DOE/RL-2000-63

Type B Accident Investigation

October 2000

U.S. Department of Energy Response to the 24 Command Wildland Fire on the Hanford Site — June 27-July 1, 2000

On June 30, 2000, I appointed a Type B Accident Investigation Board to investigate the June 27, 2000, Hanford Site Fire in Richland, Washington. The Board's responsibilities have been completed with respect to this investigation. The analysis, identification of contributing and root causes, and judgments of need reached during the investigation were performed in accordance with DOE O 225.1A, Accident Investigations.

I accept the report of the Board and authorize release of this report for general distribution.

Keith A. Klein
Manager
U.S. Department of Energy
Richland Operations Office

Oct. 27, 2000
Date

This report is an independent product of the Type B Accident Investigation Board appointed by Keith A. Klein, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

The Board was appointed to perform a Type B investigation of this accident and to prepare an investigation report in accordance with DOE O 225.1A, Accident Investigations.

The discussion of facts, as determined by the Board, and the views expressed in the report do not assume and are not intended to establish the existence of any duty at law on the part of the U.S. Government, its employees or agents, contractors, their employees or agents, or subcontractors at any tier, or any other party.

This report neither determines nor implies liability.

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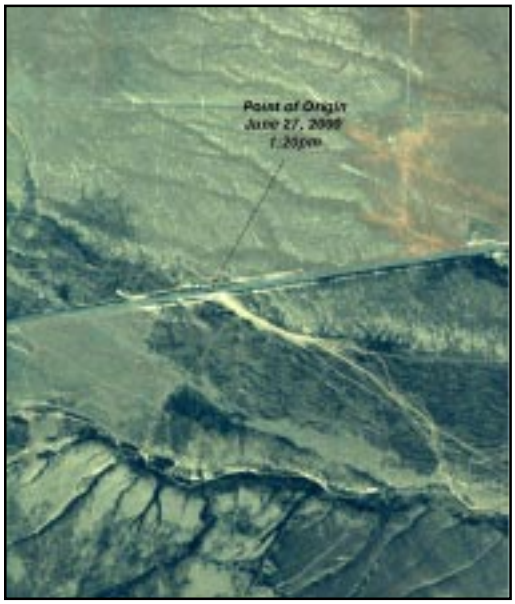
U.S. Department of Energy Response to the 24 Command Wildland Fire on the Hanford Site — June 27-July 1, 2000



October 2000

Fire destruction at accident scene

Executive Summary

Overview

On June 27, 2000, a passenger vehicle and semitractor-trailer collided on Washington State Route (SR) 24 near the U.S. Department of Energy's (DOE) Hanford Site. The vehicle fire resulting from the fatality accident quickly ignited vegetatio on both sides of the highway. An abundance of natural fuel and adverse weather conditions allowed the fire to move rapidly across the Fitzner-Eberhardt Arid Lands Ecology (ALE) Reserve, a 120-square-mile area southwest of the central Hanford Site and part of the Hanford Reach National Monument. By the afternoon of June 28, the fire jumped SR 240, threatening facilities on the central Hanford Site. From June 27 through July 1, the 24 Command Wildland Fire burned nearly 300 square miles of both public and private lands. The fire consumed an average of 2,000 acres per hour. In addition, during one 90-minute period, the fire traveled 20 miles.

Accident scene

On June 30, the manager of the DOE Richland Operations Office (RL) established a Type B accident investigation board (Board) to address the responses of DOE and its Hanford Site contractors to the fire. This report documents the Board's investigation. The report focuses on the emergency response of Hanford personnel's actions taken on lands within their jurisdiction or in response to mutual aid agreements. It also applies lessons learned from previous fires at the Hanford Site, with the goal of providing information for use in improving DOE response to fire incidents across the agency's national complex.

The Fire

The June 27 motor vehicle accident occurred at Milepost 36 on SR 24, approximately two miles west of the Yakima Barricade on the northwest corner of the Hanford Site. The semitractor-trailer involved in the accident jackknifed as a result of the collision and fully blocked both the eastbound and westbound lanes of traffic. Before the semi came to a complete stop, the fuel from the vehicle's tanks ignited and started fires on both sides of SR 24.

The area where the fires began is managed as the ALE Reserve by the U.S. Fish and Wildlife Service (FWS) under permit from DOE. The vegetation surrounding the accident site is typical of that on the Hanford Site—cheat grass, tumbleweed, and sagebrush representative of an arid shrub-steppe habitat. Hot, dry weather had accelerated the fire season in the area. The National Weather Service had posted a Red Flag warning, alerting forecast users to an ongoing or imminent critical fire weather pattern.

Hanford Fire Department grass rig fights fire on Arid Lands Ecology Reserve

Initial Response

Within minutes of the accident, the Hanford Fire Department (HFD) and Hanford Patrol received notification of the event from the dispatcher for the Washington State Patrol as well as from private citizens. At 1:39 p.m., personnel from the Hanford Patrol and HFD Medic 92 Unit were the first emergency responders to arrive on the scene. At the scene, the emergency responders found a semitractor-trailer fully engulfed in flame and two separate wildland fires estimated at five acres and rapidly growing. Considerable traffic had backed up in both the eastbound and westbound lanes of the narrow roadway, complicating the scene.

Upon receiving the initial notification, the HFD engine company captain recognized the severity of the fire based on both knowledge of the terrain and on the Red Flag warning for the day. He initially dispatched two additional fire suppression units in addition to the standard response units (engine, pumper/tanker, and two ambulances). While en route to the scene, he notified the Benton County Southeast Communications Center (SE-COMM) and requested additional HFD firefighting support, which included heavy equipment.

The HFD captain arrived on the scene at 1:44 p.m. and established an incident command. The fire was estimated to have increased to ~10 acres in size on both sides of SR 24 and was spreading at about 6 to 8 miles per hour with high winds and some upward flame heights of approximately 30 feet. Vehicles continued to enter and congest SR 24 on both sides of the accident, and the captain requested Hanford Patrol to close the highway. At approximately 1:45 p.m., HFD personnel cut the fencelines to permit pumper/tankers immediate access to the ALE Reserve.

Arriving grass units and pumper/tankers were assigned to fight the fire on both the north and south sides of SR 24. The primary objective on the north side was to protect nearby private structures and property. The units on the south side were tasked with extinguishing the flanks of the fire while working their way to the head of the fire, in addition to providing support to protect the traffic stopped on the roadway.

Incident Command

The HFD battalion chief arrived on scene and assumed command at 1:52 p.m. The HFD captain already had notified the FWS of the event and had requested FWS fire units. The battalion chief also requested additional heavy equipment to be staged at the Hanford Yakima Barricade approximately two miles from the fire location. The U.S. Army Yakima Training Center was contacted and initially agreed to provide helicopter fire suppression support.

HFD pumper/tanker attacks fire

At approximately 2:30 p.m., a HFD grass rig was approximately two miles south of SR 24, scouting ahead of pumper/tankers to locate a passable route, when its engine quit. The crew members were forced to abandon their vehicle, which was totally destroyed, and escaped through the oncoming fireline and into the burned area. The crew members were not injured and walked back to SR 24, where they were picked up by one of the pumper/tankers.

Also during this period, a private citizen volunteered his services and heavy equipment to create firebreaks. His service was declined for safety reasons.

By 3:00 p.m., all HFD wildland assets had been dispatched, and aerial assets were requested from the Central Washington Interagency Communications Center (CWICC). The fire, estimated then at approximately 500 acres, was rapidly outrunning crews on the south side of SR 24.

During the afternoon and evening, the fire continued to expand to the north, south, and west. Arriving units were assigned to fight on multiple fronts. Based upon his assessment, the Incident Commander (HFD chief) requested two strike teams of wildland apparatus under the Tri-County Mutual Aid Agreement. He also requested additional heavy equipment (caterpillars and road graders). Two air tankers accompanied by a lead aircraft began retardant drops at 4:00 p.m. and continued until dark.

Throughout the evening, resources and equipment were deployed as they arrived.

At approximately 11:36 p.m. on June 27, the HFD relinquished Incident Command to a Type 3 Incident Management Team (IMT) but remained in support at the Incident Command Post (ICP). This turnover was the last point at which Hanford personnel exercised command authority for the overall fire. From that time, the HFD participated as a responder under the National Wildfire Coordinating Group incident command structure (Type 1, 2, and 3 IMT). All HFD equipment remained fully deployed in support of the fire on the ALE Reserve and adjacent private lands on Rattlesnake Mountain.

By the morning of June 28, the fire size was estimated at 23,630 acres. The fire grew to an estimated 31,190 acres by noon and breached the last best line of defense on the ALE Reserve at Snively Canyon.

Weather conditions had deteriorated, and both wind strength and direction were affecting the Hanford Site unfavorably. Because the fire was threatening to cross SR 240 onto the central Hanford Site (200 Area), the HFD Incident Commander redeployed HFD firefighting assets to defend property and structures on the site. By 3:47 p.m., the fire had jumped SR 240 and was moving eastward toward the 200 West Area.

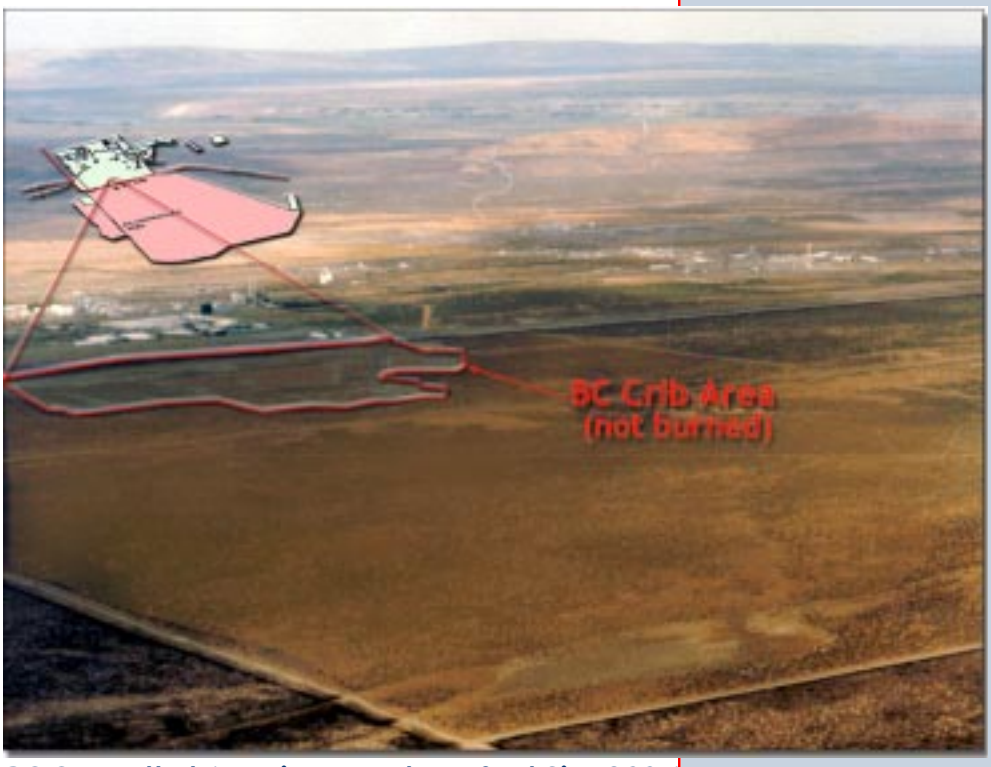
The fire's approach to the 200 Area prompted RL to declare an Alert level emergency for the Hanford Site at 4:28 p.m., and the Hanford Emergency Operations Center (EOC) in the downtown Richland Federal Building was activated.

DOE-HQ, in consultation with RL and the White House, requested that the U.S. Environmental Protection Agency (EPA) provide radiological monitoring of the event. In addition, RL requested that the Aerial Measuring System (AMS) aircraft maintained by the DOE Nevada Operations Office be deployed to the Hanford Site.

The fire's continued growth (estimated to have consumed approximately 88,640 acres by 6:00 p.m.) and the level of resources being used to fight it required escalating the Type 3 IMT to a Type 2 IMT at approximately 6:00 p.m. on June 28. (A Type 2 IMT provides state level support capabilities.) The fire's progression to the south also prompted Benton County to declare a state of emergency at 6:00 p.m. On the Hanford Site, the spreading fire threatened the Laser Interferometer Gravitational-Wave Observatory (LIGO), a non-DOE facility. The LIGO was evacuated safely.

Fighting the 24 Command fire by air

At approximately 8:00 p.m., the fire jumped SR 225 near the Wanawish Dam at Horn Rapids on the Yakima River and was approaching industrial facilities, recreational, and residential properties on the Hanford boundaries. The fire also was approaching the HAMMER and Hanford Patrol facilities on the site. Soon after 8:00 p.m., the fire jumped the Yakima River and briefly threatened lands just north of the city of West Richland. At approximately 9:00 p.m., the fire entered the Benton City area.



BC Controlled Area in central Hanford Site 200 Area

On June 29 at 1:45 a.m., the Governor of the State of Washington declared a state of emergency. The fire had been stopped successfully around the 200 West facilities but was continuing to move east and south across the central Hanford Site. During the remainder of June 29, fire crews continued to battle the blaze. Defensive lines were cut along major thoroughfares on the site, and crews kept the fire from reaching the 400 and 300 Area facilities. Reduced wind speeds significantly improved weather conditions, which contributed to fire containment. Aerial support was used to combat the fire that burned a portion of the BC Controlled Area but not the BC Crib Area.

Closure

On June 30, RL and the Hanford Site contractor organizations established a recovery team. A post-event radiological survey team was dispatched to assess unused laboratory facilities that had been overrun by fire on the ALE Reserve's southeast flank of Rattlesnake Mountain. The main facilities were found to be intact, but the fire had destroyed a nearby trailer and metal storage shed. Neither structure housed any radioactive or hazardous materials. These were the only structural losses suffered on the Hanford Site.

The EOC Alert emergency was terminated at 4:57 p.m. on June 30. On July 1 at 4:00 p.m., the fire was officially declared to be contained and out. Firefighters had patrolled the site, extinguishing remaining hotspots and looking for flare-ups during the day.

Conclusions

The Board concluded that the HFD's response to the initial event was proactive and timely. The fire was an immediate and spontaneous result of the vehicle accident. However, the lack of maintenance of defensible firebreaks along state highways running through the Hanford Site allowed the fire to spread quickly onto the ALE Reserve. The HFD leadership recognized the severity of the fire and marshaled all available resources at the disposal of the local command. Within the first hour of the event, all available HFD wildland resources were deployed. In addition, air tanker support and FWS firefighting resources were requested at a very early stage. The decisions to escalate the fire response from local command through mutual aid and to a Type 3 IMT structure were made within hours of the initial notification and were influenced appropriately by the characteristics of the fire and the unique terrain involved.

The Board also viewed the emergency response of other Site personnel as proactive. The early release of nonessential staff from Hanford was preventive, diminishing overall health effects to workers, allowing for an orderly withdrawal in front of the fire, and providing less encumbered access to emergency responders.

Sound preventive fire planning and execution, including fire-safe designs and enforcement of vegetation control and fire setbacks around facilities, contributed to the successful defense of Hanford structures and infrastructure. Vegetation management on waste sites and controlled areas contributed positively to minimizing the release of airborne radioactivity during the fire. Only very minor vegetation damage occurred on the waste sites and controlled areas. The Board concluded that the combination of sound preventive techniques and effective event management accounted for the light loss of property on the Hanford Site and minor injuries to Hanford staff observed.

The Board determined that the Hanford Site successfully activated its emergency response organization to combat the 24 Command Wildland Fire. No substantial gaps in management systems or infrastructure were identified. Consequently, the judgments of need reached by the Board represent areas for improvement and lessons learned.

Judgments of Need

Judgments of need represent managerial controls and safety measures necessary to prevent or minimize the probability or severity of a recurrence of an event. They flow from the conclusions and causal factors and require that management develop follow-up corrective actions. The specific needs identified by the Board have been targeted to provide for the most efficient and effective focus of management's energy. The Board developed four primary judgments of need based on conclusions reached through analysis of the pertinent facts and occurrences during the event. The primary judgments of need are as follows:

- RL/ORP should evaluate existing emergency response processes related to Hanford events affecting state and national systems, as well as state and national events affecting Hanford systems. (JON-1)
- RL/ORP should review and revise sitewide and protracted emergency and recovery operations, including emergency communications and resource readiness. (JON-2)
- DOE-HQ Office of Emergency Response (SO-42) should assess the Federal Radiological Emergency Response Plan (FRERP) for inclusion of EPA independent radioactivity monitoring during events and for limited deployment of the Federal Radiological Monitoring and Assessment Center (FRMAC) whenever EPA has been deployed. In addition, DOE-HQ Office of Emergency Response (SO-42) should determine if AMS assets are at an acceptable level of readiness. (JON-3)
- RL/ORP should improve the corrective action management system to ensure that improvement actions are managed adequately. (JON-4)

Judgment of Need 1

RL/ORP should evaluate existing emergency response processes related to Hanford events affecting state and national systems, as well as state and national events affecting Hanford systems. (JON-1)

RL should implement or revise agreements with external agencies and non-DOE tenants of the Site that define roles and responsibilities for emergency response. (1a)

RL/ORP and the contractors need to engage and coordinate with local clean air authorities, state regulators, the DOE-HQ Office of Environment, and the Washington State Department of Transportation to improve firebreaks along state right-of-way shoulders between Highways 24 and 240 and the DOE fenceline. (1a1)

RL/ORP need to update and enhance MOUs and agreements between RL/ORP and the FWS, and between the HFD and FWS, to address NWCG roles and responsibilities and protocols associated with ordering aerial tanker suppression support. (1a2)

RL/ORP need to put into place MOUs or agreements with the Yakima Training Center (for aerial helicopter support for wildland fire suppression) and the Washington State Patrol Yakima Detachment (for incident management) to support wildland firefighting operations. (1a3)

RL/ORP should review and revise as appropriate agreements (e.g., MOUs, contracts) with non-DOR tenants at the Hanford Site (e.g., LIGO, U.S. Ecology, Energy Northwest) that implement execution of Site emergency management. (1a4)

RL/ORP should evaluate establishment of formal MOUs with WDOH and EPA on protocols for radiological monitoring during the emergency, ingestion, and recovery phases of a radiological event. (until resolution of this issue is provided at the national level; see Recommendations for Resolution of JON-3). (1a5)

RL/ORP should review and revise existing processes for control and deployment of non-Hanford emergency personnel used during field emergency response. (1b)

The HFD needs assessment document must be updated to include NWCG planning, protocols, involvement, and resources necessary to manage future wildland fires of similar size, and results should be fed back into the Emergency Preparedness program. (1c)

RL/ORP should evaluate the need for additional liaison and interfaces between the EOC and external agencies to ensure accurate and timely exchange of emergency status and information. (1d)

RL/ORP should consider inclusion of mutual aid representatives at the EOC during sitewide emergency events. (1d1)

RL/ORP should review and revise the process for technical review for accuracy and approval of hazard communications with outside agencies. (1e)

Judgment of Need 2

RL/ORP should review and revise sitewide and protracted emergency and recovery operations including emergency communications and resource readiness. (JON-2)

RL/ORP should examine the emergency management process to ensure that facility/site abandonment is addressed in the evacuation process. (2a)

RL/ORP should review and revise existing emergency response procedures to address non-facility-specific and multiple-facility emergencies, including Incident Command Post structure and staffing. (2b)

RL/ORP should add a new Emergency Action Level based on an anticipated fire in the Snively Canyon area of the Arid Lands Ecology Reserve. (2b1)

RL/ORP should review and revise the requirements for identification of essential personnel during emergencies and for the provision of avenues of safe access. (2c)

RL/ORP should review, revise, and demonstrate effectiveness of emergency response communication capabilities to enable participation of pertinent Site and external entities in emergencies that affect the Hanford Site (cell phones, radio frequencies, information dissemination). (2d)

RL/ORP should review, revise, and demonstrate effectiveness of emergency response staffing levels to ensure shift turnovers can be supported for protracted operations. (2e)

RL/ORP should review and revise the process for identification of Site staff expertise in advisory and support capacities to enhance emergency management teams. (2f)

RL/ORP should review and revise the process for collection and analysis of radiological data during and post-event. (2g)

DOE/ORP should review and revise the recovery action process from emergency events to include scope beyond facility reentry. (2h)

RL should review and revise the need to disseminate requirements for use of non-DOE equipment. (2i)

RL/ORP should review and revise the process for the technical review for accuracy and approval of press releases. (2j)

RL/ORP should upgrade the tools available to emergency response to enhance the collection, display, and dissemination of emergency data. (2k)

RL/ORP should review and revise the process for controlling airspace and authorizing DOE-funded personnel on chartered aircraft. (2l)

RL and the General Services Administration should assess the design of the Federal Building to support Emergency Operations Center operations. (2m)

RL/ORP should review and revise the staging, maintenance, and storage of equipment used in emergency response. (2n)

Judgment of Need 3

DOE-HQ Office of Emergency Response (SO-42) should assess the FRERP for inclusion of EPA independent radioactivity monitoring during events and for limited deployment of FRMAC whenever EPA has been deployed. In addition, DOE-HQ Office of Emergency Response (SO-42) should determine if AMS assets are at an acceptable level of readiness. (JON-3)

Judgment of Need 4

RL/ORP should improve the corrective action management system to ensure that improvement actions are managed adequately. (JON-4)

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Abbreviations

ALE	Arid Lands Ecology (Fitzner-Eberhardt Arid Lands Ecology Reserve)
AMS	Aerial Measuring System
ARAC	Atmospheric Release Advisory Capability
BCCAA	Benton County Clean Air Authority
CWICC	Central Washington Interagency Communications Center
DOE	U.S. Department of Energy
DOE-HQ	U.S. Department of Energy Headquarters (Washington, D.C.)
ECT	emergency coordination team
EH	Environmental Health
EOC	Emergency Operations Center
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FRERP	Federal Radiological Emergency Response Plan
FRMAC	Federal Radiological Monitoring and Assessment Center
FWS	U.S. Fish and Wildlife Service
HAMMER	Hazardous Materials Management and Emergency Reponse
HFD	Hanford Fire Department
IC	Incident Command; Incident Commander
ICP	Incident Command Post
IMT	Incident Management Team
ISMS	Integrated Safety Management System
JIC	Joint Information Center
JON	judgment of need
LIGO	Laser Interferometer Gravitational-Wave Observatory
MOU	memorandum of understanding
NWCG	National Wildfire Coordination Group
ORP	Office of River Protection
POC	Hanford Patrol Operations Center
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RL	DOE Richland Operations Office
SE-COMM	Southeast Communications Center
SED	Site Emergency Director
SME	subject matter expert
SR	State Route
TFR	temporary flight restriction
UCP	Unified Command Post
UDAC	Unified Dose Assessment Center
WDOH	Washington State Department of Health
WSDOT	Washington State Department of Transportation

1.0 Introduction

1.1 Background

At approximately 1:20 p.m. on June 27, 2000, two motor vehicles collided in a fatal accident on Washington State Route (SR) 24, adjacent to the northwestern border of the U.S. Department of Energy (DOE) Hanford Site. Vehicle fuel tanks ruptured and fuel ignited, resulting in a fire that quickly involved the vegetation on both sides of the highway.

Before it was contained on July 1, the 24 Command Wildland Fire charred nearly 164,000 acres of land both on and off the Hanford Site. The fire burned at an average rate of 2,000 acres per hour; further, in one 90-minute period, it traveled 20 miles. More than 900 firefighters from multiple agencies ultimately were involved in the event, supported by 200 pieces of firefighting apparatus, including dozens of bulldozers and other heavy equipment. Two helicopters and five air tankers dumped countless loads of water and retardant on the fire.

Hanford Fire Department emergency responders at accident scene

In addition to the firefighters, the event involved hundreds of Hanford personnel from the DOE Richland Operations Office (RL) and Office of River Protection (ORP), as well as numerous contractor organizations on the Hanford Site. Their efforts focused on emergency response, radiological control and monitoring, and ensuring security and safety for site personnel and assets.

On June 30, the RL Manager established a Type B accident investigation board (Board) in accordance with DOE Order 225.1A, *Accident Investigations,* to assess the responses of DOE and its Hanford Site contractors to the fire (Appendix A).

1.2 Site Description

The Hanford Site in southeastern Washington State is adjacent to the Columbia River, which forms the site's northern and eastern boundaries . The western boundary is atop the ridge of Rattlesnake Mountain, a large, treeless basalt mountain. Elevation on the Site ranges from 400 feet at the Columbia River to 3,630 feet at the summit of Rattlesnake Mountain. Immediately to the south of the Site is the city of Richland. Adjacent to or near the Site are the cities of West Richland, Benton City, and Kennewick (all in Benton County). Across the Columbia River and to the southeast is the city of Pasco (in Franklin County).

The Site's landscape is shrub-steppe, largely sand and sagebrush, with an average annual precipitation of 6.26 inches (per Hanford Meteorological Station records). The Hanford Site also encompasses the Fitzner-Eberhardt Arid Lands Ecology (ALE) Reserve, a 120-square-mile area to the southwest of the central Site. The ALE Reserve, managed by the U.S. Fish and Wildlife Service (FWS), was designated a part of the Hanford Reach National Monument on June 9, 2000.

Since the 1940s when it was created as part of the Manhattan Project, Hanford has played a pivotal role in U.S. national defense as a plutonium production complex. Today, the Site is engaged in a new mission—environmental cleanup. Under contract to RL and ORP, multiple private-sector companies are working at Hanford to safely clean up and manage the Site's legacy wastes. The current Hanford workforce is approximately 10,600 personnel.

1.3 Investigation Scope, Conduct, and Methodology

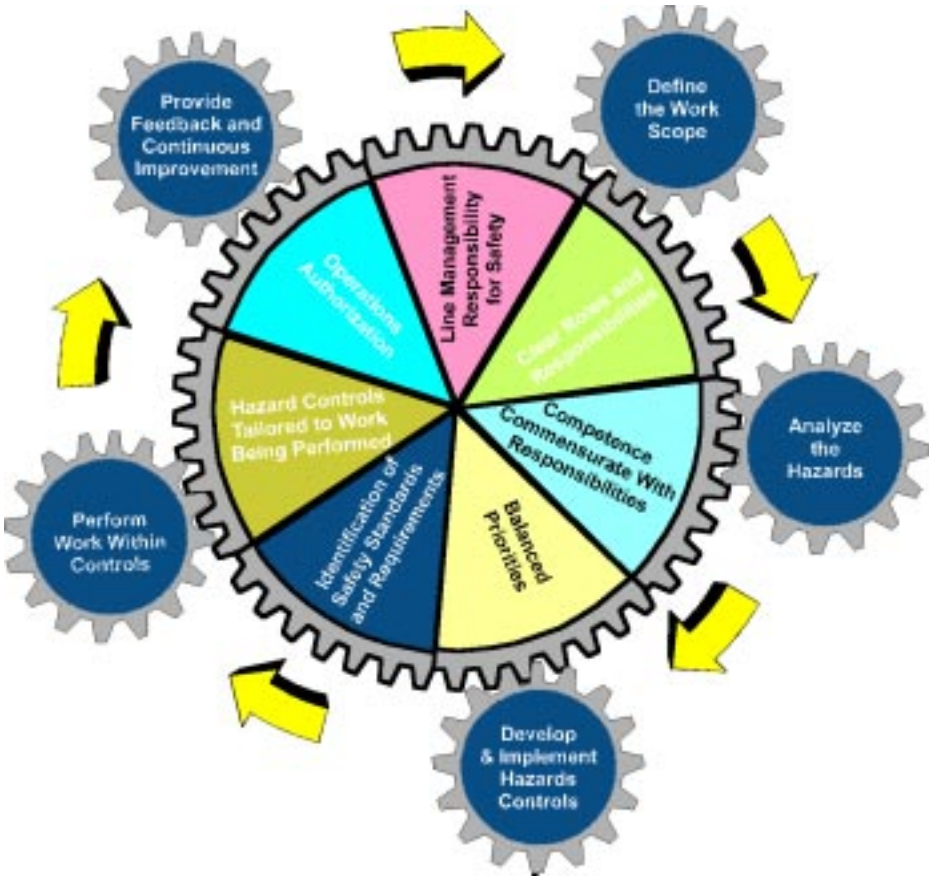
The scope of the Board's investigation, as established by the RL Manager's June 30 memorandum, was to review and analyze DOE and contractor response to the 24 Command Wildland Fire. The Board was to explore the emergency response process of Hanford resources and the application of lessons learned from previous fires at Hanford. The Board was instructed to place specific emphasis on "... any further lessons learned that can be applied to improving the DOE response to a fire incident, not just at Richland, but that might also be applicable to other DOE sites."

The investigation covered the full response of RL and Hanford emergency response personnel and organizations, including direct response to the fire, actions of the emergency operations process, Hanford Patrol activities, external interfaces and communications, radiological monitoring, and Hanford support roles. The scope of the investigation also was limited to those times and events directly controlled by Hanford personnel or which involved their direct participation.

The Board used the following methodology to conduct its investigation:

- collecting the facts relevant to the event through interviews with event participants and witnesses, reviews of event records and procedures, first-hand observation of locations critical to understanding the conditions and progress of the fire, reviews of audio tapes of communications during the event, and examination of photographs taken during and after the event
- correlating and analyzing the facts through barrier analysis, change analysis, and event and causal factors charting
- analyzing the safety management processes and controls using the core functions and guiding principles of the DOE Integrated Safety Management System (ISMS)
- developing conclusions and judgments of need, based on analysis of the data, for corrective actions addressing opportunities for improvement
- performing a tier analysis and a root cause evaluation on the conclusions, to direct the identified needs to the appropriate management level for resolution.

Fire near 400 Area on Hanford Site



Accident Investigation Terminology

A causal factor is an event or condition in the accident sequence that contributes to the unwanted result. There are three types of causal factors: direct cause, which is the immediate event(s) or condition(s) that caused the accident; root cause(s), which is (are) the causal factor(s) that, if corrected, would prevent recurrence of the accident; and contributing causes, which are causal factors that collectively with other causes increase the likelihood of an accident, but that individually did not cause the accident.

Events and causal factors analysis includes charting, which depicts the logical sequence of events and conditions (causal factors) that allowed the event to occur, and the use of deductive reasoning to determine events or conditions that contributed to the accident.

Barrier analysis reviews hazards, the targets (people or objects) of the hazards, and the controls or barriers that management systems put in place to separate the hazards from the targets. Barriers may be physical or management.

Change analysis is a systematic approach that examines planned or unplanned changes in a system that caused undesirable results related to the accident.

2.0 The Fire and Hanford's Response

2.1 Initiating Event

On Tuesday, June 27, 2000, a fatal motor vehicle accident occurred at about 1:20 p.m. on SR 24 at Milepost 36, approximately two miles west of Hanford's Yakima Barricade (on the northwest corner of the site). The semitractor-trailer involved in the accident jackknifed as a result of the collision and fully blocked both the east- and westbound lanes of traffic on the two-lane road. Before the semi came to a complete stop, the fuel from its tanks ignited and started fires on both the north and south sides of SR 24.

The fires began in the area of ALE Reserve, which is managed by the FWS under permit from DOE. The vegetation in this area is representative of those on the Hanford Site—cheat grass, tumbleweeds, and sagebrush typical of an arid shrub-steppe habitat. Hot, dry weather throughout the Columbia Basin region had accelerated the fire season in the area; a Red Flag warning had been issued earlier on the day of the accident.

Red Flag Warning

The National Weather Service issues a Red Flag warning when forecast weather conditions together with existing environmental conditions could result in extreme fire behavior, or, as in the case of dry lightning, extensive fire starts within the next 24 hours.

2.2 Initial Response

Within minutes of the accident, the Hanford Fire Department (HFD) and Hanford Patrol were notified of the event by the Washington State Patrol dispatcher and by private citizens. At 1:39 p.m., personnel from the Hanford Patrol and HFD Medic Unit 92 were the first emergency responders to arrive on the scene. Travel time for the units was approximately 14 minutes.

When they arrived, the emergency responders found a semi-tractor-trailer fully engulfed in flames and two wildland fires estimated at five acres and growing rapidly. Traffic backed up on both the east and west sides of the scene was estimated at well over 50 vehicles and included some semitractor-trailers and tankers.

Fire attack — backburning

JUNE 27, 2000

1:20 p.m. Motor vehicle accident occurs on SR 24 (Milepost 36)

1:25 p.m. Hanford Fire Department (HFD) is notified

HFD dispatches standard response for vehicle fire
HFD captain requests additional firefighting equipment while en route to scene

1:39 p.m. Hanford Patrol on scene (east side)
HFD Medic Unit 92 arrives on scene

Incident Command

The Incident Command System provides the combination of facilities, equipment, personnel, procedure and communications operating within a common organizational structure, with responsibility for the management of assigned resources to effectively accomplish stated objectives.

Incident Commander

Individual person or organization responsible for the management of all incident operations at the incident site.

While en route to the scene, the HFD captain assigned as the lead for the initial response requested the involvement of the HFD battalion chief. He also dispatched two pumper/tankers and a water tender in addition to the standard response units (an engine, a pumper/tanker, and two ambulances). The captain requested that the Southeast Communications Center (SE-COMM) be notified. He also requested that the Washington State Patrol set roadblocks and that additional firefighting support, including heavy equipment, be provided.

The HFD captain arrived on the scene at 1:44 p.m. and established an Incident Command. The fire was estimated to have increased to approximately 10 acres on both sides of SR 24. Pushed by high winds, the fire was spreading at an estimated rate of about 6 to 8 miles per hour, with some flames approximately 30 feet high. Vehicles continued to enter and congest SR 24 on both sides of the accident, and the HFD captain requested that Hanford Patrol close the highway.

By 1:45 p.m., the HFD had cut fencelines to give oncoming pumper/tankers immediate access to the ALE Reserve. Arriving grass units and pumper/tankers were assigned to fight the fire on both the north and south sides of Highway 24. The primary objective on the north side was to protect nearby private structures and property. The units on the south side were tasked with extinguishing the flanks of the fire while working their way to the head of the fire, as well as with protecting the people and vehicles stopped on the roadway. Every available wildland resource was deployed to fight the fire as it arrived.

Accident scene aftermath—initial attack access

JUNE 27, 2000

1:40 p.m. HFD reports 5- to 10-acre fire, spreading 6- to 8-mph, requests closure of SR 24

HFD captain arrives on scene, establishes Incident Command. HFD deploys fire response to north and south of SR 24 (note: two fire fronts)

1:45 p.m. HFD cuts fenceline between SR 24 and ALE Reserve

2:00 p.m. Estimated fire size: 50 acres

Helicopter support requested from U.S. Army Yakima Training Center

2.3 Incident Command

While en route to the scene, the HFD battalion chief notified the FWS of the wildland fire and requested that FWS fire units be dispatched. The battalion chief also requested additional heavy equipment to be staged at the Hanford Yakima Barricade. The HFD battalion chief arrived on the scene and assumed command of the incident at 1:52 p.m. At this time, the U.S. Army Yakima Training Center was requested to provide helicopter fire suppression support. Also during this period, a private citizen volunteered his services and heavy equipment to create firebreaks; the HFD declined his offer because of safety concerns.

Accident scene aftermath—rough terrain

At 2:35 p.m., the HFD chief arrived on the scene, assumed command, and established the Incident Command Post (ICP) and staging area at the Yakima Barricade. The Yakima Barricade was closed to traffic, and additional personnel were called in to maintain the ability to respond to secondary alarms on the Hanford Site. By 3:00 p.m., all HFD assets for wildland firefighting had been dispatched, and aerial assets were requested from the Central Washington Interagency Communications Center (CWICC). By this time, the fire was estimated at approximately 500 acres and was rapidly outrunning firefighting crews on the south side of SR 24.

During this period, a HFD grass rig was approximately 2 miles south of SR 24, scouting ahead of pumper/tankers to locate a passable route, when its engine quit. The crewmembers were forced to abandon their vehicle and escape

Incident Command Post

The location at which primary command functions are executed. The ICP may be co-located with the incident base or with other incident facilities.

JUNE 27, 2000

2:30 p.m.
Estimated fire size: 200 acres - Firefighters south of SR 24 outrun by fire due to terrain

2:35 p.m.
HFD fire chief arrives on scene, establishes Incident Command Post (ICP) at Yakima Barricade (note: all HFD resources dispatched)

2:40 p.m.
HFD IC requests air support for fire suppression through Central Washington Interagency Communication Center (CWICC)

through the oncoming fireline and into the burned area. The crewmembers were not injured and walked the 2 miles back to SR 24, where they were picked up by one of the pumper/tankers. The fire totally destroyed the grass rig.

HFD grass rig burned over by fire

At 3:00 p.m., the HFD chief (Incident Commander) requested a Type 3 Incident Management Team (IMT) to respond to the event. He also requested two strike teams of wildland apparatus from the Tri-County Mutual Aid District; those teams began arriving at 5:00 p.m. The Incident Commander asked that additional heavy equipment (caterpillars and road graders) and the Hanford Incident Command vehicle be staged at the Yakima Barricade. At around the same time, the Yakima Training Center, which initially had accepted the HFD request for helicopter support, denied the request.

During the afternoon and evening of June 27, the fire continued to expand rapidly to the north, south, and west. Arriving units were assigned to fight on multiple fronts.

Tri-County Mutual Aid District

Under an agreement last updated in 1998, the following entities are committed to aid each other with fire and related emergency services:

- **the cities of Richland, Kennewick, Pasco, Prosser, and College Place**
- **Benton County Emergency Services**
- **Franklin County Emergency Management**
- **the fire protection districts of Benton County #1 through #6, Franklin County #3, Walla Walla County #4 and #5; and RL, which maintains the Hanford Fire Department.**

JUNE 27, 2000

3:00 p.m.
HFD requests Type 3 IMT
Estimated fire size: 500 acres

4:00 p.m.
Two air tankers begin drops

5:00 p.m.
Mutual Aid District resources from Tri-Cities begin arriving at staging area and are deployed to fire lines

11:36 p.m.
HFD Incident Command transferred to Type 3 IMT

Two air tankers supported by a lead aircraft began retardant drops at 4 p.m. and continued until dark. Because of the fire-related air tanker traffic, the HFD asked for a temporary flight restriction (TFR) over Hanford from the Federal Aviation Agency's Seattle Center. A CWICC helicopter flew HFD personnel to reconnoiter the extent of the fire.

Air tankers drop fire retardant

Throughout the evening, resources and equipment were deployed as they arrived.

At approximately 11:36 p.m. on June 27, the HFD relinquished command of the incident to the Type 3 IMT but remained in support at the ICP. This was this last time during the event at which Hanford personnel exercised command authority for the overall fire. From this point on through the remainder of the event, the HFD participated as a responder under the incident command structure (Type 1, 2, and 3).

All HFD equipment remained fully deployed in support of firefighting efforts on the ALE Reserve and adjacent private lands. At this time, the fire was moving through steep, rough terrain on the ALE Reserve.

JUNE 27, 2000

11:36 p.m.

HFD IC continues to support the ICP
HFD resources continue deployment on ALE Reserve and private impacted lands

Hanford response transitions from an incident command and control role to a responder role within the incident command structure

6:00 a.m.

Type 3 IC requests Type 2 response resources (8 hand crews, 4 Type 1 hand crews, 5 air tankers, 2 Type 2 helicopters

Fire Types*

The National Wildfire Coordinating Group (NWCG) has established fire types to assist in incident management structure for firefighting based on incident complexity. Factors that determine incident complexity include size, location, threat to life and property, political sensitivity, organizational complexity, jurisdictional boundaries, values to be protected, fuel type, and topography.

Type 5 - least complex - Involves relatively few resources and a short duration. A small grass fire involving two to three pumper/tankers and a battalion chief would fit this description.

Type 4 - more complex - Involves perhaps all HFD pumper/tankers and grass rigs available on the Hanford Site.

Type 3 - Involves resources from the local mutual aid area, which may encompass surrounding counties. Type 3 incident management teams are composed of personnel from local fire departments and districts.

Type 2 - Involves resources from outside the local mutual aid area. Typically requires a declaration of a "state mobilization" event, a designation made by the county emergency operations center. In a Type 2 incident, all local resources either are committed to the emergency or are tied up covering secondary alarms. Resources are sent to the incident from across the state, based on availability and travel time.

Type 1 - Typically involves national resources. Type 1 incident managers are qualified to command national fire response resources involving more complicated coordinating issues than Type 2 events.

**Fire types are described in the NWCG's national interagency incident management system wildland and prescribed fire qualification.*

By the morning of June 28, the fire size was estimated at 23,630 acres. Winds had carried the smoke plume across the main Hanford Site, and Hanford workers began reporting to the Hanford 200 Area first aid station, Hanford Environmental Health Foundation, and Kadlec Medical Center in Richland with smoke-related complaints. In response to this information, the emergency duty officer established an event coordination team (ECT) in the Hanford Emergency Operations Center (EOC). An ECT consists of emergency preparedness personnel responsible for logistics support to personnel at an event scene, protective actions for Site personnel, and dissemination of information to employees and offsite personnel. A qualified Site Emergency Director (SED) leads the ECT. Based on an assessment of the situation, the SED recommended to RL and ORP senior manager on-call personnel that nonessential personnel be released from the 200 West Area. In addition, the determination was made that the situation met the criteria for making Abnormal Event notifications.

JUNE 28, 2000

6:00 a.m.
Estimated fire size: 23,630 acres

7:00 a.m.
Hanford employees report smoke-related compaints

9:43 a.m.
Abnormal Event notification made to offsite organizations (note: not an emergency classification) (JON-2.b)

10:19 a.m.
Industrial hygienists sample air quality in 200 East Area, find results below limits for early release

The ECT managed Hanford-specific aspects of the event and provided support to the overall effort over June 28. In accordance with procedure, the ECT maintained support to the Type 3 IMT through Hanford's Incident Commander, the HFD battalion chief. Through this channel, additional heavy equipment operators were provided during the morning. The ECT also requested that industrial hygienists ensure that conditions in the 200 East areas supported continued occupancy. The hygienists' report indicated that early release of staff was not warranted. The ECT closely monitored the fire's progress during the morning and afternoon of June 28 to determine the appropriate point for declaring an Alert level emergency.

By noon on June 28, the fire size was estimated at 31,190 acres and had breached the last best line of defense on the ALE Reserve at Snively Canyon. Weather conditions had deteriorated; both wind strength and direction were affecting the Hanford Site unfavorably. Because of the threat of the fire crossing SR 240 onto the central Hanford Site, the HFD redeployed its assets to defend Site property and structures.

Fire spreading on ALE Reserve

Abnormal Event

Abnormal Event notifications are intended to notify offsite agencies of site conditions that could potentially escalate into emergencies, or where local residents or the media would expect offsite organizations to be aware of the event. These notifications shall be made as soon as possible (within 30 minutes) following discovery by cognizant facility staff. The notifications are made with an understanding that the information is preliminary and may not include details.

Alert Emergency

An Alert emergency involves a situation in which events are predicted, are in progress, or have occurred that result in either

- an actual or potential substantial degradation in the level of control of hazardous materials (radiological and nonradiological) - The need to protect personnel from exposure to the hazard(s) resulting from this level of event would be confined to the facility involved and the immediate surrounding area, and not require protection of offsite personnel.
- an actual or potential substantial degradation in the level of safety or security of a facility or activity that could, with further degradation, produce a Site Area Emergency or General Emergency.

JUNE 28, 2000

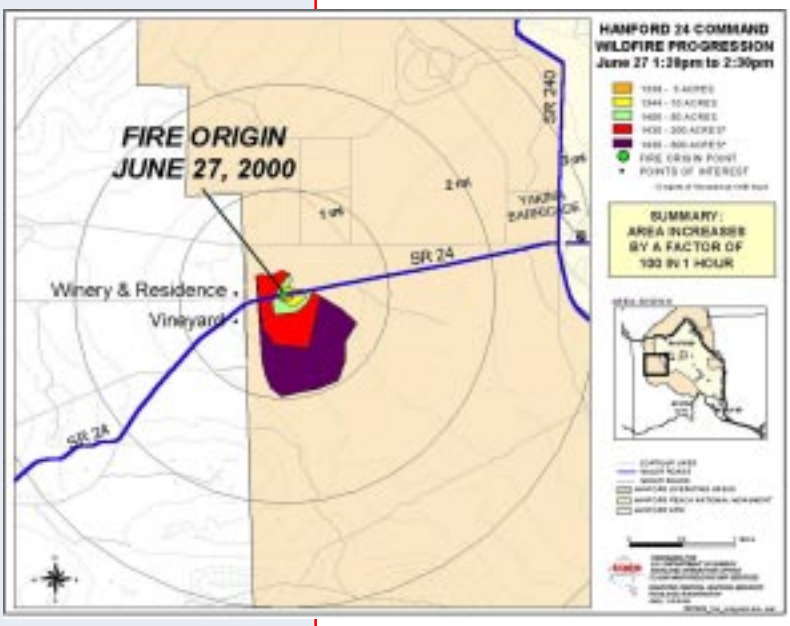
11:00 a.m. RL Manager goes to Incident Command Post for briefing

11:11 a.m. Fireline breached in Snively Canyon

12:00 p.m. Estimated fire size: 31,190 acres

Status: 276 people, 19 engines, 8 STs, 2 bulldozers, 7 handcrews, 1 medical unit 30% of requested level

State Route 24 had been reopened by the Washington State Patrol following release of the accident scene at 1 a.m. on June 28 but was closed again in the afternoon because of new excursions of the fire across the road. Closure also was intended to facilitate operations of the ICP, which had been moved to the Cold Creek Vineyard on SR 24. The fire was expanding to both the south and west, forcing closure of SR 241 near the junction with SR 24 and SR 240 from SR 225 (Benton City turnoff) to the SR 24 junction.



By 3:47 p.m., the fire had jumped SR 240 and was moving eastward toward the 200 West Area. At the request of the FWS, the Federal Aviation Administration Seattle Center repositioned the TFR over the Hanford Site to provide a safe corridor for aerial fire support.

When the fire entered the central Hanford Site and began to threaten the 222-S operating facilities, an Alert level emergency was declared. The Alert, declared at 4:30 p.m., resulted in full activation of the Hanford EOC. The emergency declaration initiated transmission of notification forms to local emergency service and regulatory agencies, and the Offsite Interface Coordinator began communications with the county and state EOCs via a dedicated phone circuit. Notification forms and associated phone conversations were used throughout the event to communicate and provide status updates. All communications of event actions not directly related to protection of Hanford were coordinated to the Type 1, 2, and 3 IMTs through Hanford's IC.

222-S Laboratories in 200 Area West

JUNE 28, 2000

12:00 p.m. Fire threatens Hanford Central Site

HFD requests reallocation and deployment to respond to tactical needs for central Hanford Site

2:24 p.m. Fire progresses toward Horn Rapids Road

3:00 p.m. Response units pull back to defensible positions. HFD assets redeployed fully to Hanford Site

3:47 p.m. Fire jumps SR 240 toward 200 West Area

Radiological Event Monitoring

Two types of radiological monitoring are performed for Site events. Both types provide airborne sampling at ground level.

- **Real-time monitoring provides detection of airborne activity for levels that would require protective action for workers, and the public.**
- **Low-level monitoring is performed to detect airborne activity over the duration of the event and in the post-event period, to quantify the potential low-level dose to workers and the public. Soil and vegetation samples are also collected during the post-event period.**

The fire's advance onto the central Hanford Site also initiated a series of events associated with radiological control. The Hanford 200 Areas maintain the principal facilities that historically and currently process or store nuclear materials on the site. Included in and near these areas are burial grounds and soil contamination areas. Hanford-based field sampling teams were dispatched to monitor the area for potential airborne release of radioactivity. In consultation with DOE-Headquarters (HQ), RL, and the White House, a request was made for the U.S. Environmental Protection Agency (EPA) to provide radiological monitoring of the event. In addition, RL requested that the Aerial Measuring System (AMS), an airborne radiological monitoring platform maintained by the Nevada Operations Office, be deployed to Hanford.

The fire's continued growth and the level of resources being used to fight it required escalating the Type 3 IMT to a Type 2 IMT. The Type 2 IMT assumed command of the fire at approximately 6:00 p.m. on June 28. The Type 2 Incident Commander requested that a DOE management representative with the authority to make financial and strategic decisions attend the IMT. The RL Manager granted this request, and the designated person reported to the Type 2 IMT.

Fire damage on ALE Reserve

JUNE 28, 2000

3:54 p.m. Hanford Patrol Operations Center requests evacuation of 222-S labs

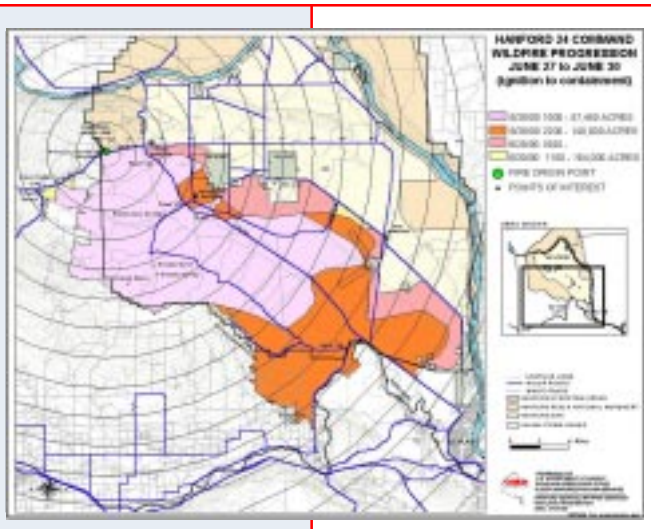
4:28 p.m. RL declares Alert level emergency

4:35 p.m. "Take Cover" alarm activated in 200 Area (based on smoke)

6:00 p.m. Type 2 IMT assumes command of fire

HFD requests offsite assistance

Estimated fire size: 88,640 acres



The Type 2 IMT initially refused a HFD request for outside firefighting resources to protect Hanford structures. The Type 2 Incident Commander expressed concern about the potential for non-Hanford firefighter exposure to radioactivity or chemical hazards, a concern that was raised by external sources. After a protracted time during which Hanford's established plan for managing and protecting non-Hanford firefighters was discussed and accepted, the Type 2 IMT provided the additional resources.

Benton County declared a state of emergency at 6:00 p.m. By this time, the fire had progressed to the southern end of the Hanford Site.

Road grader stuck in sand

A road grader became stuck in soft sand while grading a firebreak west of the Rattlesnake Barricade. Because of rapidly approaching fire, the operator abandoned the grader and moved to safety with no injuries. Fire damage to the road grader was limited to the front section.

By 6:00 p.m. on June 28, the fire had consumed an estimated 88,640 acres, an increase in size of 57,450 acres over the preceding 6 hours. Average consumption was 9,600 acres/hour during that period.

On the Hanford Site, the spreading fire threatened the Laser Interferometer Gravitational-Wave Observatory (LIGO), a non-DOE facility. The Hanford EOC notified the LIGO to evacuate. The LIGO manager was delayed at a roadblock while returning to the Site to secure the facility. When he arrived, he found a Boy Scout troop touring the facility. The troop was evacuated immediately, and the remaining LIGO personnel secured the facility and departed.

While checking Gate 106 (southern access to the ALE Reserve), a Hanford Patrol officer was caught in front of the rapidly advancing fire and was forced to escape by driving rapidly west toward Benton City. This occurred when the

JUNE 28, 2000

6:00 p.m. Assessment determines that fire progressed at rate of 9,600 acres/hour over immediately preceding 6 hours

Benton County declares state of emergency

7:14 p.m. LIGO evacuated (including facility personnel and visiting Boy Scout Troop) (JON-2.k)

8:00 p.m. Fire progresses over ridge at Gate 106 Rattlesnake Mountain

Fire jumps SR 225 near Wanawish Dam at Horn Rapids

LIGO facility threatened by fire

fire jumped SR 225 near Wanawish Dam near Horn raids on the Yakima River at approximately 8:00 p.m. Soon after, the fire crossed the Yakima River and briefly threatened lands just north of the city of West Richland. By this time, the fire also neared a residential neighborhood of Richland, approached the Hazardous Materials Management and Emergency Response (HAMMER) training center and Hanford Patrol facilities on the Site, and began to threaten industrial facilities on Hanford's southern boundary. At approximately 9:00 p.m., the fire entered the Benton City area.

During the evening, Hanford Patrol requested the Richland Police Department to assist at roadblocks at SR 240 and Stevens Drive, help with crowd control of public onlookers near HAMMER, and remove onlookers on Kingsgate and Horn Rapids Road. All nonessential personnel remaining north of the Wye Barricade were asked to evacuate the Hanford Site.

Fire crosses Yakima River

JUNE 28, 2000

8:36 p.m. Fire crosses Yakima River

Hanford Patrol needs to handle HAMMER crowd

9:00 p.m. Fire enters Benton City

Estimated fire size: 140,800 acres

JUNE 29, 2000

1:45 a.m. Governor of Washington State declares state of emergency

12:30 p.m. Air tanker drops fire retardant on BC Controlled Area

Rough terrain of Rattlesnake Mountain

Workers living west of the site were instructed to use SR 24; however, SR 24 was closed at the time, as was SR 240. Later in the evening, the SED ordered the evacuation of the 300 Area.

By 10:00 p.m., the estimated size of the fire was 140,800 acres. Press conferences were held at the Richland Federal Building, with all local agencies represented in a Joint Information Center (JIC). In addition, a Multi Agency Coordination (MAC) team was assembled to assist the Type 2 Incident Commander in financial matters and strategic decisions. Although DOE is not a general member of the MAC team, the RL Manager assigned a representative of the HFD to coordinate with this group.

On June 29 at 1:45 a.m., the Governor of Washington State declared a state of emergency. The fire had been stopped successfully around the 200 West facilities but was continuing to move east and south across the central Hanford Site.

Throughout the day on June 29, fire crews continued to battle the blaze. Defensive lines were cut along major thoroughfares on the site, and crews kept the fire from reaching the 400 and 300 Area facilities. Aerial support was used to combat the fire that burned a portion of the 200 Area BC Controlled Area. Weather conditions improved; wind speeds were reduced significantly. The RL JIC issued several press releases during the day indicating that no environmental release of contamination occurred. The Site recovery team began to plan to reopen the site.

The BC Controlled Area is a soil contamination area containing low-level radioactivity, predominantly cesium-137. The radioactivity on the surface is a result of previous animal intrusion into an old subterranean waste storage location.

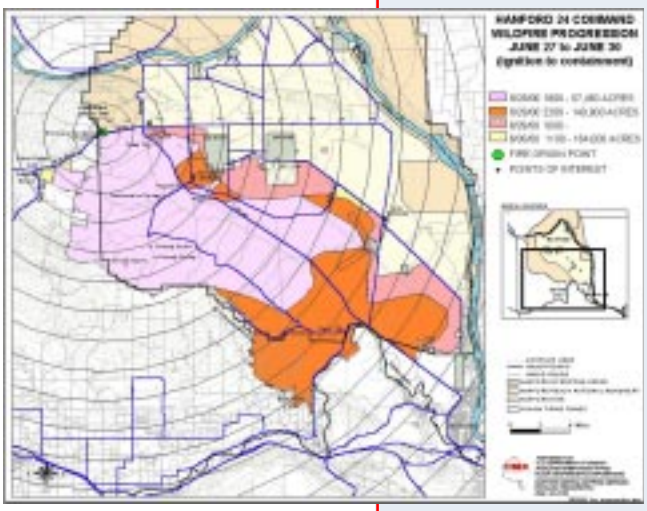
Defensive lines stop fire just short of FFTF

JUNE 30, 2000 — **July 1, 2000**

3:06 p.m. Radiological samples collected → 139 samples (52 air, 23 large area smears, 2 soil samples, 12 vegetation) → **4:57 p.m.** Hanford EOC terminates Alert emergency → **5:00 p.m.** EPA starts high-volume (24-hour) sampling (see JON-3) → **4:00 p.m.** Fire officially contained and declared out

2.4 Recovery and Closure

On June 30, the recovery team was established, and a radiological survey team was dispatched to assess unused laboratory facilities on the southeast flank of the ALE Reserve that had been overrun by the fire. The main facilities, which have maintained fire barriers, were found intact, although the fire had destroyed a nearby semi-trailer and metal storage shed that were not so protected. Neither structure housed any radioactive or hazardous materials.



Fire damage to structures on ALE Reserve

The EOC alert activation was terminated at 4:57 p.m. on June 30. On July 1 at 4:00 p.m., the fire was officially declared to be contained and out. Firefighters had patrolled the site, putting out remaining hotspots and looking for flare-ups during the day.

On July 11, a press release indicated that the EPA had detected low levels of airborne radioactivity.

A summarized chronology of the 24 Command Wildland Fire event is presented in Appendix B.

Fire on the rough terrain

3.0 Event Factors and Analysis

The Board analyzed the facts, events, and conditions related to the Hanford Site's response to the 24 Command Wildland Fire. Because this event involved so many factors, the Board categorized them into specific topical areas for analysis. Change, barrier, and causal factor analyses were conducted for most topical areas. In addition, all topical areas were evaluated using the core functions of DOE's Integrated Safety Management System (ISMS). The factors analyzed and the Board's findings for each are documented in this section.

3.1 Firefighting

3.1.1 Hanford Site Fire History

Wildland fires occasionally occur on or near the Hanford Site; many result from lightning strikes. The readily available natural fuels (cheat grass, tumbleweeds, and shrub-steppe vegetation), coupled with the Columbia Basin area's ever-changing wind patterns, can produce wildland fires that may spread rapidly. Since 1984, the Site has experienced numerous small and three major wildland fires.

Typical lightning storm on Hanford Site (file photo)

In mid-August 1984, approximately 200,000 acres both on and off the Site were burned in a fire that expanded westward 20 miles during a 24-hour period. The 1984 fire started from a lightning strike on privately owned wildland west of Rattlesnake Mountain and south of Snively Canyon.

Another fire originated at the U.S. Army's Yakima Training Center in mid-August 1996. Over three days, it spread eastward into Benton County onto the ALE Reserve and crossed portions of SR 24. The fire, believed to have started from Army ordnance practice, burned approximately 90,000 acres on and off the Hanford Site.

In late July 1998, a lightning strike started a fire in the Elk Meadows area of the ALE Reserve. The fire burned approximately 7,000 acres before it was contained on the west side of SR 240.

3.1.2 Pre-Fire Planning and Hazards Mitigation

Hanford Site organizations have taken many steps to minimize the potential for, and consequences of, a fire on the Site. These include

- annual wildland fire planning

- development of the *600 Area Pre-Fire Plan*
- preplanned radiological controls for fighting fire in the BC Controlled Area
- maintenance of barriers and defensible spaces around Hanford facilities
- improvements in the control of deep rooted vegetation on radiological burial sites and cleanup of tumbleweeds near Hanford facilities
- emergency planning.

Wildland fire planning is conducted by the Site every year as part of the HFD's Annual Work Plan. The planning is initiated at the end of the winter season, and planning sessions are held until all actions are completed prior to the wildland fire season. The planning includes roundtable discussion and coordination between onsite heavy equipment operations, the FWS, Washington State Department of Transportation (WSDOT), Bonneville Power Administration, the HFD, and RL to ensure that the following actions are being completed:

- Fire department pumper units and grass units are maintained for the fire season.
- Annual wildland refresher training is provided to firefighters and heavy equipment operators.
- Chemical herbicides are sprayed near wooden power poles along SR 24, SR 240, and Resource Conservation and Recovery Act (RCRA) well sites.
- Air tanker support has been secured by agreement with the Central Washington Interagency Communications Center.
- Radio repeaters are available for an emergency, and master call lists are available for heavy equipment and meteorological data.
- Letters have been issued to contractor and other personnel on the Hanford Site restricting off-road travel.
- Fire danger signs are being updated.
- Natural fuel assessments are being completed.
- The *600 Area Pre-Fire Plan* is up-to-date.

Following the 1996 wildland fire, the pre-fire plan was reviewed closely by the RLs biological specialist, cultural asset specialist, and fire protection experts. The review concluded that the pre-fire plan needed updating to include cultural and biological asset and radiological dose considerations.

The reviews resulted in significant changes; the plan was updated in 1998 to include

1. addition of priority to protect historic, cultural, and biological resources using firefighting tactics that provide the least impact to the environment,

yet still maintain the first priority to protect human life and government facilities and property

2. evaluation of potential of radiological exposure to firefighters doing work in wildland areas posted for radiological control-Health physicists conducted two separate studies to determine the anticipated radiological hazards, potential doses to firefighters, and the appropriate level of personal protective equipment required to handle such hazards. This information, as well as plans to conduct surveys of personnel and equipment exposed to these areas, was included in the pre-fire plan.
3. call lists including FWS contacts and contacts for heavy equipment, cultural, archeological, and biological resources and subject matter specialists.

Aerial firefighting — helicopter operations

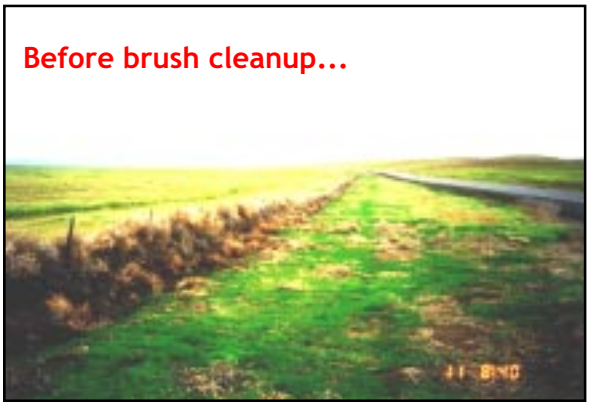
Since 1998, the *600 Area Pre-Fire Plan* has been reviewed and updated annually.

As a result of lessons learned from the 1984 Hanford range fire, firebreaks were cut each year between 1984 and 1995 by disking along the SR 24 and SR 240 rights-of-way. However, in 1995, the Benton County Clean Air Authority (BCCAA) received a fugitive dust complaint against blowing soil alleged from the disking of the firebreaks. RL formally responded to the BCCAA complaint in a 1995 letter stating that disking of firebreaks would be discontinued.

Instead of disking firebreaks along SR 24 and SR 240, Site personnel began to pre-burn vagrant tumbleweeds on the rights-of-way. However, legislative changes to the Washington State Clean Air Act in 1995 placed additional restrictions on open burning. BCCAA permits issued to the WSDOT to burn vegetation along state-controlled rights-of-way were limited to small acreage; further, only tumbleweeds could be burned. Consequently, the practice of burning along SR 24 and SR 240 was discontinued.

Firebreak

A natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work.



1995 photos

Defensible Space

An area either natural or manmade where material capable of causing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and the loss to life, property, or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure and cleared of flammable brush or vegetation.

At the May 2000 pre-fire planning session, the HFD and WSDOT discussed burning tumbleweeds in limited areas along SR 24 and SR 240. However, in the wake of the Cerro Grande fire in New Mexico (where an escaped controlled burn threatened DOE facilities at Los Alamos National Laboratory), the DOE-HQ Office of Environment, Safety, and Health was considering issuing a formal moratorium on controlled burning on DOE sites. Those plans had been communicated informally to DOE-related fire departments and the DOE fire protection community as early as May 17. For this reason, the HFD advised the WSDOT to take no actions regarding controlled burns along SR 24 and SR 240. On June 5, the Deputy Secretary of Energy issued a memorandum declaring a moratorium on controlled burning at DOE facilities.

Hanford maintains barriers and defensible spaces around facility structures. Defensible spaces include green grass areas and concrete/asphalt/graveled areas clear of vegetation and other combustible materials. These defensible spaces provide a degree of fire hazard control per DOE's ISM process.

The Board concluded that each element of Hanford's pre-fire planning and hazards mitigation work played a positive role during the 24 Command Wildland Fire, resulting in minimal injuries, minor property damage, and limited radiological release.

However, the Board found that the lack of maintenance of defensible firebreaks along state highways allowed the fire to spread quickly onto the ALE Reserve. The Board concluded that RL, ORP, and the contractors need to engage and coordinate with local clean air authorities, state regulators, the DOE-HQ Office of Environmental Health (EH), and the WSDOT to evaluate the most effective means of establishing defensible space along state right-of-way shoulders between State Routes 24 and 240 and the DOE fenceline.

3.1.3 Agreements With Offsite Agencies

Agreements in place between the Hanford Site and offsite agencies have established protocols for interagency coordination and cooperation during situations of common concern or mutual interest.

The Tri-County Mutual Aid Agreement defines the arrangements for mutual aid established between and among fire districts and fire-related emergency service providers in Benton, Franklin, and Walla Walla counties. Specific parties to the agreement include the cities of Richland, Kennewick, Pasco, Prosser, and College Place; Benton County Emergency Services; Franklin County Emergency Management; and the fire protection districts of Benton County No. 1 through No. 6, Franklin County No. 3, Walla Walla County No. 4 and No. 5; and RL, which maintains the HFD.

A permit and memorandum of understanding (MOU) between RL and the FWS for the management of the ALE Reserve was developed in June 1997. The MOU specifies that until the FWS has developed its own approved management plan and upgraded its fire protection capabilities for the ALE Reserve, RL will provide fire protection, initial attack, and incident management for the Reserve on a cost-reimbursable basis from the FWS.

In September 1998, the FWS and HFD signed a cooperative agreement that provides more specific definitions of the fire protection and wildland fire suppression responsibilities of both parties. Included in this agreement is the list of Tri-County agencies participating in the mutual aid agreement. The agreement also specifies "light-on-the-land" firefighting tactics.

An agreement to obtain air tanker support from the CWICC for fixed-wing suppression has been in place since 1996 and was last revised during the week before the 24 Command fire.

A memorandum of understanding for mutual aid law enforcement assistance exists between RL, Adams County Sheriff's Office, Benton County Sheriff's Office, Franklin County Sheriff's Office, Grant County Sheriff's Office, Kennewick Police Department, Pasco Police Department, Richland Police Department, West Richland Police Department, and Tri-City detachment of the Washington State Patrol.

Although the foregoing agreements were in place during the 24 Command fire, some issues arose related to interagency coordination. First, helicopter support from the Yakima Training Center was used previously for fire suppression on the Hanford Site, but no formal MOU or agreement exists between Hanford and the Training Center to provide such support. A dispatch call was made to the Yakima Training Center in the early part of the fire for helicopter aerial suppression support. The Training Center initially approved the request. However, after two hours and several phone calls back to the Center to check the status of the helicopters, the Yakima Training Center denied the request because operations in progress at the Center required the helicopters there. A formal agreement for helicopter support with the Yakima Training Center could have alleviated confusion in requesting this resource.

24 Command Fire rages on

Light on the Land

The HFD and the FWS have agreed to

".....avoid the use of tractors, graders and other ground surface breaking/modifying equipment without prior approval of the FWS, except when the use of such equipment is essential to protect life, private property, or prevent the spread of fire to the Hanford Site east of State Route 240*...the final decision on the use of such equipment rests with the incident commander."*

The existing MOU between RL and the FWS contains out-of-date contact lists and no information about National Wildfire Coordination Group (NWCG) protocols. The agreement between the HFD and the FWS also does not discuss coordination using NWCG protocols for ordering aerial tanker suppression support. The Tri-County mutual aid agreement for fire protection does not address coordination using NWCG tools and interagency fire center resources.

Interagency Fire Center Resources

- **National Wildfire Coordination Group - The NWCG consists of a group of Federal agencies that develop formalized standards and protocols for training, qualifications, equipment, suppression priorities, and other functions for wildland fire suppression.**
- **National Interagency Fire Center - The NIFC uses the NWCG processes and standards in the actual deployment of fire and aviation resources for wildland firefighting. The NIFC's 11 geographical coordination centers provide regional fire suppression support.**
- **Central Washington Interagency Communications Center - The CWICC, operating under the Northwest Interagency Coordination Region of the NIFC, dispatched the aerial fire suppression support on the 24 Command fire. The NIFC also provided Type 2 and Type 1 resources during the 24 Command fire.**

The existing MOU for mutual law enforcement assistance does not discuss coordination with other on-scene emergency responders in a manner consistent with Hanford's incident command system. The parties to the MOU do not include the Yakima detachment of the Washington State Patrol, who controlled the accident scene on SR 24. The Washington State Patrol reopened portions of SR 24 while wildland firefighting operations still were ongoing along the highway. An MOU with the Washington State Patrol that incorporates the Hanford incident command system could have better assisted fire department emergency responders in the wildland fire operations so that roads would be reopened only with the agreement of the responsible incident commander for the wildland fire.

The Board concluded that prearranged coordination and understanding of the NWCG and the Hanford incident command system could have assisted the FWS, RL, the Washington State Patrol, mutual aid responders, and the HFD in managing the fire better. Prearranged coordination also could have enhanced RL management understanding of the role and responsibilities of the National Interagency Fire Center.

3.1.4 Hanford Fire Department Response

After receiving notification of the vehicle accident on SR 24, the HFD immediately dispatched initial units and personnel to the scene. While en route, the HFD made required notifications and requests for heavy equipment load-up, roadblocks from the Washington State Patrol, and tender tanker top-off.

First responders arrived on scene within 14 minutes of the initial call and provided an assessment of the accident and fire. The first responders cut the fencelines to the ALE Reserve, and arriving wildland firefighting apparatus immediately started the attack on the fire. Based on the initial assessment, the HFD Incident Commander (IC) requested additional resources and support, including two strike teams of wildland apparatus from the Tri-County Mutual Aid District, additional heavy equipment, and aerial fire suppression support through the CWICC. The HFD Incident Commander also requested that a Type 3 IMT be formed for this event. All HFD wildland firefighting apparatus were committed to this event and continued to support firefighting efforts on the ALE Reserve through June 28.

As the fire grew and approached the Hanford Site, the HFD chief initiated a plan to protect the central Hanford Site by cutting firebreaks along SR 240. HFD equipment and personnel were redeployed to protect Hanford nuclear facilities. Soon thereafter, the fire jumped SR 240 onto the central Hanford Site. The decision to redeploy HFD resources and protect the Hanford Site was timely and well reasoned.

The Board concluded that the HFD's initial response was prompt and that the IC structure continually adjusted, evolved, and planned ahead to manage the incident. The Board also noted that HFD personnel performed their emergency response duties with controls established through the DOE ISMS process. Because of that process, HFD personnel understand fire hazards, and the HFD had the appropriate equipment, personnel, training, and safety equipment to respond to this emergency. The HFD firefighters, incident commanders, and supporting personnel performed duties and responsibilities necessary to minimize consequences under the FWS agreement and on the Hanford Site.

3.1.5 Hanford Fire Department Needs Assessment

In 1996, the HFD completed a baseline needs assessment in accordance with DOE Order 420.1. Although DOE Order 420.1 has yet to be incorporated into any Hanford contract, the 1996 work was accomplished by way of a specific performance agreement for that year. Since then, critical fire department resources identified by the needs assessment document have been maintained.

Needs Assessment

DOE Order 420.1, *Facility Safety*, requires completion of a baseline needs assessment establishing the minimum required capabilities of Hanford Site firefighting forces. The needs assessment is a planning tool to ensure that appropriate resources (in accordance with DOE requirements) are provided for fire and related emergency needs. These resources include staffing levels, apparatus, facilities, equipment, training, fire pre-plans, offsite assistance requirements, and procedures.

The baseline needs assessment is an ISMS-based process that provides a method for analyzing hazards requiring HFD emergency response functions. The needs assessment results in the development and implementation of fire department-related emergency response resources necessary to control and mitigate associated emergencies.

The 24 Command Wildland Fire demonstrated a weakness in the needs assessment that had not been recognized before. When the Incident Command was transferred to the Type 3 IMT at around midnight on June 27, requirements of the National Wildfire Coordinating Group (NWCG) took precedence over local and Site processes. The HFD needs assessment does not consider NWCG requirements, nor does it provide for the necessary planning and training required to integrate the HFD into NWCG firefighting operations. However, HFD personnel training and qualifications meet NWCG standards.

Although adequate resources were obtained to manage this fire, the needs assessment document underestimated the complexity of a fire the size of the 24 Command Wildland Fire and the requisite escalation to a NWCG format. While this was not a critical factor in managing this fire, the Hanford needs assessment should address coordination with the National Interagency Fire Center using NWCG protocols and provide feedback into the Emergency Preparedness program. This would result in better wildland planning initiatives and better communications during similar events.

3.1.6 Offsite Responder Management and Deployment

In addition to the countless firefighting organizations, many offsite agencies provided support to Hanford during the Site Alert emergency. DOE requested the EPA to provide radiological monitoring. Personnel from the Washington State Department of Health (WDOH) served as onsite escorts to the EPA specialists. The DOE Nevada Operations Office supplied its specialized equipment for additional radiological monitoring. Through the CWICC, fixed-wing tankers and helicopters were supplied to support the firefighting operations.

On June 28, the Type 2 IMT had denied the use of offsite firefighters on the Hanford Site. This decision was based on circulated rumors that all Hanford vegetation is contaminated and could cause harm to responders. The HFD chief dispelled these rumors through extensive dialogue and by providing the Type 2 Incident Commander with a copy of an extant plan for managing offsite firefighting support in situations involving radioactive materials. The plan requires that specific training, which includes hazards communication, be provided before firefighters can be used on the Site. Further, the plan mandates that responding crews will not be used in known radiological zones or (in extreme cases) that a knowledgeable HFD firefighter will directly supervise crews entering these areas. The requisite training was provided to the offsite crews who did respond, and no offsite firefighter was used in a radiological zone.

The Board concluded that the HFD process for bringing offsite firefighters onto the Hanford Site is commendable. In contrast, a cohesive process is not in place for governing other offsite responders. Various elements of control are in place at Hanford and were exercised during this event (e.g., General

Employee Radiological Training for EPA personnel). However, those elements are not tied directly to the emergency response process and occurred in an ad hoc manner based on individuals' understandings of requirements.

The Board concluded that a management process parallel to HFD's approach needs to be applied to all offsite emergency responders.

3.1.7 Fire Barrier Analysis

Barriers are developed and integrated into a system to protect personnel and equipment from hazards such as fire. The Board evaluated specific fire protection barriers and how they performed during the event. The Board found that, overall, the system of barriers succeeded: the Hanford Site sustained limited physical damage, and the few injuries to Hanford personnel were only minor.

Fire near facilities in Hanford Site 200 Area

To identify lessons learned and conditions that could be improved, the Board assessed the performance of SR 24, SR 240, and Hanford Site structures as fire barriers. The specific successes and failures of each barrier are tabulated in Appendix C.

Change is anything that disturbs the "balance" of a system, keeping it from operating as planned. Change analysis examines planned or unplanned changes that cause undesired outcomes. For this event, a change analysis was performed to compare fire barrier successes (structures) with fire barrier failures (SR 24 and SR 240). The Board sought to identify any lessons learned or conditions that could be improved.

The detailed results of the barrier and change analyses are presented in Appendix C. These analysis results helped formulate the conclusions on which the Board based the judgments of need presented in Section 4.

3.2 Emergency Response

The Board's analysis of emergency response activities focused specifically on the planning, command, control, and communications aspects of the Site's response to the overall event resulting from the 24 Command Wildland Fire.

The Site emergency response was successful in dealing with the fire. The Board found that the emergency response programs for the Hanford Site meet general expectations. The Board also noted no significant adverse impacts

resulting from actions taken by emergency response personnel. However, the Board did find several areas in which performance could be improved.

First, the emergency response procedures did not always cover the exact situation confronting the responders. The Board's reviews indicated that no formal guidance was in place for handling some sitewide issues that emerged during this event—e.g., security of evacuated facilities, extended monitoring for public dose during an emergency, and recovery actions. In each case reviewed by the Board, Hanford Site staff developed and implemented appropriate responses, albeit on an ad hoc basis. Because the emergency response process is outside normal operations, procedures to be used during an emergency response must contain sufficient information to direct the emergency response personnel to do the right thing. In addition, they must be self-contained and stand-alone so emergency response personnel are not required to consult multiple documents.

Second, the Board noted no lapses in personnel manning emergency response positions. However, the Board did find that the emergency response organization lacked the defense in depth to support timely shift relief.

A third area for consideration is the designation of a Facility Representative for the overall Hanford Site. Such a representative would be located at the ICP during events involving multiple facilities on the Site.

3.2.1 Emergency Response Staffing Levels

Emergency Operations Center Staffing

Staffing of EOC positions is both mandatory and voluntary. Most EOC staff are on an "on-call" list, three deep per position. When the EOC is activated, everyone on the call list (three deep) is notified to report to the EOC. The first qualified individual to arrive staffs each EOC position. As others arrive, each position is expected to develop shift lengths and relief rotations. Currently, this process is not well established. Only three positions are designated as on call—the RL Emergency Manager, the ORP Emergency Manager, and the Site Emergency Director. No other position is formally on call. As a result, the potential exists for some positions required by the procedure to remain unfilled.

During the 24 Command fire, some EOC positions were filled with untrained personnel. These staff did, however, receive a short briefing before assuming the duties of their respective positions. The Board noted that the number of individuals to staff each EOC position was insufficient.

General Hanford Staffing

Outside the EOC, the overall Hanford Site has no formal process for staffing for emergency response activities and needs. Instead, supervisors call in staff

as needed. The Board noted the following specific examples of problems encountered in staffing for the emergency:

- Insufficient numbers of heavy equipment operators were available to work during the fire response. Consequently, those who were available worked 18- to 20-hour shifts to provide coverage. The lack of a driver at one point prevented a fire barrier from being fully constructed before the fire swept past.
- Radiological technicians initially were called in all at once. Too many responded to the call, and the surplus staff were released without establishing a schedule or providing for shift relief. On the next shift, everyone again was called in, and the surplus staff sent home. Eventually, some individuals did not respond to the call. The Board found no instances of lapse of coverage, but there was no consolidated process to transition into extended shift operations during sitewide emergencies for general Hanford staffing.
- The radiological response required the use of a mobile laboratory to provide real-time sample analysis. The individual trained on the specific, required equipment was not available. No backup had been trained to operate the equipment.
- Because most Site personnel had been released from work due to the emergency, only designated essential personnel were reporting to work stations. Contacting the released individuals with skills necessary to perform specific emergency response functions was difficult. The Site has no process for contacting personnel resources during an early release.

Fatigue

This event began on June 27, with the HFD, Hanford Patrol, and heavy equipment operators requisitioned from Site contractors generally manning the lines. The EOC was fully manned by 9 a.m. on June 28 and fully activated that same evening. The EOC remained manned and fully active through 5 p.m. on June 30; some positions continued to provide service through July 1. In the EOC, many individuals worked more than 12 hours, then slept for only 4 hours before working another long shift. For example, the aviation coordinator was on duty for 37 hours straight, 29 of which were spent in the EOC. In addition, the spokesperson for the Hanford Joint Information Center (JIC) was off duty for only 9.5 hours over a three-day period. Interviews indicated that some EOC staff and most heavy equipment operators had reached their limits of endurance and could not have kept up this level of performance.

Procedures in place at the HFD and the other responding fire companies require that personnel be cycled off-shift for rehabilitation periods. Through

this managed process, firefighting staff were rotated into positions of lower stress/less physical activity. The process also tracked total time on shift and monitored physical well being. This whole process was planned ahead of time. Even so, some firefighters worked longer than normal shifts because of the scope and complexity of the fire. With only 900 firefighters, the firelines were undermanned during the height of the effort, but only one case of fatigue was reported.

In contrast, for the rest of the Hanford Site, no provisions for secondary shifts were considered. The Board received reports of individuals who did not feel safe driving home due to fatigue after working long shifts.

The Board concluded that the staffing and scheduling of the emergency response personnel is not proceduralized sufficiently to support multiple-shift, protracted events. A process to manage hours to be worked during multiple-shift events must be developed and implemented across the Hanford Site.

3.2.2 Essential Personnel

Essential personnel were delayed in getting to the Site because Hanford Patrol staff at the checkpoints did not have up-to-date lists of Site personnel categorized as "essential." No process is in place to get this information to the checkpoints efficiently. The lack of up-to-date lists led to some confusion among facility staff members and required extra coordination and effort by the Hanford EOC and Hanford Patrol at checkpoints. Hanford Patrol staff were forced to make judgment calls as to who was essential.

Currently, the management of each Site facility identifies its essential personnel based on facility needs and forwards this information to the EOC and Hanford Patrol. However, this system is too labor-intensive to work efficiently during a sitewide event. The manager of the LIGO, a non-government tenant of the Site, was offsite when notified of the threat to his facility. He returned to the Site to place the facility in a safe condition. Access beyond a barricade was denied initially because his name was not on any list of essential personnel. Radiological monitoring teams returning to spell colleagues were delayed for similar reasons. Staff of Energy Northwest, another Site tenant, initially were unable to pass the manned barricades to get to work until special provision was made through the EOC to permit passage.

Because Site decisions affect non-Hanford systems on the Site, there is a pressing need to define the concept of "essential personnel" more fully. The Board concluded that the existing process for communicating essential personnel information did not work during this event.

3.2.3 Skilled Personnel

In general, Hanford does not have a process for using skilled personnel already onsite in dealing with sitewide emergencies. This relates to the core function of ISM of identifying scope, institutionalizing a needed process before an emergency exists. The Board recognizes that there is no way to have every expert for every situation report to the EOC or the ICP. However, a process is needed for providing skilled personnel quickly and efficiently when needed.

The Hanford EOC would have benefited from a subject matter expert (SME) in firefighting operations to assist in interpreting messages coming in from the ICP. Such an SME also would have understood the protocols of offsite agencies (e.g., the National Interagency Fire Center) for requesting and directing air tanker and other fire suppression support. The EOC's lack of understanding of these aspects did not affect the outcome of Hanford's response to the fire but did cause confusion in the EOC. The EOC also lacked an SME in aviation operations until a qualified individual voluntarily reported to the center and assumed the necessary role.

The emergency management system does not provide for a process to characterize the event for associated hazards, access technical support needed, procure needed resources, or reassess issues as the event changes.

Outside the EOC, specialized skills such as radiological control technicians (RCTs) and heavy equipment operators were needed. The RCTs were at the minimum number for the monitoring. If the event had expanded, more RCTs would have had to be called in. Heavy equipment operators were needed in large numbers. The number of operators available was sufficient for the two days they were needed. However, for a longer event, an offsite source of labor would be needed. The Hanford Site has no established process for gathering needed skills from Hanford Site resources.

In an emergency, the EOC has the authority to call in whatever resources are needed to handle the situation. However, preplanning to make use of existing Hanford resources, such as an SME specialized in the type of event taking place, is missing.

During protracted emergency events, there are times when available resources have been overextended and additional help is needed. Many times, personnel with general skills can be used to temporarily fill these positions or provide other secondary support. Consideration should be given within the emergency response process to incorporate this help in a structured fashion.

The Board concluded that the EOC did not get all the SMEs needed for efficient operations. The Board concluded also that a process does not exist for obtaining people with specialized skills from outside sources and internal volunteers.

3.2.4 Use of Offsite Personnel

Many offsite agencies provided support to Hanford during this sitewide emergency alert. This is in addition to numerous firefighters whose assistance to the Site was invaluable. As discussed in Section 2, the Type 2 IMT denied the use of outside firefighters on Hanford on June 28. This decision was based on circulated rumors that all Hanford vegetation is contaminated and could cause harm to responders. The HFD chief dispelled these rumors through extensive dialogue and providing the IMT with a copy of an exact plan for managing onsite fire support in situations involving radioactive materials. This process took about 6 hours and caused a delay in the deployment of these firefighting assets.

After the fire, information regarding potential airborne radioactivity was circulated among responders. Pilots who flew airdrops expressed concern that they were exposed to contamination from flying through the fire and smoke.

These examples illustrate how an established process to use offsite personnel could have been more efficient. The Board concluded that the process of using offsite personnel during emergency operations must be reviewed and revised.

3.3 Emergency Response for Non-Facility-Specific or Multi-Facility Events

The potential exists on the Hanford Site for multiple-facility/multiple-shift events. Some examples include range fires and radiological control events at one facility that pose problems at other areas. Currently, however, emphasis is given to addressing single-facility/single-shift events. As a result, during the 24 Command fire event, process problems surfaced in several areas: staffing the Hanford ICP, declaring the Alert emergency, releasing staff early, and preparing facilities to be abandoned.

3.3.1 Incident Command Post Staffing

Emergency Response Procedure RLEP 1.1, *Hanford Incident Command System and Event Recognition and Classification,* specifies certain roles and responsibilities within the ICP are assigned to facility personnel. The procedure does not address how these positions are filled during a non-facility-specific emergency or a multiple-facility emergency.

A facility's radiological control manager is assigned by procedure as the radiological hazards assessor and is responsible for coordinating radiological control functions throughout the incident scene. During the 24 Command Wildland Fire, it became apparent that an equivalent position had not been established to perform this function within the ICP for sitewide events.

Emergency response personnel within the Unified Dose Assessment Center (UDAC) responsible for dispatching field teams for plume tracking took on the additional function. They coordinated radiological control support to the ICP, dispatching RCTs to survey firefighters and their equipment. The UDAC field team coordinators were stressed to perform not only their assigned duties but also the duties of radiological control hazards assessor for the ICP. As a result, some normal safety functions were not performed:

- Not all teams received safety briefings before being dispatched.
- Some field teams were dispatched without reflective vests.
- Some RCTs were inadvertently worked double shifts because of odd turnover times and inadequate logkeeping.

When a single facility is involved in an emergency event, the Facility Representative reports to the ICP to act as liaison to the RL staff in the EOC. However, no procedure is in place to dispatch or employ a facility representative at the ICP during sitewide events.

The Board concluded that the existing emergency response procedures fail to identify how duties normally performed by facility staff at the ICP are accomplished when the emergency is not facility-specific.

3.3.2 Alert Level Declaration

On the morning of June 28, smoke from the fire began causing health problems for personnel in the 200 West Area. Approximately 18 individuals reported to health stations with complaints. The SED determined that it was prudent to remove personnel from the 200 West Area. Governing procedures call for an evacuation when an Alert level emergency is declared; procedurally, this happens only when a facility is threatened. For this reason, the SED issued an "early release" order for the 200 West Area based on smoke-related health issues, which is allowed by procedures.

"Early release" does not carry the urgency of an evacuation order, and some problems arose with personnel leaving in a timely manner. The plant manager at one facility consulted with his company management before he released his employees from work. This delayed their release from work for about 25 minutes. The employees thought that this delay was not warranted. The plant manager's understanding of the early release process was different from that of the employees. This caused confusion and concern and could have been avoided.

The Board considers the SED's call to release personnel early proactive and noteworthy. Additional health effects were minimized, a hasty evacuation was avoided, and the absence of personnel from the area provided more maneuverable space for firefighters and equipment. The Board concluded that the governing procedures inappropriately lack an avenue for evacuating facilities in a predictive and preventive manner.

3.3.3 Snively Canyon Fire - Anticipatory Alert Level Declaration

In August 1984 and again in June 2000, under extreme weather conditions, fires in Snively Canyon on the ALE Reserve became uncontrollable and burned significant portions of the Hanford Site. Fires breaching the canyon have reached Hanford structures and private lands, including residential and commercial areas, within 6 hours on massive fronts. Once the canyon has been lost, no natural features provide a barrier to fire. Only minimal manmade barriers, SR 240 and SR 255, block the fire's path. In both the 1984 and 2000 fires, neither barrier proved to be effective.

Snively Canyon

The second factor affecting fire severity is the terrain of Snively Canyon. The canyon is isolated, inaccessible in many places, and generally steep and rough overall. Soil conditions vary from hard basalt features to dust many feet deep with the consistency of fine flour. The unique geographical features of the terrain also form a "raceway" for fires to expand across the face of Rattlesnake Mountain. Local firefighters are aware of the canyon's significance and have discussed and practiced methods of containing fires in that area.

Hanford procedures do not cover anticipatory fires when considering emergency levels. There is insufficient time to mobilize state or national resources, once the fire escapes the Snively Canyon area. An Alert level emergency declared when fires are still contained in Snively Canyon would provide the Site additional time to marshal needed external resources to combat massive wildland fires, as experience has demonstrated will occur. One of the reasons the HFD performed so well in this emergency is that the department had almost two days to prepare for a fire on the Hanford Site. The flexibility to initiate an anticipatory alert can be created by adding a specific Emergency Action Level to the Hanford procedures based on a fire in Snively Canyon.

The Board concludes that a new Emergency Action Level should be written based on an anticipated fire in the Snively Canyon area of the ALE Reserve.

3.3.4 Preparation for Facility Abandonment

Emergency response procedures address evacuation of a building or facility for an emergency situation but do not cover abandonment of a facility. During an emergency, personnel move to a safe position around the facility and address the emergency. In abandonment, all personnel leave the area (e.g., go home) without knowing when they will be able to return. To abandon a facility or area, the systems must be placed in a safe mode and security issues addressed.

During the 24 Command fire event, the fire posed the danger of overrunning sections of the Site. As the fire approached facilities in the 200 West Area, and it appeared the facility personnel would be evacuated because of smoke, staff began preparing the facilities for abandonment. Their preparations were based on the plan they had developed. In some cases, no procedures were in place regarding how to prepare a facility for abandonment. It is to the credit of Hanford staff that the responsible personnel were able to formulate and execute the appropriate actions to protect the personnel, the facilities, and the contents of the facilities prior to abandonment.

Hanford Patrol personnel also took the necessary actions to prepare facilities at risk of being overrun by fire. They moved weapons and ammunition and installed tamper-indicating devices in sensitive locations. However, in several situations these actions were not prescribed by procedures.

Facilities abandoned because of the 24 Command fire were the LIGO, HAMMER, and Patrol Training Academy. Preparations for abandonment were made at the 200 West facilities.

Emergency response procedures address evacuation of a building or facility for an emergency situation but do not cover abandonment of a facility.

3.4 Emergency Response Communications

Communications are always an issue in emergency response. The Board found one communications failure issue and two issues with communications equipment.

3.4.1 Cellular Telephones

Emergency responders often use cellular telephones as an additional mode of communication. This is particularly true when traditional landline systems are damaged or when radio systems may be affected by terrain, environmental conditions, or saturation of open channels. Although cellular phones were

used during this event, cellular phone channels were limited and occasionally became saturated, affecting numerous organizations and the public.

Reviews of the 1998 Picric Acid Event had identified an issue related to the saturation of the cellular phone system channels. The increased volume of communications during the 24 Command fire again taxed existing cellular phone channels. In the event of communications systems failure or overload, the existence of adequate backup communications is critical. The Board concluded that cellular telephones should not be considered as a reliable system for communication during emergencies.

3.4.2 Hanford Fire Department Hand-Held Radios

The hand-held radios used by the HFD do well in the traditional Site-oriented response activities involving organizations associated with the Tri-County Mutual Aid Agreement. However, these radios are not all field-programmable with the frequencies needed to communicate with personnel from agencies and air operations not normally associated with the Mutual Aid Agreement. The limited ability to communicate directly with personnel from cooperating organizations hindered response operations during the 24 Command Wildland Fire. The Board concluded that the HFD had difficulty communicating with personnel from organizations who are not part of the Tri-County Mutual Aid Agreement.

3.5 Emergency Response Equipment

The Board identified four issues with emergency response equipment that encompasses a diverse set of factors ranging from the design of the EOC to use of offsite equipment.

3.5.1 Emergency Operations Center Facilities

The fire generating this event created a large plume of smoke that drifted south and southeast across much of the Tri-Cities area. The primary EOC is in the basement of the Federal Building, a General Services Administration structure in downtown Richland. The heating, ventilating and air conditioning (HVAC) system within the Federal Building, although in a recirculation mode, drew smoke-filled air into the EOC, causing some staff to experience discomfort. The situation was resolved by taking manual control of the Federal Building HVAC system and cycling it on and off while monitoring conditions in the building. More importantly, the smoke was sufficient to potentially set off the activation system. The building's smoke detection system was therefore disabled to prevent the building's fire alarm system from activating and forcing evacuation of the EOC and flooding of the space from automatic fire protection devices. The decision to disable the system was done with forethought by a DOE manager, and fire-watches were manned.

However, no protocols or procedures for accomplishing this task exist currently for the Federal Building, and the action was taken due to necessity rather than planning.

An alternative EOC has been designated for RL operations. This alternative is located at 2420 Stevens Drive. The alternative facility was not considered a viable option during this event because it is closer to the Hanford Site and the fire was moving in its direction. Unplanned evacuation of the primary EOC would have forced a transitory response and disrupted logistical support for the event for an unforeseen period of time.

The two EOCs for the Hanford Site are housed in locations originally designed as office spaces. This fact leads to an operational vulnerability during an emergency response. The Hanford EOCs do not meet Federal Emergency Management Agency (FEMA) standards for Emergency Response Facilities. The expectation both internally and from the public is that the Hanford Site is prepared to deal with any Site emergency. Although the Board found no governing DOE requirement for the EOCs to meet FEMA standards, good practice would recommend review of this subject.

The Board concluded that the Hanford EOCs present potential operational vulnerabilities due to current design.

3.5.2 Availability of Maps

Maps in the Hanford Patrol Operation Center (POC), the UDAC, the EOC, and the JIC are hardcopy maps showing only the Hanford Site with varying levels of detail. No maps of the surrounding counties were available. The JIC was not able to show media representatives the location of the BC Controlled Area and crib, and the EOC could not track movement of the fire into Benton County. The Patrol did not have an up-to-date location of the fire throughout the event. The Site has very good cartographic capabilities, but the information was not available for emergency response. Throughout the event, the location of the fireline was not known to the EOC, POC, or facility personnel because of each entity's lack of mapping capability.

Precise information from the ICP on fireline location was difficult for the Hanford EOC to obtain for several reasons. First, the fire was moving very rapidly, and exact locations would have been very hard to keep updated. In addition, during most of the fire, the Type 3 and Type 2 IMTs reported to the Benton County EOC because they were in charge of the offsite firefighting efforts.

Reports from the field came in as "The fireline is about 3 miles north of Gate 106." No two groups used the same set of maps, so coordination with unfamiliar reference points was very difficult. During the interviews, many

people suggested the use of global positioning system devices along with a standardized set of maps to give exact locations of the event.

The Board concluded that available mapping resources for emergency response did not provide information that could be used to effectively fight the fire, provide Patrol response, or give understandable information to the public.

3.5.3 Use of Offsite Equipment

Equipment belonging to non-Hanford agencies was used during the 24 Command fire. Examples are aircraft for Site inspections and a tanker truck for water. Issues with the aircraft are covered in Section 3.6.7. The privately owned tanker truck was used by the HFD.

No emergency response procedures exist to streamline the bringing in of equipment from offsite to address an emergency. The Board concluded that the process for bringing in equipment from offsite for emergency response is not institutionalized.

3.5.4 Offer of Front-End Loader at Accident Scene

At the initial accident scene, a private citizen offered the use of a front-end loader to fight the fire. The HFD declined the use of this equipment. This interaction has caused much controversy.

The citizen who offered the equipment wanted to help. However, the HFD responder told the citizen that the fire was on the ALE Reserve and the use of equipment off the road was not allowed because of "light on the land" policies.

When interviewed, the HFD paramedic involved in this exchange indicated that he was motivated by need to respond to the immediate situation; i.e., a fatal accident with fires burning on both sides of the road, vehicle traffic backing up, and the overriding concern for the lives of the people on the road. To get the citizen to a safe place expediently and prevent him from doing something that may have required a rescue effort, the paramedic provided an explanation that offered no opening for rebuttal. The explanation achieved the desired results. The citizen did not use the equipment.

Refusal of private equipment to directly fight a fire is the standard policy of the HFD. In this situation, the citizen's training was unknown, the equipment was unknown, and use of the equipment on the fire was unsafe because of the prevailing fire conditions. In the heat of the moment, the paramedic opted to not take the time to explain the HFD policy and instead cut the conversation short.

The Board concluded that the refusal to use the offered equipment was correct, based upon the safety issues and fire conditions.

3.6 Operational Issues

The Board found six operational issues associated with the event. Overall, there were very few injuries, and the early release of Hanford workers prevented smoke-related health problems. The aviation issue is a mixture of not having institutionalized procedures ahead of time and the procedures not being understood. The remaining issues are specific command and control problems.

3.6.1 Hanford Patrol

On the evening of June 28, a Hanford Patrol officer was instructed to check Gate 106 to Rattlesnake Mountain. At this time, the fire was moving rapidly to the south. As the officer arrived at the road to Rattlesnake Mountain, he observed the fire cresting the rise to the north of his location. With the flame front advancing swiftly, he was required to travel rapidly along the only remaining escape route, toward Benton City and away from the Hanford Site. This officer effectively was cut off from the Site for the time required to drive a 30-mile roundabout route to return to the Site.

Throughout the 24 Command Wildland Fire, limited information on fire status was available in the POC. The POC has no capability for monitoring the fire status. A fixed map is available in the POC; however, no dynamic system other than reports from observers is in place to provide updated information. The Board concluded that a Hanford patrolman was sent into the path of the fire because the POC was not aware of the fire location.

3.6.2 Laser Interferometer Gravitational-Wave Observatory Evacuation

The LIGO is an independent scientific research facility on the Hanford Site, manned by a small staff. The memorandum of agreement between RL and LIGO provides for emergency notifications to be issued to LIGO staff via the Hanford Site's crash phone system.

Interviews with LIGO staff indicate that notification was received at approximately 7:00 p.m. on June 28. Most Hanford Site personnel already were offsite at that time. The LIGO manager drove back onto the Site to secure the facility. A local Boy Scout troop had arrived and was touring the LIGO with another LIGO staff member. The returning LIGO manager ensured that the tour group was evacuated. The Board concluded that the LIGO crash phone system did not provide emergency information in a timely manner and, as a result, emergency evacuation of the facility was not timely.

3.6.3 Traffic Control

Traffic on SR 24 was heavily backed up when the initial HFD responders arrived at the scene of the initiating accident. The accident blocked the

entire roadway, and wildland fires were burning on both sides of the road. An estimated 50 to 100 vehicles and numerous onlookers interfered with the firefighting mission. State Route 24 was not closed immediately, thereby increasing the hazard to both the public and responding emergency units. In addition, SR 24 was reopened after the accident scene was cleared. Reopening the route caused additional interference with emergency vehicles stationed at the Cold Creek Vineyard ICP.

Evacuation instructions from the EOC informed employees living in the Yakima area to use SR 24. However, that route was closed to traffic. Alternate routes south also were blocked by firefighting activities. The Board concluded that traffic control processes (both onsite and offsite) were not well coordinated.

3.6.4 Crowd Control

Law enforcement efforts to control spectators were hindered by the extent of the sitewide event. Although Hanford Patrol requested assistance from the Richland Police Department to man barricades and control spectators, the Richland Police Department also was heavily engaged and not available to assist. Hanford Patrol was instructed to take crowd control actions as necessary.

In addition, unknown persons approached firefighters along SR 240 at two separate locations. These groups waved instruments and claimed firefighters were exposed to radiation, causing anxiety among the firefighters. The Board concluded that crowd control was not well coordinated.

3.6.5 Recovery Preparation

By the fourth day of the event, with the fire largely under control and firefighters concentrating on maintaining firelines and mopping up hot spots, planning for recovery and re-entry actions was under way. However, guidance regarding recovery procedures was lacking. High-level personnel from RL and the major Hanford contractor organizations met to plan the recovery activities. As an outcome of this meeting, staff from Fluor Hanford, Inc., as the major Site contractor and the responsible contractor for emergency operations, took the lead in bringing together personnel representing all contractors onsite. Aside from a representative from one contractor organization, all personnel present were authorized to commit their organizations to planned courses of action. (Commitment from this organization was obtained after repeated cycles to contractor management for approval.)

The group of Hanford contractor representatives put a recovery and re-entry plan in place within 4 to 5 hours, and the organizations executed the plan within 30 hours. The plan involved inspection of all occupiable facilities

and return of those facilities to an operational state; inspection of utilities; radiation surveys of waste sites and roads; and attaining assurance that emergency response capability was back to near normal.

Hanford staff did a commendable job in meeting the challenges of planning and executing the transition from emergency operations to recovery. However, the Board concluded that institutionalizing the recovery planning process and extending emergency drills to adequately exercise the process and personnel would ease the transition from emergency activation levels to recovery and re-entry in future events.

3.6.6 Medical Response

The extent and number of reported health-related issues were very small for an event of this scope and magnitude. Most cases were related to effects of smoke inhalation and irritation. The Board concluded that the decision to release Hanford workers early for smoke-related issues rather than wait for a direct fire threat was prudent and potentially eliminated many more occurrences. In addition, the Board found commendable the proactive response of Site managers who reassigned staff with known respiratory conditions.

3.6.7 Aviation

Air operations in progress

The significant use of aviation assets to fight the 24 Command Wildland Fire culminated in the identification of two issues that need to be addressed expeditiously. These issues include significant confusion over the status and control of the closed air space over the Hanford Site during the event and inappropriate use of available aircraft by personnel.

According to DOE-0233, *Emergency Plan Implementing Procedure,* all requests for airspace closure (temporary flight restriction, or TFR) over Hanford are to be made by the Occurrence Notification Center. DOE-0233 also has a blanket statement to be provided to the FAA when requesting a TFR. In response to a TFR request, the FAA will close a discrete portion of the Hanford airspace. The language in DOE-0233 does not allow any subsequent updating or relocating of a TFR.

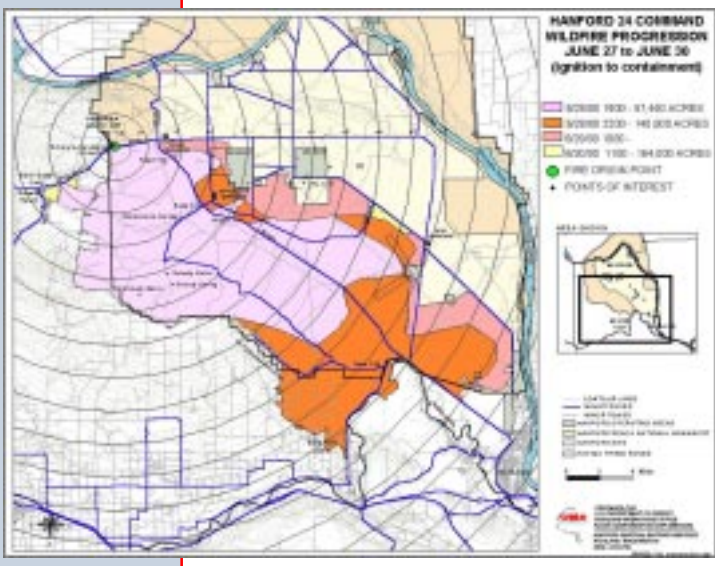
RL's Aviation Manual 440.2 requires aviation operations to be reviewed for certain requirements before any DOE-funded personnel ride on the aircraft. The manual has an emergency exemption clause, but it must be invoked by the RL Manager or Safeguards and Security Director before staff are allowed on aircraft not reviewed in accordance with the manual's requirements. No formally declared exemption was in place during the 24 Command Fire. However, discussions with the HFD staff revealed that flights were made to reconnoiter the fire with DOE-funded staff onboard. These flights were conducted outside the exemption process specified in Aviation Manual 440.2.

The Board concluded that planning for use of emergency aircraft during events such as the 24 Command fire was lacking. The Board concluded that the procedure for airspace closure did not contain flexibility to establish or move the TFR where needed, that the HFD procedures did not address establishing a TFR, and that Hanford personnel flew on chartered aircraft outside established procedures.

3.7 Radiological Control

The map in Figure 3-1 shows the areas on the Hanford Site that burned in the fire. No buildings containing radioactive materials were burned. Portions of the BC Controlled Area and a few underground radioactive material areas were burned over. However, major waste sites were protected and left undisturbed by the fire.

Good pre-fire planning resulted in protection of buildings, waste sites, and storage areas containing radioactive material. As an example, the fire swept through the ALE Reserve but the buildings containing low levels of radioactive material were protected from the fire as a result of the firebreaks and green belts established around the buildings. In contrast, a temporary trailer and a metal shed that did not contain radioactive material burned because they were not protected by firebreaks. A more detailed discussion of fire protection is contained in the barrier analysis in Appendix C.



Control of deep-rooted vegetation (e.g., tumbleweeds) on radioactive burial sites and heightened cleanup of tumbleweeds near facilities contributes to minimizing the release of radioactive material during a fire.

In 1998, Hanford identified an increase in the spread of contamination by biological vectors such as tumbleweeds. The Biological Control Program was centralized to improve its efficiency and effectiveness. The herbicide treatment effectiveness increased from 65% in 1998 to 90% in 2000. Sites where tumbleweeds are contaminated are being prioritized and cleaned.

Although the radiological impact of the 24 Command fire was low, the Board found several issues that need attention for improved response in the case of a more serious event.

Vegetation cleanup at Hanford

3.7.1 Communicating Hanford-Specific Radiological Hazards to Offsite Agencies

In preparing the *600 Area Pre-Fire Plan*, Hanford contractors had evaluated the potential radiological hazards of a fire in the soil contamination area known as the BC Controlled Area south of the 200 East Area. They identified the hazard as low. Personal protective equipment for radiological protection was not required. According to the pre-fire plan, only HFD firefighters would enter areas posted for radiological purposes.

The Benton County EOC timeline shows that offsite agencies were not aware of the low hazard or the preplanning performed by Hanford to minimize hazards to offsite firefighters participating in the response to a fire at Hanford. The Board concluded that Hanford-specific radiological hazards were not communicated adequately to offsite agencies prior to the 24 Command Wildland Fire.

3.7.2 Collecting and Analyzing Radiological Data

During a potential radiological emergency, the first priority of monitoring is to identify airborne radioactivity levels that require either onsite or offsite protective actions. This type of air sample is taken with a high-volume air sampler operated for a short duration. A second priority is obtaining high-volume, long-duration air samples to assess radiological dose to the public.

Effective Dose Equivalent

An annualized sum of the doses received by an individual from radiation sources both ingested or inhaled and external to the body.

The third priority is collection of environmental samples (e.g., soil and vegetation) to determine the extent of the release to the environment. In addition, radiological monitoring must be performed even when no release of radioactivity is expected, to demonstrate there was not a release.

During the 24 Command Wildland Fire, RL/ORP did not take any high-volume, long-duration air samples. To demonstrate that the dose to the public was below the limits of 10 millirem/year effective dose equivalent, RL/ORP prematurely collected the filters from some of the Site's low-volume, continuous air-monitoring environmental samplers, perturbing the Site's environmental monitoring program. The use of high-volume, long-duration air samplers during an event is preferable for greater sensitivity of the data, flexibility in placing the air samplers in the best location within the plume, and nonperturbation of the environmental monitoring program in order to obtain data more quickly.

A review of the emergency response procedures and interviews with RCTs indicated the following:

- The priorities for radiological monitoring are not formalized to include high-volume, long-duration air samples for assessing the low-level dose to the public.
- No RL/ORP Site emergency response procedures specify how or when to perform the airborne radioactivity, soil, and vegetation monitoring during and after an event.
- Training for RCTs does not cover performance of these specialized environmental radiological surveys.
- Use of laboratories for analysis of radiological samples was not preplanned to maximize efficiency to get results to the public as quickly as possible.
- The procedures did not provide for collection of negative data to confirm no release of airborne radioactivity when it is not expected.

In practice, the value of negative data was understood during the 24 Command Wildland Fire, and field teams were dispatched even before areas of known radioactivity (e.g., the BC Controlled Area) had burned.

The Board concluded that the process for collection and analysis of radiological data during and after the event was not formalized, resulting in inefficiencies and in the perturbation of the environmental monitoring program to obtain data for dose assessment to the public.

3.7.3 Continuing Recovery Action Process Beyond Facility Reentry

RL emergency response procedures specify that the UDAC will continue to be responsible for onsite radiological monitoring. However, the procedures did not include plans for how that responsibility is fulfilled. In addition, the

procedures in the *Onsite Recovery Plan — June 2000 Fire* (July 1, 2000) provided no guidance for developing a plan of action for continuing the operations at the UDAC to perform radiological monitoring, data collection, and analysis, and for coordinating data results with the Washington State Department of Health and EPA. Although not institutionalized, a Site team successfully performed the necessary activities. The Board concluded that processes need to be formalized for 1) continued operation of the UDAC after a Site event is terminated; 2) continuing radiological monitoring after the source of airborne radioactivity has been stopped; and, 3) coordinating and analyzing the radiological monitoring data.

3.7.4 Communicating Radiological Information

Technical Accuracy of News Releases

Some press releases issued by the Hanford JIC during the fire contained inaccuracies and incomplete information.

For example, before high-volume air sampling and laboratory analysis of samples were completed, several press releases incorrectly implied there was no release of airborne radioactivity. Later, as the analytical results of large-volume air samples became available, RL announced the potential release of airborne radioactivity. These press releases stated that ongoing monitoring during the fire had found no evidence of radioactivity above background levels. The initial lower-volume air samples were used to determine if any protective actions would be required for radiological protection of the workers and public during the emergency.

Incomplete information regarding the status of the BC cribs near the 200 West Area resulted in a press release stating that the vegetation over the cribs had been burned when it had not burned.

During a press conference, a statement was made that the fire barriers existed around Hanford facilities because combustible debris had recently been cleared from around the facilities. A more accurate explanation would have been that Hanford facilities are safe from the effects of fires by the Site's use of noncombustible construction materials including roofing and fire barriers from natural vegetation, concrete, asphalt, gravel, and green grass around buildings.

A review of EOC logs, records of news releases, and interviews with individuals responsible for the technical accuracy of the news releases revealed that no records were maintained relative to prepublication review and approval of the news releases. In addition, individuals reviewing the news releases did not ensure that appropriate terminology was used or that the news releases accurately reflected what the available radiological monitoring data meant in terms of health and safety of workers and the public. Inter-

views with the Site Management Team Emergency Preparedness Advisor responsible for the technical accuracy of these news releases revealed the contractor technical support in the EOC was not consulted for approval of the technical information. Actions normally taken during a facility event, such as the event contractor's technical review of information on the facility, were not performed.

Communication of Radiological Information within the Emergency Operations Center

There were no visual displays in the EOC relating field team locations and radiological monitoring data results. The computer system used previously to display plume projections and monitoring results was expensive and was not Y2K compliant. The Site deleted the system but never replaced it with another system. DOE personnel went directly to the UDAC to obtain radiological data, bypassing normal communications protocol and distracting UDAC personnel from performing their functions. The Board concluded the lack of tools for visual display of radiological information within the EOC contributed to ineffective communication of radiological data.

Communication of Radiological Data via the Internet

During the 24 Command fire, RL established an Internet site for posting radiological data. Although the intent is commendable, the information on the Internet site was not complete and was not kept updated. The misinformation caused public concern that Hanford officials were not being completely forthright with their radiological information.

No institutionalized process was in place to have an Internet site for radiological information during an emergency response. Because no process was established for the Internet site, it was not kept up to date and there was no way to monitor whether the information posted was correct. Inventing a new process during an emergency response situation is risky because the normal checks and balances for process implementation are not in place. No one has practiced the new process, so mistakes will be made. This goes against principles of ISMS and sound conduct of operations.

The Board concluded that the process of using an Internet site for posting radiological data has not been institutionalized.

3.7.5 Equipment

Radiological Monitoring Equipment for Field Teams

Field team radiological monitoring is designed to identify radiological conditions that would warrant protective actions for Site workers and the public.

Delays in hazards identification could adversely affect the timeliness of implementation of protective actions.

Following an event at the Plutonium Reclamation Facility in May 1997, Fluor Daniel Hanford recommended that RL's Office of Environment, Safety and Health upgrade two additional vehicles at the Federal Building for mobile field monitoring. These vehicles would be fitted for use in plume-tracking activities in case of a back-shift radiological event or other event where access to vehicles staged in the 200 Area is compromised. This recommended action never was completed. More than 4 hours were required to deploy the first radiological field team because team members had to retrieve vehicles from the 200 Area (a fire-threatened area).

In addition, the room in the EOC where radiological equipment is stored for emergency use for RL field teams was not maintained in a condition for ready access to the emergency equipment. Interviews with the RCTs responsible for field team monitoring indicated that equipment access was blocked. One technician indicated it took about an hour to move materials out of the way to gain access to the emergency equipment.

However, these conditions had no adverse impact on the radiological monitoring for this event. The field teams were deployed well in advance of the fire, reaching the soil contamination areas that were burned over in the fire.

The Board concluded that deployment of radiological monitoring field teams was delayed due to failure to stage vehicles for plume tracking at the Federal Building and because radiological equipment was not maintained in a condition for ready access.

Atmospheric Release Advisory Capability

During the 24 Command fire, the Atmospheric Release Advisory Capability (ARAC) system at Hanford would not print out the plume projection plots because of a software problem. Lawrence Livermore National Laboratory assisted RL in obtaining technical support from Las Vegas to troubleshoot and fix the software problem. The Board concluded the ARAC system at Hanford was not adequately maintained ready for use.

3.8 Emergency Response Asset Implementation

3.8.1 Federal Radiological Emergency Response Plan

During the 24 Command Wildland Fire, DOE-HQ, in conjunction with the White House and the RL Manager, determined that it was prudent to have the EPA perform independent radiological monitoring during the emergency response phase in addition to ongoing monitoring by Site personnel, which is outside the scope of the Federal Radiological Emergency Response Plan. The

The Federal Radiological Emergency Response Plan (FRERP) states "The objective of the .....FRERP is to establish an organized and integrated capacity for timely, coordinated response by Federal agencies to peacetime radiological emergencies..... The FRERP covers any peacetime radiological emergency that has actual, potential, or perceived radiological consequences...." The FRERP establishes a cooperative effort between Federal and state agencies to ensure that all Federal radiological assistance efforts fully support the objective to protect the public. The FRERP defines the roles of the different Federal agencies, including DOE and the EPA, during a radiological emergency. DOE is responsible to provide radiological monitoring and assessment activities during the emergency. The EPA is responsible for assisting DOE in monitoring radioactivity levels in the environment after the emergency condition has been stabilized. Federal agencies are trained to perform radiological monitoring in accordance with the FRERP.

EPA was not prepared to perform this new task. By the time the EPA was ready to perform airborne radioactivity monitoring, the fire was out. EPA specialists did provide air monitoring during a subsequent dust storm, which would identify if any re-suspension of radioactive material occurred. EPA monitoring results indicated that a small release of radioactive material had occurred at a level below the established limits of 10 millirem effective dose equivalent.

The Board concluded that the Secretary of Energy, White House, and RL Manager made a good decision in requesting EPA radiological monitoring during the 24 Command Wildland Fire to supplement monitoring done by Site personnel. In addition, opportunities for improvement in RL radiological monitoring were identified as a result of EPA interactions. However, the EPA was unable to perform radiological monitoring during the emergency phase because this new scope of work had not been adequately preplanned by all agencies involved.

Federal Radiological Monitoring and Assessment Center

One of the Federal assets available for use during a radiological emergency, the Federal Radiological Monitoring and Assessment Center (FRMAC) "...is established ... for the coordination of Federal radiological monitoring and assessment activities with that of State and local agencies. The FRMAC is established at an on-scene location in coordination with State and local authorities and other Federal agencies." According to the FRERP, it is DOE's responsibility to establish the FRMAC. After the emergency is stabilized, the responsibility for continued operation of the FRMAC is transferred to the EPA.

3.8.2 Federal Radiological Monitoring and Assessment Center

Although the EPA was requested to provide radiological monitoring, the Federal Radiological Monitoring and Assessment Center (FRMAC), which coordinates Federal radiological monitoring and assessment activities with those of state and local agencies, was not deployed to Hanford to interface with the EPA monitoring teams. RL staff are not trained to function as a FRMAC.

The Board concluded that DOE did not comply with its responsibility to coordinate EPA radiological monitoring (through FRMAC) in accordance with the requirements of the FRERP. The poor coordination between DOE and the EPA contributed to the EPA's inability to perform radiological monitoring during the emergency phase. The Board concluded that formal MOUs between RL/ORP and the WDOH and EPA to coordinate Federal and state radiological monitoring could be used as an interim measure until the FRERP is modified.

3.8.3 Aerial Measuring System

Public information from the DOE-HQ Office of Emergency Response states that DOE is prepared to respond immediately to any radiological accident or incident in the world with its seven radiological emergency response assets. The "Overview of Federal Radiological Monitoring and Assessment Center Operations" specifies that aerial measuring system (AMS) assets are expected to be available within 4 to 8 hours.

The preferred aerial platform for performing a detailed aerial gamma radiation survey is a helicopter. The AMS-equipped helicopters are anywhere from six to fifty times more sensitive than the AMS-equipped airplanes. Discussions with personnel requesting assets at the Hanford EOC revealed that the AMS-equipped helicopters never were requested. Individuals within the Hanford EOC were not adequately familiar with this Federal asset and its capabilities.

Multispectral imagery equipment can be used to identify the location of thermal hot spots to support the firefighting efforts. The multispectral imagery equipment had been removed from the AMS aircraft (Cessna Citation), and the aircraft was reconfigured for personnel transport and was on standby at Lawrence Livermore. As a result, the multispectral imagery equipment was not available.

Nineteen hours after HQ Defense Programs offered the services of AMS, available assets were taking measurements at Hanford. However, preferred gamma monitoring equipment was not deployed. The sensitivity of AMS gamma radiation survey instruments deployed was too low to detect any plausible release from the soil contamination area that was burned. AMS assets to support firefighting efforts were unavailable. The Board concluded that, for the 24 Command Wildland Fire, AMS assets were not available for immediate deployment.

3.9 Lessons Learned

As part of this event investigation, the Board reviewed the lessons learned and associated corrective actions from previous fires and related events at the Hanford Site. The Board evaluated this information for applicability and

effectiveness relative to the 24 Command Wildland Fire. The lessons learned and corrective action management programs are part of the ISMS feedback process and are necessary for continuous improvement and to prevent unwanted occurrences.

The 1984 Hanford wildland fire was comparable to the 24 Command fire, with similar fire progression and burn areas due to the natural terrain and prevailing wind conditions. Over the past 16 years, much has changed at Hanford relative to emergency preparedness, communications technologies, Hanford security, and cooperation with external agencies. All of these changes represent a progression toward improved firefighting and emergency response capabilities. The final critique of the 1984 event identified many issues.

HAMMER training center looking north

Significant improvements have been made in the communications area due to technology advances, corrective actions from the 1984 fire, and proceduralized communications channels and requirements. However, two communication issues from the 1984 fire were not resolved and were observed during the 24 Command Wildland Fire:

- An excessive number of Hanford employees telephoned the Hanford POC to determine status of the fire and whether to report to work.
- Although technological advances have overcome issues identified in 1984 dealing with inadequate radio equipment, new challenges presented themselves during the 24 Command Wildland Fire. Specifically, cellular telephone communications were compromised, and radio communications with other agencies were hindered by limited frequency programming capabilities of HFD equipment.

Site access issues identified in 1984 concerned the definition of essential personnel and control of onlookers. Corrective actions were put in place after the 1984 event. However,

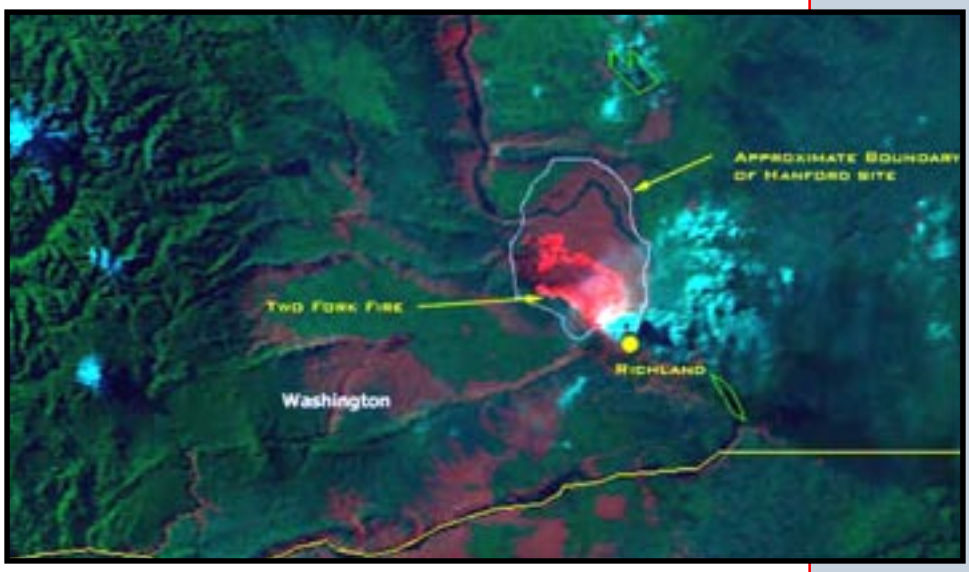
- The term *essential personnel* is defined inadequately. Corrective actions put in place after the 1984 event have degraded, and the process for defining essential personnel needs to be updated.

One firefighting strategy/prevention issue identified in 1984 was repeated during the 24 Command Wildland Fire:

- Firebreaks along roadways need improvement. Corrective actions were put in place after the 1984 event to establish and maintain firebreaks along roadways.

Substantial improvements have been made in the Emergency Preparedness program since the 1984 fire, including significant revisions resulting from the corrective actions identified from the Plutonium Reclamation Facility event. Of the identified issues, one remains:

- Maps and mapping capability in the Hanford EOC are inadequate for sitewide events.



4.0 Conclusions and Judgments of Need

The conclusions reached by the Board through the topical analyses presented in Section 3 were used as causal factors feeding a root cause analysis. This final effort looked for common themes and overarching principles within the larger set of concerns that could provide the best long-term resolution for both the Hanford Site and the entire DOE complex. Conclusions reached by the Board included positive points represented as Noteworthy Practices.

The Board identified seven root causes that represent areas for management attention. The seven issues (and the underlying contributing causes) were then subjected to a tier analysis process designed to target the areas of responsibility most likely to provide resolution. The results of the tier analysis identify four areas of differing responsibility. These ideas represent the final set of four judgments of need presented.

4.1 Overall Conclusions

The Board concluded that the HFD's response to the initial event was proactive and timely. The fire was an immediate and spontaneous result of the vehicle accident. However, the lack of maintenance of defensible firebreaks along state highways running through the Hanford Site allowed the fire to spread quickly onto the ALE Reserve. The HFD leadership recognized the severity of the fire and marshaled all available resources at the disposal of the local command. Within the first hour of the event, all available HFD wildland resources were deployed. In addition, air tanker support and FWS firefighting resources were requested at a very early stage. The decisions to escalate the fire response from local command through mutual aid and to a Type 3 IMT structure were made within hours of the initial notification and were influenced appropriately by the characteristics of the fire and the unique terrain involved.

The Board also viewed the emergency response of other Site personnel as proactive. The early release of nonessential staff from Hanford was preventive, diminishing overall health effects to workers, allowing for an orderly withdrawal in front of the fire and providing less encumbered access to emergency responders.

Sound preventive fire planning and execution, including fire-safe designs and enforcement of vegetation control and fire setbacks around facilities, contributed to the successful defense of Hanford structures and infrastructure. Vegetation management on waste sites and controlled areas contributed positively to minimizing the release of airborne radioactivity during the fire. Only very minor vegetation damage occurred on the waste sites and

controlled areas. The Board concluded that the combination of sound preventive techniques and effective event management accounted for the light loss of property on the Hanford Site and minor injuries to Hanford staff observed.

The Board determined that the Hanford Site successfully activated its emergency response organization to combat the 24 Command Wildland Fire. No substantial gaps in management systems or infrastructure were identified. Consequently, the judgments of need reached by the Board represent areas for improvement and lessons learned.

4.2 Judgments of Need

Judgments of need are managerial controls and safety measures believed necessary to prevent or minimize the probability of a recurrence. Specific needs identified by the Board have been targeted to provide for the most efficient and effective focus of management's energy. As previously described, the Board developed four primary judgments of need based on root and contributing causes. The primary judgments of need are as follows:

- RL/ORP should evaluate existing emergency response processes related to Hanford events affecting state and national systems, as well as state and national events affecting Hanford systems. (JON-1)
- RL/ORP should review and revise sitewide and protracted emergency and recovery operations including emergency communications and resource readiness. (JON-2)
- DOE-HQ should assess the Federal Radiological Emergency Response Plan (FRERP) for inclusion of EPA independent radioactivity monitoring during events and for limited deployment of the Federal Radiological Monitoring and Assessment Center (FRMAC) whenever EPA has deployed. In addition, DOE-HQ should determine if AMS assets are at an acceptable level of readiness. (JON-3)
- RL/ORP should improve the corrective action management system to ensure that improvement actions are managed adequately. (JON-4)

Table 4-1 is a summary of the conclusions, noteworthy practices, and judgments of need stemming from the 24 Command Wildland Fire on the Hanford Site. The table's hierarchy demonstrates the relationship between the judgements of need and the seven root causes and also presents the contributing causes related to each root cause. The Board concluded that many contributing causes had sufficient merit to be considered for action, and secondary judgments of need were assigned. These also appear in Table 4-1 and are numerated in relation to the principal judgment of need they support.

Table 4-1. Conclusions and Judgments of Need

Conclusions	Judgments of Need
JON-1	
The existing emergency response processes related to Hanford events affecting state and national systems, as well as state and national events affecting Hanford systems, did not perform as needed or expected in every case.	RL/ORP should evaluate existing emergency response processes related to Hanford events affecting state and national systems, as well as state and national events affecting Hanford systems. (JON-1)
MOUs and agreements with offsite agencies and non-DOE tenants did not always exist. Existing agreements/MOUs did not have enough detail, resulting in issues that had to be worked out in the field.	RL should implement or revise agreements with offsite agencies and non-DOE tenants of the site that define roles and responsibilities for emergency response. (1a)
The lack of maintenance of defensible fire breaks along state highways running through the Hanford Site allowed the fire to spread quickly onto the Arid Lands Ecology Reserve.	RL/ORP and the Hanford Site contractors need to engage and coordinate with local clean air authorities, state regulators, the DOE-HQ Office of Environment, and the Washington State Department of Transportation to improve firebreaks along state right-of-way shoulders between Highways 24 and 240 and the DOE fence line. (1a1)
While interagency fire resources were used on the fire, the MOU between RL and the FWS contained no information relative to the National Wildfire Coordinating Group (NWCG), which could have assisted RL/ORP. The agreement between the HFD and the FWS also did not discuss coordination in accordance with the NWCG system and responsibilities for ordering tanker suppression support and had to be worked out in the field.	RL/ORP need to update and enhance MOUs and agreements between RL/ORP and the FWS, and between the HFD and the FWS, to address NWCG roles and responsibilities and protocols associated with ordering aerial tanker suppression support. (1a2)
Previously used helicopter aerial fire suppression support from the Yakima Training Center was not available, and the Yakima Detachment of the Washington State Patrol was not integrated well into the incident management of the fire because no formal agreements are currently in place with these groups.	RL/ORP need to put into place MOUs or agreements with the Yakima Training Center (for aerial helicopter support for wildland fire suppression) and the Washington State Patrol Yakima Detachment (for incident management) to support wildland firefighting operations. (1a3)

Conclusions	Judgments of Need
The fire affected non-DOE Hanford tenants, but not all of these entities have explicit agreements in place with RL/ORP delineating Hanford emergency management protocols.	RL/ORP should review and revise, as appropriate, agreements (e.g., MOUs, contracts) with non-DOE tenants at the Hanford Site (e.g. LIGO, U.S. Ecology, Energy Northwest) who implement execution of Site emergency management. (1a4)
The process for collection and analysis of radiological data during and post-event was not formalized, resulting in inefficiencies and perturbation of the environmental monitoring program to obtain data for dose assessment to the public. Processes need to be developed and implemented for the continued operation of UDAC after a radiological event is terminated, for continuing radiological monitoring after the source of airborne radioactivity has been stopped, and for coordinating and analyzing the radiological monitoring data. Formal MOUs between RL/ORP and WDOH and the EPA for coordination of radiological monitoring could be used as an interim measure until the FRERP is modified (see JON-3).	RL/ORP should evaluate establishment of formal MOUs with WDOH and the EPA on protocols for radiological monitoring during the emergency, ingestion, and recovery phases of a radiological event. (Until resolution of this issue is provided at the national level, see Recommendations for Resolution of JON-3). (1a5)
There is no institutionalized process to make use of offsite personnel during emergency field operations.	RL/ORP should review and revise existing processes for control and deployment of non-Hanford emergency personnel used during field emergency response. (1b)
The Hanford Fire Department needs assessment document did not adequately address necessary wildland resources for very large wildland fires and additional resources needed to be brought to the fire through the National Interagency Fire Center.	The HFD needs assessment document must be updated to include NWCG planning, protocols, involvement and resources necessary to manage future wildland fires of similar size, and results should be fed back into the Emergency Preparedness program. (1c)

Conclusions	Judgments of Need
Status of the fire's effect on Hanford Site hazards was not communicated adequately to outside agencies on a real time basis. The delays in communication of this information affected resource allocation and deployment of non-Hanford firefighting support.	RL/ORP should evaluate the need for additional liaison and interfaces between the EOC and external agencies to ensure accurate and timely exchange of emergency status and information. (1d)
The EOC did not understand the protocols of the Tri-County Mutual Aid Agreement and the National Interagency Fire Center, resulting in incorrect communications and inefficiencies.	RL/ORP should consider inclusion of mutual aid representatives at the EOC during sitewide emergency events. (1d1)
Hanford-specific radiological hazards were not adequately communicated to outside agencies prior to the 24 Command Wildland Fire. Hanford preplanning information did not adequately provide sufficient data to outside agencies prior to the fire. The radiological and chemical hazards had to be transmitted during the event. Preplanning did not address potential hazards for air support.	RL/ORP should review and revise the process for technical review for accuracy and approval of hazard communications with outside agencies. (1e)

JON-2

The existing sitewide and protracted emergency and recovery operations processes, including emergency communications and resource readiness, did not perform as needed or expected in every case.	RL/ORP should review and revise sitewide and protracted emergency and recovery operations, including emergency communications and resource readiness. (JON-2)

Execution of Sitewide Events:

Emergency response procedures address evacuation of a building or facility for an emergency situation but do not cover abandonment of a facility.	RL/ORP should examine the emergency management process to ensure that facility/site abandonment is addressed in the evacuation process. (2a)

Conclusions	Judgments of Need
The existing emergency response procedures fail to identify how duties normally performed by facility staff at the Incident Command Post are to be accomplished when the emergency is not facility-specific. The emergency response procedures do not allow the SED to take the Site to an Alert level emergency based on a predictive/preventive analysis of the situation confronting the Site. Differences between "early release" and "evacuation" are not well known onsite.	RL/ORP should review and revise existing emergency response procedures to address non-facility-specific and multiple-facility emergencies, including Incident Command Post structure and staffing. (2b)
When adverse fire conditions exist and there is a fire in Snively Canyon, significant portions of the Hanford Site will be burned. A new Protective Action Recommendation should be developed for an anticipated fire in Snively Canyon.	RL/ORP should add a new Emergency Action Level based on an anticipated fire in the Snively Canyon area of the Arid Lands Ecology Reserve. (2b1)
The existing process for communicating essential personnel information did not work during this event.	RL/ORP should review and revise the requirements for identification of essential personnel during emergencies and for the provision of avenues of safe access. (2c)
Cellular telephones should not be considered a reliable system for communication during emergencies. The HFD had difficulty communicating with personnel from organizations who are not part of the Tri-County Mutual Aid Agreement. The LIGO crash phone system did not provide emergency information in a timely manner, and, as a result, the emergency evacuation was not timely.	RL/ORP should review, revise, and demonstrate effectiveness of emergency response communication capabilities to enable participation of pertinent Site and external entities in emergencies that affect the Hanford Site (cell phones, radio frequencies, information dissemination). (2d)

Conclusions	Judgments of Need
Extended Emergency Operations:	
The staffing and scheduling of the emergency response personnel does not support multiple-shift events.	RL/ORP should review, revise, and demonstrate effectiveness of emergency response staffing levels to ensure shift turnovers can be supported for protracted operations. (2e)
The EOC did not get all the SMEs needed for efficient operations, and a process to obtain people with specialized skills from outside sources and internal volunteers does not exist. RL emergency procedures did not address utilizing SMEs (e.g., air operations and fire protection operations). The emergency management system does not provide for a process to characterize the event for associated hazards, access technical support needed, procure needed resources, or reassess issues as the event changes.	RL/ORP should review and revise process for identification of Site staff expertise in advisory and support capacities to enhance emergency management teams. (2f)
The process for collection and analysis of radiological data during and post-event was not formalized, resulting in inefficiencies and in the perturbation of the environmental monitoring program to obtain data for dose assessment to the public.	RL/ORP should review and revise the process for collection and analysis of radiological data during and post-event. (2g)
Processes need to be developed and implemented for the continued operation of the UDAC after a radiological event is terminated, for continuing radiological monitoring after the source of airborne radioactivity has been stopped, and for coordination and analysis of the radiological monitoring data.	RL/ORP should review and revise the process for recovery from emergency events to include scope beyond facility reentry. (2h)

Conclusions	Judgments of Need
The process for bringing equipment in from offsite for emergency response is not institutionalized. The HFD's refusal to use the offered equipment was correct, based upon the safety issues and fire conditions.	RL should review and revise the need to disseminate requirements for use of non-DOE equipment. (2i)

Emergency Response Communications:

There is no formal documentation of the review and approval process for news releases during emergencies. The EOC procedures contain no checklists to ensure that appropriate technical personnel approve the accuracy of the news release.	RL/ORP should review and revise the process for the technical review for accuracy and approval of press releases. (2j)

Emergency Resource Readiness:

The lack of tools for visual display of radiological information within the EOC contributed to ineffective communication of radiological data. Available mapping resources for emergency response did not provide information that could be used to effectively fight the fire, provide Patrol response, or give understandable information to the public. A Hanford Patrol officer was sent into the path of the fire because the POC was not aware of the fire location. Traffic control processes (both onsite and offsite) were not well coordinated. Crowd control was not well coordinated. The use of the Internet for publishing radiological and other data from the 24 Command Wildland Fire was not formalized, resulting in a period of ineffective communication of data.	RL/ORP should upgrade the tools available to emergency response to enhance the collection, display, and dissemination of emergency data. (2k)

Conclusions	Judgments of Need
HFD procedures did not address temporary flight restrictions. Procedures for closure of airspace did not contain flexibility to establish or move temporary flight restrictions where needed. Hanford personnel rode on chartered aircraft outside established procedures.	RL/ORP should review and revise the process for controlling airspace and authorizing DOE-funded personnel on chartered aircraft. (2l)
The Hanford EOC was not designed as an EOC and has vulnerabilities because of environmental and security reasons.	RL and the General Services Administration should assess the design of the Federal Building to support EOC operations. (2m)
The deployment of radiological monitoring field teams was delayed due to failure to stage vehicles for plume tracking at the Federal Building and due to radiological equipment not being maintained in a condition for ready access. The ARAC system at Hanford was not adequately maintained ready for use.	RL/ORP should review and revise the staging, maintenance, and storage of equipment used in emergency response. (2n)
JON-3	
The Secretary of Energy, White House, and RL Manager made a good decision in requesting EPA radiological monitoring during the 24 Command Wildland Fire. However, EPA was unable to perform radiological monitoring during the emergency phase because this new scope of work had not been adequately preplanned by all agencies involved. DOE did not comply with its responsibility to coordinate EPA radiological monitoring (through FRMAC) in accordance with the requirements of the FRERP. The poor coordination between DOE and EPA contributed to EPA's inability to perform radiological monitoring during the emergency phase. For the 24 Command Wildland Fire, AMS assets were not available for immediate deployment.	DOE-HQ Office of Emergency Response (SO-42) should assess the FRERP for inclusion of EPA independent radioactivity monitoring during events and for limited deployment of FRMAC whenever EPA has deployed. In addition, DOE-HQ Office of Emergency Response (SO-42) should determine if AMS assets are at an acceptable level of readiness. (JON-3)

Conclusions	Judgments of Need
	JON-4
Corrective actions resulting from critique of the 1984 Hanford fire proved ineffective or were not implemented in five areas, as supported by observations of the 24 Command Wildland Fire: • Communication issues • Definition of essential personnel • Control of spectators/onlookers • Firebreaks on state routes • Maps and mapping capabilities in the EOC for sitewide events.	RL/ORP should improve the corrective action management system to ensure that improvement actions are managed adequately. (JON-4)

Noteworthy Practices

The Hanford Fire Department response to the initial event was proactive and timely.

The decisions to escalate the fire response from local command through mutual aid and to a Type 3 IMT structure were made proactively and were influenced appropriately by the characteristics of the fire and the unique terrain involved.

The emergency response to the event was proactive.

The early release of personnel from Hanford was preventive, diminishing overall health effects to workers, allowing for a more orderly withdrawal in front of the fire and providing less encumbered access to emergency responders.

Sound preventive fire planning and execution, including fire-safe designs and enforcement of vegetation control and fire setbacks around facilities, contributed to the successful defense of Hanford structures and infrastructure.

Vegetation management on waste sites and controlled areas contributed positively to the control of radioactive materials onsite. The combination of sound preventive techniques and effective management of the event account for the light loss of property and minor injuries observed.

The decision to obtain relief from the incident management team and redeploy Hanford fire suppression resources to protect Site structures was appropriate and necessary.

5.0 Board Members and Advisors

Board Members

Keith A. Benguiat
Division Director
Engineering, Safety and Standards Division

Robert G. Hastings
Facility Representative
Operations Oversight Division

Craig R. Richins
Team Leader
Analysis & Evaluation Division

Roger A. Pressentin
General Engineer
Facility Transition Division

Stanley O. Branch
Team Leader
Analysis & Evaluation Division

Emily D. Irwin
Management Analyst
Analysis & Evaluation Division

Advisors

Craig P. Christensen
Hanford Site Fire Protection Engineer
Engineering, Safety and Standards Division

Jack B. George
Hanford Site Lock & Tag/Electrical
Safety Program Manager
Engineering, Safety and Standards Division

Rex E. Jordan
Hanford Fire Marshall

Dennis J. Newland, Vice President
Environment, Safety, Healty & Quality
Dyncorp Tri-Cities Services, Inc.

Brenda M. Pangborn
Hanford Site Radiological Control Program Manager
Engineering, Safety and Standards Division

Judy L. Tokarz-Hames
Emergency Preparedness Program Manager
Security and Emergency Services Division

Appendix A

Board Appointment Memorandum

United States Government

Department of Energy
Richland Operations Office

memorandum

DATE JUN 1 0 2000

REPLY TO ATTN OF A&E:SOB/00A&E-107

SUBJECT ESTABLISHMENT OF A TYPE B INVESTIGATION BOARD FOR THE JUNE 27, 2000, HANFORD SITE FIRE

TO Keith Benguiat
Board Chairman

I hereby establish a Type B Investigation Board to investigate the June 27, 2000, Hanford Site fire at the Department of Energy, Richland Operations (RL), Hanford Nuclear Reservation. The following individuals are appointed to the Board in the indicated capacity

1. Chairperson: Keith Benguiat, Division Director, Engineering Safety and Standards Division, RL

2. Trained Accident Investigator: Rob Hastings, Operations Oversight Division, RL

3. Board Members:

   - Craig Richins, Science and Technology Operations Division, RL
   - Roger Pierstorff, Facility Transition Division, RL
   - Craig Christensen, Engineering Safety and Standards Division, RL

4. Initial Advisors:

   - Denny Newland, Environmental, Safety, Health and Quality, DynCorp
   - Rex Jordan, Site Services, DynCorp

5. Administrative Support: Emily Lewis, Analysis and Evaluation Division, RL

The Board will be assisted by additional advisors and consultants and other personnel as determined by the Chairperson. I anticipate additional advisors from external groups, such as other DOE Sites, the Hanford Advisory Board, U.S. Fish and Wildlife, or other agencies.

Keith Benguiat -2- JUN 3 0 2000
00-A&E-107

The investigation will specifically address the DOE and contractors' response to the Hanford fire. The scope will include the DOE and contractors' emergency response process and the application of lessons learned from previous fires at Hanford. Specific emphasis should be placed on developing any further lessons learned that can be applied to improving the DOE response to fire incident, not just at Richland but that might also be applicable to other DOE sites.

The Board shall provide my office with periodic reports on the status of the investigation, however will not include any conclusions until an analysis of the causal factors have been completed. Draft copies of the factual portion of the investigation will be reviewed by the Board members for factual accuracy prior to report finalization. At the request of the Deputy Secretary, I will be briefing the DOE Field Management Council July 11th on some of our initial lessons learned from this incident. I would accordingly appreciate an initial status report on facts gathered (i.e., event chronology) by July 7th.

Four copies of the draft report should be provided to me by July 25, 2000, for review prior to its preparation in final form. Any delay to this date shall be justified and forwarded to this office. Discussions of the investigation and copies of the draft report will be controlled until I authorize release of the final report.

By copy of this memorandum, I am advising the supervisors of each of the Board members that this assignment is full time until the investigation and report are complete. The advisors to the Board shall assist the Board in the investigation on a priority basis and provide input to the Chairperson's requested

Keith A. Klein
Manager

cc: R. T. French, ORP
R. D. Hanson, FHI
D. B. Van Leuven, FHI
C. Laggon, DOE/HQ

Branch, Stanley O

From: Benquist, Keith A
Sent: Thursday, July 20, 2000 4:21 PM
To: Klein, Keith A; Rooks, Harry L; Johnson, Sandra L; [illegible], Gerald M (Gerry); Spracklen, James L Jr
Cc: Benquist, Brenda M; Tolkop-Hames, Judy L; Richins, Craig R; Branch, Stanley O; Christensen, Craig G; Good, Donald F; Griffin, Gerald B (Gerry); Heyland, Dennis J; Prossentin, Roger A; Allen, Nolan J; Hastings, Robert G (Rob); George, Jack B; Swearingen, Gary L; Rotz, Francis G; Carre, Andrea J; Hair, Perry D; Hay, Dorothy L
Subject: June 2000 Hanford Fire Type B Investigation

Keith

As part of our investigation we have invited Dennis Vernon the HQ POC for Accident Investigation (DOE-O-225.1A) he was here July 18-20th. In review of the order we have concluded that the use of Craig Christensen as a board member could pose a conflict of interest as he directly reports to me as DD for ESD. In addition utilization of Jack George to replace Rob Hastings poses the same issues.

I therefore recommend with your concurrance we re assigned them as SME's and select Stanly O. Branch who is participating as an advisor to replace Craig Christensen. Rob Hastings has recovered from his surgery and is planning on returning to the team the week of July 24th. This will provide us with an independent team to report on this event.

During this week we have made significant progress to finalize the event timeline and completed our interviews for the Health and Safety portion of the event.

This week also we have had SME/Advisors from EP and FWS working with us to input into the "facts" and sequence of events.

I have contacted Pam Ensly USFWS at their request for RL support of a National Interagency Review that will be performed here in Richland July 25-28th. I briefed Harry Boston and Jim Spracklin on the request, they concurred I should be the POC for RL.

I provided input to Kris Morris HQ EM to prepare EM1 Huntoon for her July 19th DNFSB monthly meeting.

I provided DOE SRS Garry Yaffe with the timeline and lessons learned items forwarded to you as part of my July 14 memorandum ESD:KAB/00-ESD-095.

We have included a FH firefighter as an advisor to the team.

We are progressing well and will complete typing the the "briefing paper" on July 25th four copies will be provided to you.

Appendix B

Summarized Event Chronology

The event chronology for the 24 Command Wildland Fire on the Hanford Site displays cause and effect relationships of events and actions derived from various logs and records.

Event	Time/Date	Response Actions
	June 27, 2000	
Motor vehicle accident occurs on SR 24 (Milepost 36)	**1:20 p.m.**/27	
Hanford Fire Department (HFD) is notified	**1:25 p.m.**/27	• HFD dispatches standard response for vehicle fire • HFD captain requests additional firefighting equipment while en route to scene
Hanford Patrol reports wildland fire both sides of SR 24, 5 acres and spreading	1:39 p.m./27	• Hanford Patrol on scene (east side) • HFD Medic Unit 92 arrives on scene
	1:44 p.m./27	• **HFD captain arrives on scene, establishes Incident Command**
HFD reports 5- to 10-acre fire, spreading 6-8 mph, requests closure of SR 24		• HFD deploys fire response to north and south of SR 24 (Note: two fire fronts)
	1:52 p.m./27	• HFD battalion chief arrives on scene, assumes IC
Estimated fire size: 50 acres	**2:00 p.m.**/27	• HFD Incident Commander (IC) requests helicopter air support for fire suppression from U.S. Army Yakima Training Center
	2:05 p.m./27	• HFD uses private 5,000-gal. water tanker at nearby vineyard
Private citizen volunteers heavy equipment	2:10 p.m./27	• HFD paramedic declines citizen's offer because of safety/liability concerns
Estimated fire size: 200+ acres	**2:30 p.m.**/27	
Firefighters south of SR 24 outrun by fire due to terrain	2:35 p.m./27	• HFD fire chief arrives on scene, **establishes Incident Command Post (ICP) at Yakima Barricade (Note: all HFD resources dispatched)**
HFD IC requests air tanker air support for fire suppression through Central Washington Interagency Communication Center (CWICC)	2:40 p.m./27	• U.S. Fish and Wildlife Service (FWS) arrives on scene
Estimated fire size: 500 acres	**3:00 p.m.**/27	
HFD IC requests Type 3 Incident Management Team (IMT)		• HFD IC requests additional Type 3 resources

Event	Time/Date	Response Actions
	June 27, 2000	
	4:00 p.m./27	• Two air tankers begin fire retardant drops
	4:41 p.m./27	• HFD IC requests temporary flight restriction from FAA Seattle
	5:00 p.m./27	• **Mutual Aid District resources from Tri-Cities begin arriving at staging area and are deployed to firelines**
CWICC helicopter to site	**6:00 p.m.**/27	• HFD personnel survey fire impact area and reassess (JON-2.b)
	7:30 p.m./27	• HFD IC provides telephone briefings to incoming Type 3 IC on current status and resource requirements (IMT)
HFD Incident Command transferred to Type 3 IMT	**11:36 p.m.**/27	• HFD IC continues to support the ICP • **HFD resources continue deployment on ALE Reserve and private impacted lands**
Hanford response transitions from an incident command and control role to a responder role within the incident command structure.		
	June 28, 2000	
Washington State Patrol reopens SR 24	**1:00 a.m.**/28	• **Accident scene released**
Weather conditions deteriorate	6:00 a.m./28	• National Weather Service issues Red Flag warning (JON-2.b)
Estimated fire size: 23,630 acres		• **Type 3 IC requests Type 2 response resources (8 hand crews, 4 Type 1 hand crews, 5 air tankers, 2 Type 2 helicopters)**
Hanford employees report smoke-related complaints	7:00 a.m./28	
	8:35 a.m./28	• **Hanford Emergency Duty Officer requests initial staffing of Hanford Emergency Operations Center (EOC) (Event Coordination Team [ECT] to monitor response)**

Event	Time/Date	Response Actions
	June 28, 2000	
	9:43 a.m./28	• **Abnormal Event notification made to offsite organizations** (Note: Not an emergency classification) (JON-2.b)
	9:55 a.m./28	• 200 West Area notified via crash phone (early release of nonessential personnel)
	10:19 a.m./28	• Industrial hygienists sample air quality in 200 East Area, find results below limits for early release
	10:50 a.m./28	• Air support for fire suppression resumes
	11:00 a.m./28	• **RL Manager goes to Incident Command Post for briefing**
U.S. Secretary of Energy notified of fire		
Fireline breached in Snively Canyon	11:11 a.m./28	
Fire threatens Pacific Northwest National Laboratory facilities on ALE Reserve		• ICP requests technical information on radiation hazards in PNNL facilities on ALE Reserve
Radiation status of PNNL structure provided to EOC		
Type 2 IC briefing	12:00 p.m./28	• Status: 276 people, 19 engines, 2 bulldozers, 7 hand crews, 1 medical unit – 30% of requested level
Fire threatens central Hanford Site		• HFD requests reallocation and deployment to respond to tactical needs for central Hanford Site
Estimated fire size: 31, 190 acres	**12:00 p.m.**/28	
SR 24 fire threat	1:06 p.m./28	• ICP requests SR 24 closure to allow egress for response resources
Fire jumps SR 24 south to north	**1:10 p.m.**/28	
Wind speed from west increases significantly	**2:07 p.m.**/28	
Fire progresses toward Horn Rapids Road	2:24 p.m./28	• SR 240 closed from SR 225 to SR 24

Event	Time/Date	Response Actions
	June 28, 2000 **3:00 p.m.**/28	• Response units pull back to defensible positions • **HFD assets redeployed fully to Hanford Site**
Los Alamos Lessons Learned	3:37 p.m./28	• DOE-HQ Defense Programs requested Aerial Measuring System (AMS) from DOE Nevada Operations Office • Hanford EOC requests AMS support from Nevada Operations Office
Fire jumps SR 240 toward 200 West Area	**3:47 p.m.**/28	• RL Manager requests EPA air monitor (JON 3)
	3:54 p.m./28	• Hanford Patrol Operations Center requests evacuation of 222-S labs
RL declares Alert level emergency	**4:28 p.m.**/28	
	4:35 p.m./28	• **"Take Cover" alarm activated in 200 Area (based on smoke)**
Classification of the event as an "Alert" activates the Hanford Emergency Operations Center. This classification implements certain emergency responses, protective actions, and authorities under the jurisdiction of the RL Manager at the EOC. (JON-2.B)		
	4:59 p.m./28	• U.S. Forest Service dispatcher requests FAA to relocate temporary flight restriction over Hanford Site
	5:00 p.m./28	• **Hanford field monitoring teams are dispatched**
Type 2 IMT assumes command of fire	**6:00 p.m.**/28	
HFD requests outside assistance	5:56-6:00 p.m./28	• Type 2 IMT denies HFD request
Type 2 response structure resources available outside the Tri-City Mutual Aid District (state-wide)		
Road grader abandoned at Rattlesnake Barricade	6:00 p.m./28	• Rapid fire approach, damage to road grader, no personnel injuries
Estimated fire size: 88, 640 acres		• **Assessment determines that fire progressed at rate of 9,600 acres/hour over immediately preceding 6 hours**

Event	Time/Date	Response Actions
Event status	June 28, 2000 **6:00-12:00 a.m./28**	• Active firefighting over most of the Hanford Site **(actions to protect 200 East and West Areas, Waste Receiving and Processing, Central Waste Complex, 222-S Laboratory, Environmental Restoration Disposal Facility, U.S. Ecology, BC Controlled Area, Fast Flux Test Facility, LIGO, Hanford Patrol Training Academy, and HAMMER)**
At this time in the emergency, the fire response covers multiple fire lines not only on the Hanford Site but over a 20-mile area.		
Benton County declares state of emergency	**6:00 p.m./28**	
Fire threatens Laser Interferometer Gravitational-Wave Observatory (LIGO)	7:14 p.m./28	• LIGO (including facility personnel and visiting Boy Scout Troop) evacuated (JON-2.k)
Smoke and fire threaten 222-S Lab	7:52 p.m./28	• 222-S Lab evacuates nonessential personnel
Fire progresses over ridge at Gate 106 Rattlesnake Mountain	**8:00 p.m./28**	• Hanford Patrol officer forced to evacuate to west through Benton City (JON-2.k)
Fire jumps SR 225 near Wanawish Dam at Horn Rapids on Yakima River	**8:08 p.m./28**	
Public onlookers and crowd at HAMMER	8:36 p.m./28	• Hanford Patrol requests Richland Police Department assistance with roadblock at SR 240 and Stevens Drive
Hanford Patrol needs to handle HAMMER crowd	8:36 p.m./28	• Richland police assist Hanford Patrol at SR 240
Type 2 IMT requests RL representative at Type 2 ICP	**8:42 p.m./28**	• **RL Manager assigns individual with authority**
Fire enters Benton City area	**9:00 p.m./28**	
Estimated fire size: 140,800 acres	**10:00 p.m./28**	
ICP moved from Cold Creek Vineyard to City of Richland Shops	**10:20 p.m./28**	

Event	Time/Date	Response Actions
	June 28, 2000	
Incident Command Post was moved to be closer to event response, as fire at this time is 25 miles from the vineyard location		
Multi-Agency Coordination Team established to support Type 2 IMT (JON 1)	10:20 p.m./28	
	10:43 p.m./28	• **Hanford EOC issues public announcement of work cancellation at 100, 200, 300, 400 Areas, HAMMER, and Hanford Patrol Training Academy**
Private party reported to be monitoring for radiation contamination of firefighters	11:30 p.m.-12:00 a.m./28	• (JON-2.k)
	June 29, 2000	
Hanford EOC experiences power outage for 35 minutes	12:19 a.m./29	
Unified Command Post moved to Trade, Recreational, and Agricultural Center (TRAC) in Pasco	**12:23 a.m.**/29	
Governor of Washington State declares state of emergency	**1:45 a.m.**/29	
	2:14 a.m./29	• SR 240 confirmed open
	3:40 a.m./29	• Offsite resources allowed entry
Energy Northwest requests Site entry at 5:30 a.m. for 100 persons	4:13 a.m./29	
	5:00 a.m./29	• Energy Northwest accepts restricted entry, only essential personnel
Nonradiological landfill burned over	5:59 a.m./29	• Bechtel Hanford, Inc. implements RCRA contingency plan
	10:40 a.m./29	• **Aerial Measuring System flyover begins**
	10:45 a.m./29	• BC Crib wet down
	11:00 a.m./29	• Recovery team assembles to plan Site access restoration in parallel with the event response

Event	Time/Date	Response Actions
	June 29, 2000	
Fire spreads across **portion** of BC Controlled Area	12:00 p.m./29	
	12:30 p.m./29	• Air tanker drops fire retardant on BC Controlled Area
Interagency conference call	1:00 p.m./29	• White House, Forest Service, Weather Service, EPA
	June 30, 2000	
Radiological survey team deployed to facilities with radioactive material on ALE Reserve	4:45 a.m./30	
	5:53 a.m./30	• Radiological survey team reports finding building intact with no evidence of burn; semi-trailer destroyed by fire
	11:00 a.m./30	• **Recovery team established**
Radiological samples collected	**3:06 p.m.**/30	• 139 samples (52 air, 23 large area smears, 2 soil samples, 12 vegetation)
Hanford EOC terminates Alert emergency	**4:57 p.m.**/30	• EOC staffing reduced to event coordination team (ECT). The ECT provides support to the HFD during final response phase of the event.
	5:00 p.m./30	• EPA starts high-volume (24-hour) sampling (see JON- 3)
	July 1, 2000	
Fire officially contained and declared out	**4:00 p.m.**/1	

Appendix C

Fire Barrier Analysis

Fire Barrier Analysis

State Route 24 as a Barrier Against Fire

Barrier

Prevention- precut fire breaker and/or burn tumbleweed and vegetation along state right-of-way shoulder between SR 24 and the DOE fenceline.

Discussion

Precut firebreaks, "green belting" and/or burning off vegetation along right of way may have separated vehicular accident fire from spreading to ALE Reserve and DOE property.

Evaluation Failed/ Success

Failed-The barrier was last completely burned off in 1995 by a controlled burn.

Analysis

While this barrier (shoulder right-of-way vegetation burn off) was last time in place in 1995, it was not maintained along the entire lengths of SR 24, and vegetation reseeded enough to yield readily available fuel, allowing the fire to spread from the vehicular highway fire to vegetation on-site. Maintenance of this barrier may have prevented the fire that started on the highway from igniting the natural vegetation on the ALE Reserve.

Impacts

Firebreaks were cut each year as a lesson learned from the 1984 Hanford Range Fire. The disking firebreak practice was discontinued due to allegations of fugitive dust problems made by the Benton County Clean Air Authority (BCCAA) created from the disking. In 1995, after reading the fugitive dust complaint, the RL Environmental Office (concurred by the RL Office of Chief Counsel) sent a letter to the BCCAA stating that the disking of firebreaks would be discontinued. Preburning of vagrant tumbleweeds was conducted along right of ways along SR 24 and SR 240 following the discontinuance of disking firebreaks. However, due to changes in Washington State Clean Air Act legislation passed in late 1995, additional restrictions were placed on open burning, and the practice of burning the entire lengths along SR 24 and SR 240 was discontinued. Permits obtained from the BCCAA by the Washington State Department of Transportation for burning the vegetation along the state-controlled right of ways was limited to small acreage sizes, and only tumbleweeds were allowed to be burned These pre-readied widened firebreaks made by burning areas along SR 24 and SR 240 were completely burned off for the last time in 1995. The pre-readied firebreaks were not maintained, and vegetation reseeded enough to permit the fire ready available fuel to spread from the vehicular highway fire to vegetation on the Site. When the accident occurred along SR 24, readily available natural vegetation along the highway shoulders quickly caught fire, which spread onto the Site.

Fire Barrier Analysis

State Route 24 as a Barrier Against Fire (contd)

Barrier

Suppression

Discussion

Manual fire suppression along major road ways via fire department rolling stock and firefighters supplemented by aerial vehicular fire retardant drops.

Evaluation Failed/Success

Successful in many locations and unsuccessful in other locations where access and direct attack were impossible and the wind coupled, with the dry vegetation, accounted for the tremendous intensity and speed with which the fire traveled.

Analysis

Manual fire suppression of wildland fuel was accomplished primarily off-road via pumper/tankers and fire department grass rigs at fire fronts and flanks. This was supplemented by aerial fire retardant drops to slow the fire plume progression until ground fire department forces implemented manual suppression. Direct manual fire attack is generally considered safe only when flame heights are less than 8 feet. Firefighting orders were to fight the fire aggressively but safely.

Impacts

Ground fire department forces were effective where apparatus could access fire and direct manual firefighting efforts were possible. However, fire size, intensity, and speed of fire travel often made fire suppression impracticable or unsafe for firefighters, and manual wildland fire suppression by ground firefighters could not be implemented. In addition, suppression along SR 24 and other locations could not be made due to inaccessibility problems around ravines and canyons where apparatus cannot travel. After the fire initiated and grew south of SR 24, fire department apparatus could not easily access and deploy fire suppression resources due to terrain difficulties, and they had to go around to get at fire. This may have been a factor in how the fire grew to it size. Aerial fire suppression was effectively used to slow fire progression.

Fire Barrier Analysis

State Route 240 as a Barrier Against Fire

Barrier

Prevention- precut firebreaks and/or burn tumbleweed and vegetation along state right-of-way shoulder between SR 240 and the DOE fenceline.

Discussion

Precut firebreaks, "green belting" and/or burning off vegetation along right of way may have separated fire from spreading to DOE property.

Evaluation Failed/Success

Failed-The barrier was last maintained in 1995 by a controlled burn. Additional firebreaks were cut along portions of SR 240 during fire event, but the fire jumped the breaks.

Analysis

While this barrier (shoulder right-of-way vegetation burn off) was last time in place in 1995, it was not maintained. Vegetation reseeded enough to permit the fire ready available fuel to spread from the vehicular highway fire to vegetation on the Site. Because the fire started along SR 24 and the fire was massive in size, intensity, and speed by the time it reached SR 240, maintenance of the SR 240 barrier most likely may not have prevented the fire from crossing over SR 240.

Impacts

See Impacts for SR 24 barrier. Because the fire started along SR 24 and the fire was massive in size, intensity, and speed by the time it reached SR 240, maintenance of this barrier may not have prevented the fire from crossing over SR 240. However, if the accident had occurred along SR 240 and the barrier were maintained, a large range fire would be expected to be prevented. Firebreaks are most effective when wind conditions are less than 20 mph. The 24 Command fire exhibited what wildland firefighting professionals call "plume-dominated" behavior. This occurs when the fire creates its own wind, coupled with atmospheric wind conditions and the abundance of dry vegetation to burn. As flames reach over 10 feet high, vegetation debris and burn particles are lofted up and away from the flame front to as much as a half-mile ahead of the fire front, igniting a newer fire front. Precut firebreaks along SR 240 would not necessarily stop a plume-dominated fire in a high-wind condition.

Fire Barrier Analysis

State Route 240 as a Barrier Against Fire

Barrier

Suppression

Discussion

Manual fire suppression alone major road ways via fire department rolling stock and firefighters supplemented by aerial vehicular fire retardant drops.

Evaluation Failed/Success

Not successful; in most locations, impossible. The wind, coupled with the dry vegetation, accounted for the tremendous speed and intensity with which the fire traveled.

Analysis

Manual fire suppression of wildland fuel was not successful in most locations along SR 240 due to wind speed coupled with extreme amounts of dry vegetation, low fuel moisture,and fire intensity along the highway. Flame lengths of 20 to 30 feet ignited fires as much as a mile ahead of the fire front. These conditions made it impossible and unsafe for firefighters to perform direct suppression attack along SR 240.

Impacts

Fire size, intensity, and speed of fire travel made direct-attack fire suppression along SR 240 unsafe for firefighters, so manual wildland fire suppression by direct attack of ground firefighters could not be implemented. Aerial fire suppression was not fully effectively to stop fire progression across SR 240 due to high wind speeds, which carried buoyant burning particles across the highway. (Note: In other locations near HAMMER, LIGO, and Route 4, aerial fire suppression was effectively used to slow fire progression). The fire spotted out across SR 240 onto the Site at approximately 3:30 p.m.

Fire Barrier Analysis

Hanford Structures as a Barrier Against Fire

Barrier

Prevention- most all Hanford facilities and critical storage areas maintain defensible clearances around the facility. Facilities also have Underwriters Laboratories Class A roof decks and are built of either noncombustible exteriors or fire-resistive materials.

Discussion

To prevent wildland fires from exposing structures to fire, it is important to maintain defensible spaces around Hanford structures. Defensible clearances include mowed green grass areas, concrete walkways, asphalt areas, and graveled areas around facilities. The spaces are clear of natural vegetation, planted vegetation and trees, and other combustible materials and debris. In addition, to prevent air-lofted burning particles from igniting structural roofing components, RL still requires that all roofing be constructed with the following: Underwriters Laboratories Class A roofing and FM Class I roofing. System. (DOE 6430.1A, Section 0722).

Evaluation Failed/Success

Success

Analysis

Maintaining defensible firebreaks around facilities and critical storage areas including removal of debris and natural vegetation, providing green grass areas, concrete walkways, asphalt areas, and graveled areas around facilities and storage areas prevents fire continuity and travel to the facility structure and storage areas. Maintaining UL Class A roofing on a facility provides the most effective roofing system to resist exposure to air-lofted burning particles resulting from a wildland fire.

Impacts

The maintenance of defensible firebreaks around facilities and storage areas and having roofing systems for facilities that meet UL Class A and FM Class I roofing requirements provide the highest degree of protection against wildland fire.

Fire Barrier Analysis

Hanford Structures as a Barrier Against Fire

Barrier

Suppression- most all major DOE structures at Hanford are protected with automatic fire suppression systems.

Discussion

Fire suppression systems are installed inside all major Hanford facilities to provide fire control and suppression in the event of fire.

Evaluation Failed/Success

Not applicable. No fire suppression system was activated during the wildland fire.

Analysis

Fixed automatic fire suppression systems are intended to minimize the effects of fire starting inside facilities. They are not intended to minimize the effects of a wildland fire. The most effective method to protect against wildland fires is to maintain defensible barriers around facilities and storage areas.

Impacts

Automatic fire suppression systems are not intended to minimize the effects of a wildland fire. The most effective method to protect against wildland fires is to maintain defensible barriers around facilities and storage areas.

Fire Barrier Analysis

Change Analysis

Condition #1

SR 240 SR 24 [Failed]

Condition #2

Structure Barrier [Success]

Difference

The SR 240 and SR 24 barriers failed because they were not maintained to provide adequate separation from natural fuel fire propagation necessary for fire continuity. In addition, once the fire grew large in size and winds created dominant fire plumes, burning particles air-lofted from one side of SR 240 jumped to the natural vegetation on the other side of SR 240, extending the fire. Structure barriers were successful for two reasons. First, defensible firebreaks around facilities, including removal of debris and natural vegetation, providing mowed green grass areas, concrete walkways, asphalt areas, and graveled areas around facilities, prevented fire continuity and travel against the facility structure. Second, maintaining UL Class A roofing provided the most effective roofing system to resist exposure to air-lofted burning particles resulting from a wildland fire and ignition of the structure roof.

Analysis

Many factors may contribute to the spread of wildfire, including fuel arrangement, moisture content, wind, and amount of vegetation. The most significant factor in having a successful firebreak along the highways is the ability to contain and prevent products of combustion on one side of the barrier from igniting fuel on the other . High wind speed and fuel type often can result in a failed firebreak barrier along the highways. However, in the case of the 24 Command Wildland Fire, the firebreaks along the state right-of-way shoulder between SR 24 and the DOE fenceline were not maintained for reasons as discussed in the SR 24 and 240 barrier table impact column. On the other hand, the defensible barriers around the facilities and critical storage areas were maintained. That maintenance, coupled with the fire-resistant facility roofing material and system, protected Hanford Site facilities from the effects of the fire.

Impact

Maintenance of barriers along state routes and around facility structures and critical storage areas is paramount to minimize the consequences of a wildland fire.

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