Brookhaven National Laboratory

BNL Wildland Fire Assessment

Wildland Fire Hazard Severity Analysis, Issues & Needs

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Prepared by

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I. Executive Summary

BNL's operations are vulnerable to damage from fires in wildland[1] areas. Using a nationally recognized model, the severity of BNL wildland fire[2] hazard is "moderate." Adequate precautions are in place to minimize facility involvement in most major locations. Several physical improvements are needed in the wildlands interface zones to avoid loss of site power for several months with property damage approaching $1 million. Additionally, the management system defining and maintaining the fire breaks/defensible spaces[3] around BNL should be formalized to document the protective systems currently in place. The topic of prescribed burns to reduce fuel-loading also needs to be explored. A Fire Management Plan, possibly integrated into the BNL Natural Resource Management Plan, should be used to formalize these issues.

Wildland fires have an excellent transport capability. With the intense heat and destruction of materials in the fire's path, the fire plumes can transport particulate from burning radiological materials. The radiological material must be capable of dispersion. Soil contamination is not automatically a release pathway. Due to the lack of properly quantified radiological uptake into vegetation in the BNL wildland, this topic could not be fully explored. The Environmental Restoration Division has characterized several likely sites of soil contamination. How much of the radiological material has been taken up by the vegetation has not been defined clearly. All indications are that up take is very low. As these particles, suspended in the smoke column, move there is a high degree of dilution. Often quantities can only be calculated and not measured. Increased sampling of vegetation is needed to provide a site wide profile and affirm the low level of possible release.

[1] As defined by the National Fire Protection Association, wildlands are "land in an uncultivated, more or less natural state and covered by timber, woodland, brush, and/or grass."
[2] As defined by the National Fire Protection Association, wildland fires or wildfires are "any uncontrolled fire bringing in wildlands vegetation including any structure or other improvements thereon."
[3] Defensible spaces are regions between wildlands and structures minimize the direct impact by a wildland fire on the structure and allow fire department suppression.

II. Action Item Table

Action Item	Target Date	Responsible Party
Action Item #1: ATS 361.2.1 To allow access to the Northeast region of the BNL Pine Barren area, the access road running north to south between the right of way of the east power line and North Street should be made passable.	5/1/01	Tom Roza, EP
Action Item #2: ATS 361.2.2 Identify required firebreaks access roads, paths, and ways to provide consistent nomenclature for normal operations (PE, ERD, Fire/Rescue), outside fire department operations, and operations of the new nature preserve. Identification of fire breaks should be incorporated into BNL Site maps.	5/01/01	Joe Levesque, EM
Action Item #3: ATS 361.2.3 Establish a policy to provide identification of Firebreaks and Access Roads with street signs meeting NFPA 299.	5/01/01	Frank Marotta, EM
Action Item #4: ATS 361.2.4 Submit a funding request to restore the second means of egress for the Summer Cottage Area (Mendel and Aston Lanes).	5/01/01	Joe Levesque
Action Item # 5: ATS 361.2.5 Evaluate the need for an eastern emergency exit from the BNL site. The most viable solution maybe to pave Brookhaven Avenue from Bldg. 445 to the Southeast exit to North Street.	7/01/01	Ken Krasner, EM
Action Item #6: **ATS 361.2.6** BNL sponsored camping and softball activities have potential ignition sources for a wildland fire. Safeguards should be developed and implemented for camping, campfires, and disposal of hot ashes and Bar-B-Q grill placement. The camping area should be posted with safety rules and emergency contact information.	7/01/01	Peter Esposito, HRS
Action Item #7: ATS 361.2.7 While developing a wildland fire management plan, incorporate the community surrounding BNL with the various elements. Existing methods can be used with the addition of local fire departments and response units.	7/01/01	Joe Levesque, EM
Action Item #8: ATS 361.2.8 Request funding to establish a routine program for sampling vegetation for radiological uptake should be investigate ensure areas of significant radiological content have not been overlooked.	4/20/01	Tim Green, ES

III. Introduction

Purpose and scope:

1) Identify BNL operations threatened by wildland fires.

2) Determine potential severity of a wildland fire at BNL.

3) Identify safeguards and management systems to mitigate the risk.

4) Identify deficiencies and suggest improvements.

The assessment methodologies used in this report are as follows:

1) Identify operations along the wildland fire interface.

2) Group the facilities into similar units for the analysis.

3) Evaluate the hazards for each group area using a wildland fire model,

4) Evaluate the protective features when weighted against the hazards

5) Develop “needs” for future actions.

Background for the Wildland Fire Concerns

Large and destructive wildland fires have occurred nationwide over the past years. In calendar year 2000, wildland fires at three facilities directly threatened DOE operations. Los Alamos was shutdown for 13 days, burned 7,500 acres of land, and destroyed 45 structures. Hanford had portions of the site evacuated for 3 days and burned 40% of the land (over 400,000 acres). The potentials for large-scale damage from wildland fire threats were clearly demonstrated by these incidents. Despite the potential for devastation, these fires at DOE facilities have shown that proper proactive wildland management techniques can minimize fire impact.

BNL occupies 5,265 acres, of which only 1,650 acres are developed (see Appendix A for a site map). There is a real threat for a devastating fire either originating on BNL property or traveling onto BNL property from the adjacent forested areas. BNL’s 3,000 acres of Pine Barrens Region is an integral part of the 100,000 acres of Central Pine Barrens Region on Long Island. Historically BNL has experienced approximately one significant brush fire every five years (significant is defined as a fire large enough to activate BNL mutual aid plan with local fire departments). In CY 2000 BNL experienced four wildland fires requiring response from offsite agencies. The forest areas of BNL are mature with high fuel loading per acre. With high fuel loads, fires are hotter, spread further, and are less likely to be controlled. A wildland fire is a direct threat to structures along the interface between wildland and urban developments. BNL has many significant facilities along the wildland interface zone, not the least being RHIC, AGS, the housing area, Child Developmental Center, the former Hazardous Waste Management Facility, Site Power Lines, and the Sewage Treatment Plant.

Not only can fires endanger on-site programs, but also the reverse can happen. An on-site fire can sweep to the north and east destroying property of our neighbors. Such an event would cause long term damage to the relations with local communities. The DOE site at Hanford is still encountering public ire several months after their wildland fire. Likewise, fires originating off-site are a concern as they can sweep into BNL with the same devastating results.

IV. Elements Effecting Wildland Fire Severity

The following sections review and define the elements that effect the severity of a potential wildland fire on BNL property.

Fuels

Brookhaven National Laboratory (BNL) is a 5,265-acre site centrally located on New York's Long Island. The Lab is located approximately 60 miles east of New York City and 60 miles west of Montauk Point. Approximately 500 acres of the site are developed, leaving approximately 4,700 acres of wooded wildland.

William Floyd Parkway borders BNL to the west. The parkway is a four lane highway with a center median. To the south of BNL is the six-lane Long Island Expressway with a two lane service road. Both are substantial firebreaks. The remaining perimeter of BNL's wildlands is continuous with the surrounding forested areas. A fire originating onsite can spread offsite into the nearby homes and communities. Likewise, a fire offsite can travel onsite and threaten onsite operations.

The wildland terrain is primarily forested with a variety of conifers and hardwood species. The forested wildlands are mature and heavily populated. A thick ground cover of organic material (litter) is present from years of undisturbed growth. Also present is normal occurrence of "down and dead" timber. The thick layer of litter and down and dead timber increases the severity of the possible fire by providing a "ladder of combustibles" from the floor to the canopy layer of trees. While the forested areas are not populated, the area is frequently used for recreational activities such as hiking, horseback riding, bicycle riding, and hunting.

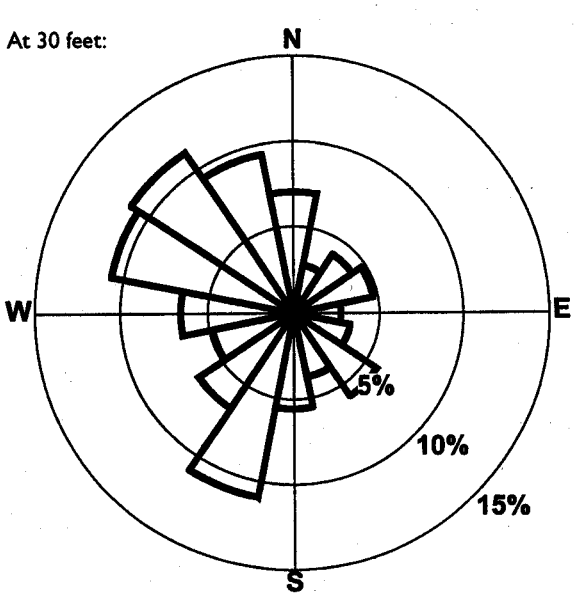
Weather

Long Island weather affords a good growing season. Normally, moisture content of the vegetation remains high, thereby keeping the fire severity index "moderate" to "high." Approximately once every ten years the growing season is exceedingly dry and escalates the fire hazards into the "extreme" range (highest rating by NFPA 299). Under the extreme conditions, the vegetation is easily ignited and will propagate flame rapidly. The wildland fire season is a threat on Long Island from May to November.

Wind

During the Wildland fire season, the wind speeds are “low” to “moderate.” Long Island does not face 40 mph to 50-mph winds with any regularity, except during stormy weather (not concurrent with wildland fire concerns). During a typical summer day, winds start from the north in the morning and shift to the south by mid day. This shore effect phenomenon is due to the large bodies of water to Long Island north and south. Nominal wind direction is to the northwest (25% of the time) and south by southwest (20% of the time). The wind direction and intensity affects which facilities are more likely to be exposed to a fire and the intensity of the fire.

The following is a wind rose from the 1999 Site Environmental report showing BNL wind patterns.



Explanation: The arrows formed by the wedges indicate wind direction. Each concentric circle represents a 5% frequency. The wind direction was measured at heights of 30 feet and 300 feet. For example, this diagram indicates that the predominant wind direction at 30 feet in 1999 was from the northwest.

Topography

BNL property and the adjacent wildland are relatively flat. Slopes less than 10% are the rule. The wildland elevations range from 50 ft. above mean sea level to 80 ft. above mean sea level. Low slopes decrease the severity of a possible fire. Localized hills and ridges do exist. They are examined as part of the “defensible space” evaluations, rather than a global risk factor.

Risk Evaluation System and Methodology

This report uses the National Fire Protection Association's (NFPA) "Standard for Protection of Life and Property from Wildfire," NFPA 299 1997 Edition to evaluate BNL's Wildland Fire Risk. The NFPA Standard is one of the nationally recognized methods of performing an assessment of the wildland fire hazard to a community. NFPA 299 is part of the National Fire Codes, which are contractually required documents in the operating contract between Brookhaven Science Associates (operators of BNL for DOE) and DOE.

The NFPA 299 scope as follows:

> "This standard presents the minimum planning, construction, maintenance, education and management elements for the protection of life and property from wildfire."

As previously alluded to, the methodology used to evaluate this risk is to:

1. Define the areas on-site that are Wildland/Facility interfaces. Woods border much of the site. For the purpose of this analysis at BNL, a facility is considered within the Wildland Interface if the structure or operation outside of the structure is within 100 ft. wildlands. Lawns and unpaved roads are not counted as part of the wildland areas.

2. Group facilities into logical "Wildland Facility Interface Zones." This was a subjective grouping of facilities based on location and similarity of use, construction and wildland exposures. Facilities included other structures besides buildings, such as utilities.

3. Determine the severity of the wildland fire hazard for each logical "Wildland Facility Interface Zones" using the risk model within NFPA299. NFPA 299 worksheets were filled out for each defined zone. In the work sheets, several items have to be interpreted for application at BNL. "Average Lot Size" was interpreted to mean the density of structures in the area. Street signs that were plastic instead of reflectorized were given partial credit.

4. Evaluate the adequacy of protective measures and management systems. NFPA 299 itemizes several support systems used to mitigate wildland fire hazards. These systems were expanded on from NFPA 299. They are defined and evaluated in the latter part of the report.

5. Develop needs for future actions. Throughout this report, issues and needed improvements were identified. Items resulting in "action items" are being entered into the BNL Directorate Level Action Tracking System (ATS) to ensure completion. A list of the action items has been extracted from the analysis section and provided in Section II of this report.

V. Defining the Wildland/Facility Interface Zones

In order to perform the wildland fire severity analysis, various areas on-site were grouped based on similar construction, facility function, and wildland characteristics. The following "Wildland Facility Interface Zones" were chosen.

Site Power Supply Lines – Two sets of overhead power lines provide electricity to BNL from the Long Island Power Authority's power grid. The supply lines are designated as Primary and Alternate feeders. The lines traverse two and one half miles of wildland on the east side of the site. They terminate at independent substations. Neither line is able to supply BNL with the full electrical load required to run all the larger experimental machines. The power lines are on wooden poles. Cables have electrically insulating plastic jackets. Shown to the left is the east end of the Sixth Ave power lines and East Fire Break at the Long Island Power Authority's Right of Way.

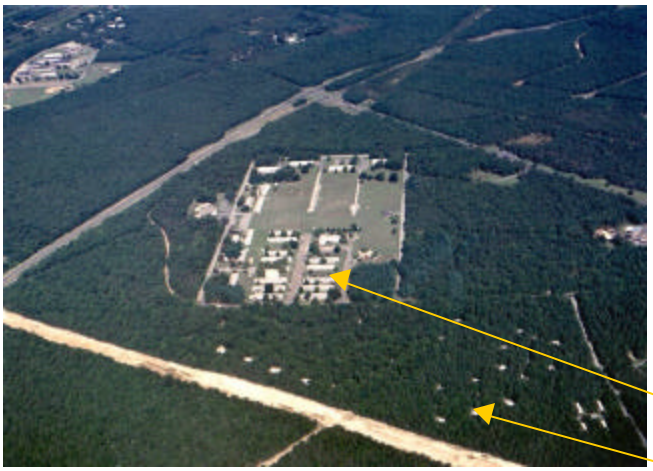
Example of overhead power supply line route

RHIC Complex – The Northern part of BNL is predominately occupied by accelerator facilities. Most predominate is the RHIC accelerator buildings. The tunnels, collision halls with detectors and support buildings are nested in the wildland of BNL's northern property. Typically, the buildings are constructed using non-combustible walls and roofs. The north edge of RHIC touches the Peconic River headwaters and is less than ¼ mile from private residences. The RHIC Ring (circular area) is shown during initial construction.

Former Hazardous Waste Management – A cluster of buildings located in the southwest portion of BNL, currently undergoing remediation and decommissioning. Formerly the facilities were used for the storage and disposition of radiological and hazardous waste. Legacy materials currently exists. The facilities are constructed of non-combustible materials. Detailed information is available at: http://www.oer.dir.bnl.gov/soils/ou1/ou1-rira.html

New Waste Management Facility – A 10 acre complex of building handling current inventories of hazardous waste and radiological materials. Facilities are constructed of non-combustible materials, provided with clear defensible areas.

AGS/LINAC Buildings – A complex of facilities at the north west section of BNL supporting the major accelerator. Construction is typically insulated metal skinned buildings with steel frames. Cable trays (with essential power, control and data cables) and cooling towers are the primary components vulnerable to fire damage.



Apartment/Cottage Area – A complex of single story wooden residences, used to house single and multiple families, including juveniles. The area includes 30 single-family cottages, deeply embedded in the woods. The facilities include daycare, laundry and playgrounds. Class A roofing materials are used.

General Perimeter of BNL Central Core Buildings[4] – General catchall list of buildings used to evaluate the majority of buildings on-site. Typically, these facilities have "fingers" of vegetation that extend near the facility. There are no major exposures from these isolated island of fuels and there are ample access roads. Wildland fires originating in these regions will not have the ability to develop into large area fires due to the restricted amount of vegetation. However, localized fires can cause localized damage to facilities.

[4] **These facilities are included for comparison. They are technically outside the interface region.**

Miscellaneous Small Monitoring and Well Houses – Typically located within the wildland region, these remote facilities are used to house environmental monitoring equipment. They are constructed of heavy non-combustible walls and non-combustible roofs. Value of the structure is minimal. Samples taken from these facilities are used in the BNL Environmental Monitoring Program.

VI. Analysis

The Wildland Fire Severity Index rating is based on vegetation hazards. Some wood species burn more intensely than others. The Wildland Severity Rating is assigned to a section of woods by matching descriptions of vegetation to one contained in the model from the NFPA 299. Being a typical Northeast Pine-Oak and Oak-Pine type forest, the highest rating on-site was "Moderate" (see Appendix B for worksheets).

Another element in the analysis is the Building Material Combustibility. Most building on-site have non-combustible roof (UL Class A) and non-combustible walls (insulated metal skin, concrete block). This general category is has the Building Material Combustibility rating of "low." The exceptions are:

- Apartments (wood frame, vinyl siding over asbestos shingles, UL Class A roof),
- Cottages (wood frame, wood exterior, UL Class A roof),
- Bldg. 51 (wood frame, vinyl siding over asbestos shingles, UL Class A roof),
- Bldg. 170 (wood frame, vinyl siding over asbestos shingles, UL Class A roof),
- Bldg. 244 (wood frame, asbestos shingles, UL Class A roof), and
- Bldg. 348 (wood frame, vinyl siding over asbestos shingles, UL Class A roof).

These exceptions have "high" Building Material Combustibility ratings.

The next factor is the terrain. As stated earlier the terrain is predominately level across the BNL site. The Slope Hazard Index is therefore "low" (0-20 percentage).

Based on a fire severity rating of “moderate”, the slope rating of “low”, the Building Material Combustibility index becomes the predominate element influencing the overall rating’s change from “moderate” to “high.”

The following table summaries the results of the NFPA 299 worksheets:

Wildland Fire Area	Points Assigned	Hazard Rating
Site Power Supply Lines	39	Low
RHIC Complex	38	Low
Former Hazardous Waste Management	49	Low
New Waste Management Facility	29	Low
AGS/LINAC Buildings	35	low
Apartment/Cottage Area	51	Moderate
General Perimeter of BNL Central Core Buildings[5]	23	Low
Miscellaneous Small Monitoring and Well Houses	51	Moderate

[5] **These facilities are included for comparison. They are technically outside the interface region.**

VII. Resulting Protective Criteria

The following protective actions represent minimum requirements and are contained in Table A-3-2(c) of NFPA 299 for "Defensible Space Clearing and Structural Summary ":

Low Hazard Rating	Moderate Hazard Rating	High Hazard Rating
30 ft (9.14 m) clearance	30 ft (9.4 m) irrigated	30 ft (9.4 m) irrigated
Class C roof	Class B roof	Class A roof
No portion of trees or other vegetation within 10 ft (3.05 m) of chimney outlets	Noncombustible siding/wood decks	100 ft (30.48 m) fuel treatment
Trees within defensible space shall be pruned to minimize ladder fuels	Selected fire- resistant trees within 30 ft (9.14 m) of structures	Noncombustible siding/decks and boxed eaves
	Trees within defensible space shall be pruned to minimize ladder fuels	Selected fire-resistant trees within 30 ft (9.14 m) of structures
	No portion of trees or other vegetation within 10 ft of chimney outlets	Selected thinning of trees and shrubs
		Trees within defensible space shall be pruned to minimize ladder fuels
		No portion of trees or other vegetation within 10 ft (3.05 m) of chimney outlets

A general tour of the site was conducted as part of this report. However, a detailed examination of the facilities was not preformed. This detailed analysis will be conducted as part of the commitment to incorporate wildland fire protection measures into FUA for facilities in the wildland interface zone (ATS 361.1.2).

VIII. Protective Features and Management Systems

The following section reviews the various Management Systems in place to provided protection and/or control of wildland fires.

Fire Response

BNL Fire/Rescue Group is a full time, paid Department. Normal staffing is eight firefighters and one officer per shift. Minimum staffing is six Fighters and one Fire Officer. The firefighters are trained in structural fire fighting and wildland fire fighting (Suffolk County's wildland fire fighting curriculum is used).

For the initial response to wildland fires, the following BNL equipment is available:

- One 6 wheel drive Brush Truck with a 500 gallon pump and 1,000 gallons of water for off road operations.
- Two 1500 gpm Class A Fire Engines with 500 gallons of water each, and over 1500 feet of hose each (2 ½", 3", and 5" hose).
- Four wheel drive Incident Command Vehicle
- D7 bulldozer for clearing firebreaks (Plant Engineering).

The following external assistance is available:

- BNL is a participating member of the Suffolk County Mutual Aid Agreement. For wildland fires, over one hundred departments and their equipment are available to assist BNL in controlling a fire. Over twenty-brush truck and additional supporting equipment can be summoned with 45 minutes
- Suffolk County Police, Air National Guard, Army Aviation, and US Coast Guard can provide a helicopter for aerial recognizance.
- Town of Brookhaven and Riverhead can provide bulldozers and repair mechanics.
- New York State Forest Rangers are available for extended fire fighting operations.

This is considered an adequate response. However, the DOE required "fire protection baseline needs assessment " should be updated to incorporate this wildland aspects. This commitment was already made to DOE under the "Wildland Fire Safety Enhancement Plan" (ATS 361.1.5).

Massive wildland fire pose special emergency planning issues. Preparedness for such events should be documents in procedures. In the BNL Wildland Fire Safety Enhancement Action Plan, a commitment to DOE was made to finalize the Wildland Fire Response procedure for BNL Fire/Rescue (ATS 361.1.8).

Communications

All BNL emergency response vehicles are equipped with Suffolk County fire radio frequencies for direct communication. Communication is also available through cellular telephones and land-based telephones. With exception of the cellular telephones, these have been proven reliable means of communications during emergencies.

Water Supplies

BNL has it own water supply system separate from the Suffolk County Water Authority. Multiple deep-water wells pump directly into the system. Wells are provided with electric drives. Several key wells have LP powered backup drivers. Two elevated storage tanks stabilize the water pressure and provide reserves. Water supply mains are well grided and equipped with fire hydrants. The distribution system reaches every major building (excluding are the remote monitoring buildings). This enables wildland fire operations to be within ¾ of a mile of water supplies.

Refill time for fire fighting equipment will be less than 15 minutes. Outside fire departments can provide tanker trucks or establish relay systems with Class A fire pumpers in case of water system failures. Drafting water supplies are not possible since there are no significant bodies of water. Drafting from the ponds in the area will also threaten tiger salamander populations (a New York State endangered species). Water supplies are considered adequate and reliable.

Access Roads

The site has a network of roads. The center portion of site and most major facilities are accessed through two lane paved roadways (designed as “roads,” “avenues,” or “streets”). Remote portions of the site have “fire breaks” and “access roads.”

BNL’s intentions are to maintain “fire breaks” as 60 foot wide roads, free of combustible vegetation. “Access roads” are maintained, two lane roads in the context of NFPA 299. The formalization of maintenance on these road will be provided in the Subject Area on Wildlands. This development of this Subject Area was committed to as part of the BNL Wildland Fire Safety Enhance Plan and is being tracked under ATS 361.1.6.

In the more remote areas, roadways decrease to single lane dirt roads. Most often, remote facilities have bluestone-covered access roads. Roads in the wildland areas are typically hard packed dirt. BNL access roads into the wildland are sufficient to allow access by Class A pumper during dry spells (the highest hazard times). These access roads allow the brush truck to come within ¼ mile of any wildland area without making entry into the woods. The exceptions are the eastern most woods. A former north to south running road between the power line right of way and North Street has grown over. This road nearly is impassable by fire response vehicles.

> **Action Item #1:** *To allow access to the North East region of the BNL Pine Barren, the access road running north to south between the east power line’s right of way and North Street should be made passable. (ATS 361.2.1)*

The fire breaks, access roads, paths, and ways have not been identified in any formal means (maps or by road signs). The use of GPS systems has not yet been implemented within the fire service on Long Island. These factors have a potential for creating operational delays with fire fighting efforts being unable to locate fires or communicate locations accurately.

Action Item # 2: *Identify required firebreaks access roads, paths, and ways to provide consistent nomenclature for normal operations (PE, ERD, Fire/Rescue), outside fire department operations, and operations of the new nature preserve. As a guideline, roads should allow access within ¼ mile any forested area.* (ATS 361.2.2)

Action Item #3: *Establish a policy to provide identification of Firebreaks and Access Roads with street signs meeting NFPA 299.* (ATS 361.2.3)

Access roads are to be arranged so that "dead end" paths do not exceed 300 feet. This minimizes the chance for occupants becoming trapped in an area as fire blocks off the sole escape route. The Summer Cottage Area has dead end paths that exceed three hundred feet (NFPA 299 requirement).

Action Item # 4: *A second means of egress is needed for the Summer Cottage Area (Mendel and Aston Lanes). (ATS 361.2.4)*

The site as a whole has two primary exits, both leading to the west of BNL on William Floyd Parkway. It is conceivable that an incident from the west could be block off or create extremely difficult egress from BNL's two western gates, which lead to William Floyd Parkway.

Action Item # 5: *Evaluate the need for an eastern emergency exit from the BNL site. The most viable solution maybe to enhance the road from Brookhaven Avenue by Bldg. 445 to the South East exit to North Street. (ATS 361.2.5)*

BNL's Internal Community Awareness

BNL has an established method of communicating requirements placed on its facilities and to its workers. Operational envelopes for BNL facilities are defined within Facility Use Agreements (FUA). Currently FUAs do not identify facilities that are along the Wildland/Facility Interface Zone. As part of the corrective actions listed in the BNL Wildland Fire Safety Enhancement Plan sent to DOE, a commitment has been made to incorporate required wildland fire protection elements in to the FUAs (ATS 361.1.2).

The Standards Based Management System (SBMS) is used site-wide to establish criteria for operations and worker behavior. This system currently does not have topics which include wildland issues (access roads, fire breaks, minimum building construction standards, roof coverings, defensible space, vegetation selection, controlled burns for vegetation reduction, extreme fire hazard precautions). As part of the corrective actions listed in the BNL Wildland Fire Safety Enhancement Plan sent to DOE, a commitment has been made for the development of a "Wildland" Subject Area (ATS 361.1.6).

Action Item # 6: *BNL sponsored camping and softball activities have potential ignition sources for a wildland fire. Safeguards should be developed and implemented for camping, camp fires, and BBQs following National Fire Code requirements.* (ATS 361.2.6)

External Community Awareness

Wildland fire risks have not been explored with the external community. The Central Pine Barrens Commission is piloting a Fire Protection Assessment. This will provide an excellent opportunity to involve the surrounding communities. As other activities progress, involvement of outside fire departments and BNL Community Relations and Public Affairs will increase.

Action Item # 7: *While developing a wildland fire management plan, incorporate the community surrounding BNL with the various elements. Existing methods can be used with the addition of local fire departments and response units. (ATS 361.2.7)*

IX. Wildland Fires as a Means of Radiological Release

Given a wildland fire excellent transport capability, the potential for transport of smoke containing radiological material was examined. Based on past BNL operations there are several sites that have been characterized by the Environmental Restoration Division (ERD) as facilities with ground contamination (Appendix C). The levels of soil contamination limit the uptake of vegetation. The quantities that could be released in case of a wildland fire are in the environmental levels of exposure to on-site and off-site personnel. The available calculations were preformed as the result of an emergency drill excise and should be refined and formalized. As part of the corrective actions listed in the BNL Wildland Fire Safety Enhancement Plan sent to DOE, a commitment has been made for these calculations to be complete (ATS 361.1.1).

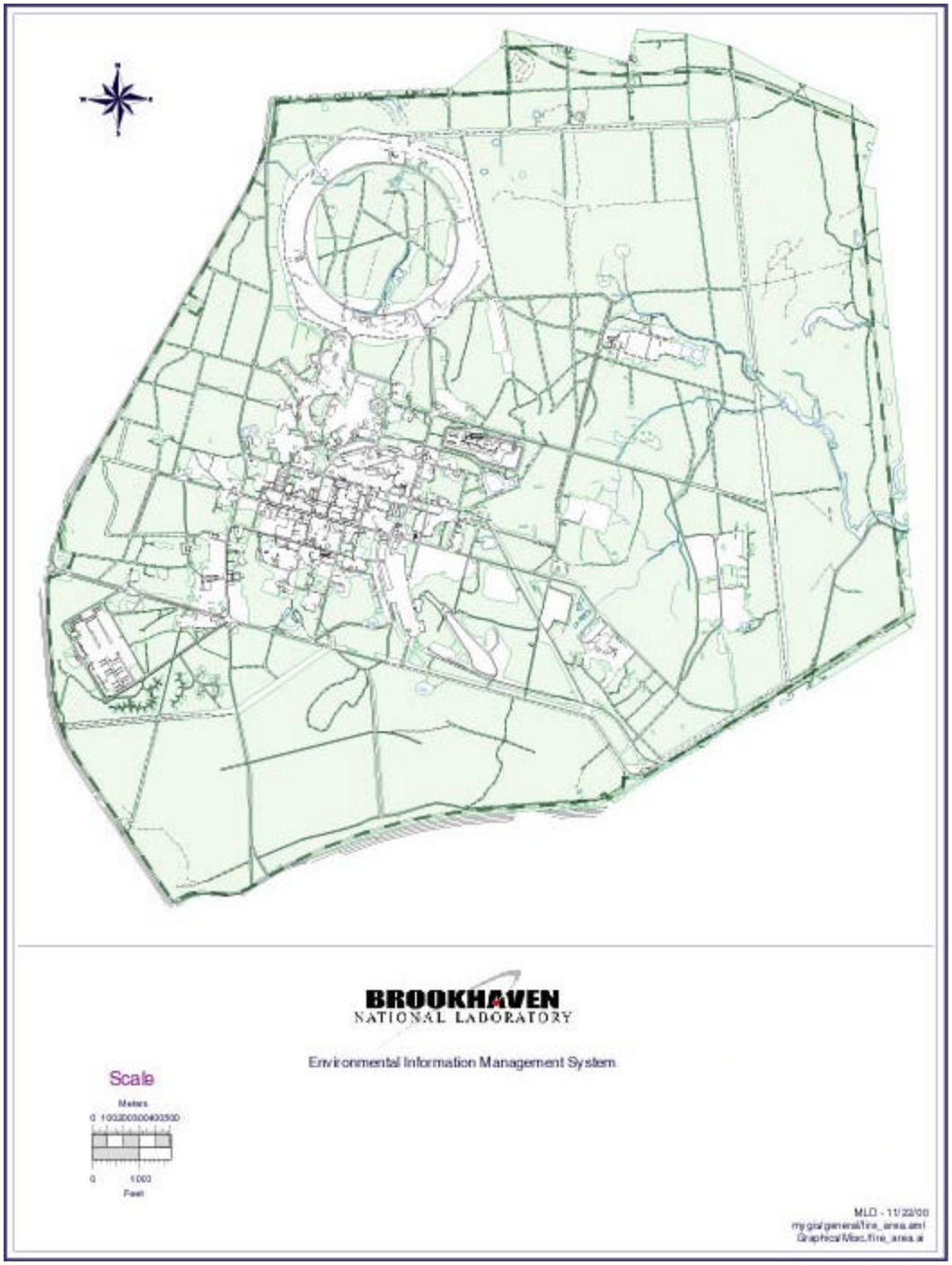
Given BNL use of radilonuclides, a request was made for site wide sampling of vegetation for radiological. A comprehensive examination of vegetation has not been performed.

Action Item # 8: *Request funding to Establish a routine program for sampling vegetation for radiological uptake should be investigate ensure areas of significant radiological content have not overlooked. (ATS 361.2.1)*

Appendix A

Site Map

The following site map shows the wildland areas shaded in light green.



Appendix B

Wildland Hazard Severity Checklist Worksheets

NFPA 299, Table A-3-2(a) Wildfire Hazard Severity Form Checklist

Site Electrical Power Supply Lines

Element	Points
A. Subdivision Design	
1. Ingress and egress	
Two or more, primary roads	1 _X
One road, primary route	3 __
One way in/out	5 __
2. Primary road width	
Minimum of 20 ft (6.1 m)	1 _X
Less than 20 ft (6.1 m)	3 __
3. Road accessibility	
Smooth road, grade < 5%	1 __
Rough road, grade > 5%	3 _X
Other	5 __
4. Secondary road terminus	
Loop roads, cul-de-sacs	
Outside radius > 50 ft (15.2 m)	1 _X
Outside radius < 50 ft (15.2 m)	3 __
Cul-de-sac turnaround	
Dead-end roads < 200 ft (61 m)	3 __
Dead-end roads > 200 ft (61 m)	5 __
5. Average lot size	
More than 10 acres (4.1 ha)	1 _X
Between 1 and 10 acres (0.4-4.1 ha)	3 __
Less than 1 acre (0.4 ha)	5 __
6. Street signs	
Present [4 in. (10.2 cm) in size and reflectorized]	1 __
Not present	5 _X
B. Vegetation (Fuel Models)	
1. NFDRS fuel models	
Light (grasses, forbs, sawgrasses, and tundra)	1 __
Fuel models A, C, L, N, S, and T	
Medium (light brush and small trees)	5 _X

Fuel models D, E, F, H, P, Q, and U
Heavy (dense brush, timber, and hardwoods) 10 __
Fuel models B, G, and O
Slash (timber harvesting residue) 10 __
Fuel models J, K, and L

2. Defensible space
More than 100 ft (30.48 m) of treatment from buildings 1 __
30-70 ft (9.1-21.3 m) of treatment from buildings 5 __
No defensible space treatment 10 _X

C. Topography

1. Slope
Less than 9% 1 _X
Between 10 and 20% 4 __
Between 21 and 30% 7 __
Between 31 and 40% 8 __
Greater than 41% 10 __

D. Additional Rating Factors

1. Rough topography that contains steep canyons 2 __

2. Areas with a history of higher fire occurrence than surrounding areas due to special situations such as heavy lightning, railroads, escaped debris burning, arson, etc. 3 __

3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds 4 __

E. Roofing Material

1. Construction material (interpreted to mean resistance to burning brands)
Class A roof 1 _X
Class B roof 3 __
Class C roof 5 __
Non-rated 10 __

F. Existing Building Construction

1. Materials (predominate) (interpreted to mean resistance side ignition)
Noncombustible siding/deck 1 _X
Noncombustible siding/wood deck 5 __
Combustible siding and deck 10 __

G. Available Fire Protection
1. Water source availability (on site)
500 gpm (1892.7 Lpm) hydrants < 1000 ft (304.8m) apart 1 __
Hydrants above or draft site 2 __
No hydrants or draft site available 3 _X

2. Water source availability (off site)
Sources within 20 min round-trip 1 _X
Sources within 21-45 min round-trip 5 __
Sources > 46 min round-trip 10 __

H. Utilities (Gas and Electric)

1. Placement

All underground utilities	1 __
One underground, one aboveground	3 __
All aboveground	5 _X

I. Totals for Subdivision **39 pts.** (low)
(Tally up all check-point totals.)

1. Low hazard: < 49 points
2. Moderate hazard: 49-68 points
3. High hazard: 69-83 points
4. Extreme hazard: 84+ points

RHIC Ring Complex

Figure 1 Aerial view of the northern developed part of BNL showing the RHIC Ring.

Figure 2 Bldg. 1010 shows the typical vegetation clearance around RHIC Buildings

Element	Points
A. Subdivision Design	
1. Ingress and egress	
Two or more, primary roads	1 __
One road, primary route	3 X
One way in/out	5 __
2. Primary road width	
Minimum of 20 ft (6.1 m)	1 X
Less than 20 ft (6.1 m)	3 __
3. Road accessibility	
Smooth road, grade < 5%	1 __
Rough road, grade > 5%	3 X[6]
Other	5 __
4. Secondary road terminus	
Loop roads, cul-de-sacs	
Outside radius > 50 ft (15.2 m)	1 __
Outside radius < 50 ft (15.2 m)	3 X[7]
Cul-de-sac turnaround	
Dead-end roads < 200 ft (61 m)	3 __
Dead-end roads > 200 ft (61 m)	5 __
5. Average lot size	
More than 10 acres (4.1 ha)	1 X
Between 1 and 10 acres (0.4-4.1 ha)	3 __
Less than 1 acre (0.4 ha)	5 __
6. Street signs	
Present [4 in. (10.2 cm) in size and reflectorized]	1 __
Not present	5 X (3 pts. for plastic)
B. Vegetation (Fuel Models)	
1. NFDRS fuel models	
Light (grasses, forbs, sawgrasses, and tundra)	1 __
Fuel models A, C, L, N, S, and T	
Medium (light brush and small trees)	5 X
Fuel models D, E, F, H, P, Q, and U	
Heavy (dense brush, timber, and hardwoods)	10 __
Fuel models J, K, and L	
2. Defensible space	
More than 100 ft (30.48 m) of treatment from buildings	1 __
30-70 ft (9.1-21.3 m) of treatment from buildings	5 X
No defensible space treatment	10 __
C. Topography	
1. Slope	
Less than 9%	1 __
Between 10 and 20%	4 __
Between 21 and 30%	7 X

[6] Blue Stone road for access to Bldg. 1008D,E and grade of road by 1010
[7] Turnarounds at experimental buildings are <50 ft., radius

Between 31 and 40%	8 __
Greater than 41%	10 __

D. Additional Rating Factors

1. Rough topography that contains steep canyons	2 __
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations such as heavy lightning, railroads, escaped debris burning, arson, etc.	3 __
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	4 __

E. Roofing Material

1. Construction material

Class A roof	1 X_
Class B roof	3 __
Class C roof	5 __
Non-rated	10 __

F. Existing Building Construction

1. Materials (predominate)

Noncombustible siding/deck	1 X _
Noncombustible siding/wood deck	5 __
Combustible siding and deck	10 __

G. Available Fire Protection

1. Water source availability (on site)

500 gpm (1892.7 Lpm) hydrants < 1000 ft (304.8m) apart	1 X _
Hydrants above or draft site	2 __
No hydrants or draft site available	3 __

2. Water source availability (off site)

Sources within 20 min round-trip	1 X _
Sources within 21-45 min round-trip	5 __
Sources > 46 min round-trip	10 __

H. Utilities (Gas and Electric)

1. Placement

All underground utilities	1 __
One underground, one aboveground	3 X _
All aboveground	5 __

I. Totals for Subdivision

(Tally up all check-point totals.) **38 pts**. (Low)

1. Low hazard: < 49 points
2. Moderate hazard: 49-68 points
3. High hazard: 69-83 points
4. Extreme hazard: 84+ points

Former Hazardous Waste Management

Figure 3 Former Hazardous Waste Management Site, currently undergoing environmental remediation and decommissioning.

Element	Points
A. Subdivision Design	
1. Ingress and egress	
Two or more, primary roads	1 __
One road, primary route	3 X _
One way in/out	5 X _
2. Primary road width	
Minimum of 20 ft (6.1 m)	1 X _
Less than 20 ft (6.1 m)	3 __
3. Road accessibility	
Smooth road, grade < 5%	1 X _
Rough road, grade > 5%	3 __
Other	5 __

4. Secondary road terminus
   Loop roads, cul-de-sacs
   Outside radius > 50 ft (15.2 m) 1 X _
   Outside radius < 50 ft (15.2 m) 3 __

   Cul-de-sac turnaround
   Dead-end roads < 200 ft (61 m) 3 __
   Dead-end roads > 200 ft (61 m) 5 _X

5. Average lot size
   More than 10 acres (4.1 ha) 1 __
   Between 1 and 10 acres (0.4-4.1 ha) 3 __
   Less than 1 acre (0.4 ha) 5 _X

6. Street signs
   Present [4 in. (10.2 cm) in size and reflectorized] 1 __
   Not present 5 X _

B. Vegetation (Fuel Models)
1. NFDRS fuel models
   Light (grasses, forbs, sawgrasses, and tundra) 1 __
   Fuel models A, C, L, N, S, and T
   Medium (light brush and small trees) 5 X _
   Fuel models D, E, F, H, P, Q, and U
   Heavy (dense brush, timber, and hardwoods) 10 __
   Fuel models B, G, and O
   Slash (timber harvesting residue) 10 __
   Fuel models J, K, and L

2. Defensible space
   More than 100 ft (30.48 m) of treatment from buildings 1 __
   30-70 ft (9.1-21.3 m) of treatment from buildings 5 __
   No defensible space treatment 10 X_

C. Topography
1. Slope
   Less than 9% 1 X_
   Between 10 and 20% 4 __
   Between 21 and 30% 7 __
   Between 31 and 40% 8 __
   Greater than 41% 10 __

D. Additional Rating Factors
1. Rough topography that contains steep canyons 2 __
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations such as heavy lightning, railroads, escaped debris burning, arson, etc. 3 __
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds 4 __

E. Roofing Material
1. Construction material
   Class A roof 1 X _
   Class B roof 3 __
   Class C roof 5 __
   Non-rated 10 __

F. Existing Building Construction

1. Materials (predominate)

Noncombustible siding/deck	1 X _
Noncombustible siding/wood deck	5 __
Combustible siding and deck	10 __

G. Available Fire Protection

1. Water source availability (on site)

500 gpm (1892.7 Lpm) hydrants < 1000 ft (304.8m) apart	1 X _
Hydrants above or draft site	2 __
No hydrants or draft site available	3 __

2. Water source availability (off site)

Sources within 20 min round-trip	1 X _
Sources within 21-45 min round-trip	5 __
Sources > 46 min round-trip	10 __

H. Utilities (Gas and Electric)

1. Placement

All underground utilities	1 __
One underground, one aboveground	3 X _
All aboveground	5 __

I. Totals for Subdivision

(Tally up all check-point totals.) **49 pts.** (low)

1. Low hazard: < 49 points
2. Moderate hazard: 49-68 points
3. High hazard: 69-83 points
4. Extreme hazard: 84+ points

New Waste Management Facility

Element	Points
A. Subdivision Design	
1. Ingress and egress	
Two or more, primary roads	1 __
One road, primary route	3 X_
One way in/out	5 __
2. Primary road width	
Minimum of 20 ft (6.1 m)	1 X_
Less than 20 ft (6.1 m)	3 __
3. Road accessibility	
Smooth road, grade < 5%	1 X_
Rough road, grade > 5%	3 __
Other	5 __
4. Secondary road terminus	
Loop roads, cul-de-sacs	
Outside radius > 50 ft (15.2 m)	1 X _
Outside radius < 50 ft (15.2 m)	3 __
Cul-de-sac turnaround	
Dead-end roads < 200 ft (61 m)	3 X_
Dead-end roads > 200 ft (61 m)	5 __
5. Average lot size	
More than 10 acres (4.1 ha)	1 __
Between 1 and 10 acres (0.4-4.1 ha)	3 X_
Less than 1 acre (0.4 ha)	5 __
6. Street signs	
Present [4 in. (10.2 cm) in size and reflectorized]	1 __
Not present	5 X_ (3 pts. for Plastic)
B. Vegetation (Fuel Models)	
1. NFDRS fuel models	
Light (grasses, forbs, sawgrasses, and tundra)	1 __
Fuel models A, C, L, N, S, and T	
Medium (light brush and small trees)	5 X_
Fuel models D, E, F, H, P, Q, and U	
Heavy (dense brush, timber, and hardwoods)	10 __
Fuel models B, G, and O	
Slash (timber harvesting residue)	10 __
Fuel models J, K, and L	
2. Defensible space	
More than 100 ft (30.48 m) of treatment from buildings	1 X_
30-70 ft (9.1-21.3 m) of treatment from buildings	5 __
No defensible space treatment	10 __
C. Topography	
1. Slope	
Less than 9%	1 X_

Between 10 and 20%	4 __
Between 21 and 30%	7 __
Between 31 and 40%	8 __
Greater than 41%	10 __

D. Additional Rating Factors

1. Rough topography that contains steep canyons	2 __
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations such as heavy lightning, railroads, escaped debris burning, arson, etc.	3 __
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	4 __

E. Roofing Material

1. Construction material	
Class A roof	1 X_
Class B roof	3 __
Class C roof	5 __
Non-rated	10 __

F. Existing Building Construction

1. Materials (predominate)	
Noncombustible siding/deck	1 X_
Noncombustible siding/wood deck	5 __
Combustible siding and deck	10 __

G. Available Fire Protection

1. Water source availability (on site)	
500 gpm (1892.7 Lpm) hydrants < 1000 ft (304.8m) apart	1 X_
Hydrants above or draft site	2 __
No hydrants or draft site available	3 __
2. Water source availability (off site)	
Sources within 20 min round-trip	1 X_
Sources within 21-45 min round-trip	5 __
Sources > 46 min round-trip	10 __

H. Utilities (Gas and Electric)

1. Placement	
All underground utilities	1 X_
One underground, one aboveground	3 __
All aboveground	5 __

I. Totals for Subdivision

(Tally up all check-point totals.) **29 pts.** (low)

1. Low hazard: < 49 points
2. Moderate hazard: 49-68 points
3. High hazard: 69-83 points
4. Extreme hazard: 84+ points

AGS/LINAC Buildings

Element	Points
A. Subdivision Design	
1. Ingress and egress	
Two or more, primary roads	1 __
One road, primary route	3 X
One way in/out	5 __
2. Primary road width	
Minimum of 20 ft (6.1 m)	1 X
Less than 20 ft (6.1 m)	3 __
3. Road accessibility	
Smooth road, grade < 5%	1 X
Rough road, grade > 5%	3 __
Other	5 __
4. Secondary road terminus	
Loop roads, cul-de-sacs	
Outside radius > 50 ft (15.2 m)	1 X
Outside radius < 50 ft (15.2 m)	3 __
Cul-de-sac turnaround	
Dead-end roads < 200 ft (61 m)	3 X
Dead-end roads > 200 ft (61 m)	5 __
5. Average lot size	
More than 10 acres (4.1 ha)	1 __
Between 1 and 10 acres (0.4-4.1 ha)	3 __
Less than 1 acre (0.4 ha)	5 X
6. Street signs	
Present [4 in. (10.2 cm) in size and reflectorized]	1 __
Not present	5 X (3 pts. for plastics)
B. Vegetation (Fuel Models)	
1. NFDRS fuel models	
Light (grasses, forbs, sawgrasses, and tundra)	1 __
Fuel models A, C, L, N, S, and T	
Medium (light brush and small trees)	5 X
Fuel models D, E, F, H, P, Q, and U	
Heavy (dense brush, timber, and hardwoods)	10 __
Fuel models B, G, and O	
Slash (timber harvesting residue)	10 __
Fuel models J, K, and L	
2. Defensible space	
More than 100 ft (30.48 m) of treatment from buildings	1 __
30-70 ft (9.1-21.3 m) of treatment from buildings	5 X
No defensible space treatment	10 __
C. Topography	
1. Slope	

Less than 9%	1 X
Between 10 and 20%	4 __
Between 21 and 30%	7 __
Between 31 and 40%	8 __
Greater than 41%	10 __

D. Additional Rating Factors

1. Rough topography that contains steep canyons	2 __
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations such as heavy lightning, railroads, escaped debris burning, arson, etc.	3 __
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	4 __

E. Roofing Material

1. Construction material

Class A roof	1 X
Class B roof	3 __
Class C roof	5 __
Non-rated	10 __

F. Existing Building Construction

1. Materials (predominate)

Noncombustible siding/deck	1 X
Noncombustible siding/wood deck	5 __
Combustible siding and deck	10 __

G. Available Fire Protection

1. Water source availability (on site)

500 gpm (1892.7 Lpm) hydrants < 1000 ft (304.8m) apart	1 X
Hydrants above or draft site	2 __
No hydrants or draft site available	3 __

2. Water source availability (off site)

Sources within 20 min round-trip	1 X
Sources within 21-45 min round-trip	5 __
Sources > 46 min round-trip	10 __

H. Utilities (Gas and Electric)

1. Placement

All underground utilities	1 __
One underground, one aboveground	3 X
All aboveground	5 __

I. Totals for Subdivision

(Tally up all check-point totals.) **35 pts.** (low)

1. Low hazard: < 49 points
2. Moderate hazard: 49-68 points
3. High hazard: 69-83 points
4. Extreme hazard: 84+ points

Apartment/Cottage Area

Element	Points
A. Subdivision Design	
1. Ingress and egress	
Two or more, primary roads	1 __
One road, primary route	3 __
One way in/out	5 X_ (cottages)
2. Primary road width	
Minimum of 20 ft (6.1 m)	1 X_
Less than 20 ft (6.1 m)	3 __
3. Road accessibility	
Smooth road, grade < 5%	1 X_
Rough road, grade > 5%	3 __
Other	5 __
4. Secondary road terminus	
Loop roads, cul-de-sacs	
Outside radius > 50 ft (15.2 m)	1 X_
Outside radius < 50 ft (15.2 m)	3 __
Cul-de-sac turnaround	
Dead-end roads < 200 ft (61 m)	3 __
Dead-end roads > 200 ft (61 m)	5 X_
5. Average lot size	
More than 10 acres (4.1 ha)	1 __
Between 1 and 10 acres (0.4-4.1 ha)	3 __
Less than 1 acre (0.4 ha)	5 X_
6. Street signs	
Present [4 in. (10.2 cm) in size and reflectorized]	1 __
Not present	5 X_ (3 pts. for plastic)
B. Vegetation (Fuel Models)	
1. NFDRS fuel models	
Light (grasses, forbs, sawgrasses, and tundra)	1 __
Fuel models A, C, L, N, S, and T	
Medium (light brush and small trees)	5 X _
Fuel models D, E, F, H, P, Q, and U	
Heavy (dense brush, timber, and hardwoods)	10 __
Fuel models B, G, and O	
Slash (timber harvesting residue)	10 __
Fuel models J, K, and L	
2. Defensible space	
More than 100 ft (30.48 m) of treatment from buildings	1 __
30-70 ft (9.1-21.3 m) of treatment from buildings	5 __
No defensible space treatment	10 X_
C. Topography	
1. Slope	
Less than 9%	1 X _

Between 10 and 20%	4 __
Between 21 and 30%	7 __
Between 31 and 40%	8 __
Greater than 41%	10 __

D. Additional Rating Factors

1. Rough topography that contains steep canyons	2 __
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations such as heavy lightning, railroads, escaped debris burning, arson, etc.	3 __
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	4 __

E. Roofing Material

1. Construction material

Class A roof	1 X _
Class B roof	3 __
Class C roof	5 __
Non-rated	10 __

F. Existing Building Construction

1. Materials (predominate)

Noncombustible siding/deck	1 __
Noncombustible siding/wood deck	5 __
Combustible siding and deck	10 X

G. Available Fire Protection

1. Water source availability (on site)

500 gpm (1892.7 Lpm) hydrants < 1000 ft (304.8m) apart	1 X_
Hydrants above or draft site	2 __
No hydrants or draft site available	3 __

2. Water source availability (off site)

Sources within 20 min round-trip	1 X_
Sources within 21-45 min round-trip	5 __
Sources > 46 min round-trip	10 __

H. Utilities (Gas and Electric)

1. Placement

All underground utilities	1 X_
One underground, one aboveground	3 __
All aboveground	5 __

I. Totals for Subdivision

(Tally up all check-point totals.) **51 pts.** (moderate)

1. Low hazard: < 49 points
2. Moderate hazard: 49-68 points
3. High hazard: 69-83 points
4. Extreme hazard: 84+ points

General Perimeter of BNL Central Core Buildings

Note: These facilities are included for comparison. They are technically outside the interface region.

Element	Points
A. Subdivision Design	
1. Ingress and egress	
Two or more, primary roads	1 X
One road, primary route	3 __
One way in/out	5 __
2. Primary road width	
Minimum of 20 ft (6.1 m)	1 X
Less than 20 ft (6.1 m)	3 __
3. Road accessibility	
Smooth road, grade < 5%	1 X
Rough road, grade > 5%	3 __
Other	5 __
4. Secondary road terminus	
Loop roads, cul-de-sacs	
Outside radius > 50 ft (15.2 m)	1 X
Outside radius < 50 ft (15.2 m)	3 __
Cul-de-sac turnaround	
Dead-end roads < 200 ft (61 m)	3 X
Dead-end roads > 200 ft (61 m)	5 __
5. Average lot size	
More than 10 acres (4.1 ha)	1 __
Between 1 and 10 acres (0.4-4.1 ha)	3 __
Less than 1 acre (0.4 ha)	5 X
6. Street signs	
Present [4 in. (10.2 cm) in size and reflectorized]	1 __
Not present	5 X (3 pts. for plastic)
B. Vegetation (Fuel Models)	
1. NFDRS fuel models	
Light (grasses, forbs, sawgrasses, and tundra)	1 X
Fuel models A, C, L, N, S, and T	
Medium (light brush and small trees)	5 __
Fuel models D, E, F, H, P, Q, and U	
Heavy (dense brush, timber, and hardwoods)	10 __
Fuel models B, G, and O	
Slash (timber harvesting residue)	10 __
Fuel models J, K, and L	
2. Defensible space	
More than 100 ft (30.48 m) of treatment from buildings	1 X
30-70 ft (9.1-21.3 m) of treatment from buildings	5 __
No defensible space treatment	10 __
C. Topography	
1. Slope	
Less than 9%	1 X

Between 10 and 20%	4 __
Between 21 and 30%	7 __
Between 31 and 40%	8 __
Greater than 41%	10 __

D. Additional Rating Factors

1. Rough topography that contains steep canyons	2 __
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations such as heavy lightning, railroads, escaped debris burning, arson, etc.	3 __
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	4 __

E. Roofing Material

1. Construction material	
Class A roof	1 X_
Class B roof	3 __
Class C roof	5 __
Non-rated	10 __

F. Existing Building Construction

1. Materials (predominate)	
Noncombustible siding/deck	1 X_
Noncombustible siding/wood deck	5 __
Combustible siding and deck	10 __

G. Available Fire Protection

1. Water source availability (on site)	
500 gpm (1892.7 Lpm) hydrants < 1000 ft (304.8m) apart	1 X_
Hydrants above or draft site	2 __
No hydrants or draft site available	3 __
2. Water source availability (off site)	
Sources within 20 min round-trip	1 X_
Sources within 21-45 min round-trip	5 __
Sources > 46 min round-trip	10 __

H. Utilities (Gas and Electric)

1. Placement	
All underground utilities	1 X_
One underground, one aboveground	3 __
All aboveground	5 __

I. Totals for Subdivision

(Tally up all check-point totals.) **23 pts.** (low)

1. Low hazard: < 49 points
2. Moderate hazard: 49-68 points
3. High hazard: 69-83 points
4. Extreme hazard: 84+ points

Miscellaneous Small Monitoring and Well Houses

Element	Points
A. Subdivision Design	
1. Ingress and egress	
Two or more, primary roads	1 __
One road, primary route	3 __
One way in/out	5 X_
2. Primary road width	
Minimum of 20 ft (6.1 m)	1 __
Less than 20 ft (6.1 m)	3 X_
3. Road accessibility	
Smooth road, grade < 5%	1 __
Rough road, grade > 5%	3 X_
Other	5 __
4. Secondary road terminus	
Loop roads, cul-de-sacs	
Outside radius > 50 ft (15.2 m)	1 __
Outside radius < 50 ft (15.2 m)	3 X_
Cul-de-sac turnaround	
Dead-end roads < 200 ft (61 m)	3 __
Dead-end roads > 200 ft (61 m)	5 X_
5. Average lot size	
More than 10 acres (4.1 ha)	1 X_
Between 1 and 10 acres (0.4-4.1 ha)	3 __
Less than 1 acre (0.4 ha)	5 __
6. Street signs	
Present [4 in. (10.2 cm) in size and reflectorized]	1 __
Not present	5 X_
B. Vegetation (Fuel Models)	
1. NFDRS fuel models	
Light (grasses, forbs, sawgrasses, and tundra)	1 __
Fuel models A, C, L, N, S, and T	
Medium (light brush and small trees)	5 X_
Fuel models D, E, F, H, P, Q, and U	
Heavy (dense brush, timber, and hardwoods)	10 __
Fuel models B, G, and O	
Slash (timber harvesting residue)	10 __
Fuel models J, K, and L	
2. Defensible space	
More than 100 ft (30.48 m) of treatment from buildings	1 __
30-70 ft (9.1-21.3 m) of treatment from buildings	5 __
No defensible space treatment	10 X_
C. Topography	
1. Slope	

Less than 9%	1 X
Between 10 and 20%	4 __
Between 21 and 30%	7 __
Between 31 and 40%	8 __
Greater than 41%	10 __

D. Additional Rating Factors

1. Rough topography that contains steep canyons	2 __
2. Areas with a history of higher fire occurrence than surrounding areas due to special situations such as heavy lightning, railroads, escaped debris burning, arson, etc.	3 __
3. Areas that are periodically exposed to unusually severe fire weather and strong dry winds	4 __

E. Roofing Material

1. Construction material

Class A roof	1 X
Class B roof	3 __
Class C roof	5 __
Non-rated	10 __

F. Existing Building Construction

1. Materials (predominate)

Noncombustible siding/deck	1 X
Noncombustible siding/wood deck	5 __
Combustible siding and deck	10 __

G. Available Fire Protection

1. Water source availability (on site)

500 gpm (1892.7 Lpm) hydrants < 1000 ft (304.8m) apart	1 __
Hydrants above or draft site	2 __
No hydrants or draft site available	3 X

2. Water source availability (off site)

Sources within 20 min round-trip	1 X
Sources within 21-45 min round-trip	5 __
Sources > 46 min round-trip	10 __

H. Utilities (Gas and Electric)

1. Placement

All underground utilities	1 __
One underground, one aboveground	3 __
All aboveground	5 X

I. Totals for Subdivision

(Tally up all check-point totals.) **52 pts.** (moderate)

1. Low hazard: < 49 points
2. Moderate hazard: 49-68 points
3. High hazard: 69-83 points
4. Extreme hazard: 84+ points

Appendix C

Radiological Uptake by Soils

The following is an outtake from the Environmental Restoration Division WebPages on Operational Unit 1, radiologically contaminated soils.

History and Description of Contaminated Locations

Soils at a number of locations on the BNL site (see maps below) contain contaminants that will require cleanup.

Radiologically contaminated soils

- *Former Hazardous Waste Management Facility (HWMF)* - The largest volume of contaminated soil is located at the HWMF. It was used from 1947 to 1997 as a central receiving, processing and storage facility for radioactive and hazardous waste generated at BNL. The primary soil contaminants at the HWMF are cesium-137 and strontium-90. Mercury is also present.
- *Waste Concentration Facility* - Cesium-137 and strontium-90 contamination was found in soils here. This facility has been used since 1949 for reducing the volume of liquid radioactive waste prior to disposal. It is still an operational facility. Three large storage tanks were in use here from 1949 to 1987, and were removed in 1994. Additional tanks and piping still remain.
- *Reclamation Facility and Sump Outfall Area* - Radioactive elements were found in soils at the reclamation facility and in a sump outfall east of the facility. This facility was used from the late 1950s through the late 1960s to clean radioactive contaminants from clothing and equipment. It is no longer used for decontamination, although it is still in use for routine laundry. Water from decontamination of equipment was discharged at the sump outfall area until late 1969.
- *Other Sitewide Soils* - Low levels of cesium-137 were found in soils near several buildings in the center of the BNL site. Soils from the HWMF were used as landscaping and fill material at these locations.

Two other areas at BNL were examined for radiological contamination. The Alternating Gradient Synchrotron (AGS) storage yards hold steel and equipment that is being stored for potential reuse at the AGS. The Low Mass Criticality Facility was used for research from the mid-1950s to the mid-1960s, and for temporary drum storage from June 1983 to March 1984.

No contamination at levels of human health concern was found at these two locations. No cleanup of these areas is required. Institutional controls and monitoring will continue.

Cleanup Goals for Radiologically Contaminated Soils

Investigation Findings

Several locations, or areas of concern (AOCs), are examined in this remedial investigation. No areas had chemical contamination above acceptable risk levels as defined under CERCLA.

Waste Concentration Facility (AOC 10)

BNL's waste concentration facility was used to temporarily store and process liquid radioactive waste. Soil sampling detected the radioactive element cesium-137. Levels of cesium-137 were greater than the cleanup goal established for residential areas. This goal is 23 pCi/g at a time 50 years in the future. (PicoCuries per gram is a measure of radioactivity per unit weight of soil.) Access to this area is currently restricted.

Cleanup has already taken place. Three 100,000-gallon aboveground storage tanks were removed in 1994 and 1995. Six underground storage tanks will also be removed. Further cleanup action may be required in this area.

Lawns and Landscaping Soils (AOC 16)

In 1980 and 1983, aerial radiation surveys identified twenty-three areas for further investigation. Radioactive contaminants, primarily cesium-137, were found above cleanup goals for residential areas in several locations. Some of these locations may require further cleanup action.

Deer graze on BNL lawns, including those containing cesium-137. Low levels of cesium-137 have been detected in deer sampled on the BNL site. The potential health risk to humans who consume deer is very low. Additionally, hunting on the BNL site is prohibited.

Tritium was detected in subsurface soils at a facility that produces medical isotopes (the Brookhaven LINAC Isotope Producer, or BLIP). Routine monitoring has also found tritium in groundwater near the BLIP. This facility may require further cleanup action. A report on the BLIP will be released later this year. The *BLIP Engineering Evaluation/Cost Analysis* will give more details about the contamination that has been found at the BLIP and examine the cleanup alternatives.

Because the lawns and landscaping soils are located in developed areas of the BNL site, no ecologically sensitive areas are affected.

Former Low Mass Criticality Facility (AOC 17)

Historical photographs show that, after decommisioning, this facility was used for storage of chemical drums. A ground-based survey found no radioactive contaminants at levels greater than residential cleanup goals.

AGS Storage Yards (AOC 18)

These three storage yards (see map) hold steel from the Alternating Gradient Synchrotron. It was suggested that radioactive particles of steel might have contaminated the soil. Sampling found no radioactive contaminants at levels greater than residential cleanup goals.

Appendix D

Reference Pictures

Picture 1 Paved access road, which turns which turns into a dirt road as it enters the remote portions of site.

Picture 2 An active access road which is becoming heavily over grown.

Picture 3 The forest canopy is overgrowing the firebreak and will allow a moderate fire to jump across the boundary. Also, combustible litter crosses the roadway, which will allow a small fire to jump with easy.

Picture 4 Fire normally starts on the floor of the forest. The flames from the combustible covering can easily climb the small branches ("the fuel ladder") from the floor to the tree canopy. Once in the canopy, fire burns intensely.

Picture 9 Example of "dead and down" trees that significantly adds to fuel loading at the floor level.

Picture 10 The depth of combustible pine needles is demonstrated by a pen stuck in the ground. The decaying litter creates a peat that is several inches thick. The peat will support combustion underground for several days, increasing the risk of re-ignition.