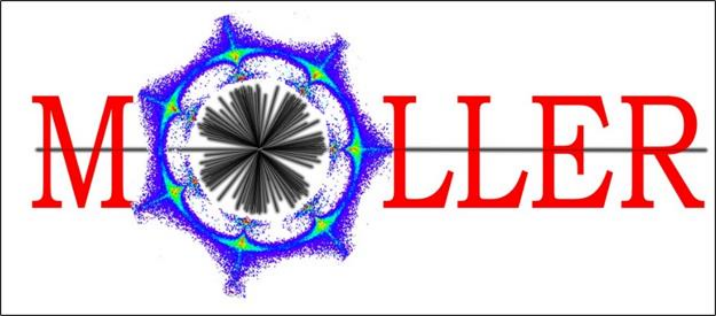
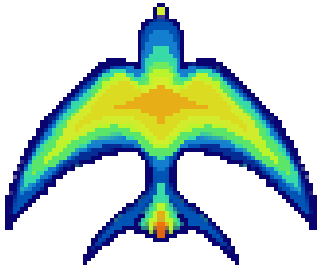


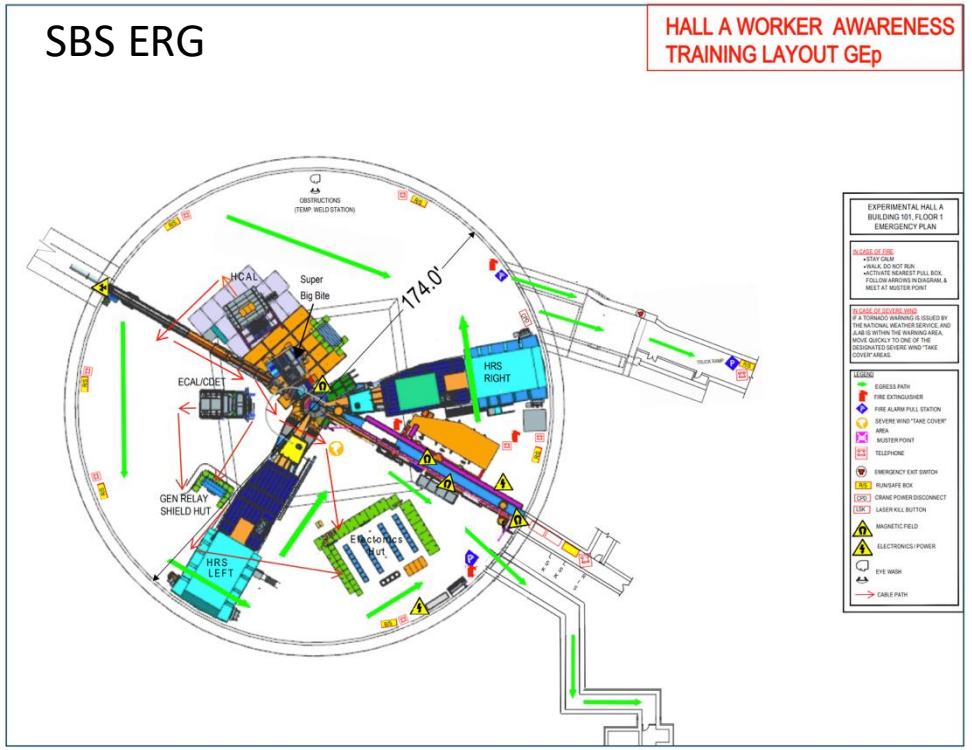


MOLLER
Experimental Documentation

Ciprian Gal

(Draft) Safety documents

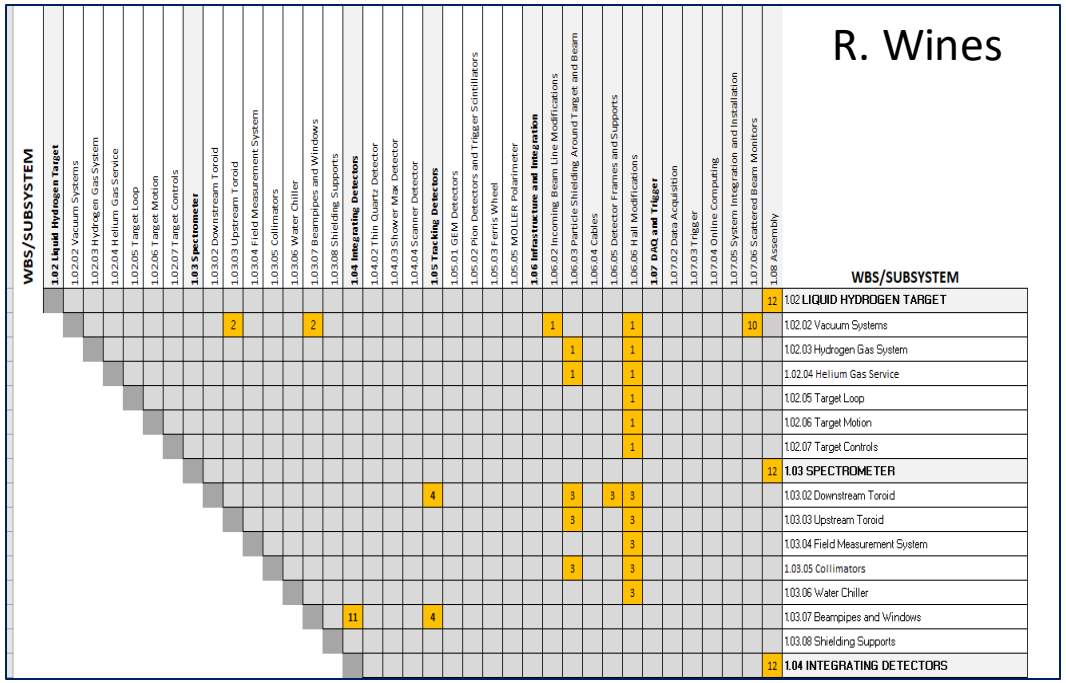
- The current versions of the safety documents are linked from the wiki page
- For the preliminary RSAD I was instructed by RadCon to use the shielding talk
- For the ERG most of the figures are still correct except for the hall layout which will need to be updated prior to running once the obstructions are finalized
- Draft COO is in place
- ESAD will be updated once manuals are created for equipment (such as spectrometers)
- For the incoming beamline the Standard Hall A equipment operations manual is still valid



Project documents

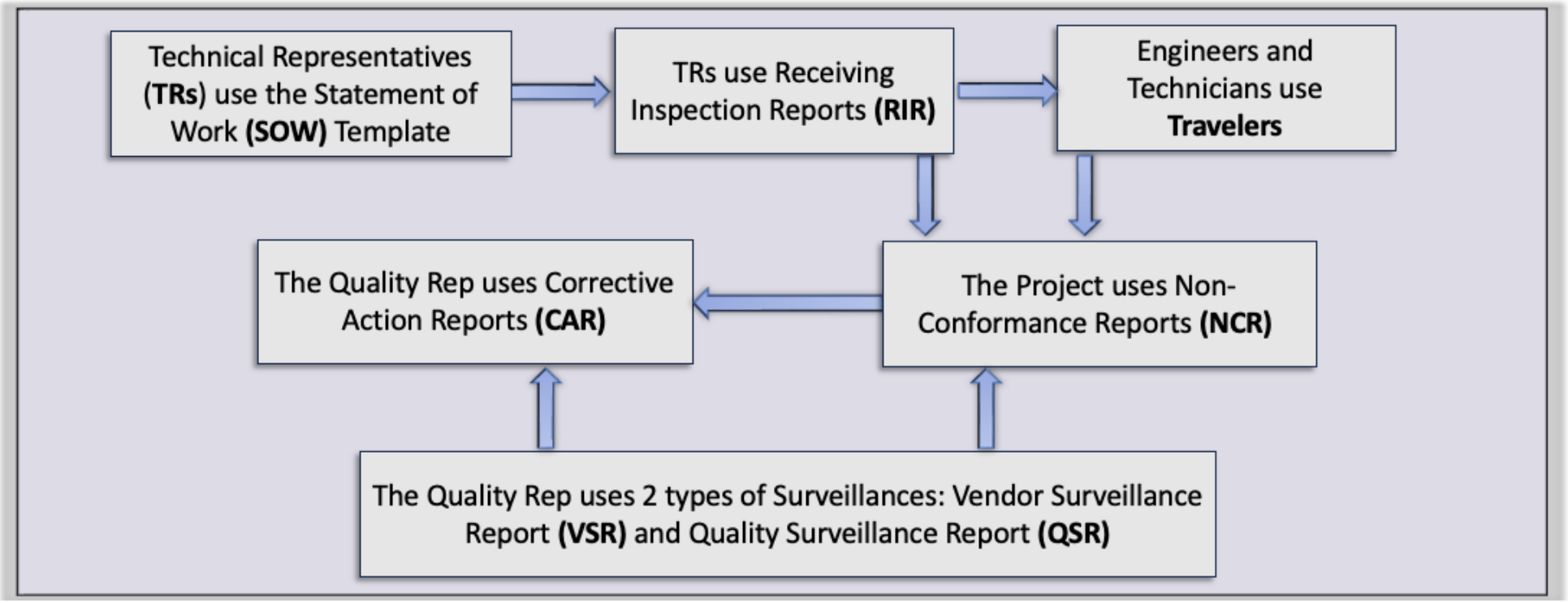
- The project has an integrated survey system (P6) for not only the MIE deliverables but also the NSF and CFI side (May forecast schedule linked on wiki page)
  - This forces us to take a careful look monthly to ensure no significant schedule slippages are occurring
- Specifications and interfaces are managed in the project and changes require signatures from all affected parties
- The design of MOLLER has been frozen since Spring 2024
  - changes (such as the target window to DP transition) can happen through a prescribed and documented Change Control process

Document	Owner - Project Until Project Completion and Transfer to Operations	Owner - Operations After transfer to Operations - Running Experiment
Master CAD Model	Project Engineer / Project Designer	Hall A Engineer / Hall A Designer
Song Sheets (Beamline, Target to Dump (The Experiment), and Dump)	CAM in charge of WBS 1.08 Assembly in Hall A	Hall A Engineer / Hall A Designer
System Requirement Documents (SRDs)	CAM for each WBS	Hall A Engineer / Hall A Designer
Interface Control Documents (ICDs)	CAMs for each WBS being interfaced	Hall A Engineer / Hall A Designer
Functional Requirements Document	Project Manager	Collaboration/Experiment Lead for Hall A
Change Control Request Form and Log	Project Manager	Collaboration/Experiment Lead for Hall A
Engineering Change Order (ECO)	WBS Tech Lead	Hall A Engineer / Hall A Designer
Engineering Change Order (ECO) Log	Project Engineer	Hall Engineer A / Hall A Lead
Technical Configuration Document Log	Project Engineer	Hall Engineer A/ Hall A Lead



MOLLER QA program

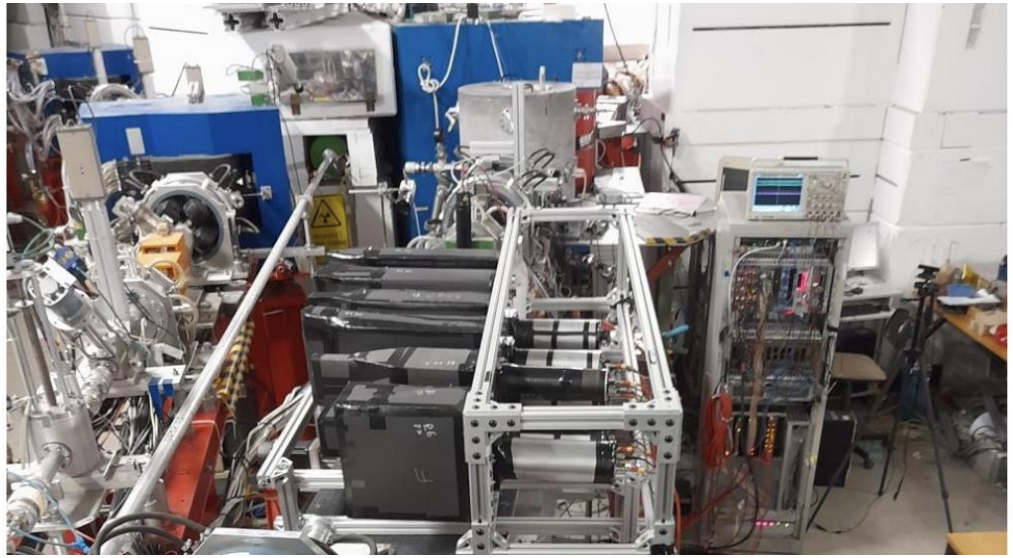
A. Riddle



- Most components purchased through MIE funds undergo a thorough QA program
- Components arriving from NSF or CFI have the same standards applied and documentation will be delivered together with the components (mostly in the form of travelers)

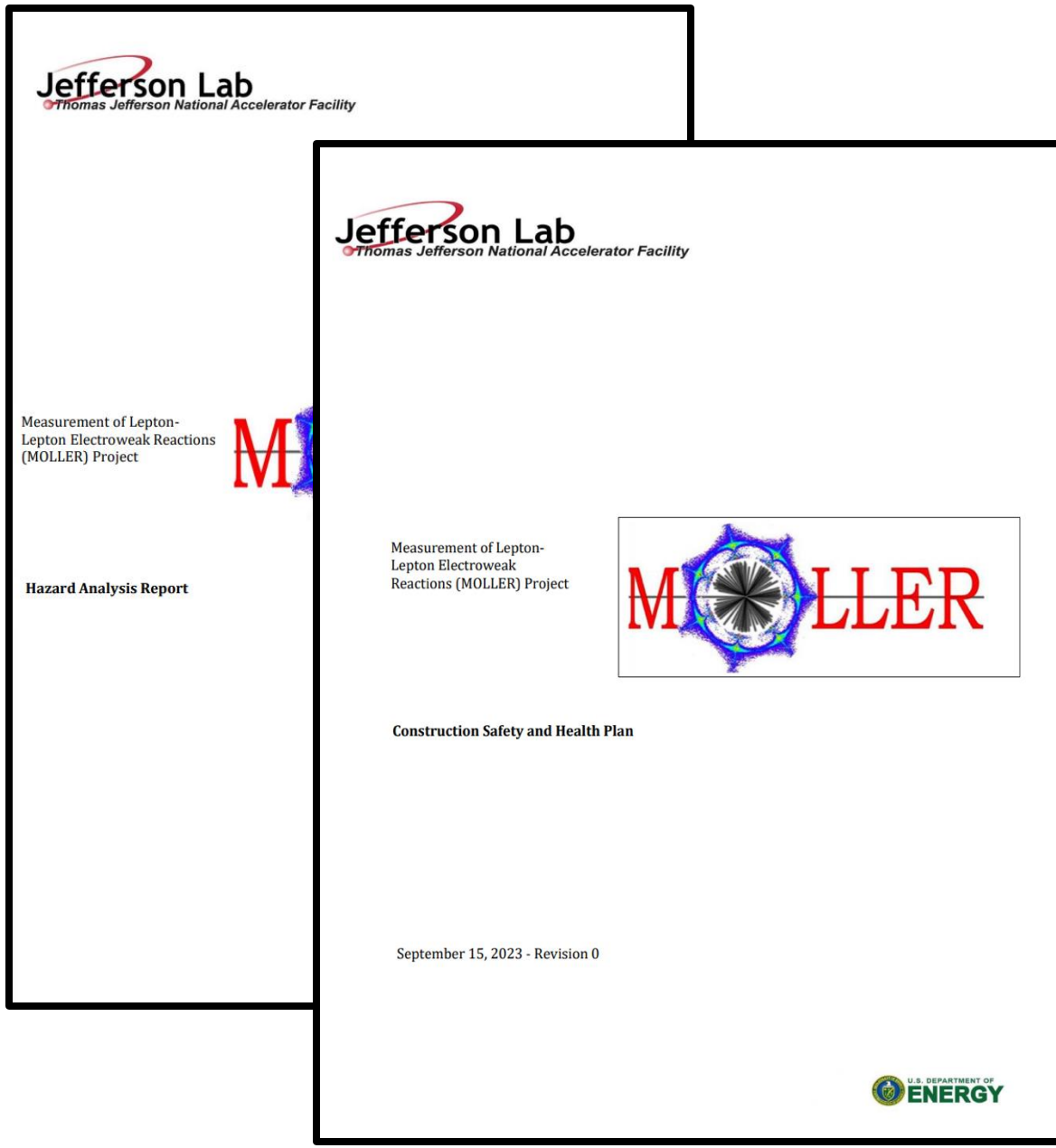
Detector KPP - traveler

- The detectors have undergone significant tests in beam and with cosmics
- The information collected will be sufficient to satisfy the MIE KPPs without the need for further testing with beam in the hall (by connecting test beam results to cosmic results)
  - This will result in some additional flexibility in the assembly schedule
- As the detectors are assembled cosmic tests will be done on each individual set and the documentation will be transmitted to JLab with the modules in the form of a traveler



MOLLER ESH integration

- Bill Rainey is our liaison to ESH and we have additional support from Rich Kenney
- They attend meetings and are aware of all the activities planned for MOLLER and offer a tremendous amount of support to ensure we do everything safely
- The project has two major documents that govern the assembly of the experiment (both linked on the wiki):
  - Hazard Analysis Report
  - Construction Safety and Health Plan



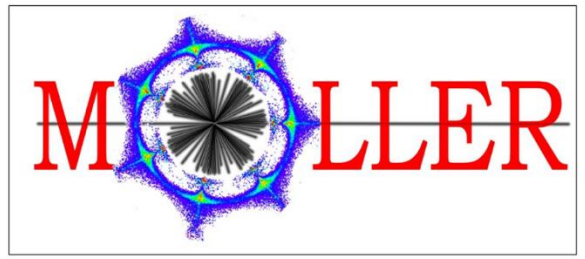
Summary

- The documentation required by a 413b project enables the MOLLER experiment to systematically check that the schedule is on track, the components received meet specifications, and the assembly is done in an efficient manner
- The safety document drafts are in place and there are no roadblocks to having final version by ERR3 (summer 2026)
  - Each major component arriving to the hall will have operating manuals and training to ensure collaborators and hall staff will be able to safely operate it
- The Transition to Operations (TOP) plan spells out project responsibilities and how the hand-off to the Lab will be performed (linked on wiki)

Jefferson Lab
Thomas Jefferson National Accelerator Facility

Measurement of Lepton-Lepton Electroweak Reactions (MOLLER) Project

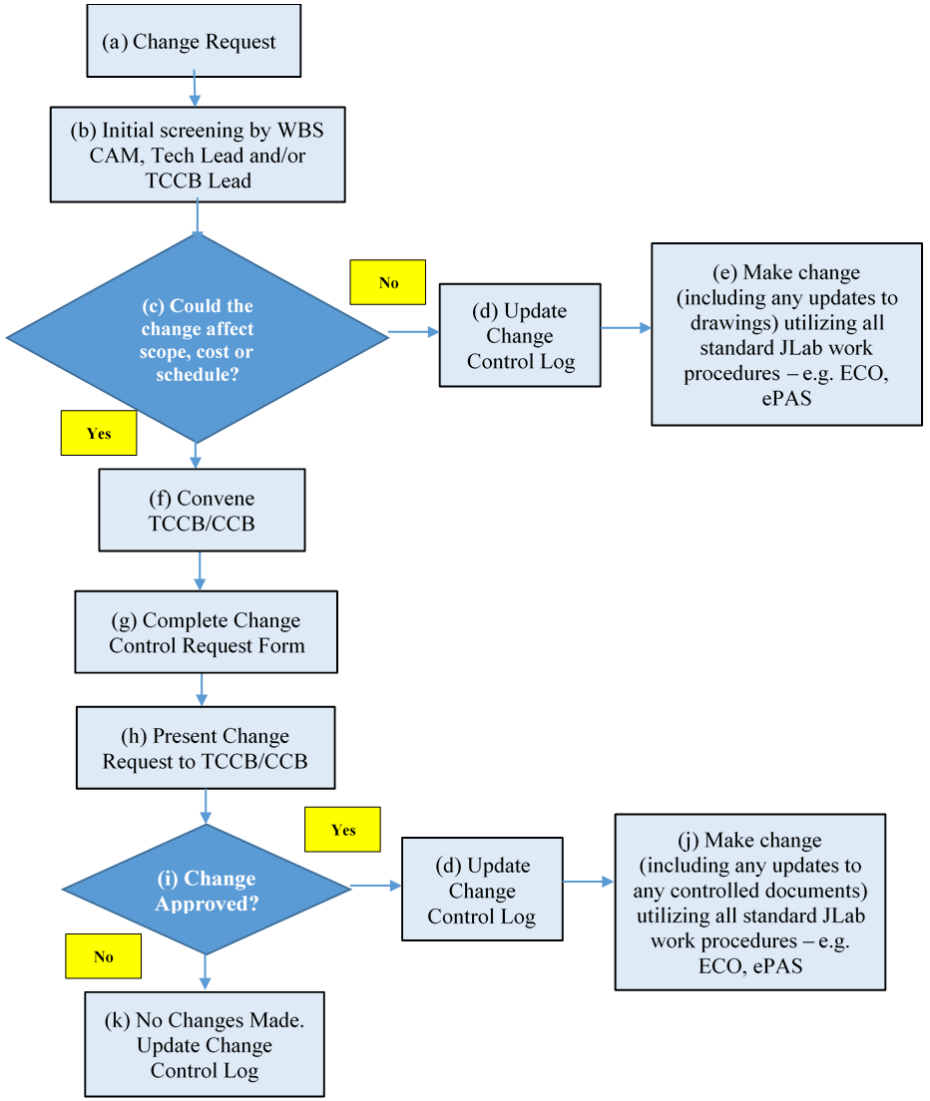
Preliminary Transition to Operations Plan



U.S. DEPARTMENT OF ENERGY

Backups

Technical Documents - Configuration Management Process Flowchart [3 of 3]



Example of Process: Target-Spectrometer Window

(Step b) Description of Proposed Change:

This requested change removes the vacuum window at the exit of the scattering chamber separating the spectrometer and target vacuum spaces and replaces the window with a differentially pumped section.

Scope Change: *Remove vacuum window separating the Spectrometer and Target vacuum spaces. Replace with differentially pumped section of beamline.*

Schedule Change: *There should be no impact to the schedule.*

Cost Change: *There is likely to be a cost impact related to this request. Any cost change will be determined and presented to the CCB for review.*

(Step f)

TCCB was convened and technical justification and design changes were presented and approved.

(Step g)

The Change control request form (BCR) was completed.

(Step h)

The CCB will be convened shortly to review this change request

Project ES&H Infrastructure

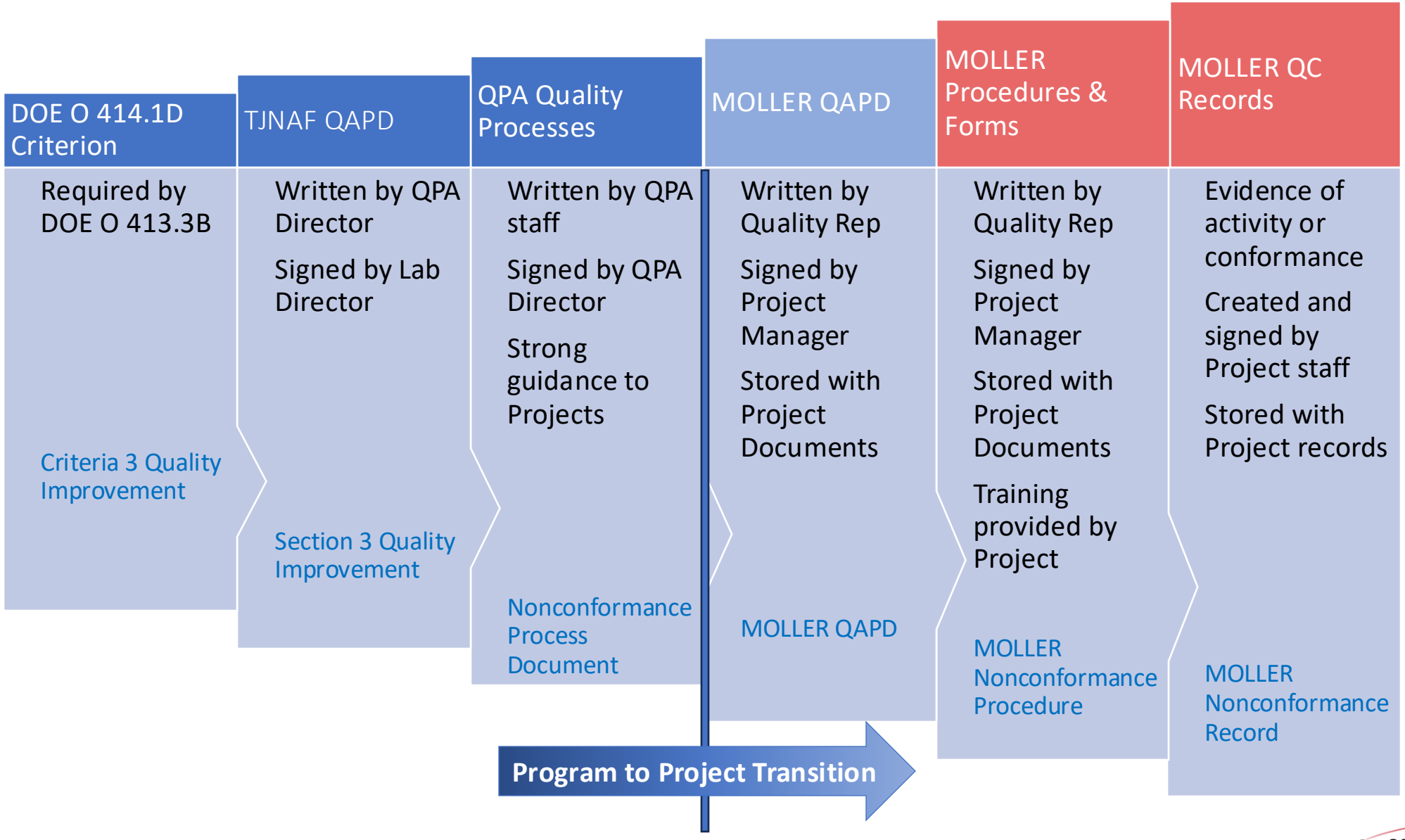
Hazard assessment / mitigation documents serve as baseline:

- **No changes to hazard profile, mitigation strategies or NEPA**

Minor, editorial and formatting changes pending:

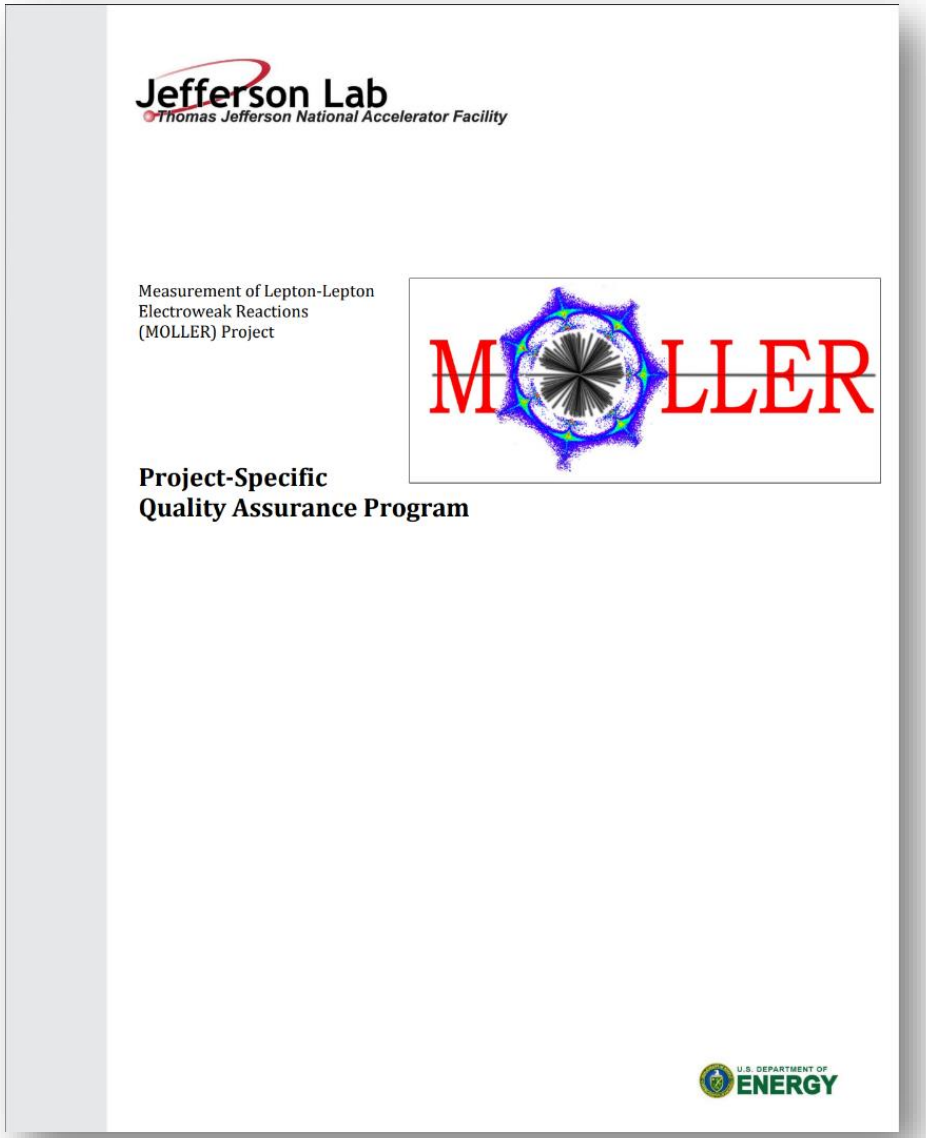
- Changes resulting from ePAS implementation
- Personnel, organizational changes
- Best practices from other DOE O 413 reviews

Quality Requirements Flow from DOE O 414.1D to MOLLER QC Records

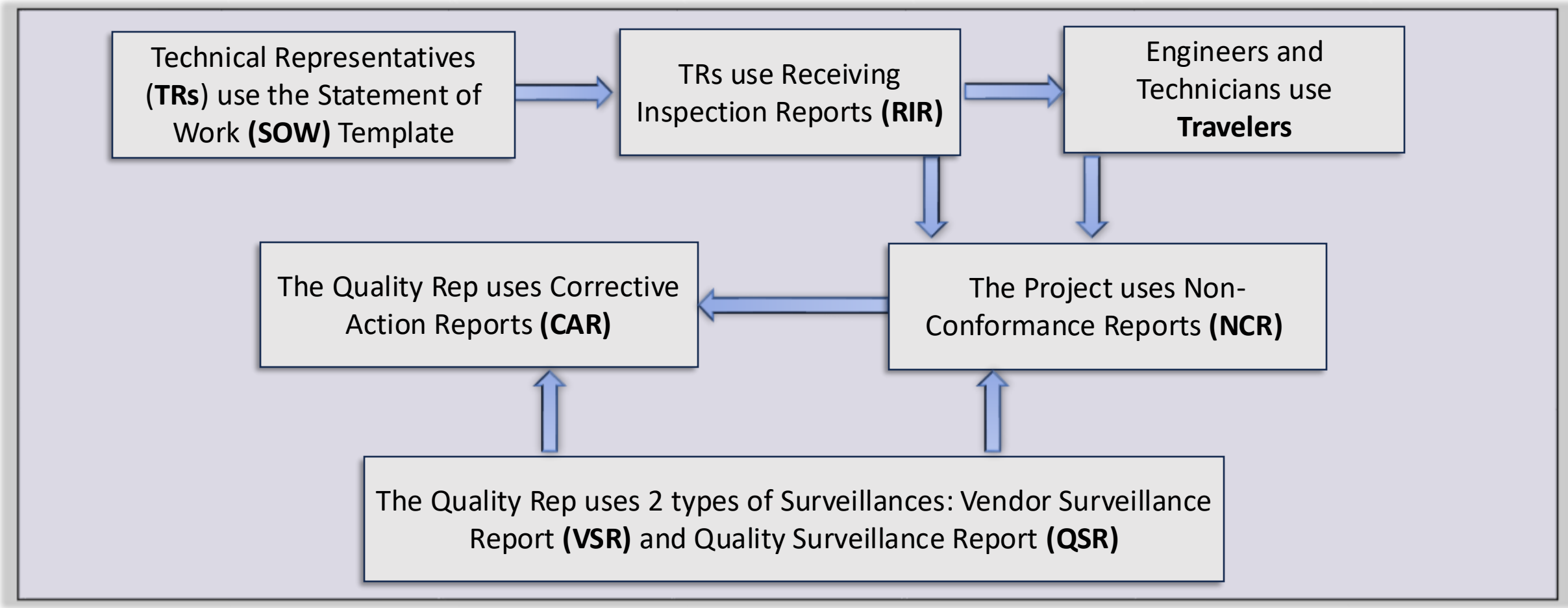


MOLLER Quality Requirements

- MOLLER Project-Specific Quality Assurance Program, Rev 2.
- Written by the Quality Representative, signed by the Project Manager.
- Top level quality document for MOLLER.
- Bridges the requirements from DOE O 414.1D and the TJNAF QAPD with the MOLLER implementation procedures.
- Currently under its annual review.



QA Processes Used by MOLLER



The Quality Rep assists with **Lessons Learned** meetings and the Project's Lesson Learned Register, along with the sharing of Lessons Learned from JLab and DOE OPEXShare.

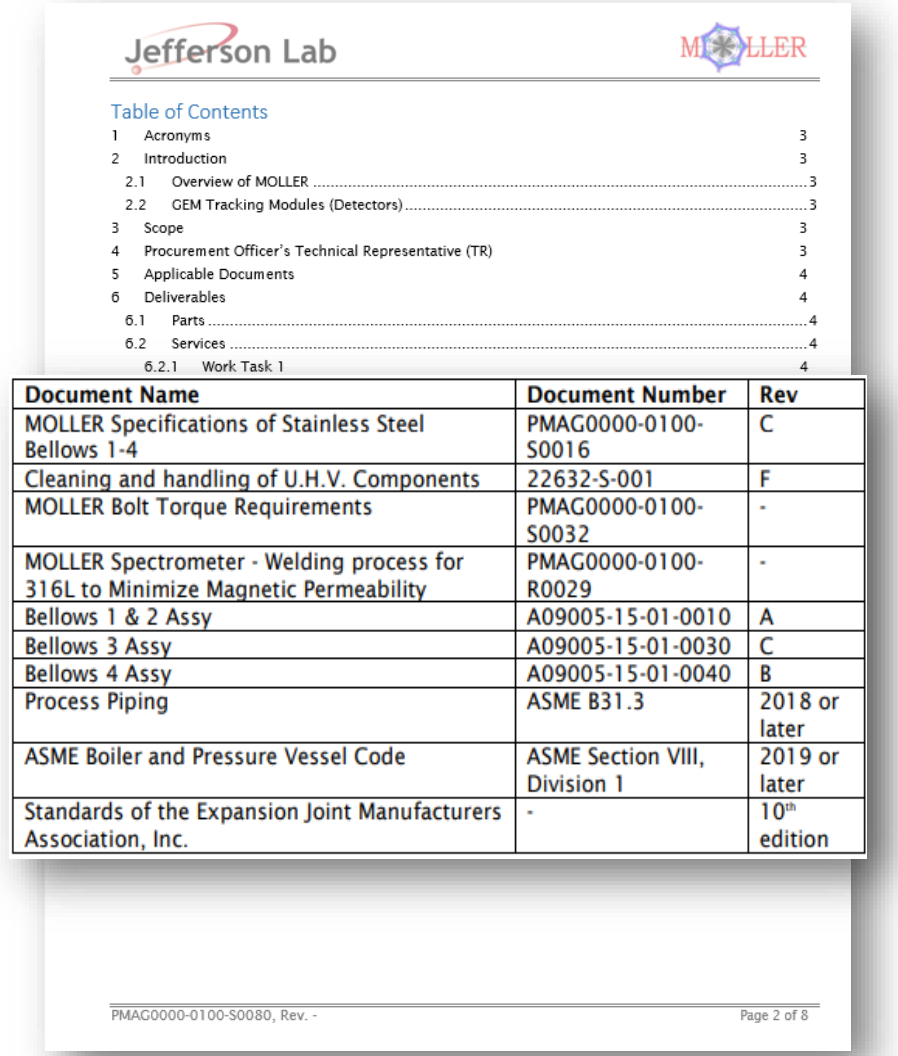
Statement of Work (SOW)

Purpose

- Provides the vendor with a complete scope of work to be completed, including specifications and requirements.
- Over 100 MOLLER SOWs are in draft or approved in the JLab Document Control System.

Example

- The SOW provided a list of all required processes and standards to make MOLLER Spectrometer Bellows #1-4.
- The RIR was used to verify requirements.



Jefferson Lab MOLLER

Table of Contents

Document Name	Document Number	Rev
MOLLER Specifications of Stainless Steel Bellows 1-4	PMAG0000-0100-S0016	C
Cleaning and handling of U.H.V. Components	22632-S-001	F
MOLLER Bolt Torque Requirements	PMAG0000-0100-S0032	-
MOLLER Spectrometer - Welding process for 316L to Minimize Magnetic Permeability	PMAG0000-0100-R0029	-
Bellows 1 & 2 Assy	A09005-15-01-0010	A
Bellows 3 Assy	A09005-15-01-0030	C
Bellows 4 Assy	A09005-15-01-0040	B
Process Piping	ASME B31.3	2018 or later
ASME Boiler and Pressure Vessel Code	ASME Section VIII, Division 1	2019 or later
Standards of the Expansion Joint Manufacturers Association, Inc.	-	10th edition

PMAG0000-0100-S0080, Rev. - Page 2 of 8

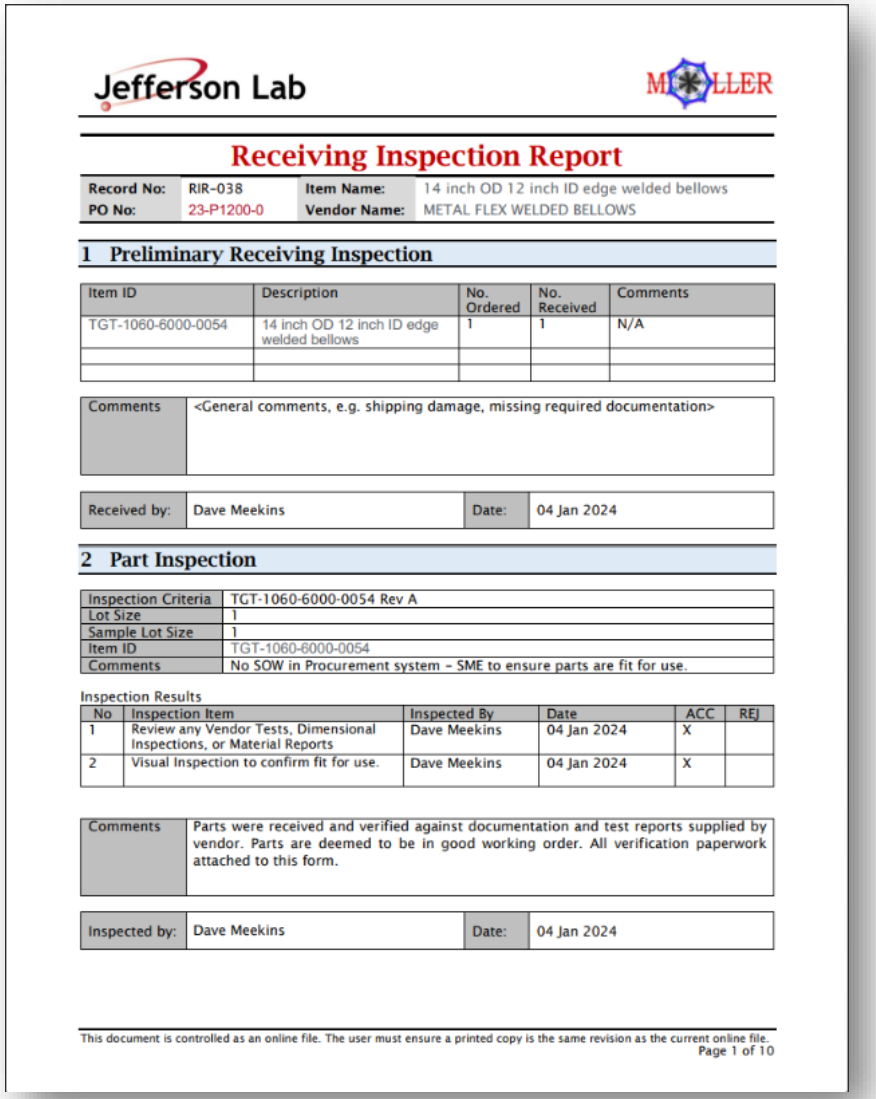
Receiving Inspection Report (RIR)

Purpose

- Provides TRs with an organized method to describe all needed inspections and then document the results.
- 91 Procurements have been identified as requiring a MOLLER RIR, and 76 inspections have been completed.

Example

- The Target Group follows the ESH Pressure System requirements, which include a SOW and RIR.
- The RIR form is used as a cover page for the inspection completed by the target group.
- This enables the critical component to be properly documented on the Project's SharePoint site with minimum disruption.



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Receiving Inspection Report

Record No:	RIR-038	**Item Name:**	14 inch OD 12 inch ID edge welded bellows
PO No:	23-P1200-0	**Vendor Name:**	METAL FLEX WELDED BELLOWS

1 Preliminary Receiving Inspection

Item ID	Description	No. Ordered	No. Received	Comments
TGT-1060-6000-0054	14 inch OD 12 inch ID edge welded bellows	1	1	N/A

Comments	<General comments, e.g. shipping damage, missing required documentation>

Received by:	Dave Meekins	Date:	04 Jan 2024

2 Part Inspection

Inspection Criteria	TGT-1060-6000-0054 Rev A
Lot Size	1
Sample Lot Size	1
Item ID	TGT-1060-6000-0054
Comments	No SOW in Procurement system - SME to ensure parts are fit for use.

Inspection Results

No	Inspection Item	Inspected By	Date	ACC	REJ
1	Review any Vendor Tests, Dimensional Inspections, or Material Reports	Dave Meekins	04 Jan 2024	X	
2	Visual Inspection to confirm fit for use.	Dave Meekins	04 Jan 2024	X	

Comments	Parts were received and verified against documentation and test reports supplied by vendor. Parts are deemed to be in good working order. All verification paperwork attached to this form.

Inspected by:	Dave Meekins	Date:	04 Jan 2024

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Page 1 of 10

Receiving Inspection Area

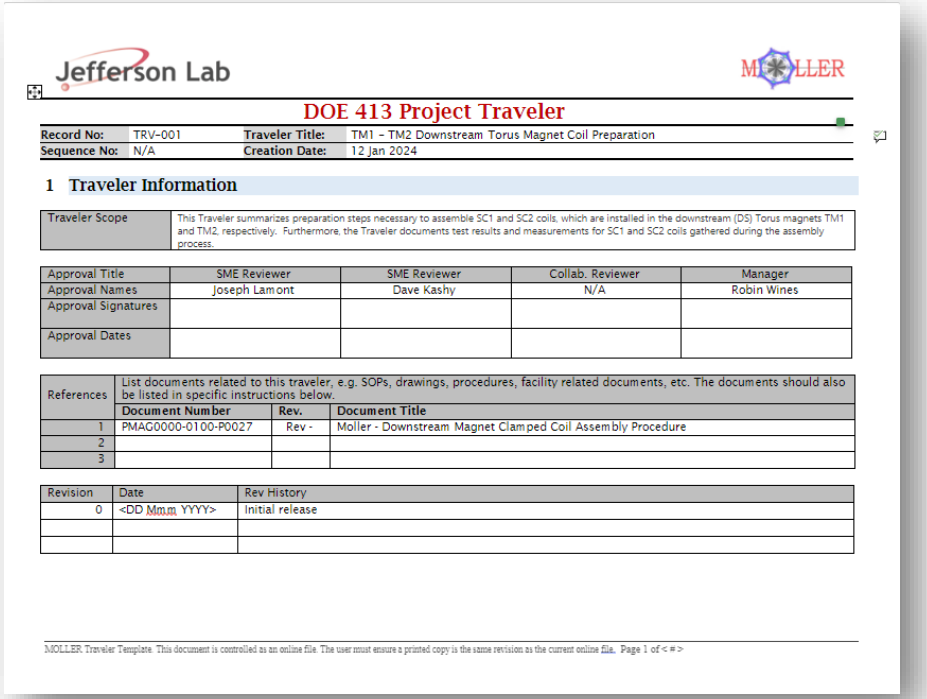
Use of Tags

- Three-part tags are applied to incoming items to indicate the item is on "**HOLD**“ prior to the RIR.
- If a defect is found, one part of the tag is removed, leaving the "**REJECTED**" portion behind to prevent using the item.
- If the item is acceptable, two parts of the tag are removed leaving the "**ACCEPTED**" portion behind to indicate the item is ready for use.

Traveler

Purpose

- Facilitates the establishment of Quality Control (QC) Hold Points and data collection during assembly or inspections of extensive activities.
- 4 test Travelers have been completed, and 1 production Traveler is currently in use.



Jefferson Lab

MOLLER

DOE 413 Project Traveler

Record No:	TRV-001	**Traveler Title:**	TM1 – TM2 Downstream Torus Magnet Coil Preparation
Sequence No:	N/A	**Creation Date:**	12 Jan 2024

1 Traveler Information

Traveler Scope	This Traveler summarizes preparation steps necessary to assemble SC1 and SC2 coils, which are installed in the downstream (DS) Torus magnets TM1 and TM2, respectively. Furthermore, the Traveler documents test results and measurements for SC1 and SC2 coils gathered during the assembly process.

Approval Title	SME Reviewer	SME Reviewer	Collab. Reviewer	Manager
Approval Names	Joseph Lamont	Dave Kashy	N/A	Robin Wines
Approval Signatures				
Approval Dates				

References	List documents related to this traveler, e.g. SOPs, drawings, procedures, facility related documents, etc. The documents should also be listed in specific instructions below.		
	Document Number	**Rev.**	**Document Title**
1	PMAG0000-0100-P0027	Rev -	Moller - Downstream Magnet Clamped Coil Assembly Procedure
2			
3			

Revision	Date	Rev History
0	<DD Mmm YYYY>	Initial release

MOLLER Traveler Template. This document is controlled as an online file. The user must ensure a printed copy is the same revision as the current online file. Page 1 of < # >

Example

- The MOLLER Spectrometer team developed the first DOE O 413 Project Traveler to track and document the assembly of Toroid Coils, following an engineer-set procedure.
- The primary items being tracked are verification of inspections and measurement results.

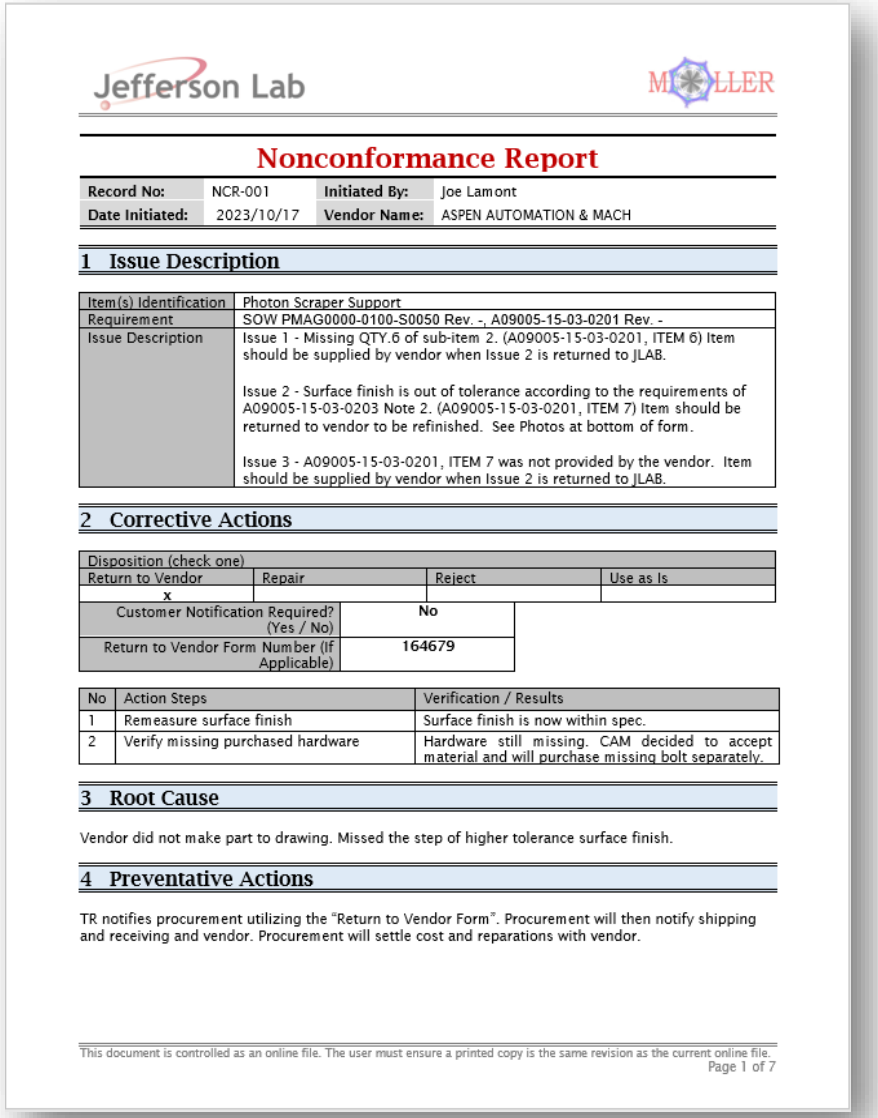
Nonconformance Report (NCR)

Purpose

- Puts items or activities on HOLD until SMEs determine a resolution and proper path forward.
- 11 Nonconformances have been identified, 9 NCRs have been completed, and 2 are currently in process.

Example

- The Photon Scraper NCR was a result of a prior RIR with a critical non-conformance.
- The vendor failed to finish machining on the Photon Scraper face, causing the item to be put on HOLD and sent back to the vendor for repair.
- After fixing and verifying by JLab, the part was released.



Jefferson Lab MOLLER

Nonconformance Report

Record No:	NCR-001	**Initiated By:**	Joe Lamont
Date Initiated:	2023/10/17	**Vendor Name:**	ASPEN AUTOMATION & MACH

1 Issue Description

Item(s) Identification	Photon Scraper Support
Requirement	SOW PMAG0000-0100-S0050 Rev. -, A09005-15-03-0201 Rev. -
Issue Description	Issue 1 - Missing QTY.6 of sub-item 2. (A09005-15-03-0201, ITEM 6) Item should be supplied by vendor when Issue 2 is returned to JLAB. Issue 2 - Surface finish is out of tolerance according to the requirements of A09005-15-03-0203 Note 2. (A09005-15-03-0201, ITEM 7) Item should be returned to vendor to be refinished. See Photos at bottom of form. Issue 3 - A09005-15-03-0201, ITEM 7 was not provided by the vendor. Item should be supplied by vendor when Issue 2 is returned to JLAB.

2 Corrective Actions

Disposition (check one)			
Return to Vendor	Repair	Reject	Use as Is
x			

Customer Notification Required? (Yes / No)	No
Return to Vendor Form Number (If Applicable)	164679

No	Action Steps	Verification / Results
1	Remeasure surface finish	Surface finish is now within spec.
2	Verify missing purchased hardware	Hardware still missing. CAM decided to accept material and will purchase missing bolt separately.

3 Root Cause

Vendor did not make part to drawing. Missed the step of higher tolerance surface finish.

4 Preventative Actions

TR notifies procurement utilizing the "Return to Vendor Form". Procurement will then notify shipping and receiving and vendor. Procurement will settle cost and reparations with vendor.

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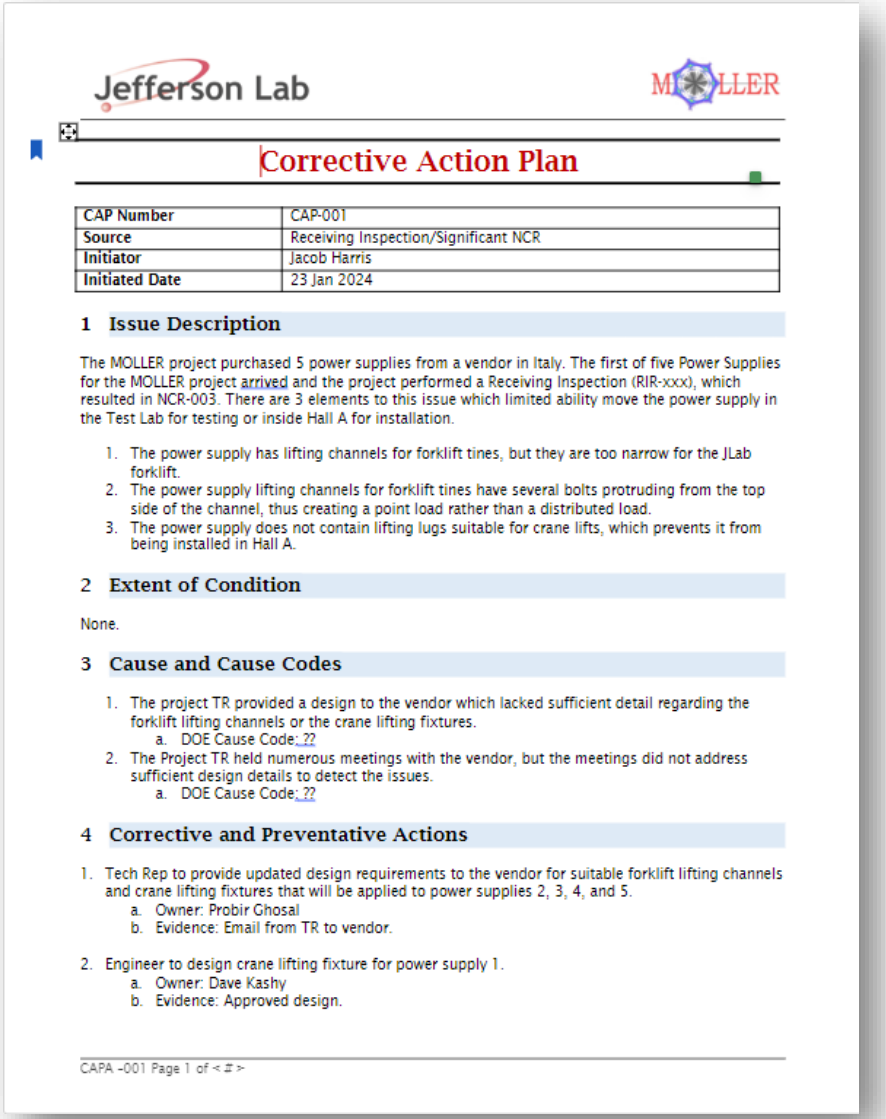
Corrective Action Report (CAR)

Purpose

- Involves gathering, evaluating, and identifying information to investigate product and service quality issues and take corrective and preventative action to prevent recurrence.
- 3 Corrective Actions have been initiated, 2 CARs have been completed, and 1 is currently in process.

Example

- The CAR for MOLLER's MPS #3 was opened for the first MPS prototype delivery, its design made it impossible to remove from the pallet making it impossible to deliver to Hall A.
- CAR is closed. Shipping cradle created by JLab. Vendor changed design for future MPS deliveries.



Jefferson Lab

MOLLER

Corrective Action Plan

CAP Number	CAP-001
Source	Receiving Inspection/Significant NCR
Initiator	Jacob Harris
Initiated Date	23 Jan 2024

1 Issue Description

The MOLLER project purchased 5 power supplies from a vendor in Italy. The first of five Power Supplies for the MOLLER project arrived and the project performed a Receiving Inspection (RIR-xxx), which resulted in NCR-003. There are 3 elements to this issue which limited ability move the power supply in the Test Lab for testing or inside Hall A for installation.

1. The power supply has lifting channels for forklift tines, but they are too narrow for the JLab forklift.
2. The power supply lifting channels for forklift tines have several bolts protruding from the top side of the channel, thus creating a point load rather than a distributed load.
3. The power supply does not contain lifting lugs suitable for crane lifts, which prevents it from being installed in Hall A.

2 Extent of Condition

None.

3 Cause and Cause Codes

1. The project TR provided a design to the vendor which lacked sufficient detail regarding the forklift lifting channels or the crane lifting fixtures.
   a. DOE Cause Code: ??
2. The Project TR held numerous meetings with the vendor, but the meetings did not address sufficient design details to detect the issues.
   a. DOE Cause Code: ??

4 Corrective and Preventative Actions

1. Tech Rep to provide updated design requirements to the vendor for suitable forklift lifting channels and crane lifting fixtures that will be applied to power supplies 2, 3, 4, and 5.
   a. Owner: Probir Ghosal
   b. Evidence: Email from TR to vendor.
2. Engineer to design crane lifting fixture for power supply 1.
   a. Owner: Dave Kashy
   b. Evidence: Approved design.

CAPA -001 Page 1 of < # >

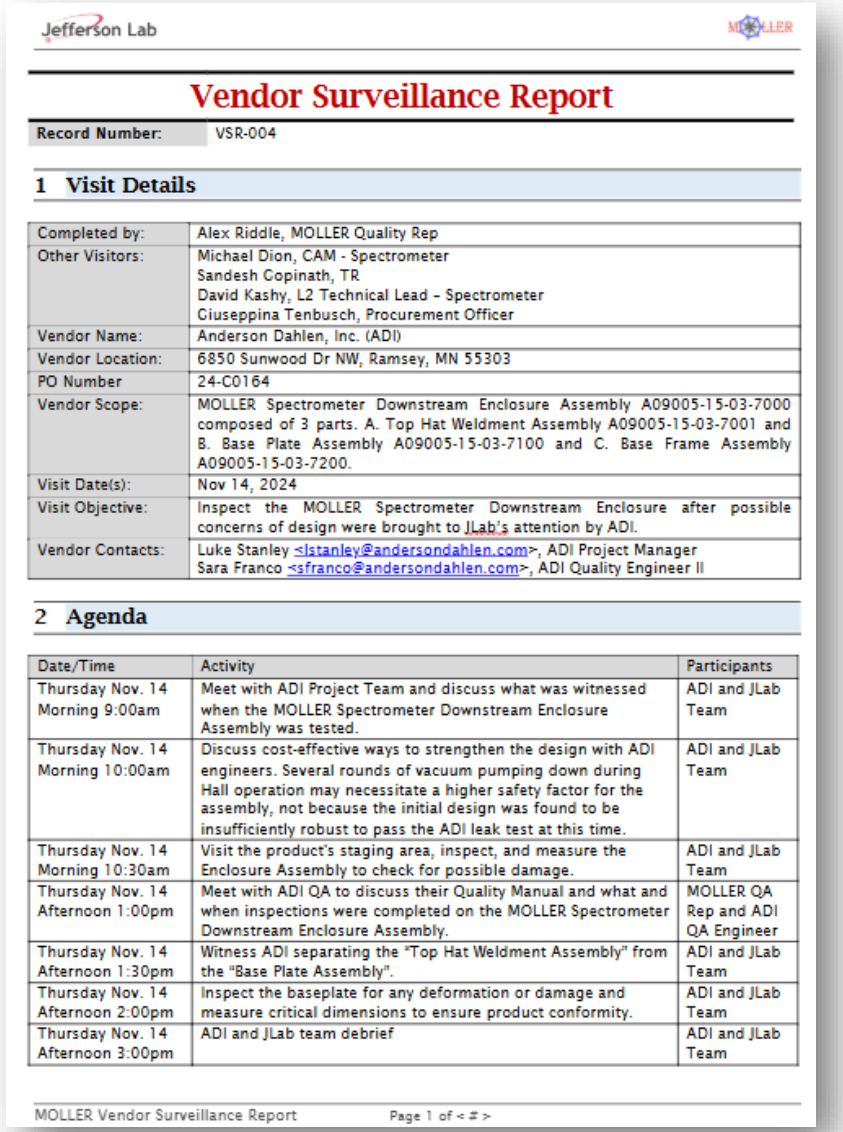
Vendor Surveillance Report (VSR)

Purpose

- Documented visit to vendors to ensure compliance with industry standards, QMS implementation, and contract requirements
- 5 Vendor Surveillances have been initiated, 3 VSRs are completed and 2 are in progress.

Example

- The Quality Rep accompanied the TR to Anderson Dahlen to review issues with the spectrometer vacuum enclosure.
- The VSR describes a review of the vendor's quality program and issues that extend beyond the visit. A Corrective Action Report was initiated because of the issue.



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Vendor Surveillance Report

Record Number: VSR-004

1 Visit Details

Completed by:	Alex Riddle, MOLLER Quality Rep
Other Visitors:	Michael Dion, CAM - Spectrometer Sandesh Copinath, TR David Kashy, L2 Technical Lead - Spectrometer Giuseppina Tenbusch, Procurement Officer
Vendor Name:	Anderson Dahlen, Inc. (ADI)
Vendor Location:	6850 Sunwood Dr NW, Ramsey, MN 55303
PO Number	24-C0164
Vendor Scope:	MOLLER Spectrometer Downstream Enclosure Assembly A09005-15-03-7000 composed of 3 parts. A. Top Hat Weldment Assembly A09005-15-03-7001 and B. Base Plate Assembly A09005-15-03-7100 and C. Base Frame Assembly A09005-15-03-7200.
Visit Date(s):	Nov 14, 2024
Visit Objective:	Inspect the MOLLER Spectrometer Downstream Enclosure after possible concerns of design were brought to JLab's attention by ADI.
Vendor Contacts:	Luke Stanley <lstanley@andersondahlen.com>, ADI Project Manager Sara Franco <sfranco@andersondahlen.com>, ADI Quality Engineer II

2 Agenda

Date/Time	Activity	Participants
Thursday Nov. 14 Morning 9:00am	Meet with ADI Project Team and discuss what was witnessed when the MOLLER Spectrometer Downstream Enclosure Assembly was tested.	ADI and JLab Team
Thursday Nov. 14 Morning 10:00am	Discuss cost-effective ways to strengthen the design with ADI engineers. Several rounds of vacuum pumping down during Hall operation may necessitate a higher safety factor for the assembly, not because the initial design was found to be insufficiently robust to pass the ADI leak test at this time.	ADI and JLab Team
Thursday Nov. 14 Morning 10:30am	Visit the product's staging area, inspect, and measure the Enclosure Assembly to check for possible damage.	ADI and JLab Team
Thursday Nov. 14 Afternoon 1:00pm	Meet with ADI QA to discuss their Quality Manual and what and when inspections were completed on the MOLLER Spectrometer Downstream Enclosure Assembly.	MOLLER QA Rep and ADI QA Engineer
Thursday Nov. 14 Afternoon 1:30pm	Witness ADI separating the "Top Hat Weldment Assembly" from the "Base Plate Assembly".	ADI and JLab Team
Thursday Nov. 14 Afternoon 2:00pm	Inspect the baseplate for any deformation or damage and measure critical dimensions to ensure product conformity.	ADI and JLab Team
Thursday Nov. 14 Afternoon 3:00pm	ADI and JLab team debrief	ADI and JLab Team

MOLLER Vendor Surveillance Report Page 1 of < # >

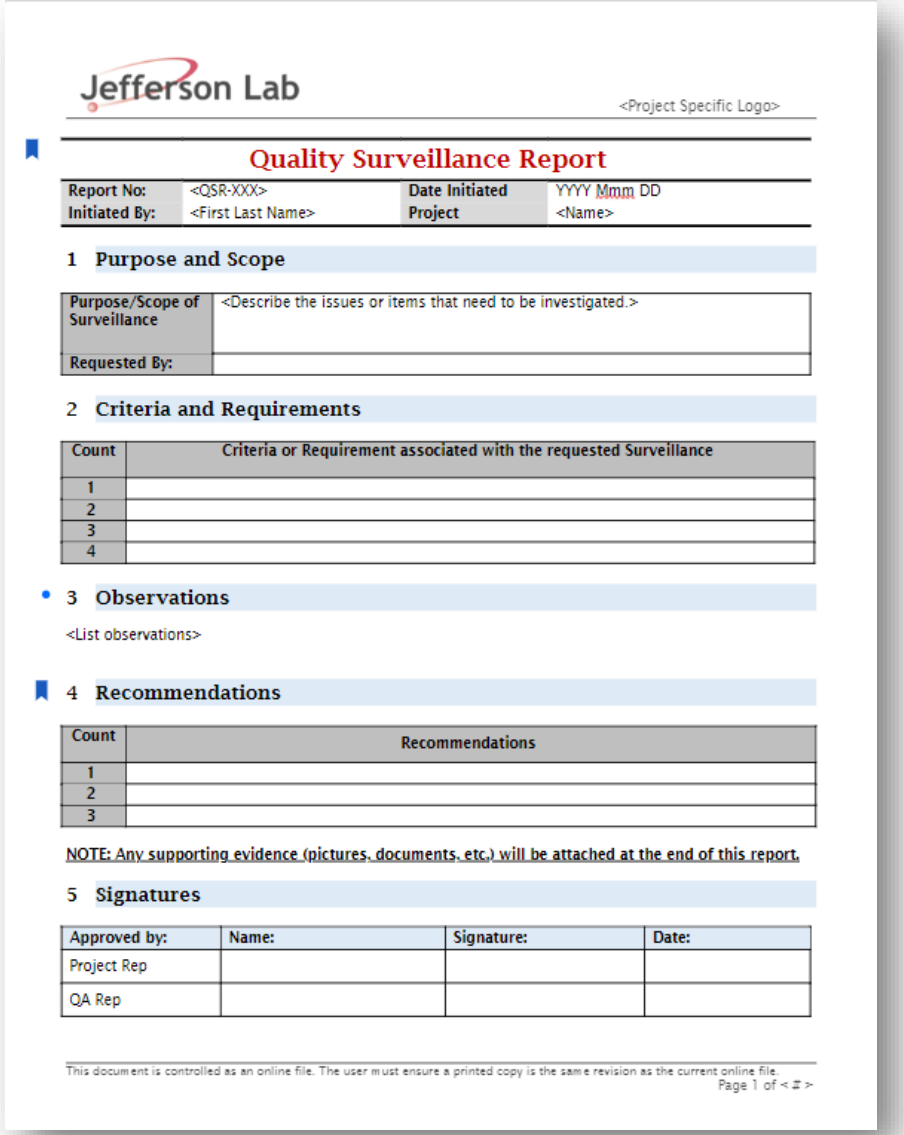
Quality Surveillance Report (QSR)

Purpose

- The Project uses the QSR to gather information and evaluate processes, with the results provided to Project Management.
- 1 MOLLER Project Quality Surveillance is in process.

Examples

- The Project Manager requested that the QA Representative review the Configuration Management process.
- The surveillance is being planned and it will be completed before affected assembly activities in Hall A.



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<Project Specific Logo>

Quality Surveillance Report

Report No:	<QSR-XXX>	Date Initiated	YYYY Mmm DD
Initiated By:	<First Last Name>	Project	<Name>

1 Purpose and Scope

Purpose/Scope of Surveillance	<Describe the issues or items that need to be investigated.>
Requested By:	

2 Criteria and Requirements

Count	Criteria or Requirement associated with the requested Surveillance
1	
2	
3	
4	

3 Observations

<List observations>

4 Recommendations

Count	Recommendations
1	
2	
3	

NOTE: Any supporting evidence (pictures, documents, etc.) will be attached at the end of this report.

5 Signatures

Approved by:	Name:	Signature:	Date:
Project Rep			
QA Rep			

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