

THE CASE OF THE RUNAWAY FILTER

(Partial Phoenix Analysis)

by

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Introduction

This is an analysis for the Fifth Annual Human Performance/ Root Cause/ Trending Workshop held in Kansas City, Missouri , May 24-28, 1999. This particular analysis is based on The Phoenix Handbook by W. R. Corcoran, PhD, PE, Nuclear Safety Review Concepts Corporation.

The basic event is a loss of positive control of a radioactive filter that had been removed from a radwaste system. The filter was placed in the auxiliary building elevator and dispatched to another level of the auxiliary building without escort (inappropriate for a “radioactive” item) or personnel posting at the terminal level (inappropriate for a “highly radioactive” item). Behaviors of the lead radiation safety technician (RST) and another RST (job observation RST) were necessary to cause the event. There were no radiation safety dose consequences, but the significance of the event was appreciable because of what the event revealed about a work culture that management had been trying to improve.

This is a partial Phoenix Analysis. It is intended only to illustrate the methods actually applied.

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EVENT SUMMARY

(provided by S. M. Davis, BGE)

On the morning of February 8, 1999, #11 Miscellaneous Waste Prefilter was changed out by mechanical maintenance personnel. The job took place on 27' level of the Auxiliary building.

A pre-job briefing was held at about 0830. In attendance at the pre-job briefing were three mechanical maintenance personnel, two radiation safety technicians (RST) (the lead RST for the job and the 27' Auxiliary building level RST), and one maintenance General Supervisor, who was observing the job.

All personnel interviewed agreed the pre-job briefing went well with one exception. The briefing was held in the 69' contractor break room, consequently, it was interrupted several times by personnel taking their break, eating breakfast etc.

During the pre-job briefing, one mechanic had a question about the requirement for notifications to the control room and the Radiation Control supervisor, prior to moving high rad material. The Lead RST checked the procedure, conferred with the Radiation Control Shift Supervisor (RCSS), and verified that a notification was required for movement of high rad material per procedure RSP-1-111 (Identification and Control of Radioactive Material).

After the pre-job briefing, the job proceeded normally. The prefilter was removed from its housing, surveyed, and placed into a storage container. Survey data is as follows:

- 420 mrem/h contact on bare prefilter 150 mrem/h at 30 cm
- 180 mrem/h contact on storage container 70 mrem/h at 30 cm

The 27' Auxiliary building level RST assisted the lead RST during the prefilter replacement. She then returned to her normal level RST duties while the lead RST prepared to transport the prefilter to the 45' level.

The lead RST properly completed a serialized Radioactive Material (RAM) tag and placed it on the container. The prefilter was placed on a cart for transport to the 45' level of the auxiliary building. The lead RST also made the notification of a pending high rad movement to the control room and had previously notified the RCSS, even though the container did not meet the requirements for high rad. (100mrem/h at 30cm vs. actual reading of 70 mrem/h at 30 cm)

The lead RST had asked a second RST¹ who was performing a job observation of the prefilter replacement, to hold the elevator while he went to get the filter. The lead RST and one of the mechanics pushed the cart containing the filter, into the elevator, and were preparing to accompany it to the 45' level. The second RST questioned the lead RST about riding the elevator to the 45' with the prefilter. He had heard the announcement about the pending high rad movement, and he was aware that the Special Work Permit (SWP) specifically written for movement of high rad waste, prohibited riding in the elevator with the prefilter. The second RST was not aware the prefilter did not actually meet the criteria of high rad. He believed an SWP violation was about to take place. The second RST suggested the correct way to proceed would be to send an RST to the 45' to await the prefilter, then sending the prefilter alone to the 45' level. The second RST then disappeared from view.

The lead RST assumed the second RST was going to the 45' level to standby to receive the prefilter. The second RST had no intention of becoming involved in the performance of the job since he was not on the proper SWP, nor had he attended the pre-job briefing.

The lead RST exited the elevator, containing the prefilter, and allowed it to proceed to the 45' level. Upon entering the 27' hallway, he observed the second RST standing there. He immediately realized no one was waiting on the 45' for the prefilter, so he ran up the stairs to the 45' level.

The maintenance General Supervisor who had observed the job had already gone up the stairs to the 45' level, and was at the elevator when the lead RST arrived. The elevator doors were already closed, and the frisker at the elevator was alarming. The lead RST attempted to open the elevator doors, but could not. He then asked the 45' level RST to notify all Auxiliary building level RSTs via radio, of what had happened, and requested them to proceed to the elevator on their level, to intercept the prefilter, should it stop there.

The second RST ran up the stairs to the 69' level, and determined the prefilter was not there. He then ran down to 27' level and notified the level RST to stand by the elevator in case the prefilter stopped there.

He proceeded to the 5' level, and there he met two electricians who found the prefilter when the elevator doors opened. They immediately knew something was not right. They read the serialized RAM tag to determine dose rates on the container. One electrician held the elevator doors to prevent it from moving to another level, while the second electrician went to notify the 5' level RST of the situation. The second RST arrived on 5' level about

¹ The RST identified as the second RST was not part of the assigned work crew and not present at the pre-job briefing

3 minutes after the electricians found the prefilter. He instructed them to stand back from the elevator door, and allow the elevator to proceed to the 45' where the lead RST was waiting for it.

The elevator containing the prefilter, returned to the 45' level. The lead RST removed the prefilter from the elevator. He took it to the designated storage location in the 45' Solid Waste room, and locked it behind the rail car pit door.

This event resulted in numerous violations of Administrative procedure RP-1-300 (Radiation Safety Section Conduct of Operations), concerning supervisory oversight, communications, and stop work/backout criteria. This event also presented the potential for a violation of procedure RSP-1-104 (Area Posting and Barricading), by allowing an unposted radiation area to exist in the elevator for approximately 5 minutes. It does not appear procedure RSP-1-104 was actually violated, because all levels of the Auxiliary building where the prefilter traveled unescorted were actually posted as a "Radiation Area". If it would have traveled to the 69' level, there would have been an unposted radiation area there.

Note: This event occurred after the closure of a recent NRC Confirmatory Action Letter (CAL) on the station's radiation protection program. The CAL was issued after several significant radiation protection related events in 1996 and 1997.

PARTIAL PHOENIX ANALYSIS

The Comparative TimeLine

The Comparative TimeLine is a tabular representation of the information in the event narrative above together with the analyst’s determination of what should have happened (corresponding functional behavior), the immediate result of the actual behavior, and the significance of the behavior to the ultimate outcome. This is the most crucial mechanistic step of the Phoenix Approach. All that follows the Comparative TimeLine depends on it.

Business is about consequences. Consequences are influenced by behaviors and conditions. The Comparative TimeLine captures the behaviors and conditions in a way that promotes subsequent analysis.

Comparative TimeLine				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
Note: The event was loss of positive control of a radioactive material shipment. The radioactive filter inside a storage container was in an elevator in motion without an escort and without personnel stationed at the terminal floor elevation. This was not a desirable situation for any station, but would be particularly disturbing if the station had, in recent years, received a civil penalty for radiation safety problems and/or had received a Confirmatory Action Letter related to radiation safety issues. This event may indicate disappointing results for radiation safety performance improvement efforts if they had been in effect. This event had no radiation safety consequences, but is of great radiation safety significance. Note: This analysis was based on information provided to the analyst almost two months after the event with no opportunity to validate, clarify, or enlarge.				
2/8/99 0830	Pre-job Brief. Attendees: Three (3) Mechanical Maintenance personnel, Lead Radiation Safety Technician (RST) , 27’ Level RST, Maintenance General Supervisor (GS)	Job Observation RST should have attended briefing.	Potential missed opportunity to 1) notice missing element from briefing and 2) notice the beginning of the potential “high rad” mindset.	Potential missed opportunity to head off problem.

Comparative TimeLine				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
<p>Note: There were two job observers, the Maintenance General Supervisor (attended briefing) and the Job Observation RST (not at briefing). Note: We do not know the extent to which records of post-job critiques of previous instances of similar jobs were available or were reviewed prior to the pre-job brief.</p>				
2/8/99 0830	Job Observation RST is not at briefing.	Job Observation RST should have been at briefing.	Job Observation RST does not note failure to discuss differences in expectations for rad versus high rad prefilter storage container.	Missed opportunity to head off problem.
<p>Note: As the event unfolds the reader will see that if there had been no Job Observation RST there would probably have been a “conservative” announcement error, but probably no “event”. The avoidance of the event would have been because, if the Job Observation RST had been at the brief there would have been a chance to anticipate the problem.</p> <p>Observations: 1. There should be a special coding for events whose causation involves oversight activities. 2. There should be a “Hypocratic” oath for oversight personnel that starts like the doctors’ Hypocratic Oath: <i>Primum non nocere</i> (First, do no harm.) 3. (Lesson to be Learned) : Job observation personnel should be required to observe the whole job from brief to closeout, not just pieces of it. 4. Station should consider a written procedure for job observations that is appropriate to the circumstances. 5. There should be a training module for job observation personnel to keep them from becoming a part of the problem. Lesson to be learned: Job Observation personnel should attend the briefing for the job they are observing.</p>				
2/8/99 0830	Briefing in contractor break room repeatedly interrupted personnel taking breaks and eating breakfast.	Brief should have been held at time/place where it would not have been interrupted.	Increased probability for brief defects.	Extraneous condition adverse to quality.
<p>Note: This Extraneous Condition Adverse to Quality is probably worth a “Gold Card” or an Issue Report. We cannot tell if things would have gone differently with a better environment for the briefing. We do know that poor briefing environments correlate with defective briefings, but the cause-effect relationship is not established. Lesson to be learned: If you are involved in a brief in an unacceptable environment you should call it to the attention of the person in charge. Observation: We do not know why the contractor break room was selected.</p>				

Comparative TimeLine				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
2/8/99 0830	Briefing does not consider the differences between what will be done if prefilter in storage container is “high rad” vs. “rad”.	Briefing should have considered the differences between what will be done if prefilter in storage container is “high rad” vs. “rad”.	Decisions left for later in the process.	Missed opportunity to head off problem.
<p>Note: This was a key occurrence. If the team had thought this difference through they would not have made the high rad announcement, the Job Observation RST would not have had the wrong impression and would not have asked the question about riding the elevator, and the event would not have happened. Unanswered questions: What is it about the expectations for a pre-job brief that allowed the omission of consideration of the decision branch? What is it about the way job observers are trained that allows them 1) to excuse themselves from the briefing (Job Observation RST) or 2) miss the omission of a branch point (Maintenance GS)?</p> <p>Key lesson to be learned: Cover reasonably expected contingencies in pre-job briefs.</p>				
2/8/99 0830	Maintenance GS does not remark that the briefing does not consider the differences between what will be done if prefilter in storage container is “high rad” vs. “rad”.	Maintenance GS should have remarked that the briefing does not consider the differences between what will be done if prefilter in storage container is “high rad” vs. “rad”.	Decisions left for later in the process.	Missed opportunity to head off problem.
<p>Note: The Maintenance GS probably was not knowledgeable enough about RS matters to pick up this subtlety. That is a problem with having non-expert job observers. Non-expert job observers sometimes do notice things that experts wouldn’t notice. The trade-offs are not crystal clear.</p>				
2/8/99 0830	Mechanic asks about notifications before material moves.	OK (Notification should probably have been covered in the basic briefing.)	Lead RST confirms that notification is required prior to move of high rad material.	Missed opportunity to head off problem by clarifying the difference between “rad” and “high rad”.
2/8/99 0830	Lead RST covers requirement for “high rad” notifications, but does not cover the “rad” case.	Lead RST should have also covered what will be done if the storage container turns out to be only rad (not high rad).		Missed opportunity to head off problem by clarifying the difference between “rad” and “high rad”.
<p>Note: This may have established the mindset that the storage container would be high rad. We can’t tell.</p>				

Partial Phoenix Analysis (Comparative TimeLine, Missed Opportunity Matrix, Why Staircase Dendrograms, Causal Influence Matrix, and Safety Break Tailboard Discussion Topics) **for # 11 Miscellaneous Waste Prefilter Loss of Positive Control** (This work was sponsored by the Nuclear Safety Review Concepts Corporation. © 1999 W. R. Corcoran, NSRC Corporation.)

Comparative TimeLine				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
2/8/99 0830	No one asks what will be done if the storage container turns out to be only rad (not high rad).	Someone should have asked what will be done if the storage container turns out to be only rad (not high rad).	It is now unclear what the rules are.	Missed opportunity to abort event.
2/8/99	Prefilter removed, surveyed, and placed in storage container.	OK	OK	The problem marches on.
2/8/99	Survey results in storage container being rad (not high rad), i.e., dose rate at 30cm is less than 100mrem/hr.	OK	OK	The problem marches on.
Note: If the storage container had been handled as rad (not high rad) the event would not have happened. Lessons to be learned: 1. "Conservative" is not necessarily better. 2. Variation is the enemy of quality. (Handle all rad items the same way. Handle all high rad items the same way. Don't mix them up.)				
2/8/99	27' Level RST leaves the job and returns to normal duties.	27' Level RST should have asked the Lead RST for permission to withdraw from the briefed task before the task was complete. Lead RST should have thought it through before granting the request. Lead RST may have granted permission anyway.	Now there are not enough RSTs to handle a high rad job. If you have a high rad elevator move you need an RST at the starting elevation and one at the terminal elevation.	This set the stage for the event.
Note: Just leaving a task without asking permission of the task leader seems like an infraction of "High Hazard Industry 101". This should be covered in job task leader training and in basic trade training. One does not just leave a post of duty. Lesson to be Learned: The person in charge of a task should establish and maintain positive control of who is working on the task. They should not allow unofficial joining of the task or uncontrolled leaving of the task.				
2/8/99	Lead RST makes notifications of high rad movement.	Lead RST should not have made notifications since it was not a high rad movement.	Job Observation RST thinks it is a high rad movement. There are not enough RSTs to handle a high rad movement.	Key occurrence. The event marches on.

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Comparative TimeLine				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
<p>Note: If the notification, which was not required, had not been made the event would not have happened. Lesson to be Learned: “Conservative” is not always safe or proper.</p> <p>Note: The Lead RST probably had positive intent when he asked for the high rad announcement. He may have been influenced by management emphasis on conservative decision making.</p> <p>Note: It would be a serious error to call this “the root cause”. It is only one of a number of dysfunctional behaviors and is undoubtedly caused by deeper more important underlying issues.</p>				
2/8/99	Job Observation RST does not read survey.	Job Observation RST should have read survey.	Job Observation RST does not notice his own “fatal” error. If Job Observation RST had read the survey he would have known that 1) it was ok to ride the elevator with the filter and 2) that the announcement was ‘conservative’ (but wrong).	The event marches on. Job Observation RST becomes part of the problem. Missed opportunity to prevent the event.
<p>Note: When the Job Observation RST hears the announcement he assumes that the announcement is correct and appropriate, i.e., that a high rad transportation is going to go on. Having made this assumption he sets himself up to believe that it is inappropriate to accompany the cart in the elevator. This is the fatal error that makes the situation almost unrecoverable. The final error that the Job Observation RST makes, as we will see, is to “correct” the job without stopping it. One wonders if there is a reluctance to stop jobs to explore perceived problems. Lesson to be Learned: It is better to stop a job when a discrepancy is noticed than to try to rectify the discrepancy on the fly. (In this case there was a discrepancy, but not the one the Job Observation RST thought existed. The discrepancy was in the announcement, not the elevator accompaniment.)</p>				
2/8/99	Lead RST asks Job Observation RST to hold elevator while Lead RST gets filter.	People doing oversight should not be asked to join the activity they are overseeing.	Job Observation RST becomes a helper, not an overchecker.	The event marches on. Job Observation RST becomes part of the problem.
<p>Note: When an oversight person helps the activity being overseen, independence is lost. Also, when an oversight person is needed in a job it is clear that the job was not properly staffed, a condition that the oversight person should note as a condition adverse to quality.</p>				

Comparative TimeLine # 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
	Job Observation RST holds elevator.	People doing oversight should not join the activity they are overseeing.	Job Observation RST becomes a helper, not an overchecker.	The event marches on. Job Observation RST becomes part of the problem.
	Job Observation RST fails to stop job he perceives to be understaffed.	Job Observation RST should have stopped the job rather than relinquish his role as Job Observation RST.	Discrepancy is not resolved.	Missed opportunity to abort the event.
Note: If it was a high rad item, as the Job Observation RST thought, the job was understaffed. If it was a rad item, as the Lead RST knew, the job was not understaffed. A fatal error was “correcting” the situation on the fly rather than stopping the job.				
	Lead RST and mechanic push the cart holding the filter (in the storage container) into the elevator and indicate that they are going to accompany it to the 45’ level.	OK	--	The event marches on.
Note: It is acceptable to accompany radioactive material in an elevator but it is not acceptable to accompany high radiation materials in an elevator.				
2/8/99	Job Observation RST remembers hearing high radiation announcement.	OK, given what he knew.	Job Observation RST thinks that an SWP violation is about to take place.	The event marches on.

Comparative TimeLine				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
Note: If the Job Observation RST had read the survey he would have known that it was OK to accompany the filter and may have been sharp enough to notice that the announcement was in error, but that the rest of the job was going acceptably.				
2/8/99	Job Observation RST questions the Lead RST's decision to accompany the filter in the elevator.	OK, given what he knew.	This calls the original intended plan into question.	This causes the event.
	Job Observation RST does not issue verbal Stop Work Order or Work Hold.	Job Observation RST should have issued verbal Stop Work Order or Work Hold and had the cart removed from the elevator.	On the spot job plan change is prompted.	Missed opportunity to prevent the event.
Note: If the Job Observation RST had not been there at all the only "event" would have been an erroneous ('conservative') announcement. The behavior of the Job Observation RST was part of the causation of the event.				
	Job Observation RST suggests sending the filter up to the 45' level unaccompanied and having another RST meet it there.	Job Observation personnel should not give advice or direction without stopping the job and writing an Issue Report.	The Lead RST treats the Job Observation RST as a part of the work team even though the Job Observation RST has no intention of playing that role.	The event marches on.
Note: What training do Job Observation personnel receive? Do they know enough to avoid causing events by harmful kibitzing? Not in this case.				
	Lead RST accepts Job Observation RST's advice, but does not discuss the change in tactics with the rest of the team.	Lead RST should have stopped the job and regained positive control. The change should have been deliberately managed.	Previous "game plan" is abandoned. New game plan is not explained to team.	This was the next to last missed opportunity to abort the event.
	Job Observation RST leaves the job scene without discussing his intentions.	Job Observation RST should have said what he was doing.	Lead RST assumes that the Job Observation RST is headed for the 45' level to carry out his own suggestion.	Trigger for fatal error.
Note: Lead RST should have known that Job Observation RST was not signed in on the SWP for this job and should not have been part of it.				

Partial Phoenix Analysis (Comparative TimeLine, Missed Opportunity Matrix, Why Staircase Dendrograms, Causal Influence Matrix, and Safety Break Tailboard Discussion Topics) **for # 11 Miscellaneous Waste Prefilter Loss of Positive Control** (This work was sponsored by the Nuclear Safety Review Concepts Corporation. © 1999 W. R. Corcoran, NSRC Corporation.)

Comparative TimeLine				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
	Lead RST assumes that the Job Observation RST is headed for the 45' level to meet the filter.	Lead RST should have asked Job Observation RST what the intentions were.	Lead RST exits elevator, allowing elevator to go to ordered level (45').	This was the last missed opportunity to abort the event.
Note: This was a classic "facilitative assumption", an assumption that facilitated keeping the job in motions without reflecting on what was actually going on.				
	Lead RST exits elevator, allowing elevator to go to ordered level (45').	Lead RST should have had rad shipment removed from elevator. Should have held interim critique and rebrief of job with new information.	Unaccompanied rad item headed for an unstaffed destination. Procedure violation.	This is the event. Loss of positive control of rad material shipment. Procedure violation.
	Lead RST enters 27' hallway.	OK	Lead RST sees Job Observation RST and concludes that there is no one to meet the rad item at the 45' level.	Event is manifested.
Note: Consider the awkward situation that now exists because of two RSTs both doing what they think is correct or conservative. Is this typical of the culture? Why do people not talk to each other more? What's wrong with this picture?				
	Lead RST runs up the stairs to the 45' level.	Lead RST should have called the Control Room and asked to have an announcement made to stay clear of the elevator at all levels because of a rad item out of control.	Delay in responding to the problem.	The event marches on.
	When Lead RST reaches 45' level he finds the Maintenance GS already there, the frisker in alarm, and the elevator shaft doors closed.	OK	--	
	Lead RST tries to open elevator shaft doors.	OK	--	The event marches on.

Comparative TimeLine				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
	Lead RST requests 45' level RST to radio notify all Auxiliary Building RSTs to proceed to elevator and intercept the rad item.	OK	45' level RST does as requested.	The event is coming to a close.
	Job Observation RST runs to 69' level. Determines that filter is not there.	OK	--	--
	Job Observation RST runs to 27' level and notifies the 27' level RST to stand by elevator in case the filter stops there.	OK	--	--
	Job Observation RST proceeds to 5' level.	OK	--	--
	Two electricians at 5' level notice the prefilter when the elevator doors open. Read the RAM tag to check dose rates. One holds elevator while other notifies 5' level RST.	OK	Control of the radioactive material is regained.	Event is coming to an end.
	Job Observation RST at 5' level finds the two electricians. He asks them to let the elevator go to the 45' level.	OK	Radioactive material is sent to intended intermediate destination.	Event continues to be controlled.

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Comparative TimeLine				
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When	What did happen	What should have happened	Immediate Result (Consequence)	Significance (Impact on Final Consequences)
	Lead RST at 45' level removes prefilter cart and properly handles it from here on.	OK	End of event.	End of event.
Note: So far nothing has been said about root causes.				

Missed Opportunity Matrix

The Missed Opportunity Matrix captures and displays the opportunities various individuals had to do things that would have decreased the actual consequences of the event. The purpose of the Missed Opportunity Matrix is to allow people to learn how different ordinary behaviors could have influenced the outcome of the event.

Missed Opportunity Matrix # 11 Miscellaneous Waste Prefilter Loss of Positive Control				
Who	Situation	Opportunity (action)	Expected Result	Impact on Consequences
Radiation Safety Management	Setting and/or reinforcing expectations for Job Observations.	Better set and/or reinforced expectations for RS Job Observers and/or non-RS Job Observers (i.e., Maintenance GS).	No missed opportunities for Job Observation RST or Maintenance GS when acting as a Job Observer.	No event.

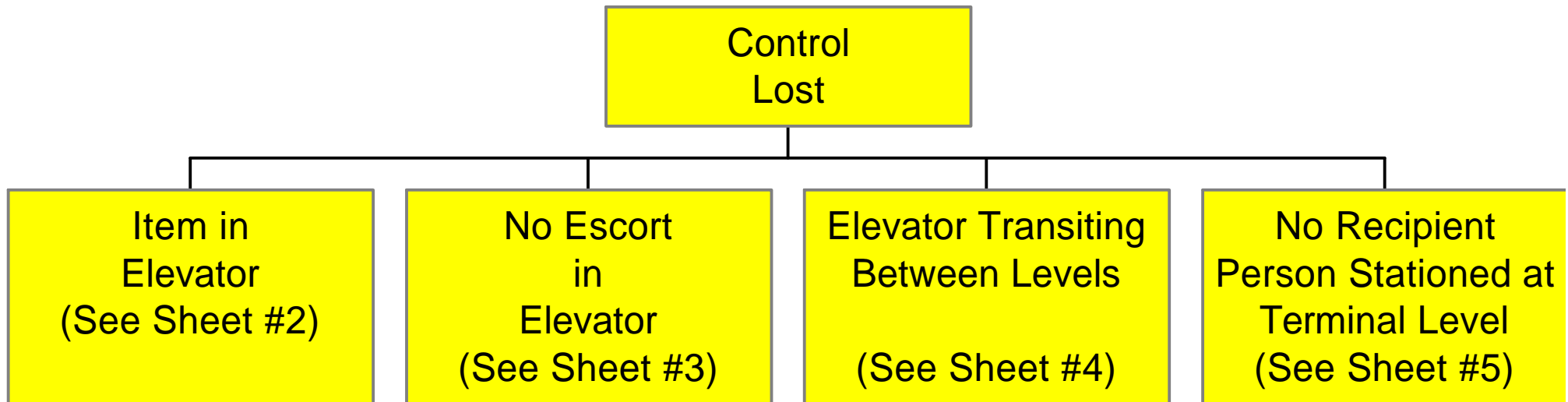
Missed Opportunity Matrix				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
Who	Situation	Opportunity (action)	Expected Result	Impact on Consequences
Radiation Safety Management	Setting and/or reinforcing expectations for task command and control.	Better set and/or reinforced expectations for 1) pre-job briefings content, 2) pre-job briefing environment, 3) control of task team membership, 4) asking Job Observers to help in tasks, 5) responding to Job Observer comments and concerns, 6) recognizing and responding to understaffed situations, 7) inconsistent application of conservatism (notification but not escorting).	Better Lead RST and Job Observation RST performance.	No event.
Lead RST	Pre-job Brief	Discuss the differences between the way the filter would be handled if it were “rad” versus “high rad”.	No discrepancy with notification, no apparent discrepancy with in-elevator escort.	No event.
Job Observation RST	Pre-job Brief	Attend Pre-job Brief	Notice the failure to discuss the branch contingency as to how the filter would be handled if it were “rad” rather than “high rad”.	No event.

Missed Opportunity Matrix				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
Who	Situation	Opportunity (action)	Expected Result	Impact on Consequences
Maintenance GS	Pre-job Brief	Notice disruptive environment for briefing.	Move brief to a better time and place.	Potential for having more effective brief.
Maintenance GS	Pre-job Brief	Notice the failure to discuss the branch contingency as to how the filter would be handled if it were “rad” rather than “high rad”.	Have failure corrected.	No event.
Mechanical Maintenance Personnel	Pre-job Brief	Notice the failure to discuss the branch contingency as to how the filter would be handled if it were “rad” rather than “high rad”.	Have failure corrected.	No event.
Lead RST	Time of notification.	Either not make the (unrequired) notification or indicate the the notification was a “courtesy notification” of a radioactive item movement and not a required notification of a high radioactive item movement.	Job Observation RST would not have intervened at elevator.	No event.
Job Observation RST	After radiation survey of item.	Read survey. Notice that it was only “rad”.	Job Observation RST would not have intervened at elevator.	No event.
Job Observation RST	At 27’ Level Elevator	Decline to hold elevator. (Decline to assist in a task that he was supposed to be observing.)	Opportunity to discuss situation calmly while the elevator was not being held up.	Potential of better resolution of notification discrepancy.

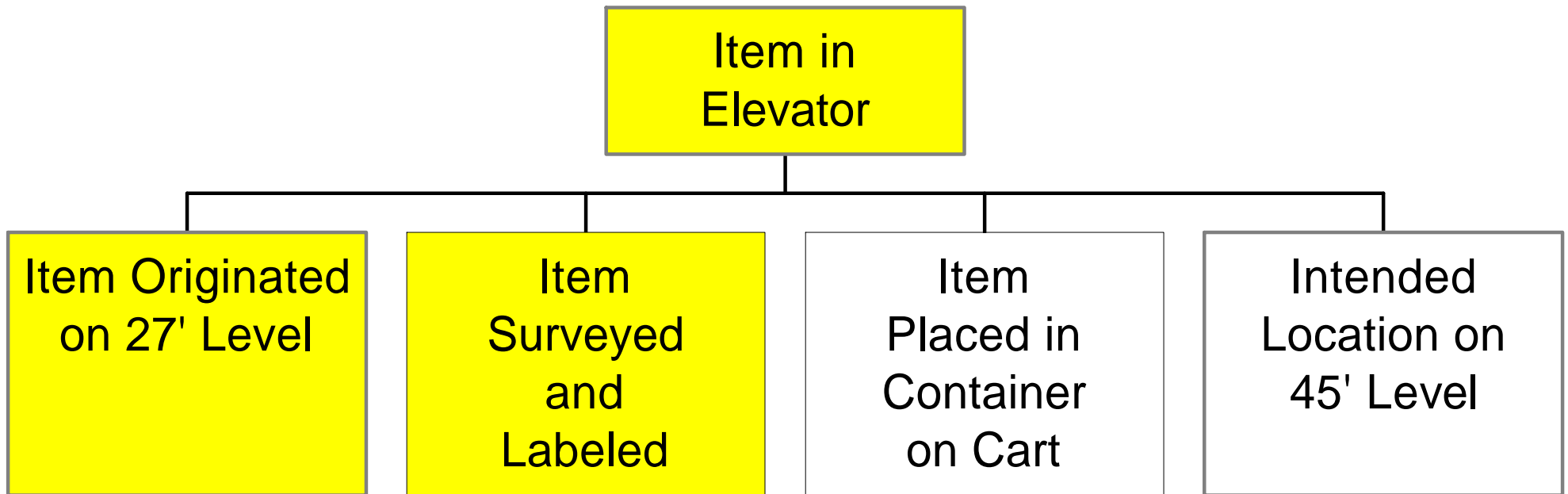
<p align="center">Missed Opportunity Matrix # 11 Miscellaneous Waste Prefilter Loss of Positive Control</p>				
Who	Situation	Opportunity (action)	Expected Result	Impact on Consequences
Job Observation RST	At 27' Level Elevator	Stop the job because it was understaffed. There were not enough people to send the item up on the elevator from the 27' level and meet it at the 45' level.	Notification/ survey discrepancy would have been surfaced.	No event.
Job Observation RST	Job Observation RST questions Lead RST's decision to accompany the item movement.	Stop the job because their was a perceived incipient violation of the SWP.	Notification/ survey discrepancy would have been surfaced.	No event.
Lead RST	Receiving advice from RST.	Realizing that this was a change of plan.	Stop the job and consider the effects of the change. These effects included the need to have another person on the 45' level to receive the item.	No event.
Job Observation RST	Leaving the elevator lobby without discussing intent.	Telling the Lead RST that the Job Observation RST was simply exiting the observation.	Lead RST would not have assumed that Job Observation RST was going to the 45' level.	No event.
Lead RST	Assuming that the Job Observation RST was going to the 45' level to meet the item.	Not assuming that a Job Observation person would join his team.	Stop the job and consider the effects of the change. These effects included the need to have another person on the 45' level to receive the item.	No event.

Why Staircase Trees (Dendrograms)

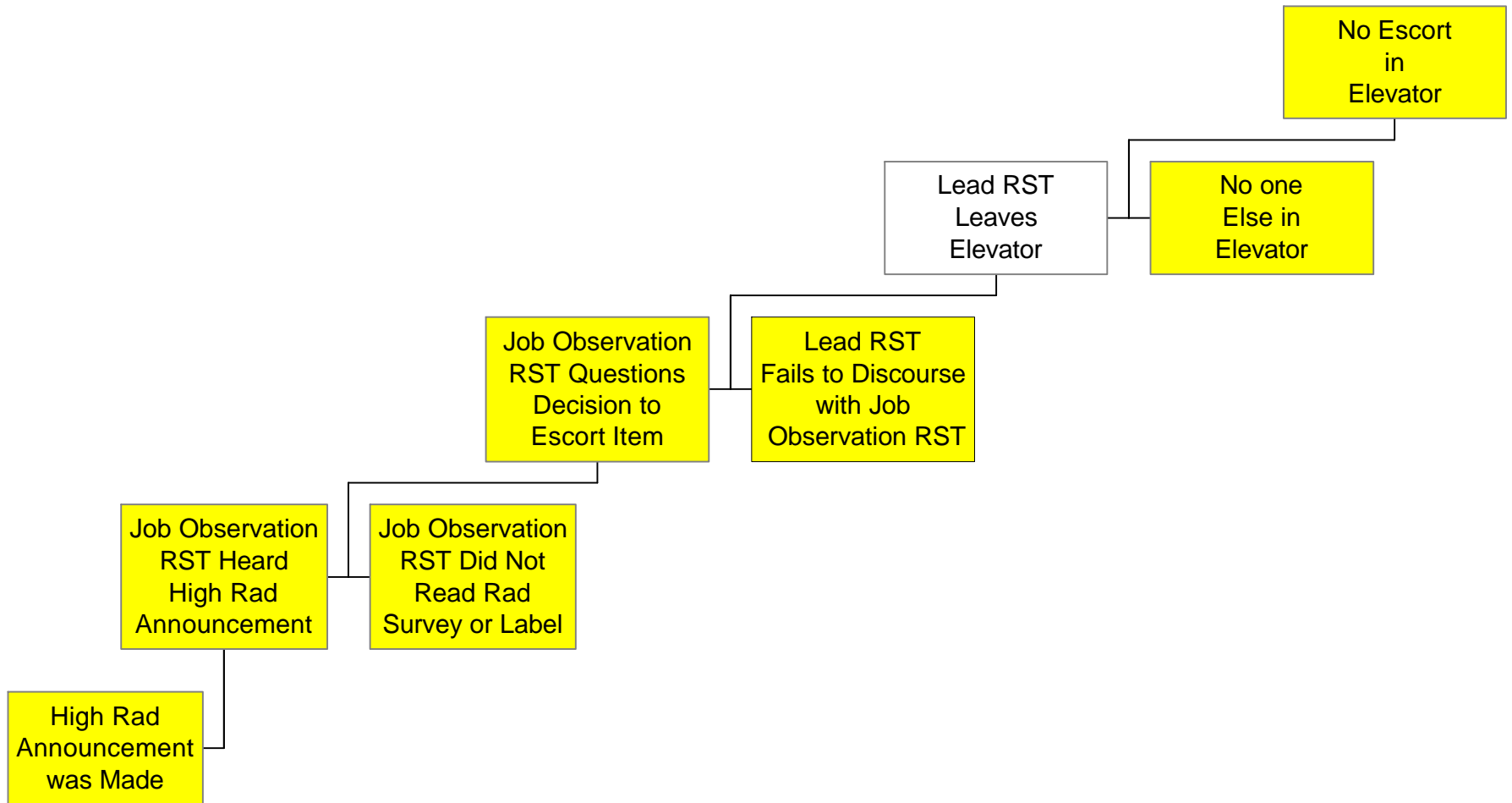
Loss of Positive Control of Radioactive Item (Sheet #1)



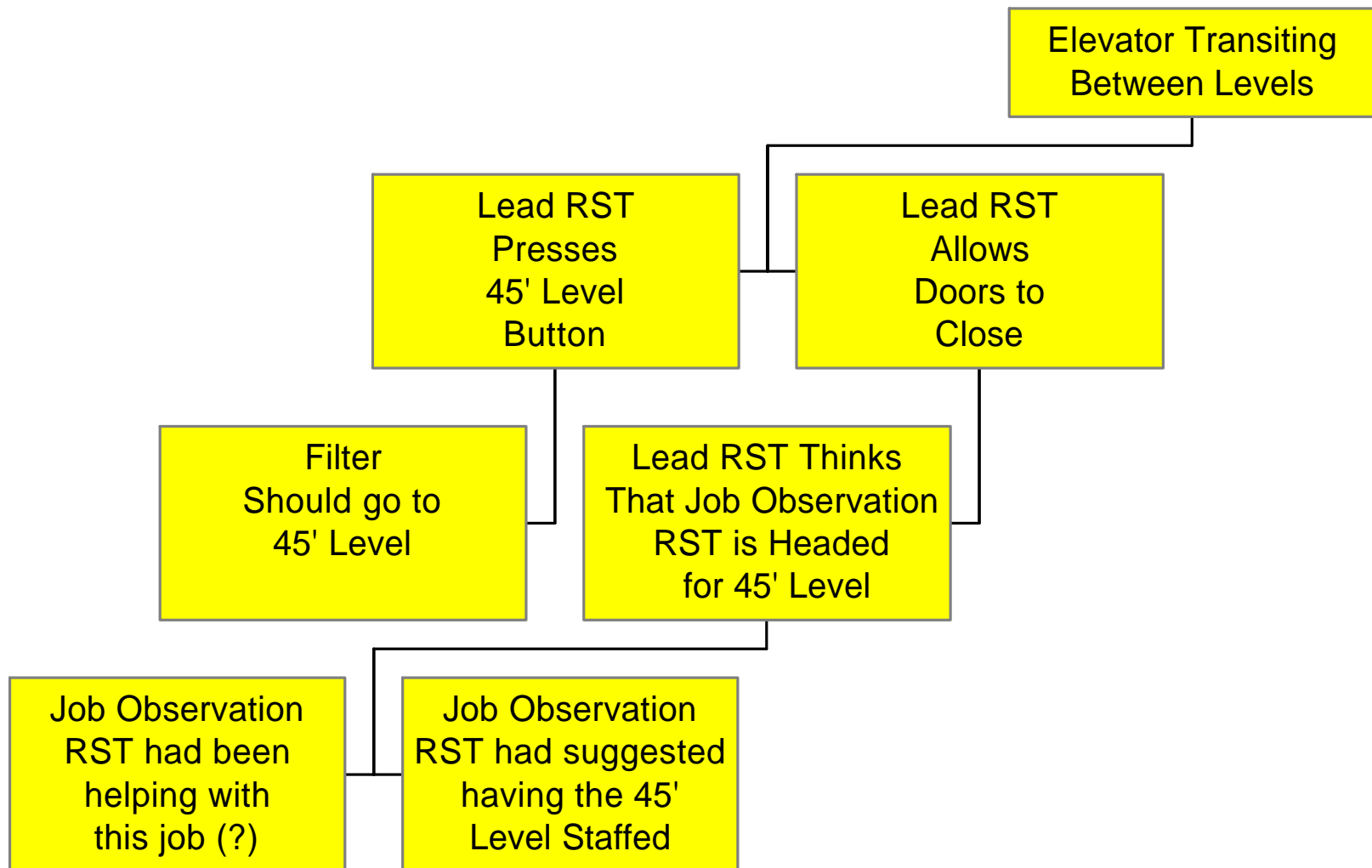
Loss of Positive Control of Radioactive Item (Sheet #2)



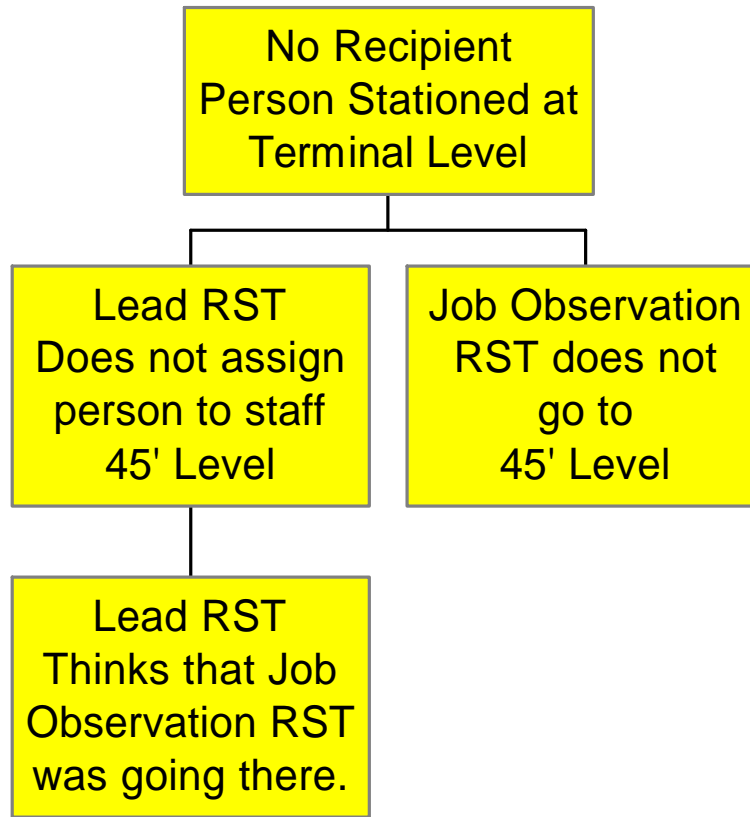
Loss of Positive Control of Radioactive Item (Sheet #3)



Loss of Positive Control of Radioactive Item (Sheet #4)



Loss of Positive Control of Radioactive Item (Sheet #5)



Causal Influence Matrix

The Causal Influence Matrix provides a tabular answer to the question, “What influenced the consequences of the event?” What influenced the consequences are those factors that 1) set the stage for the event, 2) triggered the event, 3) made the consequences as bad as they were, and 4) kept the consequences from being worse. Notice that asking what influenced the consequences demands a different answer than asking what caused the event.

Causal Influence Matrix				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
Vulnerability	Trigger	Exacerbation	Mitigation	Remarks
	Need to change out prefilter. (Sequence initiator.)			Not likely corrective action topic.
Pre-job brief disrupted by break room activities.				Likely corrective action topic. Influence not definite. Could be extraneous condition adverse to quality. HHI 101
Note: The disrupted brief, like many other factors of this event, could be indicative of inappropriate high hazard industry behavior expectation, i.e., “High Hazard Industry 101”. These will be marked as HHI 101.				
Job Observation RST not at pre-job brief.				Likely corrective action topic. Influence not definite. Could be extraneous condition adverse to quality. HHI 101
Pre-job brief does not cover the differences between what will be done if the filter is “rad” versus “high rad”				Likely corrective action topic. HHI 101 (Pre-job brief should cover branch point contingencies.)
		Maintenance GS does not notice pre-job brief omission even after question from mechanic.		Likely corrective action topic. HHI 101

Causal Influence Matrix				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
Vulnerability	Trigger	Exacerbation	Mitigation	Remarks
	Announcement notification is made appropriate to “high rad” but item is only “rad”. (Event initiator.)			Likely corrective action topic. HHI 101 (Either do exactly what is required or make the whole job consistent with the conservative decision.) (It is often worse to be “half conservative” than to just do the bare requirements.)
		Job Observation RST does not read rad survey or item label.		Likely corrective action topic. HHI 101
		Job Observation RST assumes that Lead RST is about to violate SWP. Does not check it out with Lead RST.		Likely corrective action topic. HHI 101 (A good job observation rule would be to check out perceived dysfunctional behaviors before assuming they are wrong. This rule would have to be situational.)
		27’ RST leaves prefilter task and returns to normal duties without requesting or receiving permission.		Likely corrective action topic. HHI 101
		Job Observation RST becomes part of task crew by holding the elevator.		Likely corrective action topic. HHI 101 (Make a clear distinction between oversight and help.)

Causal Influence Matrix				
# 11 Miscellaneous Waste Prefilter Loss of Positive Control				
Vulnerability	Trigger	Exacerbation	Mitigation	Remarks
		Job Observation RST fails to stop job he perceives to be understaffed and which he believes to be in danger of violating the SWP.		Likely corrective action topic. HHI 101
		Job Observation RST gives suggestion as to how to do the task without issuing a stop work of a hold work.		Likely corrective action topic. HHI 101
		Lead RST accepts suggestion without discussing it with the Job Observation RST and without discussing it with the task team.		Likely corrective action topic. HHI 101
		Job Observation RST leaves the job scene without discussing intent.		Likely corrective action topic. HHI 101 (This is the second instance of just departing a task.)
		Lead RST assumes that Job Observation RST is helping with task by going to the terminal level (45' level).		Likely corrective action topic. HHI 101
			Lead RST notices Job Observation RST at 27' level.	OK
			Lead RST and Job Observation RST take measures to get control of item.	OK

Partial Phoenix Analysis (Comparative TimeLine, Missed Opportunity Matrix, Why Staircase Dendrograms, Causal Influence Matrix, and Safety Break Tailboard Discussion Topics) **for # 11 Miscellaneous Waste Prefilter Loss of Positive Control** (This work was sponsored by the Nuclear Safety Review Concepts Corporation. © 1999 W. R. Corcoran, NSRC Corporation.)

Causal Influence Matrix # 11 Miscellaneous Waste Prefilter Loss of Positive Control				
Vulnerability	Trigger	Exacerbation	Mitigation	Remarks
			Electricians take control of rad item.	OK.
			No appreciable exposure or contamination spread.	OK

Safety Break Tailboard Discussion Topics

Safety Break Tailboard Discussion Topics		
# 11 Miscellaneous Waste Prefilter Loss of Positive Control		
Topic	Topic Description	Remarks
1.	What should you do if you are part of a pre-job brief that is disrupted by activities in the vicinity?	
2.	Who should be at a pre-job brief?	
3.	What are authority and duties of a job observation person? Where are they clearly established and delineated in writing?	
4.	Discuss “conservatism” and how it should be complemented by consistency of approach.	
5.	How should job observation people intervene when they notice a perceived problem? How should they avoid stepping over the line between oversight and help and the line between oversight and direction? When should a verbal Stop Work be issued?	
6.	What should you do when you are leaving one task to go to another?	
7.	How would you hold an elevator that you thought contained a highly radioactive item?	
8.	Can you think of other events whose causation involved positively intended conservatism?	
9.	Can you think of other events whose causation involved oversight?	