

- Quality Affecting Significant Events**
(Examples)
- 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 Nuclear Industry Quality / Safety / Management Failures (U.S.)**
 - 1986 **Challenger Shuttle (U.S.)**
 - 1986 **Chernobyl (Russia)**
 - 1988 **Piper Alpha Oil Spill (North Sea)**
 - 1989 **Exxon Valdez Oil Tanker Spill Prince William Sound (Alaska, U.S.)**
 - 2001 **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)**

1940

1960

1970

1985

2001

2017

U.S. Quality Leaders Emerge

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

Conformance to Requirements

(Concept Emerges 1979)
"Quality is Free"
 Philip B. Crosby

QM & Quality Tools

- SixSigma, QFD, FEMA,
- PDCA, C&E Diagraming, Process Mapping, Software, Self-Assessments
- **ISO QMS Certifications Reach 450 Million 2000**

"The Next Industrial & Quality Revolution"

Considerable Emphasis on Quality | Safety Begins 1970s

"Cost of Poor Quality" U.S. Military Concept Begins Military Supplier Chain

1971
OSHA Created

Quality Management

Integrated Management Systems

- ISM, QMS, EMS, RM, SCM, others
- **ISO QMS Certifications Reach 1.5 Million (2011), 178 Countries**
- **Post 911 Safety / Security**
- Requirements Matrix (Advanced)
- Process Hazards Mgt
- Enterprise Software (Advanced)
- Cyber Security
- Supply Chain Mgt (Advanced)

World War II

Mass Production

Quality Assurance w/ Quality Control

Three Mile Island Nuclear Power Plant Accident - 1979

Quality Management Systems (QMS)

911 - 2001

BP Deepwater Horizon Oil Spill - 2010

Self - Inspection

Productivity Studies (SPC)

Quality Control

Quality Control In-Process Inspection

Quality Control Evolves as Basis for Quality Assurance

Complex Engineered Products / Systems / Software

Pre - 1900 **SI**

1920s

1930s **QC**

1940s **QC IP Inspection**

1960s **QA**

1970s

1980s **QM**

1990s

2000s **ISM**

2017

1884 U.S. BLS Collects Data

1907 Report, 60 Workers Died in Pittsburgh Factories

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

1913 U.S. DOL Created

IAEA & ISO Formed

U.S. Commercial Nuclear Power

- Industry Standards - 1962 U.S. Mil-Q-9858A, UK BS-5750

- Nuclear Power Industry - 1965 Regulations / Standards

- Nuclear Power Public Law - 1969 10CFR50 Appendix B

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

QMS Movement

- 1987 **ISO 9001 QMS Certifications International Sectors**
- 1987 **U.S. Baldrige Quality Performance Program (Department of Commerce)**
- 1990 Quality Management Consultants

U.S. Report to U.S. Congress NUREG - 1055 Nuclear Safety / Quality Management Failures

