

January 6, 2021



TO: Distribution  
FROM: M. Quinn  
SUBJECT: Radiation Safety Subcommittee Meeting of January 6, 2021

MEMBERS (P=Present, A=Absent): Maddie, Joel, Mark, Dee, Rachel, Joe, Matt, Wayne, Dave H, Sue

S. Borton	A	D. Hahn	P	M. Quinn, Chair	P	P. Sedory	A
N. Chelidze	A	D. Hockin	P	D. Reitzner	A	K. Vaziri	A
J. Compton	P	R. Madiar	P	W. Schmitt	P	M. Zientarski	P
K. Gollwitzer	A	S. McGimpsey	P	M. Schoell, Deputy Chair	P		
K. Graden	A	D. Newhart	A	J. Scott	A		

Others Present: J. Fulgham

## New Buisness

- Outdoor Hazard Assessment** – M. Schoell reported that the CSO has asked all subcommittees to perform an assessment of potential outdoor hazards in their area, this effort is being led by R. Bushek but each subcommittee is participating. Need to determine what kinds of hazards are present outdoors, not within a locked fence or building, that members of the public or untrained workers could come across and either cause harm to themselves or harm to the equipment/component. Initial list below, **please review and send any additional locations or information for current locations/answers to highlighted questions to M. Schoell by COB Wednesday 1/20.** (Will be meeting with other subcommittees again Friday 1/22 and need RSSC input by then.)
  - Posted Radiation Areas & Posted High Radiation Areas around accelerator enclosures
    - FRCM 236.2.b.(2) through 236.2.b.(4)
      - Accelerator/beamline areas shall be posted and controlled for the normal operating conditions in accordance with Table 2-6 when the safety analysis documents that delivering the maximum dose to an individual is unlikely.
      - Accelerator/beamline areas shall be posted and controlled in accordance with Table 2-7 when the safety analysis documents a scenario in which it is likely that the maximum dose may be delivered to an individual. Appendix 2C provides an approved methodology for taking into account the role of machine controls in determining the maximum dose that may be delivered to an individual to be used in the application of Table 2-7.
      - For roads over berms, culverts, parking areas adjacent to beamlines, and berm areas considered to be minimally occupied, if the safety analysis indicates an unlikely scenario which could result in a maximum dose corresponding to a posting status of no higher than a radiation area during the unlikely scenario, and no precautions are required for the normal operating condition, then no posting is required if the duration of the unlikely scenario is less than one hour.
    - Table 2-6

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Table 2-6 Control of Accessible Accelerator/Beamline Areas for Prompt Radiation Under Normal Operating Conditions (refer to Article 236.2(b))

Dose Rate (DR) Under Normal Operating Conditions	Controls
All interlocked doors or gates leading from non-enclosures into an interlocked Exclusion Area	Signs (EXCLUSION AREA – No Access Permitted with Beam Enabled.)
DR < 0.05 mrem/hr	No precautions needed.
0.05 ≤ DR < 0.25 mrem/hr	Signs (CAUTION -- Controlled Area). No occupancy limits imposed.
0.25 ≤ DR < 5 mrem/hr	Signs (CAUTION -- Controlled Area) and minimal occupancy (occupancy duration of less than 1 hr).
5 ≤ DR < 100 mrem/hr	Signs (CAUTION -- Radiation Area) and rigid barriers (at least 4' high) with locked gates. For beam-on radiation, access restricted to authorized personnel. Radiological Worker Training required.
100 ≤ DR < 500 mrem/hr	Signs (DANGER -- High Radiation Area) and 8 ft. high rigid barriers with interlocked gates or doors and visible flashing lights warning of the hazard. Rigid barriers with no gates or doors are a permitted alternate. No beam-on access permitted. Radiological Worker Training required.
DR ≥ 500 mrem/hr	Prior approval of SRSO required with control measures specified on a case-by-case basis.

○ Table 2-7

Table 2-7 Control of Accessible Accelerator/Beamline Areas for Prompt Radiation Under Accident Conditions When It is Likely that the Maximum Dose Can Be Delivered (See Article 236.2b for more details)

Maximum Dose (D) Expected in 1 hour	Controls
All interlocked doors or gates leading from non-enclosures into an interlocked Exclusion Area	Signs (EXCLUSION AREA – No Access Permitted with Beam Enabled.)
D < 1 mrem	No precautions needed.
1 < D ≤ 10 mrem	Minimal occupancy only (duration of credible occupancy < 1 hr) no posting
1 ≤ D < 5 mrem	Signs (CAUTION -- Controlled Area). No occupancy limits imposed. Radiological Worker Training required.
5 ≤ D < 100 mrem	Signs (CAUTION -- Radiation Area) and minimal occupancy (duration of occupancy of less than 1 hr). The assigned RSO has the option of imposing additional controls in accordance with Article 231 to ensure personnel entry control is maintained. Radiological Worker Training required.
100 ≤ D < 500 mrem	Signs (DANGER -- High Radiation Area) and rigid barriers (at least 4' high) with locked gates. For beam-on radiation, access restricted to authorized personnel. Radiological Worker Training required.
500 ≤ D < 1000 mrem	Signs (DANGER -- High Radiation Area) and 8 ft. high rigid barriers with interlocked gates or doors and visible flashing lights warning of the hazard. Rigid barriers with no gates or doors are a permitted alternate. No beam-on access permitted. Radiological Worker Training required.
D ≥ 1000 mrem	Prior approval of SRSO required with control measures specified on a case-by-case basis.

● Radioactive Material

- Approved by RSO, must have CA/RMA postings/ropes
- Long term (30+ days) has SRSO approval
- FRCM 415.9

9. Outdoor storage of radioactive material is discouraged.

- a. Any new outdoor storage locations that will be used more than 30 days shall be approved by the SRSO.
- b. The use of shielding blocks for storing radioactive materials outdoors with limited protection against the outdoor weather environment and as the dominant structural element is strongly discouraged.
- c. Outdoor storage locations that will be used for periods of less than 30 days may be approved by the assigned RSO.
- d. In cases where outdoor storage is necessary and where removable radioactivity is present, containers of high integrity shall be chosen to prevent degradation from weathering and the resultant release of radioactive material.
- e. Radioactive items and associated pieces of equipment shall be stored in a structurally sound manner that provides the long term ability to safely retrieve the items from both a material handling and radiation safety perspective.

○ Permanent outdoor storage places

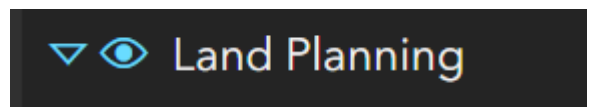
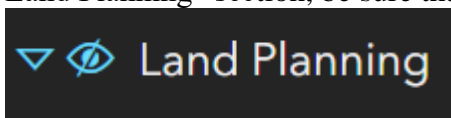
- PW5 is 4ft fence, locked at all times, uses padlock
- FESS Site 39, locked unless Fermilab person actively working
- Behind MAB, locked 8ft CA/RMA fenced area

- Site 40, not-locked 8ft CA/RMA fenced area
- Railhead, locked 8ft fence when Railhead personnel not present, unlocked with Railhead personnel there
- Temporary outdoor storage of rad. Material (mainly shielding blocks being transported for installation) - CA/RMA posted ropes/stanchions
- Nuclear Material
  - Outdoor storage behind DAB, DZero test cryostat – locked 8ft fence
  - D2 gas cylinders within fenced portion of Railhead
- Outdoor chipmunks with checksources
  - Some outside that are outside of fences, but within doghouses
  - May have temporary chipmunks not within a doghouse
- Skyshine/Air emissions
  - Evaluated in Shielding Assessments
- Dose from Beam
  - Evaluated in Shielding Assessments
  - Currently working on beam-on surveys for all beamlines
  - Also expanding area monitoring program to monitor outdoor/publically accessible locations

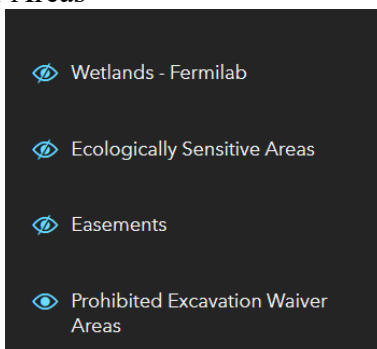
2. **Review “JULIE Excavation Waiver Prohibited Zone” Map in GIS** – M. Schoell reported a recent event at MC7 where minor excavation (< 6 inches) was done outside of the MC7 enclosure to aid in shielding block installation, however no JULIE was submitted. Beam was off during the time and no required shielding was impacted. FESS is performing an HPI. However it did bring up the question about when do we (radiation safety) need to see a JULIE (for which areas as well as for which type of activity).

There is currently a map on the GIS website showing “Prohibited Excavation Waiver Areas”, indicating areas that are required to have a JULIE before work. This area has been reviewed by RSSC, and ensures RP review of planned excavation activities. Please take a look and review the map. **Let us know if any updates are needed by February meeting.**

- GIS website: <https://fess-app.fnal.gov/app/JsViewers/faces/fermilabViewer.xhtml>
- In the “Land Planning” section, be sure that the eye is not crossed out



- Within “Land Planning”, ensure everything is crossed out except for “Prohibited Excavation Waiver Areas”



We've also been asked by the DSOs to clarify what activities we are concerned about and need to be part of the review/approval process within this "area" (i.e., excavation of soil, excavation of parking lots, excavation of gravel, drilling into walls/floors/ceilings, etc.), and why it's necessary (i.e., to ensure beam is off for affected areas, to ensure required shielding is returned before beam operations, to ensure survey of potentially activated soil, to ensure survey of potentially activated facility/infrastructure, etc.). They've asked that we provide ½-1 page memo/description to the DSOs so they can pass along to Task Managers/Construction Coordinators, Building Managers, etc. See initial thoughts below, **please review and send additional comments by February meeting, we will finalize memo/description for DSOs at February meeting.**

In addition, they've asked that we review FESHM 7030 (Excavation) and 7040 (Concrete Cutting/Coring) for any necessary updates from radiological perspective. Are any changes necessary for FRCM as well? **Please review FESHM chapters and have comments ready by February meeting.**

M. Quinn asked if there was any connection between IMPACT and JULIE systems. If there is drilling into a wall, would that be in IMPACT? Will need followup with DSOs.

An HPI is being performed by FESS. M. Schoell will reach out to Jon to see if an update can be given in February.

- Excavation
  - Soil
  - Parking Lots
  - Gravel
  - Any excavation of any material within the "Prohibited Excavation Waiver Area" requires JULIE to be submitted to allow for radiation safety review to determine if excavation will potentially impact berm and/or required shielding. If berm is impacted, beam to the affected area must be configuration controlled off by the RSO prior to the start of work, and the berm confirmed restored by the RSO at the end of the work prior to resuming beam operations. Depending on the size and scale of the excavation, confirmation may be done visually by the RSO or may warrant a topographic survey performed by the Alignment Group. If excavation will impact required shielding, the soil will be required to be surveyed by RCTs to determine if it's activated. If the soil is activated, excavation personnel may need full Radiological Worker training and equipment may need to be decontaminated. If excavation impacts required shielding and the soil is not planned to be replaced, it must remain on site.
- Facilities (drilling walls/floors/ceiling, removal of metals/infrastructure)
  - Posted CA/RMA
    - For facilities only posted as CA/RMA, no rad restrictions apply.
  - Posted RA/EA
    - For areas where beam is present (EA/RA), infrastructure and facility equipment has the potential for activation and/or contamination. JULIEs should be performed for this work in these areas to ensure radiation safety review and approval. Material should be surveyed by RCTs prior to work, and prior to disposal (using the MMR process). Metals may be subject to the

metals recycling suspension, and should be reviewed on a case-by-case basis by the RSO.

- NOTE: MT6.1, MT6.2, MC7, NM4 and MC-1 Hall are posted EAs in addition to CA/RMA. These enclosures would fall into this category, requiring radiation safety review of all facility work (drilling walls/floors/ceilings, removal of metals/infrastructure).

**3. Target Service Integration Building** – M. Schoell reported that a new facility, Target Service Integration Building (TSIB), is in the building planning phase. This facility will be an expansion of the existing MI-8 service building and will house the following activities related to LBNF and other Fermilab accelerator research/operations:

- Additional floor space for new horn/target fabrication & testing
- Additional storage space for completed horns/targets and lifting fixtures
- Hot Lab, including Hot Cells, and Microscope Lab for material science R&D for new horn/target design research
- NOMA (Nominal Material) Tech Lab for nanofiber work for R&D for new horn/target design research
- Additional floor space for setup to do mock-ups of remote handling work

Currently in the building Project planning phase, with plans for additional reviews in the future. Plans for activities within the building are in the very early stages.

Work in the Hot Lab/Cells will involve material that has been irradiated, potentially from other Labs and sent to Fermilab, that will be directly related to LBNF/Fermilab accelerator research. Preliminary plans to create a SAD chapter for this facility within Section 4 “Radiological Facility Supporting Accelerator Operations”.

Still need to sort out details as activity plan further develop to eliminate potential scope creep beyond SAD/420.2c space, determine how material is reviewed/approved prior to use, determine how activities will be approved and how they will be controlled and monitored (i.e., contamination, air monitoring, internal dosimetry, etc.).

M. Schoell and E. Schlatter are ESH representative and will be included in the Project planning aspects for the building as well as planned activities within the building.

FSO asked if there was a document to show that activities fall within DOE O 420.2c space. M. Schoell reported that they’re not yet there in the planning phase, but would be something forthcoming. This would also include scope/scale of activities (i.e., limits for activity and contamination, etc.).

**4. 8 GeV Line LCW Leak** – S. McGimpsey reported that LCW leaked in the MI 8 GeV collimator region on Christmas day. All personnel involved followed proper RWP and RSO requirements. Any work in water was done with rubber boots & PPE with RSO approval. Repair work also had job-specific RWP. Water sample taken and submitted to RAF, showed nothing. Water left in place to evaporate, will do contamination wipes of the floor once water has dried up to confirm no spread of contamination or modify postings. J. Fulgham reported that there is a plan to inspect water and take additional samples/wipes during the next access day. FSO has also reached out to K. Gregory to look into water detection systems around posted Contamination Areas to help prevent water getting into that area.

5. **DUNE** – M. Quinn reported that M. Quinn, K. Graden and M. Schoell met with DUNE ESH and SURF RSO to discuss plan for source use in leased space (i.e., leak checks, shipping receiving, dose, etc.), since Fermilab managed by DOE and SURF managed by NRC. Will need to look at RPP/835 requirements and see how NRC requirements would be equivalent. Will meet with LBNF again in early February. Ideally would have a general plan established prior to CD-2 at the end of 2021. SURF/LBNFs general impression is that NRC would likely not allow sources on the site unless it's included in the license.

M. Quinn reported that for LZ, SURF manages all the sources for LZ. It's unclear if this is an option for DUNE in the leased space.

R. Madiar mentioned potentially involving J. Blakie and J. Lewis (SURF Facility Representative). This will be a good idea once we have an idea of the 835 requirements compared to NRC requirements.

R. Madiar also mentioned that R. Snyder might have dealt with something similar at PNNL, so could be another potential resource.

6. **2021 10 CFR 835 Triennial** – M. Quinn will start reaching out to reviewers for this year's portion of the 10 CFR 835 triennial. Plan to review Sections B, F, G, and K.

#### **Old Business Carried Forward**

7. **Frisker/Wallflower Station Assessment** –M. Zientarski reported that the report has been written and are working on collecting and incorporating feedback, and incorporating data into the report.
8. **Electronic Dosimeters** – M. Quin & M. Zientarski previously mentioned that RPCF is looking into modernizing/consolidating electronic dosimeters. M. Zientarski gathered more information on the dosimeter readers, and collecting additional information from other vendors. Once more information is received will be able to continue this effort.
9. **RPCF Source Replacement** – M. Zientarski reported that the work to install new source into source projector previously deferred during Tier 3 mitigations has been approved. Hoping for January timeframe for the work and will keep everyone in the loop when dates are known, because RPCF will need to be closed for replacement work and also cave calibration.
10. **MC-7 Door Replacement** – W. Schmitt mentioned that he originally requested that the door be classified Group 2 (from a radiological area), but RSOs mentioned that enclosure was posted as RMA/CA so didn't need to be Group 2. FRCM 424 statement: clearly stated and documented process knowledge if metals clearly cannot contain radioactivity. W. Schmitt mentioned that MC7 enclosure postings are for beam-off situations, but is within the Radiation Area fence (posted for beam-on situations). Suggests that FRCM should be looked at to see if it would benefit from clarification. (Since posting for this area changes based on the operating conditions (CA/RMA for enclosure when beam off, RA fence when beam on).) HPI looking into this. M. Quinn thinks the door should be classified as Group 2 until we can confirm otherwise. M. Schoell mentioned that door replacement HPI also includes looking into operating power supply with ESS that had expired interlock tests.

M. Schoell reported that postings for the fence surrounding the MC7 enclosure have been updated to say “Radiation Area when Beam Enabled”, and that S. McGimpsey is creating a memo to clarify requirements for recycling metals from various origins within this space:

- Metals recycling is allowed from this outside area/MC7 enclosure with a radiation survey, confirming the metals are not radioactive, and completed Material Move Request Form.
- Metals recycling is not allowed for MC7 enclosure/facility infrastructure (i.e., doors, walls, cable trays, rails, etc.), as this material could have been activated from previous experiments and the documented process knowledge of the history of the material is unknown.
- Metals recycling is still prohibited for beamline components that could have been activated, when process knowledge is not available or when the history of the material is unknown.

R. Madiar asked how this would affect fence postings for the rest of the complex. W. Schmitt reported that other fences remain posted as Radiation Areas. This area is unique due to the frequent access to the area when beam is disabled, and that there is a RMA/CA posted building within the fence.

11. **DOE O 435 Added to Prime Contract** – D. Hockin reported that they are gathering feedback to the incorporation plan, once received will schedule a meeting with FSO to discuss.
12. **Eating/Drinking Near Source Boxes** – M. Quinn mentioned that there’s a meeting within RPO to discuss this in more detail. No progress to report yet.

D. Hahn reported that Lab 3 would still like their source box moved. K. Graden needs Building Manager ok to drill into wall to hang source box in new location (North wall of the Clean Room). K. Graden will continue working with D. Hahn and HCTT to do this work.

From 11/4 meeting, with one *clarification*.

D. Hahn asking for clarification on what’s needed as far as eating/drinking near source boxes, from several recent emails, wondering if it depends on the size of the room, etc. What’s required and what’s needed for posting. Discussion:

- FRCM requires no eating/drinking in radiological areas
- FRCM disallows storage of radioactive material in cafeterias/etc.
- Nothing explicit in FRCM about this situation. So if we come up with new rule/guidance, need to be consistent.
- Do we want to say “no eating/drinking in any area where there is radioactive material”?
- Do we issue guidance to radiological workers/source users?
  - In one of the emailed instances, the individual wasn’t a source user, so there may be people in the areas that would be left off of these lists.
  - Also, this area hasn’t been used as a work space until COVID and people started looking for areas where they can work alone.
- How “far away” is good enough?
- Do we even need a new policy? What’s the perceived hazard/risk is for someone eating/drinking in a Radioactive Material Area. Don’t see a risk in RMAs. Do see a risk for radiological areas, so the requirements there are appropriate. If high enough Class/dose rates exist, would be posted as a radiological area. Don’t see a risk for RMAs.

- Potential risks would be possible inhalation/ingestion of low-level radioactive material.
- But just because there's a presence of radioactive material, that doesn't necessarily mean the risk for ingestion exists.
- Sources in source boxes are well shielded and remain at RMA levels.
- Selaed sources are checked monthly for contamination, so don't see a risk for ingestion.
- Imposing additional restrictions would be a challenge to implements. Writing it in FRCM would be easy enough, but policing to ensure a water bottle isn't in an RMA would be difficult. And with no risk, don't see the need for additional layer of control.
- Concerns that an individual is using a source while eating/drinking, and the source box were to start leaking, then the risk is present.
  - If there's no risk, why does FRCM disallow source boxes in established eating/drinking areas. Seems like policies contradict themselves. Why do we disallow sources in established eating/drinking areas, but allow eating/drinking in RMAs?
    - *Clarification:* The referenced article is FRCM 415, which doesn't specify sources. FRCM doesn't prohibit source boxes in established eating/drinking areas. There are no policies in FRCM or source program documents that prohibit source boxes in established eating/drinking areas. There are no inconsistencies with respect to source use in RMAs vs. use of other radioactive materials in RMAs.
- Haven't seen anyone eating/drinking while actually using radioactive sources.
- Also don't believe it's a realistic scenario for the sources to suddenly start leaking.
- Sources shouldn't be treated any differently than other radioactive material. If we impose restrictions on any area containing radioactive material/sources, should be consistently applied for all such areas.
- Should we be telling people to eat/drink in only designated eating/drinking areas?
  - Not possible with new COVID restrictions. Only one person can eat there, so many people are eating in their offices/desks.
- Additional complication, do we look at other ingestion pathways (i.e., applying cosmetics/chapsticks)? Do we disallow that in RMAs too?
  - Concerns that anywhere where radioactive material are stored/used, there is a risk for ingestion and practices shouldn't be allowed.
  - 10 CFR 835 doesn't specify, so it's not a regulatory requirement. But still have concerns.
- Keep thinking about possible solutions. We want to take our time and get things right before changing policy.

No progress made on this. Would like to do a survey to see how many areas are posted that contain eating/drinking spaces, as well as perform a risk analysis for likelihood of ingesting Class 1 material, and the potential associated internal hazard, to help determine appropriate actions.

13. **Accelerator Startup** – All machines are running except for NM (SpinQuest) and Meson Center.
14. **Dose to Public FSO Concerns** – Post-start recommendation from FSO with approval of ASE Rev 12 (MTA revision) highlighted FSO concerns about FNAL use of occupancy factors when calculating potential dose to the public. Recommended controls be put in place for any areas of



concern when removing occupancy factor. Recommendation also mentions external DOE review. This stemmed from the DOE looking at Fermilab's site accessibility.

As the Fermilab site is closed to the general public, the otherwise publicly accessible areas of the site that could exceed public dose restrictions (if not for occupancy adjustment) do not represent a public risk. Prior to Fermilab allowing public access to the site, the areas that would then be publicly accessible, that could exceed public dose restrictions (if not for occupancy adjustment), must be posted as restricted to Fermilab workers unless a subsequent DOE external review proposes alternative expectations that are subsequently accepted by the FSO Manager.

RP Departments looking into this. Planning for increasing area monitors (dosimetry badges) throughout the site as well as potential beam-on surveys. Increasing area monitor locations throughout the Lab to ~300 locations, including more publically accessible areas/site boundaries.

Current Controlled Area postings are based on 2000 hours per year. Not adjusting for occupancy factors, 8760 hours per year, is not something we've considered. We have designed facilities and our postings are also based on the 10 CFR 835 limits, which are based on 2000 hours in a year, which is considered to be extremely conservative for members of the public to be on site. Will have to see results from area monitors to understand this better.

Will also wait to see new Site Security Plan to understand any changes to public access to the site to see if there is a potential for some occupancy factors.

R. Madiar reported that there will be an 10 CFR 835 reiew on the November/December timrframe. The plan for this assessment has been in the works since pre-COVID. However additional lines of inquiry from a security standpoing.

M. Quinn stated that review may be focused on our set of criteria (our occupancy assumptions) and if that's still appropriate.

New this meeting: Area monitors received and are being deployed. Beam-on surveys nearly complete, working on compiling survey information and generating the report.

15. **NEXUS DD Neutron Generator** – D. Hahn reported that it's been removed from the Mu2e pit. The generator is moved to Lab G and the deuterium bottle is at Site 40. D. Hahn also reported that this is good because Mu2e DT Neutron Generator may be delivered soon.

No update.

16. **Safety Assessment Document review** – M. Schoell reported that she will be transitioning into SAD Subcommittee Chair role. No chapters currently out for review.
17. **Accelerator Readiness** – No update.
18. **Contamination in Enclosures** – Beam operational, build-up surveys will resume soon.
19. **SARP** – K. Gollwitzer reported no new assessments for SARP.

## ALARA Topics

20. M. Schoell reported 2020 Shutdown dose through Week 22 (ending Sunday November 15<sup>th</sup>) is 4,895 person-mrem, which is well below the pre-shutdown estimate of 6,759 person-mrem. Working on finalizing post-shutdown documentation/memo.

## Operations

J. Compton reported that Linac developed a strange loss pattern when sending beam to MTA, currently investigating. Ops are also working on training new Search & Secure procedure for MC7.

**PLACE AND DATE FOR THE NEXT MEETING: THE NEXT MEETING WILL BE ON FEBRUARY 3, 2021 AT 2:00 PM CENTRAL VIA ZOOM (MEETING INFORMATION WITHIN OUTLOOK CALENDAR EVENT).**

**FY2021 Minutes: ESH DocDB 6112**

## Distribution via E-Mail–

Amber Kenney – Chief Safety Officer	Subcommittee Members
Eric McHugh	Bridget Iverson
Raymond Lewis	Nicole Gee
Others Present	
RPO Department	