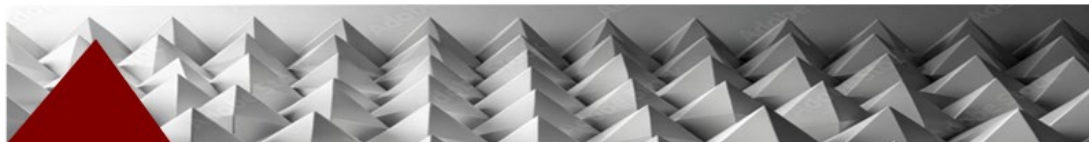


Nuclear Energy

~ **Quality** ~

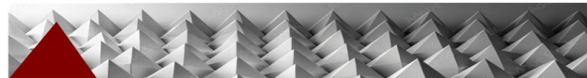
Picture v. 1,000 Words



What is It?


Quality

Can We Agree?




Quality in Context

IS QUALITY JUST A WORD WE USE?
THE EVOLUTION FROM MANAGING QUALITY TO CHAMPIONING ORGANIZATIONAL EXCELLENCE



TOM TAORMINA



Tom Taormina, CMC, CMQ/OE, BSM – More than 50 Years, June 2025 In Memoriam
The Taormina Group | Consultant | Expert Witness | Author

<https://gqmadvisors.com/professional-resources/advisors/#teamMember24>

Google context for word quality

AI Mode All Images Videos Short videos Shopping Forums More Tools

AI Overview

The word "quality" can be used to describe a **degree of excellence** or a **distinguishing characteristic or attribute**. The context **determines which meaning is intended**; it can refer to how good something is (e.g., "high-quality food") or describe a specific trait (e.g., "the quality of being penetrable").

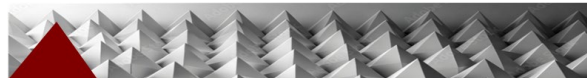
Context: Degree of excellence

- **Standard:** Refers to the level of excellence, often in a positive sense.
 - *Example:* "The company guarantees the **quality** of its merchandise".
- **Suitability:** Means something is fit for its intended purpose.
 - *Example:* "A gear for a juice machine may have a lower surface finish but still be of good **quality** if it works satisfactorily".
- **Manufacturing:** In business, quality is a measure of excellence, often related to being free from defects.
 - *Example:* "A **quality** system ensures products meet customer requirements".

Context: Distinguishing characteristic

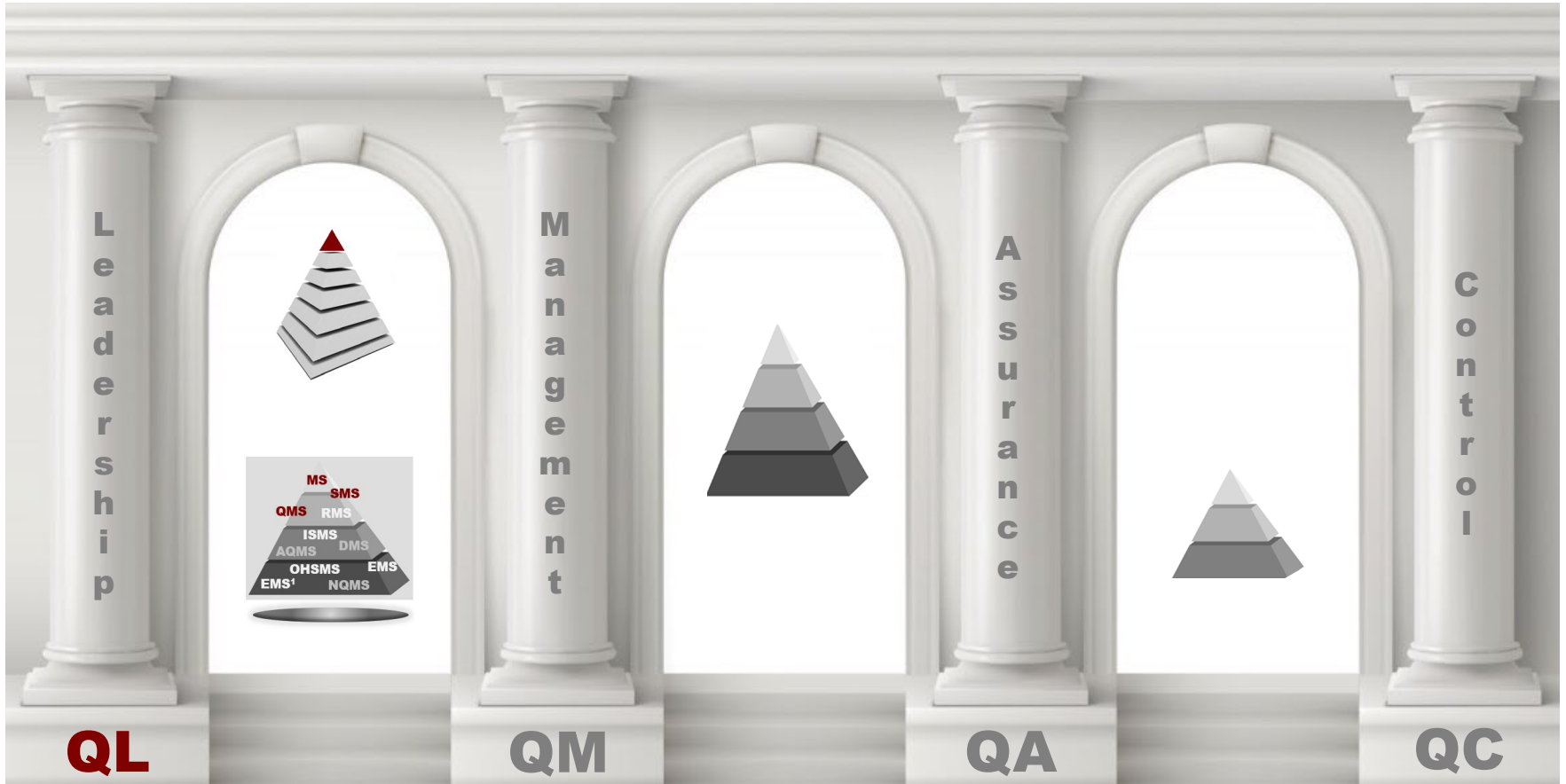
- **Attribute or property:** Describes a feature or trait that something possesses.
 - *Example:* "Honesty is a desirable **quality**".
- **Nature or essence:** Refers to the fundamental character or nature of something.
 - *Example:* "This gelato has an almost bodiless **quality**".
- **Social status:** Historically and in some contexts, it can refer to high social standing.
 - *Example:* "A man of **quality**".

[context for word quality - Google Search](#)



Quality in Context

Commitment | Integrity | Trust | Honesty



<https://gqmadvisors.com/disciplines/>

~ **The Four Quality Disciplines** ~

~ Schools of Thought ~

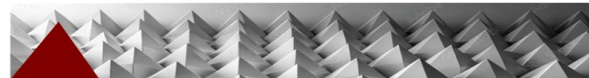


Sainte-Geneviève library, Paris, France



~ Think About It ~

Pathway to Leadership





QC | QA | QM | QL

Quality's Path to Leadership

Quality Management Tools

Risk Mitigation, SixSigma, QFD, FEMA, PDCA, C&E Diagraming, SPC, Control Charts, Remote Audits, Design / Contract Assurance, Lean, Process Mapping, Software, Modeling, Self-Assessments, CAPA, Drone Site Monitoring, Robot Inspections, Cyber Security, Others

2000 Work Cultures Emerge as Key Element to QMS Effectiveness

1990 Shift from 'Error Detection' to 'Error Prevention'

1990 U.S. Dept of Navy CNO Enacted Total Quality Leadership Concepts & Practices to Selected Fleet Units. Goal: Process Improvements.

Quality Affecting Significant Events

- 1912 RMS Titanic Atlantic Ocean (UK)
1941 World War II Mass Production (U.S.)
1955 Post-War Aerospace (U.S.)
1955 Naval Nuclear Program (U.S.)
1955 Atoms for Peace (Global Effort)
1960 Global Space Race (NASA, U.S.)
1968 Commercial Nuclear Power (U.S.)
1979 TMI Unit 2 (Pennsylvania, U.S.)
1984 NRC NUREG-1055 Report to Congress
1986 Challenger Shuttle (U.S.)
1986 Chernobyl (Russia)
1988 Piper Alpha Oil Spill (North Sea)
1989 Exxon Valdez Oil Tanker Spill
2001 Prince William Sound (Alaska, U.S.)
2002 911 (New York City, U.S.)
2002 Prestige Oil Spill (Spain)
2002 Davis Besse' Reactor Head (Ohio, U.S.)
2003 Columbia Shuttle (U.S.)
2008 Metrolink Train (Southern CA, U.S.)
2008 B2 Bomber Crash (U.S.)
2010 Deepwater Horizon BP Oil Spill, Gulf of Mexico, 87 Days, (UK)
2011 Fukushima Daiichi (Japan)
2020 Coronavirus Pandemic Global COVID19

U.S. Quality Leaders Emerge

- Dr. Walter A. Shewhart
Dr. Armand V. Feigenbaum
Dr. Joseph M. Juran
Philip B. Crosby
Dr. W. Edwards Deming's Period of Influence

- 'System of Profound Knowledge'
- Encompassed System, Variation, Knowledge, Psychology
- 4 Lenses of Reference

Conformance to Requirements

'Quality is Free concept 1979'

Philip B. Crosby



1977 DOE Formed

1975 NRC Formed

1971 OSHA Formed

Quality Assurance Emerges

1958 NASA & DARPA Formed

1957 First U.S. Nuclear Power Plant

'Cost of Poor Quality' U.S. Military Suppliers

Increased Emphasis on Quality | Safety

Inspection / Testing

Mass Production

World War II

QRs

QC / SPC
In - Process Inspection

QRs

Quality Control

Complex Software

Quality Assurance

Complex Engineered Products / Systems / Structures

Challenger Shuttle, U.S. 1986 Accident

Chernobyl, Russia Nuclear Power Plant 1986 Accident

Three Mile Island, U.S. Nuclear Power Plant 1979 Accident

Quality Management

Exxon Valdez, Prince William Sound 1989 Oil Tanker Spill, Alaska, U.S.

911, Twin Towers, U.S. 2001

Columbia Shuttle, U.S. 2003 Accident

BP Deepwater Horizon, UK 2010 Oil Spill

Fukushima Daiichi, Japan Nuclear Power Plant 2011 Accident

COVID-19 Global Pandemic

Management Systems Industry & Government - Driven

- Environmental / Health / Safety Mgt
Enterprise / Information Mgt
Integrated Mgt
Requirements Mgt
Risk Mgt
Emergency Prep Mgt
Supply Chain Mgt
Process Hazards Mgt
Cybersecurity Mgt

QRs Quality Requirements

Quality Leadership

Who's Your ~ Chief Quality Officer ?

1913, U.S. DOL Created

1911, U.S. ASME BPVCs Boiler / Pressure Safety

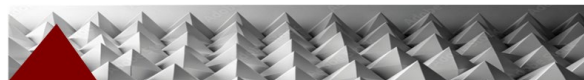
1907, 60 Workers Died in Pittsburgh Factories

1884, U.S. BLS Collects Data

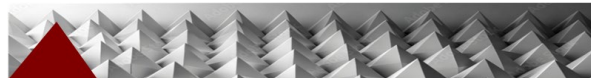
QRs Self - Inspection

Productivity Studies (SPC)

1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050



What Is Nuclear Quality?



U.S. Commercial ~ Nuclear Quality Management

2020 **2025** 2030

Renaissance ~ TBD

- SMRs > 150+ Reactor Designers
- MMRs ~ TBD
- LNPPs > 25 Reactor Designs
- Fusion ~ TBD
- CS & AI ~ TBD

Numerous global non-nuclear industry sectors have been implementing ISO 9001 Quality Management Systems & quality tools since 1987. QMS certifications now exceed 1.5 million. Many nations require QMS certification as a part of product / service / system safety-basis certifications.

The U.S. NRC recognized ISO9001:2000 in 2003. This model also suggests the industry may require provisions for implementing "Integrated Management Systems."

2018 ~ New ISO 19443 Nuclear QMS

Will U.S. Nuclear Industry Executives Recognize & Integrate Advanced Quality Management Tools to Enhance Overall Operational Effectiveness?

The U.S. chemical, oil, and gas industries have a history of QC, Inspection, & Testing as the methods for ensuring safety & specification compliance. In the mid-'60s, the nuclear industry initiated QA with the goal of "error prevention."

- Is the new generation of professionals well trained in U.S. NRC 10CFR50, App. B & ASME NQA-1 Quality Management Requirements?
- Does the nuclear industry recognize the 'Management of Quality' & its focus is driven by company executives & safety-related items?
- Do executives recognize & embrace advanced 'Quality Management Tools' available to enhance, safety, effectiveness, & compliance?
- Will industry members realize the benefits by unconditional Quality Management support?

Cyber Security | AI

1970

'79 1980

1990

2000

2005

2010

1960

U.S. Quality Leaders Emerging

- Dr. Walter A. Shewhart
- Dr. W. Edwards Deming
- Dr. Armand V. Feigenbaum
- Dr. Joseph M. Juran
- Philip B. Crosby



U.S. Reagan Baldrige Performance Excellence

Project Management Institute (PMI) Formed

1977 DOE Formed

1975 NRC Formed

OSHA Regulations

1987 Quality Management Systems (QMS)
ISO 9001 QMS Standards Released

Quality Management Tools

- SixSigma, QFD, FEMA, PDCA, C&E Diagraming, Mapping, Software, Assessments
- 1995 ISO QMS Certified 75K

Enterprise Software

- Intra- & Internet
- e-QMS
- CMM Site Wide

Integrated Management Systems (IMS)

- IMS, QMS, EMS, RM, CM, SCM, Others
 - Requirements Matrix (Advanced)
 - Process Hazards Mgt
 - Enterprise Software (Advanced)
 - Cyber Security
 - Supply Chain Mgt (Advanced)
 - Post 911 Safety / Security
- 2006 ISO 9001 QMS Certified .6 million, among 155 Countries

2012 ISO 9001 QMS Certified 1.1 mil, among 178 Countries

ISO 9001 ISO 14001 ISO 45001 ISO 27001 other Management System Certs. ISO 19443 QMS ITNS

1950 ~ 1990 LNPP Design | Build Period

65 LNPP Sites & 100+ Power Reactors

2000 Renaissance ~ AP1000 LNPP & SMR NPPs

2005 China AP1000 2 NPP Sites w/ 4 Reactors

2008 NuScalePower SMR ~ TBD

Inspection | Test Era

1957 First U.S. Nuclear Power Plant

'Cost of Poor Quality' (COPQ) U.S. Military Suppliers

Quality Assurance Programs

Quality Control Programs

App B, Needs Major Upgrade – Requirements Documents & Quality Management Practices

1970 NRC QA Public Law 10CFR50 Appendix B

1971 Industry Standards ANSI N45.2 – 1971 QA ANSI N45.2 – 1977 QA ASME / NQA-1 – 1979 QA

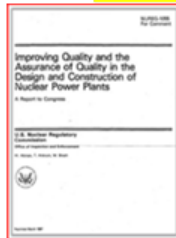
1974 NRC Regulatory Guides

RGs / Codes / Standards Audits / Assessments / Oversight

1979 Accident Three Mile Island NPP

1986 Accident Chernobyl NPP

1984 U.S. NRC NUREG-1055 Report to Congress



1987 Quality Management Systems (QMS) ISO 9001 QMS Standards Released

EMS Shift 'Paper Work' to 'Information Work'

2001 911 Twin Towers

Operational ~ Vogtle 3 & 4 AP1K ~ 2024

VC Summer AP1K Cancelled \$9 bil ~ 2017

BWXT mPower SMR Cancelled \$400 mil ~ 2016

2011 Accident Fukushima NPP

2010 BP Deepwater Horizon

QC, QA, Test, Supply Chain Management
Quality Engineering, Design Assurance

Quality Management Systems

Enterprise Management Software

Robotics

Integrated Management System

Culture
- Safety
- Quality
- Risk
- Security

1960 QA

1970 QE

1980 QM

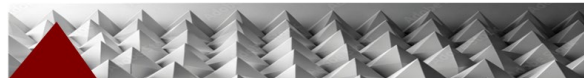
QMS 1990 EMS

2000 IMS

2010 Culture

2020 CS | AI

2030



Quality
Quality Assurance
Quality Management
Quality Management System

Quality Program
Nuclear QA Program

Management System

Utilization of ISO 9001 and Other Non-nuclear Suppliers for Safety-related Applications

Mark Richter
Technical Advisor
Nuclear Energy Institute

Prepared by the Nuclear Energy Institute
May 2025 (Rev. 0)

Ref 7, ISO 9000:2015, *Quality management systems – Fundamentals and vocabulary*

Quality – degree to which a set of inherent characteristics of an object fulfills requirements. (Ref 7)

Quality Assurance – part of quality management focused on providing confidence that quality requirements will be fulfilled. (Ref 7)

Quality Management – management regarding quality. (Ref 7)

Note: Quality management can include establishing quality policies and quality objectives, and processes to achieve these quality objectives through quality planning, quality assurance, quality control, and quality improvement.

Quality Management System – part of a management system with regard to quality. (Ref 7)

Quality Program – In the context of this document, this term is used generically to refer to any policies, processes, or procedures established to achieve quality, including a quality assurance program or quality management system. A non-nuclear quality program is understood to be a program implemented by a non-nuclear supplier. A nuclear quality program or nuclear QA program is understood to be a program implemented by a nuclear supplier.

Nuclear QA Program – A QA program that satisfies the applicable regulatory requirements of both 10 CFR 50 Appendix B and 10 CFR Part 21 and may be used for safety-related applications. The NRC has only endorsed NQA-1 as fully satisfying all 10 CFR 50 Appendix B requirements and available for the use of safety-related applications (see Regulatory Guide 1.28).

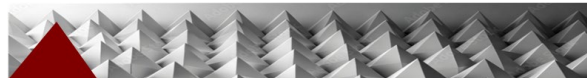
Management System – set of interrelated or interacting elements of an organization to establish policies and objectives, and processes to achieve those objectives. (Ref 7)

Note 1: A management system can address a single discipline or several disciplines, e.g., quality management, financial management or environmental management.

Note 2: The management system elements establish the organization's structure, roles and responsibilities, planning, operation, policies, practices, rules, beliefs, objectives and processes to achieve those objectives.

Note 3: The scope of a management system can include the whole of the organization, specific and identified functions of the organization, specific and identified sections of the organization, or one or more functions across a group of organizations.

We Communicate
via
Programs | Systems | Procedures



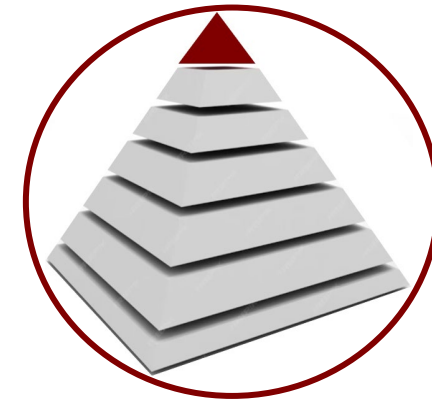
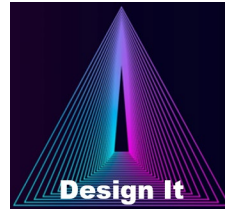
Program | System Maturation Level?

Crystal Clear?

SCOPE



Limited ~ Full



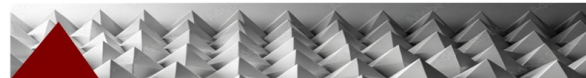
Systems

NMS U.S. NRC 10CFR50, Apps A & B

QMS U.S. DOE, Baldrige, ISOs, IAEAs

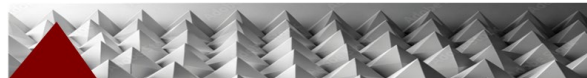
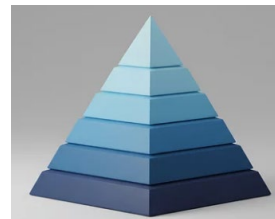
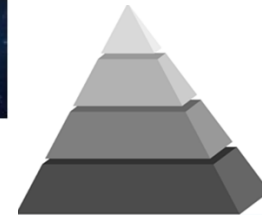
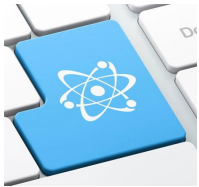
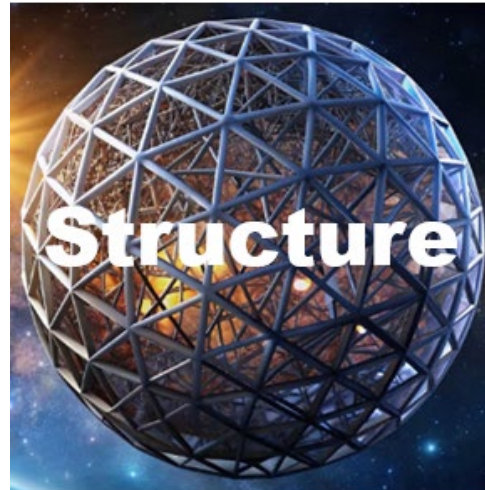


1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010 2020 2030 2040 2050



Structures

Visualize The Industry Framework ~ It Looks Like?



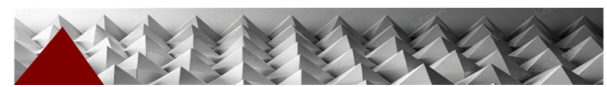
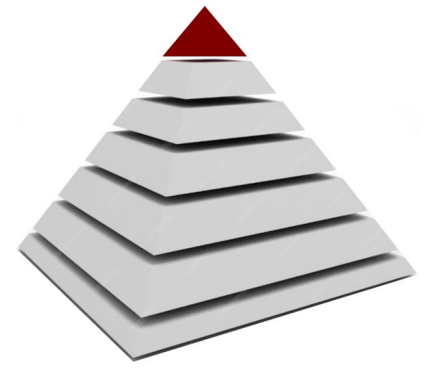
Complexity Simplicity Reality

Reactor Systems

~ **Everything Must Be Verified** ~



Management Systems

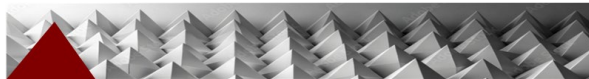
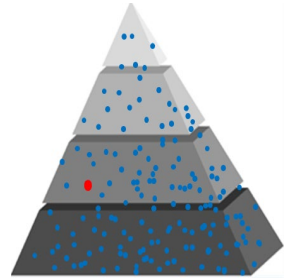
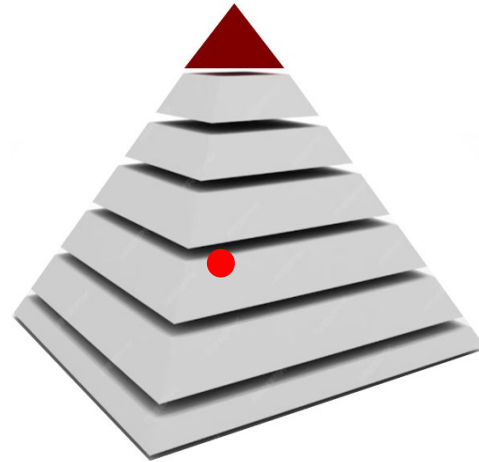


Complexity

Program | System | Procedures ‘Designed’ for Problem Prevention?



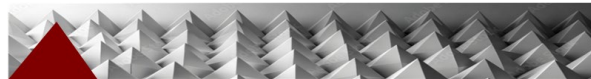
**1 ~ Nonconforming Condition[●]
in the System Can Shut Down
Your Nuclear Facility**



Safety-Related

=

Quality-Related



International Atomic Energy Agency

Consider

IAEA

- GSR Part 1 – Governmental, Legal, & Regulatory Framework for Safety
- GSR Part 2 – Leadership and Management for Safety
- SF-1 – Fundamental Safety Principles
- NG-T-1.3 – Development & Implementation of a Process Based Management System
- NG-T-1.6 – Management of Nuclear Power Plant Projects (NPPs)
- TECDEC 1910 – QA | QC Nuclear Facilities & Activities
- 1740 – Use of a Graded Approach in the Application of the Management System Requirements for Facilities & Activities
- PC-9104 – Assessment of Management Systems (NG-G-1.2)

    
Quality ~ Quality ~ Qualite' ~ Qualità ~ Hinshitsu



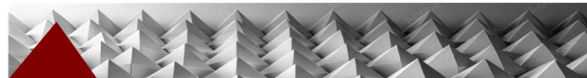
Can We Agree?

**If You Don't Master the Terms & Definitions Used by the
Four Quality Disciplines, How Can You Understand What
is Being Addressed & What's Going?**

~ Words > Actions > Results ~

Is There a Strong Chance for Mis-interpretation?

Is There a Strong Chance for a Nonconforming Condition?



Nuclear Quality

**Why the Confusion ~ Just
Attend the Course , ,**

Quality
Quality Assurance
Quality Management
Quality Management System
Quality Program
Nuclear QA Program
Management System

Ref 7, Mark Richter, NEI , Slide 9

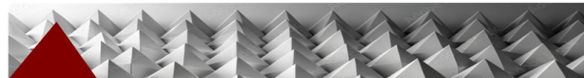


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Global Quality Management Advisors ~ Since 1991

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GQMnuv.adv NMS NEI 22-04 10-10-25 R0



Nuclear Quality

FINALLY ~ I Understand , , ,

Nuclear Management Systems



**What Executives & the Workforce Should Know
About the Management of Nuclear Quality**

