Appendix G: Environmental Health and Safety Resource Report

For Programmatic Environmental Impact Statement on Utility-Scale Solar Energy Facilities in Washington State

By

Environmental Science Associates

For the

Shorelands and Environmental Assistance Program

Washington State Department of Ecology

Olympia, Washington

September 2024

DEPARTMENT OF ECOLOGY
State of Washington

Table of Contents

List of Figures and Tables

Figures

Tables

Acronyms and Abbreviations List

BESS	battery energy storage system
BLM	Bureau of Land Management
BMP	best management practice
BMS	battery management system
CFR	*Code of Federal Regulations*
DDT	dichlorodiphenyltrichloroethane
DNR	Washington Department of Natural Resources
Ecology	Washington State Department of Ecology
EHS	environmental health and safety
FIFRA	Federal Insecticide, Fungicide, and Rodenticide
GHG	greenhouse gas
HMTA	Hazardous Materials Transportation Act
IEA	International Energy Agency
MTCA	Model Toxics Control Act
MW	megawatt
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PEIS	Programmatic Environmental Impact Statement
PV	photovoltaic
RCP	representative concentration pathway
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
UFC	United Facilities Criteria
USC	*United States Code*
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
WAC	Washington Administrative Code

Executive Summary

This resource report describes the environmental health and safety (EHS) conditions in the study area. It also describes the potential impacts and actions that could avoid or reduce impacts from solar energy facilities.

EHS risks in the study area consist of wildfire risks from and to the facilities and management of hazardous materials and battery energy storage systems. Sites contaminated with hazardous materials are present sparsely across most of the study area with a higher concentration in more developed areas. Worker health and safety risks are minimal because the facilities need maintenance but not full-time operations staff. The study area is mostly rural and agricultural land that is undeveloped or has low-intensity land uses. For all types of impacts, existing EHS laws, regulations, and industry standards greatly reduce the risk of significant impacts occurring and establish a framework under which significant impacts should be avoidable. Despite these safeguards, releases of hazardous materials could occur, though these would likely be in relatively small quantities and to secondary containment or nearby areas and able to be cleaned up. Thermal runaway events, where lithium-ion batteries overheat due to damage or failure of battery management systems (BMSs), could affect emergency responders due to releases of hazardous air emissions.

Findings for EHS impacts described in this resource report are summarized as follows:

- Through compliance with laws, permits, and with implementation of actions that could avoid and reduce impacts, most construction, operations, and decommissioning activities would likely result in **less than significant impacts** related to hazardous materials and health and safety.
- Depending on the specific location, severity, and fire response capacity, there is potential that construction, operations, and decommissioning of a facility would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.
- A thermal runaway event due to damage or BMS failure at a facility with a co-located lithium-ion battery energy storage system (BESS) would have **potentially significant adverse impacts** related to hazardous air emission risks for emergency responders.

Construction, operation, and decommissioning of utility-scale solar facilities may result in **potentially significant and unavoidable adverse impacts** related to wildfires if there are new ignition sources in remote locations with limited response capabilities. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

Demand for emergency response during incidents (including wildfires or battery incidents) is considered in the *Public Services and Utilities Resource Report* (ESA 2024a).

Crosswalk with Environmental Health and Safety Resource Report for Utility-Scale Onshore Wind Energy

Two Programmatic Environmental Impact Statements (PEISs) are being released at the same time, one for utility-scale solar energy facilities and one for utility-scale onshore wind energy facilities. This crosswalk identifies the areas with substantial differences between the EHS resource reports for each PEIS.

Utility-Scale Solar Energy PEIS (this document)	Utility-Scale Onshore Wind Energy PEIS
• Some differences in specific hazardous materials, health and safety hazards, and wildfire risks • Some differences in actions to avoid and reduce impacts	• Some differences in specific hazardous materials, health and safety hazards, and wildfire risks • Some differences in actions to avoid and reduce impacts

1 Introduction

This resource report describes environmental health and safety (EHS) within the study area and assesses potential impacts associated with types of facilities (alternatives), including a No Action Alternative. Chapter 2 of the State Environmental Policy Act Programmatic Environmental Impact Statement (PEIS) provides a description of the types of facilities evaluated (alternatives).

This section provides an overview of the aspects of EHS evaluated and lists relevant regulations that contribute to the evaluation of potential impacts.

1.1 Resource description

EHS refers to the risks or hazards that threaten the well-being of people or other elements of the environment. Workplace accidents or system failures can result in EHS hazards, such as fires, explosions, hazardous material spills, injury, or structural damage.

In this programmatic analysis of the construction, operation, and decommissioning of utility-scale solar energy facilities in Washington, EHS includes the following:

- Hazardous materials and toxic substances exposure associated with photovoltaic (PV) cells and battery systems
- Worker health and safety
- Wildfire hazards

1.2 Regulatory context

Federal, state, and local regulations for health and safety apply to solar energy facilities in Washington. Table 1 lists the statutes, regulations, and other requirements related to EHS.

Table 1. Laws, plans, and policies applicable to EHS

Regulation, statute, guideline	Description
Federal	
Comprehensive Environmental Response, Compensation, and Liability Act (as amended by the Superfund Amendments Reauthorization Act of 1986 and the Community Environmental Response Facilitation Act of 1992)	Provides a federal "Superfund" to clean up uncontrolled or abandoned hazardous waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment.
Clean Water Act	Establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters.

Regulation, statute, guideline	Description
Safe Drinking Water Act	Protects public health by regulating the nation's public drinking water supply.
Emergency Planning and Community Right-to-Know Act	Authorized by Title III of the Superfund Amendments and Reauthorization Act to help communities plan for chemical emergencies. It requires industry to report on the storage, use, and releases of certain chemicals to federal, state, Tribal, territorial, and/or local governments. It also requires these reports to be used to prepare for and protect their communities from potential risks.
Resource Conservation and Recovery Act (RCRA)	Gives the U.S. Environmental Protection Agency (USEPA) the authority to control hazardous waste from cradle to grave. This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also establishes a framework for the management of non-hazardous solid wastes.
Hazardous Materials Transportation Act (HMTA) of 1975	Empowered the Secretary of Transportation to designate as hazardous material any "particular quantity or form" of a material that "may pose an unreasonable risk to health and safety or property." Hazardous materials regulations are subdivided by function into four basic areas: Procedures and/or Policies 49 *Code of Federal Regulations* (CFR) Parts 101, 106, and 107. Material Designations 49 CFR Part 172. Packaging Requirements 49 CFR Parts 173, 178, 179, and 180. Operational Rules 49 CFR Parts 171, 173, 174, 175, 176, and 177. The HMTA is enforced by use of compliance orders [49 *United States Code* (USC) 1808(a)], civil penalties [49 USC 1809(b)], and injunctive relief (49 USC 1810). The HMTA (Section 112, 40 USC 1811) preempts state and local governmental requirements that are inconsistent with the statute, unless that requirement affords an equal or greater level of protection to the public than the HMTA requirement.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Federal Food, Drug, and Cosmetic Act	FIFRA provides for federal regulation of pesticide distribution, sale, and use. All pesticides distributed or sold in the United States must be registered (licensed) by USEPA. Before USEPA may register a pesticide under FIFRA, the applicant must show, among other things, that using the pesticide according to specifications "will not generally cause unreasonable adverse effects on the environment." FIFRA defines the term "unreasonable adverse effects on the environment" to mean: "(1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide, or (2) a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the standard under section 408 of the Federal Food, Drug, and Cosmetic Act."
49 CFR 173.185, which regulates the transportation of lithium-ion batteries	Regulations on how these types of batteries are classified and packaged.
49 CFR 173.159, which regulates the transportation of lead-acid batteries	Regulations on how these types of batteries may be packaged and transported.
29 CFR 1910.269, Electric Power Generation, Transmission, and Distribution standard	This section of the code covers the operation and maintenance of electric power generation, control, transformation, transmission, and distribution lines and equipment.

Regulation, statute, guideline	Description
Occupational Safety and Health Act of 1970	Ensures employers provide their workers a place of employment free from recognized hazards to safety and health, such as exposure to toxic chemicals, excessive noise levels, mechanical dangers, heat or cold stress, or unsanitary conditions.
2018 International Wildland-Urban Interface Code	Establishes regulations to safeguard life and property from the intrusion of wildland fire and to prevent structure fires from spreading to wildland fuels. Regulates defensible space and provides ignition-resistant construction requirements to protect against fire exposure and resist ignition by burning embers. Provides standards for emergency access, water supply, and fire protection. Provides requirements for automatic fire suppression and safe storage practices.
American National Standards Institute, design standards	Safety standards on construction sites and safe work environments; building and design standards that reduce expenses while raising quality.
American Society of Mechanical Engineers, design standards	Standards that enhance public safety, health, and quality of life, as well as to facilitate innovation, trade, and competitiveness, including energy storage.
Institute of Electrical and Electronics Engineering Guide for Substation Fire Protection (979-2012)	Guide developed to identify substation fire protection practices that generally have been accepted by industry.
International Building Code	Code preserving public health and safety that provides safeguards from hazards associated with the built environment.
International Fire Code	Establishes minimum requirements for fire prevention and fire protection systems using prescriptive and performance-related provisions.
National Electric Safety Code	Sets the ground rules and guidelines for practical safeguarding of utility workers and the public during the installation, operation, and maintenance of electric supply, communications lines, and associated equipment.
National Fire Protection Association (NFPA) Standards (NFPA 1141 Protection for Land Development, NFPA 1144 Reducing Structure Ignition Hazards)	Provides a methodology for assessing wildland fire ignition hazards around existing structures and provides requirements for new construction to reduce the potential of structure ignition from wildland fires.
National Institute for Occupational Safety and Health	Research, programs, and publications addressing occupational health and safety problems for workers.
United Facilities Criteria (UFC) for Fire Protection Engineering for Facilities (UFC 3-600-01)	This UFC must be used as the minimum standard for the planning and development of projects and design, construction, and commissioning documentation used for the procurement of facilities. It is the primary fire protection criteria reference document for services provided by architectural and engineering firms and consultants in the development of both design-bid-build and design-build contracts.
NFPA 855 Standards for Installation of Energy Storage Systems	Applies to facilities with co-located battery energy storage systems.

Regulation, statute, guideline	Description
State	
Chapter 70.94 Revised Code of Washington (RCW), Washington Clean Air Act	These regulations secure and maintain levels of air quality that protect human health and safety, including the most sensitive members of the population, to comply with the requirements of the federal Clean Air Act, to prevent injury to plants, animal life, and property; to foster the comfort and convenience of Washington's inhabitants; to promote the economic and social development of the state; and to facilitate the enjoyment of the natural attractions of the state.
Chapter 70.95 RCW, Solid Waste Management Act	These regulations establish a comprehensive statewide program for solid waste handling, solid waste recovery, and recycling.
Chapter 70.105 RCW, Hazardous Waste Management Act	These regulations establish a comprehensive statewide framework for the planning, regulation, control, and management of hazardous waste.
Chapter 70.105D RCW, Model Toxics Control Act (MTCA)	MTCA funds and directs the investigation, cleanup, and prevention of sites that are contaminated by hazardous substances.
Chapter 173.340 Washington Administrative Code (WAC), MTCA	These regulations establish administrative processes and standards to identify, investigate, and clean up sites where hazardous substances are located. Chapter 173.340 WAC implements MTCA in Chapter 70A.305 RCW.
Chapter 70.107 RCW, Washington State Noise Control Act	These regulations expand statewide efforts directed toward the abatement and control of noise.
Chapter 173-60 WAC, Maximum Environmental Noise Levels	These rules establish maximum noise levels and provide use standards relating to the reception of noise.
Chapter 90.48 RCW, Water Pollution Control Act	The Water Pollution Control Act sets standards to ensure the purity of all waters of the state and to work cooperatively with the federal government where interest overlaps in a joint effort to extinguish the sources of water quality degradation.
Chapter 173.303 WAC, Dangerous Waste Regulations	These regulations implement Chapter 70.105 RCW and designate policies for dangerous solid waste.
Chapter 173.350 WAC, Solid Waste Handling Standards	These regulations set performance standards, functions, priorities, and responsibilities for solid waste.
WAC 51-54A-8200, International Wildland-Urban Interface Code	The International Wildland-Urban Interface Code sets additional requirements code officials can require for structures and subdivisions located within the wildland-urban interface areas. These include a site plan, vegetation management plan, vicinity plan, fire apparatus access roads, and water supply.
Chapter 51-54A WAC, State Building Code Adoption and Amendment of the 2021 Edition of the International Fire Code	These regulations promote the health, safety, and welfare of the occupants or users of buildings through building codes.
Chapter 332.24 WAC, Forest Protection	These regulations are related to forest protection including burning permits, outdoor permits, forest debris, felling of snags, and burning plans.
Chapter 296.155 WAC, Safety Standards for Construction Work	These standards are minimum safety requirements for construction, alteration, demolition, related inspection, and/or maintenance and repair work performed in the state of Washington.

Regulation, statute, guideline	Description
Local	
Comprehensive plan goals and objectives, and local codes and requirements pertaining to environmental health and safety	Some local land use and environmental regulations may establish additional requirements on the storage and use of hazardous materials. Many counties and cities in Washington defer to state regulations for environmental health and safety.

2 Methodology

This section provides an overview of the process for evaluating potential impacts and the criteria for determining the occurrence and degree of impact.

2.1 Study area

The study area for EHS includes the overall solar geographic study area (Figure 1), as well as surrounding areas, for the purpose of evaluating wildfire risk, such as associated transmission lines and power stations, and regions at risk of wildfires as defined by the U.S. Department of Agriculture and Washington Department of Natural Resources (DNR). The study area also includes local disposal capacity for solid and hazardous wastes generated from construction and/or decommissioning of a solar energy facility.

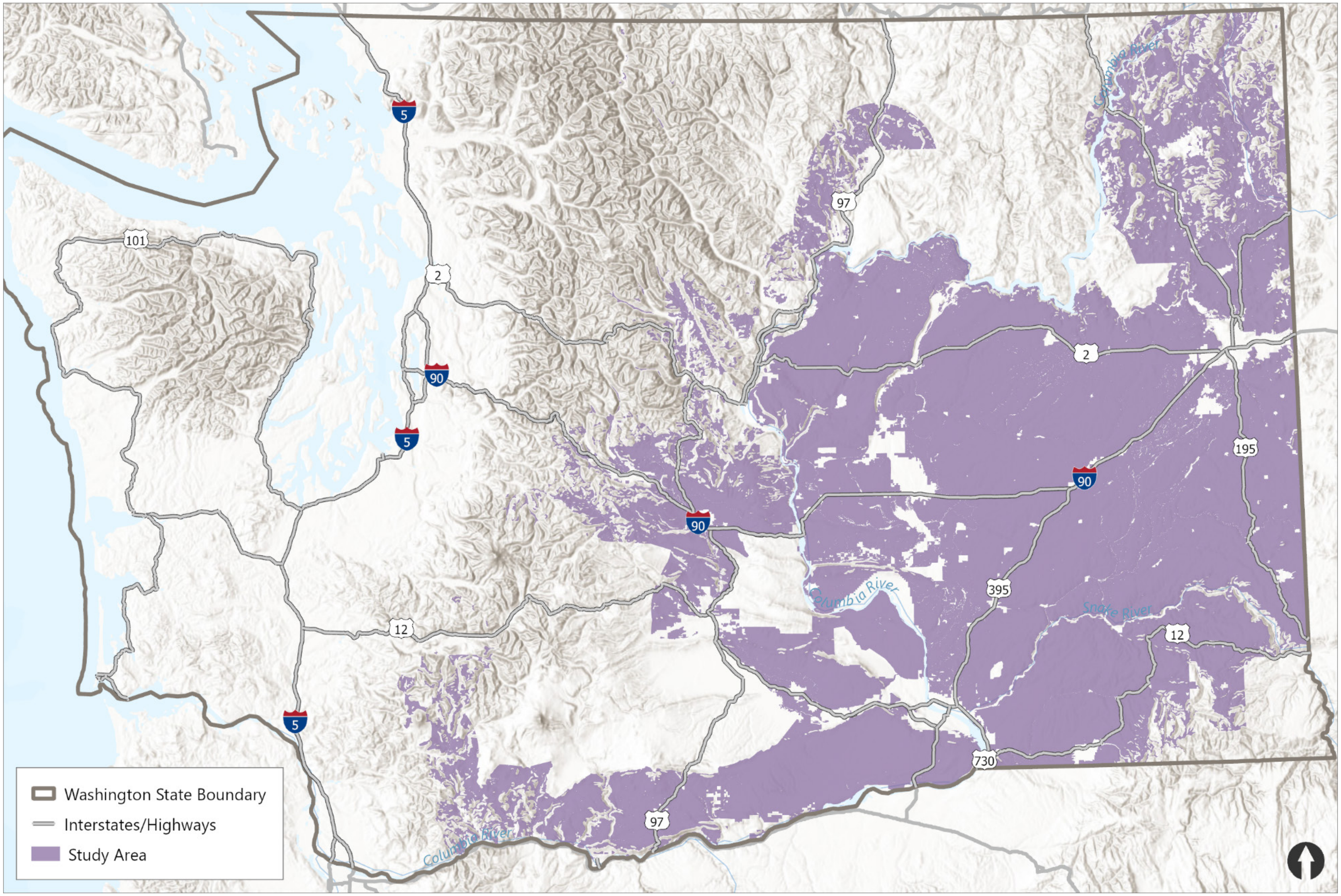

Figure 1. Solar Energy Facilities PEIS – geographic scope of study

2.2 Technical approach

The analysis was based on assumptions using similar facilities and activity types and their identified impacts. The best available science, publicly available data, and reference materials that informed impact assessments for other utility-scale solar energy projects informed this analysis. A qualitative assessment is provided of potential existing hazards in the study area, those that may result from typical facility construction, operation, and decommissioning activities, and the potential for public exposure to hazards or hazardous materials. Regulations and policies were reviewed for guidelines that may impact facility design, documentation, and reporting requirements, and best management practices (BMPs) for occupational safety. Research was conducted into additional considerations for activity types where agricultural and energy uses overlap. The content of this analysis also relies on other resource reports developed for the PEIS, including those addressing air quality, water resources, public services and utilities, and transportation.

2.3 Impact assessment

For purposes of this evaluation, a significant impact relative to EHS was considered to occur if a utility-scale solar energy facility would result in the following:

- Release of hazardous materials that increases the risk of environmental contamination (e.g., air or water) or increased threats to human health and safety
- Increase in physical safety risks resulting in a high likelihood of harm to facility workers or the public
- Increase in wildfire risk and associated hazard conditions

3 Technical Analysis and Results

3.1 Overview

This section describes the affected environment and potential EHS impacts that might occur for utility-scale solar energy facilities analyzed in the PEIS. This section also evaluates actions that could avoid, minimize, or reduce the identified impacts and potential unavoidable significant adverse impacts.

3.2 Affected environment

The affected environment represents the conditions before any construction begins. This section describes the major EHS hazards for potential facilities in the study area: hazardous materials, health and safety risks, and wildfires. Much of the study area is rural land consisting mostly of low-intensity land uses, especially agriculture, and undeveloped land. The presence of EHS hazards in the study area is mainly associated with former or existing development or other land use activities, whereas wildfire may be more prominent in undeveloped areas. Emergency response is also briefly discussed, and these capabilities are further described in the *Public Services and Utilities Resource Report* (ESA 2024a).

3.2.1 Hazardous materials

Large concentrations of hazardous materials can be present at industrial sites, as well as commercial and agricultural land uses. Hazardous materials that could be present at businesses or other sites may include, but are not limited to, petroleum products (such as gasoline, diesel, or oil); heavy metals (such as lead, cadmium, mercury, or arsenic); pesticides; solvents; compressed gases; and batteries. The quantities and use of hazardous materials vary greatly by land use. Small concentrations of hazardous materials may also be present along roads as a result of vehicular activity. This could include heavy metals, petroleum products, or hydraulic fluids. Small concentrations of hazardous materials could also be present in isolated areas away from current or past development as a result of human activity, such as illegal dumping.

The storage, use, and disposal of hazardous materials are regulated and monitored by the Washington State Department of Ecology (Ecology) under hazardous materials management programs. Sites with hazardous materials present or involved in other potentially environmentally impactful activity regulated by Ecology are listed in the Facility/Site Interaction database (Ecology 2024). Local land use and environmental regulations may establish additional requirements on the storage and use of hazardous materials.

Many active land uses in the study area are currently permitted to store, use, or dispose of hazardous materials or are required to document the presence of hazardous materials. A large portion of these hazardous materials are associated with agricultural land uses in rural areas. Hazardous materials associated with agriculture include pesticides, petroleum products, and fertilizers. The use of hazardous materials by farms in the study area largely falls under the jurisdiction of the federal Emergency Planning and Community Right-to-Know Act, which requires businesses that store hazardous materials over certain volumes to annually report the chemicals present on site to the state Emergency Response Commission, local emergency planning committees, and local fire departments for emergency planning. Parts of the study area along major roads or near concentrated development have a wider variety of land uses and associated hazardous materials uses, such as utility and fuel companies, which are often regulated as entities that generate, store, or dispose of hazardous waste (Ecology 2024).

Active and inactive land uses that are designated as toxic substance cleanup sites are documented by Ecology's Contaminated Site Register. Ecology's Toxics Cleanup Program documents and oversees cleanups of hazardous materials including petroleum, heavy metals, pesticides, and persistent organic pollutants. Cleanup sites may contain hazardous materials that are no longer permitted, many of which are classified as persistent organic pollutants, such as dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs; Ecology 2020a).

Cleanup sites are present at a low density throughout the study area, with higher concentrations of cleanup sites in areas of concentrated development. Use of any cleanup sites could pose risks of exposure to or release of hazardous materials. Use of these sites or development on former industrial sites could require remediation before construction or mitigation measures to reduce adverse impacts from disturbing contaminated sites.

The study area contains six cleanup sites on the National Priorities List under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as Superfund sites. These sites have hazardous material contamination present in the soil, surface water, or groundwater. Following remediation, some Superfund sites may be viable locations for utility-scale solar energy facilities. Superfund sites in the study area are detailed in Table 2.

Table 2. Superfund sites in the study area

Superfund site name and description	Site location description	Hazard ranking score (of 100)
Mica Landfill: 161-acre former municipal landfill.	Approximately 11 miles southeast of Spokane and 1.5 miles north of the Town of Mica. It is generally bounded on all sides by forest areas. Rural Route 7 runs parallel to the site to the west.	34.64
Colbert Landfill: 40-acre capped former municipal and commercial landfill.	Bordered by low-density residential properties and forested areas to the north, the North Elk Chattaroy Road to the south and east, and Spokane County Regional Solid Waste and North Newport Highway to the west.	41.59
Pasco Sanitary Landfill: The site is nearly 200 acres and was used as an open burning dump followed by a sanitary landfill.	In Franklin County, approximately 1.5 miles northeast of Pasco, Washington. It is surrounded by agriculture and commercial businesses.	44.46
Hanford 100-Area, Department of Energy: The site of Hanford's nine former plutonium production reactors built between 1943 and 1965. They were constructed next to the river because of the availability of hydroelectric power and cooling water needed to operate them. These reactors were needed to facilitate the process by which the natural element uranium was changed into the man-made element plutonium, which was the critical substance required for atomic weapons to be produced.	Hanford's 100 Area is the part of the Hanford Site located along the banks of the Columbia River.	46.38
Hanford 200-Area, Department of Energy: The 200-Area, known as the Central Plateau, is home to many cleanup projects and remediation efforts involving both solid and liquid wastes. The 200 Area also features hundreds of other facilities and structures. Many of these facilities were critical to processing plutonium, while others were office buildings or related to the infrastructure needs of the site. Some remain in use today as the cleanup mission continues, while others are no longer used, have been demolished, or are scheduled to be demolished in the future.	Benton County, North of the City of Richland. Barren environment with isolated areas of intense development. The 75-square-mile area is made up of the 200 East and 200 West areas, which are separated by several miles.	69.05
Hanford 300-Area, Department of Energy: The 300-Area contained the reactor fuel manufacturing plants and the research and development laboratories. A 19,000-acre portion of this area is available for lease for clean energy use.	Benton County, north of the city of Richland. Barren environment with isolated areas of intense development.	65.23

Sources: Energy 2024a; USEPA 2024a

3.2.2 Health and safety risks

Hazardous materials may affect workers and emergency responders at utility-scale solar facilities. Solar panels and electrical components and structures may pose risks of electrical hazards and accidents during maintenance activities. Distance from emergency services due to the rural nature of much of the study area is also a factor in considering occupational health and safety.

3.2.3 Wildfire risk

Wildland fires affect grasslands, forests, and brushlands, as well as any structures on these lands. They carry the potential for injury, loss of life, and damage. Such fires can occur from either human or natural causes. The type and amount of topography (e.g., slope, elevation, and aspect), weather/climate conditions (e.g., wind, temperature, and humidity), and vegetation/fuels are the primary factors influencing the degree of fire risk and fire behavior in an area. The combination of these factors, described in more detail below, can fuel or arrest the spread of wildfire if it occurs. The sections below also discuss wildfires and air pollution, as well as climate change and fire risk.

Washington has experienced many extreme fire events in recent years, partly attributed to climate change effects and the legacy of forest fire suppression practices, and this is expected to increase in the future. The combination of longer fire seasons, population growth, declining forest health, and other changing risk factors has made wildfire considerations a top priority in the state, as outlined in the *Washington State Wildland Fire Protection 10-Year Strategic Plan*. The plan recognizes the need for proactive management of the landscape, importance of maintaining a highly capable fire response workforce, and the need to prepare for expected increases in wildland fires in future years, among other considerations (DNR 2019).

3.2.3.1 Topography

Topography is the shape of the land including elevation (height above sea level), slope (the steepness of the land), aspect (the direction a slope faces), and features such as canyons and valleys. Topography can strongly influence fire behavior, including how fast a fire moves through an area; fire typically moves more quickly as it travels uphill compared to either downhill or across flat terrain. As heat rises in front of the fire, it preheats and dries upslope fuels, resulting in their rapid combustion (Bennett 2017).

Topography also influences patterns of precipitation and temperature. Washington can be categorized into geographic regions with respect to topography and the associated considerations for wildfire. The forested central Cascade Mountain region poses a relatively higher risk for extreme wildfire events compared to other parts of the state. However, due to the presence of forests and higher slopes in the mountains, fewer of these lands are included in the utility-scale solar geographic scope of study. Lands on the eastern slopes of the Cascade Range are subject to dry continental climate conditions with extreme temperatures and receive less precipitation due to the topographic rain shadow effect.

3.2.3.2 Weather/climate

Weather conditions such as wind, temperature, and humidity also influence fire behavior. Much of eastern Washington is included in the utility-scale solar geographic scope of study but is also the most arid region of the state and the region with the highest fire risk. Due to the relatively dry conditions, wildfires in eastern Washington are more common relative to other parts of the state. Fuels in hotter and drier temperatures are more susceptible to ignition and catch fire more readily than fuels in moister and/or cooler temperature conditions.

Climate change impacts multiple variables related to fire risk, including air temperature, precipitation, humidity, wind, solar radiation, and other interactive issues, such as forest health, invasive species infestations, and prolonged drought. Climate change also has an influence on forests and fire behavior because prolonged drought and invasive species infestations change conditions in a way that can exacerbate fires and lead to more extreme forest fires.

The University of Washington has conducted climate resilience mapping to model wildfire risk across the state through time. The map shows the projected change in high fire-danger days[1] compared to historical (1971 to 2000) averages. An increase in high fire-danger days indicates a greater potential for wildfire danger to damage infrastructure, interrupt businesses, and affect public health and well-being (UW 2024). Although the severity of fire risk varies across the geography of the state, it is notable that all counties show a large increase in the projected number of high fire days between the years 2040 and 2069, within the time frame of the solar energy facility lifespans.[2] The higher greenhouse gas (GHG) scenario[3] causes more warming by the end of the century than the lower GHG scenario;[4] thus, there is a notable difference in the high fire day projections across these scenarios depending on the level of projected emissions. Additional discussion of GHG emissions is provided in the *Air Quality and Greenhouse Gases Resource Report* (ESA 2024b).

The regions most at risk for wildfire are the Eastern Slope of the Cascades, Okanogan Big Bend, northeastern Washington, and the Blue Mountains of the southeastern Palouse. Among these regions, as of 2050, the likelihood of weather and fuel conditions conducive to wildfire are projected to range from 39% to 85% depending on location and scenario. As of 2075, conditions are projected to range between 42% and 90%. For reference, fire risk for these same four regions ranged from 11% to 63% during the 1980 to 2009 reference period (Hammerschlag

---

[1] A high fire-danger day is defined by UW in the context of climate resilience mapping as a day in which 100-hour fuel moisture (i.e., the amount of water in fuel/vegetation available for combustion) is less than the historical 20th percentile.

[2] To assess fire risk probability (based on the UW data) the Climate Background Report (Hammerschlag 2024) used the year 2050 as a linear interpolation between the years 2030 to 2059 and 2040 to 2069 "normals."

[3] The higher GHG emissions scenario is also referred to as the representative concentration pathways (RCP) 8.5 scenario or, more commonly, as the "business as usual" scenario. This scenario assumes that use of coal and other carbon-based pollutants may continue to dominate the energy sector in the future.

[4] The lower GHG scenario is also referred to as the RCP 4.5 climate modeling scenario. RCP 4.5 assumes that climate policies are invoked (or implemented) to achieve the goal of limiting emissions and radiative forcing.

2024). A marked increase in conditions conducive to wildfire is projected to occur within the operational timeframe of the solar energy facilities.

3.2.3.3 Vegetation/fuels

Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel sources are diverse and include dead tree leaves, twigs, branches, and standing trees; live trees; brush; and dry grasses. Additional fuel sources can include structures such as homes, buildings, and other associated combustible materials. Natural communities in the eastern Cascades and the foothill region, as noted in the *Biological Resources Report* (Anchor QEA 2024), contain vegetation highly susceptible to wildfire conditions. Fire-adapted natural communities are discussed in additional detail in the *Biological Resources Report*.

DNR has developed a mapping tool in collaboration with the U.S. Forest Service (USFS) to depict the wildland-urban interface in the state. The wildland-urban interface refers to the areas where wildlands and structures or developed, human-inhabited areas meet or intermingle. For planning purposes, the wildland-urban interface can be evaluated at the county level using the mapping tool and is illustrated on Figures 2a and 2b. Wildlands include many types of natural communities where roughly 50% of the ground surface is vegetated. Wildlands in the state include forests, woodlands, sagebrush-steppe, and open grasslands, among others. The interface is often located along the fringe of urban development. To be considered interface, development/structures must border the wildlands on at least one side. Low-density, undeveloped pockets of urban areas are referred to as wildland-urban "intermix" for mapping purposes. These areas include structures surrounded on two or more sides by wildlands (DNR 2022).

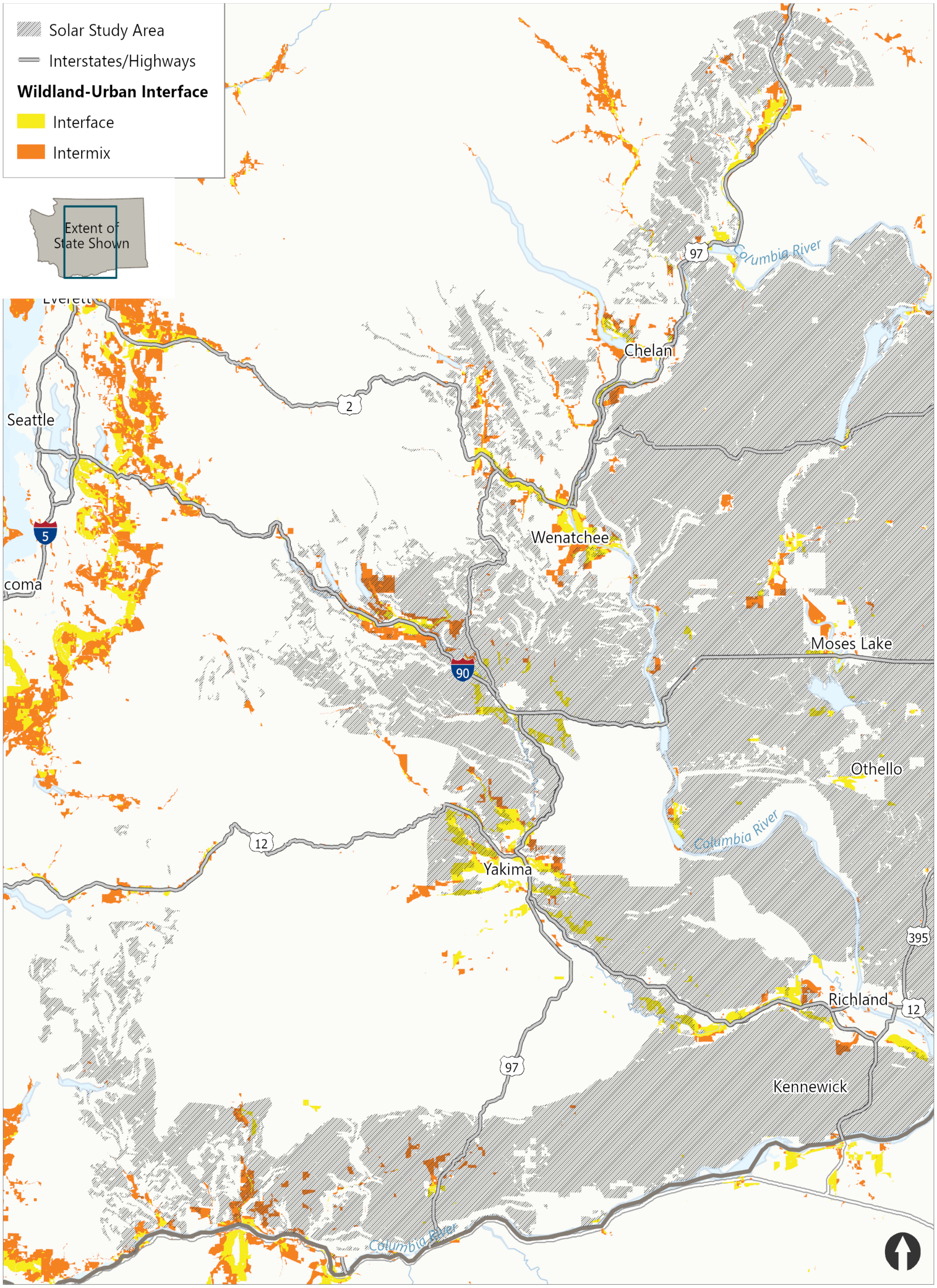

Figure 2a. Wildland Urban Interface – western Washington

Data sources: USFS 2023; DNR 2022

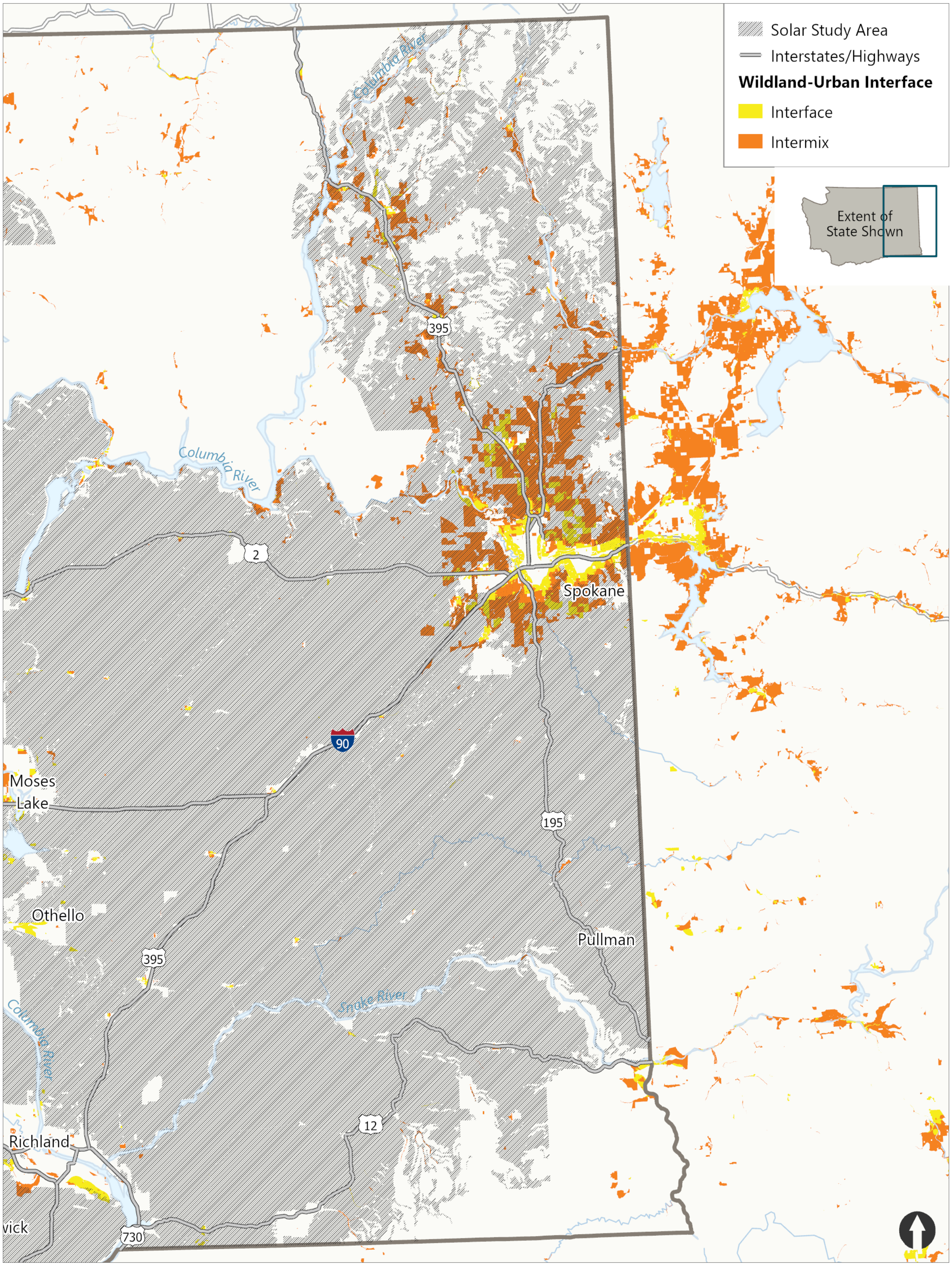

Figure 2b. Wildland Urban Interface – eastern Washington

Data sources: USFS 2023; DNR 2022

3.2.3.4 Wildfires and air pollution

Smoke generated through wildfires is composed of a mixture of gaseous pollutants (e.g., carbon monoxide), hazardous air pollutants (e.g., polycyclic aromatic hydrocarbons), water vapor, and particle pollution. Particle pollution is the main component of wildfire smoke and the principal concern for public health. The wildfire crisis is considered a public health crisis; as wildfires increase in their size and severity over time, the related public health effects are anticipated to increase. As of 2024, wildland fires and prescribed fires account for 44% of the nation's primary emissions of fine particulate matter (USEPA 2024b). As wildfires burn fuel, large amounts of carbon dioxide, black carbon, brown carbon, and ozone precursors are released into the atmosphere. Additionally, wildfires emit a substantial amount of volatile and semivolatile organic materials and nitrogen oxides that form ozone and organic particulate matter. These emissions can lead to harmful exposures for first responders, nearby residents, and populations in regions that are farther from the wildfires (NOAA 2021). Exposure to these pollutants can generate asthma attacks, coughing, and shortness of breath. Refer to the *Air Quality and Greenhouse Gases Resource Report* for additional information about potential air contaminants.

3.2.3.5 Wildfire response capabilities

Portions of the study area are not under local jurisdiction for fire response. Lands in or near national forests or Bureau of Land Management (BLM) land are under USFS or BLM jurisdiction for fire response. At the state level, DNR provides fire protection on properties it manages. DNR works with other state, federal, and local agencies to respond to wildfires and offers local fire districts and volunteer units with support with fire protection and safety equipment requirements. DNR implements industrial fire precaution levels to limit certain activities as conditions warrant in lands under their jurisdiction.

DNR manages an aviation response and helitack program available for dispatch throughout Washington state. Crews are staged in multiple locations statewide during the fire season and respond to threats to human life, property, and natural resources. Helitack crews are teams of firefighters who are transported by helicopter to wildfires. Available for dispatch throughout all of Washington state, these small teams provide initial attack capacity to fires occurring in areas not easily reached by ground (Figure 3).

Figure 3. Example of type of helicopter used to respond to wildfires

Image source: DNR 2024

DNR Wildfire Aviation is a highly trained air-ground firefighting team available for initial attack rapid response to wildland fires (Figure 4). Wildfire Aviation has 10 UH-1H(M) Huey helicopters modified for water/suppressant delivery in remote locations with the capability to deliver helitack crews into otherwise unreachable terrain. The primary aviation bases are in Olympia and Yakima. Historically, DNR helitack program crews have been staged in Omak, Deer Park, Dallesport, Pomeroy, Wenatchee, Colville, and Olympia (DNR 2024).

Figure 4. Example of aerial firefighting response

Image source: DNR 2024

DNR implements industrial fire precaution levels to limit certain activities as conditions warrant in a given region. USFS and BLM also provide aerial fire response through aviation and helitack operations for lands under federal jurisdiction.

The *Washington State Wildland Fire Protection 10-Year Strategic Plan* recognizes the need for proactive management of the landscape, the importance of maintaining a highly capable fire response workforce, and the need to prepare for expected increases in wildland fires in future years (DNR 2019). Figure 5 depicts large fires that have occurred near the study area in recent decades.

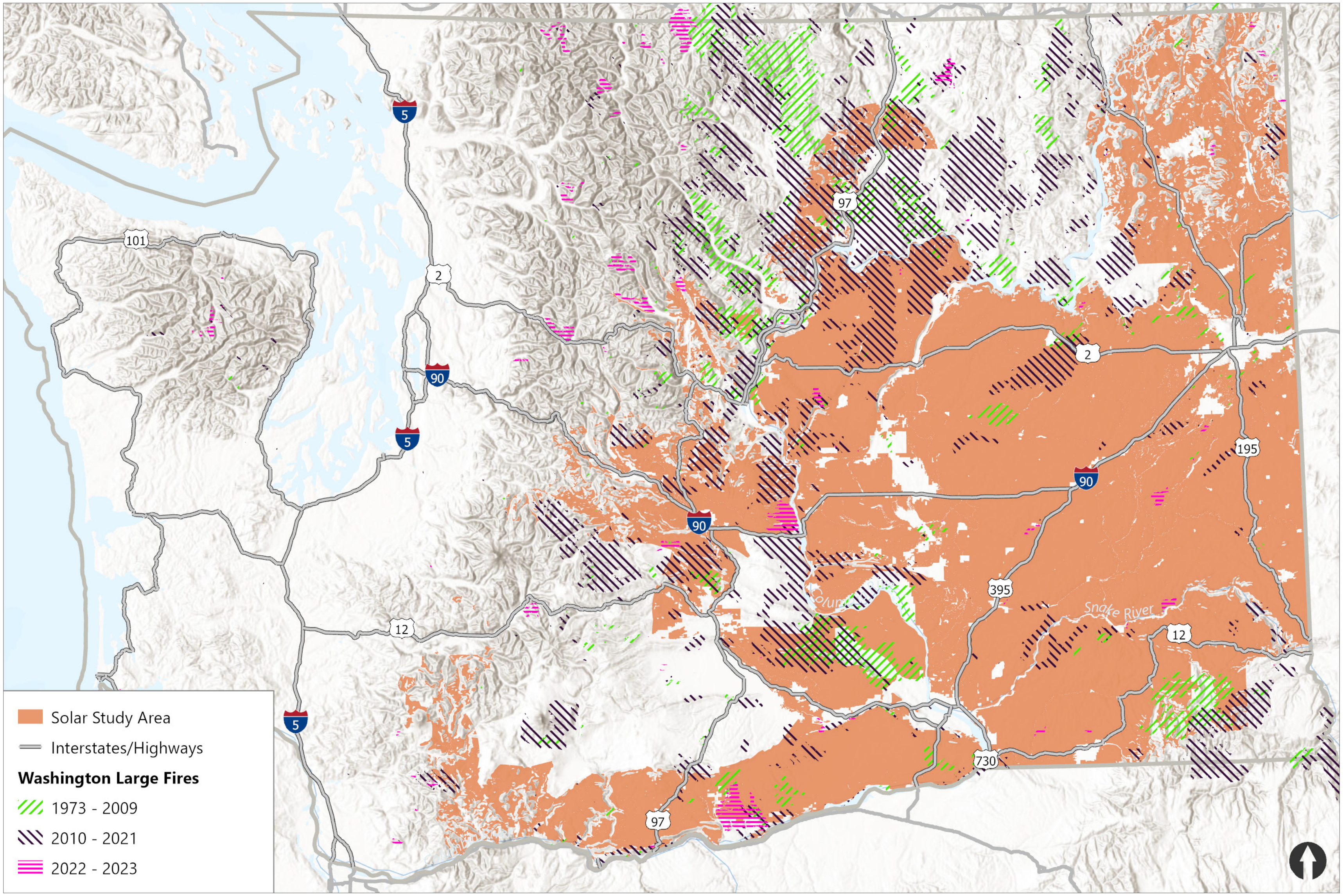

Figure 5. Washington large fires

Data sources: DNR 2023

3.2.4 Emergency response services

Emergency response in the study area includes law enforcement, fire departments, and emergency medical services. Impacts to emergency response services are addressed in the *Public Services and Utilities Resource Report*.

3.3 Potentially required permits

The following permits related to EHS would be required for construction, operation, or decommissioning of typical solar energy facilities and activities:

- **Right-of-Way (federal or state land manager):** Placement of facility infrastructure on lands under federal or state management jurisdiction requires approval from the applicable federal or state land manager.
- **Air Prevention of Significant Deterioration and Water Discharge Permit (Ecology or the Energy Facility Site Evaluation Council):** Air and water discharge permits may be required depending on the planned level of contaminants discharged to air and whether discharge to waters of the state is proposed.
- **Conditional Use Permit (local county or municipality):** Operation of a utility-scale solar facility may require a use permit or a conditional use permit subject to review and approval by the jurisdiction (county or municipality) of its proposed operation. The use permit process would include review of EHS considerations.
- **Local government permits (county or municipality):** Various construction activities and placement of new or modification of existing utilities if proposed as part of a solar facility would be subject to local permits to ensure compliance with land use, grading and drainage, stormwater management, building standards, etc.

3.4 Small to medium utility-scale facilities of 20 MW to 600 MW (Alternative 1)

This section describes potential impacts on EHS due to the construction, operation, and decommissioning of small to medium utility-scale solar energy facilities.

3.4.1 Impacts from construction

3.4.1.1 Hazardous materials

Small to medium utility-scale facilities could contain between 60,000 and 1,800,000 solar modules. Hazardous materials may be present in solar modules, including cadmium telluride, copper indium diselenide, and copper-indium gallium selenide. Hazardous materials in solar modules are typically only present in small amounts, and some modules do not contain hazardous materials or contain them in amounts small enough to not be classified as hazardous (USEPA 2023a; International Renewable Energy Agency 2016).

Failure of or damage to PV solar equipment is rare, but the potential for damage that could release hazardous materials may be increased during transport and installation during construction phases or during incidents like wildfires. The International Energy Agency (IEA) conducted a study titled *Human Health Risk Assessment Methods for PV Part 2: Breakage Risks* in 2019 (Sinha et al. 2019). PV modules are designed and tested for long-term durability in harsh outdoor environments. The IEA found 0.04% may break during installation or annually while in operation. Of this percentage, over one-third occur during shipping and installation and are removed prior to operation, and the breakage rate declines after installation. The IEA scenarios assumed a broken module would remain undetected and in the field for 1 year, though these would likely be identified during routine maintenance more frequently. Higher breakage rates are possible given extreme weather and wildfire events, but these would be subject to emergency response and cleanup. That would limit the likelihood of broken modules remaining undetected for a long period of time.

The IEA assumed the primary mechanism by which chemicals would be released is by leaching by rainwater that falls on broken modules, with breakage defined as modules with cracked glass or broken module pieces. In this case, chemicals could be transported in runoff from the modules to the soil and soil porewater, which further could be transported to groundwater. In addition, once in the soil, the particles could be emitted to air by wind erosion. The IEA evaluated potential health effects through a comparison of predicted exposure point concentrations in soil, air, and water with risk-based screening levels published by the U.S. Environmental Protection Agency (USEPA). It looked at exposure point concentrations of lead and cadmium for crystalline-silicon and cadmium telluride PV modules and found that for utility-scale system, exposure was several orders of magnitude below USEPA health screening values in soil, air, and groundwater. These values account for chronic exposure to chemicals, protective of both cancer and noncancer endpoints.

Table 3 lists the types of hazardous materials that may be used in construction of utility-scale solar energy facilities.

Table 3. Common hazardous materials used or present in solar energy construction

Materials	Typical use
Compressed gases: oxygen, acetylene, and nitrogen	Welding, cutting, and purging
Fuels: diesel, gasoline, kerosene, and propane	Vehicles, generators, and maintenance equipment
Vehicle and equipment fluids: lubricants, hydraulic fluids, brake fluids, and coolants	Used for typical functions and maintenance of vehicles and equipment
Solvents and cleaning agents	Cleaning, maintenance, and preparing surfaces for paint or other treatment
Paints, primers, thinners, corrosion control coatings, sealants, and adhesives	Weatherproofing and preservation of equipment and structures, other construction and maintenance processes
Herbicides and pesticides	Vegetation and insect control

Materials	Typical use
Battery electrolytes	Vehicle and equipment batteries
Dielectric fluids	Anti-conductive insulation for electric components, such as wires

The Washington State Model Toxics Control Act (MTCA) dictates the handling and cleanup of these types of hazardous materials. Accidental releases would need to be contained, assessed, and remediated, with hazardous waste transported and disposed of in line with state and federal regulations.

Hazardous materials are present in vehicles, construction equipment, transformers, and other materials used in utility-scale facility construction and site characterization. These include petroleum products, hydraulic fluids, batteries (including lead-acid batteries and nickel cadmium batteries), solvents, corrosion control coatings, and spent hazardous material containers. In rare instances of accidents, including equipment failure or damage to construction materials, spills of hazardous materials could be possible. MTCA regulates the handling and cleanup of these types of hazardous materials. Spills would need to be contained, assessed, and remediated, with hazardous waste transported and disposed of in line with state and federal regulations. Any waste generated from these hazardous materials would be in small quantities. Hazardous waste would be disposed of in portable containers before being transported off site by a permitted hazardous waste transporter to a permitted hazardous waste treatment, storage, or disposal facility.

Impacts from hazardous materials during construction of solar energy facilities are unlikely. Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to happen at a scale that could result in risk of environmental contamination or an increase in threats to human health and safety.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the construction of small to medium utility-scale facilities would likely result in **less than significant impacts** related to hazardous materials.

3.4.1.2 Health and safety

Construction and site characterization activities in the study area would present similar health and safety risks to workers as those that are present on other industrial construction sites. Impacts on the public are unlikely. Public access to the facility would be restricted by fences, which would limit public exposure to potential hazards.

Occupational health and safety hazards associated with the construction and site characterization of utility-scale solar energy facilities could include but are not limited to the following:

- Falls from facility structures
- Collisions with construction vehicles

- Exposure to electricity
- Exposure to hazardous materials
- Exposure to the elements, including extreme conditions, and sunlight
- Explosions, fire, or high-temperature materials
- Exposure to high-volume construction noises
- Exposure to dangerous plants or animals

Facilities would follow Occupational Safety and Health Administration (OSHA) regulations, which establish required safety protocol, risk reduction measures, and limitations on potential exposure to specific hazards. Occupational health and safety regulations relevant to the construction, operation, and decommissioning of solar energy facilities are detailed under the Occupational Safety and Health Act, including crane and hoist safety, electrical safety, fall prevention, lockout/tagout, heat/cold stress, and personal protective equipment. Additional health and safety requirements would be established during site-specific facility-level planning to address hazards specific to the facility or site. See Section 3.4.4.3 for suggested mitigation measures to include in these plans.

See Section 3.4.1.1 for IEA findings on human health exposure. This study found that for utility-scale system, exposure was several orders of magnitude below USEPA health screening values in soil, air, and groundwater (Sinha et al. 2019). These values account for chronic exposure to chemicals, protective of both cancer and noncancer endpoints.

Occupational health and safety risks during facility construction and site characterization could vary by geography across the study area and include exposure to the elements, falls in landscapes with steeper topography, or wildfire risk, as well as associated wildfire smoke exposure.

During construction and site characterization, impacts relative to health and safety are unlikely. While accidents could occur, laws, regulations, and industry standards are in place to prevent health and safety hazards in the workplace, including regulations specific to solar energy facilities. These requirements would be supplemented by facility- or site-specific health and safety plans.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the construction of small to medium utility-scale facilities would likely result in **less than significant impacts** related to health and safety.

3.4.1.3 Wildfire risk

Potential wildfire impacts associated with construction and site characterization of solar energy facilities consist of those related to the risk factors described in Section 3.2.3, combined with activities such as the use of equipment on vegetated lands that could ignite and increase wildfire risk.

Construction activities could generate ignition risks that require careful management, especially in areas of high fire risk. The likelihood of a solar energy facility or related gen-tie lines igniting a wildfire is low. Fires from PV solar panels are rare. Facilities could alter the behavior of fire due to structures, mowing, and land use changes. Equipment would need to meet state and international building and fire code standards. Where construction is proposed in wildland-urban interface or intermix areas, wildfires could spread to urban areas. As described in the *Public Services and Utilities Resource Report*, proactive planning with federal, state, and local wildfire and emergency response agencies and compliance with OSHA requirements would reduce construction-related risks that could otherwise threaten workers or spread to surrounding urban or wildland areas.

Depending on the specific location, severity, and fire response capacity, there is potential that construction of small to medium utility-scale facilities would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

3.4.2 Impacts from operation

3.4.2.1 Hazardous materials

Hazardous materials potentially present during the operation of a utility-scale solar energy facility would be similar to those present during construction, and therefore potential impacts in the event of accidental releases of hazardous materials would be similar.

Operations and maintenance of a facility would require fewer on-site personnel and less-intensive labor than construction, which would result in a corresponding smaller amount of hazardous waste and fewer vehicles and equipment on site that could accidentally release hazardous materials.

Hazardous materials present in solar modules and other facility infrastructure would be consistent with the volume and type of hazardous materials present in these structures during construction. Following construction, there would be a reduced potential for accidents from human error that could result in accidental releases of hazardous materials, but a facility’s exposure to the elements and degradation over time could also somewhat increase the risk of damage or failure of infrastructure. A report on the types of cells and chemicals used in the manufacturing of PVs in 2001 to 2002, and their potential to impact health and the environment, stated the greatest risk of releases of gases (arsine and phosphine) or trace minerals (cadmium telluride and copper indium diselenide) would be from the manufacturing process (Ladwig and Hope 2003).

Impacts from hazardous materials during operation are unlikely. Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to happen at a scale that could result in risk of environmental contamination or an increase in threats to human health and safety.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the operation of small to medium utility-scale facilities would likely result in **less than significant impacts** related to hazardous materials.

3.4.2.2 Health and safety

The types of occupational health and safety hazards during operation are similar to those present during construction. While the types of hazards that people could be exposed to remain the same during operation, the risk of exposure would decrease in conjunction with a decrease in the scale and intensity of on-site labor compared to construction. In particular, the risk of falls from facility structures, vehicle collisions, and exposure to high-volume noises would be greatly reduced during typical operation and on-site maintenance. While accidents could occur, laws, regulations, and industry standards are in place to prevent health and safety hazards in the workplace.

Impacts on public health and safety from operation are unlikely. Public access to the facility would be restricted by fencing, gates, and signage, which would limit public exposure to potential hazards. In the case of a wildfire that damages PV panels, exposure would likely be limited to on-site workers or emergency responders, though air releases may affect people nearby, depending on site-specific conditions.

The potential for glare from solar modules would be limited by the use of anti-reflective glass on the solar modules. Further consideration of impacts from glare on nearby land uses or vehicular travel is in the *Aesthetics/Visual Quality Resource Report* (ESA 2024c).

While accidents could occur, laws, regulations, and industry standards are in place to prevent health and safety hazards in the workplace, including regulations specific to solar energy facilities. These requirements would be supplemented by facility- or site-specific health and safety plans.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the operation of small to medium utility-scale facilities would likely result in **less than significant impacts** related to health and safety.

3.4.2.3 Wildfire risk

The risk and extent of wildfires in Washington is growing because of climate change. Snow is melting earlier in the spring, leading to soil and forests that are drier and stay dry longer. This leads to wildfires that can burn hotter and spread faster. Climate change causes forest fuels (the trees and plants that burn and spread wildfire) to be drier and more ready to burn.

The potential for solar energy facilities to contribute to wildfire risk considers ignition risk associated with operational activities at a facility, along with the change in the landscape due to the presence of the facility. There are two main types of fire risks during facility operation: 1) those caused by solar energy facility operational activities; and 2) fires started outside of facilities that have altered behavior (i.e., spread, movement, or ability to be suppressed) due to the presence of a solar energy facility.

Fires from PV solar panels are very rare. The flammable parts (such as polymer outer layers, other plastic parts, and wiring insulation) are not known to support a substantial fire, and heat from a small flame is not sufficient to ignite a solar panel. However, incorrectly specified, sized, or faulty wiring or other equipment can cause a fire at a solar energy facility site. Like other electrical installations, PV solar systems can be subject to electrical faults, such as arcing,[5] short circuits, and ground faults.[6] Faulty connections or cable insulation breakdowns also can cause issues. If such events occur, they can result in heat that could ignite flammable material nearby.

Most wildfires started by electrical power are caused by the contact of trees and surface fuels with power lines. This can be from downed lines caused by a falling tree or strong winds, or from overgrown trees reaching power lines. Power lines are strategically spaced apart to prevent them from coming into contact with one another. However, if they do come into contact from wind or other outside factors, there could be high-energy sparks.

All solar and electrical equipment would be required to conform to state and international building and fire code standards. Transformers and on-site generators would require grounding systems or other protective measures to reduce the potential fire effects of lightning. These design measures would reduce ignition risks. Moreover, these facilities would require testing and inspection for grid and system safety prior to commissioning, which would reduce operational fire risks. Activities involving regular maintenance of a solar energy facility may include periodic electrical repair, welding, and equipment use and fueling. Such activities introduce risk for sparks or other ignition sources to an operational facility. However, these risks can be reduced through appropriate implementation of an Operational Site Safety Management Plan.

Siting solar energy facilities in rural or wildland areas may involve land use changes that contribute to fire risk. If, for example, irrigated agricultural operations are replaced by solar energy facilities, alterations in site contours, water use, and soil conditions could contribute to fire risk.

Operations and maintenance activities would include regular mowing and trimming of trees to control vegetation on the facility sites and associated electrical corridors. While these activities reduce a fuel source, they also involve ignition risks that could generate sparks and cause wildfires, which could spread into the surrounding landscape. The presence and use of electrical equipment on the facilities, including generation-tie transmission lines, would have inherent operational ignition risks that require appropriate site management. This analysis

---

[5] An arc, or arcing, occurs when electricity jumps from one connection to another.
[6] A ground fault is an inadvertent contact between an energized conductor and ground or a grounded equipment frame. The return path of the fault current is through the grounding system and any personnel or equipment that becomes part of that system. Ground faults can result from insulation breakdown.

assumes that solar energy facilities would be regularly maintained and monitored to reduce these risks. Accidents and fires could still occur; however, there is a low likelihood of operations activities igniting a wildfire.

Depending on the specific location, severity, and fire response capacity, there is potential that operation of small to medium utility-scale facilities would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

3.4.3 Impacts from decommissioning

3.4.3.1 Hazardous materials

The types of impacts related to hazardous materials that could occur during decommissioning of utility-scale solar energy facilities would be comparable to those during construction. However, decommissioning could involve a higher risk of releasing hazardous materials due to degradation of facility components or dismantling facility components.

Decommissioning would also include more recycling and disposal of solid and hazardous waste. A substantial portion of the materials that comprise solar energy facilities are recyclable, such as steel, aluminum, glass, copper, and plastic. As discussed in the *Public Services and Utilities Resource Report*, while solar module recycling is a relatively new process with few entities providing the service currently, by 2025 manufacturers of solar energy modules that operate or sell modules in Washington state will be required to take back and recycle solar energy modules (Ecology 2020b). The requirement for manufacturers to take back and recycle solar energy modules would likely expand the industrial capacity for recycling solar modules in Washington. Additionally, decommissioning efforts at a similar scale are typically contracted to companies with expertise in solid and hazardous waste management and the knowledge and capacity to manage waste from a facility. The scale of a utility-scale facility could result in long decommissioning processes but would be unlikely to result in risk of environmental contamination or an increase in threats to human health and safety.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the decommissioning of small to medium utility-scale facilities would likely result in **less than significant impacts** related to hazardous materials.

3.4.3.2 Health and safety

The types of occupational health and safety impacts that could occur during decommissioning of utility-scale solar energy facilities would be comparable to those that could occur during construction. Decommissioning could involve a higher risk of exposure to hazardous materials, electricity, or fire due to degraded or malfunctioning facility components.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the decommissioning of small to medium utility-scale facilities would likely result in **less than significant impacts** related to health and safety.

3.4.3.3 Wildfire risk

As with construction, decommissioning of small to medium facilities would involve the use of equipment and activities that could generate ignition risks. Similar to construction, ignition risks are low, but they could occur during facility decommissioning if, for example, equipment generated sparks near dry vegetation. Additionally, the study area is likely to experience additional climate change effects by the time of decommissioning, with a projected increase in the number of high fire-danger days. As described in the *Public Services and Utilities Resource Report*, proactive planning with federal, state, and local wildfire and emergency response agencies and compliance with OSHA requirements would reduce decommissioning-related risks of wildfire ignition and spread.

Depending on the specific location, severity, and fire response capacity, there is potential that decommissioning of small to medium utility-scale facilities would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

3.4.4 Actions to avoid and reduce impacts

Site-specific mitigation actions would be developed during project-specific reviews and permitting for each facility.

3.4.4.1 Siting and design considerations

Siting and design considerations are actions that could be taken by a proponent in developing a facility design or considering a site to avoid, minimize, and/or mitigate potential impacts.

Siting and design considerations that could avoid or reduce impacts from small to medium facilities include the following:

- Design facilities to reduce risks to neighboring land uses from gen-tie lines or other solar facility components, including potential setbacks, to reduce the risk of ignitions in fire-prone environments.
- Determine appropriate setbacks in consultation with local, state, or federal land managers. Setback distances should consider proximity to residences, terrain, vegetation management clearance requirements for gen-tie lines, vegetation and natural communities on surrounding lands, and the need to maintain access for maintenance and emergency response, among other considerations.
- Install water cistern(s) on site to store water for wildfire and structure fire suppression needs, as determined by the local fire marshal.
- Implement lightning protection measures to protect generators and other associated ground equipment, as well as reduce the potential for wildfires or other damage to equipment.
- Establish roads before accessing the site to minimize vehicle contact with grass.
- Design generation-tie transmission line rights-of-way to be wide enough to ensure there is a sufficient firebreak inside the right-of-way. This distance should be determined through coordination with the local fire marshal and DNR wildfire management staff, and

their recommended actions, both active and passive (e.g., vegetation manipulation) should be undertaken.

- Design a minimum 20-foot, noncombustible, defensible space clearance around the solar site perimeter fencing and structures, particularly buildings, to serve as a fire break.
- Consider underground gen-tie lines for areas with high fire risk.
- Install fire protection equipment in accordance with Washington State fire code.
- Locate refueling areas on paved surfaces and away from surface water locations and drainages; features should be added to direct spilled materials to sumps or safe storage areas where they can be subsequently recovered.
- Align solar arrays to reduce or avoid glare impacts on off-site areas.
- Select solar panels that can be recycled (for damaged or end-of-life modules) to reduce their adverse impact on the environment.

3.4.4.2 Permits, plans, and best management practices

BMPs are activities, maintenance procedures, managerial practices, or structural features that prevent or reduce pollutants or other adverse impacts. The following BMPs may be required in permits or plans by a regulatory agency:

- If the facility has an aggregate storage capacity of oil greater than 1,320 gallons or where a discharge could reach a navigable water body, either directly or indirectly, a Spill Prevention, Control, and Countermeasure Plan is required to prevent spills during construction and operation and to identify measures to expedite the response to a release if one were to occur. The plan will be prepared in consultation with Ecology and pursuant to the requirements of the *Code of Federal Regulations* Part 112, Sections 311 and 402 of the Clean Water Act, Section 402 (a)(1) of the Federal Water Pollution Control Act, and Revised Code of Washington (RCW) 90.48.080.
- Develop and implement an Emergency Management Plan to address worker health and safety, standards concerning potential release of hazardous materials, and fire prevention and control. These plans provide safety guidelines and procedures for potential emergency-related incidents during the facility’s construction, operation, and decommissioning phases. The plan should be developed in coordination with local fire and emergency service providers. The plan must meet applicable laws/codes, such as the following:
    - Washington Administrative Code (WAC) 463-60-352(2) through 463-60-352(4), which address fire and explosion, hazardous materials release, and safety standards compliance
    - WAC 463-60-352(6), which describes emergency plans to ensure public safety and environmental protection
    - International Fire Code
- Develop and implement a Hazardous Materials and Waste Management Plan to address the selection, transport, storage, and use of hazardous materials. This includes the construction, operation, and decommissioning phases and local emergency response and public safety authorities and should address the characterization, on-site storage, recycling, and disposal of all resulting wastes.

- Develop and implement a Noxious Weed or Vegetation Management Plan to prevent the establishment of non-native, invasive species on the facility site and along transmission line rights-of-way and roads to reduce fuel loads as an aid in wildfire management.
- Develop and implement an Operational Health and Safety Plan to inform employees and others on site about what to do in case of emergencies, including rapid shutdown procedures, the locations of fire extinguishers and nearby hospitals, telephone numbers for emergency responders, first aid techniques, and readily accessible Material Safety Data Sheets for all on-site hazardous materials.
- Coordinate with local fire departments and emergency management departments and provide access to the facility.
- Ensure that emergency service providers receive specialized training as needed.
- Ensure that emergency responders are fully informed regarding the facility's fire and hazardous materials risks and how to safely respond to fires and hazardous material spills or releases at the facility.
- In areas susceptible to wildfires, coordinate with local fire organizations early in the facility planning process to determine measures that would be incorporated into the design of the facility to prevent an increase in wildland fire frequency.
- The construction and facility manager would be responsible for contacting DNR and/or USFS for updates on wildfire conditions in the area and implementing any necessary wildfire precautions.
- In compliance with RCW 17.10.140, only use herbicides that are approved for use in the State of Washington by the U.S. Environmental Protection Agency (USEPA).
- Equip power transformers with an oil-level monitoring system. A loss of oil level would be sensed by this system, and an alarm message would be sent to the central alert system.
- Equip construction vehicles with fire extinguishers, spark arrestors, and heat shields, as appropriate.
- Use diesel construction vehicles instead of gasoline vehicles, where feasible, to prevent potential ignition by catalytic converters.
- Prohibit vehicles from idling in grassy areas.
- Restrict the use of high-temperature equipment in grassy areas.
- Monitor wildfire activity during facility construction/decommissioning and operation and, if necessary, modify activities, change the schedule, cease construction or operation, or remove equipment.
- Prevent and control potential wildfires and structure fires inside the facility with trained staff who have 24-hour access to the site.
- Develop Decommissioning and Site Reclamation Plan that details end-of-life management of hazardous and solid wastes, final site conditions, includes fire prevention measures, and provides timelines for decommissioning.

3.4.4.3 Additional mitigation measures

- Develop a site-specific Emergency Response Plan in coordination with the local fire district, including volunteer fire departments, emergency management departments, USFS, and/or DNR (if facility siting is proposed on or near wildlands) prior to and during construction and throughout the life cycle of the facility.

- Coordinate with the local fire district to ensure that adequate water supply is available for fighting fires. The facility proponent may also be able to demonstrate that adequate water supply is available for firefighting via an on-site well or other water storage.
- Ensure that emergency service providers receive specialized training and are fully informed regarding the facility's fire and hazardous materials risks and how to safely respond to fires.
- Use predictive digital monitoring and systems to identify fault indicators and reduce risks of equipment failure and fires.
- Use spark arrestors on all powered construction equipment (such as cutting torches and tools) when necessary due to extreme fire-danger conditions.
- Mandate that fire extinguishers be carried in all vehicles during construction and operation.
- Minimize vehicle contact with dry vegetation through the use of non-gasoline-powered and/or high-clearance vehicles.
- Maintain site management for vegetation control along the perimeter and in utility transmission corridors to reduce fuels and minimize emergency response demands.
- Install fire station boxes with shovels, water tank sprayers, and other firefighting equipment at multiple locations along roadways during the summer fire season.
- Maintain at least one water truck with sprayers for each 1 to 2 miles of access road for construction during the fire season.
- Do not allow gas-powered vehicles outside of graveled areas. Minimize vehicle contact with dry vegetation. Use high-clearance vehicles for any off-road activities.
- If blasting is conducted, clean vegetation from the evacuation zone and prepare water spray trucks and fire suppression equipment for use.
- Conduct blasting using state-licensed explosive specialist contractors.
- Use diesel-powered construction equipment without catalytic converters to reduce the chance of sparks.
- Restrict smoking to designated areas of the site as weather conditions permit.
- Install lightning protection and grounding systems at substations.

The facility- or site-specific health and safety plan with OSHA-compliant measures (OSHA 2024) should include the following:

- Crane and hoist safety
- Electrical safety
- Fall prevention
- Lockout/tagout
- Heat/cold stress
- Personal protective equipment

3.4.5 Unavoidable significant adverse impacts

Construction, operation, and decommissioning of small to medium utility-scale solar facilities may result in **potentially significant and unavoidable adverse impacts** related to wildfires if there are new ignition sources in remote locations with limited response capabilities. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

3.5 Large utility-scale facilities of 601 MW to 1,200 MW (Alternative 2)

A large-scale solar energy facility—ranging from 6,001 to 12,000 acres with 1,800,000 to 3,600,000 solar energy modules—could involve a higher number of incidents that could produce EHS hazards, or EHS hazards occurring at a larger scale due to the increased size of facilities.

3.5.1 Impacts from construction

3.5.1.1 Hazardous materials

Hazardous materials for construction and site characterization of large utility-scale solar energy facilities are the same as those listed in Section 3.4.1.1 and Table 3 for small to medium facilities. The potential for accidental releases of hazardous materials from individual cells or modules is small, but, compared to small to medium facilities, has a higher chance of occurring across construction of a large utility-scale facility.

Impacts from hazardous materials during construction are unlikely. Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to happen at a scale that could result in risk of environmental contamination or an increase in threats to human health and safety.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the construction of large utility-scale facilities would likely result in **less than significant impacts** related to hazardous materials.

3.5.1.2 Health and safety

Large facilities would include the same health and safety risks during construction and site characterization as those described for small to medium facilities. Because of the increased scale of the facilities compared to small to medium facilities, potential health and safety risks could be higher depending on the selected location.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the construction of large utility-scale facilities would likely result in **less than significant impacts** related to health and safety.

3.5.1.3 Wildfire risk

Large facilities would include the same wildfire risks during construction and site characterization as those described for small to medium facilities. However, because of the increased scale of the facilities compared to small to medium facilities, fire risk potential could be higher for large facilities, depending on the selected location. As described for small to medium facilities, proactive planning and compliance with requirements would reduce construction-related risks of wildfire ignition and spread.

Depending on the specific location, severity, and fire response capacity, there is potential that construction of large utility-scale facilities would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

3.5.2 Impacts from operation

3.5.2.1 Hazardous materials

Hazardous materials potentially present during operation of a utility-scale solar energy facility would be similar to those present during construction, which would have similar impacts in the event of accidental releases of hazardous materials as described for small to medium facilities. While accidental releases of hazardous materials from solar energy modules are rare, the risk of this occurring at a large utility-scale facility could be higher than the risk at a small to medium utility-scale facility. However, the risk of environmental contamination or an increase in threats to human health and safety is still unlikely.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the operation of large utility-scale facilities would likely result in **less than significant impacts** related to hazardous materials.

3.5.2.2 Health and safety

The types of health and safety hazards that people could be exposed to at facilities considered for large facilities would be similar to those considered for small to medium facilities.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the operation of large utility-scale facilities would likely result in **less than significant impacts** related to health and safety.

3.5.2.3 Wildfire risk

Large facilities would include the same risks during operation and maintenance as those described for small to medium facilities. However, fire risk potential could be higher for large facilities, depending on the selected location. This analysis assumes that solar energy facilities would be regularly maintained and monitored to reduce risks of ignition. Accidents and fires could still occur; however, the overall likelihood of operations activities igniting a wildfire is low.

Depending on the specific location, severity, and fire response capacity, there is potential that operation of large utility-scale facilities would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

3.5.3 Impacts from decommissioning

3.5.3.1 Hazardous materials

The types of impacts related to hazardous materials that could occur during decommissioning of utility-scale solar energy facilities would largely be comparable to those that could occur during construction. However, decommissioning could involve a higher risk of releasing hazardous materials due to degradation or dismantling of facility components.

Similar to small to medium facilities, decommissioning of large facilities would include more disposal of solid and hazardous waste. Because of the larger scale of the solar energy facilities, the risk is greater than that of small to medium facilities. The scale of the facility could result in longer decommissioning processes but would be unlikely to result in risk of environmental contamination or an increase in threats to human health and safety.

Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to happen at a scale that could result in significant impacts.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the decommissioning of large utility-scale facilities would likely result in **less than significant impacts** related to hazardous materials.

3.5.3.2 Health and safety

The types of occupational health and safety impacts that could occur during decommissioning of utility-scale solar energy facilities would largely be comparable to those that could occur during construction. Decommissioning could involve a higher risk of exposure to hazardous materials, electricity, or fire due to degraded or malfunctioning facility components.

Through compliance with laws and permits and with implementation of actions that could avoid and reduce impacts, the decommissioning of large utility-scale facilities would likely result in **less than significant impacts** related to health and safety.

3.5.3.3 Wildfire risk

Large facilities would include the same risks during decommissioning as those described for small to medium facilities. Because of the increased scale of the facilities compared to small to medium facilities, fire risk potential could be higher for large facilities, depending on the selected location. Proactive planning and compliance with requirements would reduce decommissioning-related risks of wildfire ignition and spread.

Depending on the specific location, severity, and fire response capacity, there is potential that decommissioning of a large utility-scale facility would have **less than significant** to **potentially significant adverse impacts** of wildfire due to risk of ignition.

3.5.4 Actions to avoid and reduce impacts

Site-specific mitigation actions would be developed during project-specific reviews and permitting for each facility. Available actions for large facilities would be the same as those proposed for small to medium facilities (see Section 3.4.4). It is assumed that the various actions, plans, permits, and BMPs could be scaled to accommodate a larger solar energy facility.

3.5.5 Unavoidable significant adverse impacts

Construction, operation, and decommissioning of large solar facilities may result in **potentially significant and unavoidable adverse impacts** related to wildfires if there are new ignition sources in remote locations with limited response capabilities. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

3.6 Solar facilities with battery energy storage systems (Alternative 3)

Facilities with a BESS would include the same systems as those considered in Sections 3.4 and 3.5, with the addition of one or two co-located BESSs each capable of storing up to 500 megawatts (MW) of energy. Most construction, operation, and decommissioning impacts of a facility with co-located BESSs would be similar to facilities without BESSs.

Additional considerations for impacts that could occur associated with the BESSs—which contain hazardous materials, could cause fires, and present challenges for emergency responders—are discussed in sections below.

3.6.1 Impacts from construction

3.6.1.1 Hazardous materials

Hazardous materials for construction would be the same as those listed in Section 3.4.1.1 and Table 3 for facilities without a BESS, with the addition of the following:

- Battery electrolytes, typically used in vehicle, equipment batteries, and BESS
- Dielectric fluids, typically used in anti-conductive insulation for electric components, such as wires

Thermal runaway events, where lithium-ion batteries overheat due to damage or failure of battery management systems (BMSs), are very rare for BESSs. If properly installed and maintained, flow batteries and zinc-bromide batteries are generally not flammable. Lithium-ion or flow batteries would contain toxic chemicals that could be hazardous in the event of a system failure, which could result in the battery leaking. If the batteries overheat or are damaged, they could leak toxic gases, including hydrogen fluoride, hydrogen chloride, hydrogen cyanide, and carbon monoxide. Toxic chemical leaks from battery failures are rare and would be less likely during construction compared to operation because BESSs would not be storing energy generated on site, which would greatly reduce the likelihood of batteries failing due to overheating.

Attempts to extinguish battery fires with water, which manufacturers typically advise against, could increase exposure to toxic chemicals through smoke, vapor, or contaminated runoff (ACP 2023). Once a fire has self-extinguished, there may be releases of flammable or toxic gases, including hydrogen fluoride, hydrogen chloride, hydrogen cyanide, and carbon monoxide. Spraying water on smoke or vapor released from the battery, whether burning or not, may cause skin or lung irritation. This is one additional reason for allowing the battery to burn in a controlled manner. The site should be entered only by trained firefighters or emergency responders wearing full protective gear. For additional information pertaining to lithium-ion BESS incidents, including guidance for first responders, see Attachment 1 of the *Public Services and Utilities Resource Report*.

WAC 51-54A-0322 includes requirements for storage of lithium-ion and lithium metal batteries. Permits are required when more than 15 cubic feet of most battery types are accumulated. A fire safety plan is required and must include emergency responses to be taken upon detection of a fire of possible fire. Where required by the fire code official, a technical opinion and report complying with Section 104.8.2 should be prepared to evaluate the fire and explosion risks associated with the storage area and to make recommendations for fire and explosion protection. The report must be submitted to the fire code official and should require the fire code official's approval prior to issuance of a permit. In addition to the requirements of Section 104.8.2, the technical opinion and report should specifically evaluate the potential for deflagration of flammable gases released during a thermal runaway event. Similar to facilities without a BESS, MTCA would dictate the handling and cleanup of these types of hazardous materials.

Impacts from hazardous materials during construction are unlikely. Accidents or failures that could release hazardous materials are rare, and if they do occur, they are unlikely to happen at a scale that could result in risk of environmental contamination or an increase in threats to human health and safety.

Most impacts related to hazardous materials would be similar to findings for utility-scale solar facilities above. If a thermal runaway event due to damage or BMS failure were to occur, facilities with lithium-ion BESSs would have **potentially significant adverse impacts** due to hazardous air emission risks to emergency responders associated with the BESS.

3.6.1.2 Health and safety

Facilities with BESSs would largely include the same health and safety risks during construction as those described for facilities without co-located BESSs.

Energy storage facilities can create hazards for firefighters and emergency responders, with the possibility of explosions, flammable gases, toxic fumes, water-reactive materials, electrical shock, corrosives, and chemical burns.

Additionally, batteries in the BESS could impact worker health and safety if there were a release of hazardous materials or fire. Exposure to toxic gases leaking from damaged batteries could cause irritation to the skin and lungs (ACP 2023). Battery failures that could produce these health and safety impacts are rare. Regular maintenance and emergency plans would help mitigate risks. The Washington State Patrol, Ecology, and representatives from industry and local fire protection districts are studying electric vehicle fires, which could result in additional best practices for battery incident response risk reduction.

Impacts on health and safety would be similar to findings for utility-scale solar facilities above, with additional risks to emergency responders associated with BESSs as noted in Section 3.6.1.1.

3.6.1.3 Wildfire risk

Facilities with BESSs would largely include the same wildfire risks during construction as those described for facilities without co-located BESSs; however, the BESSs present additional fire risks.

Specialized advance planning and procedures for enhanced fire response training would be required for solar energy facilities and co-located BESSs. Proactive planning and compliance with requirements would reduce risks of wildfire ignition and spread.

Impacts related to wildfire risk would be similar to findings for utility-scale solar facilities above.

3.6.2 Impacts from operation

3.6.2.1 Hazardous materials

Hazardous materials potentially present during operation of a utility-scale solar energy facility with BESSs would be similar to those present during construction, which would have similar impacts in the event of an accidental release as those described for facilities without co-located BESSs. The additional risk of hazardous materials leaks from batteries in the BESS could increase during operation compared to construction due to the increased potential for batteries to leak or ignite when overheating from energy storage. Hazardous materials present in BESSs would be consistent with the volume and type of hazardous materials present in these structures during construction.

Accidental releases of hazardous materials from solar energy modules or BESSs are rare, and if they do occur, the risk of environmental contamination or an increase in threats to human health and safety is still unlikely.

Impacts related to hazardous materials would be similar to findings for utility-scale solar facilities above, with additional risks to emergency responders associated with BESS operation as noted in Section 3.6.1.1.

3.6.2.2 Health and safety

The types of health and safety hazards that people could be exposed to would largely be the same as those considered for facilities without co-located BESSs. Additionally, operating risks could be higher due to the associated health and safety risks associated with BESSs.

Batteries in the BESS could impact worker health and safety through release of hazardous materials or fire. Battery storage may pose a risk of fire and explosion due to thermal runaway. Flammable electrolyte products can vaporize, vent from cells, and ignite on contact with an ignition source.

In addition, depending on the technology selected, batteries contain hazardous materials that pose potential risks for environmental release if not handled correctly and can introduce hazards for first responders (ACP 2023). See Section 3.6.1 for more information on exposure during fires.

For flow batteries, the stable voltage window of water is a relatively small 1.2 volts that shifts with pH. Outside of this window, hydrogen and oxygen can evolve along with toxic gases depending on the system chemistry. Because a system's power scales directly with increased nominal voltage, batteries typically operate at or just outside of the voltage window where gas can be generated. Hydrogen gas is flammable. The generated oxygen and hydrogen may be recombined into water to refill the battery or simply vented outside via an exhaust system (Energy 2024b). Toxic or corrosive gases, such as bromine, would be managed as a hazardous material (Trovò et al. 2023).

Exposure to toxic gases leaking from damaged batteries could cause irritation to the skin and lungs (ACP 2023). Battery failures that could produce these health and safety impacts are rare but would be more likely during operation due to the increased potential for batteries to leak or ignite in thermal runaway events.

Compliance with requirements, regular maintenance, and proactive emergency planning would help mitigate risks.

Impacts on health and safety would be similar to findings for utility-scale solar facilities above, with additional risks to emergency responders associated with BESS operation as noted in Section 3.6.1.1.

3.6.2.3 Wildfire risk

Facilities with BESSs would include similar types of wildfire risks during operations as those described for facilities without co-located BESSs, depending on scale, and with additional impacts associated with the BESSs.

The BESS would result in the presence of additional hazardous materials on site, which could spill or require cleanup and remediation following an accident. Battery incidents can be difficult to extinguish, and some battery types can reignite above certain temperatures after being put out. WAC 51-54A-0322 requires lithium battery storage containers to include a fire protection system. An Emergency Response Plan would specify emergency response measures to be taken upon detection of a possible fire, and adherence to setback distances (in siting and design) would reduce risks of a fire spreading. Additionally, BESSs are typically installed in a graveled area where vegetation clearing and gravel surfacing would be required.

Thermal runaway events are very rare for lithium-ion BESSs, and, if properly installed and maintained, BESSs are generally not flammable. Battery unit installation or replacement should follow manufacturers' specifications for spacing and clearance distances. Further, BESSs generally come equipped with remote alarms for operations personnel and emergency response teams, including voltage, current, or temperature alarms from the BMS. Other protective measures include ventilation, overcurrent protection, battery controls to operate the batteries within designated parameters, temperature and humidity controls, smoke detection, and maintenance in accordance with manufacturers' guidelines. However, should a thermal runaway event occur, it can be serious. For additional information pertaining to lithium-ion BESS incidents including guidance for first responders, see the *Public Services and Utilities Resource Report* Attachment 1.

Specialized advance planning and procedures for enhanced fire response training would be required to ensure that the solar energy facilities and co-located BESSs do not generate hazards for the public or emergency responders.

Impacts related to wildfire risk would be similar to findings for utility-scale solar facilities above.

3.6.3 Impacts from decommissioning

3.6.3.1 Hazardous materials

The types of impacts related to hazardous materials that could occur during decommissioning of utility-scale solar energy facilities with BESSs would largely be comparable to those that could occur during construction. However, decommissioning could involve a higher risk of releasing hazardous materials due to the degradation or dismantling of facility components.

Similar to facilities without a BESS, decommissioning of facilities would include more disposal of solid and hazardous waste, and these facilities would have the additional materials used in the BESS for disposal.

Although most, if not all, materials that comprise lithium-ion batteries are recyclable, they are often disposed of as hazardous waste due to a lack of recycling service providers for batteries (Gignac 2020). Because of the growing use of lithium-ion batteries for energy storage and other purposes, the USEPA has proposed rules to establish waste management regulations specific to the batteries and is undertaking efforts to advance industry capacity for battery recycling (USEPA 2023b). In 2023, Washington State adopted regulations under Chapter 70A.555 RCW, requiring battery manufacturers to collect and recycle small batteries, with a mandate that the Washington State Legislature assess and recommend options for collection and end-of-life management of large batteries, such as those used in BESSs (Ecology 2023). While the outcomes of these battery disposal regulations are uncertain, implementation of a statewide large battery collection and recycling system could greatly reduce impacts on local hazardous waste management capacity. Regardless of whether the batteries are recycled or disposed of as hazardous waste at their end of useful life, the batteries would be stored, handled, and transported in accordance with either hazardous waste regulations or battery-specific disposal standards, which would reduce the risk of releases of hazardous material.

Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to happen at a scale that could result in significant impacts.

Impacts related to hazardous materials would be similar to findings for utility-scale solar facilities above, with additional risks to emergency responders associated with BESSs as noted in Section 3.6.1.1.

3.6.3.2 Health and safety

The types of occupational health and safety impacts that could occur during decommissioning of utility-scale solar energy facilities with BESSs would largely be comparable to those that could occur during construction and would be largely the same as those described for facilities without BESSs. Decommissioning facilities with BESSs could involve a higher risk of exposure to hazardous materials, electricity, or fire due to degraded or malfunctioning facility components.

Impacts related to health and safety would be similar to findings for utility-scale solar facilities above, with additional risks to emergency responders associated with BESSs as noted in Section 3.6.1.1.

3.6.3.3 Wildfire risk

Facilities with BESSs would largely include the same wildfire risks during decommissioning as those described for facilities without BESSs but would present an additional fire risk. As discussed under construction, during decommissioning, BESSs can create fire risks and hazards for firefighters and emergency responders, with the possibility of explosions, flammable gases, toxic fumes, water-reactive materials, electrical shock, corrosives, and chemical burns. Depending on the level of maintenance during operations (i.e., how frequently faulty batteries are replaced) there may be a variable risk during decommissioning. For additional details regarding emergency response guidance for BESSs, see the *Public Services and Utilities Resource Report* Attachment 1.

In addition, as noted in Section 3.4.3, another consideration with decommissioning is the increased probability of high fire-danger days within the timeframe of decommissioning. Proactive planning and compliance with requirements would reduce risks of wildfire ignition and spread.

Impacts related to wildfire risk would be similar to findings for utility-scale solar facilities above.

3.6.4 Actions to avoid and reduce impacts

Site-specific mitigation actions would be developed during project-specific reviews and permitting for each facility. Available actions for facilities with BESSs would be the same as those in Section 3.4.4. Additional actions relative to the BESS are detailed below.

3.6.4.1 Siting and design considerations

BESSs should be designed and sited in a manner consistent with the current International Building Code and National Fire Protection Association (NFPA) Standards to minimize overheating and enable clearing of hazardous gases in the event of battery leaks or thermal runaway events. They must also comply with the latest Washington State Building Code Council regulations for batteries. Setback distances allowing for emergency ingress and egress and management/clearance of dry vegetation to allow access for first responders would also reduce risks of explosion and potential release of hazardous materials. If there is a thermal runaway event, the required setback distances also prevent spread from one container to another.

3.6.4.2 Additional mitigation measures

For solar energy facilities co-located with BESSs, the following mitigation measures specific to BESS safety training and emergency response are recommended.

Fire protection, prevention, and detection measures and design features should be implemented in accordance with the current Washington Fire Code, including providing redundant separate methods of failure detection. An Emergency Response Plan should be developed in advance of construction to train local emergency response personnel on hazards specific to BESSs during development and operation of the facility to include the current NFPA 855 Standards for Installation of Stationary Energy Storage Systems. The plan would be completed in accordance with industry guidance and existing state regulations, such as those governing public health and safety, hazardous materials business plans, and emergency response plans and procedures. The contents of the Emergency Action Plan would need to comply with existing state regulations and be developed in consultation with the county fire department, USFS or BLM for forests and lands under federal jurisdiction, DNR for applicable sites in or near wildlands and forests under state jurisdiction, and the energy storage system supplier. The plan would also define the roles, responsibilities, and training for local first responders.

Additional mitigation measures include the following:

- Develop comprehensive training programs and safety protocols for personnel involved in BESS operations and maintenance. Proper training can help minimize the risk of accidents and ensure prompt and effective response in case of emergencies.
- Develop detailed emergency response plans specific to BESS operations to mitigate the consequences of potential damage or failure of BMSs. This should include protocols for

containment, cleanup, and remediation in the event of soil contamination or environmental incidents.
- Implement regular maintenance schedules and inspections for BESS components to ensure optimal performance and early detection of potential issues. Routine maintenance can help prevent failures and minimize the risk of environmental contamination.

3.6.5 Unavoidable significant adverse impacts

Construction, operation, and decommissioning of utility-scale solar facilities with BESS **may result in potentially significant and unavoidable adverse impacts** related to wildfires if there are new ignition sources in remote locations with limited response capabilities. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

3.7 Solar facilities that include agricultural uses (agrivoltaic) (Alternative 4)

For a facility that includes agricultural land uses, any existing agricultural lands would be maintained, or new agricultural use could be co-located with the utility-scale solar facility. Agrivoltaic facilities may include raising or modifying site layouts to allow for agricultural use. The scale of solar energy facilities with co-located agricultural uses is assumed to be similar to facilities without agricultural use; therefore, most potential EHS impacts would be similar.

3.7.1 Impacts from construction

3.7.1.1 Hazardous materials

Hazardous materials for construction would be the same as those listed in Section 3.4.1.1 and Table 3 for facilities without agricultural uses but would also include agricultural machinery and equipment that may require use of petroleum hydrocarbons and the use of fertilizers, herbicides, and pesticides, depending on the type of agricultural use. The risks of leaks or spills from this equipment is similar to that described for other construction equipment. Measures to protect land from spills are typically included in a Spill Prevention, Control, and Countermeasure Plan.

Impacts from hazardous materials during construction are unlikely. Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to happen at a scale that could result in risk of environmental contamination or an increase in threats to human health and safety.

Impacts related to hazardous materials would be similar to findings for utility-scale solar facilities above.

3.7.1.2 Health and safety

Construction activities would present similar health and safety risks as those that could occur for facilities without agricultural land use. Agricultural operations would not occur in active construction areas, but agricultural activities nearby could increase the presence or risk of exposure to certain occupational health and safety hazards, such as potential exposure to livestock, fertilizers, herbicides, pesticides, other chemicals associated with agriculture, or biohazards from livestock.

Impacts related to health and safety would be similar to findings for utility-scale solar facilities above.

3.7.1.3 Wildfire risk

Facilities with co-located agricultural uses could include maintenance of existing agricultural operations during construction. In these cases, active management of the vegetative landscape could result in a beneficial cooling effect to the land and reduced fire risk compared to facilities without agricultural use. Coordination to reduce potential ignition risks at the agrivoltaics sites would still be required. For other types of facilities with co-located agriculture to be added, construction would present similar risks as those that could occur for facilities without agricultural land use. Emergency responders could also face delays or obstacles to accessing the facility due to the presence of agricultural gated areas or areas with livestock, which could exacerbate wildfire conditions.

Impacts related to wildfire risk would be similar to findings for utility-scale solar facilities above.

3.7.2 Impacts from operation

3.7.2.1 Hazardous materials

Hazardous materials potentially present during operation of a utility-scale solar energy facility with agricultural use would include those present during construction, which would have similar impacts in the event of accidental release as those described for facilities without agricultural land use. Additional hazardous materials on site during operation that may not have been present during construction include fuel for farm vehicles, fertilizers, herbicides, pesticides, or biohazards from livestock. Operations and maintenance of the facility would include more workers than facilities without agricultural land uses but would still require fewer on-site personnel and less-intensive labor than construction, which would result in a decrease in the generation of hazardous waste.

Farm vehicles or equipment uses on site could increase the risk of accidents and result in more potential hazardous material releases compared to the operation of facilities without agricultural uses.

The presence of agricultural operations would not substantially increase the risk of impacts. Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, the risk of environmental contamination or an increase in threats to human health and safety is still unlikely.

Impacts related to hazardous materials would be similar to findings for utility-scale solar facilities above.

3.7.2.2 Health and safety

The types of health and safety hazards that people could be exposed to would largely be the same as facilities without agricultural use. Agricultural activities on site could also increase the presence or risk of exposure to certain occupational health and safety hazards, such as potential exposure to fertilizers, pesticides, herbicides, livestock, biohazards associated with livestock, or other hazards associated with agricultural operations. The risk of exposure to occupational hazards that were present during construction would decrease during operation in conjunction with a decrease in the scale and intensity of on-site labor compared to construction. Other health and safety hazards include damage to facilities and potential injuries due to conflicts between workers and farmers or livestock. Coordination and planning with the agricultural operators would minimize risks of health and safety hazards during operations.

Impacts related to health and safety would be similar to findings for utility-scale solar facilities above.

3.7.2.3 Wildfire risk

Facilities with agricultural use would entail a different shared land use regime to accommodate grazing or other agricultural activities along with the operations and maintenance of solar energy facilities. Because there would be active management of the vegetative landscape (e.g., grazing, crop production, pollinator habitat), ignition risks would decrease while at the same time the presence of solar facilities would provide shade resulting in a beneficial cooling effect to the land, and it is assumed that wildfire risk for the agrivoltaics sites would generally be reduced.

Because of the shared land uses, coordination to reduce potential ignition risks at the agrivoltaics sites would still be required. Emergency responders could face delays or obstacles to accessing the facility due to the presence of agricultural livestock, fencing, or other facility operations, which could exacerbate wildfire conditions.

Impacts related to wildfire risk would be similar to findings for utility-scale solar facilities above.

3.7.3 Impacts from decommissioning

3.7.3.1 Hazardous materials

The types of impacts related to hazardous materials that could occur during decommissioning of utility-scale solar energy facilities would largely be comparable to those that could occur during construction. However, decommissioning could involve a higher risk of releasing hazardous materials due to degradation or dismantling of facility components.

Similar to facilities without agricultural uses, decommissioning of facilities with co-located agriculture would include more disposal of solid and hazardous waste. The use of farm vehicles or equipment on site could somewhat increase the risk of accidents that could result in releases of hazardous materials but would not substantially increase the risk of impacts. A Spill Prevention, Control, and Countermeasure Plan would include ways to prevent and contain spills.

Accidents or failures that could result in the release of hazardous materials are rare, and if they do occur, they are unlikely to happen at a scale that could result in significant impacts.

Impacts related to hazardous materials would be similar to findings for utility-scale solar facilities above.

3.7.3.2 Health and safety

The types of occupational health and safety hazards that people could be exposed to during decommissioning of facilities with agricultural uses would be comparable to those that could occur during construction. Similar to the construction phase, agricultural operations would not be expected to occur in active facility decommissioning areas, but agricultural activities nearby could increase the presence or risk of exposure to certain occupational health and safety hazards, such as potential exposure to livestock, fertilizers, herbicides, pesticides, other chemicals associated with agriculture, or biohazards from livestock. Similar to decommissioning facilities without agricultural land use, decommissioning could involve a higher risk of exposure to hazardous materials, electricity, or fire due to degraded or malfunctioning facility components than the construction and operation phases.

Impacts related to health and safety would be similar to findings for utility-scale solar facilities above.

3.7.3.3 Wildfire risk

As described for facilities without agricultural use, decommissioning of solar facilities that include agricultural uses would involve equipment and activities that could generate ignition risks. Similar to the construction phase, agricultural operations would not be expected to occur on the decommissioning site. However, emergency responders could still face delays or obstacles to accessing the facility, which could result in an increased risk for wildfires.

Impacts related to wildfire risk would be similar to findings for utility-scale solar facilities above.

3.7.4 Actions to avoid and reduce impacts

Site-specific mitigation actions would be developed during project-specific reviews and permitting for each facility proposed in the future. Available actions for facilities that include agricultural uses would be the same as those in Section 3.4.4. Additional actions relative to the co-located agricultural land use are detailed below.

3.7.4.1 Siting and design considerations

In addition to the siting considerations and measures listed in Section 3.4.4, it is recommended that proponents coordinate with existing or planned agricultural operators early on to outline plans for co-located agricultural uses.

3.7.4.2 Additional mitigation measures

Agreements with agricultural operators should be developed to establish acceptable agricultural practices on the facility site during construction, operations, and decommissioning, to protect the health and safety of employees. Examples of measures by OSHA and the National Association of State Public Health Veterinarians include the following (OSHA 2024):

- Animal-acquired infections and related hazards, including worker infection control measures and environmental control measures
- Hazardous equipment and machinery maintenance and operations
- Pesticides and other chemical handling
- Unsanitary conditions for workers
- Vehicle hazards and methods to reduce accidents, injuries, and fatalities

3.7.5 Unavoidable significant adverse impacts

Construction, operation, and decommissioning of solar facilities that include agricultural uses may result in **potentially significant and unavoidable adverse impacts** related to wildfires if there are new ignition sources in remote locations with limited response capabilities. Determining if mitigation options would reduce or eliminate impacts below significance would be dependent on the specific project and site.

3.8 No Action Alternative

Under the No Action Alternative, the city, county, state, and federal agencies would continue to conduct environmental review and permitting on a facility-by-facility basis in accordance with existing laws, regulations, plans, and standards. The same or similar impacts as those identified in this resource report would likely still occur. The same or similar mitigation would likely be used to reduce such impacts. The potential EHS impacts for future utility-scale solar energy developments under the No Action Alternative would be the same as those noted for Alternatives 1 through 4, depending on facility size and design, and would range from **less than significant** to **potentially significant adverse impacts**.

4 References

ACP (American Clean Power Association), 2023. *First Responders Guide to Lithium-Ion Battery Energy Storage System Incidents.* July 2023. Available at: https://cleanpower.org/resources/first-responders-guide-to-bess-incidents/.

Anchor QEA, 2024. *Biological Resources Report for Programmatic Environmental Impact Statement on Utility-Scale Solar Energy Facilities in Washington State.* Prepared for the Washington State Department of Ecology. September 2024.

Bennett, M., 2017. *Appendix B. The Effects of Topography, Weather, and Fuel on Fire Behavior.* Accessed March 6, 2024. Available at: https://ir.library.oregonstate.edu/downloads/m326m2061.

DNR (Washington Department of Natural Resources), 2019. *Washington State Wildland Fire Protection 10-Year Strategic Plan*. Available at: https://www.dnr.wa.gov/publications/rp_wildfire_strategic_plan.pdf.

DNR, 2022. *The Wildland Urban Interface Mapping Washington State's Fastest Growing Environment*. Blazina, Ashley and Kirk Davis, et al. Public web mapping tool. Accessed March 5, 2024. Available at: https://storymaps.arcgis.com/stories/7016c437623a445997c072a05e26afbb.

DNR, 2023. "Washington Large Fires 1973–2023." Accessed August 15, 2024. Available at: https://data-wadnr.opendata.arcgis.com/datasets/6f31b076628d4f8ca5a964cbefd2cccc/explore.

DNR, 2024. Aviation Program. Accessed August 8, 2024. Available at: https://www.dnr.wa.gov/Aviation.

Ecology (Washington State Department of Ecology), 2020a. "Cleanup Sites." Accessed February 28, 2024. Available at: https://ecology.wa.gov/spills-cleanup/contamination-cleanup/cleanup-sites.

Ecology, 2020b. *Manufacturer Plan Guidance for the Photovoltaic Module Stewardship Program*. Department of Ecology Solid Waste Management Program. Olympia, Washington. Revised 2020. Available at: https://apps.ecology.wa.gov/publications/documents/1907014.pdf.

Ecology, 2023. "Battery Stewardship." Accessed February 28, 2024. Available at: https://ecology.wa.gov/waste-toxics/reducing-recycling-waste/our-recycling-programs/battery-stewardship.

Ecology, 2024. Department of Ecology Facility and Site Interactions. Accessed February 28, 2024. Available at: https://waecy.maps.arcgis.com/home/item.html?id=e4905453d2a8426a934c8f56fea6fd35.

Energy (U.S. Department of Energy), 2024a. *The Hanford Site*. Accessed June 27, 2024. Available at: https://www.hanford.gov/.

Energy, 2024b. *Energy Storage Safety Strategic Plan*. Accessed September 3, 2024. Available at: https://www.energy.gov/sites/default/files/2024-05/EED_2827_FIG_SafetyStrategy%20240505v2.pdf.

ESA (Environmental Science Associates), 2024a. *Public Services and Utilities Resource Report for Programmatic Environmental Impact Statement on Utility-Scale Solar Energy Facilities in Washington State*. Prepared for the Washington State Department of Ecology. September 2024.

ESA, 2024b. *Air Quality and Greenhouse Gases Resource Report for Programmatic Environmental Impact Statement on Utility-Scale Solar Energy Facilities in Washington State*. Prepared for the Washington State Department of Ecology. August 2024.

ESA, 2024c. *Aesthetics/Visual Quality Resource Report for Programmatic Environmental Impact Statement on Utility-Scale Solar Energy Facilities in Washington State*. Prepared for the Washington State Department of Ecology. September 2024.

Gignac, J., 2020. *Cracking the Code on Recycling Energy Storage Batteries.* Union of Concerned Scientists. Accessed on February 27, 2024. Available at: https://blog.ucsusa.org/james-gignac/recycling-energy-storage-batteries/.

Hammerschlag, R., 2024. *Anticipated Climate Change in the PEIS Study Areas, 2025–2075.* Prepared for the Washington State Department of Ecology Shorelines and Environmental Assistance Program. Draft. March 3, 2024.

International Renewable Energy Agency, 2016. *End-of-Life Management: Solar Photovoltaic Panels*. Accessed on March 1, 2024. Available at: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2016/IRENA_IEAPVPS_End-of-Life_Solar_PV_Panels_2016.pdf?rev=49a75178e38c46288a18753346fb0b09.

Ladwig, K., and L. Hope, 2003. *Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells*. Final Report. EPRI, Palo Alto, California, and California Energy Commission, Sacramento, California. November 2003.

NOAA (National Oceanic and Atmospheric Administration), 2021. *The Impact of Wildfires on Climate and Air Quality: An Emerging Focus of the NOAA ESRL Chemical Sciences Division.* Accessed March 6, 2024. Available at: https://csl.noaa.gov/factsheets/csdWildfiresFIREX.pdf.

OSHA (Occupational Safety and Health Administration), 2024. "Green Job Hazards: Wind Energy." Accessed May 13, 2024. Available at https://www.osha.gov/green-jobs/wind-energy.

Sinha, P., G. Heath, A. Wade, and K. Komoto, 2019. *Human Health Risk Assessment Methods for PV Part 2: Breakage Risks*. Prepared for International Energy Agency. September 2019. Available at: https://iea-pvps.org/wp-content/uploads/2020/01/Task_12-Human_Health_Risk_Assessment_Methods_for_PV_part_2.pdf.

Trovò, A., G. Marini, W. Zamboni, and S. Sessa, 2023. "Redox Flow Batteries: A Glance at Safety and Regulation Issues." *Electronics* 2023(12):1844. Available at: https://doi.org/10.3390/electronics12081844.

USEPA (U.S. Environmental Protection Agency), 2023a. "End-of-Life Solar Panels: Regulations and Management." Accessed on March 1, 2024. Available at: https://www.epa.gov/hw/end-life-solar-panels-regulations-and-management.

USEPA, 2023b. "Improving Recycling and Management of Renewable Energy Wastes: Universal Waste Regulations for Solar Panels and Lithium Batteries." Accessed March 1, 2024. Available at: https://www.epa.gov/hw/improving-recycling-and-management-renewable-energy-wastes-universal-waste-regulations-solar.

USEPA, 2024a. Superfund National Priorities List (NPL) Where You Live Map. Accessed June 27, 2024. Available at: https://www.epa.gov/superfund/search-superfund-sites-where-you-live#map.

USEPA, 2024b. *Wildland Fire, Air Quality, and Public Health Considerations Fact Sheet.* Accessed March 6, 2024. Available at: https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-wildland-fire-air-quality-fact-sheet-final.pdf.

USFS (U.S. Forest Service), 2023. Wildland Urban Interface: 2020. Updated October 2, 2023. Accessed July 10, 2024. Available at: https://data-usfs.hub.arcgis.com/documents/7804d89ed1094ccb9aae753228e8d89a/explore.

UW (University of Washington College of the Environment), 2024. Public web mapping tool: "Climate Mapping for a Resilient Washington." Accessed March 1, 2024. Available at: https://data.cig.uw.edu/climatemapping/.