Human Performance Culpability Evaluations

A comparison of various versions of the Culpability Decision Tree from various Department of Energy sites

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Abstract

The purpose of this paper is to document the findings of the review of culpability decision trees and associated procedures or guidelines used at various DOE sites or DOE-related companies. The culpability decision tree is a valuable tool for evaluating the culpability of an individual whose involvement in a workplace incident is in question. Through a process a comparison with Dr. James Reason’s original tree, his explanations, and available references, this study found a number of variations that were determined to be enhancements that strengthen the tool and broaden its applicability. In addition to a version of the tree that integrates the “best” of the various versions, this study has also developed guidance for each question and conclusion of the tree, as well as the structure and aesthetic appearance of the diagram as a whole.
1.0 Overview

1.1 Background

Since its introduction into the Department of Energy community in the early 2000's, training materials on Human Performance Improvement (HPI) have included a culpability decision tree. As the principles and concepts taught in this training have been put into practice, the culpability decision tree has found its way into use in investigations of events and occurrences in which the culpability of an individual’s behavior was in question. Some DOE sites have even incorporated a culpability tree into their standard operating procedures, while others have merely taken the training materials and used them. Although the culpability decision tree itself appears to have originated from one source, a quick review of a few of the trees in use in the DOE found that the trees being used were not the same, nor was the terminology used consistent from one site’s tree to another. In most cases, many assumptions appear to have been made regarding the user’s knowledge and expertise in HPI concepts, for example by not defining terms used or giving instructions for how the tree is to be used.

1.2 Purpose

The purpose of this paper is to document the findings of the review of culpability decision trees and associated procedures or guidelines used at various DOE sites or DOE-related companies. It will also document the development of the tree based on published sources, establish definitions for the terms used in the tree, and provide a standard set of instructions to guide investigators, causal analysts and other users employing the tree as part of their investigative efforts.

1.3 Objective

The ultimate objective of this paper is to develop a tool that provides instructions for evaluating human performance in cases where individual culpability for certain behavior is not clear. The Culpability Decision Tree is a tool that may be used in the investigation and analysis of an event that involved behavior that deviated from that which was expected. Once facts and first-hand information have been obtained from the individual or individuals involved (by means of interviews, critique, etc.), this tool can be used to understand the mindset of the personnel involved, the context of the situation, and the organizational influences that may have affected their decisions and resultant behavior.

2.0 Sources and References for Development

2.1 James Reason

The original culpability decision tree was given by Dr. James Reason in his 1997 book Managing the Risks of Organizational Accidents. The tree appears as figure 9.4 in a section entitled...
“Engineering a Just Culture.” The figure floats at the top of a page with the caption “A decision tree for determining the culpability of unsafe acts.” The tree is presented in the immediate context of the section and chapter in which it occurs, and in the greater context of the book itself. The tree as a whole and the individual questions in the boxes that form the tree are discussed by Reason in the paragraphs that precede and follow the floating figure; no separate, step-by-step instructions for use of the tree are given. The author obviously expects the reader to have an understanding of the terms and concepts that occur on the tree as they are discussed in the text of the book prior to introduction of the tree. Thus, reference to and use of the culpability decision tree requires that it be done in the context in which Reason presents it. Therefore, any operating procedure or work standard that establishes the culpability decision tree as a tool must also provide sufficient support material so that the user can utilize the tool in the manner in which its author presented it.

As for terms used on the tree, such as blame, error and violation, Reason’s lengthy discussions earlier in the book enable us to develop working definitions. For other terms like culpability, unsafe act, and reckless violation, the paragraphs surrounding the tree provide sufficient material from which working definitions can also be developed. For one term on the tree, Reason gives what almost seems to be a passing reference to Neil Johnston’s substitution test, as if the reader is expected to be very familiar with Johnston’s work. Reason provides the source for Johnston’s test in an endnote and briefly summarizes how it is used. After discussion of the tree, Reason continues his discussion of unsafe acts and the considerations for punishment of such acts.

2.2 Institute of Nuclear Power Operations (INPO)

HPI training materials first introduced in the DOE community were those obtained from INPO. In addition to presentation materials, the Human Performance Fundamentals Course Reference manual was made available, mostly to those who were trained as instructors for teaching HPI fundamentals training. Mention of Reason’s “culpability decision tree” is made in a subsection labeled ”A Just Environment” in a section entitled “Facilitate Open Communication” in Chapter 4 “Leadership.” The tree itself is not shown in the INPO manual (yet some INPO HPI training materials contained a slide of Reason’s tree), but a reference to Reason’s book is given with the following direction: “A ‘culpability decision tree’ can be developed using station-specific criteria following Dr. Reason’s description in the referenced publication.”

The manual follows with a brief mention of the substitution test as “a means of determining culpability,” but refers the reader to “Diablo Canyon’s policy.” It then summarizes the substitution test and its possible results.

In October 2006, INPO published a revised version of this manual, titling it Human Performance Reference Manual, and made it a formal INPO document. The context for discussion of a tool for determining culpability level is essentially the same, although the tool is referred to as a “logic diagram.” In this revised manual, a figure of the diagram is shown, but, as the text explains, it is “an adaption of Dr. James Reason’s culpability decision tree.” The caption of the figure states that it was “adapted with permission from” the author, and cites Reason’s book that we previously
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referenced. The manual states that Reason’s book “provides an in-depth description of the chart,” even though the diagram differs in multiple and significant details (which will be discussed later). No other discussion of how the diagram is to be used is given.

3.0 Standard Terminology

As Dr. Reason is the author of the culpability decision tree, it is prudent to seek an understanding of many of the terms used directly from him. In some cases where a straightforward definition of a term is not given, it may be necessary to draw out and develop a working definition based on the discussions in the book from which the tree is taken, as well as those in other references.

3.1 Performance, Behavior, and Results

The “P” in HPI stands for performance, and its definition is a core concept. Performance is simply explained as “behavior plus results,” or P = B + R. In the workplace, performance may involve one person or it may involve several persons working together. For purposes of evaluation of culpability, it may be necessary to distinguish those who are peers from those with an oversight or command role.

Behavior is summarized as “what people say and do—a means to an end.” INPO further explains that “it is an observable act; it can be measured.” Although this definition equates behavior to a single “act,” it is readily recognized that the term “act” is often used to refer to things that a person does that consist of a singular action as well as multiple actions (often in series or in a predetermined order). Common usage employs behavior and act synonymously. Therefore, to facilitate our working definitions, we will distinguish act (conceptually plural) from action (singular).

Reason explains that there are three important elements to behavior:

- a plan or intention (consisting of a goal and the means to achieve it)
- a sequence of actions initiated by that plan
- the extent to which these actions are successful in achieving their purpose.

If behavior is the means, then results are the ends. INPO cites a definition for results as “the outcomes of behavior.” As will become evident, it is necessary to limit these “outcomes” to those that are manifest during or immediately after the behavior and as they describe the extent to which the behavior (actions) achieve the goal. We must distinguish these outcomes from those that follow sequentially from (or with) the immediate outcomes (which we will later call consequences). However, to do so requires insight into the plan, goal and intended actions of the individual (or individuals) under consideration.

From this discussion the following working definitions for these three terms are proposed:
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*Performance* – the *behavior* of an individual or group of individuals plus the *results* of that behavior, considered as a whole. (If the behavior under evaluation involves multiple individuals acting together as a team, their performance as a single unit should also be evaluated in addition to that of individual members of the team.)

*Behavior* – a human act or sequence of human actions. Behavior consists of a plan or intention (a goal plus the means to achieve it), a sequence of actions initiated by the plan, and the extent of success in achieving the goal as each action is performed.

*Results* – the final outcomes of *behavior* strictly in terms of success or failure in achieving the intended goal, irrespective of the correctness or accuracy of risk perception on the part of the individual(s) involved.

### 3.2 Error

Reason provides a direct definition of error as “the failure of planned actions to achieve their desired ends—without the intervention of some unforeseeable event.” He provides essentially the same definition in his previous work, *Human Error*, but clarifies that it is “a generic term to encompass all those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome.” Clearly, an understanding of *behavior* is necessary before the concept of *error* as defined by Reason can be understood, part of which is that the plan or intention that the individual had in mind must be known in order to assess the results of his/her behavior.

Another expert supports the importance of intention when he describes error as “a failure to perform an intended action which was correct given the circumstances.” A third author’s description clarifies the distinction in terms used by these various authors: “Goals do not state precisely what to do—where and how to move, what to pick up. To lead to actions, goals must be transformed into specific statements of what is to be done, statements that I call *intentions*. A *goal* is something to be achieved, often vaguely stated. An *intention* is a specific action taken to get to the goal.”

Building on the significance of intent, INPO cites a definition of *error* as a “human action that unintentionally departs from an expected behavior.” The definition cited by INPO is also supported by Reason, who states that “all errors involve some kind of deviation.” All of this leads us to a working definition that is sufficient for our purpose here:

*Error* – an unintentional deviation from expected behavior.

### 3.3 Performance Mode

Reason attributes the taxonomy for *performance modes* to Jens Rasmussen. Another study refers to Rasmussen’s “framework for the classification of errors” as “the most usable.” Reason elsewhere informs us that Rasmussen’s framework has “effectively become a market standard”
for the distinction of performance levels. Hence, for this document it seems only prudent to adopt Rasmussen's skill-rule-knowledge framework without going into a detailed examination of the nature of the three modes of performance. Basically, the mode in which an action is taken is a function of the familiarity of the individual with the specific task and the amount of attention (information processing) that individual must give when executing that action.

From the standpoint of performance, it is logical to think of errors in terms of the performance mode that the person was in when the error occurred. Thus, we may sometimes refer to skill-based errors, rule-based errors and knowledge-based errors as another way of describing the performance mode. (These categories should not be confused with error mode as discussed by INPO\textsuperscript{2.3}, which are generalities used to anticipate and manage error-likely situations.) Therefore, if we first define performance mode as follows:

\textit{Performance Mode} – the manner in which a person acts in terms of information processing when executing a task or activity. The three performance modes are skill-based, rule-based and knowledge-based.

We can then describe\textsuperscript{3} the performance modes in terms of errors committed.\textsuperscript{1} We do this because identifying the performance mode of an erroneous action will aid in determining measures that are appropriate for addressing individual errors:

\textit{Skill-based Error} – an error associated with highly-practiced actions in a familiar situation usually executed from memory without significant conscious thought or with little attention. In terms of failing to achieve the intended goal, the plan was adequate, but the action(s) failed to go as planned.

\textit{Rule-based Error} – an error associated with behavior based on selection of stored rules derived from one’s recognition of the situation; it follows an \texttt{If (symptom X) / Then (situation Y)} logic. In terms of failing to achieve the intended goal, actions conformed to the plan, but the plan was inadequate to achieve its intended outcome due to misinterpretation.

\textit{Knowledge-based Error} – an error associated with behavior in response to a totally unfamiliar situation (no skill, rule or pattern recognizable to the individual). Usually arises as a problem-solving situation that relies on personal understanding and knowledge of the system, the system’s present state, and the scientific principles and fundamental theory related to the system. In terms of failing to achieve the intended goal, actions conformed to the plan, but the plan was inadequate to achieve its intended outcome due to an inaccurate mental picture.

3.4 Results vs. Consequences

We earlier defined results in terms of achieving the intended goal, but restricted them temporally to those outcomes that immediately follow the action. This allows us to distinguish those
primary outcomes \textit{(results)} from those that follow them—either in time or in scope of effect. We will call these \textit{consequences}, since these secondary outcomes appear “with” the primary outcomes when retrospectively viewing the “sequence” of the situation as a whole. We can define them thus:

\textit{Consequences} – the final, overall effect(s) or outcome(s) of an individual’s behavior with respect to the situation or environment in which the behavior occurred.

The distinction is necessary because the term \textit{consequences} is used by Reason in one of the questions/blocks of his decision tree (as well as in his explanation of \textit{violation}). If at the heart of error is the person’s intention, both in terms of the goal and the results, then it will become important to gather first-hand information that gives us insight into the plan, goal and intended actions of the individual (or individuals) under consideration. Therefore, along with an individual’s behavior we will see not only those outcomes that were envisioned by that individual, but also those that were not, which is another important distinction. At the point in time that the individual was formulating his/her action to reach the intended goal, all consequences that might occur would be theoretical or potential, since they would not yet have occurred. From our perspective in evaluating the behavior after it has occurred, we can more easily distinguish between those consequences that actually did occur, as well as those that could have occurred as a result of the actual behavior (as opposed to the intended behavior). In other words, we can qualify consequences as \textit{actual} or \textit{potential}. However, we must keep in mind that this distinction will be one made from an external and after-the-fact perspective, which is not the perspective that the individual had before acting. To judge the behavior and the consequences, we must seek to understand the individual’s assessments of the situation and why the actions taken made sense to him/her at the time.\textsuperscript{11}

By distinguishing between the results of the behavior and the consequences, we can more fairly evaluate the consequences of the individual’s overall performance. In some instances the consequences may be on the same level or order as the results of the behavior, while in other cases the consequences may be over and above (on a higher/broader level) as the results.

3.5 Error vs. Violation

Previously, we defined \textit{error}, in terms of intention and expectations. Basically, what makes an error an error is the fact that deviation was unintentional: the reasons why the error occurred may vary (e.g. performance mode), but the commonality is that deviation was not intended. With this premise made, what almost immediately comes to mind is the question: “What do you call behavior that \textit{intentionally} deviates from expected behavior?” The simplest response is “a \textit{violation},” although an explanation of the cognitive processes involved is by no means simple. Nevertheless, this fundamental distinction between error and violation is actually a critical one if we want to be able to evaluate a person’s behavior regarding culpability.

Although the connotation of “expected behavior” for error includes unwritten/verbal direction, norms, cultural influences, etc., Reason limits that of violations by saying that they can “only be
described with regard to a social context in which behavior is governed by operating procedures, codes of practice, rules and the like.”

Reason elsewhere states that violations “can be either deliberate or erroneous (for example, speeding without being aware of either the speed or the local restriction).” However, since we are trying to distinguish between violation and error, we must find a definition for violation that facilitates making a distinction. Thus, an “erroneous violation” we would call an error, leaving violation to be concerned solely with “deliberate” deviations “where the actions—though not their possible bad consequences—are intended.” This explanation is helpful in not only pointing out the importance of intention, but also guides us in our goal to fairly evaluate behavior in light of the consequences. INPO tells us that “most violations are well intentioned, arising from a genuine desire to get a job done according to management’s wishes.”

Another reference (co-authored by Reason), gives several ways in which violations differ from error, which include:

1. “Errors are unintended. Violations are deliberate.”
2. “Whereas errors arise primarily from informational problems ..., violations are more generally associated with motivational problems.”
3. “Errors can be explained by what goes on in the mind of an individual, but violations occur in a regulated social context.”

In many regulated work environments, “violation” is often used, with a strong negative connotation, to describe a condition or instance primarily in terms of compliance with safety regulations, standards or other important requirements. (Interestingly, “a deviation from the standard job procedures” is called an “unsafe practice” by the National Safety Council.) For our discussion here, we will refer to those as noncompliances with a focus solely on whether a written requirement was complied with, and reserve violation to be used to describe behavior both in terms of intent and whether behavior was in accord with established rules, procedures or standards. Along these lines, Reason reminds us that violations are “deliberate but not necessarily reprehensible.” This is why we distinguished between results and consequences, because a violation usually involves results that were intended, but also consequences that were not intended.

Additionally, just as errors are classified by performance mode, so also are violations classified as skill-based (routine violations), rule-based (situational violations), and knowledge-based (exceptional violations).

This leads us to a working definition:

Violation – the intentional deviation from expected behavior as specified in operational procedures, rules, or standards, but in which the consequences were not intended.
Thus, in order to evaluate noncompliant behavior, we must be able to answer questions in terms of intent and the rules for behavior, and how those relate to the consequences of the situation under scrutiny. The nature, or severity, of the consequences should also be taken into account when evaluating behavior, as will be discussed later regarding the different types of violations.

Reason further explains that violations are “shaped by both organizational and individual factors,” and fall into “three major categories: ... routine, optimizing and necessary.” If it is concluded that the behavior-in-question was a violation, further evaluation should seek to determine which type of violation occurred.

3.6 Violation vs. Sabotage

In discussing violations, we emphasized that although the deviations were deliberate, the bad consequences were not intended. If the harmful or destructive consequences of one’s deliberate deviating actions were intended, then it cannot merely be a violation as we have defined it. In fact, Reason highlights this point of contrast between violations and the cases where “both the act and the consequences are intended,” which he calls sabotage. INPO uses the word, in its discussion of violations but does not define it.

Interestingly, the original meaning of the French sabotage meant “to botch” or “to do in a clumsy or slipshod way,” which we would probably tend to call an error today. However, in modern usage it refers to “malicious destruction of or damage to property with the intention of [injury] ... or [impairment].” As Reason puts it, sabotage is malevolent, whereas “most violations are non-malevolent in terms of intent.” Elsewhere, Reason uses sabotage as a general category for violations where “there was a prior intention to cause damage to the system.” In establishing boundaries or ranges for violations that can be analyzed for their contribution to “most accident scenarios,” he draws the line at those that “involve the goal of system damage.” And, in the context of determining if one is culpable for their behavior, as we will see, Reason puts sabotage at the very beginning of the spectrum to indicate full individual culpability. For our purposes, we can define it thus, using verbiage we have used to define other terms:

Sabotage – behavior in which both the act and the damaging outcome were intentional.

3.7 Accountability vs. Culpability

As Reason presents it, the evaluation of certain behaviors in an “accident” or “serious incident” scenario is a task of “grading” the individual’s (or team’s) actions according to “blameworthiness.” As his words indicate, the amount of blame that may be put on an individual for the consequences of his/her behavior will vary, i.e. it should not be the same in all instances or situations. Let us consider briefly the variables that should influence the extent to which one should be held blameworthy or culpable for his/her actions and the consequences.

Sidney Dekker stresses that “it is impossible to hold somebody accountable for something over which the person had no authority.” He goes on to “define accountability as responsibility for which the person in question had requisite authority.” If responsibility must be accepted or
agreed to, so then also accountability must be voluntary. As another author explains, accountability “isn’t something that managers can mandate ... or enforce. It’s something that subordinates feel.... Employees must choose accountability.” In terms of behavior, we can only expect each individual to account for, or give an accounting of, his/her own actions, the intended results, and the individual’s understanding of his/her responsibility.

As said earlier, the extent of blame or culpability will vary, based on the accountability of the individual, and “situational factors,” i.e. the circumstances of the situation. As Reason’s decision tree shows, there is far less individual culpability when behavior was erroneous and not a violation. From the perspective of deviation (from expected behavior), culpability should be viewed as the possible extent of blame, ranging from blamelessness (not to be held personally responsible) at one end to blameworthiness (deserving of blame) for one’s behavior. Therefore, in terms of those who are evaluating behavior in an accident/incident scenario, we can explain it thus:

*Culpability* – the amount of blameworthiness that an individual’s behavior merits based on the nature of the deviation from expected behavior, the outcomes of the deviation, and the responsibility and authority of that individual, in the context of the situation in which the behavior occurred.

### 4.0 Culpability Decision Tree

#### 4.1 The Original Design

The original decision tree is provided by James Reason as follows:
In referring to this diagram Reason states that it “sketches out the bare essentials of a decision tree for discriminating the culpability of an unsafe act.” This statement conveys two important items of information about the tree: its completeness and its intended application. Regarding the former we infer that although it has all the principal components, he allows that it could be added to or expanded. As to its intended application Reason also states the following assumption: “It is assumed that the actions under scrutiny have contributed either to an accident or to a serious incident in which a bad outcome was only just averted. In an organizational accident, there are likely to be a number of different unsafe acts, and the decision tree is intended to be applied separately to each of them.” He later adds that the number of “individuals whose unsafe acts are justly considered culpable” will be a “small proportion.”

The flow of the tree is indicated by arrows. Boxes are only identified by either the question or outcome that they contain. Regarding the arrangement of the tree, in the diagram we point out the underlying figure of an inclined arrow labeled “diminishing culpability.” As is evident, the degree to which the individual is culpable for the actions being scrutinized diminishes as one progresses further and further through the tree with each question that leads to another question, rather than to an outcome or conclusion. Variations on this figure will be discussed later.

Step-by-step instructions for using the tree are not given by Reason per se. Rather, the tree is presented in the midst of several pages of discussion on the topic of engineering a just culture. The intent of some of the questions is discussed, but a procedure for applying the tree in a
methodical, consistent manner is not provided by Reason. However, his explanations and discussion in the immediate chapter, as well as the concepts provided in the entire book, will enable us to develop step-by-step instructions for applying Reason's decision tree to a given instance in which the culpability of an individual is in question.

4.2 Variations on and Modifications of Reason's Design

For purposes of comparison, the following are various versions of culpability decision trees taken from documents obtained from various DOE sites. To facilitate discussion, each design will be given an unique identifier that we can use to reference it in our discussion.

4.2.1 Idaho National Laboratory (INL-1)

This version is the nearly the same as Reason's in content, with only a few exceptions. One we point out here is that the left-to-right arrangement is flat (not-inclined) without the “diminishing culpability” arrow along the bottom. Although the tree is preceded by a few introductory paragraphs, there are no specific instructions given for how to use the tree.

4.2.2 Oak Ridge National Laboratory (ORNL-1)

This version comes from a undated draft document that was presumably prepared by a former manager in the Safety Services Division who left ORNL in June 2006. Sources for development of the document are unknown. Although there are indications that copies were given to certain individuals for use, it apparently was never formally adopted in ORNL procedures.
Aside from the textual differences, the “Start” box and the flat layout are the most “eye catching” differences. This version also includes “numbering” (via lower-case letters) of boxes. This adds to the sequential aspect of the tree’s design. The first two pages of the 3-page document list “process steps” identified with the same numbering as the boxes on the tree, which restate the content of the box on the tree, with some guidance or examples given.

4.2.3 Oak Ridge National Laboratory (ORNL-2)

This tree was included in the ORNL version\(^{19}\) of *HPI Fundamentals Training*, first presented to ORNL employees in June 2006, and represents the first approved document to contain the culpability decision tree. The slide notes include general guidance about use of the tree, with some material about the application of the “substitution test.”
This version is nearly identical to Reason’s tree in almost every detail. A “source” statement on the page cites Reason (reference 1). The only difference is inconsequential, where in the third box from the left at the top where “violating” is given as “violate.” Since it is essentially the same as Reason’s original version, it will not figure prominently into the comparison discussion hereafter.

4.2.4 BushCo (Bush-1)

This version was included in the presentation materials of Shane Bush, at that time an employee of Idaho National Laboratory, at the Fall 2005 meeting of the DOE EFCOG Price-Anderson Working Group (now the Safety & Security Regulatory Working Group), held at ORNL in October 2005. This version was also used by Shane Bush (founder of BushCo) in the HPI Fundamentals Certificate Course, conducted at ORNL in October 2007.

In addition to the flat layout, this version differs in several important points from Reason’s original version. These differences will be considered later.
4.2.5 Los Alamos National Laboratory (LANL-1)

This version was included in a LANL publication entitled *Human Performance Improvement Concept Guide*, published in October 2006. LANL’s version is also now being included in HPI training materials at Lawrence Livermore National Lab. Reason (reference 1) and INPO (reference 2) are listed in the “Selected Sources” section at the end of the booklet. A couple of definitions are given, as well as some general instructions for using the tree, with particular focus on how to properly conduct the substitution test.

Although the layout is drastically different from Reason’s original tree, it still follows the general progression of Reason’s decision tree, though it lacks the underlying inclined “diminishing culpability” arrow. The top-to-bottom design conveys a sense of “drilling down” as one follows the diagram from one question to the next. This version uses color to distinguish the questions from the conclusions, as well as the differences in level of culpability of the various conclusions. This version departs from Reason’s tree on several significant points, which will be considered hereafter.
In addition to the “top to bottom” arrangement, this version also employs a uniform style of branching by always putting the ‘Yes’ response on the left and the ‘No’ response on the right.

4.2.6 Battelle Corporate (Battelle-1)

This version is used by the ESH&Q Office of Battelle Corporation, a prime contractor at several DOE sites.

There are several key textual differences and steps are numbered, but the general layout is very similar to Reason’s original format.
4.2.7 INPO (INPO-1)

This version was published by INPO in their revised Reference Manual, issued in October 2006.² The caption of the figure states that it was “adapted with permission” from Dr. James Reason.

This version is also included in the draft DOE HPI Handbooks,²³ currently in the Review and Comment (REVCOM) process. It was also used in the Advanced HPI Training course conducted by HS-31 at Oak Ridge in July 2007.²⁴

Of course, this version differs from Reason’s original tree on many notable points. The underlying arrow is enhanced to emphasize that diminishing (individual) culpability also means increasing organizational culpability. Also, the use of shapes consistent with those used in flowcharts makes questions and conclusions easily distinguishable.
4.2.8 Hanford (Hanford-1)

This version is found in the Causal Analysis Guidance document used by Fluor Hanford. No instructions for use of the tree are given in this document, but were included in another document specific to the culpability decision tree issued earlier the same year.

This version shares similarities with Reason's original tree as well as with INPO's modifications shown above. Differences will be discussed in the comparison discussion to follow.
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4.2.9 Savannah River Site (SRS-1)

This version is taken from a draft procedure for the disciplinary process under Human Resources requirements manual.27

NOTE: Would other employees have made the same error?
4.3 Comparison Analysis of Decision Tree Components

This section will compare each of the variant trees with Reason’s original decision trees in an effort to discover those variations that are beneficial and should be considered as improvements that would be worthwhile to be incorporated into ORNL’s version of the tree. For simplicity, and to avoid confusion with the step-numbering methods used on some of the trees, we will use a Latin numbering (1, 2, 3, etc.) in conjunction with questions (Q) and conclusions (C). We will also adapt some of the modifications of the various versions that tend to enhance the appearance and understandability of the tree as a tool.

4.3.1 Actions (Q1)

As Reason explains, “the key questions relate to intention.”1 Reason’s first question on the tree is, therefore, “Were the actions as intended?” INPO-1, Hanford-1 and SRS-1 drop the article ‘the.’ Although this change appears minor, the nuance of the changed sentence could lead the
evaluator to consider all the individual’s actions collectively, rather than a specific “unsafe act” or set of actions that are in question. ORNL-1, Battelle-1, Bush-1 and LANL-1 replace “actions” with “behavior.” As discussed previously in section 3.1, “behavior” includes both actions and intentions, which makes the question “Was the behavior intended?” essentially redundant. Since an error is a case where actions departed from intentions, the first question is intended to help determine if the actions were, generally speaking, an error or a violation. However, it only partially enables that broad categorization, because behavior also includes the extent to which actions are successful in achieving their purpose. Thus, if his/her actions were as the individual intended, we are naturally led to ask the next question.

Therefore, it is concluded that Reason’s wording is the clearest. The first question should be:

Q1. Were the actions as intended?

Guidance:

At this point you are only concerned about behavior. In order to answer this question, as the evaluator you must know:

a. the actions being evaluated
b. the goal and how those actions related to the goal
c. the degree of success the individual had in executing the actions he/she planned to execute.

If the answer is ‘No,’ then the behavior is almost certainly an error, since what he/she did is not what he/she intended to do. It could very well have been a skill-based error, which Reason calls “the least blameworthy of errors,” but further evaluation of the behavior is still needed.

If the answer is ‘Yes,’ you need to more completely describe the behavior and what the outcomes of that behavior were.

4.3.2 Consequences (Q2)

Reason’s next question is constructed the same as the first, but with a different noun: “Were the consequences as intended?” INL-1 and SRS-1 retain this exact wording, whereas all others drop the preposition “as”. (INPO-1 also drops the article “the,” but this time the effect is null.) Although, the deletion is small (in terms of number of characters), the change in meaning is significant.

Asking “Were the consequences intended?” might lead one to hastily tie the consequences directly to the behavior, which includes intentions, as if all the actual consequences were known and considered by the individual as part of the planning of behavior. However, we previously made a purposeful distinction between results and consequences (section 3.4). Since expected results are part of the process of planning behavior, it is useful to provide another category for outcomes of the individual’s actions that were not part of the planned or expected results. These
secondary outcomes, though many times essentially concurrent with the primary ones, can be viewed as directly and immediately related to the actions. Reason’s wording tends to obscure the distinction that is needed.

The importance of this key question is to further clarify the intentions. Distinguishing between outcomes helps us to identify those outcomes that relate to the goal of the planned actions (results) and the extent to which they were successful in achieving their intended purpose, and those other outcomes that were also manifested but that may or may not have been intended, or even considered, by the individual (consequences). This will be important if what happened in the end is what the individual wanted to happen, even if what they did, technically, only indirectly caused it to happen.

Reason clarifies that the category of behavior affects how this question applies; specifically whether it was a mistake or a violation,¹ which will be dealt with in later questions.

Therefore, it is concluded that the revised wording is the best. The second question should be:

Q2. *Were the consequences intended?*

**Guidance:**

In order to answer this question, as the evaluator you need to know:

a. the planned actions intended to achieve the goal
b. how successful the actions were in achieving the goal
c. the expected outcomes
d. the actual outcomes (i.e. results)
e. the other outcomes that occurred, and if they were considered/conceived of by the individual

Even though item “e” above relates the most to consequences, it is important to have as much insight into the individual’s actions as possible in order to fully evaluate his/her behavior.

If the answer to the question is ‘No,’ our distinction between results and consequences will become important as you answer further questions, especially if the results were what was desired, but the consequences were not. If the actions were as intended, but the consequences were not, then the error was most likely a mistake or (possibly) a violation¹ (see also section 3.5). This case is likely to be a rule- or knowledge-based error.²⁶ Continue to the next branch of the tree.

If the answer is ‘Yes,’ this will mean that not only were the results what was desired, but so were the consequences. As Reason states, “we are likely in the realm of criminal behavior and that is probably beyond the scope of the organization to deal with internally.”¹ A ‘Yes’ to this question leads to the first possible conclusion (C1).
4.3.3 Conclusion 1 (C1)

To arrive at this conclusion, the evaluator must have answered ‘Yes” to the first two (or key\textsuperscript{1}) questions, i.e. Q1 and Q2. Reason provides several possible labels (followed by “etc.”) for this conclusion, but several of the other versions limit it to a single label. These are:

<table>
<thead>
<tr>
<th>Reason, INL-1, ORNL-2</th>
<th>“Sabotage, malevolent damage, suicide, etc.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORNL-1, Bush-1, LANL-1, Battelle-1</td>
<td>“Intentional sabotage”</td>
</tr>
<tr>
<td>INPO-1</td>
<td>“Intentional act to cause harm”</td>
</tr>
<tr>
<td>Hanford-1, SRS-1</td>
<td>“Intentional act (not an error)”</td>
</tr>
</tbody>
</table>

The definition of sabotage makes it clear that it is intentional, deliberate and willful\textsuperscript{14}, so to say “intentional sabotage” is basically redundant. Although “harm” may often have a human connotation, it can apply to equipment and property as well as to people. An “intentional act to cause harm” is a concise definition for sabotage, but those concerned about “big words” could say that the simpler wording eliminates any question about what is meant by “sabotage,” or at least reduces the potential for any graphic images that might be conjured by the word.

We previously discussed (in section 3.1) how “act” is broader than “actions,” and is synonymous with behavior. We also earlier distinguished between violation and sabotage, and established a working definition for the latter term (see section 3.6). As Reason pointed out, the first two questions relate to intention. A ‘Yes’ to both questions tells us that the actions and consequences were as intended, which means that it was not an error nor a violation. The individual’s goal was “system damage,” but a consequence of personal death by one’s own actions (suicide) would not bring any personal benefit, despite what was accomplished with the system. Reason wisely leaves it to others to evaluate the individual’s behavior from this point. As far as the system is concerned, the behavior was outside of systemic influences, and the individual is fully culpable for his/her actions.

Error is often used as a broad category that includes both errors and violations. Thus, in terms of the first two questions, two ‘Yes’ answers means that we are out of the “realm” of error. It is concluded, therefore, that the Hanford-1/SRS-1 wording is best for purposes of the decision tree in evaluating personal culpability. The first conclusion should be:

\textit{C1. Intentional act (not an error)}

4.3.4 Unauthorized substances (Q3 & Q4) / Medical Restrictions (Q5 & Q6)

Having answered the key questions regarding intention, the remainder of Reason’s tree considers various influences on behavior. Before assuming that all influences are from the organization or “the system,” the next question posed looks at one potential, non-system influence on individual behavior. The question cryptically posed on the tree is “Unauthorized substance?” which Reason explains is to “establish whether or not the individual was under the
influence of alcohol or drugs known to impair performance at the time the unsafe act was committed.”¹ If the answer is ‘Yes,’ Reason’s next question asks if there was a “Medical condition?” for which the substance was taken. We must not forget that an “authorized substance” could influence behavior, but any actual influence on behavior should be considered as part of the authorization process (and if it wasn’t considered, that says something about the system). But taking an unauthorized substance does not automatically mean substance abuse. Thus the need to consider if an actual medical condition precipitated the individual using/taking the substance, albeit without authorization.

Other versions of the tree differ not simply in minor rewording but in the structure of the tree itself regarding this line of questioning. INPO-1, Hanford-1 and SRS-1 completely eliminate this branch of Reason’s tree. Although the reasons why INPO dropped the entire line of questioning about unauthorized substances in their adaptation of Reason’s tree are not given, there is justification for retaining this branch at DOE sites. DOE O 350.1 “Contractor Human Resource Management Programs” requires contractors to establish procedures for “occurrence testing,” as well as for “reasonable suspicion testing” which is to also include provisions for supervisor training, as part of their Workplace Substance Abuse Program.²⁹ For our discussion here this basically means that supervisors who are responsible for regularly observing employee behavior, as well as those investigating an incident or accident, may be required to consider testing of employees involved in a workplace incident. If an evaluation of worker behavior must be conducted in light of unauthorized substances, especially if a workplace incident resulted, it seems sensible to include that line of questioning in the overall evaluation of the individual’s culpability regarding the incident.

ORNL-1, Bush-1, LANL-1 and Battelle-1 drop Reason’s first question entirely regarding unauthorized substances and instead ask about medical “restrictions” rather than conditions. Bush-1 and Battelle-1 use a terse two-word question similar to Reason’s by asking “Medical restrictions?” ORNL-1 and LANL-1 flesh out the question as “Were there medical restrictions?” and “Did the employee have medical restrictions?” respectively. If the answer to this question is ‘Yes,” these versions pose a new question: “Were restrictions communicated and clearly understood?” (ORNL-1, Bush-1 and Battelle-1 actually employ the pronoun “they’, but as it follows the previous question it is obvious this second question is referring to the medical restrictions.)

Unlike Reason’s tree, these other versions acknowledge that the physiological state of the individual is an important consideration, but they place it within “the system”—they address it as being associated with medical restrictions, which if there were such restrictions would presuppose that a medical condition had been reported to and acknowledged by the company. If restrictions were in place, the follow-up question in these other versions of the decision tree seeks to determine how well those restrictions were communicated to the employee. Fortunately, the “and” in the question requires that both parts of that communication be considered. The “communicated” (to the employee) is obviously the responsibility of the
company, and so information on this communication will need to be obtained from whomever performed, or was responsible for performing, that communication. The “understood” (by the employee) portion can only be answered with information from both the communicator and the employee, although the employee's behavior may also be a good indicator as to how well any restrictions were actually understood. But regardless of the answer to this second question, both possible conclusions are violations. Furthermore, as one of these is labeled “system-induced” violation, a label used for a different conclusion on a subsequent branch of the tree, the progression of “diminishing culpability” along the bottom of the tree is lessened; that is, one system-induced violation would be more culpable than another. This could lead to confusion as what the conclusion of the evaluation is and what action should be taken if the path through the tree is not clearly delineated.

Yet, by following this line of questioning at this point there is already a greater shared culpability between the organization and the employee, as a result of the restrictions “process.” This is in contrast to Reason’s tree, which, in the first question of this branch, separates “individual” from “system/organization” by seeking to find any non-systemic influences on the individual’s behavior that would imply greater individual culpability than would behavior that has some system influence. In Reason’s version, if the substance was “authorized,” the answer is ‘No,’ and we are immediately sent to the next branch of the tree, where behavior begins to be within the influence of the organization, to an increasingly greater degree as we continue to subsequent branches of the tree.

It is probably fair to refer to “medical restrictions” generally as policies (yet specific to the individual), but not as procedures which are usually step-by-step documents. Therefore, assuming that this alternate line of questioning (about medical restrictions and whether they were understood) is valid and justified, it probably would not be appropriate to simply expect that medical restrictions would be considered in the next branch of the tree pertaining to safe operating procedures. Therefore, it is concluded that both Reason's original branch and the modified branch should both be included in the decision tree, and that Reason’s branch (Q3 and Q4) would indicate greater individual culpability than the modified branch (Q5 and Q6). The conclusions of the original second branch would remain the same as Reason gave them (C2 and C3).

4.3.5 Conclusions 4 and 5 (C4 & C5)

The conclusions on the “medical restrictions” branch, would need to be revised to use terminology consistent with our definitions. In section 3.5 we discussed that violations are intentional. If so, then it would be confusing to refer to one violation as an “intentional violation,” as this would imply that other violations were somehow not intentional. Since on the modified trees the labels of conclusions on the “medical restrictions” branch are the same as those on the next branch regarding safe operating procedures, we can retain the same wording if appropriate. On the modified versions, the conclusions labeled “system-induced violation” send us to the same place further down the tree, which clearly delineates the path to be traversed.
(We will discuss the implications of medical restrictions on the application of the substitution test, as indicated by LANL-1, at a later point.) Therefore, all that is needed is a replacement for the redundant “possible intentional violation" label.

Reason’s original branch uses conclusions (C2 and C3) that are specific to substance abuse. Since the conclusion on the additional branch would be specific to a 'Yes' answer that medical restrictions were clearly communicated and understood, it would be consistent that this conclusion should also be specific. We propose this conclusion (C4) to be worded thus: “Disregard of medical restrictions”. The two branches of the tree would thus be:

<table>
<thead>
<tr>
<th>Q3. Were unauthorized substances used?</th>
<th>Q5. Were there medical restrictions on the employee?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>C2. Substance abuse without mitigation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q4. Was there a medical condition?</th>
<th>Q6. Were restrictions clearly communicated and understood?</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>C2. Substance abuse without mitigation</td>
<td></td>
</tr>
<tr>
<td>C3. Substance abuse with mitigation</td>
<td></td>
</tr>
</tbody>
</table>

| C4. Disregard of medical restrictions |
| C5. System-induced violation |

4.3.6 Level of Culpability

As illustrated by the inclined arrow along the bottom of Reason’s tree, the level of individual culpability diminishes as we progress to the right along the tree. Although the arrow reminds us of diminished culpability on the part of the individual as that rightward path is traversed, the inclined arrow suggests an increase. Therefore, it would be better for the arrow to decline (point downward) so as to reinforce the concept of diminishing individual culpability, as is already shown on SRS-1.

Although INL-1, ONRL-1, Bush-1, LANL-1, and Hanford-1 drop this visual reminder, it is retained by ORNL-2 and Battelle-1. INPO-1 modifies this figure and turns it into a range, with “individual culpability” at the left end and “organizational culpability” at the right end, with left- or right-pointing arrows to indicate the “increasing” level of individual or organizational culpability respectively. While in section 3.7 we defined culpability in terms of individual blameworthiness, we can easily recognize that as the level of individual culpability diminishes, the level of culpability that falls or can be “blamed” on the organization or system grows. While it could be
said that Reason's tree implies this other "half" of the idea, the INPO version removes the necessity of the user to infer the implication of increasing organizational culpability, which we will adopt in our integrated version of the tree.

4.3.7 Violation (Q7)

As just discussed, if we have arrived at this next branch of the decision tree, the influence on the individual that is attributable to the organization and its systems or processes is increasing. When organizations develop processes and systems in order to accomplish work, they also establish policies and procedures to define how those processes and systems will function, and how employees are expected to behave when interacting with them. In section 3.5 when defining error and violation, we did so in terms of "expected behavior." Obviously, in order for employees to comply with those expectations they must be clearly communicated by the organization to the employees, and they must be understood by those employees.

When reaching this branch of the tree, the evaluator must keep in mind that either the employees actions or the consequences of his/her intended actions were not intended. Reason's next question at this point on the decision tree is not about deviating from any or all expectations, but in the more limited subset of expectations embodied in written procedures, rules and standards established to govern and control operations.

Reason's first question on this branch is worded as "Knowingly violating safe operating procedures?" Although the definition of violation tells us that they are intentional, and thus knowing, the redundancy of the expression “knowingly violate” is not detrimental to our purpose, since it reminds us to consider the individual’s intention with respect to expected behavior. INL-1 drops the “safe operating” qualifier, while the ORNL-2 version apparently is a correction of the verb tense while retaining the object. In the text Reasons refers to this inquiry as to whether "the individual was knowingly engaged in violating safe operating procedures at that time," which sheds light on his wording, and how noncompliant behavior is to viewed in the greater context of the situation. He goes on to explain that “violating increases both the likelihood of making an error and the chances of bad consequences.”

Elsewhere, Maurino et al tell us that “rule-based violations are likely to be more deliberate than skill-based violations.... Situational violations tend to be deliberate acts carried out in the belief that they will not result in bad consequences. These violations are shaped by cost-benefit trade-offs, where the benefits are seen as outweighing the possible costs.”

The change in this question found in other versions of the decision tree are less subtle. LANL-1 makes the wording more complete, but poses the question as “Did the employee knowingly violate a requirement?” While ORNL-1, Bush-1 and Battelle-1, probably to save space, drop the two articles ("the" and "a"), the difference in meaning from LANL-1 is negligible. However, the differences between LANL-1, INL-1 and Reason are significant, since “requirement” is more broad than "procedures" which is broader than "safe operating procedures." And yet the remaining three versions, INPO-1, Hanford-1 and SRS-1, are even broader when they ask "Knowingly violate expectations?" (although Hanford-1 employs the singular "expectation.") At
first glance this may seem to be too great an expansion of Reason’s original question, but in light of the follow-up question, it actually strengthens the tool by eliminating the gap that some evaluators might see between written “procedures” and other forms of expected behavior that exist in the organization. The key point of this question is to establish the employee’s intention with respect to expected behavior. The best wording is:

**Q7. Did the employee knowingly violate expectations?**

**Guidance:**

Reasonable expectations consist of directions communicated through procedures, policies, work practices. If it is established that the individual was aware of the expectations, but consciously elected not to conform to those expectations, then the answer would be ‘Yes.’

If the answer is ‘No,’ the evaluator should proceed to the next branch of the tree.

If the individual understood (to whatever degree) that his/her actions would deviate from what they knew to be proper or “expected” behavior, then the evaluator should answer ‘Yes’ and proceed to the next question below on the same branch.

4.3.8 Adequacy of Expectations (Q8)

Since we established in the previous section that we are considering a violation of expectations, it follows that the next question should also be in terms of expectations. Although Reason, as well as similar versions, asks about the adequacy of “procedures,” the criteria he gives by which we can determine adequacy are fourfold: “available, workable, intelligible, and correct.” INPO-1, Hanford-1 and SRS-1, of course, ask about “expectations,” while adding a fifth criterion: “reasonable.” This addition is valuable, since we have expanded our inquiry to examine “expectations,” which may or may not have been reasonable, even though the employee understood that he was violating them. Thus, the wording of the question should be:

**Q8. Were expectations reasonable, available, workable, intelligible, and correct?**

**Guidance:**

To answer this question, the evaluator may need to obtain feedback from the supervisor or even other employees who perform the same task or have similar duties.

If the answer is ‘Yes,’ then the problem lies more with the individual. However, further evaluation may still be warranted before drawing a final conclusion about the violation.

If the answer is ‘No,’ then the violation was induced by organizational weaknesses. Nevertheless, because the deviation was intentional, the evaluation should compare the individual’s behavior to that of peers. Therefore, proceed to the next branch of the tree.
4.3.9 Conclusions for Violations (C6 & C7)

If expectations were knowingly violated, and those expectations were determined by the evaluator to have been reasonable, available, workable, intelligible, and correct, then Reason deems this to be a "possible reckless violation." INL-1, ORNL-2, INPO-1, Hanford-1 and SRS-1 retain this verbiage. Other versions of the tree instead use "possible intentional violation," which really says no more than a ‘Yes’ to the first question in this branch of this tree.

Reason indicates that if the answer is 'Yes' to both questions on this branch, the evaluator must consider “whether the behavior was reckless in the legal sense of the term.”¹ This explains his use of the qualifier “possible,” which means that just because the individual knowingly violated expectations that there clear and correct, it is not a foregone conclusion that his/her behavior was reckless. Accordingly, the evaluator’s consideration about the individual’s “recklessness” should weigh at least two factors: 1) “how violations were shaped by cost-benefit trade-offs,”¹³ and 2) the correctness or accuracy of risk perception on the part of the individual involved (see section 3.1). Earlier in the same chapter Reason tells us that “a person who acts recklessly is one who takes a deliberate and unjustifiable risk; that is, one that is foreseeable, and where a bad outcome is likely, though not certain.” He then quotes a criminal law reference which adds that justifiable risk “depends on the social value of the activity involved, as well as on the probability of the occurrence of the foreseen evil.”¹

The wording for the other conclusion to this branch of the tree is consistent between most versions of the decision tree. Instead of “system-induced violation,” the INPO-1 version words it as “organizationally-induced violation,” while Hanford-1 and SRS-1 express it as “organization induced violation,” both of which essentially convey the same idea as Reason’s wording.

Immediately following his reference to “reckless,” Reason discusses the application of the substitution test, a concept he had already discussed as background to introducing the decision tree. Even though his tree has a "dotted arrow" going from a conclusion of 'No' to the question about adequacy of expectations to the next branch of the tree—which, he says, indicates how the evaluator is to judge "the culpability of system-induced violations"—his discussion also indicates that “it seems appropriate to apply [the] substitution test” even if the answer is 'Yes.' Interestingly, the Hanford-1 version reflects this by having the dotted line going from both conclusions of this branch up to the substitution-test block at the top of the next branch of the tree. ORNL-1, Bush-1, Battelle-1 indicate, by use of “numbering” references, a jump to the substitution-test block only if the answer to the second question is ‘Yes.’ Likewise LANL-1 switches the dotted-line’s anchor to the ‘Yes” conclusion.

From the indicated flow of most versions of the tree one could assume that upon “jumping” to the substitution-test branch, one would then continue through the tree based on the results of that first block. Relying only on one’s interpretation of the tree, this might be a valid deduction. However, a careful reading of our references indicates that this is not always the correct path. It is noted that the Battelle-1 version indicates that after answering what we would call the substitution-test question, if the evaluator had been directed to that point from a “possible
intentional violation," the evaluator is to “stop here.” Similarly, the Hanford-1 and SRS-1 versions indicate an upward flow to the substitution test with a dotted arrow, but also have a downward flow to another box (which is not a question) with a solid arrow.

For now, we conclude that both conclusions (C6 and C7) should lead to the next branch, with guidance on how to proceed thereafter, which will be discussed in section 4.3.11.

4.3.10 Substitution Test (Q9)

The next branch of the decision tree begins with another vital question. Although the wording varies minimally in other versions, the next question is about the results of a test. This test will momentarily take the specific individual out of the picture and replace him/her with another person, in order to give us further insight into the influence of the organization on the behavior of an individual in the situation being evaluated.

Reason precedes his introduction of this branch of the tree with a brief discussion of the need for an alternative to a 'one strike and you’re out' standard for judging unsatisfactory performance. The substitution test—credited to Neil Johnston, a human factors specialist and Reason’s colleague and collaborator—is, as Reason puts it, a “much sounder guideline” that “is in keeping with the principle that the best people can make the worst errors.” Reason discusses the basics of the test and its applications at several points in his discussion of the decision tree, some of which we have dealt with in previous sections of this paper.

According to Reason, it is a “mental test,” performed by the one “faced” with evaluating the individual-in-question’s “unsafe” behavior that implicates him/her in an accident or incident scenario. Maurino, Reason, Johnston and Lee spell out the dilemma such an evaluator faces: “On the one hand we must recognize the importance of individual accountability, while on the other we must recognize that front-line personnel do not act in a manner which is independent of company working custom and practice—or ‘organizational sub-culture.’ The objective at this point is to determine “the role played by organizational working ‘realities.’”

Elsewhere Johnston himself “argues that in order to interpret the meaning of a human ‘error’, particularly where individual actions are embedded in and possibly driven by wider organizational and cultural systems, we should mentally substitute another actor for the person involved and ask the question, ‘In the light of how events unfolded in real time, is it probable that this new individual would have behaved any differently?’ If the answer to this question is no, then the act of apportioning blame has no role to play. Rather we should seek to identify the wider causes of the action.”

Maurino, Reason, Johnston and Lee similarly explain that the essence of the substitution test “merely involves mentally substituting another actor,” but further explain that this other actor must be “from the same operational background.” Or, as Reason instructs, the substitute actor is “someone else coming from the same domain of activity and possessing comparable qualifications and experience.” He later describes this other actor as a “well motivated, equally
human performance culpability evaluations

This means that the evaluator cannot simply put himself/herself into the situation and ask if he/she would have done the same thing; the substitute individual must be a peer in work responsibilities, experience, and job- or duty-specific qualifications.

It is interesting to note that all the above citations refer to the substitution test as being done “mentally.” However, as was just stated, unless he/she is a peer, which will usually not be the case, the evaluator will need find out how a true peer would view and behave in the same situation. Obviously, if possible under the circumstances, this information should be obtained directly from a peer, which will require the evaluator to talk to such a peer or peers to find out how those other actors would probably have behaved. This could be done through direct questioning or by observing peer behavior in the workplace. If possible, the perspective of multiple peers would give a more complete and balanced hypothetical view of “typical” or likely behavior. In cases where clearly-understood medical restrictions were disregarded, finding suitable peers may be difficult.

Thus, obtaining information from these peers will require skills in observation, investigation and interviewing. Once that information is obtained, the evaluator can then perform the test mentally. As Johnston words it, the question we really want to ask is “‘In the light of existing knowledge and how events unfolded sequentially, is it probable that this new individual would have behaved any differently?’”

The variations in wording of this question on the decision tree are interesting. Some merely seek to improve the original wording, while others seek to convey the same idea:

<table>
<thead>
<tr>
<th>Reason, ORNL-2, Bush-1, SRS-1</th>
<th>“Pass substitution test?”</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPO-1</td>
<td>“Passes the substitution test?”</td>
</tr>
<tr>
<td>ORNL-1</td>
<td>“Does the situation pass the substitution test?”</td>
</tr>
<tr>
<td>LANL-1</td>
<td>“Did the employee pass the substitution test?”</td>
</tr>
<tr>
<td>Hanford-1</td>
<td>“Pass substitution test? (See note) — Note: Would other employees have made the same error?”</td>
</tr>
<tr>
<td>INL-1</td>
<td>“Would another person do?”</td>
</tr>
<tr>
<td>Battelle-1</td>
<td>“Would peers do the same?”</td>
</tr>
</tbody>
</table>

As stated above, the object of the substitution test is to evaluate behavior in a given situation. Although Reason’s question (as well as ORNL-2, Bush-1, and SRS-1) probably intends for the situation to be evaluated, the ORNL-1 version makes it explicit. On the other hand, the LANL-1 version seems confusing, as it makes the test specific to the original employee. The key idea of the substitution test is to look at the situation with a different actor on the stage. If the substitute actor would have acted differently (‘Yes’), then the situation passes the test; while, if the substitute actor would not have behaved any differently (‘No’), then the situation fails (does not pass) the substitution test.
Although the Hanford-1 version retains Reason's original wording in the box on the tree, the footnote clarifies the intended meaning by offering an alternate version. Unfortunately, the footnote version is specific to error, which would tend to exclude situations involving a violation. The INL-1 version replaces the question with simpler wording—although the thought is incomplete as to whether the other person would do “the same” or “differently”—but would require guidance to explain who “another person” can be if the intended concept of the substitution test is to be upheld.

The Battelle-1 version offers much better alternate wording by asking about “peers” and whether or not they would “do the same.” However, this wording reverses the binary logic of the ‘Yes’ and ‘No’ answers as compared to the indicated path on Reason’s tree for those answers, even though the Battelle-1 version incorrectly retains the same ‘Yes’ and ‘No’ paths as the original. (Reason does the same thing in one of his discussions about the substitution test. He words the question in that case as “Could (or has) some [peer] make (or made) the same kind of error under those or very similar circumstances?” which is the converse of pass/fail of the test.)

As discussed previously, there are several potential paths through the decision tree to the branch that starts with the substitution test. It would seem prudent to understand which path brought the evaluator to this point on the tree before initiating the test. Since the path to the substitution test can be for violations as well as for errors, we note Reason’s suggestion of another question that could be asked: “Given the circumstances that prevailed at the time, could you be sure that you would not have committed the same or similar type of unsafe act?” The phrase “unsafe act” is consistent with Reason’s original explanation for using the decision tree. It would tend to suggest a violation, rather than an error, but this would depend on the evaluator’s interpretation. In some safety cultures, the way that “unsafe acts” are perceived or viewed within the organization could influence a peer’s response, not wanting to admit that they would do something unsafe. This potential suggests that the wording of this alternate question should be as specific as possible to the actual behavior of the original individual, rather than labeling it as an error, mistake, violation or unsafe act.

We also recall that the context in which Reason introduces the culpability decision tree is that of “Engineering a Just Culture.” He ends his discussion of the tree itself by asking “what should happen to the small proportion of individuals whose unsafe acts are justly considered culpable?” and moves on to a discussion about punishment. This suggests that until the an individual’s allegedly unsafe behavior has been evaluated, nothing should have “happened” to him/her in terms of punishment. This is not only important to establishing a just culture, but it indicates another premise upon which the culpability decision tree is conceived. In particular regarding the substitution test, if “punishment” or disciplinary action has already been dispensed, if a subsequent investigation were then to evaluate that employee’s behavior using the decision tree, any validity of the substitution test would be compromised, since peers would know what happened to their fellow employee, which would undoubtedly affect the way in which they would respond to questions about how they would have behaved in that situation.
The idea of the substitution test is to determine if the employee can be justly “blamed” for his/her behavior in a given situation. If peers would not have behaved any differently, then “apportioning blame will have no material role to play other than to hide systemic deficiencies.”

We should also point out that there may be occasions in which a substitute actor can be found in a similar incident scenario that has already occurred. In this case, it would seem logical to apply the substitution test retrospectively and compare the behavior of the individual in the situation under evaluation with that of the individual(s) in the prior scenario. Similar behaviors by peers in similar situations is a good indicator that a “systemic deficiency” is influencing employee behavior.

From our comparison of the various versions it is concluded that the best wording for the question on the tree is that on the ORNL-1 version of the tree. Guidance for this question should employ alternate wording similar to that on the INL-1 and Battelle-1 versions, but should be expressed in terms to the effect of ‘Would peers do differently?’

Q9. Does the situation pass the substitution test?

Guidance:

Could have (or has) some well-motivated, equally competent and comparably qualified individual behaved differently under those or very similar circumstances? The answer to this question will probably need to be obtained from “peers” in a manner and environment that will yield frank and honest responses. This question will indicate if violations are condoned and/or have become routine.

If ‘Yes,’ the situation passes the test.

If ‘No,’ then the situation does not pass the test, and the person should not be individually blamed.

4.3.11 Paths to the Substitution Test (and Conclusions)

At this point, it depends on the path previously traversed through the decision tree as to whether a conclusion has been reached or if the evaluator should continue through the tree. Based on the above citations and discussion, the possible paths to the substitution test are:

a. from ‘No’ to Q7, i.e. the employee did not knowingly violate expectations.

b. from C6 – possible reckless violation

c. from C5 – system-induced violation (of medical restrictions)

d. from C7 – system-induced violation (of adequate expectations)

The INPO-1 version of the decision tree provides for the first possibility (a) as the only potential path to the substitution test. The Hanford-1 and SRS-1 versions indicate two paths from the last possibility (d), one of which is the substitution-test-block, indicated by a dotted arrow. The other
path, indicated by a solid arrow, leads to a block floating below the rest of the tree. The INPO-1 version has a similar block below the tree that is also the object of the path from its version of the last possibility (d).

As quoted previously, Johnston stated that if the results of the substitution test are “‘no,’ then the act of apportioning blame has no role to play. Rather we should seek to identify the wider causes of the action.”31 This statement supports the addition of the block below the rest of the decision tree in the INPO-1, Hanford-1 and SRS-1 versions. This block is not another question, but rather a direction or instruction associated with a conclusion of a system- or organizationally-induced violation. In the Hanford-1 and SRS-1 versions, the evaluator is instructed to “evaluate organizational processes and management supervisory methods” that will help explain why the violation occurred in the situation under evaluation. The INPO-1 version improves on this wording by directing that “relevant” organizational processes and “related” management and supervisory “practices” be evaluated.

The INPO-1 version is good because it not only directs the evaluator to do what Johnston says should be done, but also guides us to look at those processes and practices/methods that came into play in the situation being evaluated. Earlier in this paper (section 4.3.4), we concluded that the “medical restrictions” branch of the tree should be integrated into the decision tree. In the case where the violation was of medical restrictions, the medical-restrictions process and the practices that management and supervision use to determine and communicate those restrictions would be the first place to “seek” when analyzing the situation to “identify the wider causes” of the violation. If the evaluation were to only look at methods, this might not consider the normal or typical practices of the specific management and supervision involved, but only look at the established or proceduralized methods in general.

The several versions of the tree that include the “Evaluate processes” block also send the evaluator to this block from other conclusions that can be reached further on in the decision tree, which we will consider later. For now, we conclude that the addition of the block is good and that the best wording is INPO-1’s with additional words to indicate the objective:

Evaluate relevant organizational processes and related management and supervisory practices to identify systemic causes.

At this point, we can give additional guidance on the possible paths or conclusions from the substitution test:
<table>
<thead>
<tr>
<th>Previous Point on Tree</th>
<th>Conclusion / Path Forward</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. From ‘No’ to Q7, i.e. the employee did not knowingly violate expectations.</td>
<td>Interim conclusion: This was an error. So, if:</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>then proceed right to the next branch of the tree as indicated.</td>
</tr>
<tr>
<td>b. from C6 – possible reckless violation</td>
<td>Interim conclusion: This was not an error, but a violation. So, if:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stop.</td>
</tr>
<tr>
<td></td>
<td>Conclusion: This was a reckless violation. Invoking the organization’s disciplinary process is warranted.</td>
</tr>
<tr>
<td></td>
<td>Stop.</td>
</tr>
<tr>
<td>c. From C5 – system-induced violation (of medical restrictions)</td>
<td>Conclusion: This was a system-induced violation. However, if:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stop.</td>
</tr>
<tr>
<td></td>
<td>Invoking the organization’s disciplinary process is warranted.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 4.3.12 Systemic Deficiencies (Q10)

As discussed above the primary path to the substitution test is that the individual did not knowingly violate expectations—it was an error. If the situation does not pass (i.e. fails) the substitution test, the next question on the same branch of the tree looks to evaluate contributions from the system that help to discriminate the type of error that occurred. However, regardless of the conclusion, we must remember that, as indicated by the figure below the tree, the degree of individual culpability has been greatly diminished at this point.

Therefore, if the situation passes the substitution test, Reason’s next question is “Deficiencies in training & selection or inexperience?” The LANL-1 and ORNL-1 versions insert “Were there” at the beginning of the question, making it less terse and more understandable as a question. In his discussion Reason indicates that we are looking for “system-induced” deficiencies. The syntax of the actual question on the tree can be confusing. As worded the question asks about the existence of either “deficiencies” in “training” or “selection”, or if it is a case of “inexperience,” which is a deficiency in experience. It is observed that most versions of the tree use the same wording, while a few make a small change by replacing the “&” with either a comma (LANL-1) or “or” (Hanford-1), which could cause the sentence to be read as ‘a deficiency in ... inexperience.’ The SRS-1 version eliminates any confusion by listing “experience” as one of the possible deficiencies.

<table>
<thead>
<tr>
<th>d. from C7 – system-induced violation (of adequate expectations)</th>
<th>Conclusion: This was a system-induced violation. However, if:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>‘Yes’ (passed substitution test)</td>
</tr>
<tr>
<td>Stop.</td>
<td>Stop.</td>
</tr>
<tr>
<td>Invoking the organization’s disciplinary process is warranted.</td>
<td>Causal analysis should be used to determine the type of violation (routine, optimizing or necessary) and the systemic causes that prompted, or influenced the violation.</td>
</tr>
<tr>
<td>Any required disciplinary or corrective action toward the individual should take into account that peers would probably not have acted differently in the same situation.</td>
<td></td>
</tr>
</tbody>
</table>
The SRS-1 and INPO-1 versions add “assignment” to the list of possible system-induced deficiencies to be considered, and the INPO-1 version asks if there are deficiencies “with” any of the four. Taking all this into consideration, it is concluded that the best wording for this question is:

Q10. Were there deficiencies in training, selection, assignment, or experience?

*Training* provides workers the appropriate behavioral skills, related knowledge, and attitudes needed to perform their job duties. *Selection* and *assignment* refer to considerations and processes used to hire people and assign them specific responsibilities and on-the-job tasks. *Experience* is knowledge, skill or practice derived from direct observation of or participation in events. If the answer to Q10 is ‘Yes,’ subsequent analysis should be directed at the specific deficiency in order to determine systemic causes.

4.3.13 Conclusions to Systemic Deficiencies (C8 & C9)

The conclusions to the question about systemic deficiencies are the same as Reason’s in almost every version of the decision tree. For an answer of ‘No,’ Reason words the conclusion as a “possible negligent error.” The only versions that differ are ORNL-1 and LANL-1, both of which indicate a flow that continues to the systemic-deficiencies question following a ‘No’ to passing the substitution test. Apparently, to address the other potential paths to this branch of the tree, the ORNL-1 version adds “or intentional violation” to the name of this conclusion. The LANL-1 version does the same but drops the “possible” at the beginning of the phrase. In section 4.3.9 we mentioned that those versions indicating a “jump” to the substitution test to determine the type of violation also indicate that the evaluation should thereafter be stopped. In the case of the ORNL-1 and LANL-1 versions no “stop” is indicated. In fact, the instructions that accompany the LANL-1 version specifically state: “After the substitution test, one should continue through the final questions and answers until an outcome is reached.” What the instructions do not state, but which appears is to be done with that version, is that if the path to the substitution test was for one of the “intentional violations,” then the conclusion to ‘No’ about systemic deficiencies would be “intentional violation,” whereas for the path from “employee did not knowingly violate a requirement” the conclusion would be a definite “negligent error.”

“Negligence,” as Reason explains, “involves bringing about a consequence that a ‘reasonable and prudent’ person would have foreseen and avoided.” He further explains in citing criminal law that a person can act “negligently with respect to a circumstance when a reasonable [person] would have been aware of the existence of the circumstance and, because of its existence would have avoided acting in that manner.” This accounts for his use of “possible” in wording this conclusion of negligent error. The evaluator, having applied the substitution test (see section 4.3.10) to the situation, must use the information about peers gathered for that test in order to determine if the error was indeed attributable, at least in part, to negligence on the part of the individual.

-38-
Reason provides further insight when he tells us that “negligence is historically a civil rather than a criminal law concept, and has a much lower level of culpability than recklessness.”¹ This last statement reinforces the difference, shown on the "scale" of diminishing culpability in the figure below his tree, between those respective conclusions (C6 and C8). It also serves to remind us that even if the error resulted, to whatever degree, from negligence, the balance of culpability is attributable to the system, which must be analyzed if we want to find the other deficiencies or weaknesses in the system that provoked the error or failed to prevent it and/or its consequences.

For an answer of 'Yes,' Reason and all other versions but one give the conclusion as “system-induced.” The exception is INPO-1, which also calls it an error, but words it as “organizationally-induced.” It could be argued that "organization" is broader in scope than "system" in that a company or business will have a number of “systems” and processes that it implements in order to control its operations. However, there are many instances, such as in the airline industry, where the “system” by which a passenger boards, travels and disembarks from his/her point of departure to his/her final destination, includes or involves multiple companies or employers, including regulatory entities and their employees. When seen in this light, “system” can potentially convey a broader span of influence on behavior than just one organization by which the individual is employed. The INPO-1, Hanford-1 and SRS-1 versions indicate that this is the next step to be taken by directing a conclusion of 'Yes' to the “Evaluate organizational processes...” box below the tree.

Thus, we deduce that the conclusions to Q10 of the culpability decision tree should be as Reason originally worded them:

C8. Possible negligent error
C9. System-induced error

Guidance:

Both conclusions are errors. Determine the type of error (skill-, rule- or knowledge-based) to help determine actions to take to reduce the risk of recurrence.

Negligent error – This is an appropriate conclusion if another person (peer) would have foreseen and avoided bringing about the consequence. It suggests more individual culpability than a system-induced error. Corrective action should seek to understand why the individual did not recognize the potential consequence and why he/she believed his/her behavior was appropriate for the situation.¹¹
System-induced error – This was an error provoked by the system in which the individual was working. If there was a deficiency in selection and/or assignment, further analysis should focus on the hiring process. Deficiencies in training or experience should analyze the training and qualification process for the individual’s job position.

4.3.14 Employee History (Q11)

In section 4.3.10, we learned that if a peer would have behaved differently under the same or very similar circumstances, then the situation passes the substitution test. Thus, an answer of ‘Yes’ to Q10 leads us to the last branch of the tree. In accordance with Reason’s original premise for the tree to be used to discriminate the culpability of an unsafe act, his next question is about a “History of unsafe acts?”; that is, have there been “any previous” instances of the individual committing this unsafe act. At first glance this could be read as asking about the task being performed in the situation under consideration. In fact, the ORNL-1 version’s “Is there a history of unsafe acts?” might lead the evaluator to consider the question in that light. However, since the situation passed the substitution test, the question could only be about the individual. Thus, in the text Reason explains that the question pertains specifically to the “person in question.” The LANL-1 version removes any potential for misapplication of the question by asking “Did the employee have a history of unsafe acts?”.

INPO explains that the decision-tree tool is “intended primarily” to determine the level of individual culpability “in response to events or near misses triggered by human error.” They also state that some nuclear-reactor stations use it “during investigations of human performance events.” Accordingly, their version of the tree rewords this questions as “History of performance problems?” The Hanford-1 and SRS-1 versions make the question more explicit by adding that we are interested in any history of problems with “human performance.” Since this wording makes the tree useful for more than just for evaluating “unsafe acts,” it seems wise to adopt it, as well as the LANL-1’s wording that it is specifically about the individual in the situation being evaluated.

Q11. Does the employee have a history of human performance problems?

Conclusions to this question are uniform throughout the various versions of the tree. These will be discussed in section 4.3.16.

4.3.15 Self-reporting of Errors (Q12)

Reason gives only two conclusions to Q11. However, the INPO-1 and Hanford-1 versions add another question if the employee does not have a history of performance problems. The additional question on the INPO-1 version is “Performance problem was self-reported?”, whereas the Hanford-1 version simply asks “Self reported[?]”

INPO states that continuous improvement processes should include “problem reporting” because “the workforce is the best source of information about weaknesses in the organization as it
applies to support of work in the field.” They include the following as one of the “Individual Behaviors” criteria in its performance objectives for reliable human performance: “Individuals recommend improvements and willingly report problems, near misses, error-likely situations, and safety hazards.” A report on best practices in nuclear power plants further tells us: “In the environment of continuously improving safety and performance, low level events, small degradations and near misses are reported, including good practices and positive examples. They are taken as a valuable source of information for a learning organization. Plant staff understands and believe[s] that their efforts to report these issues are worthwhile and useful to contribute to the improvement of safety and performance. Also they believe that the self-reporting of errors will not have negative consequences for the reporting person.”

Likewise, the DOE has promulgated similar objectives in the supplemental safety culture elements of its Integrated Safety Management (ISM) system. Under “Individual Attitude and Responsibility for Safety” element, one of the attributes stated is: “Individuals promptly report errors and incidents. They feel safe from reprisal in reporting errors and incidents; they offer suggestions for improvements.” Another attribute under the “Organizational Learning for Performance Improvement” element is the following: “A high level of trust is established in the organization. Reporting of individual errors is encouraged and valued. A variety of methods are available for personnel to raise safety issues, without fear of retribution.”

From the perspective of individual accountability, the instructions for the Hanford-1 version of the tree state that “self-reporting indicates that the individual is willing to change behaviors and to assist in developing corrective actions.” It also indicates that self-reporting can be in the form of the individual notifying management of the error or “when the individual acknowledges that an error was made” upon it being identified or pointed out by supervision or co-workers.

From these references we conclude that the additional question regarding an error where there has not been a history of performance problems with that individual is a valid question. We conclude it as such because, as this question is at the end of the tree where “system culpability” is at its greatest, the need to determine other potential influences on behavior is necessary. As it pertains to that individual, if the individual did not self-report the error, correction/remediation for that individual is warranted. Thus, the additional question on the last branch of the tree should be:

Q12. Was the performance problem self-reported?

4.3.16 Conclusions to Employee History and Self-Reporting (C10 & C11)

Both conclusions on the final branch of Reason’s tree are designated “blameless errors,” but one is qualified due to a history of performance problems with the individual of concern. This qualification is that although the error was blameless, “corrective training or [career] counseling” is “indicated” or appropriate. This verbiage varies somewhat in other versions. The ORNL-1, Bush-1, LANL-1, Battelle-1, Hanford-1 and SRS-1 versions all drop the “blameless error”
designation. The LANL-1 version simplifies the rest of the wording to “corrective measures indicated.” The Hanford-1 and SRS-1 versions expand the conclusion to be “corrective training or other intervention may be warranted.”

The INPO-1 version changes the designation for both conclusions to “organizationally-induced error,” with one having the qualification of “with remediation” if either there is a history of performance problems or if the problem was not self-reported. The Hanford-1 version also has this dual flow for the first conclusion. Since we concluded in the previous section that the “self-reporting” question is a good addition to the tree, this dual flow to a conclusion with a recommended action is also sensible. Although Reason’s suggestion that a change of career may be in order for a blameless error where there is a history of “unsafe acts,” the expanded application of the tree to performance problems suggests that “taking on some other job within the company” will only be an appropriate path forward in certain situations. Therefore, the addition of the conditional “may be warranted” seems judicious.

Only the INPO-1 and LANL-1 versions use wording other than “blameless error” for the least individually-culpable conclusion. ORNL-1 labels the error “organizationally-induced” while the LANL-1 version designates it “system-induced error or blameless error.” This option of two conclusions stems from the unconditional flow from the substitution-test question in the LANL-1 version, as discussed in section 4.3.13. As far as the error itself is concerned, the figure below the tree (see section 4.3.6) indicates that the culpability for the error lies fully with the organization. The designation of the error as “blameless” reinforces the idea that the individual is not culpable, which only leaves the organization to be blamed for the error and its undesirable consequences.

Other than differences in wording, all versions of the tree that have only one question on this branch indicate a flow to C10 if the answer is ‘Yes’ and to C11 if the answer is ‘No.’ As for guidance to these conclusions, both should also indicate a “follow-up” flow to the “evaluate relevant processes” block below the tree similar to the previous branch, as shown on the INPO-1 and SRS-1 versions.

Based on the various versions, the best wording for these conclusions is deemed to be:

C10. Blameless error; corrective training or other remediation may be warranted.


Guidance:

*Blameless error with remediation* – this was an error. However, the behavior (or history of this type of behavior) may warrant some form of remediation to correct it. Determining the performance mode of the error (skill-, rule- or knowledge-based) will serve to indicate the appropriate training or form of remediation needed. Analysis of organizational processes and management/supervisory practices should also be conducted.
**Blameless error** – this was an error; the individual should not be individually blamed. Analysis of organizational processes and management/supervisory practices should be conducted to identify conditions that provoked the error and weaknesses in the defenses that did not mitigate the consequences of the error.

### 4.3.17 Circular Flow

One last variation we should mention is the full-circle flow indicated on the Hanford-1 and SRS-1 versions. The two versions have an arrow that goes out of the “evaluate organizational processes” box leading back to the top of the first branch of the tree. The INPO-1 version does not have this last variation from Reason’s original design. As there is no explanation in the two versions about this, and it does not seem logical to indefinitely repeat the evaluation process, this variation will not be integrated into our composite version of the tree.

### 5.0 Summary and Conclusions

The culpability decision tree is a valuable tool for evaluating the culpability of an individual whose involvement in a workplace incident is in question. Although there is significant detail on the tree, additional guidance is needed to assist the evaluator in using the tree as a tool. Since a number of terms used on the tree cannot be taken at face value, definitions also need to be provided as part of that guidance. To be of utmost utility to contractors in the DOE complex, the tool and any associated guidance for its implementation should particularly take into account the standards and expectations of DOE.

Although James Reason is the original architect of the culpability decision tree, a number of other versions of the tree have come into use in the DOE complex. Through a process a comparison with Reason’s original, his explanations, and available references, this study found a number of variations that were determined to be enhancements that strengthen the tool and broaden its applicability. In addition to a version of the tree that integrates the “best” of the various versions (see Attachment A), this study has also developed guidance for each question and conclusion of the tree (see Attachment B), as well as the structure and aesthetic appearance of the diagram as a whole. It is hoped that this version will be adopted by UT-Battelle and incorporated into its accident investigation and causal analysis processes.

### References

17. (undated). “Culpability Decision Tree Process,” draft rev. 2, found in ORNL HPI Program files. (Internal correspondence indicates that this document was prepared at least prior to February 2006. See e-mail from Lynn R. Eberhardt to Karen M. Downer, “HPI Culpability Decision Tree,” Feb. 10, 2006.)
22. See e-mail correspondence from Adrian L. McCall to Michael L. McIntosh, “RE: Culpability Decision Tree,” May 21, 2008. Copy in possession of author.


Attachment B

Culpability Decision Tree

Q1. Were the actions as intended?
Q2. Were the consequences intended?
Q3. Were unauthorized substances used?
Q4. Was there a medical condition?
Q5. Were there medical restrictions on the employee?
Q6. Were restrictions clearly communicated and understood?
Q7. Did the employee knowingly violate expectations?
Q8. Were expectations reasonable, available, workable, intelligible, and correct?
Q9. Does the situation pass the substitution test?
Q10. Were there deficiencies in training, selection, assignment, or experience?
Q11. Does the employee have a history of human performance problems?
Q12. Was performance problem self-reported?

C1. Intentional act (not an error)
C2. Substance abuse without mitigation
C3. Substance abuse with mitigation
C4. Disregard of medical restrictions
C5. System-induced violation
C6. Possible reckless violation
C7. System-induced violation
C8. Possible negligent error
C9. System-induced error
C10. Blameless error; corrective training or other remediation may be warranted
C11. Blameless error

Evaluate relevant organizational processes and related management / supervisory practices.

Increasing individual culpability
Increasing organizational culpability

2008 : Andy Hobbs
Guidance for Using the Culpability Decision Tree

This guideline provides instructions for evaluating human performance in cases where individual culpability for certain behavior is not clear. The Culpability Decision Tree (Attachment A) is a tool that may be used in the investigation and analysis of an event that involved behavior that deviated from that which was expected. Once facts and first-hand information have been obtained from the individual or individuals involved (by means of interviews, critique, etc.), this tool can be used to understand the mindset of the personnel involved, the context of the situation, and the systemic and organizational influences that may have affected their decisions and resultant behavior.

Definitions

**Behavior** – a human act or sequence of human actions. Behavior consists of a plan or intention (a goal plus the means to achieve it), a sequence of actions initiated by the plan, and the extent of success in achieving the goal as each action is performed.

**Consequences** – the final, overall effect(s) or outcome(s) of an individual’s behavior with respect to the situation or environment in which the behavior occurred.

**Culpability** – the amount of blameworthiness that an individual’s behavior merits based on the nature of the deviation from expected behavior, the outcomes of the deviation, and the responsibility and authority of that individual, in the context of the situation in which the behavior occurred.

**Error** – an unintentional deviation from expected behavior.

**Knowledge-based Error** – an error associated with behavior in response to a totally unfamiliar situation (no skill, rule or pattern recognizable to the individual). Usually arises as a problem-solving situation that relies on personal understanding and knowledge of the system, the system’s present state, and the scientific principles and fundamental theory related to the system. In terms of failing to achieve the intended goal, actions conformed to the plan, but the plan was inadequate to achieve its intended outcome due to an inaccurate mental picture.

**Performance** – the behavior of an individual or group of individuals plus the results of that behavior, considered as a whole. (If the behavior under evaluation involves multiple individuals acting together as a team, their performance as a single unit should also be evaluated in addition to that of individual members of the team.)

**Performance Mode** – the manner in which a person acts in terms of information processing when executing a task or activity. The three performance modes are skill-based, rule-based and knowledge-based.

**Results** – the final outcomes of behavior strictly in terms of success or failure in achieving the intended goal, irrespective of the correctness or accuracy of risk perception on the part of the individual(s) involved.

**Rule-based Error** – an error associated with behavior based on selection of stored rules derived from one’s recognition of the situation; it follows an **If** (symptom X) / **Then** (situation Y) logic. In terms of failing to achieve the intended goal, actions conformed to the plan, but the plan was inadequate to achieve its intended outcome due to misinterpretation.

**Sabotage** – behavior in which both the act and the damaging outcome were intentional.

**Skill-based Error** – an error associated with highly-practiced actions in a familiar situation usually executed from memory without significant conscious thought or with little attention. In terms of failing to achieve the intended goal, the plan was adequate, but the action(s) failed to go as planned.
Violation – the intentional deviation from expected behavior as specified in operational procedures, rules, or standards, but in which the consequences were not intended.

Questions

Q1. Were the actions as intended?

At this point you are only concerned about behavior. In order to answer this question, as the evaluator you must know:

a. the actions being evaluated
b. the goal and how those actions related to the goal
c. the degree of success the individual had in executing the actions he/she planned to execute

No – the behavior is almost certainly an error, since what he/she did is not what he/she intended to do. It could very well have been a skill-based error, which Reason calls “the least blameworthy of errors,” but further evaluation of the behavior is still needed.

If the answer is ‘Yes,’ you need to more completely describe the behavior and what the outcomes of that behavior were.

Q2. Were the consequences intended?

In order to answer this question, as the evaluator you need to know:

a. the planned actions intended to achieve the goal
b. how successful the actions were in achieving the goal
c. the expected outcomes
d. the actual outcomes (i.e. results)
e. the other outcomes that occurred, and if they were considered/conceived of by the individual

Even though item “e” above relates the most to consequences, it is important to have as much insight into the individual’s actions as possible in order to fully evaluate his/her behavior.

No – the error was most likely a mistake or (possibly) a violation. This case is likely to be a rule- or knowledge-based error. Continue to the next branch of the tree.

Yes – go to conclusion C1.

Q3. Were unauthorized substances used?

The purpose of this question is to establish whether or not the individual was under the influence of alcohol or drugs known to impair performance at the time the actions were committed.

Q4. Was there a medical condition?

This question prompts you to determine if there was an actual medical condition that precipitated the individual using/taking the substance, albeit without authorization.

Q5. Were there medical restrictions on the employee?

If a medical condition had been reported to and acknowledged by the company, then there may have been medical restrictions imposed on the employee’s job duties and tasks.

Q6. Were restrictions clearly communicated and understood?
If medical restrictions were in place, this follow-up question seeks to determine how well those restrictions were communicated to the employee and if they were understood by the employee.

**Yes** – the employee disregarded the medical restrictions (C4).

**No** – the violation of the medical restrictions was system-induced (C5). So, further evaluation about the violation is warranted. Jump to Q9 (as indicated by the dashed line).

**Q7. Did the employee knowingly violate expectations?**

If it is established that the individual was aware of the expectations, but consciously elected not to conform to those expectations, then the answer would be ‘Yes.’

**No** – proceed to question Q9 on the next branch of the tree.

**Yes** – proceed to question Q8 below on the same branch of the tree.

**Q8. Were expectations reasonable, available, workable, intelligible, and correct?**

To answer this question, you may need to obtain feedback from the supervisor or even other employees who perform the same task or have similar duties.

**No** – the violation was induced by organizational weaknesses. Nevertheless, because the deviation was intentional, you should compare the individual’s behavior to that of peers. Therefore, jump to Q9 on the next branch of the tree (as indicated by the dashed line).

**Yes** – the problem lies more with the individual. However, further evaluation may still be warranted before drawing a final conclusion about the violation. Jump to Q9 (as indicated by the dashed line).

**Q9. Does the situation pass the substitution test?**

Could have (or has) some well-motivated, equally competent and comparably qualified individual behaved differently under those or very similar circumstances? The answer to this question will probably need to be obtained from “peers” in a manner and environment that will yield frank and honest responses. This question will indicate if violations are condoned and/or have become routine.

**Yes** – the situation passes the test.

**No** – the situation does not pass the test, and the person should not be individually blamed.

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<th>Previous Point on Tree</th>
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</tr>
<tr>
<td></td>
<td>Stop.</td>
</tr>
<tr>
<td></td>
<td>Conclusion: This was a reckless violation. Invoking the organization’s disciplinary process is warranted.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### From C5 – system-induced violation (of medical restrictions)

<table>
<thead>
<tr>
<th>'Yes' (passed substitution test)</th>
<th>'No' (failed substitution test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop.</td>
<td>Stop.</td>
</tr>
<tr>
<td>Invoking the organization’s disciplinary process is warranted.</td>
<td>Causal analysis should be used to determine the causes associated with medical restrictions that prompted or influenced the violation.</td>
</tr>
</tbody>
</table>

Any required disciplinary or corrective action toward the individual should take into account that peers would probably not have acted differently in the same situation.

### From C7 – system-induced violation (of adequate expectations)

<table>
<thead>
<tr>
<th>'Yes' (passed substitution test)</th>
<th>'No' (failed substitution test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop.</td>
<td>Stop.</td>
</tr>
<tr>
<td>Invoking the organization’s disciplinary process is warranted.</td>
<td>Causal analysis should be used to determine the type of violation (routine, optimizing or necessary) and the systemic causes that prompted, or influenced the violation.</td>
</tr>
</tbody>
</table>

Any required disciplinary or corrective action toward the individual should take into account that peers would probably not have acted differently in the same situation.

Q10. Were there deficiencies in training, selection, assignment, or experience?

Training provides workers the appropriate behavioral skills, related knowledge, and attitudes needed to perform their job duties. Selection and assignment refer to considerations and processes used to hire
people and assign them specific responsibilities and on-the-job tasks. Experience is knowledge, skill or practice derived from direct observation of or participation in events.

**No** – Go to conclusion C8, and use the information about peers gathered for the substitution test in order to determine if the error was indeed attributable, at least in part, to negligence on the part of the individual.

**Yes** – Go to conclusion C9. Subsequent analysis should be directed at the specific deficiency in order to determine systemic causes.

Q11. **Does the employee have a history of human performance problems?**

Have there been any previous instances where the individual had this performance problem?

Q12. **Was the performance problem self-reported?**

Self-reporting can be in the form of the individual notifying management of an error, or if the individual acknowledged that an error was made when it was identified or pointed out by a supervisor or co-worker.

**Conclusions**

C1. **Intentional act** (not an error) – this was not an error; the behavior is possibly sabotage, malevolent damage, willful violation, etc.

C2. **Substance abuse without mitigation** – company procedures for dealing with instances of substance abuse should be initiated.

C3. **Substance abuse with mitigation** – company procedures for providing mitigation when dealing with instances of substance abuse should be initiated.

C4. **Disregard of medical restrictions** – company procedures for establishing and enforcing medical restrictions should be initiated.

C5. **System-induced violation** – this was a violation of medical restrictions that were not clearly communicated or understood by the employee. However, influences from the system on behavior also need to be evaluated.

C6. **Possible reckless violation** – If the situation passes the substitution test, this type of behavior is more culpable than system-induced violations because of reasonable and correct expectations were available and others (peers) would not have done the same thing in the same situation.

C7. **System-induced violation** – this was a violation that was induced by weaknesses in the system. You should see if the situation passes the substitution test, and then evaluate the system for influences on behavior.

C8. **Negligent error** – This is an appropriate conclusion if another person (peer) would have foreseen and avoided bringing about the consequence. It suggests more individual culpability than a system-induced error. Corrective action should seek to understand why the individual did not recognize the potential consequence and why he/she believed his/her behavior was appropriate for the situation.

C9. **System-induced error** – This was an error provoked by the system in which the individual was working. If there was a deficiency in selection and/or assignment, further analysis should focus on the hiring process. Deficiencies in training or experience should analyze the training and qualification process for the individual’s job position. Other parts of the system should also be evaluated for related causes.
Attachment B

C10. *Blameless error with remediation* – this was an error. However, the behavior (or history of this type of behavior) may warrant some form of remediation to correct it. Determining the performance mode of the error (skill-, rule- or knowledge-based) will serve to indicate the appropriate training or form of remediation needed. Analysis of organizational processes and management/supervisory practices should also be conducted.

C11. *Blameless error* – this was an error; the individual should not be individually blamed. Analysis of organizational processes and management/supervisory practices should be conducted to identify conditions that provoked the error and weaknesses in the defenses that did not mitigate the consequences of the error.