Investigation of Radiation Protection Observation Data at a Nuclear Facility

Michael E. Cournoyer, Leigh Cash (lcash@lanl.gov), and Gerald L. George

Los Alamos National Laboratory, Los Alamos, NM, U.S.A.

1. Introduction

- Programmatic operations at the Los Alamos National Laboratory (LANL) Plutonium Facility (TA-55) involve working with various amounts of plutonium and other highly toxic, alpha-emitting materials.
- The spread of radiological contamination on surfaces, airborne contamination, and excursions of contaminants into the operator's breathing zone are controlled through the Radiological Protection Program.
- A key element of the program is in-field monitoring of radiological conditions, observations, and incidents reports.
- The LANL Radiation Protection Observation System (RPO), supported by the Health Physics Operations Group (RP-1), captures, documents, and records radiological conditions, observations, or incidents that are considered off-normal.

2. Objectives

- Mine the RPO database for glovebox glove event detection data.
- Employ Lean Manufacturing and Six Sigma (LSS) business practices to identify statistically significant variations (trends) in RPO reports.
- Develop an input metric that measure glovebox glove event detection opportunities.
- Incorporate this information into a visual format that TA-55 management can use to make decisions.

| Detection Outcome	Opportunity
Routine Survey	1st
Daily Inspection	2nd
Glovebox Glove Event	3rd
Glovebox Monitor	4th
Hand and Foot Monitor	5th
Personal Contamination Monitor – Model 2 (PCM-2)	6th

3. Methods

- Rank glovebox glove event detection opportunities.
- Validate the variation of glovebox glove event detection opportunities data with an Individual Chart .
- Determine trends with an established criteria.
- Rate Individual Chart performance using the following flow chart:
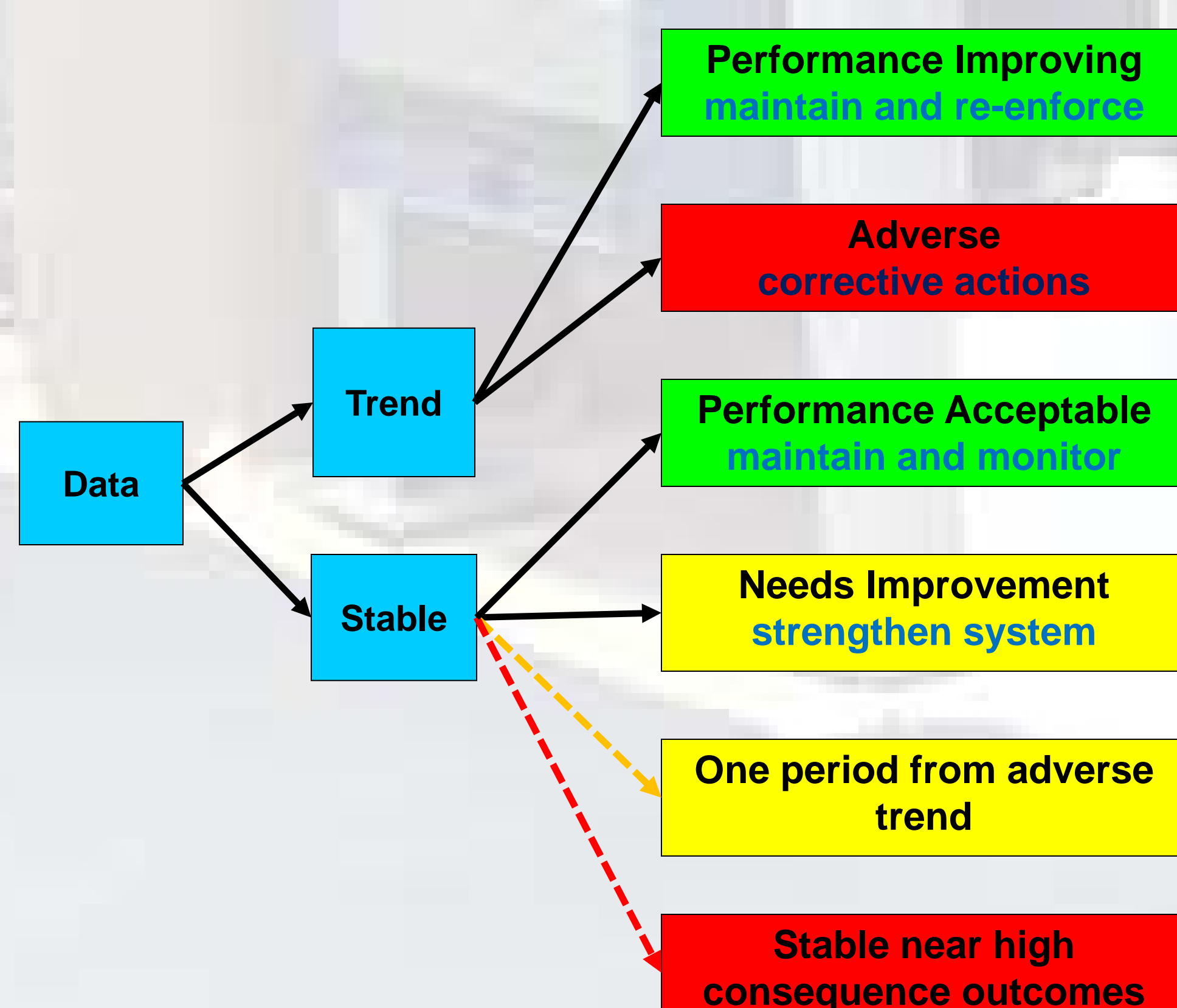
4. Results

Ideally, all glovebox glove events should be detected between the third and fourth opportunity. Detecting an event sooner means that the glovebox glove inspection program is less than adequate. Detecting an event later means that job performance and self-checking standards are less than adequate. The tighter the upper and lower control limits, the more predictable is the performance of glovebox glove event detection.

The average level of opportunity to detect glovebox glove events as of March 2012 is 3.9. The TA-55 Glovebox Glove Event Detection Metric is stable, but needs improvement; strengthen system.
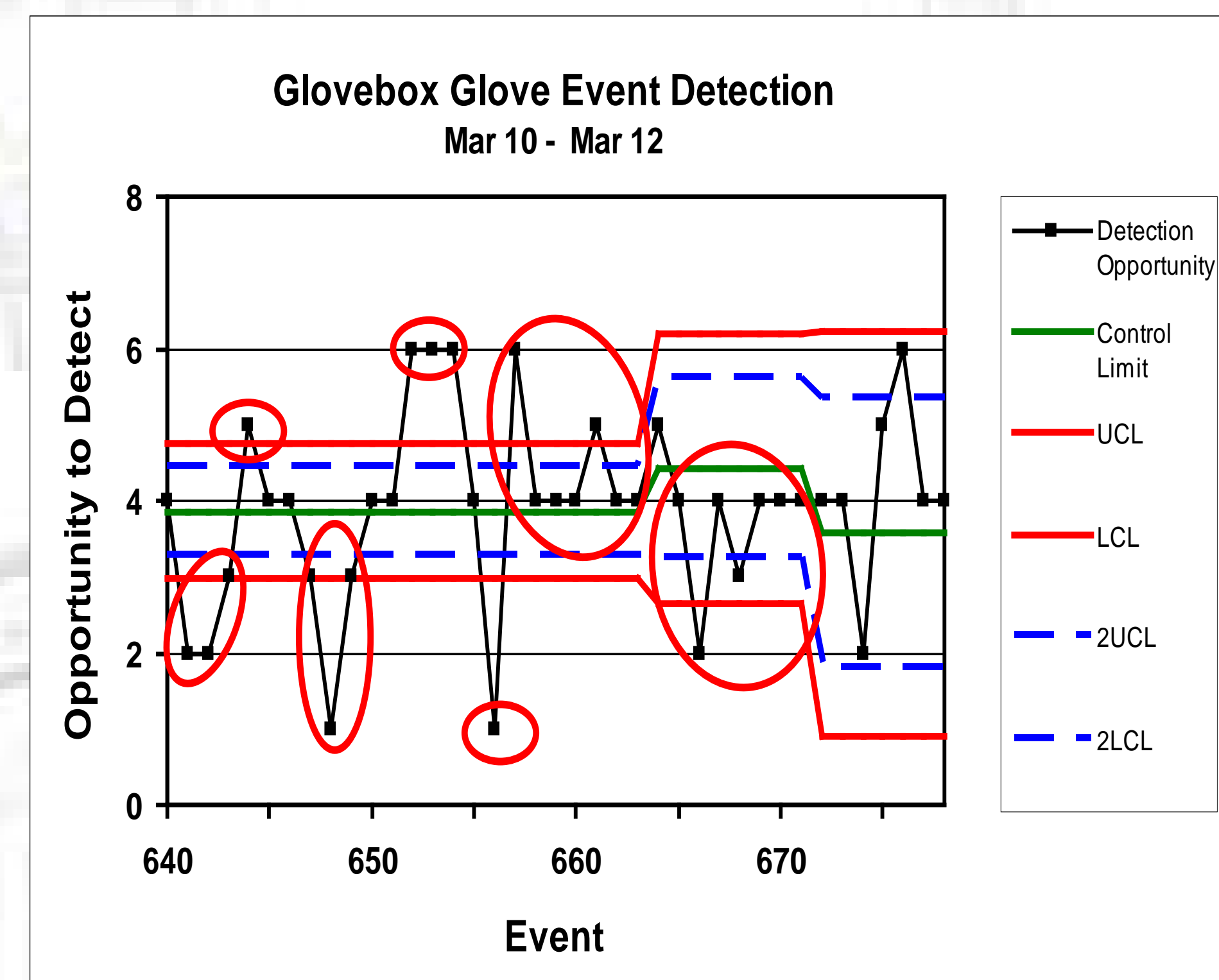

5. Discussion

Five Definitive, two Sigma Zones, and two Pattern trends are observed between March 2010 and 2012. While all trends must be analyzed, Patterns warrant a recalculation of the baseline and control limits. As this metric deviates from the optimum, corrective actions were executed to bring it back into control. Line managers have been informed that the following actions need to be taken:

- Awareness of job performance and self-checking standards will be passed on to the glovebox workers who work in the gloveboxes where glovebox glove events were detected at the PCM-2.
- Awareness of the importance of glovebox glove inspections will be passed on to the glovebox workers who work in the gloveboxes where glovebox glove events were detected by routine surveys.

As low as reasonably achievable protective measures reduce external and internal dose by minimizing time, maximizing distance, using shielding, and using source reduction. Glovebox glove event detection contributes to source reduction, i.e., the sooner a glovebox glove event is detected, the less likely the possibility that a recordable outcome significant to TA-55 management or external regulators will occur.

TA-55's defense-in-depth is TA-55's built-in capacity to detect or prevent errors without suffering undesirable consequences, i.e., TA-55's "safety envelope." Redundant defenses improve safety margins, but also increase complexity. Flawed defenses and safety hazards become more difficult to detect. Without quality trending, defenses can degrade or be eliminated over time. In this regard, trending of the glovebox glove event detection performance indicates the effectiveness of TA-55 management initiatives.
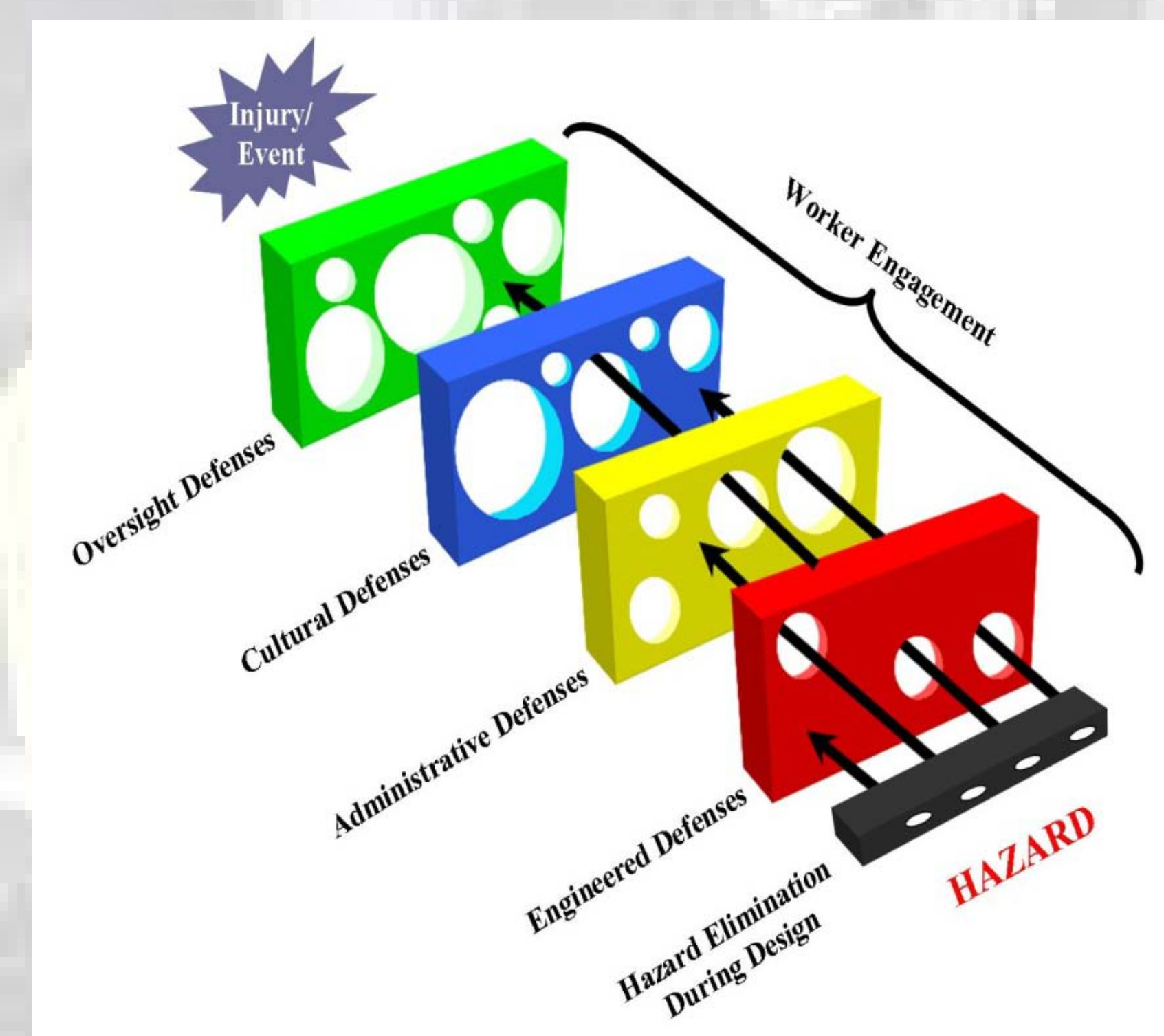
6. Conclusions

Data generated from RPOs supports the TA-55 Radiation Protection Program by establishing processes that methodically identify and eliminate the causes of flawed defenses. Employing LSS, trends can be identified in glovebox glove event detection data. This increases technical knowledge and augments operational safety.

LA UR 12-10325