Exhibit G

Materials Analysis

Wagon Trail Solar Project
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Prepared for

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Acronyms and Abbreviations

Applicant	Wagon Trail Energy Center, LLC c/o NextEra Energy Resources, LLC
EPA	Environmental Protection Agency
Facility	Wagon Trail Solar Project
Li-ion	lithium-ion
MW	megawatt
O&M	operations and maintenance
OAR	Oregon Administrative Rules
SPCC Plan	Spill Prevention, Control, and Countermeasure Plan

1.0 Introduction

Wagon Trail Energy Center, LLC c/o NextEra Energy Resources, LLC (Applicant) proposes to construct and operate the Wagon Trail Solar Project (Facility), a solar energy generation facility and related or supporting facilities in Morrow County, Oregon. This Exhibit G was prepared to meet the submittal requirements in Oregon Administrative Rules (OAR) 345-021-0010(1)(g).

2.0 Construction Materials Inventory

OAR 345-021-0010(1)(g) A materials analysis including:

(A) An inventory of substantial quantities of industrial materials flowing into and out of the proposed facility during construction and operation.

The Applicant is requesting to permit a range of technology in order to preserve permitting flexibility and will stipulate the precise details of photovoltaic solar energy generation and related and supporting facilities during final design and engineering prior to construction. Therefore, this exhibit analyzes the maximum amount of materials anticipated within the Facility site boundary to address the maximum impact.

For the Facility, the Applicant will use photovoltaic solar modules composed of mono- or poly-crystalline cells supported on non-specular, galvanized steel racks. The modules are inert and will not introduce any hazardous materials to the Facility. Each tracker will be supported by steel posts. Other onsite equipment will include overhead and buried conduits, inverters, combiners, and transformers.

The Applicant proposes using a lithium-ion (Li-ion) battery energy storage system. Li-ion batteries are modular systems that contain multiple smaller battery cells. The cells are the primary containment for the gel or liquid electrolyte materials. The module containing the cells is relatively small, generally about the size of a desktop computer processer, and serves as leak-proof secondary containment. Modules are placed in anchored racks within concrete containers. Although leaks from the modules are very unlikely, because any leak will require failure of the individual cells as well as the sealed module, any material that might leak from the cell into the module and then to the floor of the container will easily be contained within the container. The Li-ion batteries will be manufactured offsite and will be shipped to the site as self-enclosed prefabricated modules, which will be installed and electrically connected on site.

The primary construction materials for the Facility are rock and gravel (aggregate), steel, water, concrete, and assorted electrical equipment. Table G-1 provides an inventory of materials that will be used during Facility construction, based on current engineering estimates. The amount of water required for construction is discussed in Exhibit O. Solid wastes generated and flowing out of the Facility during construction are discussed in Section 5.1 and outlined in greater detail in Exhibit W.

Table G-1. Inventory of Construction Materials

Material	Quantity/Units	Ultimate Disposition
Solar modules	Maximum 965,007 modules	Throughout each solar module string
Steel solar module tracker posts	213,585 posts, 3.2 million tons steel (150 pounds per post)	Throughout each solar module string
Solar modules per string	27 modules (54 modules per rack, max 35,741 strings)	Throughout each solar module string
Aggregate (rock and gravel)	213,406 tons total	See below by location
• Battery storage	18,200 tons (35.0 acres)	On-site graveled area
• Inverters/Transformers	62 tons (142 stations)	On-site graveled area
• Access roads	125,950 tons (47 miles new road)	On-site graveled area
• Substations	55,104 tons (2 substations, the first 5 acres and second 11 acres)	On-site graveled area
• Operations and maintenance (O&M) building[1]	220 tons (0.2 acre)	On-site graveled area
• Temporary construction areas	13,870 tons (10 acres each, 4 temporary construction areas)	On-site graveled area
Concrete	70,781 cubic yards (yd^3) total	See below by location
• Battery storage	1,051 yd^3	Foundation
• Solar array (tracker posts)	64,076 yd^3	Foundation
• Inverters/Transformers	4,544 yd^3	Foundation
• Substations	1,000 yd^3	Foundation
• O&M building[1]	50 yd^3	Foundation
• Meteorological stations	60 yd^3 (4 stations)	Foundation
Lithium-ion battery racks	2,000 racks	Battery storage system
Combiner boxes	17,870 boxes	Aboveground throughout each solar module string
Collector lines (underground)	67.9 miles	Between solar array and substations, buried underground
Transmission line	0.6 miles	Between southern collector substation and Blue Ridge Substation
Inverter/transformers	142 (2-megwatt [MW]) stations	Aboveground throughout solar array
Fencing	247,632 feet	Will remain around solar array areas and collocated infrastructure

1. The Facility will either utilize the existing O&M building for the Wheatridge Renewable Energy Facilities I, II, and III or a new O&M building. Material amounts provided assume a new O&M building will be constructed for worst-case scenario estimates.

2.1 Rock and Gravel

Road construction will utilize rock and gravel (aggregate) for new, permanent access roads. No improvements or alterations are proposed for existing roads. Rock and gravel will also be used as ground-surfacing material for the battery energy storage system, around inverter/transformer stations in the solar array, access roads, collector substations, the operations and maintenance (O&M) building (if a new O&M building is constructed), and the temporary construction areas. Table G-1 provides the estimated tons of aggregate for each of these purposes.

The gravel placed at temporary construction areas will be removed following construction. The construction contractor will acquire the rock and gravel from existing or new commercial gravel pit sources in Morrow County.

2.2 Water and Concrete

Concrete will be required to create foundations for the battery energy storage system, solar array tracker system posts, inverter/transformer stations, collector substations, O&M building (if a new O&M building is constructed), and meteorological stations (Table G-1). This analysis conservatively assumes that all posts for the solar tracker system will require concrete foundations; however, the use of concrete for the posts is not anticipated. The actual foundation method may vary depending on the final tracker system and site-specific geological conditions.

Water will be required during construction for dust control, road compaction, concrete mixing, and drinking/sanitation.[1] The amount of water needed for construction will depend on site weather conditions during the construction period, as well as the final design of Facility components. Exhibit O provides detail on water quantities, assumptions, and sources.

2.3 Steel

Large quantities of steel will be needed for the solar array, as listed in Table G-1. The estimate is based on the proposed solar array layout using 213,585 steel posts to support the solar module trackers. Each post is assumed to have an average length of 10 feet, requiring approximately 150 pounds of steel per post.

2.4 Other Typical Construction Materials

A number of other materials will be brought on site to construct the solar array, battery energy storage system, and other related or supporting facilities (Table G-1). Electrical cable and combiner boxes will be used to connect the solar strings within the array and to the collector substations. The solar array will be constructed from prefabricated solar modules composed of mono- or poly-crystalline cells supported on non-specular, galvanized steel racks. Additional elements associated with the battery energy storage system will include fire-suppression systems and the batteries themselves. The Facility will include approximately 0.6 miles of new 230-kilovolt transmission line from the proposed southern collector substation to the existing Blue Ridge Substation. The

[1] Note that other dust suppressants besides water may be utilized as necessary during extreme drought conditions (synthetic polymer emulsions, chemical suppressants, organic glues, and wood fiber materials) depending on the site and condition (to be applied by trained and certified vendors familiar with applicable environmental regulations including the federal Endangered Species Act, the Clean Water Act, the Salmon Recovery Act, and state and local regulations).

transmission system will be aboveground (see Exhibit B for example support structures). The solar array will include up to 142 inverter and transformer stations, which will be placed together on the same slab of concrete. Chain-link fencing will be used to enclose the solar area, substations, O&M building (if a new O&M building is constructed), and battery energy storage system (see Exhibit C, Figure C-2).

3.0 Operational Materials Inventory

Table G-2 provides an inventory of industrial materials that will be used in substantial quantity during operation of proposed Facility elements.

Table G-2. Inventory of Operational Materials

Material	Quantity/Units	Ultimate Disposition
Lithium-ion battery racks	91,685 racks	Disposed of at approved facility
Transformer oil	Substation transformers: 263,387 gallons Solar array transformers: 43,432 gallons (244 gallons per station)	Within transformer boxes for cooling (No extra oil stored outside of transformers. Additional oil only required due to failure, provided on an as-needed basis.)

3.1 Solar Array and Collector Substations

No substantial quantities of industrial materials will be brought onto or removed from the Facility site during operations. The materials that will be brought onto or removed from the site will relate to maintenance or replacement of damaged equipment (e.g., solar module components, electrical equipment). The materials replaced and removed will not constitute significant amounts. Table G-2 includes materials and amounts that will be used during operation of the transformers for the solar array and collector substations.

Solar modules may require periodic washing to minimize the effects of solar module dust and dirt on energy production (referred to as soiling) although this is not anticipated and will be dependent on weather conditions; during drought conditions when there is more dust, the panels may require washing. For the purpose of this analysis, it is conservatively assumed that all modules will be washed twice per year and require 482,504 gallons per wash, for a total of approximately 965,008 gallons per year. Water will be applied via robotic panel cleaners and will not have any cleaning solvents in it. Wash water will be discharged by evaporation and seepage into the ground. See Exhibit O for further information.

3.2 Battery Energy Storage System

The types and quantities of industrial materials used during operation of the battery energy storage system are listed in Table G-2. A Li-ion system will require regular replacement of the batteries, as they degrade over time.

Li-ion system batteries will be replenished at a rate depending on usage. For example, a battery that is cycled more often will degrade faster than one that is used less often. For this analysis, it is assumed that the battery will be fully discharged each day and it is assumed that 11 battery racks per MW will be replaced every 3 years over the life of the Facility (50 years). This assumption likely overestimates the number of batteries that will flow into and out of the Facility, because not all batteries will be replaced during each replenishment cycle (e.g., fewer batteries will need replacing early in the Facility lifecycle). A group of Li-ion battery cells will comprise a "rack." Because approximately 2,000 battery racks will be needed for the proposed 500-MW storage system, 91,685 battery racks will be used over operation term of the battery energy storage system.

Li-ion battery systems typically are air cooled, and do not have a liquid component. However, some lithium-ion battery systems are liquid cooled, such as the Tesla Powerpack, which uses coolant similar to automotive antifreeze. The coolant, if used, is recirculated through a closed system to cool the batteries.

4.0 Hazardous Substances

> *OAR 345-021-0010(1)(g)(B) The applicant's plans to manage hazardous substances during construction and operation, including measures to prevent and contain spills.*

All potentially hazardous substances, during both phases, will be used in a manner that is protective of human health, protective of the environment, and that complies with all applicable local, state, and federal environmental laws and regulations. For any necessary, potentially hazardous substance used during the Facility's construction or operation, Safety Data Sheets will be made available and located at the construction area or the relevant Facility component. Extremely hazardous substances in excess of threshold planning quantities, highly toxic substances, or explosive materials will not be necessary to support either the construction or the operations phase of the Facility. Additionally, materials used during the construction and operations of the Facility will be selected so that they minimize the potential for producing "hazardous waste," as defined by the Resource Conservation and Recovery Act. Accidental releases of hazardous materials will be prevented or minimized through proper containment of these substances during use and transportation to the Facility site as described in the Spill Prevention, Control, and Countermeasure Plan (SPCC) Plan.

4.1 Construction Materials

Potentially hazardous materials that will be used for construction include herbicide, paint, unused solvents, and spent vehicle and equipment fluids and components (e.g., used oil, used hydraulic fluids, spent fluids, oily rags, and spent lead-acid or nickel-cadmium batteries). Potentially hazardous substances will not be permanently present within the construction areas in quantities that exceed Oregon State Fire Marshal Reportable Quantities.

During construction, on-site fuel storage may be placed in designated areas within the temporary construction areas. Secondary containment and refueling procedures for on-site fuel storage will follow the contractor's SPCC Plan. Fuel for construction equipment will be delivered to the site via a specialized mobile vehicle by a licensed service contractor on an as-needed basis. Following the completion of fueling activities, these vehicles will not remain at the on-site longer than necessary to complete their fueling tasks. Construction-based equipment will be regularly inspected to detect potential leaks or other issues that may require maintenance. Potentially hazardous substances related to the maintenance of the construction equipment will only be brought to the construction site by a maintenance technician on an as-needed basis, and any unused or waste substances will be removed during the same service call. Refueling will take place a substantial distance from waterways or wetlands to prevent water quality impacts in the event of an accidental release.

In the unlikely event that an accidental spill occurs, any spilled or released substances will be cleaned up, and any contaminated media impacted by the spill will be managed in accordance with all applicable regulations as described in the SPCC Plan. As specified in the contractor's SPCC Plan, larger spill kits with absorbents, absorbent pads, spill socks, and disposable bags will be maintained, in close proximity to construction activities. In addition, to reduce the response time to a spill, smaller spill kits containing absorbent pads will be located on key pieces of construction equipment. All employees will be instructed in the location, handling, and usage of the spill kits. Any reportable spills will be immediately called in to the Oregon Emergency Management Division's Oregon Emergency Response System, per OAR Chapter 340 Division 142. See Exhibit CC for a listing of applicable regulations.

4.2 Operational Materials

Use of the battery energy storage system may include hazardous substances within internal battery components; however, batteries are considered non-hazardous equipment when used according to the recommendations of the manufacturer and as long as their integrity is maintained (not damaged and internal seal is intact). Li-ion batteries present a flammability hazard and require cooling systems to prevent overheating. The battery energy storage system will have integrated safety systems that monitor battery performance to detect malfunctions and implement response measures (such as notifying operators, depowering the system, or deploying fire suppression devices). Batteries will be housed in leak-proof containers to prevent inadvertent releases of hazardous materials. O&M staff will conduct inspections of the battery cells for damage. Note that used Li-ion batteries are not considered hazardous waste by the U.S. Environmental Protection Agency (EPA); at present, there are optional EPA guidelines (EPA's Universal Waste Regulations) that address the responsible disposal and recycling of these batteries.

Small quantities of lubricants, degreasers, herbicides, or other chemicals may be stored in the O&M building. Storage of these chemicals will follow label instructions. No underground storage tanks will be installed at the O&M building. No extremely hazardous materials (as defined by 40 Code of Federal Regulations 355) are anticipated to be produced, used, stored, transported, or disposed of at this Facility during operation.

The Applicant will have an operational SPCC Plan to detail appropriate response measures. In the unlikely event of an accidental hazardous materials release, any spill or release will be cleaned up and the contaminated soil or other materials disposed of and treated according to applicable regulations. Employees will be trained to be aware of the potential hazards of the contents of the module through the availability of Material Safety Data Sheets, and to handle such releases in accordance with applicable regulations. See Exhibit CC for a list of applicable regulations. Spill kits containing items such as absorbent pads will be located on equipment and in onsite temporary storage facilities to respond to accidental spills, if any were to occur. Employees handling hazardous materials will be instructed in the proper handling and storage of these materials, as well as where spill kits are located. The Applicant will report spills or releases of hazardous materials during operation as noted above to the Oregon Emergency Response System, per reporting requirements detailed in OAR Chapter 340 Division 142.

For the replacement of batteries during operation, the Applicant will follow the handling guidelines of 49 Code of Federal Regulations 173.185 – Department of Transportation Pipeline and Hazardous Material Administration related to the shipment of Li-ion batteries. The regulations include requirements for prevention of a dangerous evolution of heat, prevention of short circuits, and prevention of damage to the terminals. They also require that no battery will come into contact with other batteries or conductive materials. Licensed third party battery suppliers will be responsible for transporting batteries to and from the Facility in accordance with applicable regulations, as required through their licensure. Spent batteries will be disposed of at a facility permitted to handle them in compliance with applicable Resource Conservation and Recovery Act and Toxic Substances Control Act regulations administered by the EPA or Oregon Department of Environmental Quality. Adherence to the requirements and regulations (including personnel training, safe interim storage, and segregation from other potential waste streams) will minimize safety hazards related to transport, use, or disposal of batteries.

5.0 Non-Hazardous Waste Materials

> *OAR 345-021-0010(1)(g)(C) The applicant's plans to manage non-hazardous waste materials during construction and operation.*

5.1 Construction Materials

Waste construction materials generated from construction may include scrap steel, wood, concrete waste, excavated soil, and packaging material waste. Further information regarding waste materials is included in Exhibit W.

Construction will not require the use of specialized structures, systems, or equipment for waste management or disposal. Standard construction waste bins will be kept on site to keep construction debris until it is hauled off site by a licensed waste hauler (see Exhibit U for waste service provider information). Excess excavated material will be used to restore ground contours after construction, and to provide fill on site or be transported off site for disposal. Waste concrete will consist of concrete solids contained in the concrete chute washout water. Washdown methods will be determined by the contractor, and may occur at contractor-owned batch plants or a designated concrete washout. Any excess concrete will be incorporated into the foundation, rather than disposal of the material. There will be no disposal of hardened waste concrete on site other than as described here. Portable toilets will be provided for on-site sewage handling during construction and will be pumped and cleaned regularly by the construction contractor. Construction stormwater will be generated at the location of the solar array and battery energy storage construction sites. Such stormwater will be covered under the Facility's National Pollutant Discharge Elimination System 1200-C construction permit and its associated Erosion and Sediment Control Plan.

5.2 Operational Materials

Little solid waste will be generated from Facility operations. The solar array and battery energy storage system will rely on the O&M building for sanitation. Therefore, it will not generate any additional sewage streams. Administrative activities related to the solar array and battery energy storage system will be conducted at the O&M building. Office waste generated at the O&M building will be disposed of at the Finley Buttes Regional Landfill or other local contractors. Sewage from the O&M building will be disposed of on site with a septic system.

Solar panels will be washed, but this limited quantity of wash water will evaporate or will infiltrate into the ground near the point of use (see Exhibit W). No additional industrial wastewater streams will be generated at the solar array.

6.0 Submittal Requirements and Approval Standards

6.1 Submittal Requirements

Table G-3. Submittal Requirements Matrix

Requirement	Location
OAR 345-021-0010(1)(f) A materials analysis including:	–
(A) An inventory of substantial quantities of industrial materials flowing into and out of the proposed facility during construction and operation.	Sections 2.0 and 3.0
(B) The applicant's plans to manage hazardous substances during construction and operation, including measures to prevent and contain spills.	Section 4.0
(C) The applicant's plans to manage non-hazardous waste materials during construction and operation.	Section 5.0

6.2 Approval Standards

OAR 345 Division 22 does not provide an approval standard specific to Exhibit G.

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