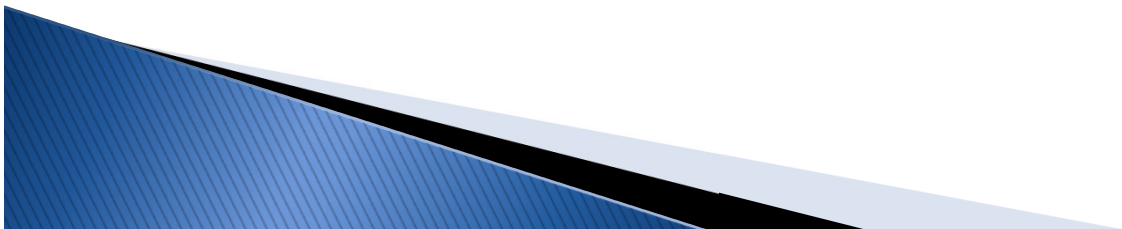# Software Quality

Rachel Kelley Czuba, SSI
Milt Concepcion, DOM

Software Quality

Introduction

What brought us here today?
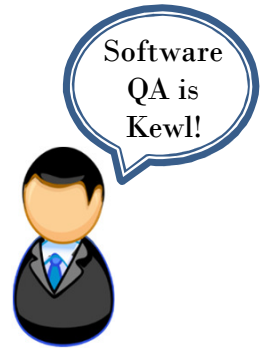
Recent encounters we have had
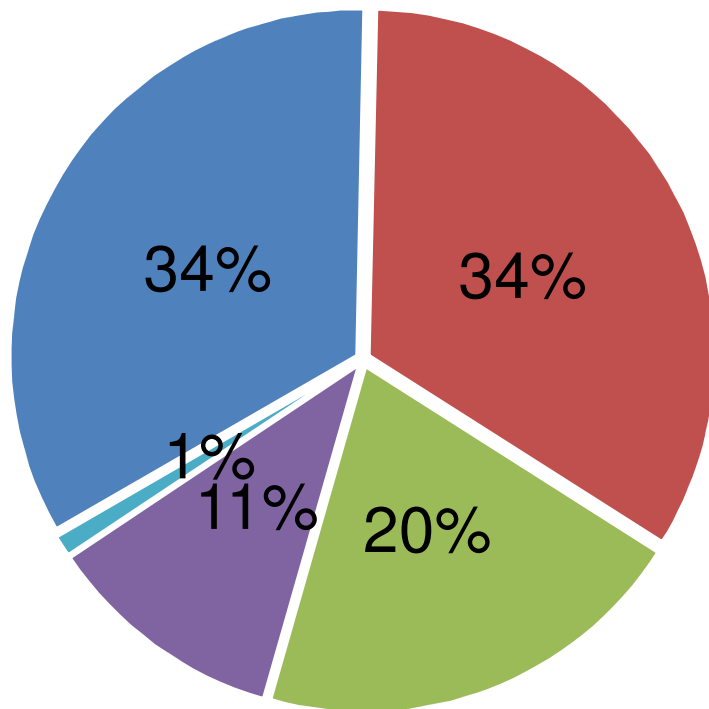
Software Quality
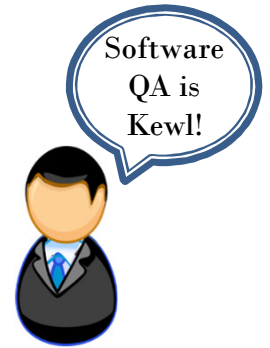
Introduction

Last 3 years of NUPIC findings

- 34% — Error Notification and Evaluation
- 34% — Verification and/or Validation
- 20% — CGD
- 11% — Program Unadequacies
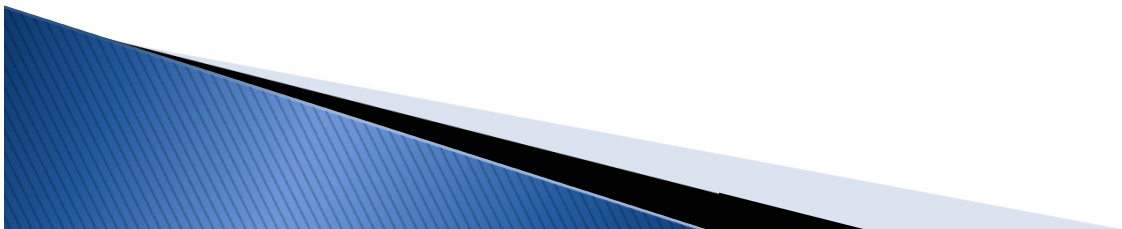- 1% — Program Ownerships

Software Quality

Software Life Cycle

Software Life Cycle – from Conception to Retirement
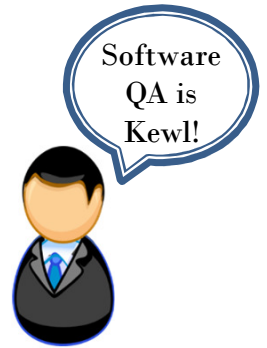
- Concept
- Requirements
- Design
- Implementation

- Test
- Installation and Checkout
- Operation and Maintenance
- Retirement

Software Quality

Software Quality Program

Top Level Document Describing Software Life Cycle

- Ownership

- Classification

- Development

- Procurement

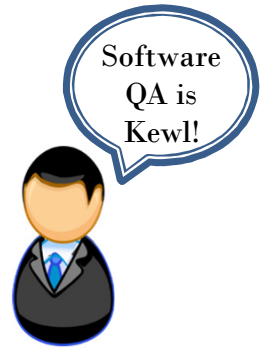- Configuration Management

- Errors

Output: Plan, Program, Procedure, Description

Software Quality
Ownership

▸ Management – Understanding and Support

▸ Three Legged Stool

- Engineering
- Quality
- Procurement

Software Quality
Software Classification
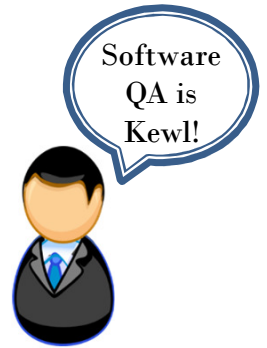
Software QA is Kewl!

Things to Consider

▶ Importance to Nuclear Safety

▶ Regulatory Commitment

▶ Impact To Business

Output

▶ Documents Required

▶ Level of Documentation

▶ Resources Needed

Software Quality
Software Development Cycle

FIGURE 3.1. Software Life Cycle

from: NUREG-4640

Software Quality
Software Development Cycle

Software QA is Kewl!

Development Cycle

From decision to develop to delivery

- ▶ User/Design Requirements
- ▶ Design
- ▶ Implementation

Software Quality
Software Development Cycle

▶ **Want/Need – User Requirements**

- Direct
- Complete
- Verifiable

Output: URS, FRS

▶ **Design – (Technical Info)**

- Language
- Operating System
- Methodology/ Eng Standard

Output: SDD, SDS

Software Quality
Verification and Validation

Software QA is Kewl!

Verification - Design Review

From NQA-1 "…determining of the product of the software design activity fulfills the software design requirements

Does the application do what the user needed?
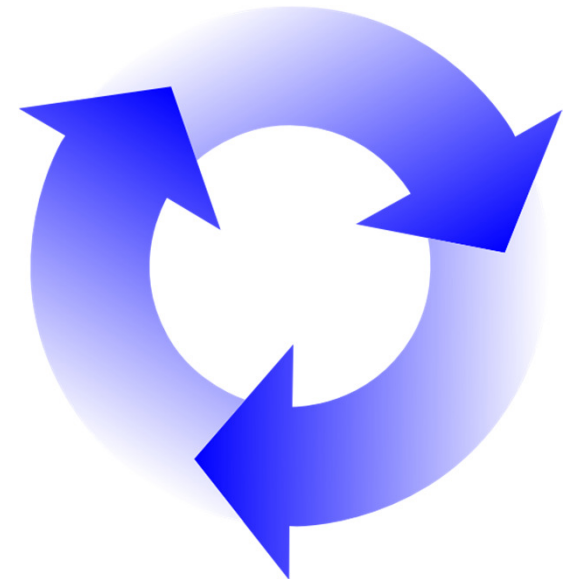
Validation - Acceptance Testing

From NQA-1 "…evaluation of a system or system component by manual or automated means to ensure that is satisfies the specified requirements and to identify differences between expected and actual results in the operating environment

Does the app do its job in its environment?

Output: SVVP, SVVR

Software Quality

Software Procurement

▶ **PO Quality and Technical Requirements**

- Scope of Work
- Technical requirements (by preference to specific drawings, codes, specification)
- Documented Quality Assurance program
- Right of access for source inspection/audit
- **Documents submittal of approval**
- **Deliverable records**
- **Reporting and approving nonconformance dispositions**
- **Records availability, retention, and disposition**
- **Extending Technical and QA requirements to lower tier suppliers**
- **10CFR21 applicability**

Software Quality

Software Dedication

Software QA is Kewl!
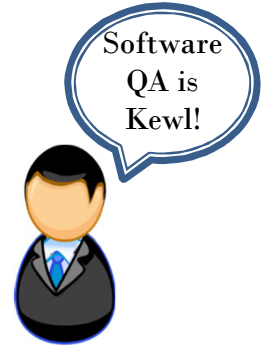
No different than "widget" dedication except...

> ## CCs based on
> ◦ Conceptual error
> ◦ Arithmetic error
> ◦ Interface error

> ## Types Of CCs
> ◦ Physical
> ◦ Performance
> ◦ Dependability

Software Quality

Software Error Evaluation and Notification

Software QA is Kewl!
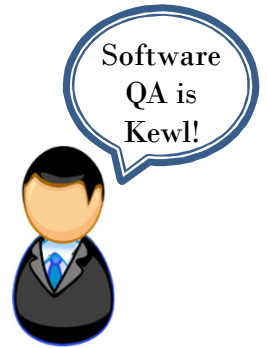
- Classification
- True Problem or Not
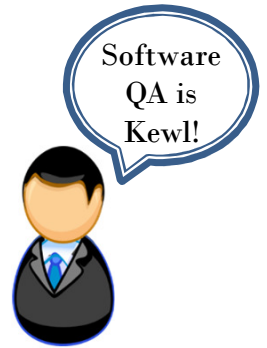- Notification to users

From a developer standpoint

From the user standpoint

- Impact to past, present work
- Notification to users for future work
- Work arounds?

Software Quality
Software Configuration Management

From NQA-1, "..defining the configuration items in a system(i.e.., software and hardware), controlling to release and change of these items throughout the system's life cycle, and recording and reporting the status of configuration items and change requests."

- ▶ Documentation

- ▶ Support Software

- ▶ Change Control

Software Quality
References

- ANSI/ASME NQA-1, "Quality Assurance Program Requirements for Nuclear Facility Applications" 2015 edition
- RG 1.28, "Quality Assurance Program Criteria (Design and Construction)" R5 October 2017
- EPRI TR 1025243, "Plant Engineering: Guideline for the Acceptance of Commercial-Grade Design and Analysis Computer Programs Used in Nuclear Safety-Related Applications: Revision 1 of 1025243" December 2013
- RG 1.231, "Acceptance of Commercial Grade Design and Analysis Computer Programs Used in Safety Related Applications for Nuclear Power Plants" R0 Jan 2017
- Information Notice 86-77, "Computer Program Error Report Handling," issued August 28, 1986
- NRC Inspection Procedure 35710, "Quality Assurance Inspection of Software Used in Nuclear Applications" Issued Jan 2018
- Various IEEE Standards
  - IEEE Std. 830-1993, "IEEE Recommended Practice for Software Requirements Specifications"
  - IEEE Std. 1008-1987, "IEEE Standard for Software Unit Testing
  - IEEE Std. 1012-1998, "IEEE Standard for Software Verification and Validation Plans
  - IEEE Std. 1028-1997, "IEEE Guide to Software Configuration Management
  - IEEE Std. 1074-1995, "IEEE Standard for Developing Software Life Cycle Processes

Questions?