## Table 2. Summary of Baseline and Residual Risks – Radiation Analysis Facility (RAF)

| Risk Tables Description | | Baseline Risk | Residual Risk |
|---|---|---|---|
| 2.1 | Radiological – Onsite-1 Facility Worker | R: III | R: IV |
| 2.2 | Radiological – Onsite-2 Co-located Worker | R: III | R: IV |
| 2.3 | Radiological – MOI Offsite | R: IV | R: IV |
| 2.4 | Toxic Materials – Onsite 1 Facility Worker | R: * | R: * |
| 2.5 | Toxic Materials – Onsite 2 Co-located Worker | R: * | R: * |
| 2.6 | Toxic Materials – MOI Offsite | R: * | R: * |
| 2.7 | Flammable & Combustible Materials – Onsite-1 Facility Worker | R: * | R: * |
| 2.8 | Flammable & Combustible Materials – Onsite-2 Co-located worker | R: * | R: * |
| 2.9 | Flammable & Combustible Materials – MOI Offsite | R: * | R: * |
| 2.10 | Electrical Energy – Onsite-1 Facility Worker | R: * | R: * |
| 2.11 | Electrical Energy – Onsite-2 Co-located Worker | R: * | R: * |
| 2.12 | Electrical Energy – MOI Offsite | R: * | R: * |
| 2.13 | Thermal Energy – Onsite-1 Facility Worker | ~~R: *~~ | ~~R: *~~ |
| 2.14 | Thermal Energy – Onsite-2 Co-located Worker | ~~R: *~~ | ~~R: *~~ |
| 2.15 | Thermal Energy – MOI Offsite | ~~R: *~~ | ~~R:~~ |
| 2.16 | Kinetic Energy – Onsite-1 Facility Worker | R: * | R: * |
| 2.17 | Kinetic Energy – Onsite-2 Co-located Worker | R: * | R: * |
| 2.18 | Kinetic Energy – MOI Offsite | R: * | R: * |
| 2.19 | Potential Energy- Onsite-1 Facility Worker | R: * | R: * |
| 2.20 | Potential Energy – Onsite-2 Co-located Worker | R: * | R: * |
| 2.21 | Potential Energy – MOI Offsite | R: * | R: * |
| 2.22 | Other Hazards – Onsite-1 Facility Worker | R: * | R: * |
| 2.23 | Other Hazards – Onsite-2 Co-located Worker | R: * | R: * |
| 2.24 | Other Hazards – MOI Offsite | R: * | R: * |
| 2.25 | Environmental Hazards | R: * | R: * |

* This hazard has been evaluated within the common Risk Matrix table included in SAD Section I Chapter 04 *Safety Analysis*. Work in the specified areas involving this hazard implements the controls specified in the common Risk Matrix table. No unique controls are in use.

**NOTE:**

Per DOE-HDBK-1163-2020, Appendix C, "Risk Assessment Methodology":
"Events with an unmitigated risk value of III or IV would not require additional control assignments to provide reasonable assurance of adequate protection. Whereas, for events with an unmitigated risk value of I or II, controls would need to be assigned to either reduce the likelihood or the consequence, and therefore the overall mitigated risk. Generally, preventive controls are applied prior to a loss event – reflecting a likelihood reduction and mitigative controls are applied after a loss event – reflecting a consequence reduction. Each control is credited for a single "bin drop" either in likelihood or consequence; not both. Following a standard hierarchy of controls, controls are applied until the residual risk is acceptable – reflecting a mitigated risk value of III or IV. After controls are credited, events with a remaining unacceptable residual risk (i.e., I or II) are candidates for additional analyses and additional controls, often quantitative in nature."
For Fermilab, these controls for accelerator-specific hazards are identified as Credited Controls and further summarized in the Accelerator Safety Envelope (ASE).

**Table 2.1 Radiological – Onsite-1 Facility Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Residual activation | *Hazard: Presence of activated samples for analysis.* | L: A<br>C: L<br>R: III | P: SOPs provides the process for workers to follow to avoid exposure to residual radiation in samples.<br>P: Only trained workers allowed to perform sample analysis at RAF (over)<br>M: RWPs provide work controls to mitigate exposure of workers to residual activation.<br>M: postings inform workers of potential hazard to mitigate exposure to residual activation.<br>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing workers the opportunity to mitigate their exposure. | L: EU<br>C: N<br>R: IV |
| Radioactive waste | *Hazard: Presence of analysis materials and containers that are designated as radioactive waste after preparation or analysis.* | L: A<br>C: N<br>R: IV | P: SOPs provides the process for workers to follow to generate radioactive wastes while avoid exposure to it,<br>P: Only trained workers allowed to perform sample analysis at RAF (over)<br>M: RWPs provide work controls to mitigate exposure of workers to radioactive waste.<br>M: postings inform workers of potential hazard to mitigate exposure to radioactive waste.<br>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing workers the opportunity to mitigate their exposure. | L:EU<br>C: N<br>R: IV |

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Contamination | *Hazard: Contamination from spills or inadvertent transfer of material from analytical samples.* | L: A<br>C: N<br>R: IV | P: SOPs provide the process for workers to follow during analytical work to prevent contamination transfer to themselves,<br>P: Only trained workers allowed to perform sample analysis at RAF (over)<br>M: RWPs provide work controls to mitigate exposure of workers to contamination.<br>M:PPE mitigates to movement of contamination between objects and workers.<br>M: postings inform workers of potential hazard to mitigate exposure to radioactive waste.<br>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing workers the opportunity to mitigate their exposure. | L:EU<br>C: N<br>R: IV |
| $^{7}$Be | *Hazard: Potential radiation exposure to 7Be (uptake/committed dose).* | L: A<br>C: N<br>R: IV | Not Applicable. No prevention or mitigation is required. $^{7}$Be isn't hazardous in this pattern of use by facility. | L: A<br>C: N<br>R: IV |
| Radioactive Sources | *Hazard: Presence of check sources for detector calibration.* | L: A<br>C: L<br>R: III | P: SOPs provides the process for workers to follow to avoid direct exposure to radioactive sources,<br>P: Only trained workers allowed to perform sample analysis at RAF (over)<br>M: RWPs provide the work controls to mitigate radiation exposure by limiting time, distance and shielding.<br>M: postings inform workers of potential hazard so they can actively mitigate exposure to radioactive sources.<br>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing workers the opportunity to mitigate their exposure. | L: EU<br>C: N<br>R: IV |

**Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual
- **rem =** Roentgen equivalent man

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ 25.0 rem | **C** ≥ 100 rem | **C** ≥ 100 rem |
| **M** | 25.0 rem > **C** ≥ 5 rem | 100 rem > **C** ≥ 25 rem | 100 rem > **C** ≥ 25 rem |
| **L** | 5 rem > **C** | 25 rem > **C** | 25 rem > **C** |
| **N** | 0.5 rem > **C** | 5 rem > **C** | 5 rem > **C** |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.2 Radiological – Onsite-2 Co-located Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Residual activation | *Hazard: Presence of activated samples for analysis.* | L: A<br>C: N<br>R: III | P: SOPs provide the process for co-located workers to follow to avoid samples with residual activation.,<br>P: Only trained workers allowed to perform sample analysis at RAF (over)<br>M: RWPs provide work controls with prohibit co-located workers from working with samples containing residual activation.<br>M: postings inform co-located workers of potential hazard so they can actively mitigate exposure to residual activation.<br>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing co-located workers the opportunity to mitigate their exposure. | L: EU<br>C: N<br>R: IV |
| Radioactive waste | *Hazard: Presence of analysis materials and containers that are designated as radioactive waste after preparation or analysis.* | L: U<br>C: N<br>R: IV | P: SOPs provides the process for co-located workers to follow to avoid radioactive wastes staging areas in the facility,<br>P: Only trained workers allowed to perform sample analysis at RAF (over)<br>M: RWPs provide work controls to mitigate exposure of co-located workers to radioactive waste.<br>M: postings inform co-located workers of potential hazard so they can actively mitigate exposure to radioactive waste.<br>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing co-located workers the opportunity to mitigate their exposure. | L:BEU<br>C: N<br>R: IV |

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Contamination | *Hazard: Contamination from spills or inadvertent transfer of material from analytical samples.* | L: U<br>C: N<br>R: IV | P: SOPs ,<br>P: Only trained workers allowed to perform sample analysis at RAF (over)<br>M: RWPs provide work controls to mitigate exposure of workers to contamination.<br><br>M: posting postings inform co-located workers of potential hazard so they can actively mitigate exposure to contamination.<br>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing co-located workers the opportunity to mitigate their exposure. | L:BEU<br>C: N<br>R: IV |
| $^{7}$Be | *Hazard: Potential radiation exposure to 7Be (uptake/committed dose).* | L: A<br>C: N<br>R: IV | Not Applicable. No prevention or mitigation is required. $^{7}$Be isn't hazardous in this pattern of use by facility. | L: A<br>C: N<br>R: IV |
| Radioactive Sources | *Hazard: Presence of check sources for detector calibration.* | L: A<br>C: L<br>R: III | P: SOPs provide the process for co-located workers to follow to avoid radioactive sources in the workplace,<br>P: Only trained workers allowed to perform sample analysis at RAF (over)<br>M: RWPs provide work controls to mitigate exposure of co-located workers to contamination.<br>M: postings inform co-located workers of potential hazard so they can actively mitigate exposure to radioactive sources.<br>M: dosimetry (down) provides an ongoing method to measure exposure buildup allowing co-located workers the opportunity to mitigate their exposure. | L: EU<br>C: N<br>R: IV |

**Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual
- **rem =** Roentgen equivalent man

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ 25.0 rem | **C** ≥ 100 rem | **C** ≥ 100 rem |
| **M** | 25.0 rem > **C** ≥ 5 rem | 100 rem > **C** ≥ 25 rem | 100 rem > **C** ≥ 25 rem |
| **L** | 5 rem > **C** | 25 rem > **C** | 25 rem > **C** |
| **N** | 0.5 rem > **C** | 5 rem > **C** | 5 rem > **C** |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.3 Radiological – MOI Offsite**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Residual activation | *Hazard: Presence of activated samples for analysis.* | L: EU<br>C: N<br>R: IV | P: RAF is a locked facility, preventing access by members of the public. | L: BEU<br>C: N<br>R: IV |
| Radioactive waste | *Hazard: Presence of analysis materials and containers that are designated as radioactive waste after preparation or analysis.* | L: EU<br>C: N<br>R: IV | P: RAF is a locked facility, preventing access by members of the public. | L:BEU<br>C: N<br>R: IV |
| Contamination | *Hazard: Contamination from spills or inadvertent transfer of material from analytical samples.* | L: EU<br>C: N<br>R: IV | P: RAF is a locked facility, preventing access by members of the public. | L:BEU<br>C: N<br>R: IV |
| $^{7}$Be | *Hazard: Potential radiation exposure to 7Be (uptake/committed dose*). | L: EU<br>C: N<br>R: IV | Not Applicable. No prevention or mitigation is required. $^{7}$Be isn't hazardous in this pattern of use by facility. | L: BEU<br>C: N<br>R: IV |
| Radioactive Sources | *Hazard: Presence of activated samples for analysis.* | L: UE<br>C: L<br>R: IV | P: RAF is a locked facility, preventing access by members of the public. | L: BEU<br>C: L<br>R: IV |

**Radiological Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual
- **rem =** Roentgen equivalent man

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ 25.0 rem | **C** ≥ 100 rem | **C** ≥ 100 rem |
| **M** | 25.0 rem > **C** ≥ 5 rem | 100 rem > **C** ≥ 25 rem | 100 rem > **C** ≥ 25 rem |
| **L** | 5 rem > **C** | 25 rem > **C** | 25 rem > **C** |
| **N** | 0.5 rem > **C** | 5 rem > **C** | 5 rem > **C** |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.4 Toxic Materials – Onsite 1 Facility Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Lead | *Hazard: Potential exposure to lead dust during manual handling of un-encased lead bricks, lead shot, and lead sheets.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |
| Liquid Scintillator Oil | *Hazard: Potential exposure to liquid scintillator oil during sample preparation or analysis.* | L: A<br>C:L<br>R: III | P: SOPs require samples to be prepared in a fume hood.<br>P: Only trained workers allowed to perform sample analysis at RAF<br>M: SOPs require gloves when preparing LSC samples. | L: EU<br>C: N<br>R: IV |

**Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **IDLH** = Immediately Dangerous to Life and Health
- **MOI =** Maximally-exposed Offsite Individual
- **PAC** = Protective Action Criteria
- **PEL** = Permissible Exposure Limit
- **$TLV_c$ =** Threshold Limit Value (ceiling)

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ PAC-2 | **C** ≥ PAC-3 | **C** ≥ IDLH |
| **M** | PAC-2 > **C** ≥ PAC-1 | PAC-3 > **C** ≥ PAC-2 | IDLH > **C** ≥ PEL or $TLV_c$ |
| **L** | PAC-1 > **C** | PAC-2 > **C** | PEL or $TLV_c$ > **C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences \ Likelihood | A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

## Table 2.5 Toxic Materials – Onsite 2 Co-located Worker

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Lead | *Hazard: Potential exposure to lead dust during manual handling of un-encased lead bricks, lead shot, and lead sheets*. | L:<br>C:<br>R:I | **See Section I Chapter 04**. | L:<br>C:<br>R: |
| Liquid Scintillator Oil | *Hazard: N/A* | L: U<br>C: L<br>R: III | P: SOPs require samples to be prepared in a fume hood.<br>P: Only trained workers allowed to perform sample analysis at RAF<br>M: SOPs require gloves when preparing LSC samples. | L: BEU<br>C: N<br>R: IV |

**Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **IDLH** = Immediately Dangerous to Life and Health
- **MOI =** Maximally-exposed Offsite Individual
- **PAC** = Protective Action Criteria
- **PEL** = Permissible Exposure Limit
- **$TLV_c$ =** Threshold Limit Value (ceiling)

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| H | **C** ≥ PAC-2 | **C** ≥ PAC-3 | **C** ≥ IDLH |
| M | PAC-2 > **C** ≥ PAC-1 | PAC-3 > **C** ≥ PAC-2 | IDLH > **C** ≥ PEL or $TLV_c$ |
| L | PAC-1 > **C** | PAC-2 > **C** | PEL or $TLV_c$ > **C** |
| N | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences \ Likelihood | A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

## Table 2.6 Toxic Materials – MOI Offsite

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Lead | *Hazard: Potential exposure to lead dust during manual handling of un-encased lead bricks.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |
| Liquid Scintillator Oil | *Hazard: Potential exposure.* | L: EU<br>C: L<br>R: IV | P: Public screening at the Fermilab site boundary.<br>P: RAF is a locked facility which does not allow unaccompanied public access. | L: BEU<br>C: L<br>R: IV |

**Chemical Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **IDLH** = Immediately Dangerous to Life and Health
- **MOI =** Maximally-exposed Offsite Individual
- **PAC** = Protective Action Criteria
- **PEL** = Permissible Exposure Limit
- **$TLV_c$ =** Threshold Limit Value (ceiling)

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| H | **C** ≥ PAC-2 | **C** ≥ PAC-3 | **C** ≥ IDLH |
| M | PAC-2 > **C** ≥ PAC-1 | PAC-3 > **C** ≥ PAC-2 | IDLH > **C** ≥ PEL or $TLV_c$ |
| L | PAC-1 > **C** | PAC-2 > **C** | PEL or $TLV_c$ > **C** |
| N | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences \ Likelihood | A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.7 Flammable and Combustible Materials – Onsite -1 Facility Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Combustible materials (cables, Boxes, Paper, wood cribbing, etc.) | *Hazard: Smoke inhalation and or burns from a fire involving combustible materials.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |
| Flammable Materials (Flammable gas, cleaning materials, etc.) | *Hazard: Smoke inhalation and or burns from a fire caused by flammable materials resulting in smoke inhalation or burns.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.8 Flammable and Combustible Materials – Onsite -2 Co-located Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Combustible materials (cables, Boxes, Paper, wood cribbing, etc.) | *Hazard: Smoke inhalation and or burns from a fire involving combustible materials.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |
| Flammable Materials (Flammable gas, cleaning materials, etc.) | *Hazard: Smoke inhalation and or burns from a fire caused by flammable materials resulting in smoke inhalation or burns.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.9 Flammable and Combustible Materials – MOI Offsite**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Combustible materials (cables, Boxes, Paper, wood cribbing, etc.) | *Hazard: Smoke inhalation and or burns from a fire involving combustible materials.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |
| Flammable Materials (Flammable gas, cleaning materials, etc.) | *Hazard: Smoke inhalation and or burns from a fire caused by flammable materials resulting in smoke inhalation or burns.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.10 Electrical Energy – Onsite-1 Facility Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| High Voltage Exposure | *Hazard: Shock hazard from bias greater than 50V.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences \ Likelihood | A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.11 Electrical Energy Onsite-2 Co-located Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| High Voltage Exposure | *Hazard: Shock hazard from bias greater than 50V.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences \ Likelihood | A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.12 Electrical Energy – MOI Offsite**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| High Voltage Exposure | *Hazard: Shock hazard from bias greater than 50V.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization > **C** | Minor injuries; no hospitalization > **C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.13 Thermal Energy – Onsite-1 Facility Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Cryogenic Liquids | *Hazard: Burns to face or extremities during liquid nitrogen transfer from Tank #53 to 5 l or 600 ml vessels.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.14 Thermal Energy – Onsite-2 Co-located Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Cryogenic Liquids | *Hazard: Burns to face or extremities during liquid nitrogen transfer from Tank #53 to 5 l or 600 ml vessels.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.15 Thermal Energy – MOI Offsite**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Cryogenic Liquids | *Hazard: Burns to face or extremities during liquid nitrogen transfer from Tank #53 to 5 l or 600 ml vessels.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.16 Kinetic Energy – Onsite-1 Facility Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Mobile Shielding | *Hazard: Injury from mishandling of lead shielding bricks during movement or transfer.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization > **C** | Minor injuries; no hospitalization > **C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.17 Kinetic Energy – Onsite-2 Co-located Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Mobile Shielding | *Hazard: Injury from mishandling of lead shielding bricks during movement or transfer.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization > **C** | Minor injuries; no hospitalization > **C** |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.18 Kinetic Energy – MOI Offsite**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Mobile Shielding | *Hazard: Injury from mishandling of lead shielding bricks during movement or transfer.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| H | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| M | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| L | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization > **C** | Minor injuries; no hospitalization > **C** |

**Risk Matrix**

| Consequences \ Likelihood | A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.19 Potential Energy – Onsite-1 Facility Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Compressed Gasses | *Hazard: Injury from unexpected failure of P-10 (Ar/CH4) gas cylinder regulation during routine handling.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |
| Vacuum Pumps | *Hazard: Injury from unexpected failure of vacuum pumps during liquid transfers between containers.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.20 Potential Energy – Onsite-2 Co-located Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Compressed Gasses | *Hazard: Injury from unexpected failure of P-10 (Ar/CH4) gas cylinder regulation during routine handling.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |
| Vacuum Pumps | *Hazard: Injury from unexpected failure of vacuum pumps during liquid transfers between containers.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.21 Potential Energy – MOI Offsite**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Compressed Gasses | *Hazard: Injury from unexpected failure of P-10 (Ar/CH4) gas cylinder regulation during routine handling.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |
| Vacuum Pumps | *Hazard: Injury from unexpected failure of vacuum pumps during liquid transfers between containers.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.22 Other hazards – Onsite-1 Facility Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Ergonomics | *Hazard: Injury from sitting/standing for extended periods at benchtops or workstations.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.23 Other hazards – Onsite-2 Co-located Worker**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Ergonomics | *Hazard: Injury from sitting/standing for extended periods at benchtops or workstations.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>R: |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| **C** | **Offsite (MOI)** | **Onsite-2 (co-located worker)** | **Onsite-1 (facility worker)** |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| **Consequences** | **Likelihood** A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.24 Other hazards – MOI Offsite**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Ergonomics | *Hazard: Injury from sitting/standing for extended periods at benchtops or workstations.* | L: BEU<br>C: N<br>R: IV | NA. | L: BEU<br>C: N<br>R: IV |

**Other Hazard Consequences, derived from Figure C-1, "Example Qualitative Consequence Matrix", DOE-HDBK-1163-2020.**

**Likelihood (L, of event)/year**
- **A** = Anticipated (L > 1.0E-02)
- **U** = Unlikely (1.0E-02> L >1.0E-04)
- **EU** = Extremely Unlikely (1.0E-04 > L >1.0E-06)
- **BEU** = Beyond Extremely Unlikely (1.0E-06> L)

**Consequence (C, of event)/year**
- **H** = High
- **M** = Moderate
- **L** = Low
- **N** = Negligible

**Risk (R, Qualitative Ranking)**
- **I** = situation (event) of major concern
- **II** = situation (event) of concern
- **III** = situation (event) of minor concern
- **IV** = situation (event) of minimal concern

**Control(s) Type**
- **P** = Preventive (reduce event occurrence likelihood)
- **M** = Mitigative (reduces event consequences)

**Acronyms**
- **MOI =** Maximally-exposed Offsite Individual

| C | Offsite (MOI) | Onsite-2 (co-located worker) | Onsite-1 (facility worker) |
|---|---|---|---|
| **H** | **C** ≥ Irreversible, other serious effects, or symptoms which could impair an individual's ability to take protective action. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. | **C** ≥ Prompt worker fatality or acute injury that is immediately life-threatening or permanently disabling. |
| **M** | **C** ≥ Mild, transient adverse effects. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. | **C** ≥ Serious injury, no immediate loss of life no permanent disabilities; hospitalization required. |
| **L** | Mild, transient adverse effects > **C** | Minor injuries; no hospitalization **> C** | Minor injuries; no hospitalization **> C** |
| **N** | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level | Consequences less than those for Low Consequence Level |

**Risk Matrix**

| Consequences | Likelihood: A | U | EU | BEU |
|---|---|---|---|---|
| H | I | I | II | III |
| M | II | II | III | IV |
| L | III | III | IV | IV |
| N | IV | IV | IV | IV |

**Table 2.25 Environmental**

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Airborne | *Hazard:*<br>• *Airborne release of radionuclides beyond permitted limits.*<br>• *Discharge of chemicals into onsite surface waters beyond permitted limits.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>**R:** |
| Water | *Hazard:*<br>• *Discharge of radionuclides into onsite surface waters beyond permitted limits.*<br>• *Discharge of chemicals into onsite surface waters beyond permitted limits.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>**R:** |

| Hazard | Hazard Description | Baseline Qualitative Risk (without controls) | Preventative (P)/ Mitigative (M) | Residual Qualitative Risk (with controls) |
|---|---|---|---|---|
| Soil | *Hazard:*<br>• *Discharge of radionuclides beyond allowable concentrations of radionuclides beyond calculated Fermilab limits.*<br>• *Discharge of chemicals into onsite soils beyond permitted limits.* | L:<br>C:<br>R: | **See Section I Chapter 04** | L:<br>C:<br>**R:** |