Key QA/QC Concepts

- Quality auditing independent review
- Metrology "science of measurement"
- Root cause analysis identification of the original reason for process nonconformance
- Preventive/corrective actions change enacted to eliminate nonconformance
- Continual improvement on-going effort to improve a process

QA/QC Concentrations

- Civil Soil testing, inspection of structural steel or concrete
- Mechanical Inspection of valves, pumps, piping systems, hangers/supports, lubrication systems, etc.
- Electrical/I & C Need basic understanding of electrical equipment such as batteries, breakers, transformers, relays, motors, grounding systems, etc.
- Nuclear Need understanding of codes, standards and regulations for operating safely, Management of Quality Systems critical for Risk Management, Controls for tools, techniques and resources (including suppliers and contractors)

QA/QC in Other Industries

- > Automotive
- Aerospace
- > Safety
- Environmental
- Manufacturing and Supply Chain
- Medical
- Financial
- Food, Drug, Cosmetic, Medical Device and Tobacco
- Transportation (Rail, Road and Water)
- Security

American Society for Quality (ASQ)

- Offers 17 quality certifications
- Web-site provides description and education/experience requirements for:
 - CQI (Certified Quality Inspector)
 - CQE (Certified Quality Engineer)
 - CQA (Certified Quality Auditor)
 - CQT (Certified Quality Technician)
 - CQM/OE (Certified Manager of Quality/Organizational Excellence)

Quality Management

"It costs a lot to produce a bad product"

Norman Augustine

Cost Of Quality

- Prevention costs
- Appraisal costs
- Internal failure costs
- External failure costs
- Opportunity costs

Quality System Basics

- Documentation (Records)
- Roles and Responsibility
 - Management Responsibilities and Communication
 Organization Chart
 - Job Descriptions
- Training
- Organizational Processes (What We Do!)
 - Design Manufacture
 - Receiving

- Packaging Shipping

- Testing

- Quality Control
- Other Things (Finance, HR, Marketing, etc.)

Quality System Basics

- Auditing
- Nonconforming Product
- Monitoring and Measuring
 - Metrics
 - Key Performance Indicators
 - Data Analysis
- Corrective Action
- Preventive Action
- PDCA Plan, Do, Check, Act



What is quality management all about?

Try to manage all aspects of the organization in order to excel in all dimensions that are important to "customers

Two aspects of quality:

- Features: More features that meet customer needs = higher quality
- Freedom from trouble: fewer defects = higher quality

The Quality Gurus – Edward Deming

- Quality is "uniformity and dependability"
- Focus on SPC and statistical tools
- "14 Points" for management
- PDCA method





1900-1993

- The Quality Gurus Joseph Juran
- Quality is "fitness for use"
- Pareto Principle
- Cost of Quality
- General management approach as well as statistics





1904 - 2008

Quality History: How did we get here?

- Deming and Juran outlined the principles of Quality Management.
- Tai-ichi Ohno applies them in Toyota Motors Corp.
- Japan has its National Quality Award (1951).
- U.S. and European firms begin to implement Quality Management programs (1980's).
- U.S. establishes the Malcolm Baldridge National Quality Award (1987).
- Today, quality is an imperative for any business.

What does Total Quality Management encompass?

TQM is a management philosophy:

- continuous improvement
- leadership development
- partnership development



Developing Quality Specifications



Six Sigma Quality $\pm 6 \delta$

- A philosophy and set of methods companies use to eliminate defects in their products and processes
- Seeks to reduce variation in the processes that lead to product defects
- The name "six sigma" refers to the variation that exists within plus or minus six standard deviations of the process outputs

What Is Six Sigma?

 A statistical concept that measures a process in terms of defects – at the six sigma level, there 3.4 defects per million opportunities.

Six Sigma is:

Six Sigma is a rigorous and a systematic methodology that utilizes information (management by facts) and statistical analysis to measure and improve a company's operational performance, practices and systems by identifying and preventing 'defects' in manufacturing and service-related processes in order to anticipate and exceed expectations of all stakeholders to accomplish effectiveness.

Six Sigma is a methodology that provides businesses with the tools to improve the capability of their business processes. This increase in performance and decrease in process variation leads to defect reduction and vast improvement in profits, employee morale and quality of product.

Six Sigma is not:

- A standard,
- A certification,
- Another metric like percentage Rather!



- It is a Quality Philosophy and the way of improving performance by knowing where you are and where you could be.
- Methodology to measure and improve company's performance, practices and systems

SIGMA LEVELS

Sigma Level (Process	Defects per Million
Capability)	Opportunities
2	308,537
3	66,807
4	6,210
5	233
6	3.4

WHAT IS DMAIC?

DMAIC is (Define, Measure, Analyze, Improve, Control)

A logical and structured approach to problem solving and process improvement.

An iterative process (continuous improvement)

A quality tool which focus on change management style.



Phases of Six Sigma are:

- Define specific goals to achieve outcomes, consistent with customers demand and business strategy
- Measure reduction of defects
- Analyze problems , cause and effects must be considered
- Improve process on bases of measurements and analysis
- Control process to minimize defects



Phases of Six Sigma are:

- **Define:** Define is the first step in the process. In this step, it is important to define specific goals in achieving outcomes that are consistent with both your customer's demands and your own business's strategy. In essence, you are laying down a road map for accomplishment.
- Measure: In order to determine whether or not defects have been reduced, you need a base measurement. In this step, accurate measurements must be made and relevant data must be collected so that future comparisons can be measured to determine whether or not defects have been reduced.

Phases of Six Sigma are:

- Analyze: Analysis is extremely important to determine relationships and the factors of causality. If you are trying to understand how to fix a problem, cause and effect is extremely necessary and must be considered.
- **Improve:** Making improvements or optimizing your processes based on measurements and analysis can ensure that defects are lowered and processes are streamlined.

Phases of Six Sigma are:

 Control: This is the last step in the DMAIC methodology. Control ensures that any variances stand out and are corrected before they can influence a process negatively causing defects. Controls can be in the form of pilot runs to determine if the processes are capable and then once data is collected, a process can transition into standard production. However, continued measurement and analysis must ensue to keep processes on track and free of defects below the Six Sigma limit.

Quality Tools

- Process flow chart
- Run diagram
- Control charts
- Fishbone
- Check sheet
- Histogram
- Pareto analysis

How does this apply to you?

- Documents?
- Organization?
- Manufacturing?
- Tools?
- Quality Control?
- Quality Assurance?