



Prescribed Fire Escapes and Near Miss Lessons Learned

Using the High Reliability Organizing
Concept of Mindfulness
to Better Anticipate and Contain
Unexpected Events on Prescribed Fires



Information Collection
Team Report
October 2008



“This report is specially designed to help all prescribed fire practitioners—especially burn bosses and agency administrators—improve their skills in planning and implementing prescribed burns.”



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I Summary of Significant Lessons Learned

Overall Program Observations

1. Mindful Communication

Key Finding

The success of a prescribed fire is dependent on the continuity of open and comprehensive conversations between the agency administrator, planners, cooperators, dispatch centers, and those actually implementing the burn plan. Gaps or weaknesses in coordination and communication greatly increase the probability of failure of the burn.

Background

On many of the prescribed fire escapes examined during this Information Collection Team effort, frequent problems stemmed from a lack of adequate communication and coordination between members of the burn team—in both the planning and implementation phases.

One person might write the burn plan, the agency administrator approves the plan, the plan is peer-reviewed by someone in a separate location, and, finally, a burn boss arrives the day of the burn—along with some or *all* of the other resources—to implement the plan.

Assuming that everyone did their jobs competently, the cause for an escape does not reside with any one person. Therefore, closer—open and comprehensive—communication and *true* team involvement in the burn's planning and preparation stages could significantly lessen the probability of escape.

While this level of communication and coordination might not always be possible, burn bosses *always* need to recognize that they could be walking into a situation where the expectation to successfully burn is high and problems—not apparent in the burn plan—could exist that might easily jeopardize the success of their burn.

2. The Snowball Effect

Key Finding

Problems encountered throughout the entire prescribed fire process will have a cumulative effect that can significantly reduce the probability of success for the burn.

Background

The problems that occurred on the escaped prescribed fires examined in this effort varied widely, but typically occurred in multiples. The effect of multiple problems is cumulative.

Multiple small problems—when combined together—can effectively jeopardize the success of the burn. Many of these problems could have been mitigated through more comprehensive and complete planning and discussions.

Planning and Preparation

3. Smoke Management

Key Finding

Smoke is an unavoidable product of prescribed fire that can be managed if appropriately modeled. Smoke problems can quickly unite the public against prescribed fire. Great care must be taken to avoid negative impacts to public health and safety.

Background

Smoke can often create problems of enormous significance when projections are absent or inaccurate. People might argue the points of “good fire” and “bad fire”, but no one will argue for the advantages of smoke. Public health and safety issues caused by smoke—when cities, airports, and highways become “unexpectedly” smoked in—can quickly become the burn boss and agency administrator’s number one concern.

Monitoring smoke and always being aware of its impact—often miles from the burn site—is not only critical to the success of the burn, but is even more important to public safety and the success of the overall prescribed fire program.

4. Heavy Fuel Loadings

Key Finding

Fire managers and agency administrators should thoroughly examine the probable effectiveness of planning or igniting burns with heavy fuel loadings that have the potential to extend into an area's normal fire season. The commitment required to sustain these burns will likely increase, while the probability of success correspondingly decreases.

Background

Long-duration burns that continue into a period of escalating fire danger have an increased likelihood of escaping due to increasing fire behavior, decreasing resource availability, and commitment by management. This might be particularly true in units with heavy fuel loadings. Adjustment of management complexity levels, staffing, and the establishment of management action points¹ are examples of additional planning that is necessary.

5. Contingency Planning

Key Finding

The ability to successfully manage the unexpected is dependent on having comprehensive contingency plans. Almost all of the people interviewed by the Information Collection Team expected that their burn would have a successful outcome. However, when their fire escaped, many felt that adequate contingency plans were not in place. Problems encountered in transitioning to a suppression organization can be mitigated through more complete planning and development of contingency plans prior to the prescribed fire's ignition. This includes knowing the suppression qualifications of burn personnel.

¹ Similar to the National Wildfire Coordinating Group's definition, in this report the term "management action point" will be used rather than "trigger point" to define: "Geographic points on the ground or specific points in time where an escalation or alternative of management actions is warranted. These points are defined and the management actions to be taken are clearly described in an approved Wildland Fire Implementation Plan or Prescribed Fire Plan. Timely implementation of the actions when the fire reaches the action point is generally critical to successful accomplishment of the objectives."

Background

A contingency plan tells a burn boss how to respond when an unexpected event occurs. Unexpected events and changing situations require members of the burn team to quickly recognize subtle changes, to know the contingency plan, and to take the appropriate action. Contingency plans can be either written or verbal (during the actual implementation). It is essential that they be clearly understood by *all those* who could potentially be called on to assist in the burn.

Unexpected events such as strong downdrafts from thunderstorms miles away, jet stream winds unexpectedly touching down, equipment breakdown, diverted or delayed resources, and converting to a suppression fire are only a few examples of unexpected events that can occur during the implementation of a prescribed fire. In one instance, when an unpredicted weather event resulted in a prescribed fire being converted to a suppression fire, it was quickly discovered that burn team members were *not* qualified for all the needed suppression positions.

All potential unexpected events should be “*what if’d*” during the burn’s planning phase. While burn bosses cannot know which, if any, of these events will occur, they should develop comprehensive contingency responses that address the full range of possible events—*prior* to the burn’s implementation.

6. Using Management Action Points

Key Finding

Contingency plans with identified management action points (spatial or temporal), stating the appropriate response and needed resources should be identified and briefed prior to ignition. The availability and effectiveness of contingency resources also need to be well planned and coordinated *prior* to ignition.

Background

Identification of “management action points” by a burn team might prevent the escape of the burn by establishing planned responses. In this way, needed resources can be identified and ordered with adequate time for them to arrive and take necessary actions.

The alternative to using “management action points” is often a subjective and unplanned response (“*Give me one more crew or engine and we can catch it*”). The success of this alternative is dependent on the judgment of the burn boss, adequate response time, resource availability, and other variables—all of which are difficult to manage in the short term.

The use of “management action points” reduces the risk to firefighters, the public, and adjacent values at risk. This process also increases the probability of successfully completing the burn.

Implementation

7. Reassessing on Short-Duration Burns

Key Finding

Problems encountered on short-duration burns (one operational period) are often not visible until the implementation phase is initiated. At this point, a burn boss’s ability to adjust to these emerging problems is significantly reduced. A mindful infrastructure that continually reassesses the situation is particularly valuable as time and opportunity to perceive problems—and react to them—is very limited.

Background

Unfortunately, oftentimes the following typical problems are not apparent until the implementation phase has already started: inaccurate burn plans, incorrect weather forecasts, lack of leadership, poor communications, unclear understanding of roles and responsibilities, equipment in marginal operating condition, and inadequate experience or skills. At this point, much of a burn boss’s flexibility and ability to adjust to emerging problems is significantly reduced.

If a burn escapes, should it be attributed to “bad luck” or to inadequate planning and preparation? If management has appropriately weighed and balanced the risks, benefits, resource needs, and has made comprehensive contingency plans, a “bad luck” event can be mitigated and handled. However, if any of these factors are not adequately addressed, the term “bad luck” simply becomes an excuse.

8. Onsite Leadership

Key Finding

Fire behavior, weather predictions, and staffing levels will continually fluctuate on long-term burns. As the complexity of the burn increases and decreases, the level of onsite leadership must be reassessed to accurately reflect the current burn complexity.

Background

Several burns reported problems when the size and complexity of a burn exceeded the ability of those trying to manage it. On these events, fire activity periodically increased and decreased, making it difficult to determine and provide the appropriate level and amount of necessary leadership. This dilemma resulted in individuals, on site, being over- or under- qualified for the current level of activity.

As managers are faced with additional projects and deadlines, priorities tend to shift away from a long-term prescribed fire project—especially if the burn has not recently been active. During these time periods, the tendency to staff with individuals not having the necessary skill and experience levels seems to become even more pronounced. It was additionally noted that while there are qualifications and complexity levels for those implementing a burn, there needs to be more coordination with those involved in the planning.

9. Anticipating Needs on Long-Duration Burns

Key Finding

Resource allocation priorities for long-term burns (two or more operational periods) will change as conditions warm and dry, making it difficult to assure the availability of needed resources for future operations. Future conditions and resource needs should be anticipated as far in advance as possible. Scarce resources could take longer to be located and delivered.

Background

Long-duration burns—either planned or unplanned—that did not have adequate contingency plans, typically shifted from proactive to reactive management when fire activity increased. This reactive mode also tended to result in a continuation of a short-term management approach rather than a long-term analysis of the situation and needs.

If a prescribed burn continues long enough to overlap with the fire season, an increased potential for problems in resource availability and allocation emerges. Typically, as an area enters fire season, temperatures rise, precipitation falls off, and the number of wildfires increases. This increased activity creates further demands on existing resources and necessitates close communications with cooperating dispatch centers and neighboring agencies to best utilize existing resources.

10. Managing (or Coordinating) Multiple Burns**Key Finding**

Multiple burns have a large potential to either work to a burn boss's advantage or disadvantage. If all burns are successful, the cost per treated acre can be lowered significantly. However, if unexpected problems are encountered, existing resources are less likely to be able to achieve a favorable outcome. A prescribed fire manager may be needed—particularly during times of actual or predicted fire activity.

Background

Several of the escaped burns analyzed for this report were implemented in conjunction with other burns, either as separate units or as phases of the same burn plan. Conducting multiple burns can have either a positive or negative effect on the outcome of each burn. On the positive side, multiple burns greatly increased cost effectiveness of acres treated. This occurred because resources were helpful in reinforcing each other when timing and proximity were factored into the burn plans. However, negative aspects were also associated with multiple burns, including increasing the risk of escape due to multiple factors.

Having fires in two or more locations increased problems with communications, response time, splitting available resources, and coordination of efforts and resources between the burns. Therefore, the desire to maximize the number of acres treated with the available resources needs to be balanced with the increased potential for escape.

If the probability of successfully managing one fire experiencing increased fire behavior is considered, then multiply these problems by the total number of fires in the area. In this way, the scope of the problem can be more clearly seen. During such events, it should be remembered that additional resources might not typically be readily available. In addition, existing resources will likely soon suffer from fatigue and lack of logistical support.

On burns where active and predicted fire activity is occurring and more than one fire is burning, it is essential that a prescribed fire manager be in place and actively coordinate the actions, resources, and needs of all fires. This person should not only communicate and coordinate with the individual fires, but also with the agency administrator, local coordination or dispatch center.

Pressures and Expectations

11. Self-Imposed Pressures

Key Finding

Most direct pressure felt by burn bosses is self-imposed rather than applied by supervisors or program leaders.

Background

Few of the individuals interviewed by the Information Collection Team for this report said that they did not feel any direct external pressure to burn to meet quotas or acreage expectations. Nonetheless, the pressure to produce treated acres exists indirectly. There was one mention of pressure to get a person qualified as a burn boss to help distribute the heavy workload. However, it was universally stated that people felt a *self-imposed* indirect pressure to burn. People believed it was their job to burn and they took this responsibility very seriously. This self-imposed pressure seems to be derived from positive factors, including professional and personal pride, as well as peer esteem. This self-imposed pressure needs to be recognized as having the ability to influence the decision-making process.

“Mindful organizing lies at the heart of reliable functioning. Managing the unexpected is about curbing the temptation to treat unexpected events as normal, and then dealing with the consequences when you fail to curb that temptation. Mindful action means that you pay close attention to small, early failures so that you can correct them while they still can be corrected.”

Karl Weick, Co-Author “Managing The Unexpected”

II Background and Introduction

1. Expectations – and the Principles of Mindfulness

During 2007 and 2008, the Wildland Fire Lessons Learned Center used an Information Collection Team to examine ten prescribed fire escapes and near misses to determine key underlying factors that contributed to these events.

The analysis framework used in this subsequent report—to better understand the causes of these 10 prescribed fire escapes and near misses—was developed using the concept of mindfulness as it is applied to High Reliability Organizations (HRO).

An HRO is an organization that operates in a high-risk environment and yet—when compared to other organizations—maintains a relatively low accident/error rate. This low accident/error rate associated with HROs is attributed to a process for thinking about the work environment that is called *mindfulness*.

To successfully manage risky operations with this capability of “mindfulness” is to be:

1. Preoccupied with Failure,
2. Wary of Simplifications,
3. Sensitive to Operations,
4. Capable of Resilience, and
5. Deferring to Expertise.

For instance, mindful managers of high-risk operations:

1. Constantly seek out small problems or indications that things are not going as expected.
2. Don’t settle for simple interpretations of complex problems.
3. Listen to the advice and concerns of the people who are actually doing the work.
4. Don’t let problems overwhelm them or prevent execution of the assigned mission.
5. Utilize, as needed, the special knowledge of experts within the organization.

“Think of it like defensive driving: being constantly alert to the possibility of what could go wrong and having a mental plan of action to deal with the situation should it arise. Practicing the five principles of high reliability is called “mindfulness”. Mindfulness is a rich awareness of discriminatory detail and an enhanced ability to discover and correct errors that could escalate into a crisis.

In contrast, a tendency toward mindlessness is characterized by a style of mental functioning in which people follow recipes, impose old categories to classify what they see, act with some rigidity, operate on automatic pilot, and mislabel unfamiliar new contexts as familiar old ones. A mindless mental style works to conceal problems that are getting worse.”

Jim Saveland

Program Manager for Social, Economic, and Design Sciences for the Rocky Mountain Research Station

Mindfulness: Anticipating and Containing Unexpected Events Before They Occur

The overall goal of “mindfulness” is to perform a more thorough job of anticipating unexpected events *before* they occur. If and when unexpected events do start to unravel, through “mindfulness” we can contain them *before* they become massive problems.

HROs use the five principles of mindfulness to constantly update expectations of what will happen. By using this process—continuously implementing these five principles—these organizations do a much better job of *anticipating and containing* unexpected events.

In addition, HROs also use the five principles of mindfulness to *disconfirm* what is expected to happen.

Through this “disconfirmation” process, a series of open-ended questions is typically asked:

- *What could go wrong here?*
- *What am I not seeing that you might be seeing?*
- *Who holds the “big picture” of what is going on?*
- *As a crew and an organization, are we prepared? Have we practiced to respond to unexpected events?*
- *Or, are we operating on automatic pilot? Are we basing our predictions on using old routines or past successes?*

How “Mindfulness” was Used to Prepare this Report

The ten escaped or near miss prescribed fires that form the basis for this analysis occurred in different parts of the United States, with different agencies, in various fuel regimes.

Land management agencies and organizations included in this examination of prescribed fire mishaps: the U.S. Forest Service, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, The Nature Conservancy, and one state forestry department.

The prescribed fires were located in the Northwest, Northern California, Rocky Mountains, Northern Rockies, Eastern Great Basin, and Southern Geographic Areas.

The various personnel associated with each prescribed fire were interviewed by the Information Collection Team. (See VI Appendix.) These interviews focused on the entire life of the project—from planning to ignition, from implementation to mop-up.

During this process, the Information Collection Team members tried to determine where people could have been more attentive by using the five principles of mindfulness.

The team focused on people’s expectations of what they thought would occur on a prescribed burn after thorough analysis and planning. As these original expectations began to break down, the team was specifically interested in how the original expectations were reconfirmed or modified through a more comprehensive job of:

1. Updating,
2. Then *reconfirming* their expectations.

To best illustrate these findings, this report provides the following format:

1. Major expectations are highlighted.
2. A corresponding list of some of the five principles of mindfulness is then provided. These “prompts” are usually questions that *should* have been asked—or, if asked, were not answered in enough detail to fully update the current expectation.

It is vital that you, the reader, become better at anticipating and containing unexpected events on your own prescribed fires. The “prompts” highlighted in this report should therefore help you to begin to accomplish this—immediately.

2. How to Use This Report

After you have read this report and you want to apply this HRO “mindfulness” approach to your work:

- Using a recent or an upcoming prescribed fire, draw it out on a sand table, flip chart, or chalk board. (This drawing doesn’t have to be fancy or take a lot of time to create.)
- Gather your burn team around this sketch (or sand table) of your burn.
- Make sure to include a diversity of viewpoints: line officers, fire weather meteorologists, the lowest ranked person on your burning crew, the biologist, archeologist, silviculturist, and so on. (The more diverse perspectives you have the better.)
- Create an environment where people can speak up—and feel comfortable doing so.
- Use the questions listed in this report as “prompts” to start your own discussions.
- To increase the richness of your

discussions, try using this simple script:

- *Here’s what I think our historical and current issues are, where problems might occur.*
- *This is why I think there might be a problem.*
- *Do you see it differently?*
- *Is there anything I am missing?*
- *Does anyone have an intuition that we are missing something or not thinking about something important?*
- Document your discussions. Incorporate your findings into your upcoming burn’s planning and implementation.
- After you implement prescribed fires, make a habit, as you do with After Action Reviews (AAR), of going back to your notes and evaluating where you did well—and not so well—at anticipating and containing the unexpected. *What did you miss seeing? Why did you miss seeing it? What surprised you?*

3. Karl Weick's Pointers on How to Create Practices of Applying HRO Mindfulness to Your Work

“HROs are not error-free, but errors don't disable them. HROs don't necessarily see discrepancies any more quickly, but when they do spot discrepancies, they understand their meaning more fully and can deal with them more confidently. These capabilities seem to be

enhanced when people create practices and ways of working that:

1. Track small failures,
2. Resist oversimplification,
3. Remain sensitive to operations,
4. Maintain capabilities for resilience, and
5. Take advantage of shifting locations of expertise.

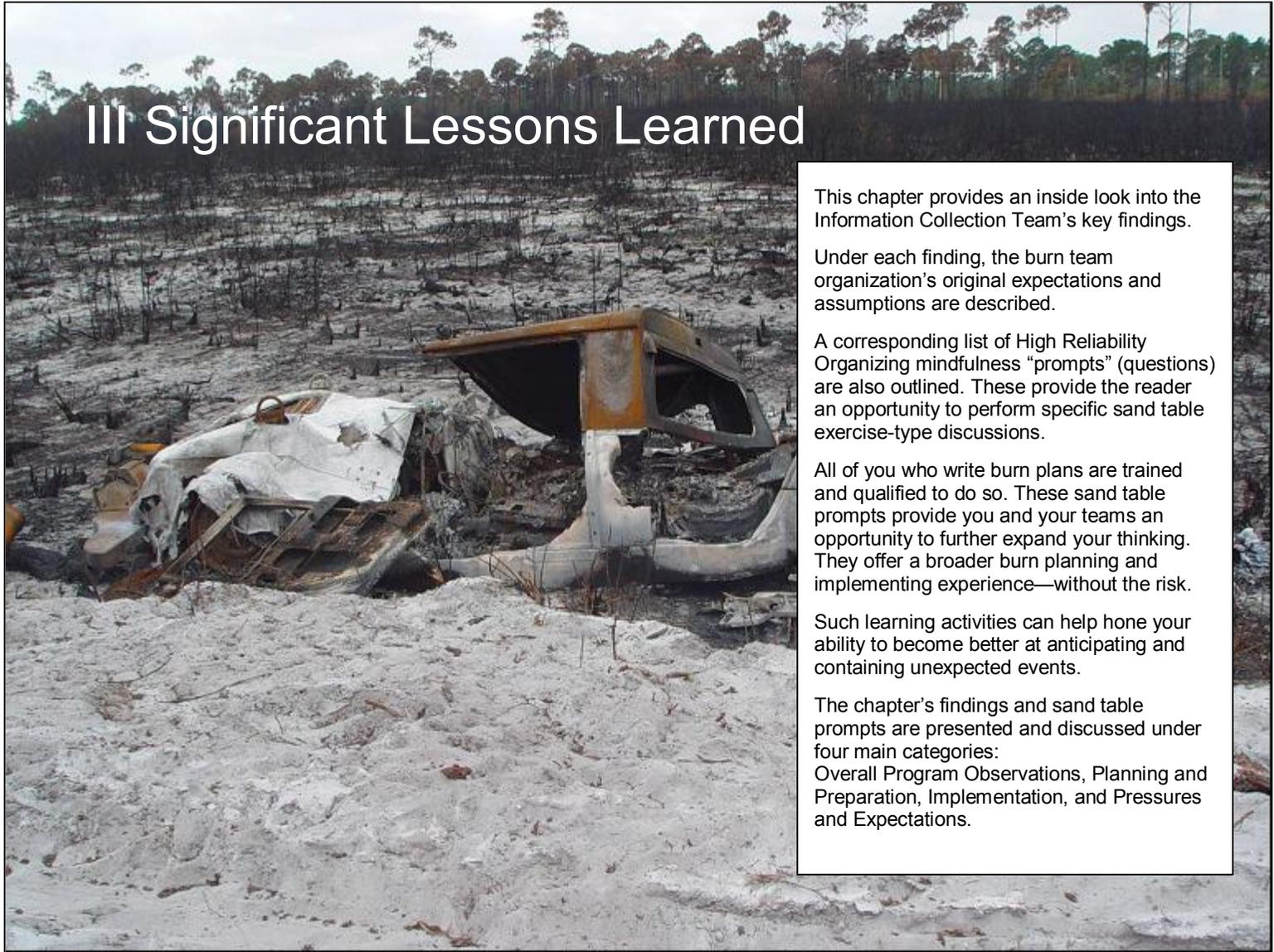
Specifically, when people follow these five principles of mindful organizing they weaken tendencies to:

- Look solely for confirmation of their hunches,
- Develop tunnel vision under pressure,
- Misunderstand and misestimate the complexity of events,
- Treat unexpected deviations as normal,
- Blame others for errors,
- Discount worst case scenarios, and
- Underestimate the rate of change.

If these tendencies go unchecked they can lead to unreliable performance, escaped fires, injuries, and fatalities. Efforts to reverse these tendencies are much harder than they look. They're hard because—to organize mindfully—you have to forgo the 'pleasures' of attending to success, simplifying, planning, following checklists, and pushing decisions up the chain-of-command.”

Karl Weick
Co-Author “Managing The Unexpected”

III Significant Lessons Learned



This chapter provides an inside look into the Information Collection Team's key findings.

Under each finding, the burn team organization's original expectations and assumptions are described.

A corresponding list of High Reliability Organizing mindfulness "prompts" (questions) are also outlined. These provide the reader an opportunity to perform specific sand table exercise-type discussions.

All of you who write burn plans are trained and qualified to do so. These sand table prompts provide you and your teams an opportunity to further expand your thinking. They offer a broader burn planning and implementing experience—without the risk.

Such learning activities can help hone your ability to become better at anticipating and containing unexpected events.

The chapter's findings and sand table prompts are presented and discussed under four main categories: Overall Program Observations, Planning and Preparation, Implementation, and Pressures and Expectations.

Overall Program Observations

1. Mindful Communication

The success of a prescribed fire is dependent on the continuity of open and comprehensive conversations between the agency administrator, planners, cooperators, dispatch centers, and those actually implementing the burn plan. Gaps or weaknesses in coordination and communication greatly increase the probability of failure of the burn.

“Relationships must be well developed prior to the start of the burn.”

“We under evaluated during the planning phase.”

“Everyone knew the big picture, but didn’t put the [big picture] together well.”

From Information Collection Team interviews

Expectation

These quotes from burn personnel interviewed by the Information Collection Team indicate that there was an expectation that coordination and communication, at whatever the stage of the burn, would naturally fall into place.

Prompts to be Used During Sand Table Exercises

- **Preoccupation with Failure:** As you prepared your burn plan, did you get diverse perspectives from your burn crew, line officers, meteorologists, or others on what could go wrong?
- **Wary of Oversimplification:** As you wrote the burn plan, what were the hardest areas to pin down because they were fuzzy or hard to explain? Did you find that you skimmed over these hard-to-explain spots in the plan? Was the preparation of the burn plan just an exercise of filling in the blanks, cutting and pasting?
- **Resilience:** Even after the burn plan was officially approved, did you take time to have an open and comprehensive discussion with your burn organization about the emergence of new clues that something might still be out of place? Did you discuss with your crew up and down the chain of command on how you would work together when an unexpected event occurred?

2. The Snowball Effect

Problems encountered throughout the entire prescribed fire process will have a cumulative effect that can significantly reduce the probability of success for the burn.

“One week before the escape, the people who were continually on the burn repeatedly said ‘It’s just a matter of time until this escapes.’ This thought was not clearly communicated.”

“I didn’t pick up the extent of the drying trend as reported by field personnel.”

“In the field we were a little ‘fuzzy’ about the ramifications...”

“We missed checking the weather radar.”

From Information Collection Team interviews

Expectation

These quotes from burn personnel interviewed by the Information Collection Team indicate that to better anticipate their prescribed burn operation’s probable effects associated with these “cumulative effects” would have required a more vigorous updating of expectations.

Prompts to be Used During Sand Table Exercises

- **Deference to Expertise:** One of the basic premises of mindfulness is that “someone always sees it coming.” The difficult part, especially if you are a lower-ranked or relatively inexperienced prescribed burn crew member, is to have the courage to speak up, to communicate your intuitions—your “gut feelings”—so that they can be heard and used to either confirm or disconfirm the current expectation. As with all five principles of mindfulness, this, too, takes practice. Work with your burn crew to develop the ability to swiftly, confidently—and with mutual respect—talk about what others are seeing and feeling. Practice disagreeing with each other. In a simulation with your crew, begin with these types of questions: *“What is the best way to for us to disagree with each other? When might disagreement go overboard?”* If you think you haven’t been heard, what are the best ways to reengage? Is it possible to disagree too much? If someone disagrees with you, what are the best methods for overcoming your defensiveness?

Planning and Preparation

3. Smoke Management

Smoke is an unavoidable product of prescribed fire that can be managed if appropriately modeled. Smoke problems can quickly unite the public against prescribed fire. Great care must be taken to avoid negative impacts to public health and safety.

“There were no indications that anything might go wrong.”

From Information Collection Team interviews

Expectation

On one of the prescribed burns, smoke was not expected to be a major down-wind problem. Yet, as the duration of the burn increased, a populated community was smoked-out.

Prompts to be Used During Sand Table Exercises

- **Preoccupation with Failure:** Instead of assuming that smoke won't be a problem, imagine as many situations as you can where something could go wrong on the burn—or with the weather—to cause a smoke problem.
- **Sensitivity to Operations:** Do you have a “big picture” of the burn in relationship to smoke management? Who holds this big picture and ensures that it is constantly updated: The line officer? The burn boss? The fire weather meteorologist? The citizens of the nearby population center? Or, can any one individual have the big picture? Perhaps the big picture concerning smoke management is shared by the entire group?
- **Deference to Expertise:** Have you, or someone with the expertise, modeled the smoke plume trajectories beyond the burn boundaries under various worst-case situations?
- **Resilience:** After an unwanted event has occurred (smoking out a major population center), are you and your organization ready to “bounce back,” to learn from your mistakes, and to get ready to ignite another burn? If not, what does this say about you and your organization?

4. Heavy Fuel Loading

Fire managers and agency administrators should thoroughly examine the effectiveness of planning or igniting burns with heavy fuel loadings that have the potential to extend into an area's normal fire season. The commitment required to sustain these burns will likely increase, while the probability of success correspondingly decreases.

"When we started out, this was a relatively simple burn."

"I didn't pick up the extent of the drying trend as reported by field personnel."

"We didn't anticipate that conditions would change."

"I had concerns over our ability to hold the fire for a long period of time."

From Information Collection Team interviews

Expectation

As these quotes from burn personnel interviewed by the Information Collection Team indicate, we are often blinded by our original expectations. The burn might start as a relatively low-key prescribed fire without serious ramifications. But, as days turn into weeks, the burn steadily becomes larger and larger. Yet, the human tendency is to continue to view the "larger" burn through the lens in which it was originally planned. Once again, a more rigorous updating of the original expectation is required to either confirm or disconfirm the original expectation.

Prompts to be Used During Sand Table Exercises

- **Wary of Oversimplification:** To classify a burn as "simple" is to name it. Once so named, it is much more difficult to disconfirm. The correct mindful method would be to ask: *"This burn looks simple but I am going to make it look complex. Now, does anything new I haven't thought of arise?"*
- **Deference to Expertise:** The field personnel, the people closest to the action, often have a better idea of what is going on than those higher up the chain of command. As a burn boss, how do you know when to defer to the front line? How can you be sure that you are sensing all the critical elements within the prescribed burn environment?

5. Contingency Planning

The ability to successfully manage the unexpected is dependent on having comprehensive contingency plans. Almost all of the people interviewed by the Information Collection Team expected that their burn would have a successful outcome. However, when their fire escaped, many felt that adequate contingency plans were not in place. Problems encountered in transitioning to a suppression organization can be mitigated through more complete planning and development of contingency plans prior to the prescribed fire's ignition. This includes knowing what resources are qualified in the "suppression" positions.

"...run all scenarios through the 'what if' game..."

"The only thing that was not known was the house was over the hill a half mile away."

"There were no indications that anything might go wrong."

"When the wind gust occurred, there was nothing to do but run."

"A level of complacency on our part...we'd all seen it before..."

From Information Collection Team interviews

Expectation

A basic underlying concept of "mindfulness" is that conditions are always changing. Our jobs as mindful prescribed fire practitioners is to sense potential change—even without strong evidence that things are changing. As conditions on the ground change, the expectations formed while developing the contingency plan must also be updated. In addition, you should remember that the ratings in a complexity analysis are also expectations—and are also prone to mindlessness. Because complexity ratings are relative ("Low", "Moderate," and "High"), they are especially vulnerable to the cognitive errors of overconfidence and simplification.

Prompts to be Used During Sand Table Exercises

- **Preoccupation with Failure:** It is ironic that after the burn escapes, the advice most people give to others to prevent an escape from occurring on their home unit is to be more diligent in running continually through the "what-if" game. Mindful organizations are always wary of past successes. Every prescribed fire is a clean slate.

(Continued on next page)

A feeling that you “think you’ve seen it all before” is a good indicator of being mindless, of operating off run-of-the-mill routines rather than using fresh updates based on what is actually occurring. For a moment—regardless of what you have rated each complexity element—rate them all “High.” Then imagine the worst that could happen if these risks actually were high. By doing this, you are admitting to yourself that your rating might be wrong.

Practice playing the “what-if?” game with your burn team present. Force yourself to imagine the worst that could happen. Ask your burn crew members to give you some “bad news.” By answering these questions, pausing to ponder them for a few moments, you will have done a good job of disconfirming your expectations about the contingency plan. Furthermore, you will now be ready to balance these worst-case scenarios with your expectation of a positive outcome for the burn.

- **Resilience:** If prescribed fire crews had to make a “run” to flee from an approaching flame front being pushed by downdrafts from a thunderstorm, then there is some probability that this “near miss” was very serious and could have been a life and death situation. Burn crews can take credit for having excellent survival tactics in place and that, in the end, no one got hurt. After this “run” occurred, the key question becomes what sort of conversations did the burn organization have about this event? Did they think they “did everything right” because everyone safely made it out? Rather, shouldn’t the primary question be: *“Why didn’t we anticipate this blowup beforehand and prevent anyone from needing to run?”*
- **Wary of Oversimplification:** Did you routinely, without disconfirmation, rate any complexity element “Low” or “Moderate” because they had been “Low” or “Moderate” before”? If you did, there is a good chance that you might have oversimplified your thinking. You need to look at the entire burn plan with fresh eyes. Ask yourself: *“What has changed since the plan was prepared? For instance, are resource availability, fuel conditions, and drought as they were before?”*

6. Using Management Action Points

Contingency plans with identified management action points (spatial or temporal), stating the appropriate response and needed resources should be identified prior to ignition. The availability and effectiveness of contingency resources also need to be well planned and coordinated prior to ignition.

“Our burn plan did not define long-term holding needs adequately...”

“Fire escaped in a spot that was unexpected.”

From Information Collection Team interviews

Expectation

The expectation was that either management action points were not needed or not updated, or that they were not initially even thought about.

Prompts to be Used During Sand Table Exercises

- **Sensitivity to Operations:** The unexpected always unfolds in the most unlikely spot. That is what makes it an “unexpected event.” That is also why it takes a serious dose of imagination to anticipate the unexpected before it happens. If the unexpected was easy to see, to pin down, then we would have already done so and the spot fire would have been anticipated.

It is important to develop the “big picture” of what could occur on your prescribed burn before you ignite it. The trouble with developing a prescribed burn plan alone is that you are susceptible to the “fallacy of centrality.” This basically means that if you don’t see it, it must not be there. To ensure that you are not falling into this “trap,” it is best that this big picture is constructed from as many perspectives as possible. Ask your fellow burn team members: *“Do you see something that I don’t see? Am I missing something?”*

Implementation

7. Reassessing on Short-Duration Burns

Problems encountered on short-duration burns (one operational period) are often not visible until the implementation phase is initiated. At this point, a burn boss's ability to adjust to these emerging problems is significantly reduced. A mindful infrastructure that continually reassesses the situation is particularly valuable as time and opportunity to perceive problems—and react to them—is very limited.

“We focused our attention on where the heat was. This was misleading because it was furthest from the values at risk.”

“There was no reason to believe that the outcome could have been predicted.”

From Information Collection Team interviews

Expectation

On short-duration burns, events that occur on the burn are more tightly coupled and the amount of time is shortened in which prescribed burn crews have to update their original expectations.

Prompts to be Used During Sand Table Exercises

- **Preoccupation with Failure:** Practice restating your beliefs—“no reason to believe”—as forms of mistakes that you don't want to occur. For example, say to yourself: *“I don't want to believe that this burn could escape. We've done everything we can to prevent that from happening. But, even so, just for a few minutes, I am going to force myself to think that it can escape.”*
- **Sensitivity to Operations:** Many of the prescribed burns analyzed in this report escaped in locations where it was least expected that something could go wrong. For instance, sections of fire line that were thought to be completely mopped up, or a single smoking tree that is patrolled daily and sized-up not to be problem. Sometimes, the burn crew's attention was diverted by a more intense hot spot, only to have the burn cause problems in what was thought to be a benign section of the fire. It is important to constantly ask your fellow team members: *“Is there something that we're missing? Are we absolutely sure that the cool section of the burn won't cause us problems? What if an 'unexpected' wind event occurs? Can we handle fire that might erupt on a section of line that is thought to be controlled?”*

(Continued on next page)

- **Wary of Oversimplification:** To the mind's eye, a small burning block may be seen as a "slam dunk" just because it is small. But to categorize the risk of a burn based on its size is dangerous. Such a characterization oversimplifies a complex fire event. You should ask the same question regarding a small burning block as you would of a large one: *"What could go wrong here?"* And, *"What am I not thinking about just because it is small?"*

8. Onsite Leadership

Fire behavior, weather predictions, and staffing levels will continually fluctuate on long-term burns. As the complexity of the burn increases and decreases, the level of onsite leadership must be reassessed to accurately consider the current burn complexity.

“Our prescribed burn plan addressed how to deal with an escape and converting to a wildfire. But there needs to be practice on implementation.”

“The fire burned at a faster-than-anticipated rate.”

“It started getting hotter and drier but this was not quantified.”

“Fire exhibiting considerably greater fire activity than we’d been seeing.”

From Information Collection Team interviews

Expectation

From the perspective of mindfulness, there is some truth to the adage that after a burn is ignited *“the plan isn’t worth the paper it is written on.”* This is not to suggest that planning isn’t a worthwhile effort. But, planning is only the first attempt at managing the unexpected. It is impossible through planning alone to anticipate everything that might go wrong on a burn. What is needed after the burn is ignited is to be constantly updating the original expectations formed in the burn plan, particularly whether onsite leadership is appropriate to the current level of prescribed fire activity.

Prompts to be Used During Sand Table Exercises

- **Preoccupation with Failure:** As part of updating, confer with your burn team and ask: *“Do we have the proper staffing and organizational structure to handle what is going on now—and what might be going on in the future?”* If you are the burn boss, as the prescribed fire burns longer and becomes larger, ask yourself: *“Am I qualified to handle the current situation? Is my burn boss experience deep enough to deal with our burn’s new complexities? Am I prepared to handle changes in staffing as the burn situation changes? Who will be in charge, or ordered, in the event of an escape?”*

9. Anticipating Needs on Long-Duration Burns

Resource allocation priorities for long-term burns (two or more operational periods) will change as conditions warm and dry, making it difficult to assure the availability of needed resources for future operations. Future conditions and resource needs should be anticipated as far in advance as possible. Scarce resources could take longer to be located and delivered.

“We did not anticipate that significant rainfall would not occur for such a long period of time...”

“Burn plan became unclear” [as a four-day burn continued over 40 days].”

“Prior to this event, no one had ever witnessed or was aware that a wind front might occur.”

“We had no clue that there was going to be a wind event.”

From Information Collection Team interviews

Expectation

An expectation was formed that as the prescribed fire burned longer than expected, the original control forces would be adequate.

Prompts to be Used During Sand Table Exercises

- **Sensitive to Operations:** To be sensitive to operations, to have the “big picture” (or what the U.S. Navy calls “the bubble”) of a prescribed burn is to be aware that the picture or bubble will inevitably break down and must be recreated. This is bound to occur on any long-duration burn. To be mindful is to detect the weak signals that the bubble is starting to “become unclear” and that a new bubble must be formed through the updating of expectations.
- Before you ignite your next prescribed burn, work with your burn team to construct a list of weak signals, lapses, and discrepant events that might indicate that the “big picture” or “bubble” is no longer in place. Determine if events on the burn have significantly changed. *Is an intense reconfirmation of the original expectation needed?* This reconfirmation is especially necessary when the fire has burned into different fuel beds, or burned much longer than originally expected. Practice having a conversation about the “bubble” breaking down and what that conversation would sound like on the actual burn. Questions that are excellent starting points: *“Is the big picture still in place?” “Who has the big picture of the burn?” “I think the burn boss has lost the big picture.”* If you truly think that the burn boss has lost the big picture, practice telling him/her your thoughts. What does it sound and feel like to tell a burn boss that they might have lost the overall picture of the burn?

10. Managing (or Coordinating) Multiple Burns

Multiple burns have a large potential to either work to a burn boss's advantage or disadvantage. If all burns are successful, the cost per treated acre can be lowered significantly. However, if unexpected problems are encountered, existing resources are less likely to be able to achieve a favorable outcome. A prescribed fire manager may be needed—particularly during times of actual or predicted fire activity.

“Residual burning can be a problem.”

“The Park and the neighboring Forest “had not enjoyed the best working relationship.”

From Information Collection Team interviews

Expectation

As the prescribed fire burned longer than expected—becoming larger and more complex—the original expectation regarding the type and amount of burn overhead was not updated.

Prompts to be Used During Sand Table Exercises

- **Wary of Oversimplification:** One can fall into the trap of oversimplification by the name one uses to categorize a prescribed fire event. For example, prescribed fires, as they become much larger and more complex, burning into new fuel beds under a variety of weather conditions may be “prescribed fires” in name only. If they were viewed through other perspectives—for example, from a wildfire or a wildland fire use event—there is a good chance that the questions one would ask and the strategies developed to manage these fires would also be different. To protect your burn organization from being caught in the trap of oversimplification, discuss these questions with your burn team: *“Is this a prescribed burn in name only? If it weren't labeled a prescribed burn, what would we be doing?”*

Pressures and Expectations

11. Self-Imposed Pressures

Most direct pressure felt by burn bosses is self-imposed rather than applied by supervisors or program leaders.

“I had some trepidation.”

“Burn overhead anxious to make their mark.”

“Effective decisions won’t be made by being panicky and emotional.”

“Regional Office was not supportive, blamed rather than making the escape a learning experience.”

From Information Collection Team interviews

Expectation

There is often an expectation that if we can be rid of the pressures being placed upon us as prescribed burners—the need to meet regional office targets, the desire to “make our mark” as burn organizations (to show them that we can do it), for example—many burns would not have escaped. We imagine that these “pressures” forced us into igniting the burn when burning conditions were not optimum for complete safety and control. But, we can be just as mindful about updating the expectations associated with the “pressure to burn” as one can be about picking up the weak signals on a prescribed fire that is being ignited.

Prompts to be Used During Sand Table Exercises

- **Sensitivity to Operations:** As you develop the “big picture” of a prescribed burn, pay attention not only to the tactics involved with igniting and holding the burn, but consider the less specific pressures that might be influencing your organization that can affect how you think about the burn. Each entity within the “big picture”—the individual burn crew members, the burn boss, the prescribed fire manager, the line officer, and your Washington Office—has expectations that might put pressure on you to complete the burn in a certain way. With your burn crew and line officers, actively discuss what pressures are influencing the overall burn system. *“Are those pressures unrealistic? Are you more strongly influenced by one pressure than another? What explains this difference?”*

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- **Wary of Oversimplification:** It is unrealistic and an over-simplification to expect that we would never have pressures placed on us as prescribed burners. As Paul Langowski, a Forest Service regional fuels specialist explains: *“We have a box of policies, rules, regulations, budgets, and Congressionally mandated targets that we must work within. We cannot change that box; it is a given. We must learn to work within that box.”* To blame a prescribed fire escape on excessive target pressures is a sign that you ignored the pressures in the first place. To prevent this from happening, ask yourself these questions: *“Have we talked with our District Rangers, Park Superintendents, Forest Supervisors about the pressures that are being placed on them and how that might affect us? And if these pressures seem excessive, have we challenged these ‘higher ups’? Do we trust our burn overhead to be resilient enough to withstand the pressure to burn?”*

IV Conclusion

**How Can HRO
Help You to Become
Better at Managing Prescribed Fire?**



An ability to use the five HRO principles in maintaining a mindful infrastructure is critical for a burn boss to avoid or mitigate problems before they become unmanageable.

When the reality of a burn (fire behavior, resources, fuels, etc.) exceeds a burn boss's expected outcome, there is high potential for an escape. To keep the burn from escaping, operations must be altered and contingency plans implemented in an attempt to adjust for the difference between *current reality* and the *original expectations*.

When our expectations do not match reality, the problems can fall into two categories—or a combination of both:

- ❖ Problems that stem from the *planning* of a prescribed fire, and
- ❖ The *implementation* of the fire's plans.

The effect of all errors related to these two categories is cumulative. Thus, together, these errors diminish our probability of success.

A prescribed fire escape is most likely the result of the cumulative effect of the planning and implementation events that exceeded management's ability to adjust through contingency plans and resources. Frequently, even more key factors in planning or implementation determine a prescribed fire's success or failure.

Planning problems are often the easiest to overcome because they are typically *not* time sensitive. Planning problems, especially strategic ones, often go undetected as they fall outside the realm of checklists, training, and other built-in reviews. These problems often represent a disconnect between unit/program managers and those implementing the on-the-ground burn actions.

This report's Information Collection Team review process revealed that a successful burn boss will develop a situational awareness that extends far beyond the fireline.

A significant number of burn bosses seem to be managing almost entirely for the *expected*. This practice places them in a very precarious position regarding the successful outcome of their burns.

On the other hand, the Information Collection Team interviews revealed that a *successful* burn boss will develop a situational awareness that extends far beyond the fireline. This awareness includes an understanding of the concerns held by those involved in the burn, including the public—from the burn's inception to final completion.

Ideally, to provide appropriate input and to gain a better understanding of the burn's goals and objectives, a burn boss should be involved in the burn's planning as well as its implementation.

Lastly, an ability to use the five HRO principles in maintaining a mindful infrastructure is critical for a burn boss to avoid or mitigate problems *before* they become unmanageable. A burn boss who has developed these skills and abilities is well on the way to developing "deep smarts" (experience-based business wisdom) that will be useful in managing much more than prescribed fires.

There is no question that by incorporating the sand table prompts outlined in this report, burn bosses will develop a better situational awareness and improve their ability to manage both the expected and unexpected in our dynamic, volatile, and ever-changing arena of wildland fire.

V References and Resources

The following references and resources, all easily obtained, are excellent places to begin a more thorough study of Organizational Learning and High Reliability Organizing (HRO). Many of these references are available for downloading from the Wildland Fire Lessons Learned Center's Website at <http://wildfirelessons.net/Home.aspx>, or, for purchase from a private company or bookstores.

Dekker, Sidney. 2006. *The Field Guide to Understanding Human Error*. Ashgate Publishing Company. Burlington, VT.

Dether, Deirdre M. 2005. Prescribed Fire Lessons Learned Initial Impressions Report. What key lessons have been learned in prescribed fire escapes and what knowledge gaps exist?
http://www.wildfirelessons.net/documents/Rx_Fire_LL_Escapes_Review.pdf

Holt, Jonetta T. 2008. Morning Briefings Reinforce Deference to Expertise – An HRO Story.
<http://wildfirelessons.net>

Holt, Jonetta T. 2008. Tracking and Responding to Small Errors in High Risk – An HRO Story.
<http://wildfirelessons.net>

Keller, P. 2004. Managing the Unexpected in Prescribed Fire and Fire Use Operations: A Workshop on the High Reliability Organization. General Technical Report RMRS-GTR-137.
http://www.wildfirelessons.net/documents/MTU_Santa_Fire_Workshop_rmrs_gtr137.pdf

Reason, James. 1997. *Managing the risks of organizational accidents*. Aldershot, UK: Ashgate.

Weick, Karl and Sutcliffe, Kathleen. 2007. *Managing the Unexpected – Resilient Performance in an Age of Uncertainty*. Josey-Bass Publishers.

In addition, the Lessons Learned Center has created numerous HRO-related DVD/video productions to aid the learning needs of the professional wildland firefighter community. The titles listed below can be ordered from Custom Recording and Sound: phone (208) 344-3535, fax (208) 323-0373, e-mail: customorders@cableone.net. Cost per product is \$12.95, including shipping and handling.



1. **Managing the Unexpected Series** – Includes three programs: Overview of High Reliability Organizations (50 minutes), Return to Cerro Grande (1 hour), and Overcoming Your Immunity to Change (20 minutes).
2. **Dude Fire Staff Ride** – Re-released in 2005 from 1998 national fire behavior analyst workshop (30 minutes).
3. **Burn Boss Stories** – Learning from veteran burn bosses, 2005 (20 and 40 minute versions).
4. **Prescribed Fire and Fire Use Lessons Learned** – Experiences of veteran fire management officers, 2005 (1 hour).
5. **Building a More Effective Learning Organization** – Organizational learning in wildland fire featuring *Learning in Action* author David Garvin, 2005 (1 hour and 30 minute versions).
6. **Decision Making for Prescribed Fire and Fire Use Managers** – Effective decision-making featuring *Learning in Action* author David Garvin, 2005 (1 hour and 30 minute versions).

7. **Fire Effect Monitoring Stories** – Learning from experienced interagency fire effects monitors, 2004 (30 and 15 minute versions).
8. **Conducting Effective After Action Reviews (AAR) Training Package** – Lessons Guide, AAR Power Point, How To Conduct an AAR, Facilitation Techniques for AARs, 2006.
9. **Managing the Unexpected** – A Second Workshop on High Reliability Organizing, featuring the Field Study of the Okefenokee Ecosystem Fire Management Program, 2007.
10. **The Hawkins Wildland Fire Use Trilogy DVD** – Learning from the Hawkins Wildland Fire Use event that occurred on the Dixie National Forest.

The downloadable “**Firefighter: Remember This**” series:

- **Why Did He Die? Lessons from the Devil's Den Fatality Fire** (12 minutes).
- **How Did They Survive? Lessons Learned from the St. Sebastian Prescribed Fire Burnover** (12 minutes).
- **Why Were They Entrapped? Lessons Learned from the Madison Arm Fire Entrapment** (12 minutes).

These three 2008 presentations are available for downloading free of charge at the Wildland Fire Lessons Learned Center Website (<http://wildfirelessons.net>).

The overall intent is to help fire management personnel reproduce success and avoid recurrent mistakes.

VI Appendix

Methodology, Assumption, and Limitations

1. Information Collection Teams

An Information Collection Team (ICT) includes two to six members, including a team leader. ICTs gather data and make observations regarding issues identified by the Lessons Learned Center (LLC) in consultation with subject matter experts. Issues may pertain to policies, processes, tactics, techniques, or procedures. The LLC uses the data collected by the ICT to inform and update agency administrators, incident commanders, incident management teams, and other fire management personnel via various “knowledge” products. The LLC also shares information with training managers, developers, and instructors to help assure that agency training reflects the current reality of practices and conditions in the field.

An Information Collection Plan, sometimes supplemented by a Statement of Work, guides the team’s assignment and conduct. ICTs are not dispatched to evaluate, review, or assess performance. ICT members observe field operations and interview people to collect information that may be of value to others. The overall intent is to help fire management personnel reproduce success and avoid recurrent mistakes. The information collected by the team or the knowledge products developed by the LLC may become a catalyst for policy change. However, identifying lessons learned, effective practices, innovative ways of overcoming challenges, and knowledge gaps must remain the sole focus of an ICT.

2. Information Collection Methods

ICTs dispatched by the LLC may employ a combination of two data collection methods: 1) inquiry and 2) observation. Inquiry essentially involves formal interviews with fire personnel. Inquiry served as the primary information collection method used for this information collection effort. ICT members are dispassionate observers, not reviewers or evaluators, critics or cheerleaders. Our job is to identify lessons learned, potential effective practices, innovative ways of overcoming challenges, and knowledge gaps. The observations, conclusions and recommendations reported here were primarily derived from interviews conducted during 2007 and 2008.

This report's Information Collection Team members:

- **Paula Nasiatka**, Center Manager, Wildland Fire Lessons Learned Center;
- **Dan O'Brien**, Wildland Fire Associates; and
- **Riva Duncan**, Assistant Fire Management Officer, Klamath National Forest.

Assumptions and Limitations

The number of escaped fires analyzed in this report is numerically insufficient to determine or indicate trends. This report, therefore, is not intended to be comprehensive or definitive. Each prescribed fire included in this report was selected for its unique set of circumstances and its resulting problems in managing fire.

Individuals involved in prescribed fires typically hold different positions. Each position is accompanied by different responsibilities, expectations, and perceptions for the individual in that position. The totality of these differences can make it difficult—and, in some cases impossible—to determine what happened and why on a burn.

Confidentiality

The conversations that ICT members have with interviewees are strictly confidential. Team members inform everyone of their commitment to confidentiality and respect the privacy to the various individuals they contact. The Lessons Learned Center does not identify people by name, unit, or other identifier in final notes or in the combined and condensed final report. The Center is interested in the “what” not the “who.” Thus, Information Collection Team members will not attribute individual comments to persons interviewed. In addition, the Lessons Learned Center does not release interview notes to others—including other teams, supervisors or managers.

3. Prescribed Fire Data Set

Ten escapes or near misses that occurred between 2004 and 2007 served as this report's dataset. The primary data came from approximately 20 interviews with burn bosses and trainees, ignition specialists, holding bosses, and fire management officers. The LLC either received a briefing on the prescribed burn or analyzed the review or after action review. The documents used were submitted to the LLC, collected from agency Websites, or from interviews with individuals involved in the prescribed fire.

The prescribed fires included in this project were purposely selected from different agencies, areas of the country, and fuel types. Through this diversity it is hoped to reveal that the problems encountered on these particular incidents potentially can be encountered on any prescribed fire—anywhere.

Information and documentation for the ten selected prescribed fires was provided by individuals from the following land management agencies and organizations: the U.S. Forest Service, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, The Nature Conservancy, and one state forestry department. These prescribed fires were located in the Northwest, Northern California, Rocky Mountain, Northern Rockies, Eastern Great Basin, and Southern Geographic Areas.

4. Information Collection Team Interview Questions

1. *What did you expect would happen with the prescribed burn?*
2. *Looking back, were you bothered by anything at the time? Was there anything out of the ordinary that bugged you but which you assumed would take care of itself?*
3. *What do you see now that you missed then? Have you seen these same kinds of features or issues before?*
4. *Did you have your eye on certain parts of the burn that turned out not to be important? How were these features misleading? How were you misled?*
5. *When you sensed something was amiss, what did you do?*
6. *Describe the quality and kind of feedback you received from others both inside and outside of your planning and implementation team before and during the burn. Were there others with whom*

*you would seek input from in future burns?
Describe the expertise they would provide.*

- 7. Using the gift of hindsight, how would you now re-evaluate the probability of success for the burn?*
- 8. Did you feel any unusual amount of pressure to meet this burn project? If so, why?*
- 9. Did everyone on the planning and implementation team know the big picture as well as the details of*

the burn? If so, describe how you made this happen. If not, describe what you would do differently.

- 10. If one of your major resources became unavailable for this burn, how would you respond?*
- 11. What is the most import piece of advice or lesson you learned from this experience that others can benefit from?*