

# **Quality Management National Occupational Standards**

Developing and Sustaining ESA  
Quality Assurance



**SONY**



**Google**

What is quality?

**NOKIA**



Mercedes-Benz



# Quality Concepts

Quality System (QS); management system describing policies, objectives, principles, organizational authority, responsibilities, accountability, and an implementation plan to ensure quality in products and services.

Quality Management Plan (QMP); document describing the organization's quality system organizational structure; policy and procedures; functional responsibilities; lines of authority for planning, implementing, documenting, and assessing activities conducted.

# Quality Concepts

Quality Assurance (QA); integrated system of policies and procedures for planning, implementation, documentation, assessment, reporting, and quality improvement to ensure the process, item, or activity is acceptable.

Quality Assurance Project Plan (QAPP); formal document that describes, in comprehensive detail, the necessary QA/QC and other technical activities that must be implemented to ensure that the results of the work performed will satisfy predetermined performance requirements.

# Quality Concepts

Quality Control (QC); system of technical activities measuring attributes and performance of a process, item, or activity against defined standards to verify it meets specifications. QC involves the action of testing, measuring, and evaluating the effectiveness of the program or activity. Examples include duplicate sampling, calibration checks, audits, reviews, assessments, peer reviews, and management oversight activities.

# Quality Assurance

- Develop reliable processes, goods and services
- Provide accountability
- Prevent inconsistent and poor output
- Detect and correct variation
- Measure and verify expectations
- Assure a level of reliability

# W.I.I.F.M. (What's In It For Me?)

- Reduced scrap and waste costs
- Reduced product liability
- Improve overall performance
- Increase competitiveness
- Increase customer satisfaction
- Increase public perception



# Explosive Competence

## Context: Quality Management

- Verifying explosive substances and articles meet specifications

## Performance Criteria

- a) work safely at all times, comply with company SH&E procedures and guidelines
- b) verify conformity of explosive substances or articles against specifications
- c) verify conformity of explosive substances or articles with applied performance standards (e.g., regulatory, ISO, etc.)
- d) verify conformity of ESA production processes
- e) detect and correct variation of ESA production processes and product performance
- f) ensure quality documentation recorded and exchanged is accurate, up to date and complete

## Knowledge Requirements

- a) company SH&E procedures, safe work practices and other guidelines
- b) assessment and measurement of explosive substances and article performance (e.g., regulatory, ISO, industry standard, etc.)
- c) detect and correct variation of production processes and explosive substances and articles performance
- d)

# Training and Competence

- Establish a culture aware of the importance of quality
- Establish a culture that rewards meeting quality expectations
- Determine competence for positions that affect product quality
- Provide training to achieve the necessary competence
- Evaluate the training, knowledge and performance outcomes
- Maintain records of training, skill, experience and outcomes

# State Expectations and Metrics

- Start with the position role and responsibilities
- Determine the expectations and metrics for the position
- Determine the skills, knowledge needed for the position

*Quality takes effort, don't expect it from poor execution*

# Conduct a Gap Assessment

- Evaluate who has success in the current positions?
  - Education Level
  - Training
  - Certificates
  - Licenses
  - Skills
  - Awareness
  - Experience

# Fill the Gaps

Position	Name	Responsibilities	Competency	Needs
QA Auditor	J. Alford	<ul style="list-style-type: none"> <li>• Monitor QA metrics</li> <li>• Conduct QA internal audits</li> <li>• Implement QA corrective actions</li> <li>• Support line QA improvements</li> <li>• Train line supervisors/leads</li> <li>• ESA Knowledge</li> </ul>	BS Engineering 2 Years Experience	Six Sigma Black Belt ISO9001 Additional Training (ISO) Professional Development
QA Auditor	R. Dawe		GED Six Sigma Black Belt 25 Years Experience ISO9001 Team Lead	Professional Certificate Professional Development
QA Auditor	M. Smith		BS Engineering 6 Years Experience ISO9001 Team	Six Sigma Black Belt Additional Training Professional Development
QA Auditor	B. Tanner		MS Engineering Six Sigma Black Belt 10 Years Experience ISO9001 Team	Professional Development

# Examine the Outcome

- Assess whether training and actions achieved desired results
  - Certificate or accreditation from outside agency/consultant
  - Key performance metric improvements
  - Direct supervision and observation
  - Written tests
  - Practical tests

# Recording and Rewarding Performance

- Record results
  - Favorable and unfavorable outcomes
  - Licenses, certificates, training records
  - Record quality escapes and incidents
  - Record discrepancy reports
  - Record customer concerns

# Rinse and Repeat

- Re-examine position roles
- Re-examine position responsibilities
- Determine the expectations and metrics for the position
- Determine the skills, knowledge needed for the position



# Lessons Learned:

## Hercules Titan IV Solid Rocket Motor Upgrade



The Titan IV was a large capacity space vehicle and the largest solid rocket booster used by the US Air Force. Only the Space Shuttle rivaled the load capacity.

## **Titan IV**

1. Payload Fairing
2. Center Upper Stage
3. Core Vehicle
4. Liquid Rocket Engine
5. Solid Rocket Motor



# Titan IV Solid Rocket Motor Static Test Failure



Hercules Aerospace  
Titan IV Solid Rocket Motor  
\$250,000,000 - \$350,000,000  
Static Test Facility  
Edwards Air Force Base  
Solid Rocket Motor Upgrade  
Preliminary Qualification  
Static Motor Test  
1 April, 1991

[https://www.youtube.com/watch?v=2VHJu\\_fKQZI](https://www.youtube.com/watch?v=2VHJu_fKQZI)

# Titan IV Solid Rocket Motor Static Test Failure

Air Force investigators believe the failure was the result of a defect in the Solid Rocket Motor Upgrade design that allowed:

- Hot gases generated by the solid rocket fuel that were unable to escape freely through the 40-inch (102mm) diameter channel in the propellant which funnels the thrust jet to the base of the rocket motor
- An obstruction to be created by burning gases shooting horizontally across the hollow core, which also pushed a portion of the solid fuel into the channel, creating more blockage

The static test failure:

- Caused no significant injuries
- Demolished a large portion of the test site (\$40millionUS)
- Caused nearly a year delay in site reconstruction and repairs

# Titan IV Solid Rocket Motor Static Test Failure

The US Air Force confirmed the failure was the result of a defect in the Solid Rocket Motor Upgrade design, not manufacturing.

- The SRMU design was changed
- The SRMU test site was repaired
- The SRMU was successfully tested in June, 1992
- Four qualification motor tests took place by September, 1993
- Seventeen Titan IV launches took place until the Titan IV program was suspended in 2005
- The program suffered to two upper stage failures, but the SRMU stage functioned as expected

# Lessons Learned:

Takata Holdings, Inc.

Automotive Airbag Recall

# Takata Airbag Recall

The US National Highway Transportation Safety Administration (NHTSA) conclusion for Takata inflator failures states:

- Affected inflators are inadequately sealed, which permits moisture intrusion
- Moisture causes the formation of pores and channels in the propellant;
- Over the course of years, the extent of this degradation progresses by a slow process driven by temperature fluctuations;
- During combustion, hot gas enters the pores and channels in the propellant, causing a transition from layer-by-layer burning to an *en masse* burning that causes over pressurization and inflator rupture.

Takata airbag inflator failures:

- Caused significant injuries and some fatal injuries to occupants
- Affected 42,000,000 Vehicles

# Takata Airbag Recall

3 Nov, 2015 the US National Highway Transportation Safety Administration (NHTSA) and Takata entered into a Consent Order, the Order stated:

1. Takata failed to provide timely notice to the NHTSA of one or more safety-related defects relating to the 2013-2015 recalls;
2. Takata produced testing reports that contained selective, incomplete, or inaccurate data;
3. Takata failed to clarify inaccurate information provided to NHTSA; and,
4. Takata failed to comply fully with NHTSA Special Orders

The Order imposed a civil penalty of \$70,000,000 and authorized the NHTSA to penalize Takata an additional \$60,000,000 if Takata failed to comply with certain requirements.



# Takata Airbag Recall

## Remedial Steps Taken by Takata:

- A. Established an Independent Monitor to oversee safety and compliance
- B. Established a safety hotline
- C. Established a Chief Safety Assurance and Accountability Officer
- D. Terminated several persons in relation to the subject matter of the Order
- E. Established a data vault to secure test information
- F. Established an internal compliance and regulation posting system
- G. Established an enterprise-wide Product Safety Group
- H. Established daily quality meetings

# Takata Airbag Recall

## Remedial Steps Taken by Takata:

- I. Established an early warning system to notify all potentially affected manufacturing plants about a potential risk of quality incidents
- J. Established a global horizontal deployment system to report and monitor quality incidents
- K. Established third-party audit of inflator validation reports
- L. Established an independent review of non-Ammonium Nitrate propellant and inflators under development
- M. Established an independent Takata Quality Assurance Panel to review and assess Takata's policies, practices, procedures, structure and personnel to ensure Takata achieves best practices

## Takata Airbag Recall

*“Takata deeply regrets the deaths and injuries that have occurred as a result of the failure of its products to perform properly, and extends its sincerest apologies and condolences to those victims and their loved ones. Takata also deeply regrets the instances in its history where the integrity of its testing data and reporting has been compromised, and the company is committed to ensuring that no such lapses ever recur.”*

*“Takata continues to increase its efforts to improve production quality, to test products safely and accurately, and to support appropriate recalls of vehicles on the road.”*

# Lessons Learned: The SDI Story

# SDI Key Indicators, 1999

- Full-time Employees >500
- Significant Injury Rate 9.0
- Unplanned Downtime >40%
- Scrap Rate >15%
- Average Weekly Production Not good
- Past Due Shipments >100,000 parts

# SDI Rises from the Abyss

New Management Team in place by November 2000

- Safety, Quality and Productivity Priorities Implemented
- Fact-based, Data-driven Metrics Used (Six Sigma, DOE)
- Safety, Quality and Productivity Training is Revised
- Millions Invested to ensure Safety, Quality, Productivity
- Competence becomes a watch-word
- Compliance is an expectation

# SDI Key Indicators, 2004

- Full-time Employees 300
- Significant Injury Rate 2.66
- Unplanned Downtime <14%
- Scrap Rate Reduced 78%
- Average Weekly Production 2 X 1999 rate
- Past Due Shipments 0

# SDI Key Indicators, 2017

- Full-time Employees 430
- Significant Injury Rate <1.0
- Unplanned Downtime <10%
- Scrap Rate World Class
- Average Weekly Production 10 X 1999 rate
- Past Due Shipments 0



# What Made the Difference?

- The SDI Management team clearly understood the impact of competence on safety and quality
- Competence to recognize problems and opportunities changed the culture
- Competence was written into job descriptions
- Competence became an integral part of the employee annual review

# What Is ESA Quality?

The establishment and sustainment of desired product outcomes with competence at every stage.