Quality Planning

IceCube Upgrade NSF PY4 Re-Baseline Review
April 26-28, 2022

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WBS #1.1.3 / Quality & Safety Management

Quality Plan Highlights

M3: Adequate QA Practices

- NSFLR6: Shipment Quality
- Quality Plan (2020-001.2)
- Quality Process Hierarchy
- Quality Plan Interactions
- Configuration Management Plan (2019-007.2)
  - Document Control
  - Design Baseline Control **(Detailed in FF Talk)**
  - Software Control
  - Change Control **(Detailed in FF Talk)**
- Nonconforming Material
- Manufacturing Plan
- Training

NSFLR6: Shipment Quality

- IceCube Upgrade Logistics – Cargo Estimation and Shipment Planning
  - Revised in 12/21 to address NSFLR6.

    - Seeking to improve Shipment Quality and Efficiency through on-going process improvement.
      - Design of systems and components with shipping in mind.
        - Minimizing surplus materials to reduce waste.
      - Minimizing storage time, and touch points throughout the process.

    - Shipment List validated by subject matter expert and Logistics Mgr. at each point of departure to ensure accuracy of the shipment.
    - Key packing requirements are listed in document and in a "Pre-Shipping Quality Checklist.".

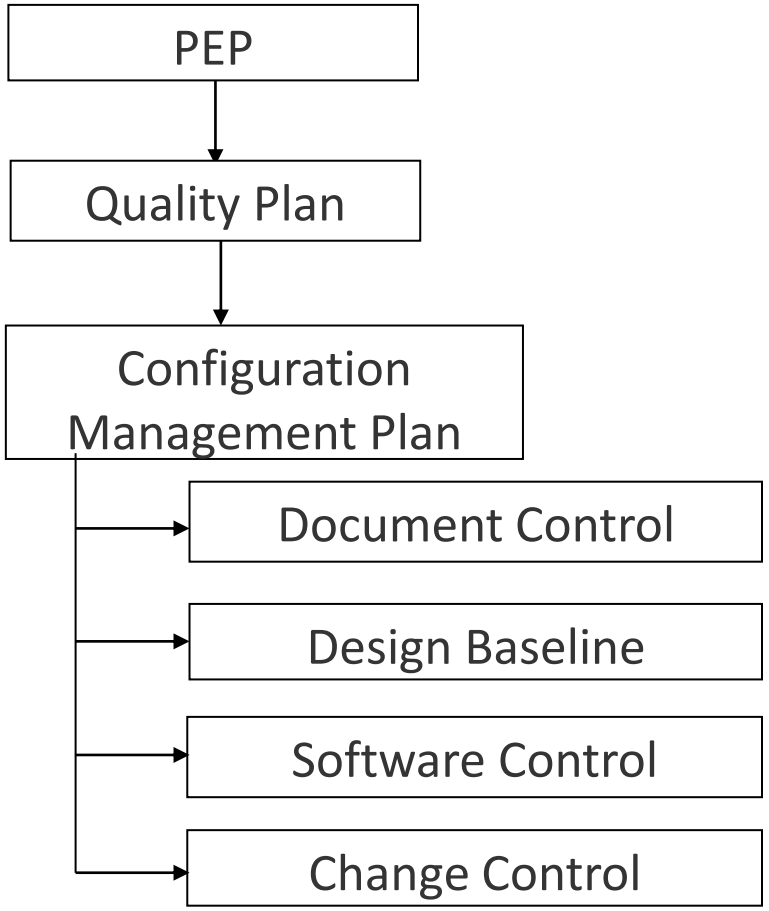
Quality Plan

M3: Adequate QA Practices

- Describes how the IceCube Upgrade Quality Program will be conducted
- Flows down from Project Execution Plan (PEP)
- Includes high level descriptions of:
  - Design
  - Configuration Management
  - Manufacturing
  - Corrective and Preventive Actions
  - Training

Quality Process Hierarchy

M3: Adequate QA Practices



Quality Plan Interactions

M3: Adequate QA Practices

Configuration Management Plan

M3: Adequate QA Practices

- Contains:
  - Document Control
  - Design Baseline
  - Software Control
  - Change Control
- Purpose:
  - Traceability of design and components
  - [Engineering Requirement Docs.(ERDs), Design Status & Notes (DSNs), Config. Mgt. Docs (CMDs), and Interface Definition Documents (IDDs.)]
  - Formal process to manage changes
  - Maintenance of s/w, f/w configurations for test and operations
  - Device improvement

Document Control

M3: Adequate QA Practices

- SharePoint:
  - Project repository for documents (1-stop shopping)
    - Umbrella over local document control repositories
    - Eliminates need to access multiple websites
  - Repositories for:
    - Quality Documents
    - Design reviews, white papers, action item tables, In-process documents; multiple libraries
    - Design Baseline Documents
    - PEP support documents
- Status:
  - Document Control Plan developed.
  - Use of AdobeSign for Document Approval.
  - Controlled Document List = Project Execution Documents Library

Software Control

M3: Adequate QA Practices

- The IceCube Upgrade software will be controlled in accordance with the M&O Plan.
  - Testing emphasized in development
  - Unit tests for individual components / functionality
  - Integration and system testing at (SPTS) South Pole Test Station
  - Releases named, numbered, and tagged in version control system
  - All major changes (DAQ, DOM mainboard software) reviewed at collaboration-wide teleconference before rollout
  - 8- to 24-hour test runs of release candidates at pole – data quality vetted by operations group

Software Control (cont.)

M3: Adequate QA Practices

- IceCube Upgrade Code Development Plan

- All software and firmware for the IceCube Upgrade is maintained and version controlled using industry-standard tools, primarily **GIT.** Access is controlled to the primary **GitHub** workspace; most instrumentation software / firmware repositories are private to the collaboration.

- **Best practices** are followed around issues and releases, with issues documented in **issue-tracking systems**, resolved issues documented in **change logs**, and repositories tagged with release versions.

- Key interfaces are documented for each subsystem to ensure interoperability, and subsystem integration is performed using existing test systems to exercise data flows during project development.

Non-Conforming Material Report (NCMR)

M3: Adequate QA Practices

The NCMR process's most important job is to make sure any non-conforming materials are

- Identified quickly. All serial #s are noted in NCMR.
- Isolated and not put into production until issue(s) are fixed/resolved/etc
- Ensure procedures in place will catch similar failures
- Make sure everyone that needs to know about it, does.

Beyond this, the (FRB) Failure Review Board to advise the Upgrade L2s, look for larger patterns of failures across hardware being constructed.

FRB: Erik B., L2-1.6, (chair), Mike Z., QA & Safety Mgr., Perry S. Project Engineer, Kalle S., 1.3 Engineer, Chris N., 1.4 Engineer, and Ryo N., 1.3 Engineer

NCMR Process

M3: Adequate QA Practices

1. An issue is found at a production or testing site.
2. A NCM form is completed, and material(s) are tagged and isolated to prevent use.
3. NCM form is sent to QA & Safety MGR. AND appropriate L2 ASAP.
    a. Here, it's logged into Sharepoint library and the FRB is notified.
4. L2/on-site experts perform needed investigations (if any), make needed repairs, etc.
5. L2/on-site experts report resolution to FRB for review.
    a. Can be a simple "reported fixed" or a full investigation of issue w/ CRs to address items.
6. FRB marks as resolved
    a. Ensure this is reported in the HW DB (at minimum link to NCM report No.)

Manufacturing Plan

M3: Adequate QA Practices

- Process control
  - Common procedures
- Assembly/test procedures/records
- Identification & traceability
- Device acceptance
  - Final acceptance
- Shipment Quality
- Calibration of test equipment
- Non-conforming material
  - Project Office MRB with each mfg. site to review disposition of material
- Receiving inspection
- Handling & storage
- Selection of Vendors:
  - Defined criteria based upon the vendor's ability to meet specs and schedule.

Training

M3: Adequate QA Practices

- Paramount to Quality/Safety Objectives
  - Very difficult to institute quality processes at multiple locations without appropriate training
- IceCube Upgrade Training:
  - Safety Training: No one can get hurt
    - (SafeStart/OSHA prescribed Training/First Aid/CPR/Defib.)
  - Driller Training: Folks must operate equipment properly and Safely
  - Document Control (SharePoint Training)
  - D-Egg & mDOM manufacturing processes
  - Job-Related Seminars as appropriate
- Training records maintained either electronically or manually as applicable

Backup

Design Baseline

M3: Adequate QA Practices

Interaction with PEP, Mfg. Plan, document control and change control processes

- Define design, manufacture, installation and service of hardware--In Design Baseline Library
- Traceability of components and devices
- Configuration Item = Item
- Each Item is described by up to 4 CMS Documents:
    - CMD (Config. Mgt. Doc.); DSN (Design, Status, Notes); ERD (Engr. Req. Doc.) and IDD (Interface Definition Doc.
- Includes: Examples of items in Upgrade Project (hierarchical series):
    - Upgrade Detector
        - Upgrade String
            - mDOM
                - mDOM HV
                    - **mDOM HV Test Procedure**
- The Hardware Controls may include: requirements, specifications, assembly drawings, assembly procedures, BOMs, test procedures, travelers, installation/commissioning procedures, all forms.

Change Control

M3: Adequate QA Practices

- Defines process for updating technical and project baseline documents
  - 3 classes of changes
    - **Class 1**- Affects science goals, total cost >/= $150K, >6 month project schedule slip (NSF approval)
    - **Class 2**- Affects project objectives, L2 cost, >3 month L2 schedule slip, performance, safety, reliability, crosses interfaces (Project Mgr. approval)
    - **Class 3**- Does not affect cost/schedule baselines, nor form, fit, or function of material. (L2 Approval)
  - Project Change Control Board (CCB)
    - Chaired by Project Manager
    - Reviews all Class 1 & 2 changes
    - Reviews include impact on cost, schedule, safety, quality, verification, in-process materials

How change is managed in project

M3: Adequate QA Practices

- Change Owner or CCB Member initiates a CR (Change Request) for a WBS area.
- Technical Coordinator reviews CR for scope of impact
- Technical Coordinator distributes CR for review by appropriate parties including:
  - Project Engineer (reviews technical accuracy, item scope, and technical impacts)
  - Quality & Safety Manager (reviews impacts on Quality and Safety)
  - Project Controls Manager (reviews impacts on budget and schedule)
  - Logistics/Ops Manager (Reviews impacts on deliverables and logistics)
  - Principal Investigator or assignee (Reviews Science impact)
  - Other L2 Managers, as applicable (Review impacts to their area)
- CR is discussed at next Tech Board teleconference
- CR is discussed and approved or denied at next CCB teleconference (Class 1 and 2 only)
- Changes are made by L2 Mgr or assignee to affected docs in Technical Baseline Library
- Changes to documentation are reviewed and noted in document history by Q&S Manager

Change Control-Flow Chart

Change Request Form