

3 **WORK AND WORKER AUTHORIZATION**
4 **BASED ON HAZARD REVIEWS**
5 **(“HAZARD REVIEW”)**

6
7 NIST S 7101.20

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12 **1. PURPOSE**

13 The purpose of this suborder is to define the requirements and associated roles and
14 responsibilities for authorizing both hazardous activities (“work”) and workers based on a
15 systematic level of work planning and control commensurate to the hazards, job
16 complexities, and physical location, *i.e.*, based on hazard reviews.
17
18

19 **2. BACKGROUND**

- 20 a. This suborder describes NIST’s graded approach to managing the safety of a wide range of
21 hazardous activities, from those that are relatively simple and routine to those that are highly
22 complex one-time projects. The graded approach is based on the severity of the consequences
23 of hazardous events or exposures to hazards and the likelihood of such events or exposures.
24
25 b. While this suborder primarily focuses on hazardous activities performed under normal and
26 off-normal operating conditions, there are provisions for authorizing work and workers under
27 abnormal operating conditions in which external factors may alter the risk assessment or
28 present additional hazards to those directly associated with performance of the activity.
29
30 c. This suborder supersedes NIST Administrative Manual Subchapter 12.06, *Hazard Analysis*
31 *and Control*.
32
33

34 **3. APPLICABILITY**

- 35 a. The requirements of this suborder apply to all activities conducted by NIST employees and
36 associates as part of their assigned duties under normal operating conditions except for the
37 following:

38 (1) *Common Everyday Tasks Performed Routinely by Members of the General Public at*
39 *Work and Home and that Do Not Involve Extraordinary Hazards.* This exception
40 recognizes that NIST staff members possess the knowledge, skills, and abilities to
41 perform a wide variety of common everyday tasks safely without written hazard reviews.
42 Examples of such common everyday tasks include working at a computer, reviewing
43 documents, walking, climbing stairs, picking up objects, and using scissors or short step
44 stools.

45
46 (2) *Inherently Low-Risk Activities.* This exception applies to activities that are considered to
47 present low safety risks without NIST personnel having to implement any safety controls
48 to mitigate those risks.^{1,2} The following activities are considered to present low safety
49 risks:

50
51 (a) Activities that could result in injuries requiring first aid but only infrequently; and

52
53 (b) Activities that could result in injuries requiring medical treatment beyond first aid but
54 are very unlikely to do so.

55
56 Examples of inherently low-risk activities include calibrating a balance, preparing non-
57 hazardous solutions, and using an optical microscope to examine non-hazardous samples.

58
59 b. The requirements of this suborder apply to any activity, regardless of the hazardous nature of
60 the activity itself, when performed under abnormal operating conditions (see Section 2.b)
61 where external factors may present hazards or pose additional risk beyond those associated
62 with performance of the activity, except when:

63
64 (1) Following the general requirements and/or guidance associated with the abnormal
65 condition provides sufficient protection from the hazards associated with the abnormal
66 condition;

67
68 (2) No activity-specific instructions are needed to implement the general requirements and/or
69 guidance associated with the abnormal operating conditions; and

70
71 (3) The activity-specific risks do not change as a result of the abnormal conditions.

¹ This presumes that if such an activity involves the use of equipment with built-in safety features, these features do not require written safe work practices, are not easily defeated, and will not be intentionally defeated or separated from the equipment.

² The requirements of this suborder apply to any activity for which PPE is *required* to mitigate the activity's safety risks. They do not apply to the following uses of PPE: PPE required solely for entry into the space in which the inherently low-risk activity is conducted, not for protection from the hazards associated with the activity; PPE used *voluntarily* as an additional layer of protection; and PPE worn solely to protect equipment or materials.

72 c. The exemptions provided in Section 3a do not relieve NIST staff members or management
73 from their responsibility to manage the safety risks associated with common everyday tasks
74 and inherently low-risk activities. NIST focuses on these using a variety of mechanisms,
75 including general safety training, safety-related communications, and incident awareness and
76 reduction efforts. In addition, the exemptions do not relieve NIST of its responsibility to
77 evaluate the compatibility of such activities with more hazardous activities in the same
78 spaces.

79
80

81 4. REFERENCES

82 a. 29 Code of Federal Regulations 1910.132, [Personnel Protective Equipment](#).

83
84

85 5. APPLICABLE NIST DIRECTIVES

86 a. NIST S 7101.04: [Safety and Health Requirements for Minors](#)

87

88 b. NIST S 7101.21: [Personal Protective Equipment](#)

89

90 c. NIST S 7101.58: [Respiratory Protection](#)

91

92 d. NIST S 7101.55: [Hearing Protection](#)

93

94 e. NIST S 7101.22: *Hazard Signage*

95

96 f. Other OSH suborders that contain sections focused on the identification, assessment, and
97 mitigation (*i.e.*, control) of hazards in specific OSH areas, *e.g.*, chemical hazard
98 communication, chemical management, cryogen safety, dispersible engineered
99 nanomaterials, hearing protection, and magnetic-field safety, to name several

100

101 g. NIST S 7101.23: [Safety Education and Training](#)

102

103

104 6. REQUIREMENTS

105 Requirements are provided for the risk-assessment methodology to be used in conducting
106 hazard reviews; the content, conduct, and approval of hazard reviews; the authorization of
107 work and workers; the re-review, and re-approval, of hazard reviews and the re-authorization
108 of work that falls outside the scope of current hazard reviews; retraining and reauthorization
109 of workers according to updated hazard reviews; records; activities involving workers from
110 multiple OUs; and Organizational Unit (OU) implementing procedures. Appendix B
111 illustrates the processes for authorizing work and workers and the role of hazard reviews.

112 a. Risk-Assessment Methodology
113 Procedures for implementing this suborder shall use the risk-assessment matrix in Appendix
114 C as the basis for conducting risk assessments. Once a hazard has been identified, the risk of
115 a hazardous event or exposure associated with that hazard shall be characterized, as indicated
116 in Appendix C and below, by a Relative Hazard Index (RHI) based on the severity of the
117 consequences of a hazardous event or exposure to a hazard and the likelihood of such an
118 event or exposure.

119
120 (1) Severity of the consequences of a hazardous event or exposure to a hazard (“Severity”)
121

122 (a) The severity categories in Appendix C provide qualitative measures of the
123 consequences of the worst credible hazardous event (see definition of “Worst
124 Credible Hazardous Event”) or exposure associated with an identified hazard due to
125 design inadequacies; procedural deficiencies; human error; environmental conditions;
126 or system, subsystem, or component failure or malfunction. The severity categories
127 that shall be used are:

- 128
- 129 i. CATASTROPHIC: Death or permanent disability; system or facility loss;
130 major property damage, lasting environmental or public-health impact.
131
 - 132 ii. SEVERE: Serious injury; temporary total disability (more than 3 months);
133 subsystem loss or significant facility/property damage, temporary
134 environmental or public-health impact.
135
 - 136 iii. MODERATE: Medical treatment beyond first aid; lost workdays; more than
137 slight facility/property damage; external reporting requirements; more than
138 routine clean-up.
139
 - 140 iv. MINOR: First aid or minor medical treatment; negligible or slight
141 facility/property damage; no external (outside NIST) reporting requirements,
142 routine cleanup.
143

144 (2) Likelihood of a hazardous event or exposure (“Likelihood”)
145

146 (a) The likelihood categories in Appendix C broadly estimate the probability that a
147 hazardous event or exposure involving an identified hazard will occur in carrying out
148 an activity. The likelihood categories that shall be used are:

- 149
- 150 i. FREQUENT: Likely to occur frequently or repeatedly.
151

- 152 ii. PROBABLE: Likely to occur multiple but infrequent times.
153
154 iii. OCCASIONAL: Likely to occur at some time.
155
156 iv. REMOTE: Possible, but not likely to occur.
157
158 v. IMPROBABLE: Very unlikely: can reasonably be assumed not to occur.
159

160 To the extent practical, likelihood should be assigned based on research, analysis,
161 experience, or evaluation of historical safety data from work with similar hazards.
162

163 (3) RHIs

164
165 (a) RHIs shall be associated with identified hazards by assigning both severity and
166 likelihood categories as indicated above and by identifying the corresponding RHIs at
167 the intersection of the severity column and likelihood row in the risk-assessment
168 matrix in Appendix C. The RHI levels that shall be used are:

- 169
170 i. Critical (RHI = 4)
171
172 ii. Serious (RHI = 3)
173
174 iii. Medium (RHI = 2)
175
176 iv. Low (RHI = 1)
177
178 v. Minimal (RHI = 0)
179

180 The RHI for an identified hazard provides a measure of the risk associated with that
181 hazard *assuming* that some set of controls has been implemented, where that set of
182 controls could range from inherent/built-in controls only to inherent/built-in controls
183 plus additional controls. In this sense, *RHIs are based on mitigated hazards.*³
184

185 b. Hazard-Review Process

186 Hazard reviews shall consist of the following primary elements, each of which must be
187 documented: (1) activity description, (2) activity hazard identification, (3) physical-location
188 review, (4) compatibility assessment, (5) initial hazard assessment, (6) hazard mitigation, (7)

³ RHIs are sometimes conceptualized as being based on (a) severity *taking into account inherent/built-in controls only* and (b) likelihood *after the implementation of additional controls*. This is valid to the extent that additional controls reduce, or are considered to reduce, *only* likelihood, *not* severity.

189 incident-response plan, and (8) risk assessment. Appendix D provides a flowchart
190 illustrating the relationship of these elements.

191
192 (1) Activity Description

193 Hazard reviews shall:

- 194
195 (a) Fully and accurately describe the activity being reviewed, including its intended
196 outcome or expected result, in a way that is detailed enough for someone outside of
197 the division or group to understand it;⁴
198
199 (b) Define the activity boundaries by identifying what is included in the activity as well
200 as what is specifically excluded from the activity, *e.g.*, commissioning, normal
201 operations, and maintenance of an instrument could be considered separate activities
202 with their own hazard reviews, depending on how different the hazards and
203 associated controls are in the three phases;
204
205 (c) Identify distinct subtasks within an activity based on significant differences in the
206 nature of the work and associated hazards (hazards may differ from task to task and
207 must be managed accordingly);
208
209 (d) Specify the physical location in which the activity is to be conducted; if the activity is
210 to be conducted in multiple locations, describe the general environment in which the
211 activity will be conducted and describe any specific restrictions, if applicable. When
212 the restrictions vary from location to location, subtasks should be assigned by
213 location.

214
215 (2) Activity Hazard Identification

216 The activity hazard identification shall:

- 217
218 (a) Identify the hazards associated with the activity, or, if the activity comprises distinct
219 subtasks, the hazards associated with each of those subtasks; and
220
221 (b) Note, reference, or include as attachments to the hazard review the results of any
222 exposure assessments or calculations conducted to characterize or quantify identified
223 potential hazards associated with the activity.
224

225 (3) Physical-Location Review

226 The physical-location review shall determine if the venue in which the activity is to be
227 conducted is appropriate and adequate. Routine laboratory, shop, or mechanical activities

⁴ An activity description similar to a scientific abstract would represent a best management practice.

228 are typically acceptable in spaces intended for such activities. OSHE should be consulted,
229 however, when unique, atypical, or unusual activities may not be consistent with the
230 proposed venue, and the results of the consultation should be noted in the review. For
231 example, OSHE should be consulted when the activity involves unusual quantities or
232 classes of hazardous materials or requires specialized fire and life-safety systems or
233 emergency-response equipment, and the results should be noted in the review.

234

235 (4) Compatibility Assessment

236 The compatibility assessment shall examine the hazard reviews associated with the
237 totality of activities conducted in the proposed physical location, both in the actual space
238 itself and, when applicable, neighboring spaces, to identify any potentially negative or
239 antagonistic interactions, taking into account both planned operations and off-normal
240 conditions that could reasonably be expected to occur.

241

242 (5) Initial Hazard Assessment

243 The initial hazard assessment shall:

244

245 (a) Identify for each identified hazard the key stages in the activity, or its subtasks, at
246 which a hazardous event or exposure could occur, focusing on those stages essential
247 to safe conduct of the activity or its subtasks; and

248

249 (b) Assign severity levels to each of the identified hazards, taking into account
250 inherent/built-in controls only, *i.e.*, prior to identifying any other controls (see
251 definition of “Inherent/Built-In Controls”);

252

253 (c) Consider any synergistic, negative, or antagonistic interactions identified in the
254 compatibility assessment.

255

256 (6) Hazard Mitigation

257

258 (a) Hazard mitigation shall employ the following “hierarchy of controls” (*i.e.*, preferred
259 order of implementation of controls) to mitigate each of the identified hazards, with
260 each subsequent control category being less effective and reliable than the previous
261 category:

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263 i. Elimination;

264

265 ii. Substitution;

266

267 iii. Engineering controls;

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- iv. Administrative controls (including signage, warnings, alarms, and training), and;
- v. Personal protective equipment (PPE).

Hierarchy of controls shall be employed until enough controls have been identified to mitigate the hazards to acceptable levels; in some cases, a combination of controls may be necessary, *e.g.*, engineering controls such as machine guarding and local exhaust ventilation could be used in conjunction with training and PPE to mitigate a hazard. There must be a clear connection between the hazards, the controls, and the mitigation of the hazards.

- (b) Hazard mitigation shall stipulate the engineering controls required for an activity, *e.g.*, chemical fume hood, gas cabinet, enclosures, interlocks, blast wall, safety interlock.
- (c) Hazard mitigation shall specify the alarms and other warnings required for an activity, *e.g.*, toxic gas alarms, oxygen sensors, warning lights, hazard signage.
- (d) When engineering controls and alarms and other warnings must be integrated into the building infrastructure, the hazard review shall confirm that the physical location in which the activity is to be conducted contains, or will contain, such equipment.
- (e) Hazard mitigation shall specify safe operating guidelines, as applicable (see definition of “Safe Operating Guidelines”), and incorporate these explicitly in the hazard review, either in their entirety or by reference.
- (f) Hazard mitigation shall specify any restrictions on employees conducting activities alone or out of hours, and if there are such restrictions, the additional safety measures that must be implemented, *e.g.*, buddy system, safe operating guideline.
- (g) Hazard mitigation shall specify any ongoing direct supervision required for employees to engage in the activity when ongoing direct supervision is deemed a necessary administrative control.
- (h) Hazard mitigation *should* specify any restrictions on:
 - i. The number of hours employees spends on the activity during a workday;
 - ii. The time of day employees conduct the activity; and

- 308
- 309 iii. The environmental conditions under which employees conduct the activity.
- 310
- 311 (i) Hazard mitigation shall specify the PPE required for conduct of the activity or
- 312 subtasks of the activity.
- 313
- 314 i. All PPE, including employee-owned PPE, shall be of safe design and
- 315 construction for the work to be performed.
- 316
- 317 ii. PPE shall be selected in accordance with the requirements in the PPE and
- 318 other OSH suborders (*e.g.*, Biosafety, Cryogen Safety, Hearing Protection,
- 319 Respiratory Protection, *etc.*), as applicable.
- 320
- 321 iii. PPE that properly fits each affected employee shall be selected.
- 322
- 323 (j) Hazard mitigation shall, based on the physical-location review, identify any
- 324 additional controls necessary to conduct the activity safely in the proposed physical
- 325 location.
- 326
- 327 (k) Hazard mitigation shall, based on the compatibility assessment, identify any
- 328 additional controls necessary to conduct the proposed activity safely in proximity to
- 329 other activities in the space and, when applicable, neighboring spaces.
- 330
- 331 (l) Hazard mitigation shall specify the activity-specific training, to be provided by the
- 332 OU, required for employees to engage in the activity, or distinct subtasks of the
- 333 activity, in the proposed physical location, and, when applicable, in proximity to other
- 334 activities in the space and neighboring spaces.
- 335
- 336 i. The Safety Education and Training suborder requires employees to complete
- 337 the training specified in OSH suborders (*e.g.*, Biosafety, Cryogen Safety,
- 338 Magnetic Fields, *etc.*) applicable to the work they are to conduct. This training
- 339 is documented and recorded in accordance with the requirements of the Safety
- 340 Education and Training suborder and need not be specified in the hazard
- 341 review.
- 342
- 343 ii. When activities involve the use of PPE, the activity-specific training must
- 344 result in employees being able to demonstrate an understanding of the
- 345 following requirements, and any special activity-specific abilities needed to
- 346 use the applicable PPE properly, before they are permitted to perform work
- 347 with that PPE:

- 348 (i) What PPE is necessary;
349
350 (ii) When PPE is necessary;
351
352 (iii) How to properly don, doff, adjust, and wear the PPE;
353
354 (iv) The limitations of the PPE; and
355
356 (v) The proper care, maintenance, useful life, and disposal of the PPE.
357

358 This activity-specific training must address only those activity-specific aspects
359 of the PPE not covered in either (1) the training provided by OSHE on the
360 PPE program, or (2) the training completed previously by affected employees
361 for other activities. This training shall be provided by OU employees, or
362 others, who have demonstrated an understanding of the activity-specific
363 aspects of the applicable PPE and any activity-specific ability to use that PPE
364 properly.
365

- 366 (m) Voluntary use of controls should be documented in the hazard mitigation section of
367 the Hazard Review when such use is subject to requirements in other OSH
368 suborders.⁵
369

370 (7) Incident-Response Plan (Activity Specific)

371 Planning for incidents, including off-normal conditions⁶, as applicable, is a critical
372 element of the hazard review process. In addition to providing guidance during an
373 emergency, the development of incident-response plans may result in the identification of
374 hazardous conditions that could aggravate or compound an emergency situation.
375 Additionally, the planning process may bring to light deficiencies, such as the lack of
376 resources (equipment, trained personnel, supplies) or adequate controls that can be
377 rectified before an emergency occurs. Hazard reviews shall include activity-specific
378 incident-response plans that:
379

- 380 (a) Stipulate any activity-specific equipment and supplies required for incident response,
381 *e.g.*, emergency shut-off switch, spill containment, special-purpose vacuum cleaner;
382
383 (b) Include the following when necessary to protect employee safety and health, the
384 physical location, and the environment:

⁵ For example, the voluntary use of respiratory protection is governed by specific requirements in the Respiratory Protection suborder.

⁶ Examples of off-normal conditions, *i.e.*, conditions outside of expected operating limits, include over or under pressure, over or under temperature, over or under flow rates, and loss of electrical power.

- 385 i. Procedures for shutting down or placing systems in a safe configuration;
386
387 ii. Plans for responding to off-normal conditions resulting from the failure of one
388 or more controls in the activity itself and, when necessary, other activities
389 conducted in the same space or neighboring spaces;
390
391 iii. Plans for responding to events such as utility losses, *e.g.*, power or water, and
392 building evacuations; and
393
394 iv. The identification of additional controls deemed necessary to reduce risks to
395 acceptable levels;
396
397 (c) Ensure that decisions regarding employees working alone or out of hours fully
398 consider the need to respond promptly, if necessary, to incidents that threaten
399 employee safety and health or the environment; and
400
401 (d) Specify the activity-specific incident-response training, to be provided by the OU,
402 required for employees to engage in the activity or distinct subtasks of the activity.
403

404 (8) Risk Assessment

- 405
406 (a) Hazard Reviews shall include an assessment of the risks by assigning RHIs to each of
407 the identified hazards subsequent to the application of controls.
408
409 (b) If the risk assessment subsequent to hazard mitigation results in RHIs that feasibly
410 could be lower, additional steps to mitigate the hazards shall be taken to reduce the
411 RHIs to those lower levels.
412

413 (9) Additional Requirements

- 414
415 (a) Hazard reviews shall meet the additional requirements established in other OSH
416 suborders, when applicable;⁷
417
418 (b) Hazard reviews shall flag, *e.g.*, using checkboxes, activities requiring the control of
419 hazardous energy (lockout/tagout), confined-space entry, hearing protection,

⁷ For example, hazard reviews of activities involving the use of biohazardous materials must include a Biohazardous Materials Registration and Authorization Form approved by the NIST Biosafety Officer; hazard reviews of activities involving the use of radioactive material at NIST Gaithersburg must include (among other things) a specific hazard assessment and hazard mitigation plan whose safety evaluation by the NIST Gaithersburg Radiation Safety Officer has been approved by the NIST Ionizing Radiation Safety Committee.

420 respiratory protection, fall protection, and assessments of exposure to carcinogenic
421 chemicals;

422
423 (c) Hazard reviews shall be readily available in hard-copy or electronic form in or near
424 the space in which the associated activities are to be conducted; and

425
426 (d) Hazard reviews shall identify hazardous wastes generated in the conduct of the
427 activity and include management of those wastes, as applicable. Arrangements for
428 disposal shall be coordinated with OSHE.

429
430 c. Conduct of Hazard Reviews

431 Hazard reviews shall be conducted by, or in consultation with, individuals with the
432 knowledge, skills, and abilities to identify, assess, and mitigate the hazards associated with
433 the activity under review, to conduct the physical-location review and compatibility
434 assessment, and to develop plans for incident response.

435
436 (1) Hazard reviews shall be conducted by individuals who collectively⁸ have taken the
437 training provided by OSHE on the Hazard Review program and on all OSH programs
438 pertinent to the activity under review.

439
440 (2) Hazard reviews should include subject matter experts from OSHE, the Office of Facilities
441 and Property Management (OFPM), and other OUs when the OU conducting the hazard
442 review requires additional safety or facilities expertise.

443
444 (3) Hazard reviews shall include consultation with the relevant groups in OSHE, ESO, and
445 OFPM (*e.g.*, Fire and Facilities Safety Group, Police Services Group, Fire Protection
446 Group, Facilities Maintenance Division) when activity-specific alarms must be tied into
447 building or facility alarm systems.

448
449 d. Approval of Hazard Reviews^{9, 10}

450 Completed hazard reviews shall be approved by line management, with the approval
451 signifying that the RHIs associated with the activity represent an acceptable level of safety
452 risk.¹¹

453

⁸ At least one member of the team must have taken the required training.

⁹ Sections 6d-i focus on activities that involve workers from a single OU. Section 6j indicates how Sections 6d-i apply to activities that involve workers from multiple OUs.

¹⁰ OUs may approve hazard reviews and authorize work at one time provided that the requirements in this section and Section 6e, respectively, are met.

¹¹ The approved hazard review serves as the Certification of Hazard Assessment required by 29 CFR 1910.132, *Personal Protective Equipment*.

- 454 (1) Hazard reviews shall be approved by line managers who have taken the training provided
455 by OSHE on the Hazard Review program.
456
- 457 (2) Activities with any RHI = 4 shall not be conducted at NIST.
458
- 459 (3) Hazard reviews of activities involving minors (individuals under age 18) that could result
460 in their being exposed to hazards with RHI = 2 shall be approved by OU Directors.^{12, 13}
461
- 462 (4) With the exceptions noted in items (5) and (6) below, all other hazard reviews shall be
463 approved at the following *or higher* levels of the line management of the OU responsible
464 for the activity (see [NIST 7101.00](#)):¹⁴
465
- 466 (a) Group Leaders:
467
- 468 i. Activities with all RHIs ≤ 1 .
469
- 470 (b) Division Chiefs:
471
- 472 i. Activities with some RHIs = 2 but no RHIs = 3.
473
- 474 (c) OU Directors:¹⁵
475
- 476 i. Activities with at least one RHI = 3.
477
- 478 (5) Activities for which the highest hazards have RHI = 2 and these are fully controlled to
479 industry standards (see definition of “Fully Controlled to Industry Standards”), as
480 determined by OSHE, may be approved by Group Leaders.
481
- 482 (6) Activities for which the highest hazards have RHI = 3 and these are fully-controlled to
483 industry standards (see definition of “Fully Controlled to Industry Standards”), as
484 determined by OSHE in consultation with experts in the OUs, may be approved by
485 Division Chiefs.
486

¹² As indicated in Section 10. AUTHORITIES, OU Directors may delegate the authority to approve such hazard reviews to OU Deputy Directors or Division Chiefs.

¹³ Activities with RHIs > 2 and a list of other specific activities are prohibited for minors; see the Safety and Health Requirements for Minors suborder.

¹⁴ OUs may require lower levels of line management (and others, e.g., chairs of hazard review committees, OU/division safety personnel, and project leaders) to sign off on hazard reviews prior to those hazard reviews being approved at the levels of line management indicated.

¹⁵ OU Directors may wish to establish (standing or *ad hoc*) Hazard Review Committees to conduct (or review) hazard reviews for such activities and recommend their approval or disapproval.

- 487 e. Authorization of Work¹⁶
488 Activities covered by approved hazard reviews shall be authorized to commence by line
489 management, with the authorization signifying that controls other than training¹⁷ have been
490 verified to have been implemented and that the controls will continue to be implemented as a
491 condition for the ongoing conduct of the work.¹⁸
492
493 (1) Activities shall be authorized by line managers who have taken the training provided by
494 OSHE on the Hazard Review program.
495
496 (2) Activities with any RHI =4 shall not be authorized by NIST.
497
498 (3) With the exceptions noted in item (4) below, activities covered by all other hazard
499 reviews shall be authorized at the following *or higher* levels of line management:¹⁹
500
501 (a) Group Leaders:
502
503 i. Activities with all RHIs ≤ 2 .
504
505 (b) Division Chiefs:
506
507 i. Activities with at least one RHI = 3.
508
509 (4) Activities for which the highest hazards have RHI = 3 and these are fully-controlled to
510 industry standards (see definition of “Fully Controlled to Industry Standards”), as
511 determined by OSHE, may be authorized by Group Leaders.
512
513 (5) If an activity of one OU is to be conducted in space assigned to another OU, access to
514 that space must be authorized by the line management of the second OU subject to any
515 conditions established by that OU to protect other employees working in the space from
516 the hazards associated with the activity. These conditions must be included as part of the
517 formal authorization of work (see [NIST 7101.00](#)).
518

¹⁶ OUs may approve hazard reviews and authorize work at one time provided that the requirements in this section and Section 6e, respectively, are met.

¹⁷ Training is addressed not in the authorization of work, but in the authorization of workers; see Section 6f.

¹⁸ So, for example, if a chemical fume hood is a required control, and the chemical fume hood is out of service or suspected to be functioning improperly, the work must stop until the fume hood is fully operational or an equivalent control is identified and implemented. Similarly, PPE must be in good working condition; defective or damaged PPE shall not be used.

¹⁹ OUs may require lower levels of line management (and others, such as chairs of hazard review committees, OU/division safety personnel, and project leaders) to sign off on authorizations of work prior to work being authorized at the level of line management indicated.

519 f. Authorization of Workers

520 To engage in activities that have been authorized by line management, workers must
521 themselves be authorized to perform that work by line management. This authorization
522 signifies that:

- 523
- 524 • The workers have taken the training specified in the OSH suborders applicable to the
525 work they are to conduct and the activity-specific training identified in Sections
526 6b(6)(i) (Hazard Mitigation) and 6b(7)(c) (Incident-Response Plan);
 - 527
 - 528 • Line-management has an appropriate degree of confidence, based on personal
529 knowledge, observation, or reliable input from others, that the workers to be
530 authorized:
 - 531
 - 532 ○ Have the knowledge, skills, and abilities to perform the work safely and
533 correctly; and
 - 534
 - 535 ○ Fully understand the boundaries/conditions imposed on the activity by the
536 activity hazard review, the need to work within those boundaries/conditions,
537 and the process for requesting work that falls outside of those
538 boundaries/conditions.

539

540 (1) Workers shall be authorized by line managers who have taken the training provided by
541 OSHE on the Hazard Review program and, in the case of official first-level supervisors,
542 on all OSH programs applicable to the work to be conducted;²⁰ and

543

544 (2) Workers shall be authorized by their official first-level supervisors, *or at that level and*
545 *higher.*^{21, 22}

546

547 g. Re-Review and Re-Approval of Hazard Reviews and Re-Authorization of Work and
548 Workers

549

²⁰ The Safety Education and Training suborder requires official first-level supervisors to complete training on the OSH suborders applicable to the work to be conducted by employees they supervise. This training is documented and recorded in accordance with the requirements of the Safety Education and Training suborder and need not be specified in the hazard review.

²¹ If a worker is to be authorized to carry out only a specified set of subtasks of a larger activity, that worker need only take the training applicable to that specified set of subtasks.

²² If an activity involves workers from one or more groups or divisions within a single OU, the OU may wish to establish additional requirements for authorizing workers across organizational lines. For example, if an activity owned by one group involves workers from a second group and the two Group Leaders are the official first-level supervisors, the OU may wish to have the workers from the second group authorized first by their Group Leader and then by the Group Leader of the group that owns the activity.

- 550 (1) Hazard reviews shall be re-reviewed whenever:
551
552 (a) Changes in existing activity parameters would introduce new hazards or increase
553 existing hazards;²³
554
555 (b) Changes in engineering controls, administrative controls, or PPE would increase
556 safety risks; or
557
558 (c) Previously unrecognized safety issues are identified, *e.g.*, through direct observation
559 or discussion, relating to an incident or audit that indicates inadequate controls, or
560 abnormal operating conditions which affect availability or efficacy of documented,
561 planned controls.
562
- 563 (2) Hazard reviews shall be re-reviewed on a predetermined basis to verify that the hazards
564 have not changed substantially since the hazard review was last approved or reviewed,
565 and that existing controls are adequate. Predetermined review periods:
566
567 (a) Shall be established when hazard reviews are initially reviewed and approved and
568 when they are re-reviewed;
569
570 (b) Shall not exceed three years;
571
572 (c) Shall be included in the hazard review documentation;
573
574 (d) Shall be based on risk and the potential for change, with higher-risk, more potentially
575 variable activities being reviewed more frequently; and
576 (e) May be more frequent based on the likelihood for change within an activity.
577
- 578 (3) When re-reviews indicate that hazards *have not* changed *and* that existing controls are
579 *adequate*, the re-reviewed hazard reviews shall include the date of the re-review, the
580 signature(s) of the individual(s) conducting the re-review, and the signature of the
581 responsible line manager.
582
- 583 (4) When re-reviews indicate that hazards *have* changed *or* that existing controls are
584 *inadequate*:
585

²³ For example, changes in equipment, equipment operation, materials, maximum quantities of materials, concentrations, operating temperatures and pressures, power levels, or process rates, or changes in permit conditions for permit-required activities, that would introduce new hazards or increase existing hazards.

586 (a) The re-reviewed hazard reviews shall be re-approved in accordance with the
587 requirements in Section 6d; and

588
589 (b) Work and workers shall be re-authorized in accordance with the requirements in
590 Sections 6e and 6f, respectively.

591
592 The re-approval of the hazard review and the re-authorization of work shall take place at
593 the levels of line management determined by the hazards that have changed or for which
594 the existing controls are inadequate, or at a higher level of line management.

595

596 h. Retraining and Re-Authorization of Workers

597

598 (1) Employees who have been authorized to conduct work shall, as a condition of their
599 authorization, complete retraining identified by the OUs whenever there is reason to
600 believe that employees lack the knowledge, understanding, or skill necessary to conduct
601 their work safely. Individual OSH suborders list specific circumstances under which such
602 retraining is required. General circumstances under which retraining is required include,
603 but are not limited to:

604

605 (a) An observation or other condition reveals that a worker lacks the necessary
606 knowledge understanding or skill; or

607

608 (b) An inspection or audit points to a systemic deficiency warranting retraining.

609

610 i. Records

611

612 (1) Copies of all current hazard reviews and work and worker authorizations shall be
613 maintained in hard copy or electronic form.

614

615 (2) Copies of hazard reviews and work and worker authorizations for activities that have
616 ceased shall be maintained in hard copy or electronic form for at least one (1) year unless
617 the hazard assessment involved exposure monitoring, in which case the hazard review
618 and work and worker authorizations shall be submitted to OSHE for retention in
619 accordance with the requirements of the Industrial Hygiene program.

620

621 (3) Training shall be documented and recorded in accordance with the requirements, roles,
622 and responsibilities in the Safety Education and Training suborder.

623

624 j. Activities Involving Workers from Multiple OUs

625

- 626 (1) The activity shall be owned by the *de facto* lead OU or, if it is not obvious which OU is
627 the *de facto* lead OU, by the OU determined to be the lead OU by discussion among the
628 involved OUs.
629
- 630 (2) The hazard review shall be approved by the lead OU in accordance with the
631 requirements in Section 6d, Approval of Hazard Reviews.
632
- 633 (3) Work shall be authorized by the lead OU in accordance with the requirements in Section
634 6e, Authorization of Work.
635
- 636 (4) Workers from the lead OU shall be authorized by the lead OU in accordance with the
637 requirements in Section 6f, Authorization of Workers.
638
- 639 (5) Workers from OUs other than the lead OU shall be authorized by their respective OUs
640 in accordance with the requirements in Section 6f *and* by the lead OU (“final
641 authorization”) in accordance with its own requirements.
642
- 643 (a) In authorizing workers from their OUs, OUs other than the lead OU should
644 determine that the hazard review is adequate, that the safety risk to workers from
645 their OUs is acceptable, and that the work has been authorized by the lead OU.
646
- 647 (6) Hazard reviews shall be re-reviewed and re-approved and work and workers from the
648 lead OU shall be re-authorized by the lead OU in accordance with the requirements in
649 Section 6g, Re-Review and Re-Approval of Hazard Reviews and Re-Authorization of
650 Work and Workers.
651
- 652 (7) Workers from OUs other than the lead OU shall be re-authorized by their respective
653 OUs in accordance with the requirements in Section 6g *and* by the lead OU (“final re-
654 authorization”) in accordance with its own requirements.
- 655 (8) Workers from the lead OU shall be retrained and re-authorized by the lead OU in
656 accordance with the requirements in Section 6h, Retraining and Re-Authorization of
657 Workers.
658
- 659 (9) Workers from other than the lead OU shall be retrained and re-authorized by their
660 respective OUs in accordance with the requirements in Section 6h *and* by the lead OU in
661 accordance with its own requirements.
662
- 663 (10) Records related to hazard-review documentation, the authorization of work, and the
664 authorization of workers from the lead OU shall be maintained by the lead OU in
665 accordance with the requirements in Section 6i, Records.

666 (11) Records of the authorization of workers from OUs other than the lead OU shall be
667 maintained as follows:

668
669 (a) Records of the authorization of workers from OUs other than the lead OU shall be
670 maintained by the workers' respective OUs; and

671
672 (b) Records of the final authorizations of such workers by the lead OU shall be
673 maintained by the lead OU.

674
675 k. OU Hazard Review and Work and Worker Authorization Procedures
676 Written procedures, which, if followed, would result in the requirements in Sections 6a-j
677 being met, shall be developed and maintained by each OU.

678
679
680 **7. DEFINITIONS**

681 a. Abnormal Conditions – Operational occurrences caused by external factors which are not
682 expected to occur as part of normal and off-normal conditions and may alter the risk
683 assessment or present additional hazards to those directly associated with performance of the
684 activity. Examples include restricted access to campus or need to work in close contact with
685 another staff member during pandemic conditions.

686
687 b. Activity – An experiment, operation, process, or job, often comprising subtasks, conducted to
688 achieve a specific outcome.

689
690 c. Direct Supervision – Relative to an employee, a term meaning that a second employee,
691 proficient in the activity being conducted by the first employee, shall be either present in the
692 work area while the activity is being conducted or available for consultation within a
693 reasonable amount of time commensurate with the need for consultation, based on the
694 proficiency of the first employee.

695
696 d. Fully Controlled to Industry Standards (Used in Reference to Hazards) – Controlled by a
697 device, apparatus, or system being designed in accordance with applicable regulatory and
698 consensus standards and predicated upon that device, apparatus, or system being used in a
699 prescribed manner. The mitigation of hazards that are fully controlled to industry standards
700 relies primarily on built-in/engineering controls or inherent design features but may, in some
701 cases, rely upon best practices. In either case, the control should be traceable to a broad
702 industry, consensus-based set of controls.

703

- 704 e. Hazard – Source, situation, or act with a potential for harm in terms of human injury or ill
705 health, adverse impact on the environment, damage or loss of equipment or property, or a
706 combination of these (from NIST 7101.00).²⁴
707
- 708 f. Hazard Identification – Process of recognizing that a hazard exists and defining its
709 characteristics (from NIST 7101.00).
710
- 711 g. Hazard Review (Document) – A document describing the results of the hazard-review
712 process.
713
- 714 h. Hazard Review (Process) – The formal process, aspects of which could be iterative, of
715 describing an activity, identifying the hazards associated with the activity, reviewing the
716 physical-location in which the activity will be carried out, assessing the compatibility of the
717 activity with nearby activities, conducting an initial hazard assessment, identifying controls
718 to mitigate the hazards, developing an incident-response plan, conducting a risk assessment,
719 and developing plans for managing wastes generated during the conduct of the activity.
720
- 721 i. Hierarchy of Controls – A range of hazard control methods arranged in order of
722 implementation preference from elimination to substitution, engineering controls,
723 administrative controls, and personal protective equipment.
724
- 725 j. Inherent/Built-In Controls – Features of a system's design that prevent or limit the severity of
726 the consequences of system failure. Inherent/built-in controls cannot be defeated or separated
727 from the system without conscious or willful effort.
728
- 729 k. Likelihood of a Hazardous Event or Exposure (“Likelihood”) – An estimate of the
730 probability of a hazardous event or exposure.
731
- 732 l. Line Management – For the purposes of this suborder, the OU Director, Division Chief, and
733 Group Leader, or equivalent.
734
- 735 m. Office-Like Space – A space, such as a conference room, copier room, break room, or
736 ordinary computer room that has the same types of hazards as a typical office or office
737 environment.

²⁴ This definition parallels that in *Occupational Health and Safety Assessment Series (OHSAS) Standard 18001:2007, Occupational Health and Safety Management Systems – Requirements*. For comparison, *OSHA 3071, Job Hazard Analysis, 2002 (revised)* defines a hazard as “the potential for harm, often associated with a condition or activity that, if left uncontrolled, can result in injury, illness or damage to property or the environment”, and *American National Standard for Occupational Safety and Health Management Systems, ANSI/AIHA Z10-2005*, defines a hazard as “a condition, set of circumstances, or inherent property that can cause injury, illness or death”.

- 738 n. Off-Normal Conditions – Operational occurrences which may be expected to occur that are
739 generally outside routine or planned operations. For example, loss of cooling water would be
740 an “off-normal” condition which could cause a heat-sink to overheat and combust. Other
741 examples include power failure, error at power-up or power-down, loss of cryogen
742 containment, human error, *etc.*
743
- 744 o. Relative Hazard Index (RHI) – A measure of the risk of a hazardous event or exposure based
745 on a combination of the severity of the consequences of the hazardous event or exposure to a
746 hazard and its likelihood.
747
- 748 p. Risk – Combination of the likelihood of an occurrence of a hazardous event or exposure and
749 the severity of injury or ill health that can be caused by the event or exposure (from NIST
750 7101.00).
751
- 752 q. Risk Assessment – Process of evaluating the risks arising from hazards, taking into account
753 the adequacy of any existing controls, and deciding whether or not the risks are acceptable
754 (from NIST 7101.00).
755
- 756 r. Safe Operating Guideline – A written set of requirements or practices developed or designed
757 to enable a task to be carried out safely. Safe operating guidelines can include, but are not
758 limited to, standard operating procedures, job hazard analyses, and instrument/equipment
759 instruction manuals.
760
- 761 s. Severity of the Consequences of a Hazardous Event or Exposure to a Hazard (“Severity”) –
762 A qualitative measure of the consequences of the worst credible hazardous event or exposure
763 associated with an identified hazard due to design inadequacies; procedural deficiencies;
764 human error; environmental conditions; or system, subsystem, or component failure or
765 malfunction.
766
- 767 t. Standard Operating Procedure – A written step-by-step procedure or operational protocol
768 used to document how a given task **must** be carried out to ensure safe operation. Standard
769 operating procedures are generally needed when failure to follow a prescribed set of steps
770 results in significant increase in risk.
771
- 772 u. Worst Credible Hazardous Event – Most severe or serious event capable of being believed,
773 taking into account all relevant considerations.
774
775

776 8. ACRONYMS

- 777 a. HR – Hazard Review

- 778 b. OSH – Occupational Safety and Health
- 779
- 780 c. OSHE – Office of Safety, Health, and Environment
- 781
- 782 d. OU – Organizational Unit
- 783
- 784 e. PPE – Personal Protective Equipment
- 785
- 786 f. RHI – Relative Hazard Index
- 787
- 788

789 **9. ROLES AND RESPONSIBILITIES**

790 a. NIST Director and Associate Directors:

- 791
- 792 (1) Concur or non-concur on approvals by OU Directors of hazard reviews of activities
- 793 elevated to the directorship level.
- 794

795 b. OU Directors:

- 796
- 797 (1) Ensure that written OU procedures are developed, maintained, and implemented to
- 798 ensure that the requirements of Sections 6a-j are met within their respective OUs.
- 799

800 c. Line Management:

- 801
- 802 (1) Take the training provided by OSHE on the Hazard Review program;
- 803
- 804 (2) Ensure that hazard reviews are conducted for all new activities;
- 805
- 806 (3) Involve employees in the conduct of hazard reviews as appropriate;
- 807
- 808 (4) Ensure that hazard reviews are conducted by individuals who collectively have taken the
- 809 training provided by OSHE on the Hazard Review program and on all NIST OSH
- 810 programs pertinent to the activity under review;
- 811
- 812 (5) Approve hazard reviews in accordance with the requirements of Section 6d, with the
- 813 approval signifying that the RHIs associated with the activity represent an acceptable
- 814 level of risk;
- 815
- 816 (6) Authorize activities in accordance with the requirements of Section 6e, with the
- 817 authorization signifying that controls other than training have been verified to have been

818 implemented and that required safety equipment shall be maintained in proper working
819 order in accordance with manufacturers' specifications and all applicable standards;
820

821 (7) Authorize workers in accordance with the requirements of Section 6f, with the
822 authorization signifying that (a) the workers have taken the training provided by OSHE
823 on all NIST OSH programs pertinent to the activity to be conducted and the training
824 identified in Sections 6b(6)(l) and 6b(7)(d), (b) line management has an appropriate
825 degree of confidence, based on personal knowledge, observation, or reliable input from
826 others, that the workers to be authorized have the knowledge, skills, and abilities to
827 perform the work safely and correctly, and (c) the workers fully understand the activity
828 boundaries/conditions, the need to work within those established boundaries/conditions,
829 and the process for requesting work that falls outside those boundaries/conditions;
830

831 (8) Re-review and re-approve hazard reviews and re-authorize work and workers in
832 accordance with the requirements of Section 6g;
833

834 (9) While visiting laboratories, discussing work, or conducting management observations:
835

836 (a) Be vigilant for "scope creep", i.e., advertent or inadvertent changes in activity
837 boundaries/conditions or controls that introduce new hazards, increase existing
838 hazards, or otherwise increase safety risk; and
839

840 (b) If scope creep is identified, stop work and require re-review and re-approval of the
841 hazard review and re-authorization of work and workers, as per Section 6g;
842

843 (10) Maintain records in accordance with the requirements of Section 6h.
844

845 d. Official First-Level Supervisors Authorizing Work (in addition to their responsibilities as
846 part of Line Management):
847

848 (1) Complete the training provided by OSHE on all NIST OSH programs pertinent to the
849 work to be authorized; and
850

851 e. Employees Conducting Hazard Reviews:
852

853 (1) Take the training provided by OSHE on the Hazard Review program.
854

855 f. Employees Authorized to Engage in Work:
856

- 857 (1) Complete the training provided by OSHE on all NIST OSH programs pertinent to the
858 work to be conducted and the training provided by the OU identified in Sections 6b(6)(i)
859 (Hazard Mitigation) and 6b(7)(c) (Incident-Response Plan), as applicable; and
860
- 861 (2) Work within the boundaries/conditions of the hazard review at all times and in
862 accordance with required controls and training;
863
- 864 (2) If it is necessary or desirable to work outside the boundaries/conditions of a hazard
865 review or change existing controls, request line management re-review of the hazard
866 review as per Section 6g; and
867
- 868 (3) Be vigilant for scope creep, and if scope creep is identified, stop work and request line
869 management re-review of the hazard review, as per Section 6g.
870
- 871 g. Employees Assigned Responsibility for Safety Equipment:
872
- 873 (1) Ensure that required safety equipment is maintained in proper working order in
874 accordance with manufacturers' specifications and all applicable standards.
875
- 876 h. Employees:
877
- 878 (1) Participate in the conduct of hazard reviews as appropriate.
879
- 880 i. Chief Safety Officer:
881
- 882 (1) Maintain this suborder;
883 (2) Develop and maintain any necessary supporting NIST directives, including procedures,
884 guidance, and notices;
885
- 886 (3) Review the efficacy of written OU procedures for meeting the requirements of this
887 suborder and provide the results of those reviews to the respective OU Directors; and
888
- 889 (4) Support, through the OSHE staff, OU implementation of this suborder.
890
- 891 j. OSH Program Manager for the Hazard Review program:
892
- 893 (1) Make determinations that particular hazards are controlled to industry standards and
894 maintain and make available to the OUs a list of such hazards and their associated RHIs;
895

896 (2) Develop and maintain any necessary deployment tools, including forms, instructions, IT
897 applications, training, and user guides;

898

899 (3) Serve as the primary point of contact and subject matter expert on:

900

901 (a) Federal, State and local regulatory requirements and guidelines; and

902

903 (b) Consensus industry standards and best practices.

904

905 (4) Ensure effective communication with management and staff on program-related issues.

906

907

908 **10. AUTHORITIES**

909 For authorities applicable to all NIST OSH suborders, see NIST 7101.00. There are no
910 authorities specific to this suborder alone.

911

912

913 **11. DIRECTIVE OWNER**

914 Chief Safety Officer

915

916

917 **12. APPENDICES**

918 Appendix A. Revision History

919

920 Appendix B. Processes for Authorizing Work and Workers

921

922 Appendix C. Risk-Assessment Matrix

923

924 Appendix D. Elements of the Hazard Review Process

925

926 **Appendix A. Revision History**

927

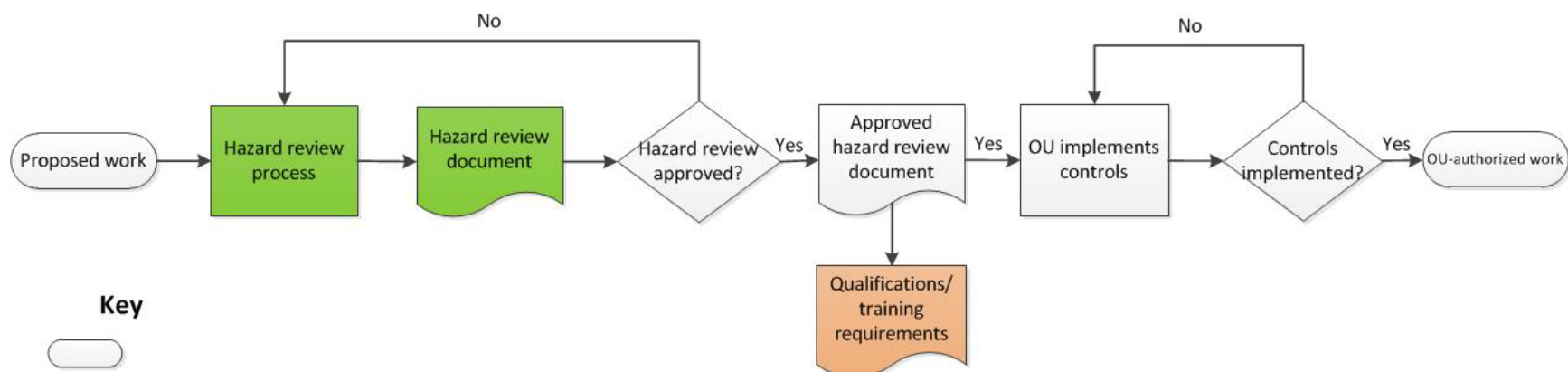
Revision	Date	Responsible Person	Description of Change
1	01/23/15	Richard Kayser	Modifications made to Section 3. Applicability, subsequent to Executive Safety Committee review.
2	11/07/17	Richard Kayser	Modified Section 6 to make more explicit the need for workers to understand the requirements of hazard reviews and the need to stay within scope or request re-review. Modified Section 9 to reflect the responsibilities necessary to fulfil the modified requirements in Section 6.
3	05/05/2020		<ul style="list-style-type: none"> • Modified Section 2.b to include abnormal conditions • Modified Section 3.b to include applicability of abnormal conditions. • Modified Section 6g(1)(c) to include abnormal conditions
4	12/23/2020	April Camenisch	Updated links under References and Applicable Suborders.

928





929

Appendix B. Processes for Authorizing Work and Workers (for details on the hazard-review process, see Appendix D)

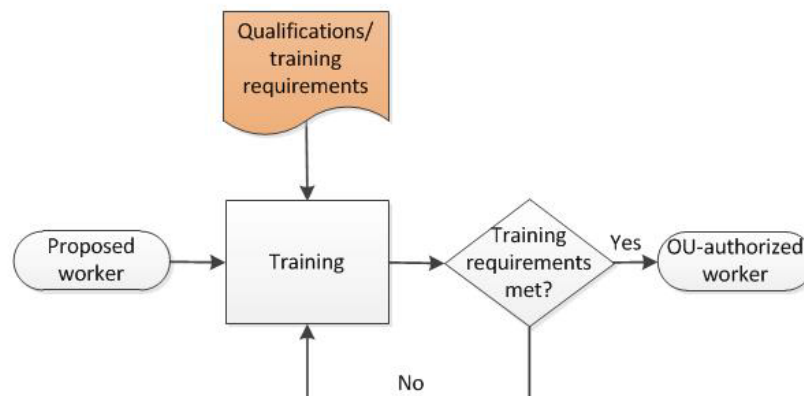
Authorization of Work



Key

-  Start/End Document
-  Process
-  Start/End Document
-  Decision

Authorization of Workers



Appendix C. Risk-Assessment Matrix

This matrix is used to determine the risk level, or Relative Hazard Index (RHI), for a given hazard.

		POTENTIAL SEVERITY OF THE CONSEQUENCES OF A HAZARDOUS EVENT OR EXPOSURE TO A HAZARD			
		Catastrophic Death or permanent disability System or facility loss Lasting environmental or public-health impact	Severe Serious injury; temporary disability Subsystem loss or significant facility/property damage Temporary environmental or public-health impact	Moderate Medical treatment beyond first aid; lost-work-day(s) More than slight facility/property damage External reporting requirements; more than routine clean-up	Minor First-aid only Negligible or slight facility/property damage No external reporting requirements; routine clean-up
LIKELIHOOD OF OCCURRENCE	Frequent Likely to occur repeatedly	CRITICAL RHI=4	CRITICAL RHI=4	SERIOUS RHI=3	Medium RHI=2
	Probable Likely to occur multiple but infrequent times	CRITICAL RHI=4	CRITICAL RHI=4	SERIOUS RHI=3	Medium RHI=2
	Occasional Likely to occur at some time	CRITICAL RHI=4	SERIOUS RHI=3	Medium RHI=2	Low RHI=1
	Remote Possible, but not likely to occur	SERIOUS RHI=3	Medium RHI=2	Medium RHI=2	Low RHI=1
	Improbable Very unlikely; can reasonably assume it will not occur	Medium RHI=2	Low RHI=1	Low RHI=1	Minimal RHI=0

Appendix D. Elements of the Hazard Review Process (see Section 6b)

