

1 Chapter 1918

2 Reviews & Investigations Analyses

3

4 Introduction

5 Reviews and investigations are ~~two methods~~ used by wildland fire and aviation  
6 managers to assess and improve the effectiveness and safety of organizational  
7 operations.

8

9 Reviews

10 Reviews are ~~critical evaluations of operational preparedness, policies, or~~  
11 ~~practices prior to, during, or after actual operations. The purpose of a review is~~  
12 ~~to identify deficiencies in operational preparedness, policies or practices and~~  
13 ~~recommend specific corrective action. Types of reviews include preparedness~~  
14 ~~reviews, fire and aviation safety team reviews, National Cost Oversight Team,~~  
15 ~~individual fire reviews, escaped prescribed fire reviews, and after action~~  
16 ~~reviews.~~

17

18 Investigations

19 ~~Investigations are critical methodical examinations and systematic inquiries into~~  
20 ~~incidents or accidents. The purpose of an investigation is to determine the~~  
21 ~~organizational deficiencies that are the source of the incident or accident and~~  
22 ~~recommend specific corrective actions. Types of investigations include non-~~  
23 ~~serious wildland fire accident investigations, serious wildland fire accident~~  
24 ~~investigations, entrapment investigations, shelter deployment investigations, and~~  
25 ~~fire trespass investigations.~~

26

27 Incident

28 ~~An incident is an unexpected occurrence in a sequence of events that produces~~  
29 ~~no injury, death, or property damage, but has the potential to do so.~~

30

31 Accident

32 ~~An accident is an unexpected occurrence in a sequence of events that produces~~  
33 ~~an injury, death, or property damage.~~

34

35 Policy

36 ~~The complexity and severity of the event will determine the type of review or~~  
37 ~~investigation required, the level of investigation (local, state/regional, or~~  
38 ~~national), and notification requirements. Fires, incidents, or accidents will be~~  
39 ~~reviewed or investigated of system elements such as follows:~~

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Nature of Event	Type of Review or Investigation Required	Investigation Level
Fire in which entrapments/burnovers and/or fire shelter deployments have occurred	Serious Accident Investigation	Determined at National Level
Fire in which multiple serious injuries or fatalities have occurred	Serious Accident Investigation	National Level
Fire in which property damage exceeds \$250,000	Serious Accident Investigation	Determined at National Level
Fire in which a non-serious accident occurs	Non-Serious Accident Investigation	Determined at Local/State/ National Level (based upon severity)
Fire that has escaped area defined in prescribed fire plan	Escaped Prescribed Fire Review	Determined at Local Level
* Immediate Notification of National Office Required		

Agency specific policy guides

<del>Safety</del>	<del>Prescribed Fire</del>
<del>BLM Manual 1112-2, 1112-1</del>	<del>Prescribed Fire Handbook</del>
<del>FWS Service Manual 095</del>	<del>Fire Management Handbook</del>
<del>NPS DO/RM 50</del>	<del>RM 18, Chapter 10</del>
<del>FS FSH 6709.11</del>	<del>FSM 5140</del>

Reviews

Reviews address all or any aspects of wildland fire and aviation program management. Reviews may focus on program oversight, safety, leadership, operations, specific incidents, preparedness, training, staffing, business practices, budget, cost containment, planning, and interagency or intra-agency cooperation, and coordination between fire and other agency programs. Review teams will develop findings and recommendations and establish priorities for action. Reviews do not have to be associated with a specific incident. The purpose of a review is to ensure the effectiveness of the system element being reviewed, and to identify deficiencies and recommend specific corrective actions. Established review types are described below and include:

Reviews may be conducted in the form of Escaped Prescribed Fire Reviews; Preparedness Reviews; Fire and Aviation Safety Team (FAST) Reviews; Individual Fire Reviews; or program specific reviews.

Types of Reviews  
preparedness review

- 1 [after action review](#)
- 2 [fire and aviation safety team review](#)
- 3 [aviation safety assistance team review](#)
- 4 [national cost oversight team review](#)
- 5 [individual fire review](#)
- 6 [lessons learned review](#)
- 7 [escaped prescribed fire review](#)

9 Preparedness Reviews

10 ~~Wildland fire and aviation preparedness reviews are conducted annually prior to~~  
 11 ~~the fire season to help the field unit prepare for the fire season, identify Fire~~  
 12 ~~preparedness reviews assess fire programs for compliance with established fire~~  
 13 ~~policies and procedures as outlined in the current Interagency Standards for Fire~~  
 14 ~~and Fire Aviation Operations and other pertinent policy documents. Reviews~~  
 15 ~~identify organizational, operational, procedural, personnel, or equipment~~  
 16 ~~deficiencies, and recommend specific corrective actions. Standards for~~  
 17 ~~preparedness reviews are based and conducted according to established agency~~  
 18 ~~procedures. Interagency Preparedness Review Checklists can be found at:~~  
 19 ~~[http://www.nifc.gov/references/prep\\_review.htm](http://www.nifc.gov/references/prep_review.htm)~~  
 20 ~~BLM/FS - Preparedness reviews utilize several review functional checklists that~~  
 21 ~~can be found at:~~  
 22 ~~[http://www.fire.blm.gov/Standards/FIRE\\_AVIATION\\_PREPAREDNESS](http://www.fire.blm.gov/Standards/FIRE_AVIATION_PREPAREDNESS)~~  
 23 ~~[\\_REVIEW\\_GUIDE.htm](#)~~

24  
 25 ~~Review teams should include line and fire managers, fire and aviation operations~~  
 26 ~~specialists, dispatch and logistics specialists, fire business management~~  
 27 ~~specialists, and other technical experts as needed (safety & occupational health~~  
 28 ~~specialists, contracting officers). This expertise may be internal, interagency, or~~  
 29 ~~contract, and include members from other states/regions, geographic areas.~~  
 30 ~~Reviews will benefit greatly if interagency in composition. The agency~~  
 31 ~~administrator determines local level review team membership; state/regional~~  
 32 ~~level review team membership is identified by the State/Regional Director; and~~  
 33 ~~national review teams are identified by the National Fire Directors.~~

34 Preparedness Review Frequency/Reviewing Level

	Local	State/Regional	National
37 BLM	Annual/Any Level	2 yrs/National	4 yrs
38 FWS	Annual/Any Level	3-5 yrs/National	N/A
39 NPS	Annual	3-5 yrs/Regional	N/A
40 FS	Annual	N/A	N/A

41 ~~BLM - Copies of~~  
 42 ~~<http://www.blm.gov/nifc/st/en/prog/fire/fireops/preparedness/preparedness>~~  
 43 ~~review reports will be distributed to the Director, Office of Fire and Aviation,~~  
 44 ~~and to the reviewed field office through the State Director. A copy of the~~  
 45 ~~written action plan addressing the executive summary findings will be submitted~~

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~~to the Director, National Office of Fire and Aviation, within (30) calendar days upon receipt of the review. [review/checklists.html](#)~~

~~BLM – Field office preparedness reviews will be conducted annually. Field Office will be reviewed every other year by the state office. National level reviews of each — state are conducted every four years.~~

~~FS – FS preparedness reviews are guided by FSM 5100 /5190 on frequency of reviews and reporting requirements.~~

After Action Reviews (AAR)

An AAR is a learning tool intended for the evaluation of an incident or project in order to improve performance by sustaining strengths and correcting weaknesses. An AAR is performed as immediately after the event as possible by the personnel involved. An AAR should encourage input from participants that is focused on:

what was planned

what actually happened

why it happened

what can be done the next time

It is a tool that leaders and units can use to get maximum benefit from the experience gained on any incident or project. When possible, the leader of the incident or project should facilitate the AAR process. However, the leader may choose to have another person facilitate the AAR as needed and appropriate. AARs may be conducted at any organizational level. However, all AARs follow the same format, involve the exchange of ideas and observations, and focus on improving proficiency. The AAR should not be utilized as an investigational review. The format can be found in the Interagency Response Pocket Guide (IRPG), PMS #461, NFES #1007

Fire and Aviation Safety Team (FAST) Reviews

Fire and Aviation Safety Teams assist agency administrators during periods of high fire activity by assessing policy, rules, regulations, and management oversight relating to operational issues. They can also do the following:

Provide guidance to ensure fire and aviation programs are conducted safely.

Assist with providing immediate corrective actions.

Review compliance with OSHA abatement plan(s), reports, reviews and evaluations.

Review compliance with Interagency Standards for Fire and Fire Aviation Operations.

FAST reviews can be requested through geographic area coordination centers to conduct reviews at the state/regional and local level. If a more comprehensive review is required, a national FAST can be ordered through the National Interagency Coordination Center.

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1 FASTs include a team leader, who is either an agency administrator or fire  
2 program lead with previous experience as a FAST member, a safety and health  
3 manager, and other individuals with a mix of skills from fire and aviation  
4 management.

5  
6 FASTs will be chartered by their respective Geographic Area Coordinating  
7 Group (GACG) with a delegation of authority, and report back to the GACG.

8  
9 ~~The team's report~~ FAST reports includes an executive summary, purpose,  
10 objectives, methods/procedures, findings, recommendations, follow-up actions  
11 (immediate, long-term, national issues), and a letter delegating authority for the  
12 review. As follow-up, the team will gather and review all reports prior to the  
13 end of the calendar year to ensure identified corrective actions have been taken.  
14 FAST reports should be submitted to the geographic area with a copy to the  
15 Federal Fire and Aviation Safety Team (FFAST) within 30 days. See Appendix  
16 O for sample FAST Delegation of Authority.

17 Aviation Safety Assistance Team (ASAT) Reviews  
18 During high levels of aviation activity it is advisable to request an Aviation  
19 Safety Assistance Team (ASAT). The team's purpose is to assist and review  
20 helicopter and/or fixed wing operations on ongoing wildland fires. An ASAT  
21 team should be requested through the agency chain of command and operate  
22 under a delegation from the appropriate state/regional aviation manager or  
23 multi-agency coordinating group. Formal written reports will be provided to the  
24 appropriate manager. An ASAT should consist of:  
25 Aviation Safety Manager  
26 Operations Specialist (helicopter and/or fixed wing)  
27 Pilot Inspector  
28 Maintenance Inspector (optional)  
29 Avionics Inspector (optional)

30  
31 National Cost Oversight Team Reviews  
32 A National Cost Oversight Team will be assigned to a fire with suppression  
33 costs of more than 5 million dollars. This team will include a Line Officer (team  
34 lead), Incident Business Specialist, Incident Management Team Specialist, and a  
35 Financial Specialist. The team lead and the receiving agency administrator can  
36 agree to add team members as needed to address issues specific to the incident,  
37 i.e., aviation, personnel, or contracting specialists.

38  
39 Individual Fire Reviews  
40 ~~Fire Individual fire~~ reviews examine all or part of the operations on an  
41 individual fire. The fire may be ongoing or controlled. These ~~evaluations~~  
42 ~~reviews~~ may be a local, state/regional, or national ~~review~~. These reviews  
43 ~~examine a fire to~~ evaluate decisions, ~~and~~ strategies, ~~or,~~ correct deficiencies;  
44 identify new or improved procedures, techniques or tactics; determine cost-  
45 effectiveness ~~of an operation;~~ ~~and~~ compile ~~consistent~~ and ~~completed~~ develop

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1 information to improve local, state/regional or national fire management  
2 programs.

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10 **Reviewing Levels**

11 **Local Level Lessons Learned Review (LLR)**

12 Should be conducted by the local manager (or designated representative) to  
13 provide the agency administrator with recommendations or commendations  
14 pertaining to the fire program or operations.

15 Examples of local reviews may include a daily review of WFSAs and fire  
16 incident objectives, or closeouts with Incident Management Team (IMT) prior to  
17 a team's release from the incident. IMT closeouts ensure effective transfer of  
18 command of the incident to the local unit, or to another team, evaluates the  
19 status of fire business, and addresses issues or suggested improvements. See  
20 Appendix B.

21 **State/Regional Level Review**

22 Convened by the state/regional Fire Management Officer (FMO) (or designated  
23 representative). This review is generally conducted for any fire that results in  
24 controversy involving another agency, adverse media attention, or in large  
25 expenditures of funds or involves serious injury to less than 3 personnel,  
26 significant property damage, or is an incident with potential.

27 **National Level Review**

28 Convened by National Fire Director (or designate). This review is generally  
29 conducted for any fire that involves agency wide or national issues, significant  
30 adverse media or political interest, multi-regional resource response, a  
31 substantial loss of equipment or property.

32 The LLR provides the wildland fire community an immediate learning  
33 opportunity in the form of a written report in an effort to identify underlying  
34 factors that could lead to future accidents and/or provide reasons for successes--  
35 all in support of organizational learning and accident prevention. This process  
36 bridges the gap between the after action review (performed on site immediately  
37 after the operation and conducted by the participants themselves) and the  
38 accident investigation (formally mandated effort to identify causes and develop  
39 control measures). LLRs provide an outside perspective with appropriate

1 technical experts assisting involved personnel in identifying root causes and  
2 sharing findings and recommendations.

#### 3 Notification

4 Near misses or successful operations should be reported to first line supervisors.  
5 Supervisors will notify unit fire management officer, who will then notify their  
6 agency administrator. In cases of entrapment near misses, notification to the  
7 respective agency's national fire office is required and determination for  
8 review/investigation level will be made from the national level.

#### 9 LLR Process

10 A LLR will be led by a facilitator who was not involved in the event. A  
11 facilitator should be an appropriate fire management expert who possesses skills  
12 in interpersonal communications, organization, and be unbiased to the event.  
13 Personnel who were involved in the event will also be full participants in the  
14 review process. Depending upon the complexity of the event, the facilitator may  
15 request assistance from technical experts (e.g., fire behavior, fire operations,  
16 etc.).

17 The LLR facilitator will convene the participants and:  
18 Identify facts of the event (sand tables maybe helpful in the process) and  
19 develop a chronological narrative of the event.  
20 Identify underlying reasons for success or failure.  
21 Identify what individuals learned and what they would do differently in the  
22 future.  
23 Provide a final written report including the above items to the pertinent agency  
24 administrator(s) within two weeks of event occurrence. Names of involved  
25 personnel should not be included in this report (reference them by position).

26 A copy of the final report will be submitted to the respective agency's national  
27 fire safety lead who will provide a copy to the Wildland Fire Lessons Learned  
28 Center (WFLLC). Website: <http://wildlandfirelessons.net>  
29 FS - The Forest Service has developed two processes for conducting Lessons  
30 Learned Reviews: the Facilitated Learning Analysis (FLA) and the Accident  
31 Prevention Analysis (APA). Guides have been produced for these processes and  
32 are available from Regional and National risk management and safety personnel.

#### 33 Escaped Prescribed Fire Reviews

34 For escaped Escaped prescribed fire review requirements see "direction is found  
35 in Chapter 18 of this document and in these agency documents:  
36 Interagency Prescribed Fire Planning and Implementation Procedures Reference  
37 Guide" or Chapter 18 of the book, (September 2006)

38 Escaped prescribed fire review direction is found in the following agency  
39 manuals/direction.

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BLM - BLM 9214 ~~Prescribe~~Prescribed Fire Handbook and the 9215 BLM Fire Training Handbook.  
FWS - Fire Management Handbook  
NPS - RM-18, ~~Chapter 10 & 13~~Chapter 7 & 17  
FS - 5140-1

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- what was planned
- what actually happened
- why it happened
- what can be done the next time

It is a tool that leaders and units can use to get maximum benefit from the experience gained on any incident or project. When possible, the leader of the incident or project should facilitate the AAR process. However, the leader may choose to have another person facilitate the AAR as needed and appropriate. AARs may be conducted at any organizational level. However, all AARs follow the same format, involve the exchange of ideas and observations, and focus on improving proficiency. The AAR should not be utilized as an investigational review. The format can be found in the Interagency Response Pocket Guide (IRPG), PMS #461, NFES #1007

Investigations

Guidance

The following provides guidance and establishes procedures for accident investigations (as defined below). The following information may be used as a guide for this procedure as well as referencing the following applicable agency guidance.

- BLM - Handbook 1112-1, Safety and Health Management
- FWS - Fire Management Handbook
- NPS - RM 18, Chapter 3, and RM 50b
- FS - FSM 5100 and FSH 6709.11 FSM 5720 (Aviation), FSM 5130 (Ground Operations), FSM 6730 (Specific policy), FSH 6709.12, Chapter 30 (General guidance), and most recent Accident Investigation Guide, for specific guidance."

Per the 1995 Memorandum of Understanding between the U.S. Department of the Interior and the U.S. Department of Agriculture "Investigation of Serious Wildland Fire Related Accidents," serious wildland fire related accidents will be investigated through the use of interagency investigation teams.

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1 Investigation Categories

3 Non-Serious Wildland Fire Accidents

4 A non-serious wildland fire accident is an accident occurring to personnel and/or  
5 property that may or may not result in serious injuries or substantial loss/damage  
6 of property but given similar environment and a set of circumstances could have  
7 resulted in serious injury or fatality or total property loss (example: engine  
8 rollover with minor injuries). An accident is an unplanned, unwanted event that  
9 results in injury and/or property damage.

10  
11 Investigations are required and normally conducted at the state/region or local  
12 level. However, a national level investigation may be conducted at the  
13 discretion of the National Office. Notification to the National Fire Safety Office  
14 is required.

16 Non-Serious Wildland Fire Accident Investigation Process

17  
18 Notification

19 Agency specific reporting requirements shall be followed. In most instances,  
20 supervisors will notify unit fire management officer, who will then make  
21 notification through chain of command.

22  
23 Personnel Involved

24 Treatment, transport, and follow-up care should be immediately arranged for  
25 injured and involved personnel. Develop a roster of involved personnel and  
26 supervisors and ensure they are available for interviews by the investigation  
27 team. Attempt detailed and methodical efforts to collect initial statements from  
28 the involved individuals prior to a Critical Incident Stress Management (CISM)  
29 session.

30  
31 Site Protection

32 The site of the incident should be secured immediately and nothing moved or  
33 disturbed until the area is photographed and visually reviewed. Exact locations  
34 of injured personnel, and the condition and location of personal protective  
35 equipment, and any damaged property or equipment must be documented.

36  
37 Investigation

38  
39 Investigation Team

40 Investigation team membership will depend upon the severity of the accident.  
41 At a minimum, the team should consist of a chief investigator, a safety advisor,  
42 and one technical specialist. Team members may have dual roles (e.g., chief  
43 investigator/safety advisor). More complex accidents may require the need for a  
44 Team Leader and multiple technical specialists.

45  
46 Reports

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24 Hour Preliminary Brief Report

This report contains only the most obvious and basic and interpret facts about the accident. It will be completed and forwarded to the unit FMO who will then distribute through chain of command. Names of injured personnel are not to be included in this report (reference them by position) related to an incident or accident. identify causes (organizational factors, local workplace factors, unsafe acts), and develop control measures to prevent recurrence. Established investigation types include:

72 Hour Expanded Report

This report provides more detail about the accident and may contain the number of victims, severity of injuries, and information focused on accident prevention. Names of injured personnel are not to be included in this report (reference them by position).

Final Report

Within 45 days of the accident, a final report detailing the accident to include facts, findings, and recommendations shall be submitted to the senior manager dependent upon the level of serious wildland fire accident investigation non-serious wildland fire accident investigation entrapment/ burnover investigation (e.g., Local agency administrator, State/Regional Director, and Bureau Fire Director).

The Final Report (minus recommendations, conclusions and observations) will be submitted to Wildland Fire Lessons Learned Center (WFLLC) by the respective agency's National Fire Safety Leads. Website: <http://www.wildfirelessons.net/Reviews.aspx>

Final Report Format

Executive Summary

A brief narrative of the facts involving the accident including dates, locations, times, name of incident, jurisdiction(s), number of individuals involved, etc.

Narrative

A detailed chronological narrative of events leading up to and including the accident, as well as rescue and medical actions taken after the accident. This section should spell out in detail who, what, and where.

Investigation Process

A brief narrative stating the team was assigned to investigate the accident. It should include a standard statement that human, material, and environmental factors were considered. If one of these factors is determined to be noncontributing to the accident, it should be addressed first and discounted. For example, if the fire shelter deployment investigation revealed that there were no

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1 environmental findings that contributed to the accident. Then simply the fact  
2 and move on to the next factor. Human factors or material factors paragraphs  
3 should not be formulated so as to draw conclusions, nor should they contain  
4 adjectives or to adverbs describe and thus render an opinion into pertinent facts.  
5

6 **Findings**

7 Findings are developed from the factual information and are listed in the  
8 following order:

9 Direct cause of the accident.

10 Indirect causes which contributed to the accident.

11 Other findings which, if left uncorrected, could lead to future accidents.

12

13 Opinions or recommendations are not findings.

14 Findings must be substantiated by the factual data within the report.

15

16 **Discussion**

17 Provide a brief explanation of factual and other pertinent information that lead to  
18 the finding(s).

19

20 **Recommendation**

21 Provide a recommendation that is consistent with the finding(s) and identify at  
22 which level the action(s) needs to occur.

23

24 **Conclusions and Observations**

25 Investigation team's opinions and inferences may be captured in the section.

26

27 **Maps/Photographs/Illustrations**

28 Graphic information used to document and visually portray facts.

29

30 **Appendices**

31 Reference materials (e.g., fire behavior analysis)

32

33 For additional information on accident investigations, refer to:

34 [http://www.nife.gov/safety\\_study/accident\\_invest/index.htm](http://www.nife.gov/safety_study/accident_invest/index.htm)

35 [fire trespass investigation](#)

36

37 **Wildland Fire Accident and Event Definitions**

38

39 **Serious Wildland Fire Accident**

40 A Serious Wildland Fire Accident is one that involves:

41 Wildland fire shelter deployments or entrapments

42 Any An unplanned event or series of events that resulted in death; injury;

43 occupational illness; or damage to or loss of equipment or property. For

44 wildland fire operations, a serious accident involves any of the following:

45 One or more fatalities

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Three or more personnel who are inpatient hospitalized as a direct result, of or in support of, wildland fire operations;  
~~Substantial property~~ Property or equipment damage of \$250,000 or more-

~~Notification to the National Fire and Aviation Safety Office is required. National Office will determine~~ Consequences that the level of investigation.

~~Designated~~ Agency contacts are listed below:

~~BLM~~ — Michelle Ryerson

~~FWS~~ — Rod Bloms

~~NPS~~ — Al King

~~FS~~ — Larry Sutton

~~FS~~ — Forest Service protocol for multiple fatalities or 3 or more serious injuries requiring hospitalization investigation teams are assigned by the Safety and Health Branch in the WO and are Chief's Office Official (DASHO) judges to warrant Serious Accident Investigation-

Non-Serious Wildland Fire Accident

An unplanned event or series of events that resulted in injury, occupational illness, or damage to or loss of equipment or property to a lesser degree than defined in "serious wildland fire accident."

Near-miss

An unplanned event or series of events that could have resulted in death, injury, occupational illness, or damage to or loss of equipment or property but did not.

Entrapment

~~Defined by National Wildfire Coordinating Group (NWCG) as situations~~ A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes ~~and or~~ safety zones are absent, inadequate, or ~~have been~~ compromised. Entrapments may or may not include deployment of a fire shelter for its intended purpose, ~~and they~~ (NWCG Glossary of Fire Terminology). Entrapment may or may not result in injury. They include "a serious wildland fire accident, a non-serious wildland fire accident, or a near misses." Notification to the National Fire and Aviation Safety Office of the jurisdictional agency is required. ~~Level of investigation will be determined at the national level~~ miss.

Fire Shelter Deployment

~~Shelter deployment may occur in situations where individuals are not entrapped. The removing of a fire shelter from its case and using it as protection against fire (NWCG Glossary of Fire Terminology). Fire shelter deployment may or may not be associated with entrapment. Fire shelter deployment may result in a serious wildland fire accident, a non-serious wildland fire accident, or a near-miss.~~ Any time a fire shelter is deployed (other than for training purposes), regardless of circumstances, notification to the National Fire and Aviation

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1 Safety Office of the jurisdictional agency is required. Level of investigation will  
2 be determined at the national level.

3  
4 For more information on conducting investigations, refer to USDI, Interior 485  
5 Departmental Manual 7, Serious Accident Investigation; USDA Forest Service  
6 Manual 6730, Accident Reporting Escaped Prescribed Fire  
7 A prescribed fire which has exceeded or is expected to exceed its prescription.

8  
9 Fire Trespass  
10 The occurrence of unauthorized fire on agency-protected lands where the source  
11 of ignition is tied to some type of human activity.

12  
13 Review and Investigation; the Interdepartmental Memorandum of  
14 Understanding between the U.S. Department of the Interior and the U.S.  
15 Department of Agriculture dated October 26, 1995; Executive Order 12196,  
16 Occupational Safety and Health Programs for Federal Employees; 29 CFR  
17 1960.29, Accident Investigation; 29 CFR 1960.70, Reporting of Serious  
18 Accidents; Investigating Wildland Fire Entrapments; Interagency Standards for  
19 Fire and Fire Aviation Operations; and the Fireline Handbook. Requirements

<u>Wildland Fire Event</u>	<u>Review/Investigation Type</u>	<u>Management level that determines review type and authorizes review*</u>
<u>Serious Wildland Fire Accident</u>	<u>Serious Accident Investigation (SAI)</u>	<u>National</u>
<u>Non -Serious Wildland Fire Accident</u>	<u>Non-Serious Accident Investigation (NSAI)</u>	<u>Region/State/Local</u>
<u>Near-miss</u>	<u>Lesson Learned Review (LLR)</u>	<u>Region/State/Local</u>
<u>Entrapment</u>	<u>SAI, NSAI, LLR, depending on severity</u>	<u>National</u>
<u>Fire Shelter Deployment</u>	<u>SAI, NSAI, LLR, depending on severity</u>	<u>National</u>
<u>Escaped Prescribed Fire</u>	<u>Escaped Prescribed Fire Review</u>	<u>National/Region/State</u>
<u>Fire Trespass</u>	<u>Fire Cause Determination &amp; Trespass Investigation</u>	<u>Local</u>

20 \*Management may override lower level management and request a review or  
21 investigation regardless of the above criteria.

22  
23 Agency Specific Policy Documents  
24 These documents provide specific direction related to incident and accident  
25 investigations.

	<u>Safety</u>	<u>Prescribed Fire</u>
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**CHAPTER 1918 REVIEWS & INVESTIGATIONS & ANALYSES**

<u>DOI</u>	<u>485 DM Chapter 7</u>	
<u>BLM</u>	<u>Manual 1112-2, 1112-1</u>	
<u>FWS</u>	<u>Service Manual 095</u>	
<u>NPS</u>	<u>DO/RM-50B, RM-18 Chapter 3</u>	<u>RM-18, Chapter 7</u>
<u>FS</u>	<u>FSH-6709.11</u>	<u>FSM-5140</u>
	<u>FSM-5100 and FSH-6709.11 FSM 5720 (Aviation), FSM 5130 (Ground Operations), FSM 6730 (Specific policy), FSH 6709.12, Chapter 30 (General guidance), and most recent Accident Investigation Guide, for specific guidance.</u>	
<u>Interagency</u>	<u>Information on accident investigations may be found at: <a href="http://www.nifc.gov/safety/accident_resources.htm">http://www.nifc.gov/safety/accident_resources.htm</a> Also refer to <u>Investigating Wildland Fire Entrapments, 2001 Edition, MTDC.</u> For reporting use <u>PMS 405-1, Wildland Fire Fatality and Entrapment Initial Report, 2007.</u> <a href="http://www.nwcg.gov/pms/pms.htm">http://www.nwcg.gov/pms/pms.htm</a></u>	

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1  
2 **Serious Wildland Fire Accident Investigation Process**

3  
4 **Notification**

5 Interagency investigations will be co- led and/or have interagency team  
6 members. Agency reporting requirements shall be followed. As soon as a  
7 serious accident is verified, the following groups or individuals should be  
8 notified: Agency administrator, public affairs, agency law enforcement, safety  
9 personnel, county sheriff or local law enforcement as appropriate to jurisdiction,  
10 National Interagency Coordination Center (NICC), agency headquarters, and  
11 OSHA (within 8 hours only if resulting in a fatality[ies] or three or more  
12 personnel are inpatient hospitalized).  
13 After initial notification, NICC will advise the national fire director(s) or  
14 designee(s).  
15 The fire director(s) or designee(s) will ensure notification to the agency safety  
16 manager and Designated Agency Safety and Health Official (DASHO).

17  
18 **Personnel Involved**

19 Treatment, transport, and follow-up care should be immediately arranged for  
20 injured and involved personnel. Develop a roster of involved personnel and  
21 supervisors and ensure they are available for interviews by the investigation  
22 team. Consider relieving involved supervisors from fireline duty until the  
23 preliminary investigation has been completed. Attempt to collect initial  
24 statements from the involved individuals prior to a Critical Incident Stress  
25 Management (CISM) session.

1 ~~Critical Incident Stress Management (CISM)~~  
2 ~~Critical Incident Stress Management is the responsibility of local agency~~  
3 ~~administrators, who should have individuals pre-identified for critical incident~~  
4 ~~stress debriefings. The process for ordering CISM support can be found in~~  
5 ~~Appendix Q.~~  
6  
7 ~~Also refer to The Agency Administrator’s Guide to Critical Incident~~  
8 ~~Management (PMS 926), available at:~~  
9 ~~[http://www.nwec.gov/pms/pubs/PMS926\\_DRAFT.pdf](http://www.nwec.gov/pms/pubs/PMS926_DRAFT.pdf)~~  
10  
11 ~~Individuals or teams may be available through Employee Assistance Programs~~  
12 ~~(EAP’s) or Geographic Area Coordination Centers (GACC’s).~~  
13 ~~A Critical Incident Stress Defusing should be provided no more than 8 hours~~  
14 ~~after an incident, or if possible, it should be provided immediately (one to two~~  
15 ~~hours) after the incident, and usually takes 30 minutes to 1 hour.~~  
16 ~~A Critical Incident Stress Debriefing should occur between 24 to 72 hours after~~  
17 ~~the incident, and usually takes 1-3 hours.~~  
18  
19 ~~Site Protection~~  
20 ~~The site of the incident should be secured immediately and nothing moved or~~  
21 ~~disturbed until the area is photographed and visually reviewed. Exact locations~~  
22 ~~of entrapment(s), injury(ies), and fatality(ies), and the condition and location of~~  
23 ~~personal protective equipment, and any damaged property or equipment must be~~  
24 ~~documented.~~  
25  
26 ~~Investigation~~  
27  
28 ~~Order Investigation Team~~  
29 ~~Following initial notification of a serious accident, the National Fire Director(s)~~  
30 ~~will immediately dispatch an investigation team.~~  
31  
32 ~~Roles and Responsibilities~~  
33  
34 ~~Director~~  
35 ~~The Fire Director(s) or designee(s) of the lead agency, or agency responsible for~~  
36 ~~the land upon which the accident occurred, will:~~  
37 ~~[Notify the agency safety manager and Designated Agency Safety and Health](#)~~  
38 ~~[Official \(DASHO\).](#)~~  
39 ~~Immediately appoint, authorize, and ~~dispatch~~~~deploy~~ an accident investigation~~  
40 ~~team.~~  
41 ~~Ensure that~~~~Provide~~ resources and procedures ~~are~~ adequate to meet the team’s  
42 needs.  
43 Receive the factual and management evaluation reports and take action to accept  
44 or reject recommendations.  
45 Forward investigation findings, recommendations, and corrective action plan to  
46 the DASHO (the agency safety office is the “office of record” for reports).

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1 Convene ~~an accident review board/~~ board of review (if deemed necessary) to  
 2 evaluate the adequacy of the factual and management reports and suggest  
 3 corrective actions.

4 Ensure a corrective action plan is developed, incorporating management  
 5 initiatives established to address accident causal factors.

6  
 7 Agency Administrator Responsibilities

8 ~~Identify agencies with statutory/accident jurisdictional responsibilities for the~~  
 9 ~~incident; develop~~ Develop local preparedness plans to guide emergency  
 10 response.

11 Identify agencies with jurisdictional responsibilities for the accident.

12 Provide for and emphasize treatment and care of survivors.

13 Ensure the Incident Commander secures the accident site ~~to protect physical~~  
 14 ~~evidence.~~

15 Conduct an in-briefing to the investigation team.

16 Facilitate and support the investigation as requested.

17 Implement Critical Incident Stress Management (CISM).

18 Notify home tribe leadership in the case of a Native American fatality.

19 ~~Receive an in-briefing from the local agency administrator to include the 24-~~  
 20 ~~hour Preliminary Brief (if not already completed by local unit), as well as other~~  
 21 ~~general information about the accident.~~

22 ~~Produce a 72-hour Expanded Report—see reports section below.~~

23  
 24 Prepare and issue required 24 and 72 hour reports.

25 Notification

26 Agency reporting requirements will be followed. As soon as a serious accident  
 27 is verified, the following groups or individuals should be notified:

28 Agency administrator

29 Public affairs

30 Agency Law Enforcement

31 Safety personnel

32 County sheriff or local law enforcement as appropriate to jurisdiction

33 National Interagency Coordination Center (NICC)

34 Agency headquarters

35 OSHA (within 8 hours if the accident resulted in one or more fatalities or if  
 36 three or more personnel are inpatient hospitalized)

37  
 38 Notification to the National Fire and Aviation Safety Office is required.

39 National Office will determine the level of investigation. Agency fire safety  
 40 contacts are listed below:

41 BLM - Michelle Ryerson

42 FWS - Rod Bloms

43 NPS - Al King

44 FS - Larry Sutton

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1 FS - Forest Service protocol for multiple fatalities or 3 or more serious injuries  
2 requiring hospitalization investigation teams are assigned by the Office of Safety  
3 and Occupational Health in the WO.

4  
5 Designating the Investigation Team Lead

6 The 1995 Memorandum of Understanding between the U.S. Department of the  
7 Interior and the U.S. Department of Agriculture states that serious wildland fire-  
8 related accidents will be investigated by interagency investigation teams.  
9 Following initial notification of a serious accident, the National Fire Director(s)  
10 or their designee(s) will designate a Serious Accident Investigation Team  
11 Lead(s) and provide that person(s) with a written delegation of authority to  
12 conduct the investigation and the means to form and deploy an investigation  
13 team.

14  
15 Serious Accident Investigation Team Composition

16  
17 Team Leader

18 A senior agency management official, at the equivalent associate/assistant  
19 regional/state/area/division director level. The team leader will direct the  
20 investigation and serve as the point of contact ~~with~~to the ~~agency-Designated~~  
21 Agency Safety and Health Official (DASHO).

22  
23 Chief Investigator

24 A qualified accident investigation specialist is responsible for the direct  
25 management of all investigation activities. The chief investigator reports to the  
26 team leader.

27  
28 Accident Investigation Advisor

29 An experienced safety and occupational health specialist or manager who acts as  
30 an advisor to the team leader to ensure that the investigation focus remains on  
31 safety and health issues. The accident investigation advisor also works to ensure  
32 strategic management issues are examined.

33  
34  
35  
36  
37 Interagency Representative

38 An interagency representative will be assigned to every fire-related Serious  
39 Accident Investigation Team. They will assist as designated by the team leader  
40 and will provide outside agency perspective.

41  
42 Technical Specialists

43 Personnel who are qualified and experienced in specialized occupations,  
44 activities, skills, and equipment, addressing specific technical issues such as  
45 arson, third-party liability, weather, and terrain.

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1 BLM - Has established Serious Accident Investigation Teams (SAIT) that are  
2 managed on a rotational basis. ~~Dispatching/Coordinating~~ is done from the  
3 National Office of Fire and Aviation Safety Manager ~~and teams are ordered~~  
4 ~~through NICC.~~

5  
6 **Reports**

7  
8 **The 24 Hour Preliminary Report**

9 This report contains only the most obvious and basic facts about the accident. It  
10 will be completed and forwarded by the agency administrator responsible for the  
11 jurisdiction where the accident occurred. Names of injured personnel are not to  
12 be included in this report (reference them by position). In the case of an  
13 entrapment and/or fire fatality, use NWCG Wildland Fire Entrapment/Fatality  
14 Initial Report, NFES 0869.

15  
16 **The 72 Hour Expanded Report**

17 This report provides more detail about the accident and may contain the number  
18 of victims, severity of injuries, and information focused on accident prevention.  
19 Names of injured personnel are not to be included in this report (reference them  
20 by position).

21  
22 **The Final Report**

23 Within 45 days of the incident, a Factual Report (FR) and a Management  
24 Evaluation Report (MER) will be produced by the investigation team to  
25 document facts, findings, and recommendations and forwarded to the  
26 Designated Agency Safety and Health Official (DASHO) through the agency  
27 Fire Director(s).

28  
29 **Factual Report**

30 This report contains a brief summary or background of the event, and facts  
31 based only on examination of technical and procedural issues related to  
32 equipment and tactical fire operations. It does not contain opinions,  
33 conclusions, or recommendations. Names of injured personnel are not to be  
34 included in this report (reference them by position). Post-accident actions  
35 should be included in this report (emergency response attribute to survival of a  
36 victim, etc). ~~This report contains the following sections.~~

37 ~~Executive Summary: A brief narrative of the facts involving the accident~~  
38 ~~including dates, locations, times, name of incident, jurisdiction(s), number of~~  
39 ~~individuals involved, etc.~~

40 ~~Narrative: A detailed chronological narrative of events leading up to and~~  
41 ~~including the accident, as well as rescue and medical actions taken after the~~  
42 ~~accident. This section should spell out in detail who, what, and where.~~

43 ~~Investigative Process: A brief narrative stating the team was assigned to~~  
44 ~~investigate the accident. It should include a standard statement that human,~~  
45 ~~material, and environmental factors were considered. If one of these factors is~~  
46 ~~determined to be noncontributing to the accident, it should be addressed first and~~

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~~1 discounted. For example, if the investigation revealed that there were no  
2 environmental findings that contributed to the accident. Then simply state that  
3 fact and move on to the next factor. Human factors or material factors  
4 paragraphs should not be formulated so as to draw conclusions, nor should they  
5 contain adjectives or adverbs to describe and thus render an opinion into  
6 pertinent facts.  
7 Findings: Findings are developed from the factual information and are listed in  
8 the following order:  
9 Direct cause of the accident.  
10 Indirect causes which contributed to the accident.  
11 Other findings which, if left uncorrected, could lead to future accidents.  
12 Opinions or recommendations are not findings.  
13 Findings must be substantiated by the factual data within the report.  
14 Maps, Illustrations, and Photographs: graphic information used to document and  
15 visually portray facts.  
16 Records: factual data and documents used to substantiate facts involving the  
17 accident. Appendices: excerpts, tests results, and similar items used as reference  
18 information for documented facts involving the accident.~~

~~19  
20 Factual Reports will be submitted to Wildland Fire Lessons Learned Center  
21 (WFLLC) by the respective agency's National Wildland Fire Safety Leads.  
22 Website: <http://www.wildfirelessons.net/Reviews.aspx>~~

~~23  
24 Management Evaluation Report (MER)  
25 The MER is intended for internal use only and explores management policies,  
26 practices, procedures, and personal performance related to the accident. ~~It takes~~  
27 ~~the abnormalities and~~ The MER categorizes findings identified in the factual  
28 report and categorizes them for management. This report may contain:  
29 Opinions by the investigators as to the cause provides recommendations to  
30 prevent or reduce the risk of the accident.  
31 Conclusions and observations.  
32 Confidential information.  
33 Recommendations for corrective measures.~~

~~34  
35 This reports similar accidents. The MER includes the following sections:  
36 Executive Summary: A brief narrative of the facts involving the accident. Keep  
37 this section short. Readers can refer to the factual report if they want more  
38 detail.  
39 Findings: From the factual report.  
40 Other Findings: (DOI only): Other findings not contributing to the accident but,  
41 if left uncorrected, could lead to other accidents.  
42 Other Information: This paragraph can contain opinions by the investigators,  
43 conclusions and observations, and confidential information which the team feels  
44 is relevant for management consideration. (This paragraph is not required).  
45 Recommendations: Recommendations are prevention measures management  
46 may take to prevent similar accidents. ~~Although this is not an requirement, there~~~~

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~~should be a recommendation for each cause.~~ The recommendations must be reasonable, feasible, relate to the cause(s) of the accident, and allow for definitive closure. Depending upon the scope of impact the recommendations can be implemented by a local unit, the state/regional office or the national office. The team should specify who should implement the recommendations. Enclosures: Information not contained in the Factual Report, but which the team feels necessary to support their recommendations. Since this report can be obtained by the public under certain circumstances, do not include anything that is not needed to substantiate recommendations.

Accident Review Board/Board of Review  
~~A-An Accident Review Board/Board of Review is used to evaluate recommendations, determine responsibility, and follow up on serious accident investigations. After determining responsibility for an incident, the Board of Review can make recommendations ranging from no and develop a corrective action taken to termination of employment plan.~~  
~~Only the Agency Director or Deputy Director may appoint a Board of Review.~~

~~For additional information on accident investigations, refer to:~~  
~~[http://www.nife.gov/safety\\_study/accident\\_invest/index.htm](http://www.nife.gov/safety_study/accident_invest/index.htm)~~

Non-Serious Wildland Fire Accident Investigation & Trespass Process

Notification  
Agency specific reporting requirements shall be followed. In most instances, supervisors will notify unit fire management officer, who will then make notification through chain of command.

Investigation Team Membership  
Investigation team membership will depend upon the severity of the accident. At a minimum, the team should consist of a chief investigator, a safety advisor, and one technical specialist. Team members may have dual roles (e.g., chief investigator/safety advisor). More complex accidents may require the need for a Team Leader and multiple technical specialists.

Final Report  
Within 45 days of the accident, a final report detailing the accident to include facts, findings, and recommendations shall be submitted to the senior manager dependent upon the level of investigation (e.g., Local agency administrator, State/Regional Director, and Agency Fire Director or their designee).

The Final Report (minus recommendations, conclusions and observations) will be submitted to Wildland Fire Lessons Learned Center (WFLLC) by the respective agency's National Fire Safety Leads. Website:  
<http://www.wildfirelessons.net/Reviews.aspx>

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46

Processes Common to Serious and Non-Serious Wildland Fire Investigations  
Site Protection - The site of the incident should be secured immediately and nothing moved or disturbed until the area is photographed and visually reviewed. Exact locations of injured personnel, entrapments, injuries, fatalities, and the condition and location of personal protective equipment, property, and other equipment must be documented.  
Management of Involved Personnel - Treatment, transport, and follow-up care must be immediately arranged for injured and involved personnel. The agency administrator or delegate should develop a roster of involved personnel and supervisors and ensure they are available for interviews by the investigation team. The agency administrator should consider relieving involved supervisors from fireline duty until the preliminary investigation has been completed.  
Attempt to collect initial statements from the involved individuals prior to a Critical Incident Stress Management (CISM) session.  
Critical Incident Stress Management (CISM) - CISM is the responsibility of local agency administrators, who should have individuals pre-identified for critical incident stress debriefings. The process for ordering CISM support can be found in Appendix Q. Also refer to The Agency Administrator’s Guide to Critical Incident Management (PMS 926), available at: <http://www.nwcg.gov/pms/pubs/PMS926-DRAFT.pdf>. Individuals or teams may be available through Employee Assistance Programs (EAP’s) or Geographic Area Coordination Centers (GACC’s). A Critical Incident Stress Defusing should be provided no more than 8 hours after an incident, or if possible, it should be provided immediately (one to two hours) after the incident, and usually takes 30 minutes to 1 hour. A Critical Incident Stress Debriefing should occur between 24 to 72 hours after the incident, and usually takes 1-3 hours.  
24-Hour-Preliminary Report - This report contains only the most obvious and basic facts about the accident. It will be completed and forwarded by the agency administrator responsible for the jurisdiction where the accident occurred. Names of injured personnel are not to be included in this report (reference them by position).  
72-Hour Expanded Report - This report provides more detail about the accident and may contain the number of victims, severity of injuries, and information focused on accident prevention. It will be completed and forwarded by the SAIT. Names of injured personnel are not to be included in this report (reference them by position).  
Investigation Report Standard Format  
Executive Summary - A brief narrative of the facts involving the accident including dates, locations, times, name of incident, jurisdiction(s), number of individuals involved, etc.

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Narrative - A detailed chronological narrative of events leading up to and including the accident, as well as rescue and medical actions taken after the accident. This section should spell out in detail who, what, and where.

Investigation Process - A brief narrative stating the team was assigned to investigate the accident. It should include a standard statement that human, material, and environmental factors were considered. If one of these factors is determined to be noncontributing to the accident, it should be addressed first and discounted. For example, if the investigation revealed that there were no environmental findings that contributed to the accident, simply note the fact and move on to the next factor. Human factors or material factors paragraphs should not be formulated so as to draw conclusions, nor should they contain adjectives or adverbs that describe and thus render an opinion into pertinent facts.

Findings - Findings are developed from the factual information and are based on the weight of evidence, professional knowledge, good judgment and are listed in chronological order. Findings must be substantiated by the factual data within the report.

Discussion - Provide a brief explanation of factual and other pertinent information that lead to the finding(s).

Recommendations - Recommendations are the prevention measures that should be taken to prevent similar accidents. Provide recommendations that are consistent with the findings and identify at which level the action needs to occur.

Conclusions and Observations - Investigation team’s opinions and inferences may be captured in the section.

Maps/Photographs/Illustrations - Graphic information used to document and visually portray facts.

Appendices - Reference materials (e.g., fire behavior analysis, equipment maintenance reports, agreements).

Records - factual data and documents used to substantiate facts involving the accident.

Fire Cause Determination & Trespass Investigation

Introduction

Agency policy requires any wildfire to be investigated to determine cause, origin, and responsibility. Accurate fire cause determination is a necessary first step in a successful fire investigation. Proper investigative procedures, which occur concurrent with initial attack, more accurately pinpoint fire causes and can preserve valuable evidence that would otherwise be destroyed by suppression activities.

The agency or its employees must pursue cost recovery or document why cost recovery is not initiated for all human caused fires on public and/or lands under protection agreement.

Fire trespass refers to the occurrence of unauthorized fire on agency-protected lands where the source of ignition is tied to some type of human activity.

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1  
2 Policy

3 The agency must pursue cost recovery, or document why cost recovery is not  
4 required, for all human-caused fires on public lands. The agency will also  
5 pursue cost recovery for other lands under fire protection agreement where the  
6 agency is not reimbursed for suppression actions, if so stipulated in the  
7 agreement.

8  
9 For all human-caused fires where negligence can be determined, trespass actions  
10 are to be taken to recover cost of suppression activities, land rehabilitation, and  
11 damages to the resource and improvements. Only fires started by natural causes  
12 will not be considered for trespass and related cost recovery.

13  
14 The determination whether to proceed with trespass action must be made on  
15 "incident facts," not on "cost or ability to pay." Trespass collection is both a  
16 cost recovery and a deterrent to prevent future damage to public land. It is  
17 prudent to pursue collection of costs, no matter how small. This determination  
18 must be documented and filed in the unit office's official fire report file.  
19 The agency administrator has the responsibility to bill for the total cost of the  
20 fire and authority to accept only full payment. On the recommendation of the  
21 State/Regional Director, the Solicitor/Office of General Counsel may  
22 compromise claims of the United States, up to the monetary limits (\$100,000)  
23 established by law 31 U.S.C. 3711[a], 4 CFR 103-104, and 205 DM 7.1 and 7.2.  
24 The Solicitor/Office of General Counsel will refer suspension or termination of  
25 the amount, in excess of \$100,000, exclusive of interest, penalties, or  
26 administrative charges, to the Department of Justice.

27  
28 Unless specified otherwise in an approved protection agreement, the agency that  
29 has the land management jurisdiction/administration role is accountable for  
30 determining the cause of ignition, responsible party, and for obtaining all  
31 billable costs, performing the billing, collection, and distribution of the collected  
32 funds. The agency with the fire protection responsibility role must provide the  
33 initial determination of cause to the agency with the land management  
34 jurisdiction/administration role. The agency providing fire protection shall  
35 provide a detailed report of suppression costs that will allow the jurisdictional  
36 agency to proceed with trespass procedures in a timely manner.

37  
38 Each agency's role in fire trespass billing and collection must be specifically  
39 defined in the relevant Cooperative Fire Protection Agreement. The billing and  
40 collection process for federal agencies is:  
41 For example, a federal agency fire occurs on another federal agency's land and  
42 is determined to be a trespass fire. BLM provides assistance, and supplies costs  
43 of that assistance to the federal agency with jurisdictional responsibility for  
44 trespass billing. The responsible federal agency bills and collects trespass, and  
45 BLM then bills the federal agency and is reimbursed for its share of the  
46 collection.

1 For example, where BLM administered land is protected by a state agency, the  
2 billing and collection process is:  
3 The state bills BLM for their suppression costs. The BLM will pursue trespass  
4 action for all costs, suppression, rehabilitation, and damages, and deposits the  
5 collection per BLM's trespass guidance.  
6  
7 All fires must be thoroughly investigated to determine cause. Initiation of cause  
8 determination must be started with notification of an incident. The initial attack  
9 incident commander and the initial attack forces are responsible for initiating  
10 fire cause determination and documenting observations starting with their travel  
11 to the fire. If probable cause indicates human involvement, an individual trained  
12 in fire cause determination should be dispatched to the fire. Agency References:  
13 BLM - 9238-1  
14 FWS - Fire Management Handbook Chapter 4 or  
15 [www.fws.gov/fire/redbook/trespass.pdf](http://www.fws.gov/fire/redbook/trespass.pdf)  
16 NPS - RM-18, Chapter 8 and RM-9  
17 FS - FSM-5130 and FSM-5300

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