Normal.
● — Corrective Action: Task Group Established.

| Step | Process | Purpose |
|---|---|---|
| **D3** | Verification | That the containment action will stop the symptom from reaching the customer. |
| | Validation | That the containment action has satisfactorily stopped the symptom from reaching the customer according to the same indicator that made it apparent. |
| **D4** | Verification | That the real Root Cause is identified. |
| **D5** | Verification | That the corrective action will eliminate the problem. |
| **D6** | Validation | That the corrective action has eliminated the problem according to the same indicator that made it apparent. |

# Investigative Questions

**10-10-321 NOW Offers You**
**50% Off On All Calls.**

**What does this statement tell you?**
**What information does it really contain?**
**What questions does it bring to mind?**

# Investigative Questions

**What other details might you want to know about?**

**What was the program before?**

**10-10-321 NOW Offers You**
**50% Off On All Calls.**

**50% off of what?**

**All calls everywhere?**

# D1

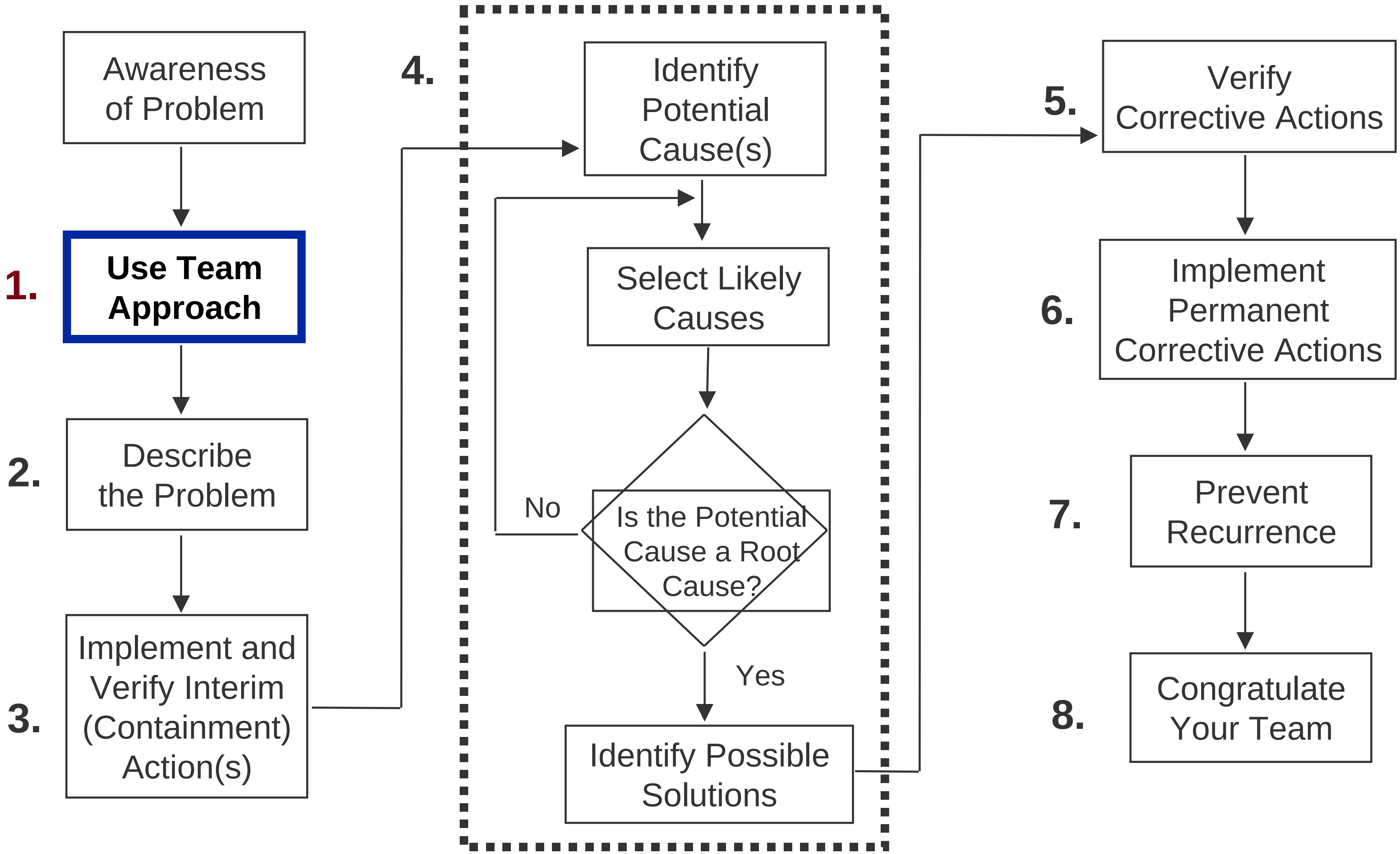
# Use Team Approach

# Team Approach

**Establish a small group of folks with the process / product knowledge, allocated time, authority and skill(s) in the required technical disciplines to solve the problem and implement corrective actions. The group must have a designated champion.**

**Team members must be empowered with the potential to 'change the rules'.**

# The 8-D System



# A Team Approach

- When a problem cannot be solved quickly by an individual, it is necessary to form a **Team**. The team will engage in the investigation and resolution of the problem. Many factors are critical to establish a group and to ensure that the group can work effectively together. Using a team approach is not just a step in the problem solving process, but an overriding framework for decision making.
- It is necessary to reevaluate team membership continually.
- Model for Effective Teamwork:

  Structure

  Goals

  Roles

  Procedures

  Interpersonal Relationships

# Establishing A Team (Flow)

Select Champion

↓

Recognition of Common Cause vs Special Cause Relationship Common Policy / Goal But Different Measures At Different Organizational Levels

↓

Select Team Members

↓

Select Leader

↓

Verify Cross-Functional Team Representation & Expertise

↓

Begin Investigation

# The Team - Basics

- What is a team?

  Two or more individuals who coordinate activities to accomplish a common task or goal.

- Maintaining Focus

  A separate team for each product or project.

- Brainstorm

  Brainstorming (the Team) is necessary as the intent is to discover many possible possibilities.

# Define Scope Of Team

- Select team members and functions
- Define roles and responsibilities
- Identify external customer needs, expectations and requirements
- Identify internal customer needs, expectations and requirements
- Complete preliminary studies
- Identify costs, timing and constraints
- Identify documentation process and method
- Develop investigation plan

# Natural Work Group vs Team

**Two Types of Team Structures**

| | Natural Work Group | Task Team |
|---|---|---|
| Membership | Work area or unit. Representatives from support groups on as-needed basis. | Representatives who have key information or are stakeholders. |
| Member Selection | Participation is mandatory. | Assigned by steering committee or uper management. |
| Project Identification | Assigned by management or identified by team and within its authority. | Assigned by or mnegotiated with steering committee or upper management. |
| Team Life Span | Ongoing. | Disbands when task is finished. |
| Leadership | Leader appointed by management. | Leadership shared or delegated by members. |

# Team Structure

- Size

  Four to 10 members. Larger teams become less effective and have minimal commitment to the problem solving effort. Larger teams should assess whether a steering committee and/or subgroups should be established.

- Support Needed

  ‘Appropriate’ levels of the organization must be represented.

- Environment

  Meeting locations are critical to good teamwork. A site should be quiet and not disruptive to team members. A site near the work area permits easy data collection and customer interaction is beneficial.

# Team Organization

**Cross-functional**

- Design Engineering (Typically the leader)
- Quality Assurance
- Purchasing
- Manufacturing Engineering
- Material Control
- Sales/Marketing
- Etc.

- Participation appropriate for phase being conducted
- Resources - Team defines 'Needs'
- *Should* involve customer or subcontractor participation (not always feasible)

# Decision Making Criteria / Model

- One person makes the decision
- One person consults the group, then makes the final decision
- Team or group makes decision based upon majority rule or consensus

# Roles In A Team

Several roles need to be established for the team. These roles are: Leader, Champion, Record Keeper (Recorder), Participants and (if needed) Facilitator.

## Leader

Group member who ensures the group performs its duties and responsibilities. Spokesperson, calls meetings, establishes meeting time/duration and sets/directs agenda. Day-to-day authority, responsible for overall coordination and assists the team in setting goals and objectives.

## Record Keeper

Writes and publishes minutes.

## Champion

Guide, direct, motivate, train, coach, advocate to upper management.

## Participants

Respect each others ideas.

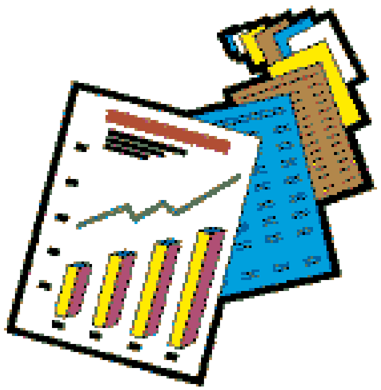
Keep an open mind.

Be receptive to consensus decision making.

Understand assignments and accept them willingly.

# Inputs To Team

- Field service reports
- Problems and issues reported from Internal customers
- Internal evaluations using surrogate customers
- Road trips (e.g.: Struts)
- Management comments and/or direction
- Government requirements and/or regulations
- Contract review
- Input from higher system level or past QFD projects
- Media commentary and analysis
- Customer letters and suggestions
- Things gone Right/Wrong reports
- Dealer comments
- Fleet operator comments



# Team Goals

For any group to come together as a team, it is critical that everyone be clear on the team's goal(s). All team member must share that goal. If any team members have different goals or have individual goals different or separate from the stated goal, these should be communicated to the team to avoid road blocks to the success of the team.

The goal needs to be clearly specified, quantifiable, and supported by all team members. The goal should be challenging, but still be attainable. By writing (documenting) the team's goal, all individuals on the team and the advisor to the team will 'stick to' and understand the goal.

# Basic Team Rules

- Team must develop their own ground rules
  - Once developed, everyone must live by them
  - Ground Rules are an aid to “self-management”
  - Team can modify or enhance the rules as they continue to meet
- Determine **if** there should be a meeting
- Decide who should attend
- Provide advance notices
- Maintain meeting minutes or records
- Establish ground rules
- Provide and Follow an agenda
- Evaluate meetings
- Allow NO interruptions

# Team Meeting Responsibility

- Clarify
- Participate
- Listen
- Summarize
- Stay on track
- Manage time
- Test for consensus
- Evaluate meeting process

# Team-to-Team Communication

- Manage by using a Team Captain or Champion
- Understanding of ‘How We Work As A Team’
- Should have a Focus Person & Distributed Minutes
- Customer teams
- Internal teams
- Supplier teams
- Sub-Teams
- Subcontractors should be encouraged to embrace APQP and QS 9000

# Successful Teams

- Are management directed and focused
- Build their own identity
- Are accountable and use measurements
- Have corporate champions
- Fit into the organization
- Are cross-functional

**Some teams just "Do Not Work"**

# Team Check List

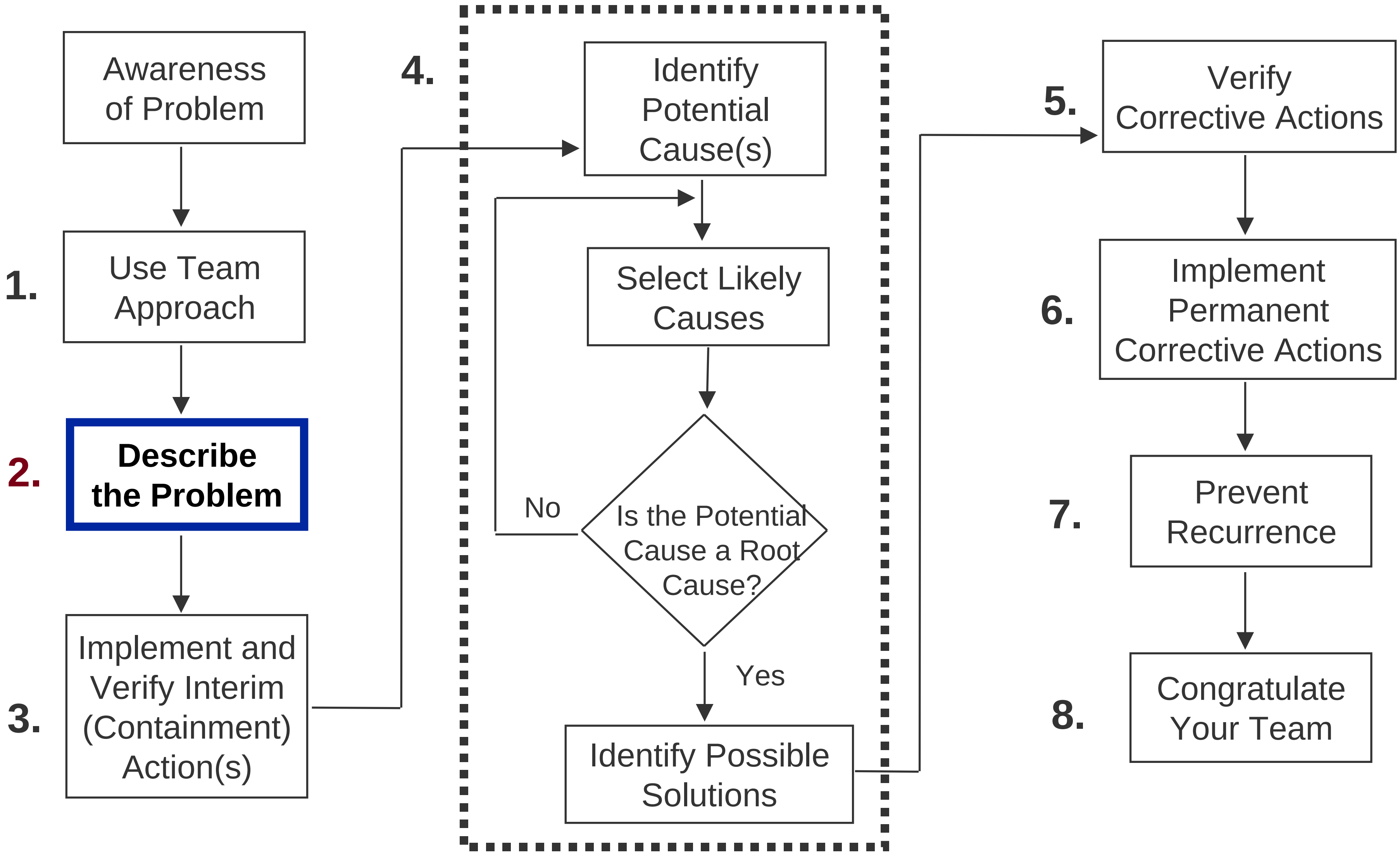
| Team Check List | Yes | No |
|---|---|---|
| Has a champion accepted responsibility for monitoring the measurables? | | |
| Have measurables been developed to the extent possible? | | |
| Have special gaps been identified? Has the common cause versus special cause relationship been identified? | | |
| Has the team leader been identified? | | |
| Does the team leader represent the necessary cross-functional expertise? | | |
| Has team information been communicated internally and externally? | | |
| Has the team agreed upon the goals, objectives, and process for this problem solving effort? | | |
| Is a facilitator needed to help keep process on track and gain consensus? | | |
| Does the team have regular meetings? | | |
| Does the team keep minutes and assignments in an action plan? | | |
| Does the team work well together in following the process and objectives? | | |

# D2
# Describe The Problem

# Describe the Problem

**Specify the internal / external customer problem by identifying in quantifiable terms the Who, What, When, Where, Why, How, How Many (5W2H) for the problem.**

# The 8-D System



# Describe the Problem

- Problem definition is the basis of problem solving. The definition is used during brainstorming sessions to identify potential causes. Potential causes are those most likely causes that appear on the surface to be the source of the problem. A potential cause may be the root cause but must be supported by evidence.
- Part of the problem solving process is to identify the root cause of the problem and understand why it existed in the first place. Only then can a permanent solution be chosen and implemented. to make certain the problem will never surface again. The root cause is the reason the problem exists - When it is corrected or removed from the system, the problem will disappear. It is important to improve our understanding of today's technology to make possible the planning required to achieve quality and productivity breakthroughs for tomorrow and into the future.

# Describe the Problem

It is important that the problem be described in terms that have the same meaning to everyone. This is best achieved through an operational definition. An operational definition consists of verifiable criteria that have the same meaning to the production workers, manager, customer, engineer, buyer, technician, team members, etc., and are used for past, present and future comparisons and analysis.

Sometimes problems are mistakenly described in terms of symptoms:

- Machine is down due to electrical problem. No backup machine or alternative available.
- The scrap rate has increased from "X" date from 3% to 22%.
- Customer warranty claims on "X" engine component is 12%.
- Failure of durability tests of a transmission component at 50,000 miles will delay launch.

# Describe the Problem

It is not uncommon for problems to be reported as symptoms. More examples are: noise, won't work, no power, machine down, broken tool, head froze up, contaminated, rough surface, porosity, shortage of parts, rattles, quality problem, worn out, line stopped, not to specification, labour problem, management problem, too much variation, etc.

The problem solving team must then use a systematic approach to define the real problem in as much detail as possible. A definition of the problem can best be developed using approaches that organize the facts to get a comparative analysis. These approaches do this by asking what 'is' against what 'is not'. Then they draw distinctions from this comparison, testing these against the problem definition and forming a statement or description of the problem which must be resolved.

# Describe the Problem

Systematic approaches to problem solving:

- Business as a System
- Analytical problem solving
- Process flow

Problem analysis methodologies:

- 5W2H
- Stratification
- Comparative analysis
- Similarity analysis

Key questions --> 5W's and 2H's:

- Who? What? Where? When? Why? How? How Many?

# Describe the Problem

Problem solving courses are offered by a number of companies. These courses can provide a basis of a systematic approach to problem solving with a generic approach to accommodate a wide range of applications.

One major concept taught in these courses is location: Where are you in the problem solving process? There are several ‘situation locations’ defined. They are:

- SA - Situation Appraisal
- PA - Problem Analysis
- DA - Decision Analysis
- PPA - Potential Problem Analysis

The extent of the problem (25%, 250 hours, 25,000 miles) and its consequences are usually known. After the initial part of the symptom definition an interim corrective action may be required.

# Describe the Problem

An in-depth analysis is required to clearly define a problem. There are many examples where the analysis for a complete problem definition results in the solution being identified. The analysis starts with preparation (or review of the existing) process flow diagram to define clearly the work process and alternative paths. Team preparation or review ensures that all individuals are familiar with the process. After the flow diagram is reviewed, there are three principle parts of the problem analysis:

- 5W2H
- Stratification
- Comparative/Similarity Analysis

First, quantify the 5W2H elements. In various problem analysis situations the investigators or problem solving teams must continually test to determine where they are located in the circle of circumstances. If a decision is made, what are the alternatives?

# Describe the Problem

It is sometimes difficult to define the problem and sort out real differences. The first, most important step, however, it to determine that the customer complaint is fully **understood**.

5W2H :

| | | | |
|---|---|---|---|
| 5 W | ∆ | **W**ho? | Identity customers complaining |
| | ∆ | **W**hat? | Identity the problem adequately and accurately |
| | ∆ | **W**hen? | Timing - When did the problem start? |
| | ∆ | **W**here? | Location - Where is it occurring? |
| | ∆ | **W**hy? | Identify known explanations |
| 2 H | ∆ | **H**ow? | In what mode or situation did the problem occur? |
| | ∆ | **H**ow Many? | Magnitude - Quantify the problem |

To reduce the risk of making wrong decisions, consideration and analysis of potential problems in advance will provide contingency actions to maintain control and protect the customer.

# Describe the Problem

5 W

- **W**ho? - Identity individuals associated with the problem. Characterize customers who are complaining. which operators are having difficulty?
- **W**hat? - Describe the problem adequately. Does the severity of the problem vary? Are operational definitions clear (e.g. defects)? Is the measurement system repeatable and accurate?
- **W**hen? - Identify the time the problem started and its prevalence in earlier time periods. Do all production shifts experience the same frequency of the problem? What time of year does the problem occur?
- **W**here? - If a defect occurs on a part, where is the defect located? A location check sheet may help. What is the geographic distribution of customer complaints?
- **W**hy? - Any known explanation(s) contributing to the problem should be stated.

2 H

- **H**ow? - In what mode or situation did the problem occur? What procedures were used?
- **H**ow Many? - What is the extent of the problem? Is the process in statistical control?

# Describe the Problem

Many problems arise from customer complaints. An internal customer's complaint could involve one department complaining that they cannot use the output of another department. An external customer complaint could involve a customer complaining to a dealer that a transmission 'shifts funny'. Frequently the wrong problem is solved and the customer complaint is not addressed. It is very important that the customer complaint be clearly understood. The only method to ensure this is to have direct customer contact. For internal customers, it is advisable to have representatives from the complaining organization as part of the problem solving team. In many cases this approach is the only way a problem can truly be solved. External customer complaints typically require direct interviews to understand why the customer is not satisfied. It is not unusual for a customer complaint to be misrepresented by a company reporting system that classifies problems in prearranges standard categories.

# Describe the Problem

Stratification Analysis determines the extent of the problem for relevant factors.

- Is the problem the same for all shifts?
- Do all machines, spindles, fixtures have the same problem?
- Do customers in various age groups or parts of the country have similar problems?

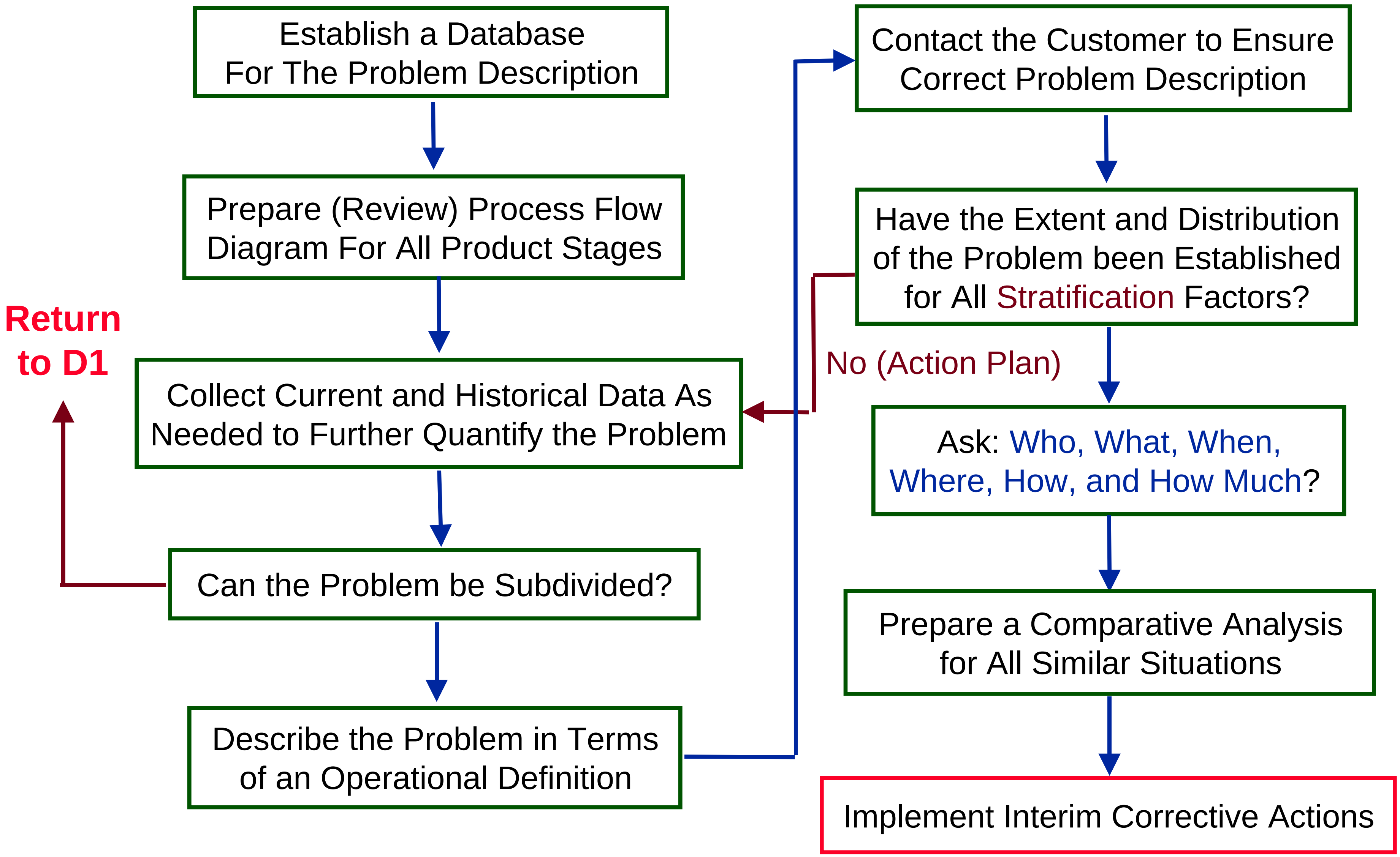
The important stratification factors will vary with each problem, but most problems will have several factors. Check sheets can be used to collect data. Essentially this analysis seeks to develop a pareto diagram for the important factors. The hope is that the extent of the problem will not be the same across all factors. The differences can then lead to identifying root cause.

When the 5W2H and Stratification Analysis are performed, it is important to consider a number of indicators. For example, a customer problem identified by warranty claims may also be reflected by various in-plant indicators. Also, customer surveys may be able to define the problem more clearly. In some cases analysis of the problem can be expedited by correlating different problem indicators to identify the problem clearly.

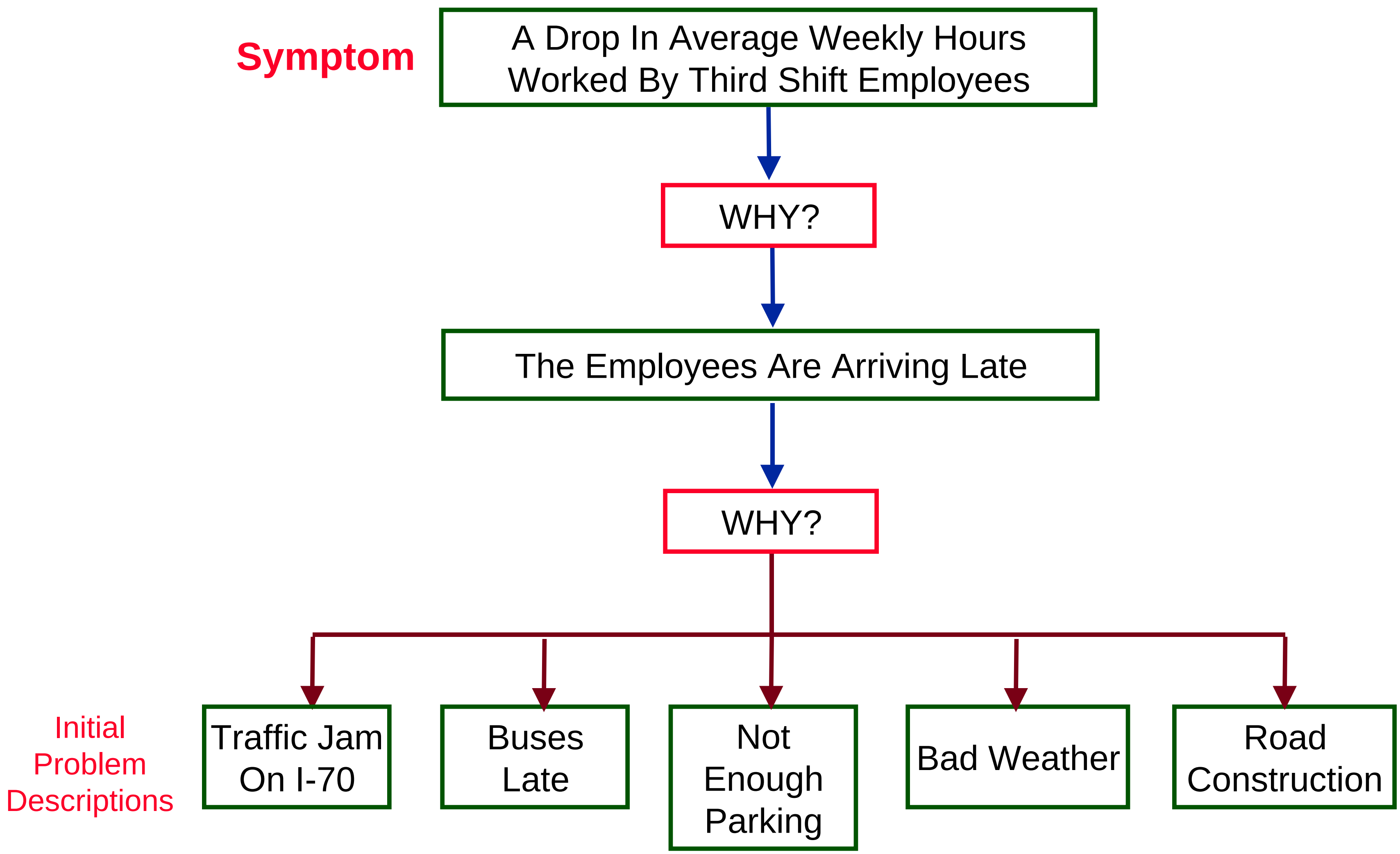
# Describe the Problem

- It has been said that there are no new problems, only different manifestations of old problems. In problem definition, it is often useful to quantify the problem in similar situations. The criteria to match similar situations will vary with the type of problem. Identifying effective matches and evaluating the presence of the problem provides useful information to generate potential causes and possible problem solutions. If the similarity analysis identifies a comparable situation where the problem does not exist, the analysis can focus on the differences in where the problem is occurring and where it is not occurring.
- Once the 3 types of analysis have been completed, it is sometimes possible to divide the problem into separate problems. It is easier to address these smaller problems because fewer root causes are involved. In the ideal case, a single root cause would be responsible for each problem. If the problem is separated, different teams may be required to address each problem.
- All three elements of the problem definition are not used for every problem. However, collectively the different analyses provide a comprehensible description. You are developing a '**specification**' of the problem.

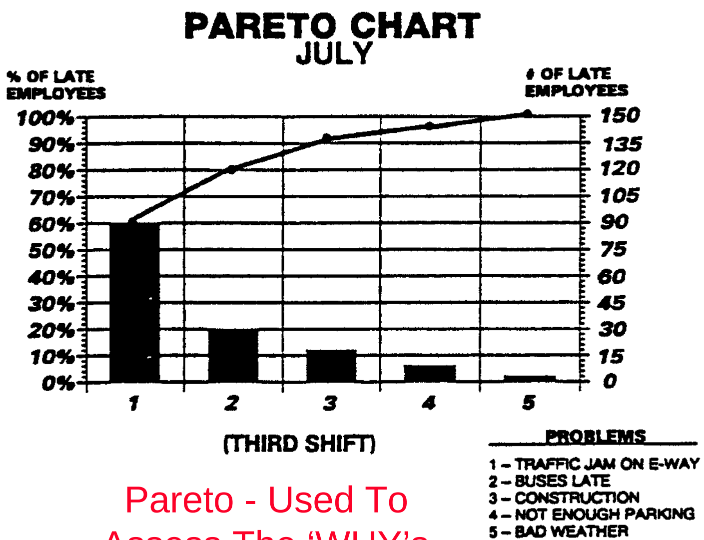
# Describe the Problem



# Describe the Problem



# Investigative / Tracking Charts




Pareto - Used To Assess The 'WHY's and for Tracking

**INITIAL PAYNTER CHART**

(Third Shift)

| | INCIDENCES: | | | | | | |
|---|---|---|---|---|---|---|---|
| PROBLEMS: | JUL. | AUG. | SEP. | OCT. | NOV. | DEC. | TOTAL |
| TRAFFIC JAM ON E-WAY | 90 | | | | | | 90 |
| BUSES LATE | 30 | | | | | | 30 |
| CONSTRUCTION | 17 | | | | | | 17 |
| NOT ENOUGH PARKING | 9 | | | | | | 9 |
| BAD WEATHER | 4 | | | | | | 4 |
| TOTAL: | 150 | | | | | | 150 |

Paynter - Used To Track Progress

# Questions To Ask For Is / Is Not

| | Is | Is Not |
|---|---|---|
| What: | What is the object you are having a problem with? | What could be happening but is not? |
| | What is the problem concern? | What could be the problem concern, but is not? |
| Where: | Where do you see the concern on the object? Be specific in terms of inside to outside, end to end, etc. | Where on the object is the problem NOT seen? Does the problem cover the entire object? |
| | Where (geographically) can you take me to show me the problem? Where did you first see it? | Where else could you have observed the defective object, but did not? |
| When: | When in time did you first notice the problem? Be as specific as you can about the day and time. | When in time could it have first been observed, buy was not? |
| | At what step in the process, life or operating cycle do you first see the problem? | Where else in the process, life or operating cycle might you have observed the problem, but did not? |
| | Since you first saw it, what have you seen? Be specific about minutes, hours, days, months. Can you plot trends? | What other times could you have observed it but did not? |
| How Big: | How much of each object has the defect? | How many objects could be defective, but aren't? |
| | What is the trend? Has it leveled off? Has it gone away? Is it getting worse? | What other trends could have been observed, but were not? |
| | How many objects have the defect? | How many objects could have had the defect, but didn't? |
| | How many defects do you see on each object? | How many defects per object could be there, but are not? |
| | How big is the defect in terms of people, time, $ and/or other resources? | How big could the defect be, but is not? |
| | What percent is the defect in relation to the problem? | |

NOTE: Every Question May Not Apply!

# Is / Is Not Example

| | Is | Is Not |
|---|---|---|
| **What:** | | |
| Object | Heavy traffic | |
| Defect | Late Employees | |
| **Where:** | | |
| Seen on object | I-70 Expressway | |
| Seen geographically | East bound I-70 near Main Street | |
| **When:** | | |
| First seen | July 7, 1996 | |
| When else seen | Ever since | |
| When seen in process (life cycle) | Afternoon | |
| **How Big:** | | |
| How many objects have the defect? | Third shift (4:00PM) | |
| How many defects per object? | Once per day | |
| What is the trend? | Increasing --> SPECIAL CAUSE! | |
| Enhanced Problem Description --> | | |

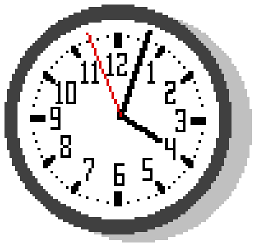
# Timing Plan

Depends upon

- Product complexity
- Customer expectations

Team plan for

- Training
- Event
- Action




**Do NOT Under Estimate the Importance of Timing!**

Framework for tracking

Basis for status reporting

Prepare a timing chart using available project or similar software

# Describe the Problem

## Summary

# Describe the Problem

## Objective

Specify the internal / external customer problem by identifying, in quantifiable terms, Who, What, When, Where, Why, How, How Many (5W2H) for the problem.

# Describe the Problem

## Phase I

- State the symptom, extent and consequence of the problem.
- Prepare / Review process flow diagram.
- Start an Action Plan to define the problem. Identify Who will do What by When.

## Phase II

- Identify Who, What, Where, When, Why, How and How Much.
- Qualify the extent of the problem to help identify relevant stratification factors.
- Evaluate similar situations where the problem might be expected to occur.
- Use all available indicators. Be creative about these.
- Subdivide the problem into natural problem groups.

# Describe the Problem

## Questions

### What Type of Problem Is It?

- Field complaint
- Quality improvement
- Manufacturing improvement
- Component design
- Labour / Personnel
- Supplier / Vendor
- Cost improvement
- Solution implementation
- Cross functional
- Research
- Safety

## Other Questions

- Can you list all of the resources and documents which might help you specify the problem more exactly?
- Do you have more than 1 problem? Can this situation be separated into smaller parts?

## Is / Is Not

- Is there any evidence this problem surfaced before?

# Describe the Problem

## Who, What, When, Where, Why, How, How Many

- What is the extent of the problem?
- Has the problem been increasing, decreasing or remaining constant?
- Is the process stable?
- What indicators are available to quantify the problem?
- Can you determine the severity of the problem? Can you determine the various ‘costs’ of the problem? Can you express the cost in percentages, dollars, pieces, etc.?
- Do we have the physical evidence on the problem in hand?
- Have all sources of problem indicators been identified and are they being utilized?
- Have failed parts been analyzed in detail?

# Describe the Problem

## Customer Terms / Symptoms

- Who is the customer?
- Is there more than 1 customer? If so, which customer first identified the problem?
- To whom was the problem reported in the customer's organization?
- What is the problem definition in customer terms?
- What is the problem definition in YOUR terms?
- Have we verified the problem with on-site visits with the customer?

# Use a Process Flow Chart!

## Because:

- You want to understand your current process
- You are looking for opportunities to improve
- You want to illustrate a potential solution
- You have improved a process and want to document the new process

Let’s Try A Process Flow Chart

# Creating a Process Flow Chart

1. Identify the process or task you want to analyze. Defining the scope of the process is important because it will keep the improvement effort from becoming unmanageable.
2. Ask the people most familiar with the process to help construct the chart.
3. Agree on the starting point and ending point. Defining the scope of the process to be charted is very important, otherwise the task can become unwieldy.
4. Agree on the level of detail you will use. It’s better to start out with less detail, increasing the detail only as needed to accomplish your purpose.

# Creating a Process Flow Chart

5. Look for areas for improvement

- Is the process standardized, or are the people doing the work in different ways?
- Are steps repeated or out of sequence?
- Are there steps that do not ad value to the output?
- Are there steps where errors occur frequently?
- Are there rework loops?

6. Identify the sequence and the steps taken to carry out the process.

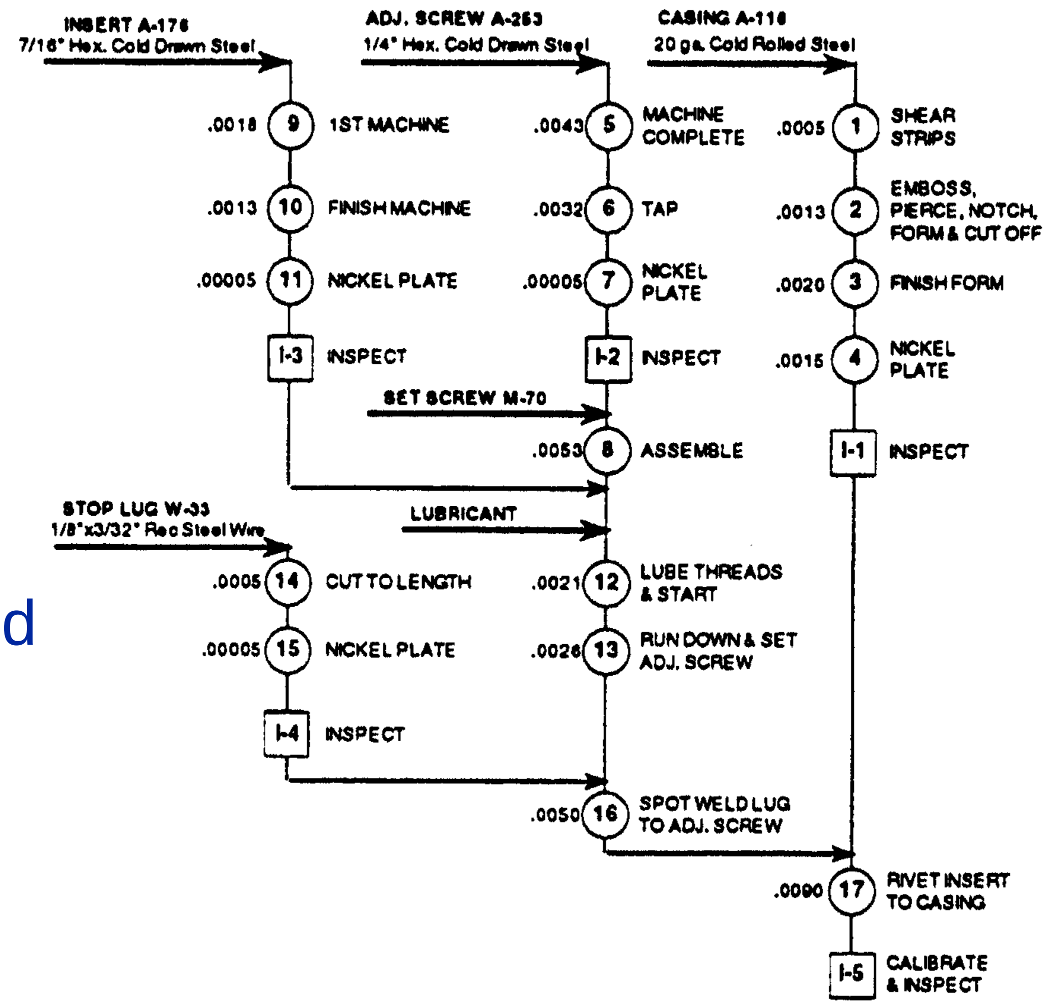
7. Construct the process flow chart either from left to right or from top to bottom, using the standard symbols and connecting the steps with arrows.

8. Analyze the results.

- Where are the rework loops?
- Are there process steps that don't add value to the output?
- Where are the differences between the current and the desired situation?

# Early Process Flow Diagram

- Inspection Points
- Inspection Frequency
- Instrument
- Measurement Scale
- Sample Preparation
- Inspection/Test Method
- Inspector
- Method of Analysis



# GM Example Process Flow Chart

## Process Flow Diagram

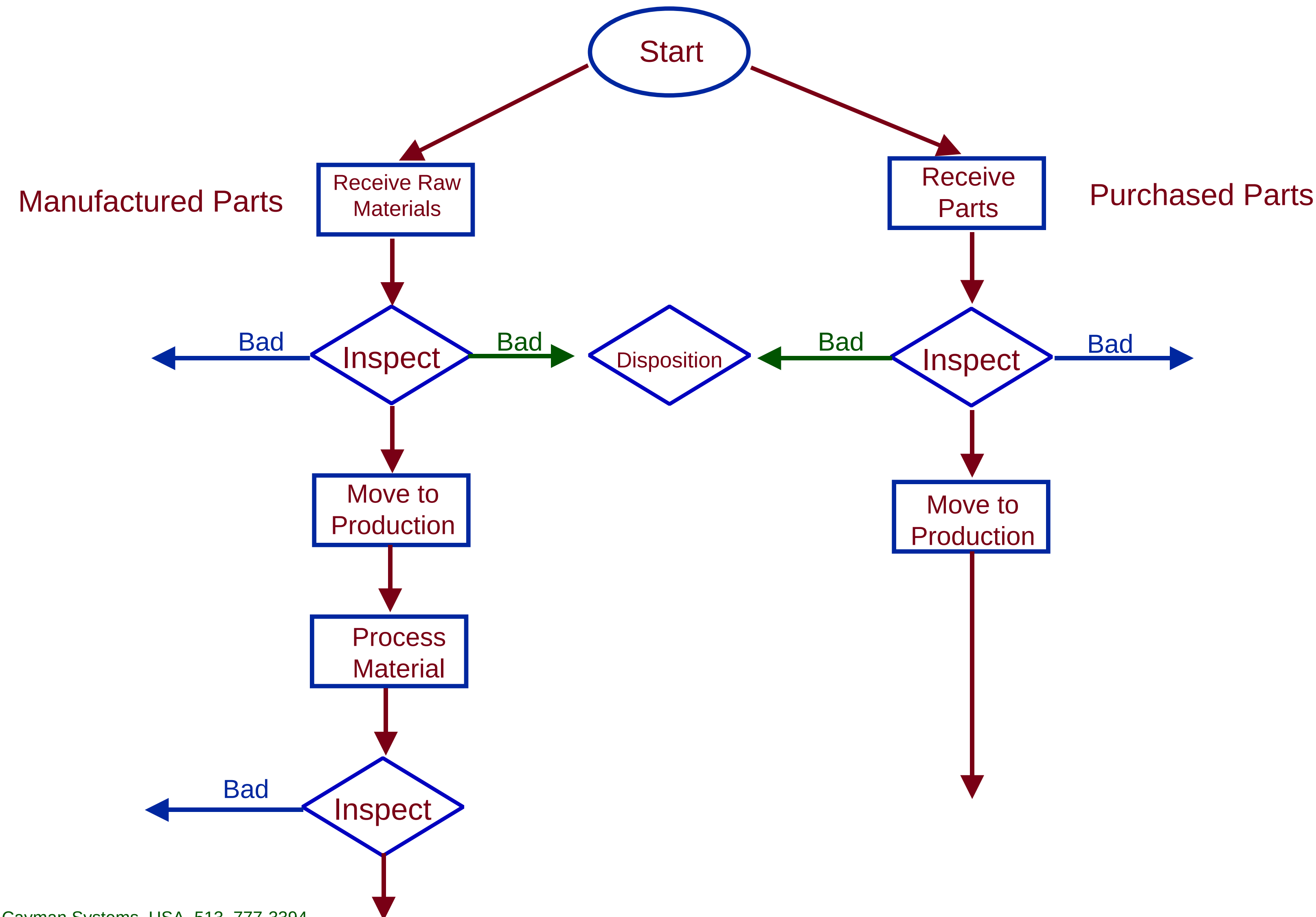
Part Number: ____________________ Date: 4/5/93
Part Description: ____________________ Rev. : C
Prepared By: ____________________

Approved By:

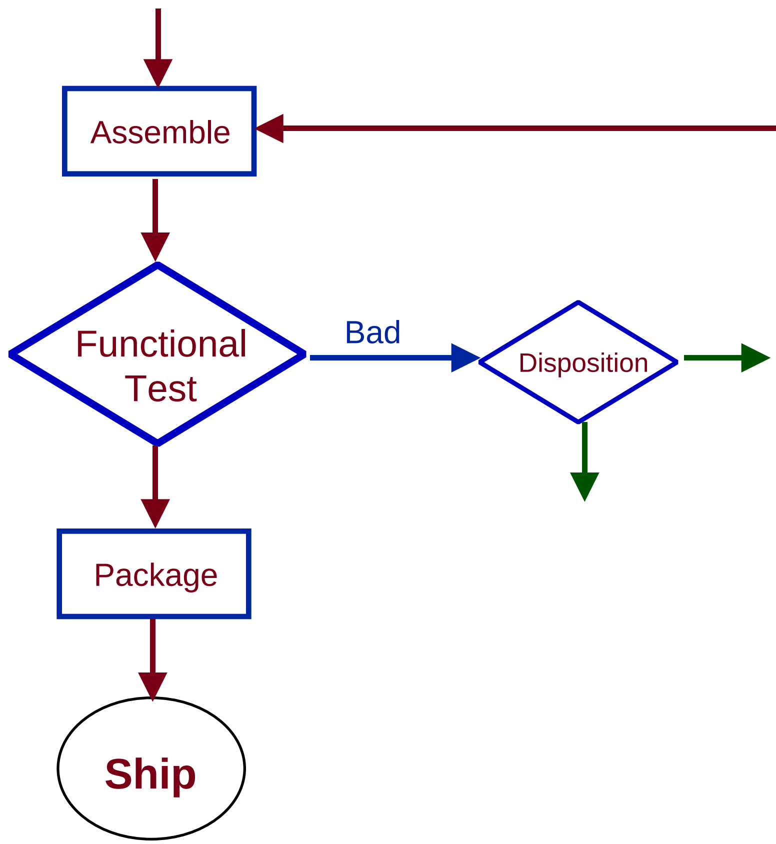
QA Manager ____________________
Operations Manager ____________________
Senior Advisor ____________________
QA Engineer

| Step | Fabrication | Move | Store | Inspect | Operation Description | Item # | Key Product Characteristic | Item # | Key Control Characteristic |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | ○ | | | Move "OK" Vinyl Material From Storage Area and Load Into Press. | 1.0 | Material Specs | 1.0 | Material Certification Tag |
| 2 | ◇ | | | | Auto Injection Mold Cover In Tool # | 2.0 | Tearstrip In Cover | 2.1<br>2.2 | Tool Setup<br>Machine Setup |
| | | | | | | 3.0 | Hole Diameter In Cover | 2.1<br>2.2 | Tool Setup<br>Machine Setup |
| | | | | | | 4.0 | Flange Thickness In Cover | 2.1<br>2.2 | Tool Setup<br>Machine Setup |
| | | | | | | 5.0 | Pressure Control Protrusions Height | 2.1<br>2.2 | Tool Setup<br>Machine Setup |
| 3 | | | | □ | Visually Inspect Cover | 6.0 | Pressure Control Protrusions Filled Out | 2.1<br>2.2 | Tool Setup<br>Machine Setup |

# Basic Flow Chart Example



# Basic Flow Chart Example



# Control Plan Example (GM)

Process Control Plan

Supplier Name: _ | Supplier Code: _ | Part Number: ______________
Supplier Rep.: _ | Telephone: _ | Part Description: ______________
Title: _ | Date: 4/5/93 | Engineering Change Letter: | Process Plan Effective Date: 4/5/93

| Key Product Control Characteristics | | | | Gage Study | | | | Process Capability (Short Term Capability) | | | Process Performance (Long Term Capability) | | | Controls | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [1] Item | [2] Key Product Characteristic/ Spec | [3] Key Control Characteristics | [4] Operation Description | [5] Gage Operation | [6] Attr./ Variable | [7] Last R&R Date | [8] % Gage R&R | [9] Process Capability Date | [10] % Process Capability | [11] Cpk or Dev From Target/Nom. | [12] Process Perform. Date | [13] % Process Perform | [14] Cpk or Dev From Target/Nom. | [15] Type Of Control Method | [16] Freq. Of Inspect. | [17] Operator Set-Up Gage Instruction (Proced. #) | [18] Process Audit Method and Frequency |
| 1.0 | Vinyl Material Spec | | | | | | | | | | | | | Check Vendor Cert(s). | Every Box | | Green "OK" Release, Each Box |
| 2.0 | Tear Strip (Cover) 1 = 0.41mm .+/- 0.11mm 2-7 = 0.685mm .+/- 0.135mm [7] | | Auto Injection Mold Cover In TL# | | | | | | [1] [2] [3] [4] [5] [6] [7] | [1] [2] [3] [4] [5] [6] [7] | | | | X bar and R Charts SQC Database | Start Of Each Run And Each Shift | 3.607 | |
| 2.1 2.2 | | Tool Setup Machine Setup | | | | | | | | | | | | Verify To Spec Sheet | | | |
| 3.0 | Hole Diameter (Cover) 4.60mm .+/- 0.25mm | | Auto Injection Mold Cover TL# | | | | | | [1] [2] [3] [4] [5] [6] | [1] [2] [3] [4] [5] [6] | | | | X bar and R Charts SQC Database | 5 Pieces Every 6 Months | 3.609 | |

# FMEAs - Predicting Failure & Problems

## How It Works

### System

Components,
Subsystems,
Main Systems

**Focus:**
Minimize failure effects on the System.

**Objective/Goal:**
Maximize System quality, reliability, cost and maintainability.

## What Its Made Of

### Design

Components,
Subsystems,
Main Systems

**Focus:**
Minimize failure effects on the Design.

**Objective/Goal:**
Maximize Design quality, reliability, cost and maintainability.

## How Its Made

### Process

Manpower,
Machine,
Method,
Material,
Measurement,
Environment

### Machines

Tools, Work Stations, Production Lines, Operator Training, Processes, Gauges

**Focus:**
Minimize process failures effects on the Total Process.

**Objective/Goal:**
Maximize Total Process quality, reliability, cost, productivity and maintainability.

# Statistical Tools

| Tool | Purpose | 8D Step |
|---|---|---|
| Trend Chart | Indicator to track magnitude of symptoms | D1 D2 D3 D4 D5 D6 D7 D8 |
| Pareto Chart | Quantifier to prioritize and subdivide the problems | D2 D8 |
| Paynter Chart | Indicator to monitor and validate the problems | D2 D3 D6 D8 |
| Repeated Why | Method to move from symptom to problem description | D2 |
| Information Database | Process to find root cause using Is/Is Not, Differences, Changes | D2 D4 D5 D6 |
| Decision Making | Method to choose best action from among alternatives | D3 D5 |
| Action Plan | Record of assignments, responsibilities and timing | D1 D2 D3 D4 D5 D6 D7 D8 |
| EW8D | Report of problem solving process for management review | D1 D2 D3 D4 D5 D6 D7 D8 |

# Interpreting Statistics

**Key Terms:**

**Hits:** The total number of files requested from the server.
**Bytes:** The amount of information transferred in filling those requests.
**Visits:** The (approximate) number of actual individual visitors.
**PViews:** The number of Web pages viewed by those visitors.

The bar graphs below are based upon number of visitors.

## Monthly Statistics

| Hits | Bytes | Visits | PViews | Month |
|---|---|---|---|---|
| 35,901 | 377,732,356 | 2,081 | 0 | Aug 1997 |
| 80,718 | 822,036,414 | 3,768 | 0 | Sep 1997 |
| 97,224 | 1,014,449,983 | 4,342 | 0 | Oct 1997 |
| 90,037 | 926,226,241 | 4,780 | 0 | Nov 1997 |
| 86,330 | 863,277,442 | 4,955 | 0 | Dec 1997 |
| 37,620 | 468,643,785 | 2,119 | 0 | Jan 1998 |
| 115,315 | 1,511,056,772 | 6,490 | 0 | Feb 1998 |
| 76,813 | 1,240,543,286 | 6,928 | 0 | Mar 1998 |
| 44,330 | 912,598,906 | 6,936 | 0 | Apr 1998 |
| 48,612 | 1,034,397,477 | 7,265 | 0 | May 1998 |
| 65,507 | 1,220,100,443 | 8,028 | 6,670 | Jun 1998 |
| 185,018 | 2,235,857,995 | 7,875 | 51,654 | Jul 1998 |
| 166,903 | 2,060,462,718 | 7,240 | 45,507 | Aug 1998 |
| 163,879 | 2,170,173,835 | 7,709 | 45,457 | Sep 1998 |
| 205,390 | 2,700,239,218 | 9,290 | 56,534 | Oct 1998 |
| 166,203 | 1,965,080,133 | 7,411 | 46,148 | Nov 1998 |

[ Return to Index ]

# Interpreting Statistics

## Top 25 Most Frequently Requested 404 Files (Nov 1998)

| Last Accessed | Hits | Bytes | File |
|---|---|---|---|
| 00:49:30 25 Nov 1998 | 241 | 1,710,753 | /robots.txt |
| 19:00:47 24 Nov 1998 | 114 | 789,270 | /qs.html |
| 13:09:29 24 Nov 1998 | 105 | 744,828 | /requirements.html |
| 10:31:42 24 Nov 1998 | 70 | 494,333 | /baldridge.html |
| 15:39:40 23 Nov 1998 | 27 | 190,221 | /cayman |
| 00:21:19 25 Nov 1998 | 23 | 157,954 | /iso.html |
| 23:52:01 23 Nov 1998 | 15 | 105,343 | /entry2.htm |
| 21:39:29 24 Nov 1998 | 15 | 107,355 | /cgi-bin/ultimate |
| 16:37:32 12 Nov 1998 | 12 | 84,878 | /fmea/fmea-f.ppt10.html |
| 00:31:04 25 Nov 1998 | 12 | 79,227 | /plexus.html |
| 17:38:23 23 Nov 1998 | 10 | 70,564 | /cgi-bin/ultimate.cgi |
| 15:16:39 16 Nov 1998 | 10 | 64,913 | /FMEA/FMEA-F.ppt02.html |
| 05:08:46 20 Nov 1998 | 9 | 57,756 | /qs9_manual.html |
| 02:10:49 20 Nov 1998 | 9 | 63,910 | /IASG_BIG.html |
| 06:09:12 17 Nov 1998 | 8 | 57,256 | /iso14000.htlm |
| 16:37:37 22 Nov 1998 | 8 | 50,599 | /qs9_imp.html |
| 03:21:32 20 Nov 1998 | 8 | 57,256 | /FMEA/FMEA-F.ppt1 |
| 19:38:17 16 Nov 1998 | 8 | 56,250 | /FMEA/FMEA-F |
| 19:38:25 16 Nov 1998 | 7 | 49,093 | /FMEA/FMEA |
| 04:29:28 20 Nov 1998 | 7 | 43,442 | /FMEA/FMEA-F.ppt.html |
| 13:59:44 24 Nov 1998 | 7 | 50,099 | /APQP/APQP_out.ppt118.html |
| 05:34:21 16 Nov 1998 | 6 | 42,942 | /FMEA/ |
| 09:42:40 18 Nov 1998 | 6 | 36,285 | /FMEA/FMEA-F.ppt03.html |
| 14:05:35 24 Nov 1998 | 6 | 29,628 | /iso_family.html |
| 10:28:22 22 Nov 1998 | 6 | 42,942 | /cgi.bin/board.cgi |

# Interpreting Statistics

## Complete 404 File Not Found Statistics (Nov 1998)

| Last Accessed | Hits | Bytes | File |
|---|---|---|---|
| 21:12:29 19 Nov 1998 | 1 | 7,157 | / |
| 04:17:15 20 Nov 1998 | 2 | 14,314 | /--------------.class |
| 10:18:19 23 Nov 1998 | 1 | 7,157 | /4_18.html |
| 10:12:50 23 Nov 1998 | 1 | 7,157 | /4_2.html |
| 01:49:02 13 Nov 1998 | 1 | 7,157 | /9004-4.html |
| 15:54:19 24 Nov 1998 | 6 | 42,942 | /9810xx/htdocs981002/Cay_Pics/Cay_Pics/groucho.gif |
| 00:50:04 25 Nov 1998 | 1,463 | 10,281,745 | /9810xx/htdocs981002/Cay_Pics/smile.gif |
| 08:49:07 17 Nov 1998 | 1 | 7,157 | /APQP/ |
| 13:33:03 15 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt.html |
| 08:48:04 17 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt02.html |
| 08:49:00 17 Nov 1998 | 2 | 14,314 | /APQP/APQP_out.ppt04.html |
| 08:17:51 23 Nov 1998 | 2 | 14,314 | /APQP/APQP_out.ppt05.html |
| 16:58:43 23 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt06.html |
| 22:33:52 11 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt110.html |
| 22:38:38 11 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt111.html |
| 22:41:59 11 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt112.html |
| 22:51:15 11 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt113.html |
| 22:56:40 11 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt114.html |
| 23:01:47 11 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt115.html |
| 13:59:44 24 Nov 1998 | 7 | 50,099 | /APQP/APQP_out.ppt118.html |
| 19:09:04 17 Nov 1998 | 2 | 14,314 | /APQP/APQP_out.ppt121.html |
| 14:27:46 16 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt13.html |
| 16:57:20 20 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt133.html |
| 20:36:33 18 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt46.html |
| 06:47:06 18 Nov 1998 | 2 | 14,314 | /APQP/APQP_out.ppt69.html |
| 17:29:49 19 Nov 1998 | 1 | 7,157 | /APQP/APQP_out.ppt89.html |
| 13:29:54 24 Nov 1998 | 23 | 164,611 | /APQP/Cay_Pics/groucho.gif |
| 06:49:51 02 Nov 1998 | 1 | 6,654 | /ASG_BIG.htm |
| 08:01:27 03 Nov 1998 | 1 | 6,654 | /ASG_BIG.html |

# Describe The Problem Check List

| Problem Check List | Yes | No |
|---|---|---|
| Based upon the pareto chart, has the problem description been established using repeated WHYs?? | | |
| Have all Is / Is-Not and What-Where-When&How Big questions been answered? | | |
| Have all sources of problem indicators been used? | | |
| Have failed parts been analyzed and the problem verified? | | |
| Does the problem description contain the object, concern, quantification and has it been included on the Paynter chart? | | |

# D3

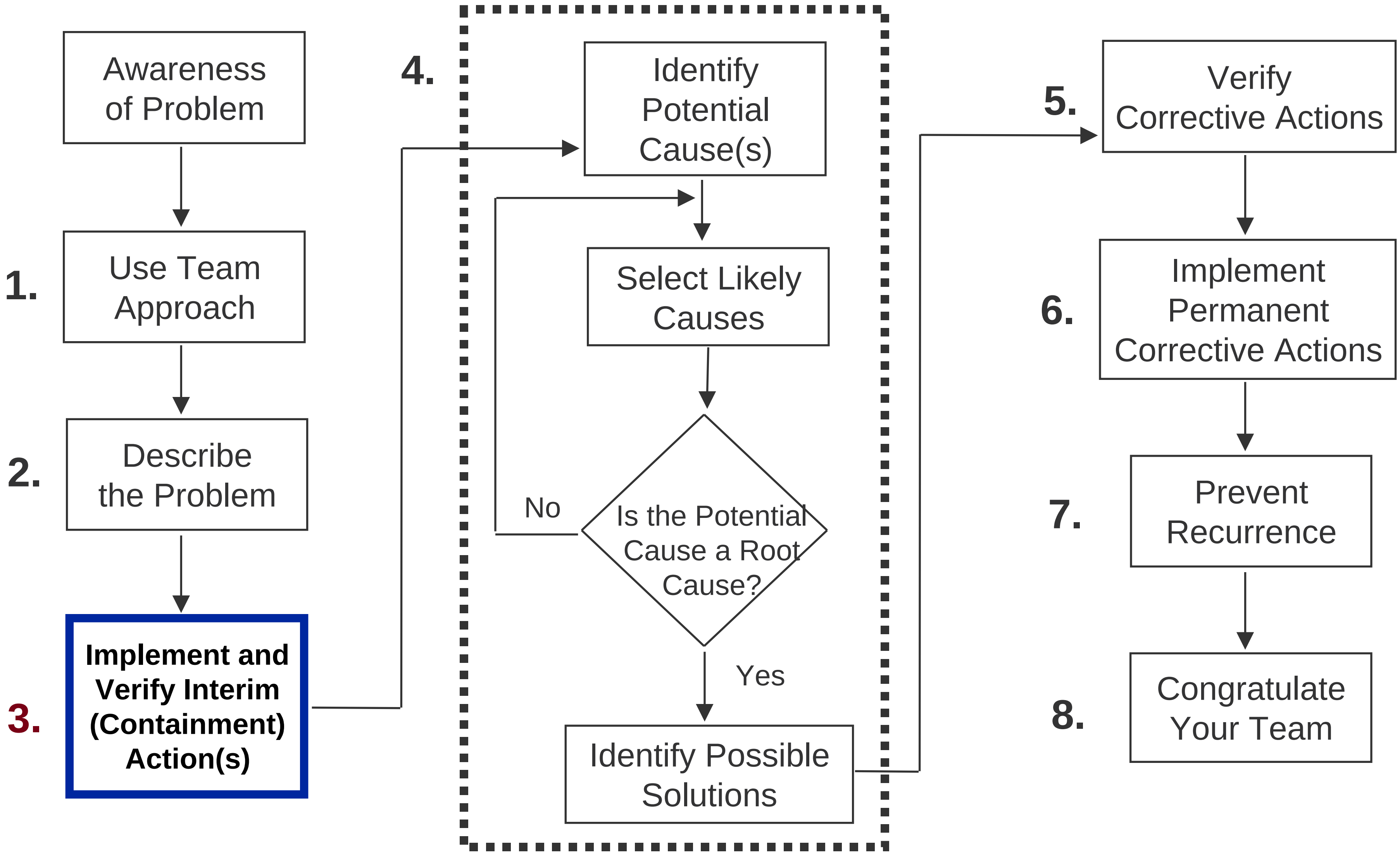
# Containment

# Implement and Verify Interim (Containment) Actions

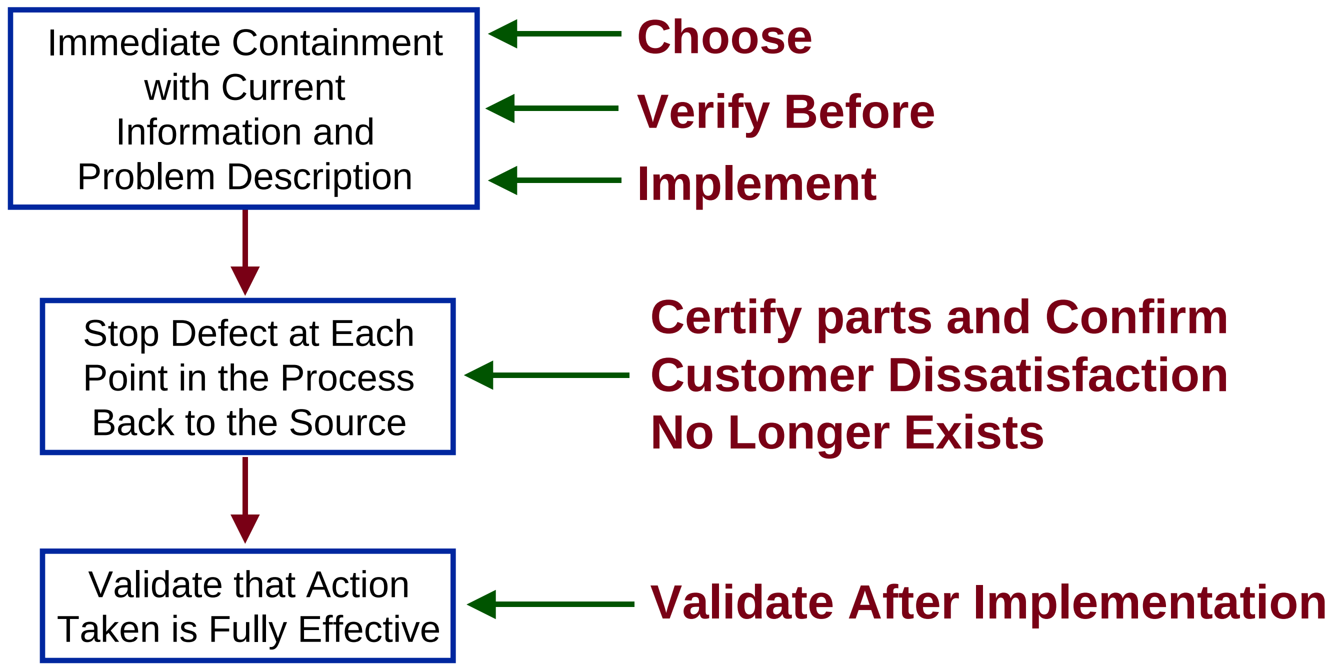
**Define and Implement containment actions to isolate the effect of the problem from any internal / external customer until corrective action is implemented.**

**Verify the effectiveness of the containment action.**

# The 8-D System



# Contain Symptom Flow



# Containment Actions

The main objective of this part of the problem solving process is to isolate the effects of the problem by implementing containment actions. A problem may be poor quality, marginal product design, or a process or system that is unpredictable. A containment action may be stopping production of a known source of a problem, or not shipping any parts or assemblies until the source of the problem is identified.

Once a problem has been described, immediate actions are to be taken to isolate the problem from the customer. In many cases the customer must be notified of the problem. These actions are typically ‘Band-aid’ fixes. Common containment actions include:

- 100% sorting of components
- Cars inspected before shipment
- Parts purchased from a supplier rather than manufactured in-house
- Tooling changed more frequently
- Single source

# Containment Actions

Unfortunately, most containment actions will add significant cost

**($)**

to the product. However, it is important to protect the customer from the problem until permanent corrective actions can be verified and implemented.

Most interim actions are 'temporary short term' actions taken until a permanent corrective action is defined, implemented and verified. The danger of many interim corrective actions is that they are considered to be a permanent solution to the problem. It must be remembered that they are typically 'band-aids'. It is a mistake to view containment actions as a solution to the problem. Containment actions typically address the **effect**. They should be considered 'immediate first-aid' to be reviewed and removed as quickly as possible.

# Containment Actions

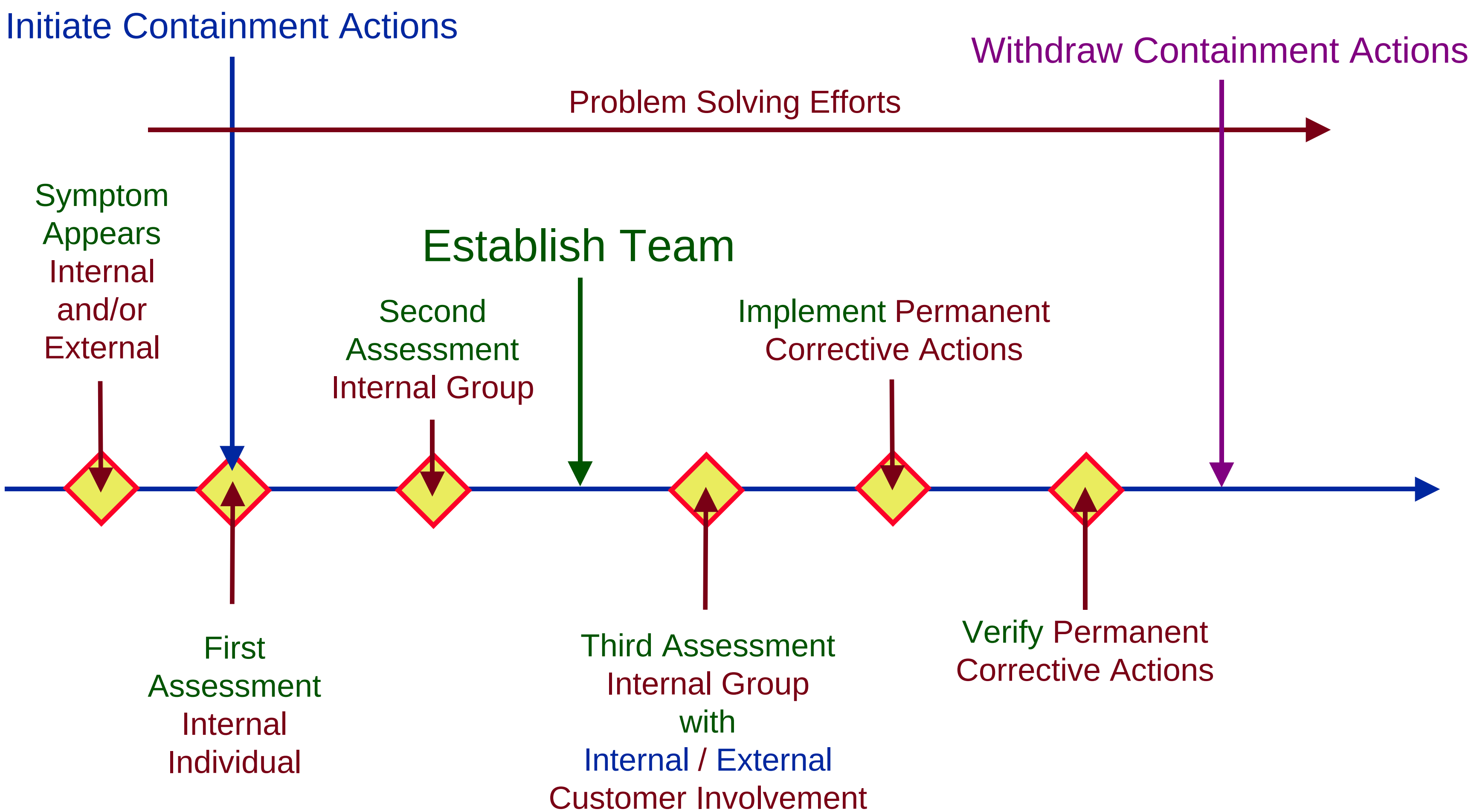
Containment actions can and often should proceed in parallel with the root cause determination investigation. During the period in which containment actions are taking place, many useful things must be pursued as a first step in finding the root cause. These things include:

- † Establishing an investigative plan
- † Obtaining baseline data
- † Initiating an on-going control system
- † Developing a follow-up and communications system
- † Correcting products already produced
- † Start systematic investigations
- † Conduct special studies and statistical experiments
- † Review experiences and data with current trends

(Understand the problem)

- † Forecast the future

# Typical Process Time Line

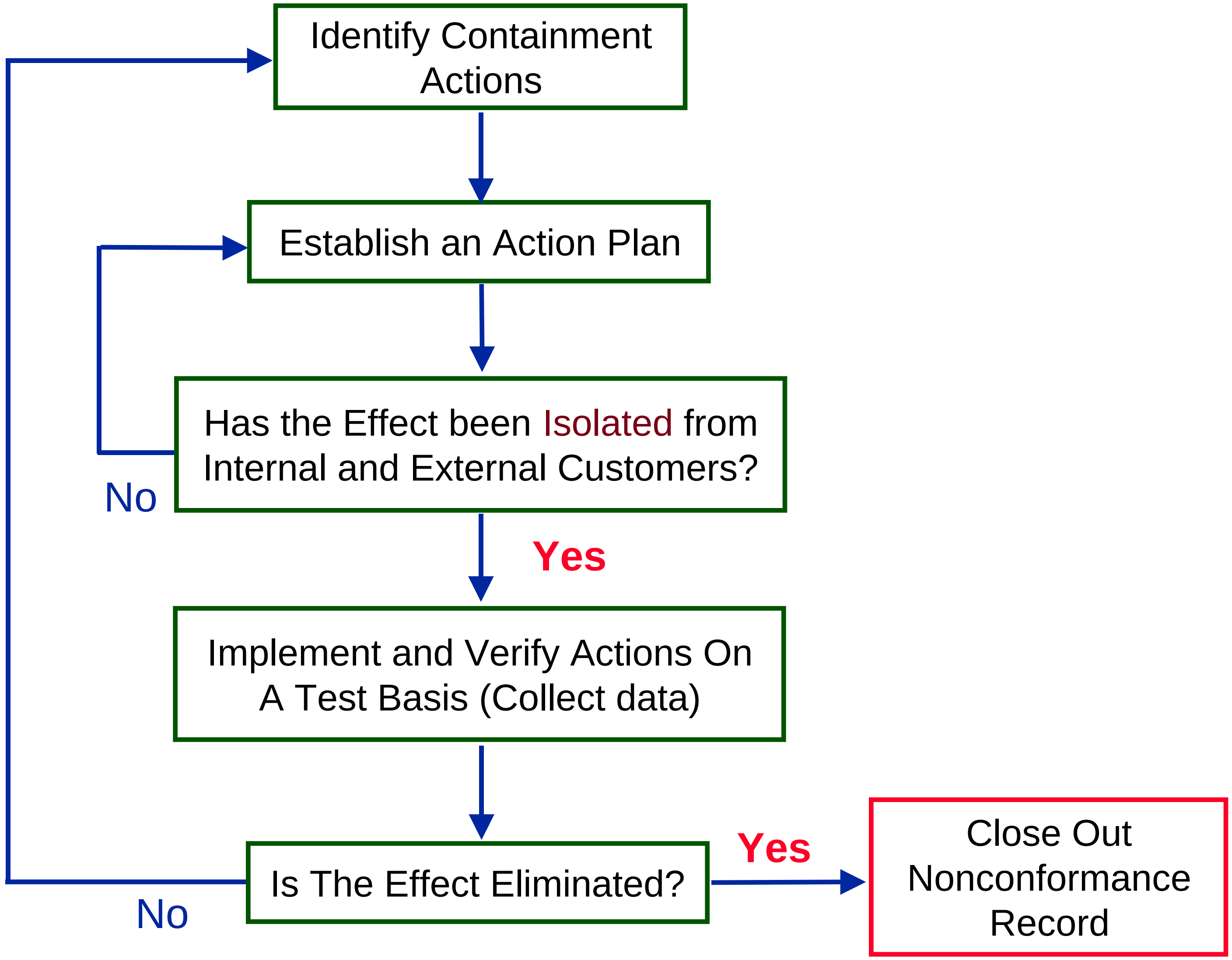



This process can stop or loop back upon its self at any point in the process.

# Containment Actions

- A design test on data collection (i.e. check sheets, control charts, etc.) can be used to evaluate the effectiveness of the actions. The process can be monitored using control charts and histograms. An action plan should define who, what and when clearly to coordinate the interim fixes.
- Individuals should be encouraged to gain knowledge about the entire process. Ask - What would be the effect of:
  - † Incorporating robust engineering designs
  - † Establishing manufacturing feasibility
  - † Determining how one operation or dimension affects another
  - † Centering the process
  - † Over adjusting and / or under adjusting a machine or process
  - † Improving machine set-up
  - † Changing tools
  - † Improving maintenance, etc.
- Well engineered management systems, practices and procedures need to be coupled with effective training programs. Together these can provide the best protection to prevent recurrence of the problem by new technologies, new methods, new employees, job rotation or improvement of individual skills.

# Containment Actions Flow



# Containment Actions

## Objective

Define and Implement containment actions to isolate the effect of the problem from internal and external customers until corrective action is implemented.

Verify the effectiveness of the containment action(s).

# Verifying Containment Actions

## Run Pilot Tests

- Artificially simulate the solution to allow actual process or field variation.
- Field test the solution using pilot customer groups.
- Verify carefully that another problem is not generated by the solution.

## Monitor Results

- Quantify changes in key indicators.
- Stress the customer / user evaluation.

# Containment Actions Verification Questions

- Have all alternatives been evaluated?
- Are responsibilities clear and defined?
- Is the required support available?
- When will the actions be completed?
- Have you ensured that implementation of the interim solution will not create other problems?
- Will all interim actions last until long-range actions can be implemented?
- Is the action plan coordinated with customers?
- Have tests been done to evaluate the effectiveness of the interim actions?
- Is data being collected to ensure actions remain effective?

# Contain Symptom Check List

| Contain Symptom Check List | Yes | No |
|---|---|---|
| Has immediate containment action been taken to protect the customer? | | |
| Has the concern been stopped at each point in the process back to the source? | | |
| Have you verified that the action taken is FULLY effective? | | |
| Have you certified that parts no longer have the symptom? | | |
| Have you specially identified the 'certified' parts? | | |
| Have you validated the containment action? | | |
| Is data being collected in a form that will validate the effectiveness of the containment action? | | |
| Has baseline data been collected for comparison? | | |
| Are responsibilities clear for all actions? | | |
| Have you ensured that implementation of the containment action will not create other problems? | | |
| Have you coordinated the action plan with the customer? | | |

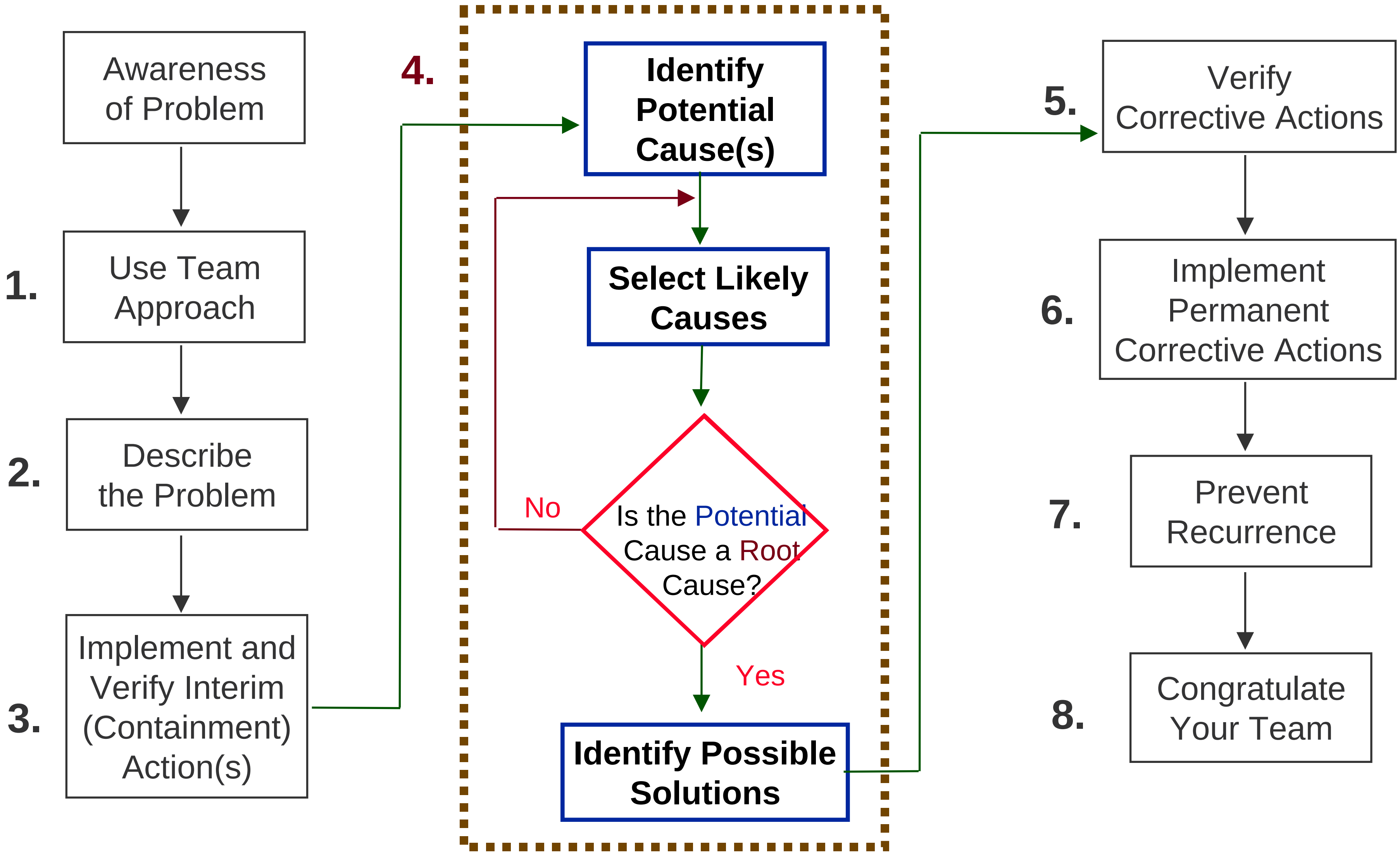
# D4
# Define Root Cause(s)

# Define and Verify Root Cause(s)

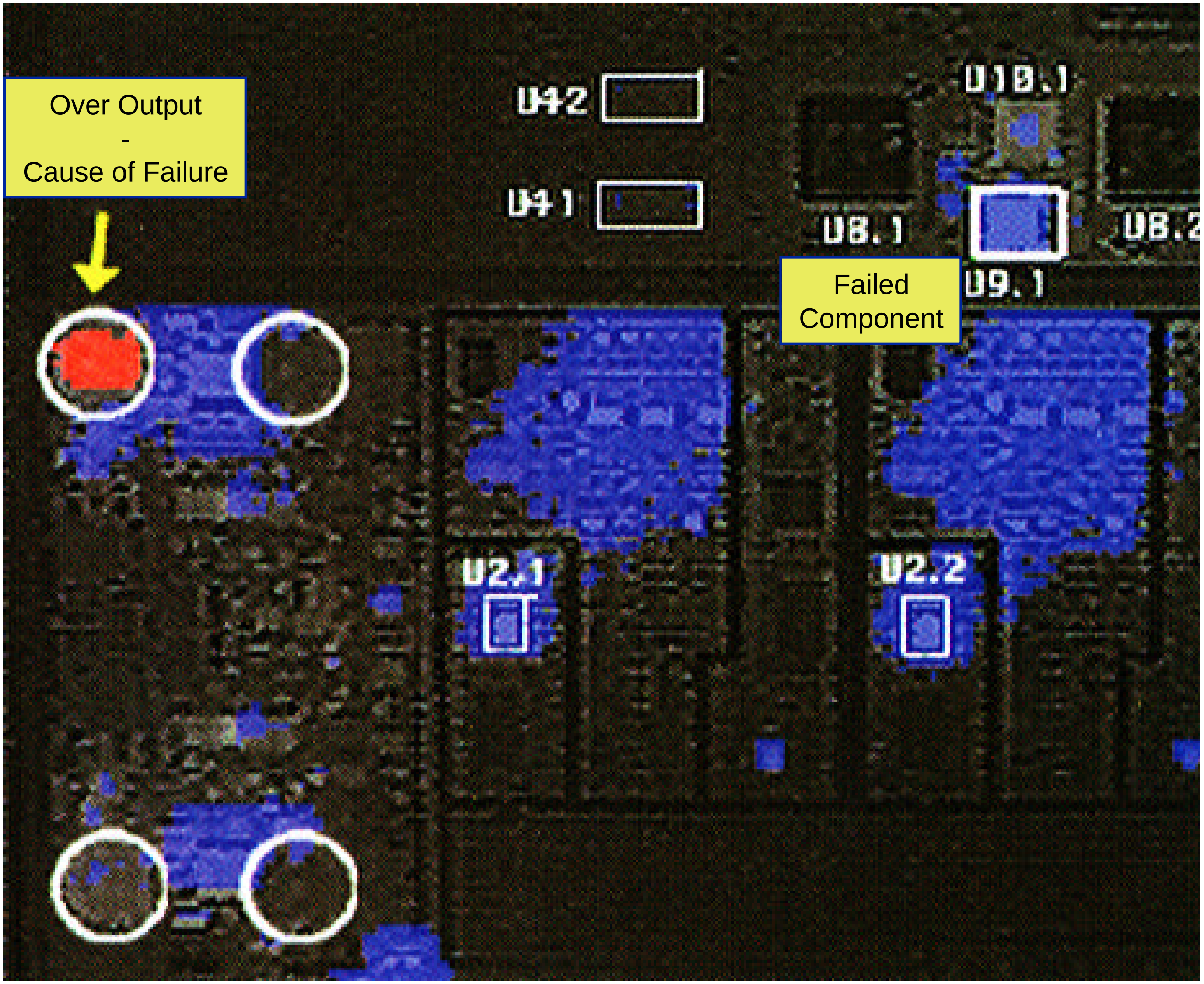
**Identify all potential causes which could explain why the problem occurred.**

**Isolate and verify the root cause by testing each potential cause against the problem description and test data. Identify alternate corrective actions to eliminate root cause.**

# The 8-D System



# Root Cause Of A Failure



# Two Root Causes

**Root Cause of Event (Occur or Occurrance)**

What system allowed for the event to **occur**?

**Root Cause of Escape**

What system allowed for the event to **escape** without detection?

# Define and Verify Root Cause(s)

- An investigation into all identified potential causes is necessary for effective problem solving. A cause and effects diagram can be used to brainstorm all potential causes of the described problem. The team should decide on what C&E diagram(s) is to be used: 5M, Process Flow and/or stratification. The more detailed the C&E diagram, the higher the chances the root cause will be included on the C&E diagram. An effective C&E diagram will include input from all team members and will be discussed in detail.
- Any existing data should be reviewed for clues to potential causes. Further data collection may be required to investigate additional causes.
- If the problem has not previously been seen, a timeline analysis should provide significant data. The timeline will identify events occurring about the time the problem developed. If enough documentation is available, potential causes can be further identified. For example, if a new operator was put on a process or if a new supplier began supplying parts. Investigation into the events occurring at the same time the problem was discovered could lead to several important potential causes.
- **"What Changed?" "When?"** are important questions.

# Define and Verify Root Cause(s)

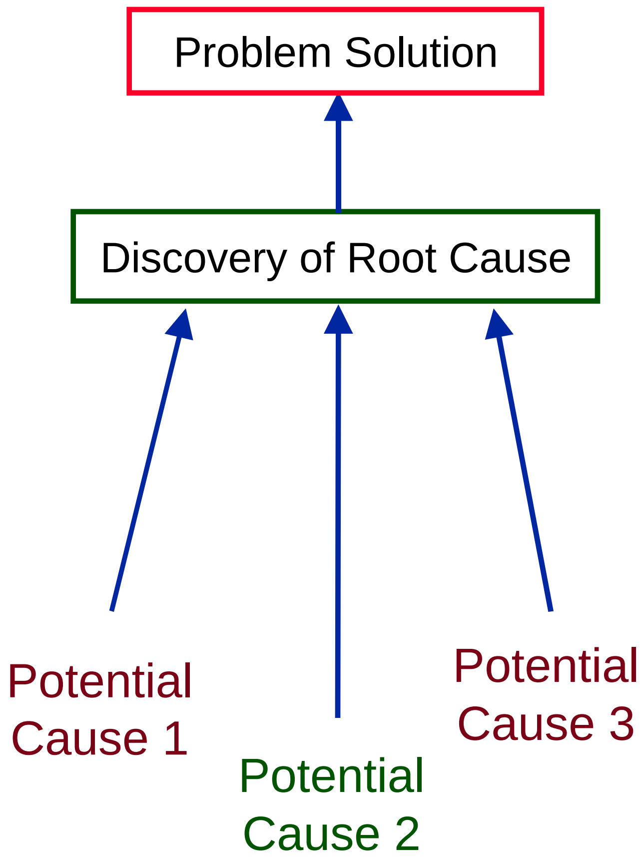
- A technique used extensively in analytical problem solving is a comparison analysis. This analysis looks at what 'is' and what 'is not' in the problem description.
- Potential causes can be discovered by conducting a survey. By surveying the customer who has witnessed the problem, more potential causes can be highlighted.
- Asking 'Why' repeatedly is effective in driving the process toward root cause and generating more complete understanding of the cause and effect.

# Define and Verify Root Cause(s)

- Once the problem has been described and the potential causes identified, the team should be evaluated. Are the right members on the team to investigate the potential causes? Are technical advisors required to assist in any special studies? Do new team members need to be added? Is the authority to pursue the analysis of the potential causes well defined? All these questions must be answered to ensure the team will be successful in investigating the potential causes and determining the root cause.
- The cause and effect diagram is used to identify the potential causes to be investigated. What is the probability that a potential cause could be responsible for the problem? Identify all potential causes that could have been present and may have caused the problem.
- Once all potential causes have been agreed upon, choose several potential causes to investigate. If only one potential cause is investigated, a lot of time may be lost if that potential cause proves not to be the culprit. To expedite a solution, investigate several potential causes at the same time (Parallel actions on several potential causes).

# Define and Verify Root Cause(s)

- If the problem is a manufacturing process, begin to establish a stable process. Once the process is stable, definition of the potential cause will be clarified.
- If design causes are identified, screening experiments may help identify the key variables which are affected by subsequent processes. Design changes may be appropriate.
- Four or five potential causes should be identified to investigate. Identifying several potential causes forces the team to address multiple possibilities rather than searching endlessly for a single cause. An implicit part of problem analysis is investigating potential causes in parallel rather that in series.



# Hypothesis Generation


Collect Data

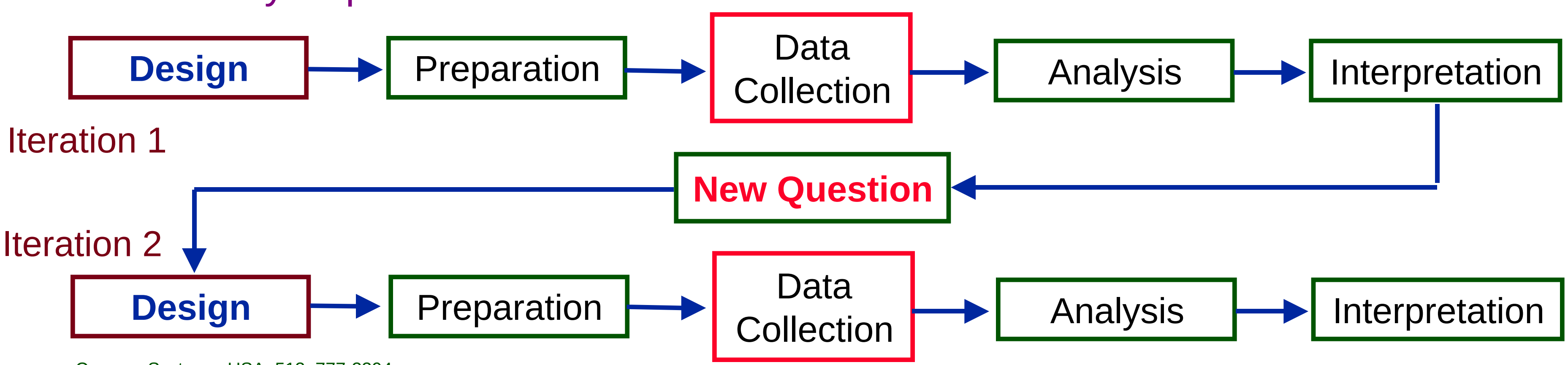
To determine importance of potential causes.

# Six Steps Of Investigation

- State how the potential cause could have resulted in the described problem.
- Establish what type of data can most easily prove or disprove the potential cause. Develop a plan on how the study will be conducted. Identify the actions on an action plan.
- Prepare the required materials to conduct the study. Training may also be required.
- Collect the required data.
- Analyze the data. Use simple statistical tools emphasizing graphical illustrations of the data.
- State conclusions. Outline conclusions from the study. Does the data establish the potential cause as being the reason for the problem?

# Define and Verify Root Cause(s)

- After the cause and effect diagram has been completed, data needs to be collected to determine which potential causes are important. Pareto diagrams and check sheets are very effective in establishing the importance of the potential causes.
- Many folks are under the mistaken belief that data oriented problem solving can be accomplished by collecting data on a problem, analyzing the results and deciding the correct solution. Once data is collected and analyzed, new questions often arise so another data collection and analysis iteration is necessary. In addition, many problems can have more than 1 root cause. Data collected investigating one potential cause may not address other important potential causes. Thus, several potential causes need to be studied using the data collection and analysis process.



# Define and Verify Root Cause(s)

- Once the data has been collected and analyzed, new potential causes often surface. These potential causes should be pursued as soon as possible since they are suggested by the data.

- The data collection for this step in the problem solving process can be as simple as check sheets or as sophisticated as design of experiments. The data analysis can rely heavily on simple graphical techniques such as histograms, pareto charts, control charts, stem-and-leaf and dot plots. By using graphical tools, quick comprehension by all participants as well as accurately communicated information will result. Comparison plots and stratified graphs are helpful in assessing stratification factors. To evaluate the relationship between characteristics, a scatter plot would be an effective tool.

# Identify Alternate Solutions

- Generate a Cause & Effects diagram.
- Survey the customer.
- Identify similar problem(s) previously solved.
- Avoid implementing the interim actions for permanent actions /solutions.
- Consider new and current technology for the solution.
- Incorporate the solution into future products.

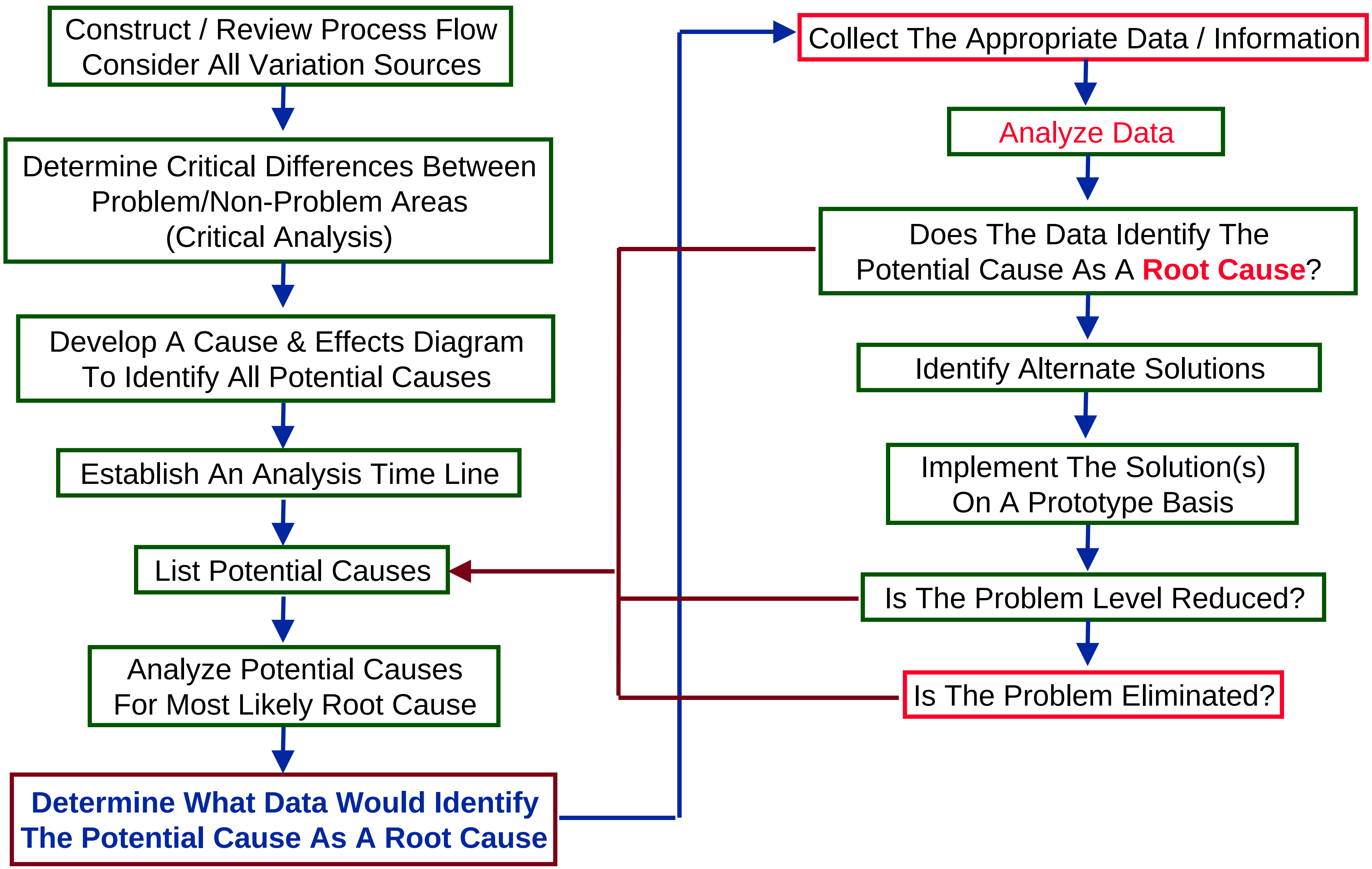
# Define and Verify Root Cause(s)

- After the root causes of a problem are identified, investigate methods to fix the problem. Evaluate several approaches to solve the problem. A thorough analysis of different approaches to eliminate a root cause is a critical part of the problem solving process.
- The first approach to generate alternate solutions is to develop a cause and effect diagram. The team should brainstorm solutions. One alternative is to redesign the part or the manufacturing process. This approach should eliminate an opportunity for a problem to recur.
- Communicate closely with the customer. How the root cause is eliminated might impact the customer in some unforeseen way. Customers should have a chance to input their needs into the problem solution.

# Define and Verify Root Cause(s)

- If similar problems have been previously identified and solved, assess those solutions. As part of every investigation, identify similarly engineered parts or plant processes that may have experienced this problem. Again, these could be a source of alternative solutions.
- Avoid 'band-aid' fixes - this will help prevent future recurrence of the problem. Sometimes due to cost and/or product life a compromise is to implement interim actions permanently. However, this is considered the least acceptable solution.
- As part of investigating problem solutions, the team should look at new and current technology around an engineered part and/or the manufacturing process. New alternatives could come from advances in these areas. In some cases a thorough understanding of the current design and/or manufacturing processes produce efficient solutions. The team should remember that the solution needs to be incorporated in future products.

# Define and Verify Root Cause(s)



# Define and Verify Root Cause(s) Summary

## Objective

Identify all potential causes which could explain why the problem occurred. Isolate and verify the root cause by testing each potential cause against the problem description and test data. Identify alternative corrective actions to eliminate root cause(es).

# Define and Verify Root Cause(s)

## Identify Potential Causes

- Define the ‘effects’ for cause and effect diagram(s).
- Prepare a 5M, Process or Stratification cause & effects diagram for each effect (you may want to use a combination).
- Team members should each assume their activity causes the problem and ask themselves “How could what I do possibly generate the problem?”
- Prepare a tome line analysis if the problem was not always present. Identify what changed when.
- Perform a comparison analysis to determine if the same or a similar problem existed in related products or processes. Identify past solutions and root causes which may be appropriate for the current problem.
- Identify the top few potential causes. Develop a plan for investigating each cause and update the action plan.
- Evaluate a potential cause against the problem description. Does a mechanism exist so that the potential cause could result in the problem?

# Define and Verify Root Cause(s)

## Analyze Potential Causes

- Use the iterative process to analyze each potential cause.
  - Δ Hypothesis generation: How does the potential cause result in the problem?
  - Δ Design: What type of data can most easily prove/disprove the hypothesis?
  - Δ Preparation: Obtain materials and prepare a check list.
  - Δ Data Collection: Collect the data.
  - Δ Analysis: Use simple, graphical methods to display data.
  - Δ Interpretation: Is the hypothesis true?
- Investigate several potential causes independently.
- Use an action plan to manage the analysis process for each potential cause being studied.

## Validate Root Causes

- Clearly state root cause(s) and identify data which suggests a conclusion.
- Verify root cause factors are present in the product and/or process.
- Conduct with / without study to verify root cause. Can you generate the problem?

# Define and Verify Root Cause(s)

## Potential Causes - Some Questions

- Have you identified all sources of variation on the flow diagram?
- Have all sources if information been used to define the cause of the problem?
- Do you have the physical evidence of the problem?
- Can you establish a relationship between the problem and the process?
- Do you continually challenge the potential root causes with the question ‘why’ followed with ‘because’ to construct alternatives?
- What are the is / is not distinctions?
- Is this a unique situation or is the likely problem similar to a past experience?
- Has a comparison analysis been completed to determine if the same or similar problem existed in related products?
- What are the experiences of recent actions that may be related to this problem?
- Why might this have occurred?
- Why haven’t we experienced this problem before?

# Define and Verify Root Cause(s)

## Analyze What Has Changed

- Manufacturing
  - Δ New supplier(s)?
  - Δ New tool(s)?
  - Δ New operator(s)?
  - Δ Process change(s)?
  - Δ Measurement system?
  - Δ Raw material(s)?
  - Δ Vendor supplied part(s)?
  - Δ Do other plants have a similar problem?
- Engineering
  - Δ Any pattern to the problem?
  - Δ Geographically?
  - Δ Time of year?
  - Δ Build date(s)?
  - Δ Did the program exist at program sign-off?
  - Δ Was it conditionally signed off?
  - Δ Did the problem exist during pre-production prototypes, functionals?

# Define and Verify Root Cause(s)

## Leftovers - Data and Root Causes

- What data is available to indicate changes in the process?
- Does data exist to document the customer's problem?
- If the potential cause is the root cause, how does it explain all we know about the problem?
- What is the likelihood that each potential cause could explain the described problem?
- What is the concern that the potential cause is actually occurring?
- What actions have been taken to the potential causes to assure their presence?

# Product - Process Assumptions

- Assumptions:
  - Features
  - Design
  - Process concepts
  - Technical innovations
  - Advanced materials
  - Reliability assessments
  - New technology
- Document assumptions as part of project plan
- Utilize as inputs to plan
- Consider alternate paths in case assumptions do not play out

# Errors 1

## Almost all errors are caused by human error.

- **Forgetfulness** - Sometimes we forget things when we are not concentrating. Example: A person forgets to set his/her alarm clock at night. Safeguard: Establish a routine which includes checking before going to bed.
- **Errors due to misunderstanding** - Sometimes we make mistakes when we jump to the wrong conclusion before we're familiar with the situation. Example: A person used to a stick shift pushes the brake petal in an automatic thinking it is the clutch. Safeguards: Training, checking in advance, standardizing work procedures.
- **Errors in identification** - Sometimes we misjudge a situation because we view it too quickly or are too far away to se it clearly. For example, a $1 bill is mistaken for a $10 bill. Safeguards: Training, attentiveness, vigilance.

# Errors 2

- **Errors made by amateurs** - Sometimes we make mistakes through lack of experience. Example: A new worker does not know the operation or is just barely familiar with it. Safeguards: Training, skill building, work standardization.
- **Willful errors -** Sometimes errors occur when we decide that we can ignore the rules under certain circumstances. Example: Crossing a street against a red light because we see no cars. Safeguards: Basic education, experience.
- **Inadvertent errors** - Sometimes we are 'absent minded' and make mistakes without knowing how they happened. Example: Someone lost in thought tries to cross the street without even noticing whether the light is red or not. Safeguards: Attentiveness, discipline, work standardization.
- **Errors due to slowness** - Sometimes we make mistakes when our actions are slowed down by delays in judgment. Example: A person learning to drive is slow to step on the brake. Safeguards: Skill building, work standardization.

# Errors 3

- **Errors due to lack of standards** - Some errors occur when there are not suitable instructions or work standards. Example: A measurement may be left to an individual's discretion. Safeguards: Work standardization, work instructions.
- **Surprise errors** - Errors sometimes occur when equipment runs differently than expected. Example: A Machine malfunction without warning. Safeguards: Total Productive Maintenance, work standardization.
- **Intentional errors** - Some people make mistakes deliberately. Crimes and sabotage are examples. Safeguards: Fundamental education, discipline.

Mistakes happen for many reasons, but almost all can be prevented if we take time to identify when and why they happen and then take steps to prevent them by using Poka-Yoke methods with consideration to other available safeguards.

# Process Failure Causes

1. Omitted processing
2. Processing errors
3. Errors setting up work pieces
4. Missing parts
5. Wrong parts
6. Processing wrong work piece
7. Mis-operation
8. Adjustment error
9. Equipment not set up properly
10. Tools and/or fixtures improperly prepared
11. Poor control procedures
12. Improper equipment maintenance
13. Bad recipe
14. Fatigue
15. Lack of Safety
16. Hardware failure
17. Failure to enforce controls
18. Environment
19. Stress connections
20. Poor FMEA(s).

# Process Control Examples

1. Standardized work instructions/procedures
2. Fixtures and jigs
3. Mechanical interference interfaces
4. Mechanical counters
5. Mechanical sensors
6. Electrical/Electronic sensors
7. Job sheets or Process packages
8. Bar coding with software integration and control
9. Marking
10. Training and related educational safeguards
11. Visual Checks
12. Gage studies
13. Preventive maintenance
14. Automation (Real Time Control)

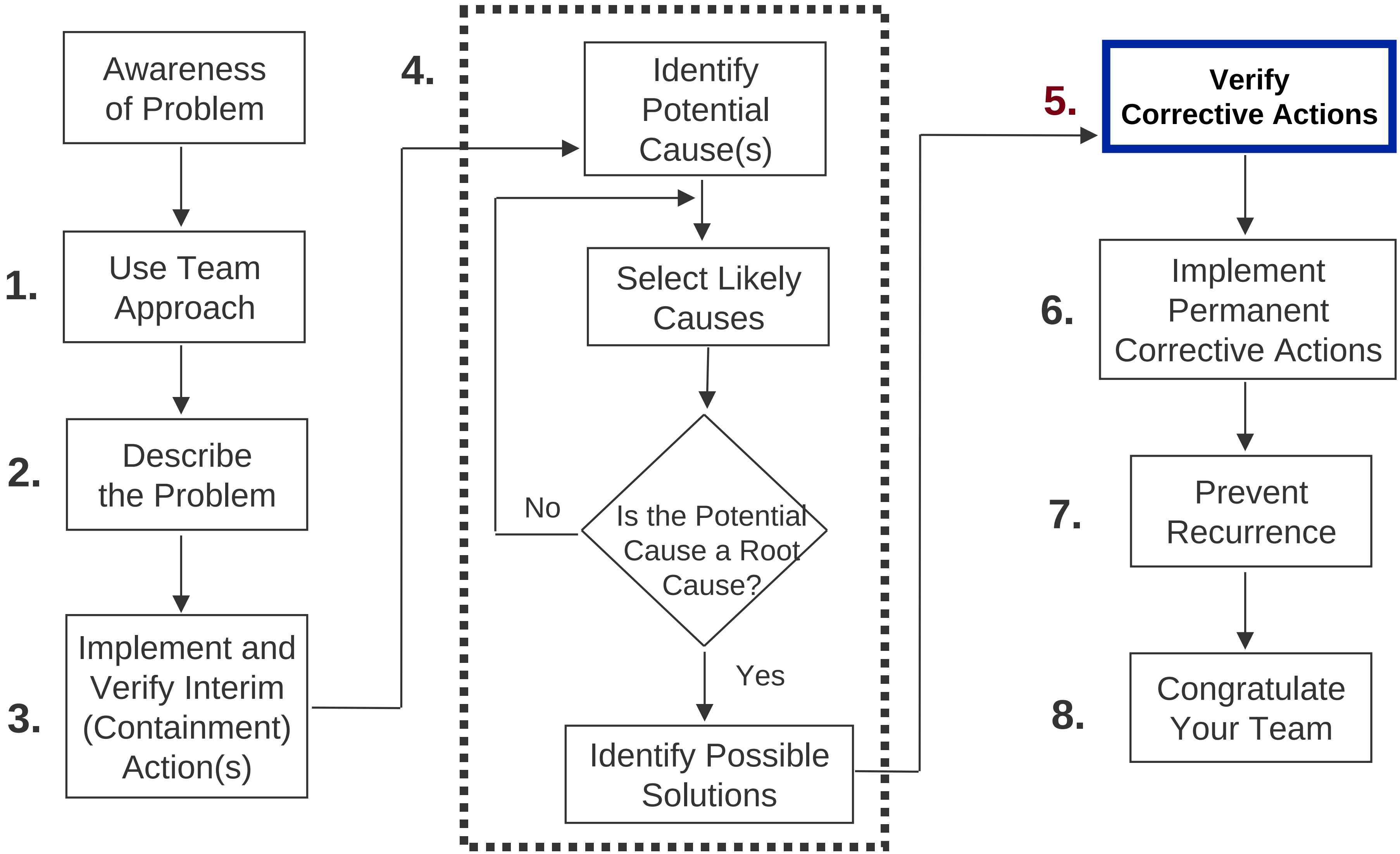
Controls can be process controls such as fixture fool-proofing or SPC, or can be post-process inspection / testing.

Inspection / testing may occur at the subject operation or at subsequent operation(s) that can detect the subject failure mode.

# D5

# Choose, Implement & Verify Corrective Actions

# The 8-D System



# Choose, Implement & Verify Corrective Actions

**Through pre-production test programs quantitatively confirm that the selected corrective action(s) will resolve the problem for each customer and that it will not cause undesirable side effects.**

**Define contingency actions based upon risk assessment.**

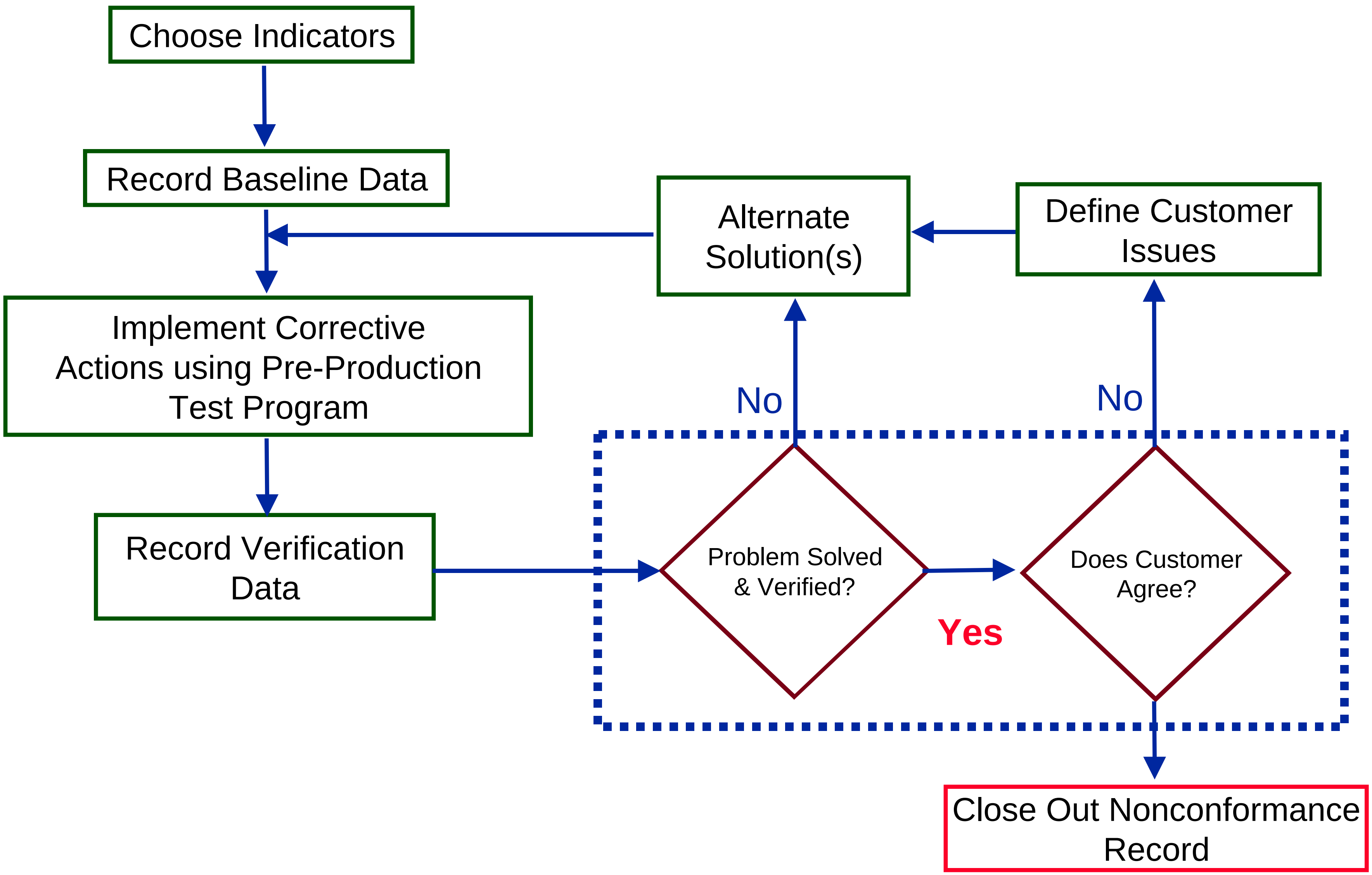
# Choose, Implement & Verify Corrective Actions

- By far the most critical step in the problem-solving process is to verify that the solution will in fact eliminate the problem. In addition, it is often the most difficult step. The most common method to evaluate a problem solution is to wait for implementation of the solution, then see if the problem goes away. However, too much time may be lost before conclusive information is available. Verification, where ever possible, should come before implementation.
- Several approaches to verification are available. In engineering, design verification and production validation testing provides significant information. In the short term, a bench/lab test can be used to verify. In some cases dynamometer testing can provide verification. Long term one can monitor fleet response. For manufacturing, verification is by in-plant indicators. SPC can verify the elimination of the problem. Sometimes scrap rate reports and conformance audits provide information. Sometimes a designed experiment is part of verification.

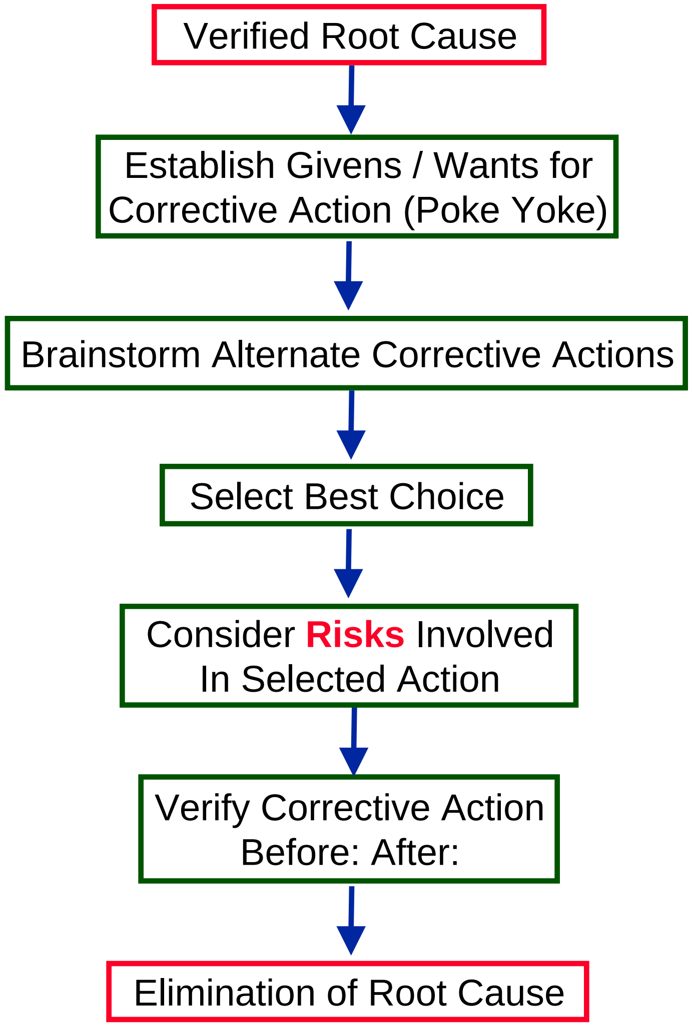
# Choose, Implement & Verify Corrective Actions

- Whatever verifications you choose, a detailed verification / action plan is required to outline **who** will be taking **what** actions by **when**. The action plan should show what data or statistics will be collected and analyzed, who is responsible and must track actual progress and scheduled completion. The action plan is the detailed Dynamic record of all phases of the problem solving process.
- Good problem solution verifies the customer is satisfied with the solution. If possible, involve the customer in choosing solutions.
- All verification of the problem solution will require decision analysis. Decision analysis is part of the cost and timing consideration of the solution. Decisions affecting cost must include effects on quality, future problem recurrence and complete elimination of the problem. In addition, management and operating procedures may be involved when choosing the solution. Evaluation of any adverse effects caused by the solution are important. The FMEA will most surely be affected.

# Choose, Implement & Verify Corrective Actions



# Choose, Implement & Verify Corrective Actions



# Choose, Implement & Verify Corrective Actions

## Objective

- Through pre-production test programs quantitatively confirm that the selected corrective actions will resolve the problem for the customer, and will not cause any undesirable side effects.
- Define contingency actions, if necessary, based upon Risk Assessment.

# Choose, Implement & Verify Corrective Actions

## Run Pilot Tests

- Artificially simulate the solution to allow actual process or field variation.
- Field test the solution using pilot customer groups.
- Verify carefully that another problem is not generated by the solution.

## Monitor Results

- Quantify changes in key indicators.
- Stress the customer / user evaluation.

# Confirmation Questions

- Can you list and measure all of the indicators related to the problem?
- Which of the indicators are most directly related to the problem? Can you use the indicators to measure problem severity?
- Can you determine how often or at what intervals to measure the problem (hourly, shift, daily, weekly, monthly)?
- If there are no changes to the indicators after taking action, can you determine what to do? Will you need to take cause, action and verification measures?
- Do all indicators reflect conclusive resolution?
- Has the team prioritized the customer / user evaluation after implementation?
- What scientific methods are being used to verify effectiveness in the short term and to predict the outcome long term?

# Verification Questions

- Has the customer been contacted to determine a date when verification will be evaluated?
- What data has been established for follow-up?
- Has a time-line (project) chart been completed?
- Have field tests been conducted using pilot customer groups?
- Have dates been established when verification of effectiveness will be evaluated?

# Corrective Actions Check List

| Corrective Action & Verify Check List | Yes | No |
|---|---|---|
| Has corrective action been established? | | |
| Does it meet the required givens? | | |
| Have different alternatives been examined as possible corrective actions? | | |
| Have Poke-Yoke techniques been considered? | | |
| Has each alternative been screened? | | |
| Have the risks involved with the corrective action been considered? | | |
| Was the corrective action verified? | | |
| Was the corrective action proven to eliminate the root cause? | | |

# D6

# Implement Permanent Corrective Actions

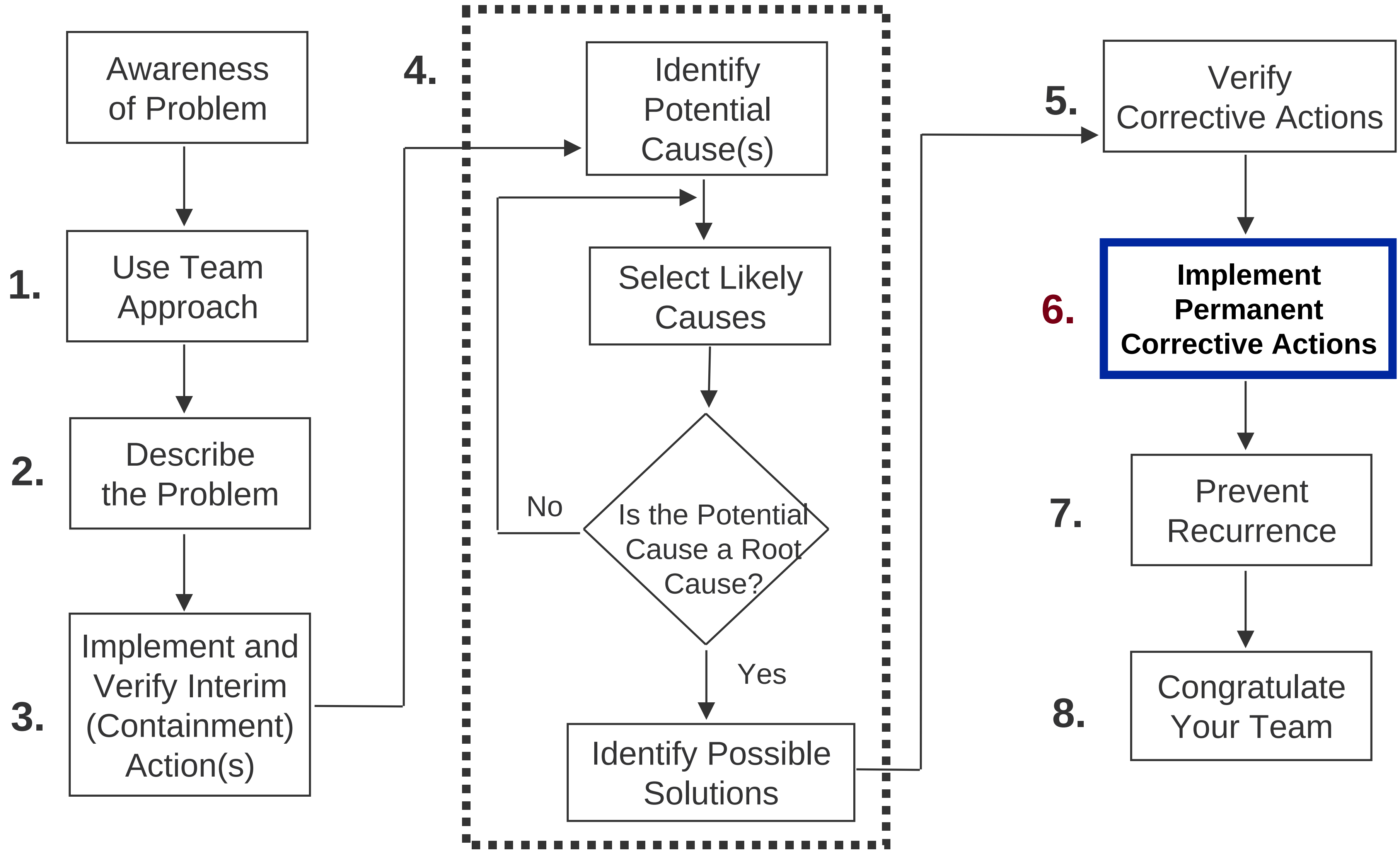
# Implement Permanent Corrective Actions

**Define and implement the 'appropriate' corrective action(s).**

**Choose on-going controls to ensure the root cause is eliminated.**

**Once in production, monitor the long term effects and implement contingency actions (if necessary).**

# The 8-D System



# Implement Permanent Corrective Actions

- Once the root cause(s) have been identified, the team establishes an action plan on the permanent actions to be taken. Again, the action plan includes **who** will do **what** by **when**. The permanent actions are implemented to solve the problem. The question “Why did this occur?” must be answered.
- Establish ongoing controls on the process to ensure the process remains in control. Once the permanent corrective actions are in place, the ongoing controls will verify the effects of the actions.
- To forecast reduction of the problem, indicators such as scrap reports, etc., can be used. A statistical plan will verify the effectiveness of the actions. A systematic approach involves a plan to establish the facts using data or evidence as a requirement for making decisions. Data is obtained by investigations and experiments to test assumptions. These assumptions are identified by translating the customer concerns into understandable definitions of what the problem is and relating these definitions of the problem to product and processes. These definitions and data are used to verify solutions.

# Implement Permanent Corrective Actions

- Once permanent solutions are in place, document the changes. In addition, all customers need to be informed about what actions were taken. In most cases, some type of training is required to institute permanent corrective actions. Training may be required to implement a product design or process change. In addition, implementation of the permanent actions may need to include the effect on design or process issues. In manufacturing, maintenance personnel often need to be informed of the changes.

- Another important part is to correct the obvious. This includes correcting defective parts already produced, changing product design, changing tooling, reworking defective machines and/or equipment, revising ineffective operating systems or working with and/or replacing suppliers.

- Contingency actions should be identified if for some reason the permanent actions cannot be implemented. For example, in manufacturing a recommendation to single source a part may be recommended. But, if one vendor is unable to meet the increased productivity alternate action is necessary. Contingency actions based upon risk assessment are essential to the success of permanent corrective actions for customer protection and problem solution.

# Implement Permanent Corrective Actions

Establish implementation action plan with actions, responsibilities, timing and required support. Identify contingency actions.

↓

Identify alternate solutions

↓

Implement permanent corrective actions

↓

Remove interim actions

↓

Establish on-going controls to ensure the permanent action is verified.

# Implement Permanent Corrective Actions

Selected
Corrective Action

Construct Corrective Action
Implementation Plan

Review / Revise Design
& Process FMEA

Revise: QOS (FORD)
Advanced Quality Planning
Current Model Engineering Change

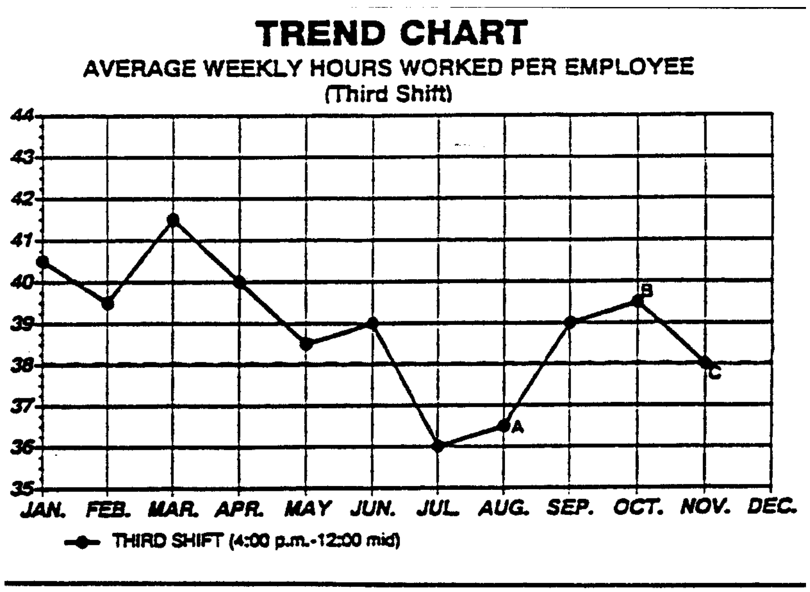
Identify Significant, Safety & Critical
Characteristics for Design
and Manufacturing Process

Develop or Revise Control Plans & Process
Sheets to Monitor Manufacturing Process

Validate for 30 days Using Variables
Data, SPC Charts / Paynter Charts

Remove Containment Action
Validate Through Paynter
Chart & **Original Measure**

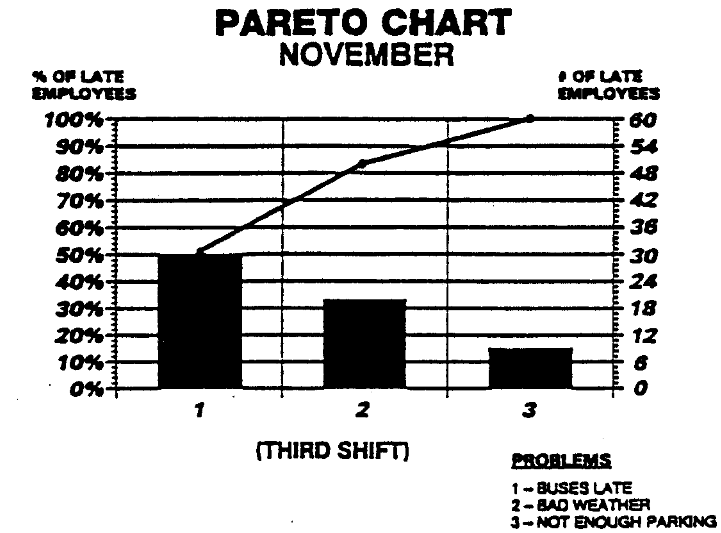
# Validation Evidence




A – Change shift starting times

B – New entrance opened

C – Task Group established




## PAYNTER CHART
(Third Shift)

| | NUMBER OF WORKERS AFFECTED: | | | | | | |
|---|---|---|---|---|---|---|---|
| PROBLEMS: | JUL. | AUG. | SEP. | OCT. | NOV. | DEC. | TOTAL |
| TRAFFIC JAM ON E-WAY | 90 | 84▲ | 4 | 3☆ | 0● | | 181 |
| BUSES LATE | 30 | 30 | 9 | 8 | 30 | | 107 |
| CONSTRUCTION | 17 | 16 | 17 | 8 | 0 | | 58 |
| NOT ENOUGH PARKING | 9 | 10 | 20 | 21 | 9 | | 69 |
| BAD WEATHER | 4 | 0 | 0 | 0 | 21 | | 25 |
| TOTAL: | 150 | 140 | 50 | 40 | 60 | | 440 |

▲ — Containment Action: Change Shift Starting Times.
☆ — Corrective Action: Open Second Entrance, Change Shift Starting Times Back to Normal.
● — Corrective Action: Task Group Established.

# Implement Permanent Corrective Actions

## Objective

Define and implement the best permanent corrective actions. Choose on-going controls to ensure the root cause is eliminated. Once in production, monitor the long-term effects and implement contingency actions, if necessary.

### Identify Alternative Solutions

- Evaluate how other groups solved similar problems.
- Use brainstorming to generate Alternate Solution C&E diagram.
- Consider redesign of the part or process to eliminate the problem.
- Anticipate failure of the solution. Develop contingency action(s).

### Implement Solution

- Use an action plan approach to implement the solution.
- Test and verify contingency actions, if possible.

# Implement Permanent Corrective Actions

## Corrective Action Questions

- Do the actions represent the best possible long-term solution from the customer's viewpoint?
- Do the actions make sense in relation to the cycle plan for the products?
- Has an action plan been defined?
  - Have responsibilities been assigned?
  - Has timing been established?
  - Has required support been defined?
  - What indicators will be used to verify the outcome of the actions, both short-term and long-term?

# Implement Permanent Corrective Actions

## Ongoing Controls

- Ensure the problem will not reoccur.
- Seek to eliminate inspection-based controls.
- Address 5M sources of variation.
- Test the control system by simulating the problem

## Questions

- Have the corrective action plans been coordinated with customers?
- What indicators will be used to determine the outcome of the actions?
- What controls are in place to assure the permanent fix is verified as intended?

# Implement Permanent Corrective Actions

## Forecast Outcome

- Will actions permanently solve the problem? Can you try out the corrective actions on a small scale to test effectiveness?
- Can scientific experiments be conducted to gain knowledge to predict the outcome of the effects of the implemented actions?
- Do the permanent corrective actions require support from external sources to be effective?

# Implement Corrective Action and Verify Over Time Check List

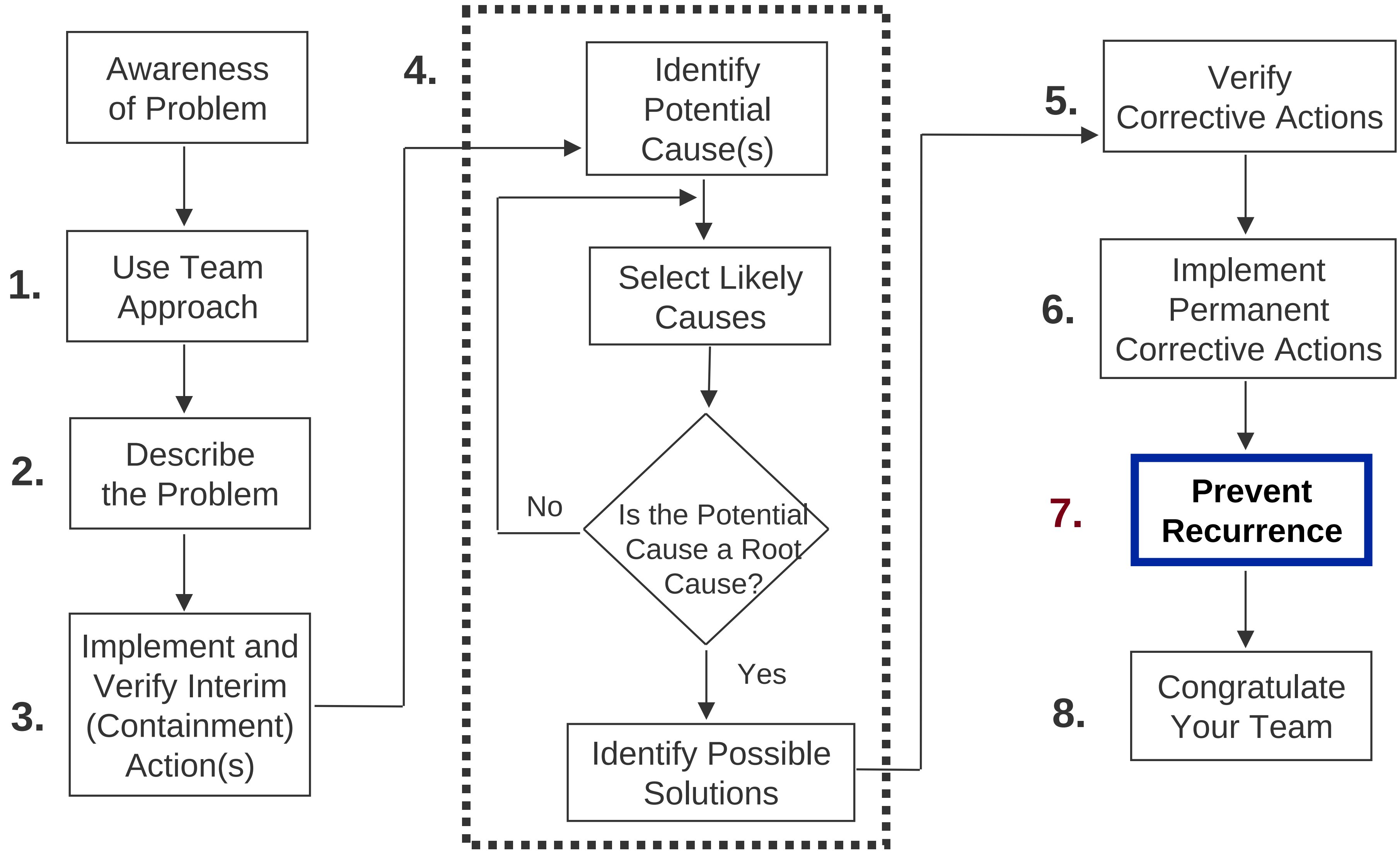
| Implement CA & Validate Over Time | Yes | No |
|---|---|---|
| Has the implementation plan been constructed to reflect Product Development Process events and engineering change process? | | |
| Do the corrective actions make sense in relation to the cycle plan for the products? | | |
| Have both Design and Process FMEAs been reviewed and revised as required? | | |
| Have significant / safety / critical characteristics been reviewed and identified for variable data analysis? | | |
| Do control plans include a reaction plan? | | |
| Is simultaneous engineering used to develop process sheets and implement manufacturing change? | | |
| Is the Paynter Chart in place for validating data? | | |

# D7
# Prevent Recurrence

# Prevent Recurrence

**Modify the management systems, operating systems, practices, and procedures to prevent recurrence of this and all similar problems.**

# The 8-D System



# Prevent Recurrence

- This next step in the Problem-Solving Process is the seventh discipline. It is important to understand what in the process allowed the problem to occur. A cause-and-effect diagram can be used to outline the reasons the problem occurred. By asking “Because?” the C&E diagram can be constructed.

- Another effective tool is a process flow diagram. The process flow of the manufacturing or engineering process can be effective in identifying where in the process the problem could have been prevented. To prevent recurrence of the problem, most of the time a change to the management system will be required. Managers must understand why their system allowed a problem develop. The same system will allow future problems to occur.

# Prevent Recurrence

- Management systems, practices and procedures need to be fully understood to be effective. Most of them are carry-overs from previous model years and organized structures. Some are outdated and need to be revised. Understanding the elements of a management system can be achieved by maintaining an up-to-date flow diagram of the system and process. Also, there should be easy to follow instructions for those who are part of the system.
- Management systems, practices and procedures should provide management support for ‘Never ending improvement’ in all areas and activities. The system should encourage individuals to participate freely in the problem solving process. It should help to understand more about their job and how each individuals’ effort affects the outcome of the final product on customer satisfaction. The system should encourage everyone to learn something new. And it should recognize individual and team effort when these new skills are applied.

# Prevent Recurrence

- Changes in the management system can require documenting new standard procedures, streamlining to remove obsolete procedures and revising previous standards. Changes in the management system need to be communicated clearly to all customers.
- To prevent recurrence additional training is often required. Training may be needed in statistical techniques and methodologies, new engineering or manufacturing technologies or disciplines, better process and/or project management.
- If concerns develop regarding changes to the system, these issues will be addressed. A new team may need to be assigned with the authority to address the management system.

# Prevent Recurrence

Notify All Personnel of the Resolution Actions

↓

Establish A Process Flow of the Management or Operating System

↓

Make Changes Needed To Prevent Recurrence

↓

Standardize the New Practices

# Prevent Recurrence

## Objective

Modify those management systems, operating systems, practices and procedures to prevent recurrence of this problem and all similar problems.

- Prepare a process flow diagram of the management / operating system that should have prevented the problem and all similar problems.
- Make needed changes to the system. Address system follow-up responsibilities.
- Standardize practices.
- Use action plan to coordinate required actions.

# Prevent Recurrence

## Questions

- Have all affected personnel been notified of the resolution actions?
- Has a process flow of the management system which will prevent this and similar problems in the future been prepared?
- Have the practices been standardized?
- Have action plans been written to coordinate actions?
- Have changes been made to the appropriate systems?
- Has the problem occurred due to a behavioral system?

# Prevent System Problems Check List

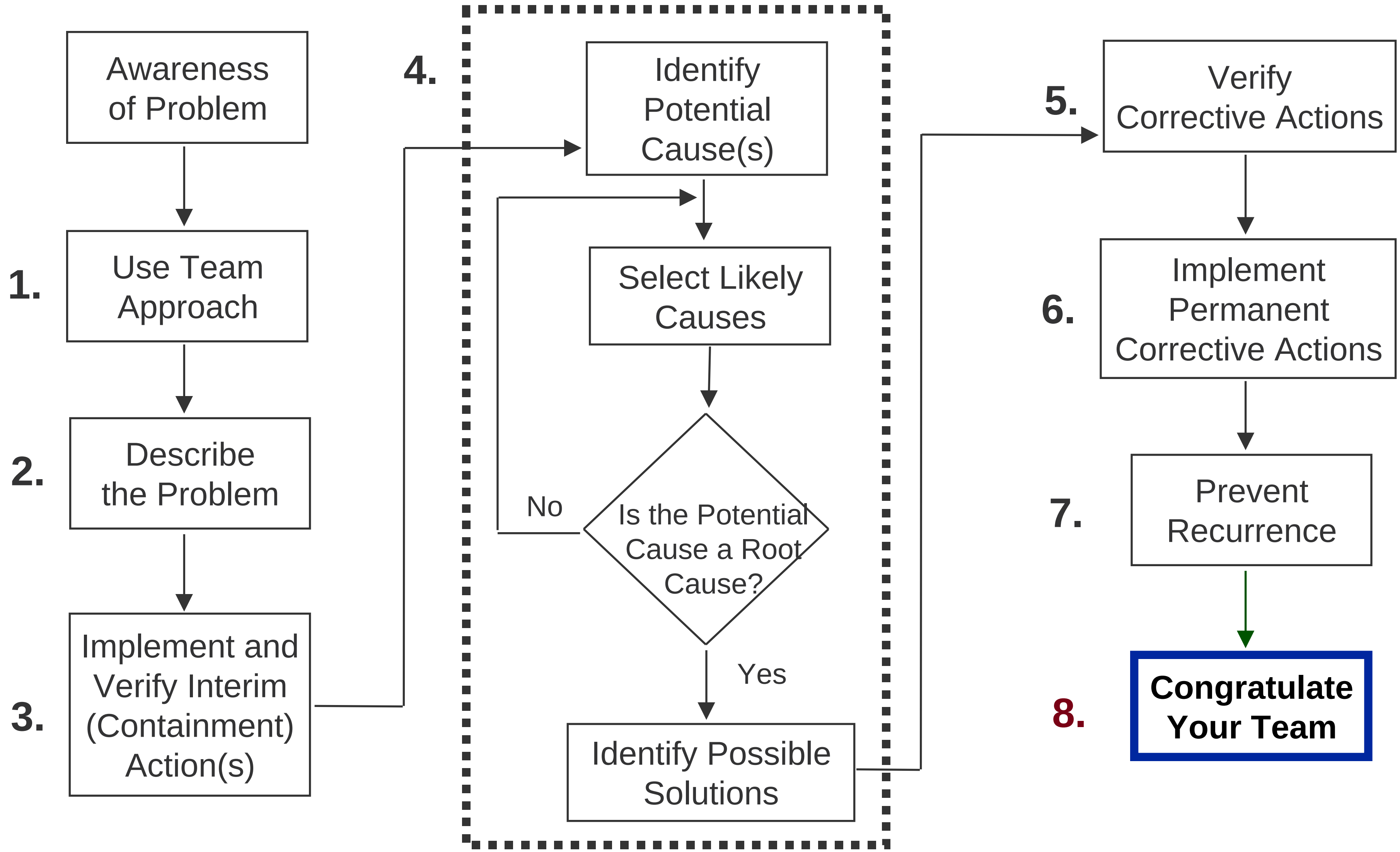
| Prevent System Problems Check List | Yes | No |
|---|---|---|
| Have the system prevention practices, procedures & specification standards that allowed the problem to occur and escape been identified? | | |
| Has a champion for system prevention practices been identified? | | |
| Does the team have the cross-functional expertise to implement the solution? | | |
| Has a person been identified who is responsible for implementing the system preventive action? | | |
| Does the system preventive action address a large scale process in a business, manufacturing or engineering system? | | |
| Does the system preventive action match root cause (occur & escape) of the system failure? | | |
| Does the team utilize error proofing and successive checks on a proactive on-going basis to eliminate the occurrence and escape of all defects? | | |
| Has a pieces over time (Paynter Chart) been used to indicate that the system preventive actions are working? | | |
| Has the System Preventive Action been linked to the Product Development phase? | | |

# D8
# Congratulate Your Team

# Congratulate the Team

**Recognize the collective efforts of the team.**

# The 8-D System



# Congratulate Your Team

The final step in a team oriented problem solving effort is to recognize the team's collective efforts in solving the problem and show gratitude by applauding individual contributions. Management will need to determine the best way to recognize the team's contribution to the origination. In addition, individual effort and talents need to be highlighted and rewarded.

Team oriented problem solving involves risk taking, some conflict, hard work and participation by everyone. It includes a free exchange of ideas,, individual talent, skill, experience and leadership. The team approach, when led effectively, produces a driving force of individuals motivated and committed to solving a specific problem.

# Congratulate Your Team

The form of recognition can vary, depending upon the complexity and severity of the problem. It is important to document what was learned while solving the problem so that this information can be used by others for planning. A description of the various actions carried out, together with the analysis and results obtained through the problem solving process, provide information that can be used to prepare a case study report. Case study reports include the purpose and objective, the procedure or problem solving steps followed, the data obtained through various investigative methodologies and the analysis of data in the form of results shown by charts and graphs, conclusions and recommendations.

This final step in the problem solving process is to conclude the successful efforts of the team is to acknowledge the significance and value, in quantifiable terms, of solving the problem for the customer and for improving quality and productivity for the company.

# Congratulate Your Team

Determine the Appropriate Recognition
for All Active, Participating Team Members

↓

Document and Communicate
The Efforts of The Team

# Congratulate Your Team

## Objective

Recognize the collective efforts of the team.

## Questions

- Have creative solutions been taken to warrant a review for a company sponsored award?
- has appreciation been shown to all the team members that contributed to the first 7-D's?
- How has the team leader identified each individual's contribution to the problem resolution?
- Was the problem and solution documented and communicated?

# Congratulate Your Team

| Congratulate The Team Check List | Yes | No |
|---|---|---|
| Have documented actions and lessons learned been linked to Product Development Process for future generations of products? | | |
| Has appropriate recognition for the team been determined? | | |
| Has application for patents & awards been considered? | | |
| Has team been reassessed? | | |
| Has the team analyzed data for next largest opportunity? | | |