DRAFT
RENEWABLE FUEL HEAT PLANT IMPROVEMENTS
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
NATIONAL RENEWABLE ENERGY LABORATORY
SOUTH TABLE MOUNTAIN SITE
GOLDEN, COLORADO

February 3, 2012

U.S. Department of Energy
Golden Field Office
National Renewable Energy Laboratory
1617 Cole Boulevard
Golden, Colorado 80401
DOE/EA-1573-S-I

COVER SHEET

Responsible Agency: Department of Energy

Title: *Draft Supplemental Environmental Assessment of the Renewable Fuel Heat Plant Improvements at the National Renewable Energy Laboratory South Table Mountain Site, Golden, Jefferson County, Colorado* (DOE/EA-1573-S-I).

Proposed Action: Approval of making improvements to the Renewable Fuel Heat Plant (RFHP) consisting of development, construction, and operation of a woodchip fuel storage silo including material handling conveyances; and expansion of the sourcing of woody biomass fuels from Front Range sources to additional available regional sources.

Report Designation: Draft Supplemental Environmental Assessment (EA)

Abstract: The Department of Energy (DOE) prepared this Draft Supplemental EA to assess the potential environmental effects resulting from the proposed improvements to the RFHP. Specifically, the DOE proposes to develop, construct and operate a woodchip fuel storage silo at the National Renewable Energy Laboratory's (NREL) South Table Mountain (STM) site in Golden, Colorado. This Draft Supplemental EA also assesses the potential environmental effects of expanding fuel sources for the RFHP from the Front Range to regional wood sources.

This Draft Supplemental EA analyzes the potential environmental impacts from proposed activities on land use and planning, traffic and circulation, air quality, visual quality and aesthetics, water resources, noise, and occupational health and safety. This Draft Supplemental EA also analyzes cumulative impacts of the Proposed Action.

Comments: Written comments regarding this Draft Supplemental EA should be directed to:

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Privacy Advisory: As required by law, comments will be addressed in the Final Supplemental EA and will be made available to the public. Due to privacy requirements, only the names of the individuals making the comments and specific comments will be disclosed. Personal home addresses and phone numbers will not be published in the Final Supplemental EA.

Availability: This Draft Supplemental EA is available on the DOE Golden Field Office Public Reading Room website, http://www.eere.energy.gov/golden/reading_room.aspx under the NREL Environmental and NEPA Documents link and on the DOE NEPA Website http://energy.gov/nepa/nepa-documents.

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ACRONYMS AND ABBREVIATIONS

AADT	Annual average daily traffic
Alliance	Alliance for Sustainable Energy LLC
BMPs	best management practices
BTU	British thermal unit
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CEQ	Council on Environmental Quality
CFR	Code of Federal RegulationsMethane
CH_4	Methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CRS	Colorado Revised Statutes
CY	cubic yards
dBA	A-weighted decibel
DOE	U.S. Department of Energy
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESIF	Energy Systems Integration Facility
FONSI	Finding of No Significant Impact
ft	feet
FTLB	Field Test Laboratory Building
H_2	hydrogen
H_2S	hydrogen sulfide
I-70	Interstate 70
km	kilometer
LOS	level of service
MAP	Mitigation Action Plan
m	meter
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_x	nitrogen oxides
N_2O	nitrogen oxide
NREL	National Renewable Energy Laboratory
O_3	ozone
OSHA	Occupational Safety and Health Administration
OTF	Outdoor Test Facility
PM	particulate matter
PM_{10}	particulate matter with a diameter of less than or equal to 10 micrometers
PV	photovoltaic
RFHP	Renewable Fuel Heat Plant
RSF	Research Support Facility
S&TF	Science and Technology Facility
SERF	Solar Energy Research Facility
SHPO	State Historic Preservation Office
SIP	state implementation plan
SO_2	sulfur dioxide
STM	South Table Mountain

SVOC	semivolatile organic compound
SWEA	site-wide environmental assessment
SWEA/S-I	first supplement to the SWEA
SWEA/S-II	second supplement to the SWEA
TPY	tons per year
VMT	vehicle miles traveled
VOC	volatile organic compound

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) is proposing an action (the Proposed Action) consisting of the following improvements to the Renewable Fuel Heat Plant (RFHP) located at the National Renewable Energy Laboratory's (NREL) South Table Mountain (STM) site at Golden, Colorado:

- Development, construction, and operation of additional woodchip fuel storage including material handling conveyances; and
- Expansion of the sourcing of woody biomass fuels from Front Range sources to additional available regional sources.

In accordance with the National Environmental Policy Act (NEPA), as amended, and DOE's implementing NEPA regulations (10 CFR Part 1021), DOE is required to evaluate the potential environmental impacts of DOE facilities, operations, and related funding decisions. DOE must address NEPA requirements, related environmental documentation, and permitting requirements prior to making a decision to undertake a Proposed Action.

In July 2003, DOE issued the *Final Site-Wide Environmental Assessment of the National Renewable Energy Laboratory's South Table Mountain Complex* and a Finding of No Significant Impact (FONSI) for proposed site development activities (DOE/EA-1440) (DOE 2003). The site-wide environmental assessment (SWEA) evaluated the impacts that would be associated with long-term buildout of the STM site and the areas suitable for future development. As project-specific funding has become available to implement the STM site buildout vision, additional project-specific NEPA analyses have been generated as well as supplemental NEPA analyses to update the SWEA in accordance with Title 10 Code of Federal Regulations (CFR) 1021.330.

In July 2007, DOE issued the *Final Environmental Assessment of Three Site Development Projects at the National Renewable Energy Laboratory South Table Mountain Site* (DOE/EA-1573) (DOE 2007). This environmental assessment (EA) tiered off the SWEA, provided updated descriptions of the existing environment at the STM site, and impacts expected from the three proposed projects including the construction and operation of the RFHP.

Subsequent NEPA analyses have been conducted. DOE issued its first supplement to the SWEA (SWEA/S-I), *Final Supplement to Final Site-Wide Environmental Assessment of the National Renewable Energy Laboratory's South Table Mountain Complex* (DOE/EA-1440-S-1) (DOE 2008) in May 2008, and a second supplement to the SWEA (SWEA/S-II), *Final Supplement-II to Final Site-Wide Environmental Assessment of the National Renewable Energy Laboratory's South Table Mountain Complex* (DOE/EA-1440-S-II) (DOE 2009) in November 2009. These supplemental NEPA documents also tiered off the SWEA, provided updated descriptions of the existing environment at the STM site, and the impacts expected from their respective Proposed Actions.

The SWEA, SWEA/S-I, SWEA/S-II, and the Three Site Development Projects EA (DOE/EA-1573) are hereby incorporated in their entirety into this draft Supplemental EA (EA) by reference, and this draft Supplemental EA tiers off the descriptions of the affected environment and the potential environmental impact assessments presented in DOE/EA-1573. All of these aforementioned NEPA documents are available under the NREL Environmental and NEPA Documents link at: http://www.eere.energy.gov/golden/reading_room.aspx.

1.1 The National Environmental Policy Act and Related Procedures

The Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (40 CFR Parts 1500-1508) and DOE's implementing procedures for compliance with NEPA (10 CFR Part 1021) require that DOE, as a federal agency:

- Assess the environmental impacts of its proposed actions;
- Identify any adverse environmental effects that cannot be avoided should a proposed action be implemented;
- Evaluate alternatives to the proposed action, including a "no action alternative";
- Describe the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- Characterize any irreversible and irretrievable commitments of resources that would be involved should the proposed action be implemented.

These requirements must be met before a final decision is made to proceed with any proposed federal action that could cause significant impacts to human health or the environment. This draft Supplemental EA is intended to meet DOE's regulatory requirements under NEPA and provide the public, tribes, State of Colorado, and other agencies information to make comments on the draft Supplemental EA.

1.2 Background

NREL is the premier DOE national laboratory dedicated to the research, development, and deployment of renewable energy and energy efficiency technologies. The Alliance for Sustainable Energy LLC (Alliance) operates NREL for DOE. As depicted in Figure 1-1, NREL is comprised of three main sites: 1) STM; 2) Denver West Office Park; and 3) the National Wind Technology Center. Other facilities include the Renewable Fuels and Lubricants (ReFUEL) Research Laboratory, Joyce Street facilities, and the Golden Hill office site.

The 327-acre (132 hectare) STM site is on the southeast side of STM, north of Interstate 70 (I-70) and west of the I-70 and Denver West Boulevard interchange in unincorporated Jefferson County near Golden, Colorado (Figure 1-2). Only a portion of the site (136 acres or 55 hectares) is available for development. A total of 177 acres (55 hectares) is protected by a conservation easement, and development of the remaining 14 acres (5.6 hectares) is restricted by utility easements. The community of Pleasant View is adjacent to the southern border of the STM site. The STM site includes acreage on the STM mesa top, slope, and toe, and was formerly part of the Colorado National Guard facility at Camp George West. Currently seven laboratory buildings, a few small test facilities, and several support buildings comprise the STM site.

1.2.1 RFHP

The RFHP is northeast of the Field Test Laboratory Building (FTLB) on the STM site and has been in operation for three years. The RFHP was designed to reduce NREL's STM site natural gas consumption, based on 2005 usage, by an estimated 75 to 80 percent by using wood waste to displace natural gas usage in the primary site heating boilers. The project was also intended to showcase the viability of wood fuel as an alternative to fossil fuel heating.

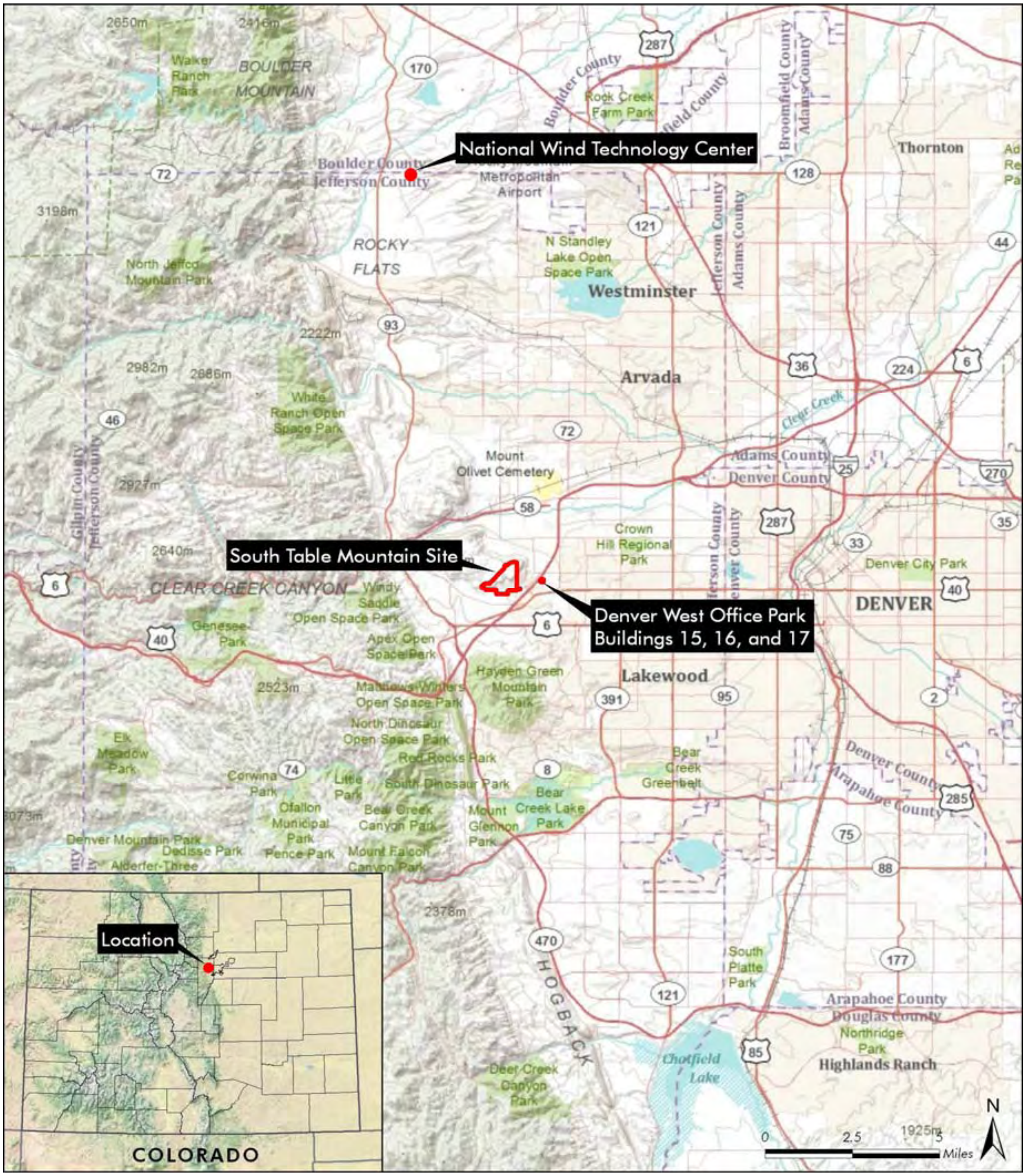


Figure 1-1. Regional location of the STM site.

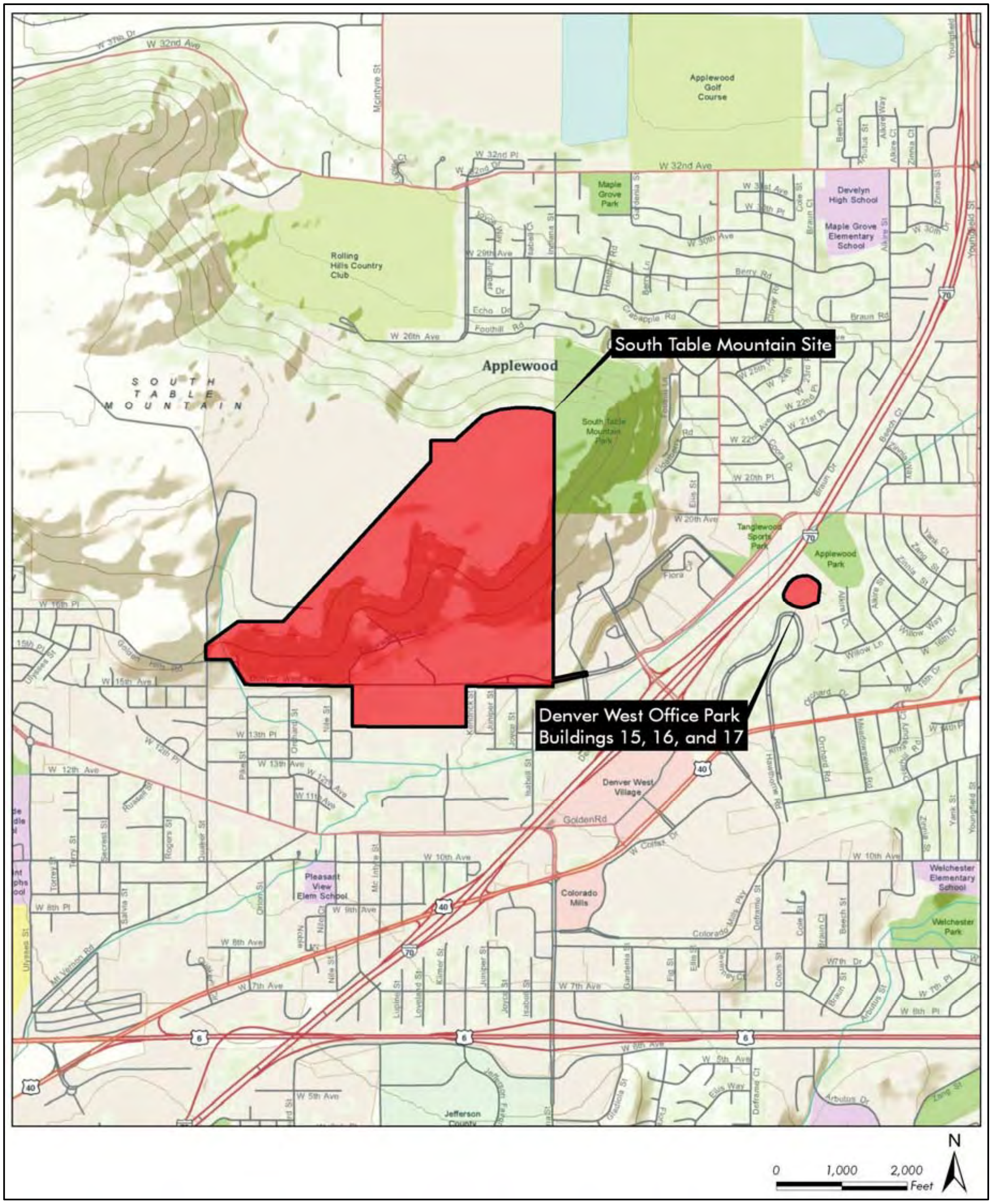


Figure 1-2. Local setting of the STM site.

As previously stated, the RFHP was originally analyzed in the *Final Environmental Assessment of Three Site Development Projects at the National Renewable Energy Laboratory South Table Mountain Site* (DOE/EA-1573) (DOE 2007), which resulted in a FONSI dated July 2007.

Prior to construction of the RFHP, comfort heat was supplied to the NREL STM site by natural gas-fired boilers, which remain available to supplement or replace RFHP demand as necessary. The wood fuels were planned to be obtained from Rocky Mountain Front Range sources, including construction waste, urban tree trimmings, wooden pallets, and forest thinnings.

During the planning stages, it was determined that the fuel storage pit should be large enough to store a sufficient quantity of woodchips so that the RFHP could operate for four days without refueling. This would allow the RFHP to run over a long weekend, and to conform to standard industry practices for on-site fuel storage. Standard practices in the woody biomass energy industry recommend having four to seven days' worth of fuel storage on-site to obtain both operational and cost efficiencies (BERC 2004; Maker 2004; CANMET 2005; INRS 2008; PSU 2010).

Site constraints realized during construction of the RFHP resulted in the entire building having a smaller footprint than originally envisioned and analyzed in DOE/EA-1573. The actual storage capacity of the RFHP's fuel pit as constructed was 144 cubic yards (CY) (110 cubic meters), compared to the 215-CY (164-cubic meter) capacity analyzed in DOE/EA-1573. This storage capacity of 144 CY (110 cubic meters) of woodchips provides fuel for approximately 20 hours of RFHP system runtime at a full firing rate of 9 million British thermal units (BTUs) per hour. In 2010, the side-walls of the fuel storage pit were built up an additional 5 feet (1.5 meters) to increase the storage capacity of the fuel pit. This added approximately 56 CY (43 cubic meters) of additional storage and was the maximum size addition feasible due to building and dock constraints. This modification added approximately 6 additional hours of fuel for the system, thus bringing the total fuel on-site storage to 26 hours of operation.

Additionally, through three years of operational experience, several challenges associated with the current RFHP configuration and operations have been identified, thereby providing an opportunity to identify areas for improvement. Challenges associated with current conditions include:

- When the RFHP fuel pit was modified, the fuel storage pit was increased to 200 CY (153 cubic meters), which is enough to run the system for approximately 26 hours. A storage capacity of about 558 CY (427 cubic meters) is needed to ensure uninterrupted operation over a four-day period at the full firing rate of 9 million BTUs.
- The existing delivery dock configuration requires that the storage pit be nearly empty before the next truckload of woodchips can be offloaded, which places the fuel delivery schedule into a "just-in-time" configuration. Upon delivery, the woodchips are offloaded into the fuel pit. During offloading, the woodchips have a tendency to "cone up," which requires additional handling with a tractor to evenly distribute them to make room for the next delivery.
- Limited outside storage of extra woodchips has been problematic because the woodchips must be handled a second time to move them from outside, resulting in additional labor hours and material handling costs, and exposes the wood fuel to potential contaminants (including foreign objects) and moisture while it is stored outside.

- Over long weekends, weekend deliveries are required to keep the plant operating, which in turn has resulted in weekend (i.e., additional) staffing requirements.

Issues have also been realized with storing woodchips off-site through a local woodchip supplier including fuel quality control issues. The fuel was consistently contaminated with nuts, bolts, rebar, sand, paint, dust, dirt, or excess bark material due to material handling activities, inadequate screening practices, and unintentional commingling of woodchips with off-specification urban wood waste. Contaminated fuel deliveries resulted in material handling conveyances within the RFHP being jammed, caused malfunction of equipment, as well as caused the formation of slag in the boiler that required the plant to shut down in order to clean out the system for proper operation.

Experience over the last three years has also indicated that the "just-in-time" delivery schedule is problematic when severe winter weather delays deliveries, which often corresponds to the times when campus demand of comfort heat is the highest. Even without the anticipated additional heating demand from the new campus facilities, the RFHP had to operate at a reduced firing rate on several occasions during the 2010 to 2011 heating season to ensure the system would not run out of fuel and have to be completely shut down. If the plant must shut down due to a lack of fuel, one day is required to restart the RFHP once fresh fuel is delivered.

Given the experience of operating the plant over the last three years, as well as the anticipated need to operate the plant at full capacity as additional NREL facilities are added to the campus, without additional on-site storage, the efficiency and operating costs of the RFHP would be compromised.

1.3 Purpose and Need

The purpose of the Proposed Action is to ensure the RFHP can operate at maximum efficiency and meet its original purpose and need put forth in DOE/EA-1573 of reducing NREL's STM site natural gas consumption. In addition, with the recent and projected growth of NREL's STM campus, additional heating loads would be placed on the RFHP, thereby requiring additional storage of woodchip fuel. These additional heating loads include the 222,000-square-foot (20,625 square-meter) Research Support Facility (RSF) occupied in June 2010; the 150,000-square-foot (13,935 square-meter) addition to the RSF, which will be occupied in early 2012; and the 185,000-square-foot (17,187 square-meter) Energy Systems Integration Facility to be completed in fall 2012. However, this Proposed Action would not exceed the maximum heating capacity of the RFHP as analyzed in DOE/EA-1573.

The need for the Proposed Action is to address the deficiency of the fuel storage pit, which is too small, thus requiring the pit to be nearly empty for a "live bottom" trailer to transfer woodchips directly without additional handling. At present, the additional handling involves several steps: the live bottom trailer discharges as much as possible into the fuel storage pit; the truck pulls away; staff use a tractor to rearrange the woodchip pile; making space to receive fuel; and the truck backs in again to discharge its remaining load.

In addition, the need for the Proposed Action is to increase automation of the RFHP to ensure operational efficiency. The current situation requiring the fuel pit to be nearly empty before additional woodchips are delivered greatly increases the risk of running out of fuel. Operational experience has shown that running at a low firing rate to stretch fuel supplies causes slag formation in the combustion chamber. The slag can destroy machinery and cause RFHP shutdown. The proposed RFHP silo would allow the fuel pit to be empty for every fuel delivery; therefore, woodchip unloading would occur in a single step without additional handling.

Furthermore, the Proposed Action would expand the sourcing of woodchips from Front Range sources to additional available regional sources, consisting of woodchips from ongoing forestry thinning practices including using trees that have been killed by the mountain pine beetle.

1.4 Public Scoping and Draft Supplemental EA Public Comment Process

1.4.1 Public Scoping Process

The provisions of NEPA provide the public an opportunity to participate in the environmental review process. This section describes the steps taken to document that all matters of public interest are considered in this draft Supplemental EA.

On May 25, 2011, the DOE initiated the scoping process by sending a letter to applicable federal, state, and local agencies requesting comments on the Proposed Action. Public notification also was achieved by posting a notice in the NREL Community News Letter (April 2011) and by posting a public notice in the Golden Transcript on May 26, and June 2, 2011. See Appendix A for actual postings. The scoping letter also provided an opportunity for public input regarding environmental concerns in the project area. The scoping letter distribution list, newspaper posting, and newsletter are found in Appendix A. The comments expressed during the scoping period are summarized below in italics; where appropriate, responses to the comment summaries note specific section(s) or chapters within this draft Supplemental EA that address the issues raised in the comments.

1. *Commenter was concerned with the height of the structure, visibility, and materials.* Section 3.2.5 presents the visual impact analysis of the Proposed Action.
2. *Commenters suggested that visual simulations or studies be done to show how the proposed silo would appear from surrounding vantage points.* Section 3.2.5.2 presents existing conditions on the STM site and the visual impact analysis of the Proposed Action.
3. *Commenter wanted to know what other options may exist to meet project goals while keeping the potential negative visual impacts to a minimum.* Alternatives considered are presented in Section 2.3.
4. *Commenter noted that certain air emission sources for this site require an Air Emissions Permit or an Air Pollution Emissions Notice (APEN), and that since this facility will be upgraded, a new APEN must be submitted and approved by the Jefferson County Health Department.* No changes to the process equipment are being proposed. Therefore the existing APEN (07JE0277) remains in effect until its expiration on August 26, 2013.
5. *Commenter noted that the Colorado Revised Statutes (Sections 25-12-101 through 108) stipulate that commercial areas must comply with the following maximum noise levels 25 feet from the property lines: 1) 60dB(A) from 7:00 a.m. to 7:00 p.m. and 2) 55dB(A) at all other times.* Section 3.2.7 discusses compliance with noise ordinances.
6. *Commenter requested that the EA address all potential safety and health concerns connected with the operation of the proposed 75-foot-tall woodchip storage silo that could affect the surrounding community.* Section 3.2.8 discusses potential impacts associated with health and safety under the Proposed Action.
7. *Commenter asked if there would be any residue or cinders associated with the renewable fuel heat plant*. This Proposed Action does not include any changes to existing ash disposal practices as described and analyzed in Section 3.1.10.2 in DOE 2007.

8. *Commenter was concerned with potential traffic impacts*. Section 3.2.2.2 discusses potential impacts associated with traffic under the Proposed Action.

1.4.2 Draft Supplemental EA Public Comment Process

[Section to be completed following the public comment period on the Draft Supplemental EA]

1.5 Organization of this Draft Supplemental Environmental Assessment

The Proposed Action assessed in this draft Supplemental EA is described in detail in Chapter 2. The affected environment within which this action would occur, and the impacts that would result if implemented, are characterized in Chapter 3. The cumulative impacts of these actions and the commitment of resources are discussed in Chapter 4. Chapter 5 provides a list of preparers for the draft Supplemental EA, and Chapter 6 lists references cited.

In addition, six appendices either provide information pertaining to the NEPA process or to the analyses in this draft Supplemental EA. Appendix A contains notice letters and distribution lists for the scoping period and comment period for the draft document. Appendix B provides correspondence relating to agency consultations. Appendix C contains comments on the draft version of this Supplemental EA and provides DOE's responses to those comments. Appendix D contains Annual Average Daily Traffic (AADT) data along representative routes associated with the regional fuel sourcing. Appendix E discusses potential risks and accidents associated with the Proposed Action. Appendix F presents calculations for greenhouse gas emissions.

2.0 PROPOSED ACTION AND ALTERNATIVES

The Proposed Action assessed in this draft Supplemental EA consists of making improvements to the RFHP including:

- Construction and operation of a woodchip storage silo and associated material handling conveyances, which would increase the woodchip storage capacity to meet the original facility need and provide additional fuel supply for the RFHP, reducing the potential for a plant shutdown due to exhausted fuel supply; and
- Utilization of regional wood sources, which would make available a wider range of high-quality wood sources available for use compared to Front Range sources, as discussed in the 2007 EA.

The RFHP is centrally located on the STM site northeast of the FTLB (Figure 2-1).

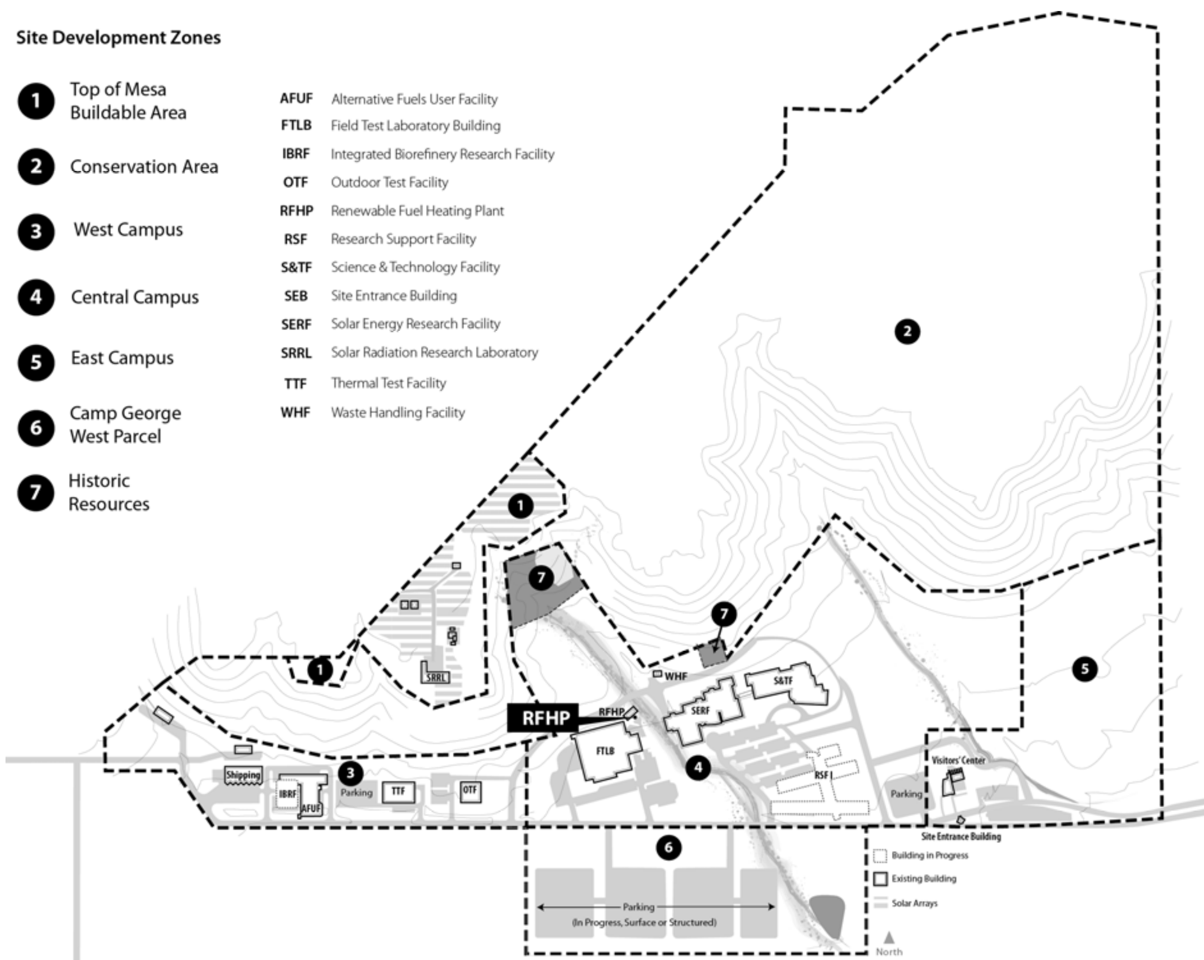


Figure 2-1. Location of the RFHP within the STM site.

2.1 Woodchip Storage Silo

2.1.1 Descriptive Overview

The proposed silo would be about 20 feet (6 meters) in diameter and about 76 feet (23.2 meters) tall, with a net storage volume of about 558 CY (427 cubic meters). The proposed silo would be a natural concrete color with a smooth texture. Figure 2-2 illustrates the derivation of the net storage volume given the headspace requirements to facilitate woodchip flow and base space needs for unloading equipment. A bucket elevator/chute would extend about 25 feet (7.6 meters) above the top of the proposed silo.

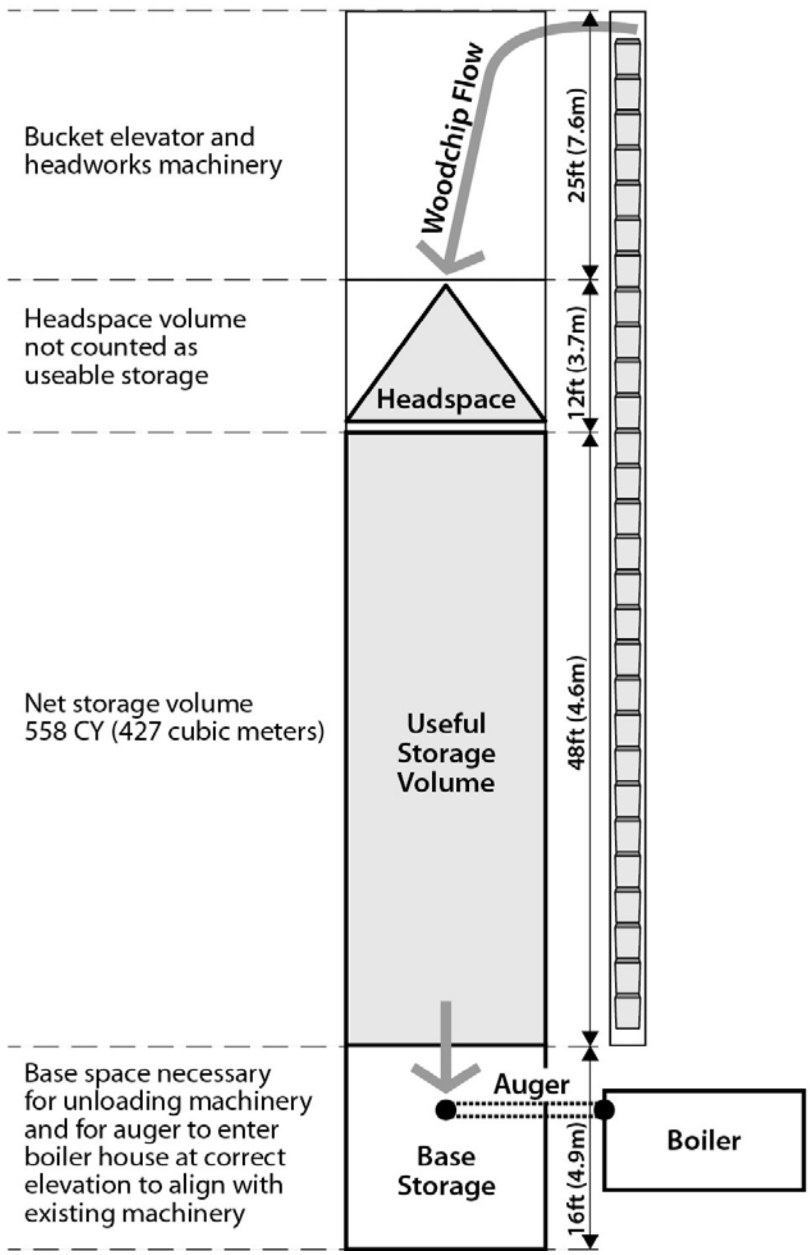


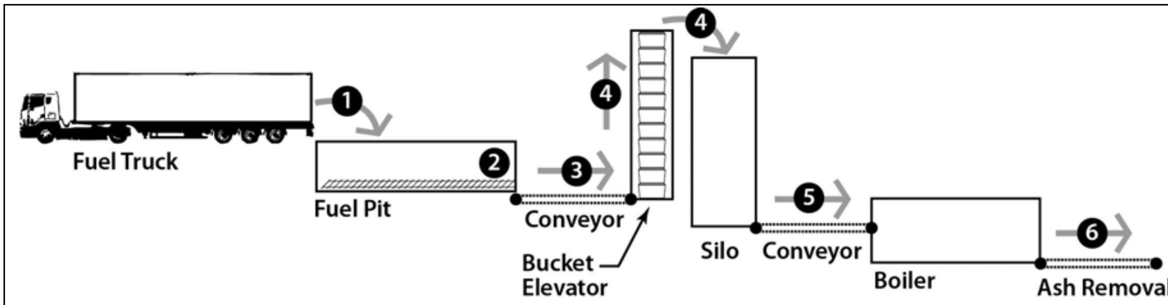
Figure 2-2. Illustration of the proposed RFHP silo showing the useful (net) storage volume.

The proposed silo would be constructed of concrete and placed on a 30-foot- (9.1-meter-) diameter pad. The proposed location for the silo is a paved, previously disturbed area immediately south of the existing RFHP facility and west of the central ephemeral channel (Figure 2-3). This area was included in Zone 4 – Central Campus as part of the STM campus build out analyzed in the 2003 SWEA. The process flow of woodchips from the time of delivery until ash removal is shown in Figure 2-4.

Figure 2-3. View of the east side of the RFHP at the unloading area for woodchips. Open bay door leads to the fuel pit. Proposed silo would be located on the asphalt area to the left and below the building.

2.1.2 Construction Overview

At the beginning of construction existing asphalt would be removed from the site, an existing fire-suppression water line would be excavated and relocated, and the surrounding area would be surfaced with gravel (as needed) to accommodate construction vehicles and help prevent site erosion. Following site preparation, a circular 33-foot- (10-meter-) diameter foundation hole would be excavated to a depth of 10 feet (3 meters). The excavation would result in about 320 cubic yards (245 cubic meters) of material being unearthed. The contractor would remove 85 percent of the excavated material and dispose of it at an appropriate disposal facility outside the STM campus. The remainder of the excavated material would be used as backfill as necessary. The silo would be built on a spread footing or drilled caissons using either a backhoe or a truck-mounted drill rig. Footings or caissons would then be poured using a concrete pumper truck. The 30-foot (9.1-meter) pad would then be poured on top of the footings or caissons and would create the foundation for the silo.



Steps in the Woodchip Use Process

1. The woodchips would be offloaded from the delivery vehicle into the fuel storage pit as they are currently for RFHP operations;
2. Woodchips would feed from the fuel storage pit into a conveyer proceeding through a gross sifter that removes debris including large wood pieces;
3. The conveyer would move the woodchips into the silo bucket elevator;
4. The bucket elevator would continuously move woodchips from the conveyor into the top of the proposed silo;
5. Woodchips at the bottom of the proposed silo would be augured through an opening into a conveyor that would transport and dump the woodchips into the boiler furnace where they would be burned to heat water;
6. Ash, as it is currently, would continue to be removed by screw conveyors and stored for pickup by a recycler.

Figure 2-4. The process flow of woodchips from the time of delivery until ash removal for the RFHP.

The silo would be built using jump-form construction utilizing three courses of 4-foot (1.2-meter) high concrete forms, in which the silo would be constructed by successively jumping and resetting the lower 4-foot (1.2-meter) course of forms on the top course of forms. The working platform would then be raised 4 feet (1.2 meters) to the top of the newly set course of forms to a position for the next concrete placement. Once the walls are completed, the platform would function as a working area for the roof construction or internal work. The jump-form method of construction would permit non-continuous work that would reduce costs. Bare areas surrounding the silo would be repaved with asphalt following construction. Stormwater runoff rates following construction would meet the preconstruction runoff rates.

After completion of the silo, the bucket elevator, unloading augers, and conveyors would be constructed and installed on-site in an assembly area between the RFHP and FTLB and west of the proposed silo location. Controls and equipment to integrate the silo machinery with the existing RFHP equipment would also be fabricated and installed. All equipment would be tested for proper operation and subject to NREL safety evaluation and approval.

During construction, all equipment, supplies, and materials would be delivered as needed and removed from the STM site upon conclusion of specific tasks. Should the RFHP be unavailable to house temporary construction offices, and there is a need for a jobsite trailer, it would be located on the paved area west of the Waste Handling Facility currently used as a truck turnaround for fuel deliveries. This area would also accommodate parking for construction personnel and any long-term staging of materials or equipment.

2.1.3 Fuel Sourcing

Biomass fuel for the RFHP would continue to be in the form of wood waste. However, the source for the fuel would transition from only Rocky Mountain Front Range wood waste (i.e., from construction waste, urban tree trimmings, pallets, and forest thinnings) to include available biomass from regional sources consisting of woodchips from trees resulting from ongoing forestry thinning practices including trees that have been killed by the mountain pine beetle. The primary supply of woodchips would originate from western slope suppliers in locations such as the Town of Kremmling in Grand County, Colorado. However, over the life of the RFHP, the source for woodchips could change and may include localities such as Steamboat Springs, Walden, Salida, Gunnison, and Colorado Springs all in Colorado; or Laramie, Wyoming – all locations within 125 miles (201 kilometers (km)) of the RFHP. Figure 2-5 shows the potential regional fuel source (west of I-25) at 125 miles (201 km) from the STM site.

The number of woodchip fuel deliveries would not change from levels of deliveries analyzed in DOE/EA-1573; there would continue to be 1 or 2 deliveries per day, or 200 annually, over the course of the heating season. The fuel would continue to be delivered at the RFHP's east side, where a large overhead door allows trucks to back into the current fuel pit storage area. The truck driver would handle fuel deliveries without an operator present as is currently necessary. From the current fuel pit storage area, woodchips would be transferred to the proposed RFHP silo via a material handling conveyor and a bucket elevator. With the addition of the proposed RFHP silo, the current fuel pit would be used for woodchip delivery and processing of the woodchips into the proposed RFHP silo only. Suppliers from locations along the Front Range would continue to be used as appropriate.

2.2 No Action Alternative

The No Action Alternative would leave the RFHP in its current configuration. The proposed woodchip storage silo and associated material handling conveyances construction, as well as use of regional wood sources, would not be undertaken.

2.3 Alternatives Considered but Not Analyzed

The Proposed Action and the No Action Alternative are the only alternatives specifically addressed in this draft Supplemental EA. The Proposed Action would implement the woodchip storage silo and associated material handling conveyances construction described in Section 2.1 and use regional sources of woodchips. Additional alternatives that were considered but were eliminated from further analysis are summarized below:

- *Other On-Site Silo Location Alternative:* This alternative was not feasible because of the technical and cost implications associated with decentralized operations and site/infrastructure complications associated with connecting machinery to the RFHP. An alternative site location on the north side of the RFHP would also increase the visual impact of the silo because of the higher elevation of this location.
- *Other Off-Site Storage Alternative:* The supplier could use off-site space to hold additional fuel. However, this alternative requires double handling of the woodchips. Additionally, this alternative does not address the fact that the fuel pit must be close to empty in order to receive the next shipment of woodchips and, therefore, does not change the "just-in-time" delivery schedule. This alternative does not address the goal of increased automation of the RFHP.
- *Reconfiguration of the Existing Fuel Pit Alternative:* This alternative was not feasible because of the interrelated nature of the auger operation with the existing fuel pit and the engineering constraints of the RFHP building foundation. In addition, the existing fuel pit was previously modified to make the holding capacity larger by increasing the height of the walls in the storage pit to the maximum amount feasible.

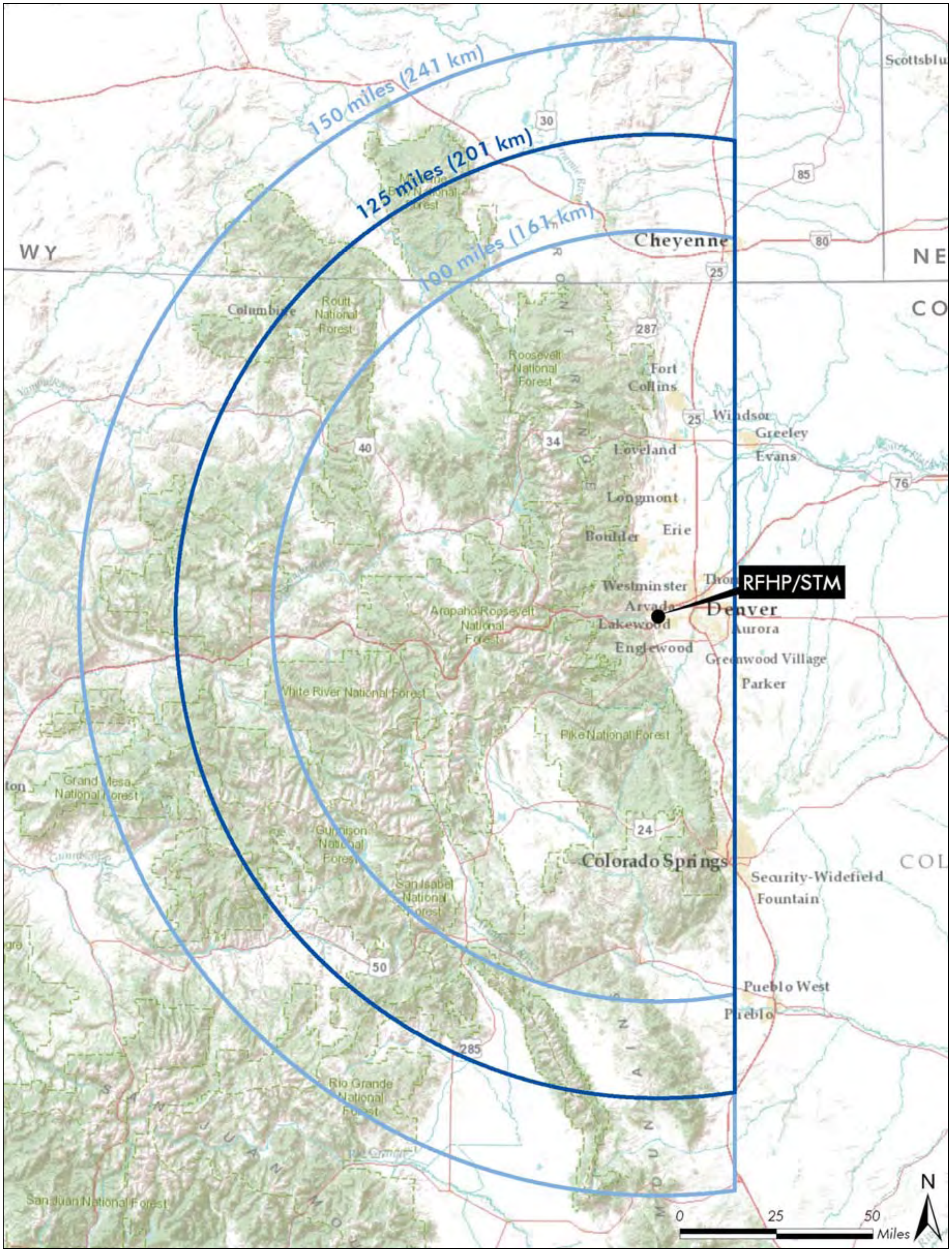


Figure 2-5. Potential regional fuel source at 125 miles (201 km) from the STM site.

- *Increased Silo Diameter Size Alternative:* This alternative was not feasible because of additional impacts, such as encroachment within the adjacent drainage, as well as utilities and site access to the FTLB.
- *Shorter Silo Height Alternative:* Due to restrictions of the site, the silo base/diameter cannot be wider, so a shorter silo would mean reduced storage capacity. This would not attain the need to have four days of storage.

3.0 EXISTING ENVIRONMENT AND ENVIRONMENTAL IMPACTS

3.1 Impact Topics Dismissed from Further Consideration

Consistent with CEQ and DOE NEPA implementing regulations and guidance, DOE focuses the analysis in an EA on topics with the greatest potential for significant environmental impact. The following impact topics or issues were eliminated from the list of potential impacts because there would be no effects or the effects of the Proposed Action would be insignificant. The rationale for dismissing specific topics from further consideration is provided in each section.

3.1.1 Geology and Soils

All project elements would be installed in a previously developed area. The Proposed Action would involve excavation or drilling, and standard best management practices (BMPs) would be implemented to minimize soil erosion during construction activities. Sedimentation patterns would not be notably altered and no structural movements or changes in seismicity would result. Therefore, there would be negligible impacts on geology and soils as a result of implementing the Proposed Action.

3.1.2 Biological Resources and Wetlands

The proposed RFHP silo would be located on previously developed land adjacent to the RFHP. Excavation and construction staging areas would not degrade the habitat value of the adjacent drainageway. No trees or vegetation would be removed and there would be no loss of habitat. The small wetland area behind the Solar Energy Research Facility (SERF) would not be impacted by construction or operation of the proposed RFHP silo. There are no jurisdictional wetlands on the STM site (USACOE 2009). For these reasons, biological resources and wetlands are not assessed further in this EA.

3.1.3 Cultural Resources

Based upon previously conducted cultural resource inventory efforts and literature, there are no known significant prehistoric archeological resources within or adjacent to the NREL STM property (DOE 2007). Additionally, there are no known significant traditional cultural resources within or adjacent to the STM site. However, there are two historic structures within the NREL STM property boundary that are listed on the National Register of Historic Places including the Colorado Amphitheater (5JF842) with an adjacent stone bridge spanning the natural drainage channel and the Ammunition Igloo (5JF843). Both of these features are associated with the Camp George West Historic District located south of the NREL STM campus.

The proposed RFHP silo would be constructed adjacent to the RFHP in a developed area, which has been previously assessed for cultural resources. The ammunition igloo is the nearest historic property to the proposed RFHP silo, but would not be affected by this proposed undertaking. The igloo is approximately 180 feet (55 meters) to the northeast of the proposed silo and the opposite side of the service road. The amphitheatre is up the drainage 1,050 feet (320 meters) northwest of the proposed RFHP silo. While the proposed silo would not directly affect the amphitheatre, DOE also considered the potential indirect visual impact to the silo.

DOE has initiated consultation with the Colorado State Historic Preservation Office (SHPO) and other consulting parties pursuant with Section 106 of the National Historic Preservation Act. Moreover, DOE submitted a finding of no adverse effect determination on November 23, 2011, which SHPO concurred with on December 9, 2011. Documentation and correspondence pertaining to the Section 106 consultation effort can be found in Appendix B. Based on the finding of no adverse effect for the Proposed Action, cultural resources are not assessed further in this EA.

3.1.4 Socioeconomics

The Proposed Action would not alter socioeconomic factors such as changes in local economic bases, salary levels, land use zoning, plans or programs of other agencies, or a particular socioeconomic group. Although the project would increase short-term employment, no substantial change to economic factors from the proposed construction activities or long-term operation of the RFHP silo would occur. For these reasons, socioeconomics are not assessed further in this EA.

3.1.5 Waste Management

The proposed RFHP silo construction would be short-term (approximately two to three months) and would not substantially increase the amounts or types of hazardous materials generated or maintained at the STM site. In the case of a spill or release of chemicals or hydrocarbons during construction activities, existing BMPs and procedures associated with spill response and materials handling would minimize impacts to surface water. These procedures are defined in the NREL's *Procedure 6.2-10: Spill Prevention Control and Countermeasures (SPCC) Plan for the STM* (NREL 2009). Any construction debris that could not be recycled would temporarily increase the weight and volume of nonregulated waste generated at the site. The proposed RFHP silo operations would not generate hazardous waste or nonregulated waste. For these reasons, waste management is not assessed further in this EA.

3.1.6 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, directs federal agencies to address environmental and human health conditions in minority and low-income communities. The evaluation of impacts to environmental justice is dependent on demonstrating that high and adverse impacts from the proposed project are not disproportionately borne by any low-income or minority groups in the affected community. According to the 2005-2009 American Community Survey, 16.4 percent of individuals living in Golden, Colorado had an income that was below the poverty level and 8.9 percent of individuals were classified as minorities (U.S. Census Bureau 2010). There would be no high and adverse impacts to any members of the community; therefore, there would be no adverse and disproportional impacts to minority or low-income populations. Consequently, this topic was dismissed from detailed analysis in this EA.

3.2 Impact Topics Retained for Further Analysis

Impact topics were selected based on the need to evaluate in detail the potential effects to resources or values of concern. Impact topics are the resources or values of concern that could be affected by the range of alternatives. Specific impact topics were developed to ensure that alternatives were compared based on the most relevant topics. The impact topics were identified based on federal laws, regulations, orders, NREL and DOE policies, and public input. The following impact topics were retained for further analysis: land use and planning, traffic and circulation, air quality, visual quality/aesthetics, water resources, noise, occupational health and safety, accident risk, and intentional destructive acts.

3.2.1 Land Use and Planning

3.2.1.1 Existing Environment

Current land use at the site includes research and development facilities, office space, support buildings, and testing areas. The Alliance manages and operates NREL for DOE under the current contract dated October 1, 2008. With the addition of several new buildings in 2010 and 2011, the STM complex provides approximately 856,000 square feet (79,525 square meters) of facilities and workspace for about 2,400 staff, including contractors and temporary personnel, of which about 1,680 are Alliance employees.

The proposed RFHP silo would be in Zone 4, the center of the STM complex. In addition to the RFHP, the 55-acre (22-hectare) Zone 4 includes major DOE facilities such as the SERF, FTLB, RSF, and Science and Technology Facility (S&TF). It also includes wet laboratories and space for research to conduct experiments with hydrogen (H_2), toxic gases, photovoltaics (PV), biofuels, and industrial technology.

3.2.1.2 Impacts of the Proposed Action

The land use and planning impacts of the proposed RFHP silo on the STM site is bounded by the discussion of impacts presented in the 2003 SWEA (DOE 2003) and subsequent STM EAs (DOE 2007, 2008, 2009). The proposed RFHP silo would be a de-facto, free-standing annex to the existing RFHP. The proposed location for the RFHP silo is a paved, previously developed area immediately south of the existing RFHP facility and west of the central ephemeral channel. It would be situated near the center of the NREL Development Zone 4 (Central Campus), where it would be generally consistent and compatible with the current land use pattern and ongoing NREL operations. Construction of the proposed RFHP silo would not convert any undeveloped land.

3.2.2 Traffic and Circulation

3.2.2.1 Existing Environment

STM Site

Section 3.1.2.1 of the May 2008 SWEA/S-I (DOE 2008) provides a detailed description of the existing traffic environment at the STM site, including discussions of transportation facilities and circulation, existing roadways and traffic volumes, existing operating conditions, and future baseline traffic volumes and operating conditions. The SWEA/S-I (DOE 2008) proposed that a second right-turn lane should be constructed at the Denver West Parkway/Denver West Marriott Boulevard (DWP/DWMB) intersection, as a near-term mitigation measure prescribed in the SWEA/S-I's Mitigation Action Plan (MAP). Two metrics were used as means to assess that traffic flow at the DWP/DWMB intersection would not deteriorate: 1) if the additional turn lane were to be constructed, an acceptable maximum level of traffic volume would be 522 vehicle-trips per hour during peak rush hours; and 2) if the additional turn lane were not to be constructed, an acceptable maximum level of traffic volume would be 387 vehicle-trips per hour during peak rush hours. Moreover, the MAP measures would be implemented or modified as needed to ensure that traffic volumes do not exceed maximum vehicle trip metrics.

Also included in SWEA/S-I are data and figures suggesting that without a new access road, unacceptable levels of service would occur on the roadway system associated with staffing increases at the STM site. That description of the existing traffic environment (existing roadway network and existing traffic volumes and conditions), which was based on traffic studies at the

STM site (FHU 2008), remains current and is incorporated into this section by reference. In addition, a second traffic impact analysis report (Baseline 2009) updated the 2008 traffic impact study to assess potential traffic volumes and operating conditions associated with the new access road assessed in SWEA/S-II (DOE 2009). A new access road would alleviate traffic volumes within the roadway system surrounding the STM including maintaining acceptable traffic levels at the DWP/DWMB.

Additionally, SWEA/S-I and its accompanying FONSI and MAP make commitments to undertake mitigating actions such as traffic demand management measures; those commitments were made to prevent unacceptable traffic impacts. Those mitigating efforts would continue under the Proposed Action in this draft Supplemental EA and are incorporated by reference.

Fuel Sourcing

As described in Section 2.1.3, the primary supply of woodchips would originate from western slope suppliers. However, over the life of the RFHP, the source for woodchips could change and may include localities such as Steamboat Springs, Walden, Gunnison, Buena Vista, Woodland Park, Colorado Springs, all in Colorado; or Laramie and Cheyenne, both in Wyoming – all locations within fuel-sourcing radius of 125 miles (201 kilometers (km)) from the RFHP (Figure 3-1). For the purposes of the draft Supplemental EA, traffic conditions (i.e., Annual Average Daily Traffic (AADT), as well as AADT figures for trucks and the percentage of trucks) on representative transportation routes are shown in Appendix D. Representative transportation routes include, for example: U.S. 40 (Hayden to I-70); State Highway 9 (Kremmling to I-70); I-70 (New Castle to Golden); I-25 (Wyoming State line to I-70); U.S. 287 (Wyoming State line to Fort Collins); SH 93 (Boulder to Golden); SH 50 (Gunnison to I-25); SH 285 (Salida to C470); and I-25 (Pueblo and Colorado Springs to C470).

Along the major transportation routes shown in Appendix D (Table D-1), the percentage of trucks at select data points ranges from a low of 3.2 percent of AADT in Steamboat Springs along U.S. 40 to a high of 23.3 percent of AADT at the Wyoming State line along I-25.

3.2.2.2 Impacts of the Proposed Action

STM Site

During RFHP silo construction, there would be a temporary increase in vehicles and increased demand for limited on-site parking to accommodate the construction workforce, which DOE estimates would be a dozen workers for two to three months. Construction-related traffic impacts are anticipated to be similar in nature to, although less severe than, those recently experienced at the site during construction of the RFHP. Temporary disruptions of on-site traffic flows and access could occur. DOE does not anticipate that construction of the RFHP silo would impact off-site traffic or parking.

Operationally, there would be no traffic impacts because no additional personnel would be hired to operate the RFHP silo; the existing operators would operate the RFHP silo as part of their overall responsibilities associated with the RFHP. Delivery of woodchip fuel would continue to require five to seven deliveries per week during the October through May operating period, and ash waste would be removed once a month. This would not represent an increase over the current on-site truck traffic associated with the RFHP. Thirty- to 35-ton (27- to 31-metric ton) capacity trucks would continue to be utilized to deliver approximately 25 tons (23 metric tons) of woodchips per trip. The trucks would continue to unload directly into the interior pit within the RFHP structure. Woodchip deliveries could temporarily impede on-site traffic flow.

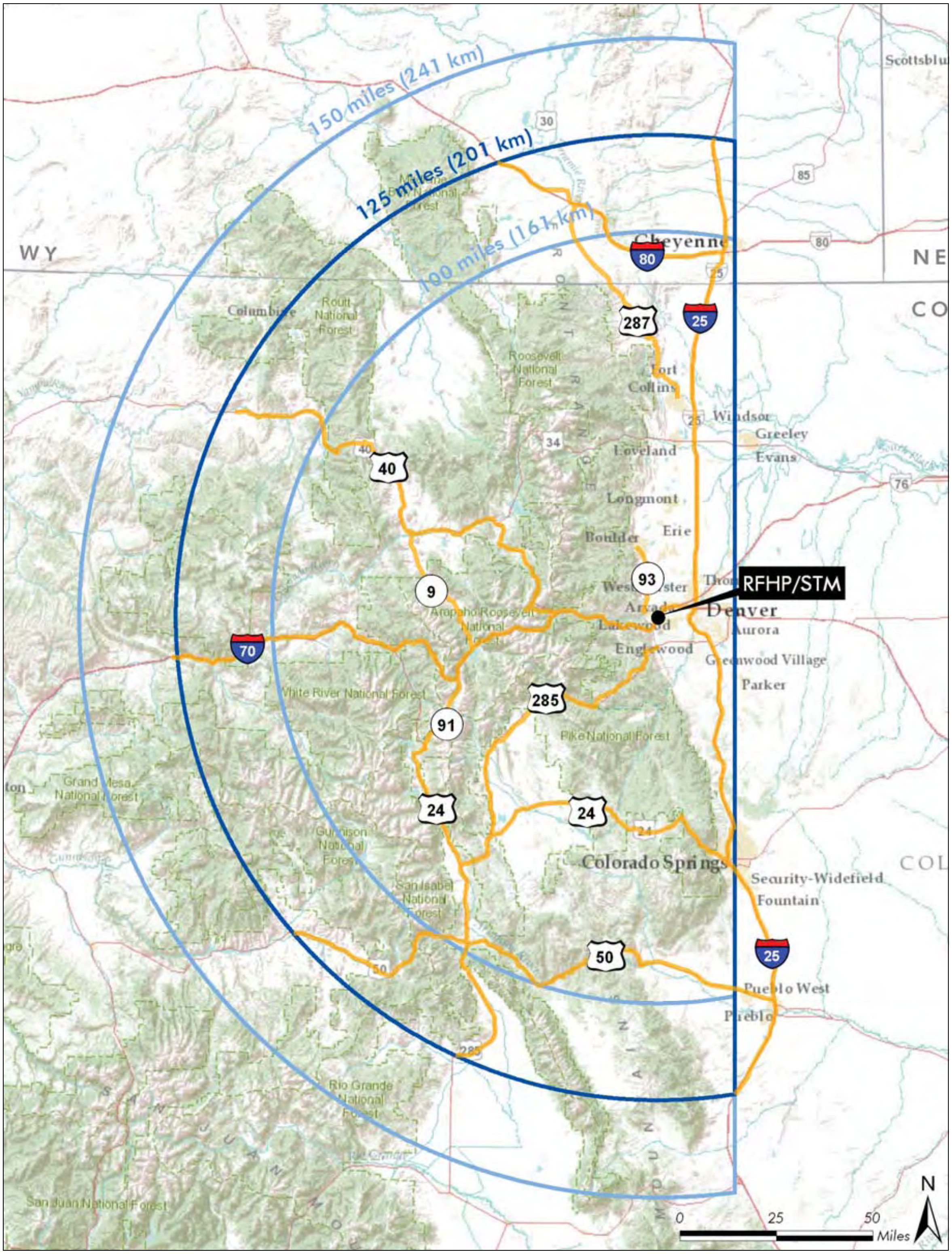


Figure 3-1. Potential major transportation routes within the regional fuel source radius of 125 miles (201 km) from the STM site.

Fuel Sourcing

The number of woodchip fuel deliveries would not change from levels analyzed in the original RFHP EA; there would continue to be 1 or 2 deliveries per day, or 200 annually, over the course of the heating season. In terms of AADT, this would represent one additional truck at any give data point along the representative transportation routes in Table D-1. The increase in AADT for trucks would be de minimis and would not change the percentage of trucks in overall AADT.

3.2.3 Air Quality

3.2.3.1 Existing Environment

National Ambient Air Quality Standards (NAAQS) set upper concentration limits for six air pollutants to protect human health. These six pollutants, called criteria air pollutants, are carbon monoxide (CO), nitrogen dioxide (NO_2, sometimes termed NO_X), ozone (O_3), particulate matter (PM), sulfur dioxide (SO_2), and lead (Pb). Geographic areas that currently exceed, or have recently exceeded, the limit for one or more of the criteria air pollutants are called nonattainment areas for that pollutant. Areas that meet the NAAQS standard for a given criteria pollutant are classified as “attainment” for that pollutant. A “maintenance” area is a former nonattainment area that, through the application of emission controls and the air permit under EPA’s State Implementation Plan process no longer violates one or more NAAQS standards. The Denver metropolitan area, which includes the STM site, is in attainment for all criteria air pollutants except O_3 (CDPHE 2010). However, the Denver metropolitan area is also a maintenance area for CO and PM, specifically, PM_{10}.

The Denver-metropolitan and North Front Range areas became “nonattainment” for the federal ozone standard on November 20, 2007. The nonattainment designation is a result of violations of the federal 8-hour ozone standard. The standard is based on a three-year average of monitoring data. The rest of Colorado attains the ozone standard.

In rural areas (where woodchip fuel would be sourced), air quality is typically good (complies with federal and state health standards) and poses little to no risk, with emissions occurring mostly from on-road and off-road vehicles and fugitive dust. Local communities can be affected at times by wood burning particulate emissions during meteorological atmospheric inversion conditions. But despite these relatively minor emissions, all areas within the fuel sourcing area are in attainment for the six criteria air pollutants with the exception of the Denver-metropolitan and North Front Range nonattainment area for the federal ozone standard. Portions of El Paso County, generally including the City of Colorado Springs and the area along I-25 to Fountain, are classified as a maintenance area for CO (PPACG 2008).

Detailed descriptions of the existing air quality at the STM site are provided in the SWEA (DOE 2003). Those descriptions address climate (Section 3.3.1), air quality regulatory authorities (Section 3.3.2), emission sources (Section 3.3.3), and STM site permit status (Section 3.3.4). The descriptions remain generally current and are summarized or updated below.

The STM site has numerous but relatively small stationary sources of air emissions, including boilers, water heaters, backup generators, and building heaters. Table 3-1 shows the STM site’s potential to emit four criteria air pollutants (PM, SO_2, NO_X, and CO) and provides estimated annual emissions of those pollutants.

In addition, with respect to hazardous air pollutants (HAPs), the STM site emits extremely small quantities of materials from laboratory hoods. Examples of these hazardous air pollutants include aliphatic and aromatic hydrocarbons, chlorinated and nonchlorinated compounds, inorganic acids, and alcohols. The HAP emission quantities are below notification and permit thresholds. Fugitive emissions also can occur from the STM site as unplanned emissions from miscellaneous routes other than stacks, chimneys, or vents. These emissions are minor. Construction activities at the STM site have the potential to increase fugitive dust levels by disturbing soil.

Table 3-1. STM site estimated air pollutant emissions for criteria pollutants in TPY (metric TPY).

Emission Type†	PM_{10}	SO_2	NOx	CO
Potential Maximum	7.61 (6.90)	3.32 (3.01)	57.24 (51.93)	30.32 (27.51)
Typical	0.96 (0.87)	0.16 (0.15)	9.50 (8.62)	5.87 (5.33)

†Includes maximum potential emissions and typical emissions for new equipment at the FTLB, RSF I, RSF II, and new parking facility.

3.2.3.2 Impacts of the Proposed Action

This section discusses general construction- and operations-related impacts to air quality that would occur under the Proposed Action. Section 3.2.3.3 (Conformity Review) discusses criteria air pollutant emissions attributable to the Proposed Action in further detail.

3.2.3.3 Conformity Review

Section 176(c)(1) of the Clean Air Act requires that federal actions conform to applicable state implementation plans (SIPs) for achieving and maintaining the NAAQS for the criteria air pollutants. In 1993, the EPA promulgated a rule titled “Determining Conformity of General Federal Actions to State or Federal Implementation Plans” (58 Fed. Reg. 63214 (1993), codified at 40 CFR Parts 6, 51, and 93). The “conformity rule” is intended to ensure emissions of criteria air pollutants and their precursors are specifically identified and accounted for in the attainment or maintenance demonstration contained in SIPs. For there to be conformity, a federal action must not contribute to new violations of air quality standards, increase the frequency or severity of existing violations, or delay timely attainment of standards in areas of concern.

The conformity rule applies to nonexempt federal actions that would cause emissions of criteria air pollutants (or their precursors) above EPA’s established threshold levels (de minimis levels) in designated nonattainment or maintenance areas. Under the rule, an agency must engage in a conformity review and, depending on the outcome of that review, conduct a conformity determination. In a conformity review, the federal agency must: (1) determine whether a proposed action would cause emissions of criteria pollutants or their precursors; (2) determine whether the emissions would occur in a nonattainment or maintenance area for any of the criteria air pollutants; (3) determine whether the proposed action is exempt from the conformity rule requirements; (4) estimate the emission rates of criteria air pollutants impacting a nonattainment or maintenance area; and (5) compare the estimate to the applicable threshold emission rates. If the estimated emission rates are below the threshold, the proposed action is assumed to conform and no further action is required. If the estimated emission rates exceed the threshold, a more detailed conformity determination is required. DOE has published guidance on how to perform Clean Air Act General Conformity Requirements within NEPA documents (DOE 2000).

DOE conducted a conformity review for the Proposed Action and determined that (1) the Proposed Action would result in emissions of criteria air pollutants, and (2) these emissions would occur in an area (Jefferson County, Colorado) that the EPA has designated as a moderate nonattainment area for O_3 and a maintenance area for CO and PM. Consequently, DOE conducted a further review of estimated emissions of these criteria air pollutants to determine the applicability of the general conformity rule and to determine if the estimated rate of these emissions would be less than or greater than the allowed thresholds.

The threshold emission rates for the O_3 nonattainment area is 100 TPY (91 metric TPY) of NO_X or VOC; the threshold emission rates for CO and PM in a CO or PM maintenance area are also 100 TPY (91 metric TPY) (40 CFR 93.153).

Construction Emissions

Construction associated with the Proposed Action would result in localized short-term increases in ambient concentrations of CO, NO_X, and PM. Construction of the proposed RFHP silo would involve some excavation, which would result in intermittent fugitive dust emissions during construction. Given the small area of the proposed construction site, the proximity to paved roads, and the anticipated short duration of the construction, potential impacts to the local air quality environment would be temporary. Construction impacts would be minimized through the use of best management practices (BMPs) such as wetting the soil surfaces, covering trucks and stored materials with tarps to reduce windborne dust; limiting freeboard on material haul vehicles; and using relatively late-model, properly maintained construction equipment.

Emissions of construction-generated fugitive dust would be permitted under NREL's CDPHE Air Permit #08JE0889L, which authorizes emissions of fugitive dust at the STM site associated with overlot grading and associated construction activities. The general conformity rule (40 CFR 93.153(d)) provides an exemption for portions of an action that require an air emissions permit because state-permitted emissions are presumed to conform to the applicable SIP. DOE has determined that because PM emissions from construction-generated fugitive dust would be permitted under CDPHE Permit #08JE0889L, they are exempt from the need for further conformity determination.

The Proposed Action also includes construction activities that would result in emissions of CO, NO_X, and PM primarily from diesel engines. EPA has published exhaust and crankcase emission factors for steady-state emission of CO, NO_X, and PM from off-road diesel engines (EPA 2010). Table 3-2 shows these emission factors for Tier 1 engines of various power ranges.[1] At least some of the equipment used would employ more stringent (lower-emitting) Tier 2 and Tier 3 technology; however, Tier 1 standards have been used as a conservative approach to demonstrate the worst case relative to emissions.

Because construction-related emissions would be short-term, no adverse health impacts to on-site workers or the public or adverse visual impacts to the local or regional viewshed would result from air emissions due to the proposed construction of the RFHP silo.

The exact types and numbers of engines that would be used for the Proposed Action and their total hours of operation are not yet known. However, based on a review of recent, similar construction projects at the STM site and at other DOE sites, DOE developed a list of the types and sizes (horsepower ranges) of equipment (Table 3-3). This equipment is believed to be representative of the equipment that would be used for the Proposed Action. Table 3-3 also shows

[1] The first federal standards (Tier 1) for new nonroad (or off-road) diesel engines were adopted in 1994 for engines greater than 50 hp (37 kW), to be phased in from 1996 to 2000. A 1998 regulation introduced Tier 1 standards for equipment under 50 hp (37 kW) and increasingly more stringent Tier 2 and Tier 3 standards for all equipment with phase-in schedules from 2000 to 2008. On May 11, 2004, the EPA signed the final rule introducing Tier 4 emission standards, which are to be phased in over the period from 2008 to 2015 (EPA 2010).

DOE's estimate of the hours that each type of equipment would operate during the Proposed Action. The emission factors shown in Table 3-2 were applied to develop the estimates of the annual emissions of NO_X, CO, and PM shown in Table 3-3.

Table 3-2. Tier 1 Non-Road Compression Ignition Engine Standards.

Engine Power (hp)	Emission Standards in grams per horsepower-hour (g/hp-hr)		
	CO	NO_x	PM
>50 to <75	2.3655	5.5988	0.4730
>75 to <100	2.3655	5.5988	0.4730
>100 to <175	0.8667	5.6523	0.2799
>175 to <300	0.7475	5.5772	0.3521
>300 to <600	1.3060	6.0153	.02008

Source: EPA 2010.

Table 3-3. Estimated CO, NO_X, and PM emissions from diesel construction equipment.

Type of Construction Equipment	Number of Units	Engine Size Range (hp)	Total Annual Operating Hours	Estimated Annual Emissions in TPY (metric TPY)		
				CO	NO_x	PM
Backhoe/Loader	1	50-100	32	0.01 (<0.01)	0.02 (<0.02)	<0.01 (<0.01)
Drilling Rig	1	150-175	16	0.01 (<0.01)	0.02 (<0.02)	<0.01 (<0.01)
Concrete Pumper	1	175-300	40	0.01 (<0.01)	0.07 (0.06)	<0.01 (<0.01)
Concrete Truck	1	175-300	40	0.01 (<0.01)	0.07 (0.06)	<0.01 (<0.01)
Dump Truck (semi)	1	300-600	20	0.02 (<0.02)	0.07 (0.06)	<0.01 (<0.01)
Total Estimated Emissions in TPY (metric TPY)				0.06 (<0.05)	0.25 (0.23)	<0.01 (<0.01)

The estimated annual emissions of each of these criteria air pollutants are very minor. Moreover, DOE believes these estimates are conservative for the following reasons: (1) the calculations assume the highest engine horsepower shown in a given engine size range; (2) the calculations assume Tier 1 technology, and at least some of the equipment used would probably employ more stringent (lower-emitting) Tier 2 and Tier 3 technology; and (3) the estimates of operating hours are conservatively high.

Operational Emissions

Fugitive dust would continue to be emitted during deliveries of woodchips to the RFHP. These emissions would continue to be kept at a low level by transferring woodchips directly from the delivery vehicles into the existing woodchip fuel pit. For example, woodchips would be directly transferred from a "live bottom" trailer to the woodchip fuel pit. The trailer would be parked adjacent to the fuel pit door, creating a space that is not exposed to cross winds. The live bottom of the trailer would move the chips directly into the fuel pit. Once the transfer is completed, the fuel pit door would be closed and the outdoor portion of the woodchip delivery area would be swept clean. This would prevent fugitive dust from being entrained during high winds or when delivery trucks drive through the area. There would be very little fugitive emissions from the proposed RFHP silo because it would be fully enclosed except for passive ventilation on the roof of the silo. Additionally, the relatively large size of the woodchips minimizes the conveyance of fine particulates.

Trucking Emissions

To estimate trucking emissions from regional woodchip sourcing, the maximum vehicle miles traveled (VMT) annually (76,800) were distributed across four roadway types based on national and regional data (FHWA 2005). Table 3-4 shows the distribution of diesel combination truck VMT by facility type. Trucking VMT would be relatively constant over the life of the Proposed Action.

Table 3-5 shows the emission factors for combination diesel trucks by the four facility types.

Table 3-4. Diesel combination truck VMT by facility type.

Facility Type	VMT (km)	Percent of Total
Local	9,984 (16,067.7)	13
Minor Arterial / Collector	26,880 (43,259.2)	35
Urban Freeway	23,040 (37,079.3)	30
Rural Freeway	16,896 (27,191.5)	22
Total	76,800* (123,597.6)	100

*Represents the maximum VMT (Gunnison, Colorado to the STM site) within the 125-mile (201-km) fuel sourcing radius (384-mile (618-km) total trip) and 200 trips annually.

Table 3-5. Emission factors for diesel combination trucks by facility type (grams/mile).

Year	VOC	CO	NO_x	PM_{10} (total)	PM_{10} (exhaust only)
Local Road					
2010	0.78	3.52	7.45	0.17	0.13
2020	0.56	0.78	1.29	0.07	0.03
Minor Arterial / Collector					
2010	0.39	1.47	6.38	0.17	0.13
2020	0.28	0.33	1.03	0.07	0.03
Urban Freeway					
2010	0.28	1.14	8.38	0.17	0.13
2020	0.20	0.25	1.28	0.073	0.034
Rural Freeway					
2010	0.27	1.44	12.39	0.17	0.13
2020	0.19	0.32	1.97	0.07	0.03

Source: FHWA 2005.

Applying the emission factors to the VMT, truck emissions in 2010 and 2020 have been estimated (Table 3-6). These results show that the proposed fuel sourcing transportation would emit less than 100 TPY (90.72 metric TPY) of any criteria pollutant. These results also show truck emissions would be expected to drop over the next decade due to use of trucks with cleaner burning engines, especially for CO and NO_x emissions.

Table 3-6. Estimated current and future diesel combination truck emissions in TPY (metric TPY).

Year	VOC	CO	NO_x	PM_{10}
Local Road				
2010	0.00859 (0.00779)	0.03874 (0.03514)	0.08199 (0.074381)	0.00187 (0.001697)
2020	0.00616 (0.00559)	0.00859 (0.00779)	0.014197 (0.012879)	0.000771 (0.000699)
Minor Arterial / Collector				
2010	0.01155 (0.01048)	0.043557 (0.039514)	0.189040 (0.171494)	0.005038 (0.004570)
2020	0.00830 (0.00753)	0.009778 (0.008870)	0.030519 (0.027686)	0.002075 (0.001882)
Urban Freeway				
2010	0.00711 (0.00645)	0.028953 (0.026266)	0.212829 (0.193075)	0.004318 (0.003917)
2020	0.00508 (0.00461)	0.006349 (0.005760)	(0.032508) 0.029491	0.001854 (0.001682)
Rural Freeway				
2010	0.00503 (0.00456)	0.026820 (0.024330)	0.230759 (0.209341)	0.003166 (0.002872)
2020	0.00354 (0.00321)	0.005960 (0.005407)	0.036690 (0.033285)	0.000559 (0.000507)
Total				
2010	0.03228 (0.02928)	0.138065 (0.125250)	0.714619 (0.648291)	0.014392 (0.013056)
2020	0.02308 (0.02094)	0.030674 (0.027827)	0.113914 (0.103341)	0.005258 (0.004770)

Total Estimated Emissions

The total estimated emissions of CO, NO_X, and PM for the Proposed Action (i.e., the sum of CO, NO_X, and PM emissions from construction (Table 3-3), operational activities, and trucking (Table 3-6)) would be below the de minimis thresholds of 100 TPY (90.72 metric TPY). Therefore, DOE has determined that further conformity determination is not required. DOE acknowledges that there would likely be additional miscellaneous sources of CO, NO_X, and PM directly or indirectly attributable to the Proposed Action (e.g., commuting construction workers and the use of equipment types not specifically identified in Table 3-3). While recognizing and acknowledging these potential additional incremental sources, DOE believes they would not result in the Proposed Action exceeding allowed threshold levels because they would be either short-term (commuting workers) or limited in their potential to emit and to put into context, these additional incremental emissions most likely would be less than those values identified in Table 3-3.

3.2.4 Climate, Greenhouse Gases, and Global Warming

3.2.4.1 Existing Environment

Table 3-7 shows the STM site's estimated annual emissions of greenhouse gases (GHG), including: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and carbon dioxide equivalent (CO_2e). The STM site-wide emissions (Table 3-7) include both permitted and permit exempt emission sources such as: emergency generators; process and steam boilers and heaters; RFHP emissions based on maximum permitted wood and natural gas use; TCPDU thermal oxidizer; hot water and radiant comfort heating equipment in all laboratories; domestic hot water heaters; and other small fuel-using equipment such as micro-turbines.

Table 3-7. STM site estimated emissions of GHG in TPY (metric TPY).

Emission Type	CO_2	CH_4	N_2O	CO_2e
Potential Maximum	39,965 (36256)	2.00 (1.81)	0.93 (0.84)	40,295 (36,555)
Typical	8,323 (7,551)	0.28 (0.25)	0.17 (0.15)	8,381 (7,603)

Note: CO_2e factors for CH_4 and N_2O derived from Table A-1 to Subpart A of 40 CFR Part 98: Mandatory Greenhouse Gas Reporting.

3.2.4.2 Impacts of the Proposed Action

The Proposed Action would constitute a short-term minor increase in the use of fossil fuel and associated GHG emissions during construction of the proposed silo. This would result in the one-time generation of approximately 9.4 tons (8.53 metric tons) of CO_2 equivalent emissions (see CO_2 emissions calculations in Appendix F. Calculations for Greenhouse Gas Emissions).

The Proposed Action would also cause a minor increase in the use of fossil fuel and associated GHG emissions during the transportation of the woodchips from the supplier to the RFHP during its 30-years of operation. This component of the Proposed Action would result in the release of approximately 145.35 tons (131.86 metric tons) per year of CO2 equivalent emissions (see CO2 emissions calculations in Appendix F. Calculations for Greenhouse Gas Emissions).

The CEQ has issued draft guidance on when and how federal agencies should consider GHG emissions and climate change in NEPA. The draft guidance includes a threshold of 27,557.78 TPY (25,000 metric TPY) of CO_2 equivalent emissions from a proposed action (CEQ 2010). CEQ suggests this threshold to agencies as an indicator that a quantitative and qualitative assessment of GHGs may be more meaningful to decision makers and the public. The GHG emissions associated with the Proposed Action would result in a worst-case calendar year emission of 154.75 TPY (140.39 metric TPY), which is far less than the CEQ threshold. In comparison, the typical total annual emissions of GHG estimated for the STM is 8,381 TPY (7603.12 metric TPY). Total 2005 GHG emissions in the State of Colorado were estimated at 127,978,300 tons (116,100,000 metric tons) (CCS 2007). Therefore, GHG emissions from the Proposed Action would represent a de minimis increase compared to existing statewide emissions.

Per the CEQ guidance, it is currently not useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such a direct linkage is difficult to isolate and to understand. At present, there is no methodology that would allow DOE to estimate the specific affects (if any) that this small incremental increase in CO_2 emissions would contribute to climate change.

3.2.5 Visual Quality/Aesthetics

3.2.5.1 Existing Environment

The text and figures describing the visual and aesthetic environment of the STM presented in the SWEA remain current and are summarized below.

Figure 3-2, Figure 3-4, and Figure 3-6 illustrate the current overall visual environment at the STM site and the proposed RFHP silo location as viewed from three off-site locations to the southeast, south, and southwest. (Note: To facilitate comparison, the RFHP silo simulations described in Section 3.2.5.2 are presented directly with the existing view.)

The dominant visual characteristics of the existing NREL STM site include the prominent slope and mesa top associated with the South Table Mountain (the Mesa; i.e., the geologic feature); the DOE facilities located on top of the Mesa; and the facilities located along the toe of the slope including SERF, FTLB, S&TF, RSF, and the Visitors Center. Two other facilities are currently under construction; a multistory parking structure and the Energy Systems Integration Facility (ESIF). The STM site buildings are prominent against the landscape of the Mesa. Other less-prominent buildings occupy the western end of the NREL STM site (Figure 2-1).

The STM site facilities are designed to reflect the laboratory activities related to modern energy concepts. Three of the larger buildings—the SERF, FTLB, and S&TF—are terraced and set against the south slope of STM. In addition to the buildings at the STM central campus, DOE has constructed a variety of solar testing and measurement structures such as the High Flux Solar Furnace, Solar Radiation Research Laboratory, Alternative Fuels User Facility, Outdoor Test Facility, Thermal Test Facility, support facilities (e.g., shipping/receiving and facilities maintenance), and numerous PV panels situated throughout the site.

3.2.5.2 Impacts of the Proposed Action

The RFHP silo that would be added to the STM site under the Proposed Action would not be unique to the site. The appearance of the proposed RFHP silo would in fact be similar to other ancillary facilities (e.g., stacks and storage tanks) that have been a part of the STM site for many years. As such, the addition of the RFHP silo would not alter the current visual character of the site. If the proposed facility was noticed at all, the casual observer would likely note only that the added RFHP silo resembled the structures already on the site.

As discussed in Section 2.1.1, the proposed silo would be about 20 feet (6 meters) in diameter, about 76 feet (23.2 meters) tall, and constructed of concrete. A bucket elevator/chute would extend about 25 feet (7.6 meters) above the top of the proposed silo. To support this future decision making, the proposed RFHP silo has been simulated from a representative range of viewing locations. Figure 3-3, Figure 3-5, and Figure 3-7 show the extent to which the proposed RFHP silo would be seen based on the same locations presented in Section 3.2.5.1.

The RFHP silo would be similar in height to the SERF and the S&TF facilities and, from most off-site observation points, would be partially blocked from view by the FTLB and the multistory parking garage under construction. Constructed of concrete, the proposed RFHP silo's color and texture would blend into the overall view. Figure 3-5 is the view looking northeast from the southwest of the STM site with the proposed RFHP silo added. From this vantage point, without artificial magnification, the proposed RFHP silo would be almost indiscernible.

3.2.6 Water Resources

3.2.6.1 Existing Environment

The description of water resources found in the SWEA remains current and is summarized below.

Surface Water

No perennial creeks, streams, ponds, or floodplains are on the STM site. Surface water, when present, is not used by NREL. There may be seasonal seeps on the STM site after small amounts of surface water percolate through the soil or the fractured basalt that caps the mesa. Intermittent storms and other seasonal precipitation events may cause water to temporarily collect in topographic lows and drainages. Surface water may briefly collect in depressions formed in the basalt on the top of the Mesa.

Figure 3-2. Current view of the STM site in April 2011 as seen from the intersection of Nile and Moss streets.

Figure 3-3. Same view as Figure 3-2 with addition of proposed RFHP silo (simulated). The distance to the proposed RFHP silo is approximately 0.6 mile (1 km).

Figure 3-4. Current view of the STM site in April 2011 as seen from the U.S. Highway 6 exit ramp westbound to I-70.

Figure 3-5. Same view as Figure 3-4 with the addition of the proposed RFHP silo (simulated). The distance to the proposed RFHP silo is approximately 2.25 miles (3.6 km).

Figure 3-6. Current view of the STM site in June 2011 as seen from the Pleasant View Community Park trail.

Figure 3-7. Same view as Figure 3-6 with the addition of the proposed RFHP silo (simulated) and multistory parking structure currently under construction represented by three-dimensional building mass. The distance to the proposed RFHP silo is approximately 0.75 mile (1.2 km).

Groundwater

Groundwater monitoring is not required of NREL by a regulatory agency; however, monitoring wells were installed at the STM site, and groundwater baseline data were accumulated beginning in 1990. The monitoring wells have since been capped. The most recent groundwater monitoring data were obtained in 1997 when groundwater beneath the STM site was analyzed for VOCs, semivolatile organic compounds (SVOCs), total metals, pesticides, and herbicides. Results of the analysis indicated the groundwater beneath STM is not contaminated with any VOCs, SVOCs, pesticides, or herbicides. Although the samples indicated that concentrations of manganese and iron were elevated, the concentrations were within naturally occurring variations and no constituent concentrations exceeded national primary drinking water standards.

3.2.6.2 Impacts of the Proposed Action

The RFHP silo would not result in untreated operational discharges of pollutants to surface water or groundwater. Any drains necessary for the RFHP silo would be connected to the STM site's existing stormwater and sewage lines, and all discharges to the publicly owned treatment works would meet the requirements of the Metro Wastewater Reclamation District and the Pleasant View Water and Sanitation District.

The RFHP silo would be located in an area (i.e., immediately south of the existing RFHP facility) that has an impervious surface and no changes to drainage patterns would result from the Proposed Action. Therefore, the proposed RFHP silo would not increase the impervious surface area, and stormwater runoff rates following construction would meet preconstruction runoff rates. The new facility would be designed to comply with current federal, state, and local stormwater discharge and water quality regulations.

As the area of disturbance for the Proposed Action is less than one acre, a National Pollutant Discharge Elimination System (NPDES) general construction permit is not required. However, the proposed project would comply with the requirements set forth in NREL's *Lab Level Procedure 6-2.15: Storm Water Pollution Prevention for Construction Activities: South Table Mountain Site.* If groundwater were encountered during excavations for the proposed silo, the groundwater would be pumped from the excavation to a vegetated area rather than into a drainage. The vegetated areas would act as filters to trap sediment and reduce impacts associated with groundwater disposal.

3.2.7 Noise

3.2.7.1 Existing Environment

Colorado Revised Statutes (CRS) 30-15-401(m)(I) authorize counties to enact ordinances that regulate noise on public and private property. The maximum permissible noise levels in Colorado are stated in CRS 25-12-103 and have been adopted into Jefferson County ordinances (Table 3-8).

Table 3-8. Maximum noise levels by sound source permitted in Jefferson County.

Sound Source in Residential Zone	Maximum Noise (dBA) 7 am to 7 pm	Maximum Noise (dBA) 7 pm to 7 am
Nonvehicular	55	50
Construction	80	75

Source: Jefferson County 2007.

For purposes of Jefferson County's noise regulations, sound from a nonvehicular source is measured 25 feet (7.6 meters) from a property line when the wind velocity at the time and place of such measurement is not more than 5 miles (1.5 km) per hour, or 25 miles (40 km) per hour with a wind screen.

Detailed descriptions of the existing noise environments at the STM are provided in the SWEA. These descriptions address sensitive noise receptors (Section 3.4.1), existing noise levels (Section 3.4.2), and noise regulations and guidelines (Section 3.4.3). They remain current and are summarized below.

Noise receptors in the immediate vicinity of the STM site include STM personnel; inhabitants of residences east, west, and south of the site boundary; and wildlife. With respect to NREL personnel, DOE has accepted the Occupational Safety and Health Administration (OSHA) noise standards and guidelines for worker exposure and manages their compliance. These regulations and guidelines focus on noise from machinery, equipment, and tools. DOE maintains compliance with all regulations related to worker health and safety.

Receptors in the vicinity of the site include inhabitants of multifamily residences approximately 50 feet (15 meters) east of the STM site boundary. Two subdivisions consisting of single-family residences are located south and west of the STM site. The nearest residence to the STM site's southwestern boundary is approximately 50 feet (15 meters) away. The nearest residence to the STM site's southeastern boundary is approximately 100 feet (30 meters) away. The nearest school, church, or daycare center is about 0.5 mile (0.8 km) from the site, near 20th and Denver West Parkway. Pleasant View Community Park, a regional park, is in the open area south of Zone 6. All receptors are currently affected by the ambient traffic noise generated by South Golden Road and I-70.

Although noise measurements were not taken for the SWEA and noise modeling was not performed, site observations indicate the acoustic environment within the boundaries of the southeastern portion of the STM site can be considered similar to that of an urban location. I-70 is a significant noise source throughout the day and during sensitive late-night and early-morning periods. It is estimated that 24-hour day-night average sound levels on the site typically range from 40 to 60 A-weighted decibels (dBA). Most activity and mechanical operations at the STM site are conducted within buildings.

3.2.7.2 Impacts of the Proposed Action

Silo Construction

Construction would normally occur Monday through Friday during daylight hours. An exception would be in cases where construction activities require interruption of site utility services; in that case, weekend work may occur. There would be a short-term (approximately two- to three-month) increase in ambient noise due to construction of the proposed RFHP silo. Heavy equipment such as, backhoes, excavators, dump trucks, and cement trucks would generate noise that would impact on-site workers and nearby residents, especially residents living immediately east and west of the STM site. Construction equipment typically emits noise in the 86- to 94-dBA range. Construction workers would use hearing protection and would follow OSHA standards and procedures. Direct exposure of NREL staff to construction noise would be generally limited to times when personnel were outdoors walking to or from parked vehicles or between buildings.

Construction activities for the proposed RFHP silo would occur in association with other construction activities at the STM site, but would not occur close to residences; however, noise could be a nuisance for some residents during construction. Construction-related noise impacts would vary with the phase of construction and would occur intermittently. The Proposed Action would adhere to county noise ordinances for allowable noise levels during construction. If construction activities resulted in an exceedance of the county noise ordinance, noise monitoring and a mitigation plan may be needed.

Silo Operation

The proposed RFHP silo would be a storage facility, not a manufacturing facility. Noise sources associated with the proposed RFHP silo would include the intermittent operation of the silo elevator.

Final selection of a silo elevator has not been made; however, based on available manufacturer information, a standard bucket elevator operates between 60 to 65 dbA. When a bucket elevator is running completely empty, the decibel level drops to about 40 dbA. The noise levels associated with this equipment are expected to stay below 70 dBA at a distance of about 10 feet (3 meters).

Levels of ambient or intrusive outdoor noise vary extensively at distances greater than about 300 feet (91 meters) from the source. This variation is caused by changes in weather and by topographical features, structures, and other obstacles between the noise source and the sensitive noise receptor. To assess potential off-site noise levels associated with the proposed equipment, it was assumed that a sound level drops 6 dBA for every doubling of the distance from the source (FHWA 2011).

The off-site noise receptors nearest to the proposed RFHP silo would be homes just south of the Visitors Center and the Outdoor Test Facility (OTF). These off-site receptor areas are approximately 1,050 feet (320 meters) to the southwest and 1,500 feet (460 meters) to the southeast from the proposed RFHP silo location. Structures are located between the noise source (i.e., the elevator associated with the proposed RFHP silo) and the receptors (the homes), which makes it difficult to quantify the noise impact from the proposed RFHP silo at these locations.

However, applying the assumption that the loudest source of noise at the RFHP silo could intermittently generate 70 dBA at a distance of 10 feet (3 meters), the noise level at 160 feet (48 meters) – well within the STM site boundary – would be approximately 46 dBA. The noise level at the nearest STM site boundary approximately 800 feet (244 meters) to the southwest would be below 34 dBA (Table 3-9). For comparison, 40 dBA is approximately the noise level for a whisper (Table 3-10).

The noise from the proposed RFHP silo elevator, which would be intermittent, would likely not be noticeable over ambient residential neighborhood, street, and highway noise. The Proposed Action would adhere to county noise ordinances for allowable noise levels for operation noises of the RFHP silo elevator.

Table 3-9. Distance attenuation for proposed RFHP silo elevator noise.

Receptor Distance feet (meters)	Noise Level at Receptor (decibels)
10 (3)	70
20 (6)	64
40 (12)	58
80 (24)	52
160 (49)	46
320 (98)	40
640 (195)	34
1,280 (390)	28

Notes: Reference noise level is 70 dBA for silo elevator noise.
Basic sound level decrease is 6 dBA for each doubling of distance.
Sound level decrease does not include atmospheric absorption or terrain and vegetative barriers.

Table 3-10. Noise level (dBA) levels for environments typically encountered.

Typical Environments	Noise Level (dBA)
Whisper	40
Conversation	60
Noisy Restaurant	80
Blender	90
Factory Machinery	100
Large Diesel Genset	110
Rock Concert	120
Power Drill	140
Jet Takeoff	150

Source: Silex 2002.

3.2.8 Occupational Health and Safety

3.2.8.1 Existing Environment

NREL has defined workplace standards, which are compliant with DOE expectations and applicable OSHA standards. NREL also has a comprehensive safety management system that establishes policies and programs to identify, analyze, and mitigate occupational health and safety risks. All activities are evaluated prior to conducting work to establish a safe working environment and implement proactive measures to monitor the effectiveness of workplace controls. Worker qualification, safe workplace design, access control, process oversight, and periodic reviews are some of the tools used to protect the health and well-being of workers, visitors, and the public. NREL also integrates emergency planning to respond to off-normal events and has established mechanisms to analyze, correct, and prevent accidents. The plans are in place to minimize injuries to people and damage to the environment. NREL has distributed the plans to its organization and to public emergency responders including the Jefferson County Sheriff and West Metropolitan Fire Protection District. The OSHA injury/illness reporting information for NREL is summarized in Table 3-11.

Table 3-11. Injury/illness reporting information for NREL from 2007-2011.

Reporting Period (Fiscal Year)	Total Recordable Case Rate	Days Away, Restricted or Transferred Rate
2011	0.24	0.08
2010	0.65	0.30
2009	0.58	0.26
2008	0.49	0.25
2007	0.47	0.19

Reports of injury/illness are far below the national average. For example, the 2010 Bureau of Labor Statistics (BLS) reported 1.0 for the Total Recordable Case Rate and 0.4 for the Days Away, Restricted, or Transferred Rate. There have been no fatalities at NREL since its inception.

3.2.8.2 Impacts of the Proposed Action

NREL has a robust health and safety program and is one of the leading laboratories in the DOE complex for safety performance. NREL has policies and procedures in place to address compliance with Safety and Occupational Health requirements. These policies and procedures address many issues including occupational health and safety (e.g. confined space, electrical safety, fall protection, industrial hygiene), fire services, and severe weather (e.g., lightning protection measures). Specific to operations of the proposed RFHP silo and the RFHP overall, NREL has procedures that monitor safety and compliance with OSHA standards and address many issues in the day-to-day site operations including: confined space entry, machine guarding, fire protection and prevention, as well as programs in place for these types of operational hazards.

The Proposed Action would not use or produce hazardous materials and waste. Industrial chemicals that may be used for maintenance of the proposed RFHP silo would be stored, handled, and used in accordance with all applicable local, state, and federal regulations. While a potential for spills would exist during the use of any chemicals for maintenance, no direct effects would be anticipated since NREL has developed and implements an active program to clean up spills.

Operation of the proposed RFHP silo would be performed in accordance with a site safety plan, which would require accident reporting, electrical safety, fire protection, and the use of personal protective equipment. This plan would be developed to minimize impacts to workers' health and safety during operation and would include, for example, silo entry procedures. In addition, all operation activities would be carried out in compliance with OSHA requirements that would include personal protective equipment (e.g., masks, ventilators, protective clothing) and standard operating procedures to reduce potential accidents.

NREL and its subcontractors would be required to comply with all other applicable local, state, and federal environmental, safety and health (EHS) standards, laws and regulations applicable to their activities. A partial listing of requirements applicable to NREL is provided in 10 CFR 851, Section 851.27, and set forth in NREL's *Procedure 6-6: Necessary and Sufficient Standards.*

There would be a remote (see 3.2.9 Accident Risk) potential for fire associated with operation of the proposed RFHP silo. Fire protection requirements would be incorporated into NREL planning and response documents, and would be communicated to public emergency responders including West Metro Fire Rescue and the Jefferson County Sheriff Office.

3.2.9 Accident Risk

3.2.9.1 Existing Environment

NREL implements DOE's Integrated Safety Management process to ensure that NREL operations are "low risk." Risk is formally defined as a quantitative or qualitative expression of possible loss that considers (1) the probability that a hazard-driven event will occur, and (2) the consequences of that event. An activity can be "low risk," even if the consequences of an accident might be catastrophic (may cause death or system loss), so long as the likelihood or probability of such an accident occurring is extremely remote (annual probability of 0.000001 to 0.0001).

NREL has a Contingency Plan in place for emergency response, which includes plans for materials that could contribute to explosion, fire, chemical, or radiation hazards. NREL complies with the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 et seq.) and CDPHE regulations. NREL would store such materials in accordance with all applicable federal, state, and local laws, codes, rules, and regulations, and it would maintain its Contingency Plan, which details the steps it would take in the event of a spill, release, explosion, or fire.

3.2.9.2 Impacts of the Proposed Action

RFHP Silo

NREL views good industrial safety practices and adherence to the guidelines essential for worker safety. The existing RFHP has been operated for several years, and safe operating procedures have been developed and implemented by NREL. A review of the operational hazards, safety features, and safe operating practices for the RFHP was undertaken to postulate possible accident scenarios that could occur as a result of the proposed improvements including the RFHP silo and regional fuel sourcing.

A detailed discussion of these analyses can be found in Appendix E. Table 3-12 identifies the accident scenarios and the likelihood of their occurrence; and describes the predicted impact to the off-site public, the involved worker (individual working in the RFHP); the uninvolved workers that work elsewhere on the STM site; and bystanders.

For the purposes of analysis in this draft Supplemental EA, a wide range of solid biofuels that are produced in different sizes and shapes originating from different raw materials has been examined. The physical properties (e.g., size, shape, moisture content, and type of raw material) all influence the handling and storage properties of the fuel. Based on the nature of the RFHP woodchips (i.e., moisture content between 15 and 25 percent); the arid Colorado climate; and the typical[2] (short) residence time of approximately one week in the proposed RFHP silo, the likelihood of occurrence and the resulting consequences would probably be much less severe than those presented in Appendix E.

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[2] A breakdown in equipment may require a 30-day shutdown for repairs. Given a 30-day residence time for the RFHP woodchips, the likelihood of spontaneous combustion would still be remote due to the low moisture content of the RFHP woodchips.

Table 3-12. Proposed RFHP silo accident consequence summary.

Accident Scenario	Likelihood of Occurrence	Impact to the Off-site Public	Impact to Involved Worker	Impact to Uninvolved Worker or Bystanders
Spontaneous or external ignition	Remote	Facility location and access would prevent any impacts to a member of the public.	Fire would do extensive damage to equipment and could lead to explosion (see below).	Fire would do extensive damage to equipment and could lead to explosion (see below).
Explosion	Extremely remote	Facility location and access would prevent any impacts to a member of the public.	Explosion would cause extensive damage to the equipment and the facility. Because the proposed RFHP silo would not be occupied and is physically separated from the RFHP building containing the control room, injuries to workers would not be anticipated.	Explosion would cause extensive damage to the equipment and the facility. Facility location and explosion could result in primary, secondary, or tertiary injuries to uninvolved workers or bystanders.
Health risks associated with exposure to gases, molds, and organic dust	Extremely remote	Facility location and access would prevent any impacts to a member of the public.	For unprotected workers, health effects would be anticipated. However, workers are trained in emergency response, and any response activities would include a risk assessment and incorporation of health and safety monitoring followed by proper selection and use of PPE to reduce the potential of permanent health effects.	Facility location and access would prevent any impacts to uninvolved workers or bystanders.
Collapse from filling or acid production	Extremely remote	Facility location and access would prevent any impacts to a member of the public.	Collapse would cause extensive damage to the equipment and the facility. Because the proposed RFHP silo would not be occupied and is physically separated from the RFHP building containing the control room, injuries to workers would not be anticipated.	Facility location and access would be unlikely to result in any impacts to uninvolved workers and bystanders.

Accidents involving fires or explosions could have direct effects on involved workers, uninvolved workers, and bystanders. However, because the RFHP operations are largely automated, workers have the required protective equipment available and NREL has emergency response procedures implemented, the likelihood of a serious injury to a RFHP worker is small. However, the facility location and explosion could result in primary, secondary, or tertiary injuries to uninvolved workers or bystanders.

Until the final design is completed for the proposed RFHP silo, DOE and NREL are unable to finalize the specific facility design elements. Prior to final design, NREL would initiate a Safety Assessment for the proposed RFHP silo and associated activities to determine what additional levels of risk assessment, if any, are required. The final process design of the proposed RFHP silo would dictate the risk assessment method selected. Whichever method is selected appropriate subject matter experts would be involved. After the risk assessment methodology and the assessment team have been selected the analysis would be completed to quantify the risk that must be mitigated using a hierarchy of controls. These safety controls would include engineering design features, as necessary. Any identified safety features, including fire and lightning protection measures, would be integrated into the final facility design before construction begins.

Additionally, as required under DOE's NEPA Implementing Regulations (10 CFR 1021.314), DOE and NREL would review the final RFHP silo design and compare it to the conceptual design assessed in the Supplemental EA and "determine whether there have been substantial changes to the proposal or significant new circumstances or information relevant to environmental concerns." This evaluation may be documented in a subsequent NEPA analysis.

Potential Accidents and Fatalities due to Regional Fuel Sourcing

Appendix E (Table E-6) lists the heavy truck mileage from various origination points to the STM site under the Proposed Action. These data include consideration of known woodchip fuel sources and some of the most distant origination points within the regional fuel source radius of 125-mile (201 km) from the STM site. The table indicates that the Proposed Action would require from 38,400 heavy truck miles (61,799 km) from a woodchip fuel source in Kremmling, Colorado to 76,800 heavy truck miles (123,598 km) from a woodchip fuel source in Gunnison, Colorado to the STM site.

The accident-injury rate for all vehicles along Colorado routes in 2004 was 69.3 per 100 million vehicle miles travelled (VMT) or 6.93×10^{-7} (0.000000693) per mile (CDOT 2008). Based on distance between Kremmling, Colorado and the STM site, there would be an estimated additional 0.027 injury due to accidents per year, or 1 injury due to an accident every 38 years. Based on the distance between Gunnison, Colorado and the STM site, there would be an estimated additional 0.053 injury due to accidents per year, or 1 injury due to an accident every 19 years. In other words, additional traffic-related injuries from operations for the Proposed Action would be unlikely over an expected facility life of 30 years.

The fatality rate for all vehicles along Colorado routes in 2009 was 1.01 per 100 million VMT or 1.01×10^{-8} (0.00000001) per mile (CDOT 2011). Accident fatalities that involved large trucks (combination trucks) indicated that 6.1 percent of all fatalities in Colorado involved large trucks (DOT 2011). Therefore, the fatality rate for heavy trucks would be 6.1×10^{-10} (0.00000000061) per mile. Based on distance between Kremmling, Colorado and the STM site, there would be an estimated additional 0.000023 fatality per year, or 1 fatality every 43,478 years. Based on the distance between Gunnison, Colorado and the STM site, there would be an estimated additional 0.000047 fatality per year, or 1 fatality every 21,277 years. In other words, additional traffic-related fatalities from operations for the Proposed Action would be extremely unlikely.

3.2.10 Intentional Destructive Acts

The DOE Office of General Counsel has issued interim guidance stipulating that each DOE environmental impact statement (EIS) and EA should explicitly consider intentional destructive acts (e.g., acts of sabotage or terrorism). DOE applied a sliding scale in considering the potential impacts of intentional destructive acts within the context of the Proposed Action.

The proposed RFHP silo would not involve the transportation, storage, or use of radioactive, reactive, or explosive materials. Consequently, it is highly unlikely that any element of the Proposed Action would be viewed as a potential target by saboteurs or terrorists. The wood fuel that would be stored in the proposed RFHP silo is necessarily combustible but it is neither explosive nor highly flammable. The limited quantities of woodchips that would be stockpiled and the limited access to the silo would limit the attractiveness of the facility to saboteurs or terrorists. The Proposed Action would not offer any credible targets of opportunity for terrorists or saboteurs to inflict significant adverse impacts to human life, health, or safety, nor would the Proposed Action render the STM site as a whole any more susceptible to such acts.

3.3 Environmental Consequences of the No Action Alternative

The No Action Alternative assumes that operations of the existing facilities at the STM site would continue, but that the construction and operation of a woodchip storage silo and use of regional wood sources that make up the Proposed Action described in this draft Supplemental EA would not occur. As such, the No Action Alternative is not tantamount to stating that no change or growth would occur at the STM site.

Regardless of whether or not the Proposed Action is implemented, in the foreseeable future, NREL would experience normal minor fluctuations, including growth, in staff levels, resource use, and environmental impacts due to currently authorized and planned programmatic growth and research activities that are not associated with the Proposed Action, but which would not cross the significance threshold under NEPA that would require separate evaluation under an EA or EIS. No major or significant proposed actions, as defined by CEQ (40 CFR 1508.27), would be taken under the No Action Alternative.

The environmental consequences of the No Action Alternative would be very similar, and in some instances identical, to the environmental consequences of the no action alternative presented in the SWEA. These are summarized or updated below.

Under the No Action Alternative, the proposed RFHP silo would not be constructed and regional wood sources would not be utilized. The impacts under the No Action Alternative would be as follows:

- Existing on-site land uses, site development density, and operations would continue to experience normal growth but would not be impacted by the proposed RFHP silo. Less local beneficial economic impacts would result because construction would not occur.
- The temporary impacts to traffic and parking from construction of the proposed RFHP silo would be avoided. On-site and off-site traffic patterns would be similar to the Proposed Action.
- In the short term, air emissions from STM site operations would remain at approximately current levels; in the longer term, increases in emissions might occur due to future site growth and development not within the scope of the Proposed Action.
- The visual character of the STM site would not be impacted by the addition of the RFHP silo.
- Similar to the Proposed Action, the No Action Alternative would not result in any increased runoff or impacts to surface water, stormwater, or groundwater resources.

- Noise associated with the construction and operation of the proposed RFHP silo would not occur because this project would not be developed. Current levels of ambient noise at the site would remain the same. Off-site noise levels in the area would continue to be dominated by vehicle traffic on I-70.
- With the No Action Alternative, regional wood sources would continue to be harvested under typical and ongoing silviculture and forest thinning activities, and be used in customary wood product markets such as mulch, lumber, firewood, and wood stove fuel pellets.
- Under the No Action Alternative, delivered woodchip fuel would not be moved from the fuel pit to the proposed RFHP silo within a few hours following delivery. Thus additional woodchip handling and associated dust creation would not be eliminated. Worker exposure to dust in the RFHP would not be reduced, which could result in impacts to occupational health and safety.
- Similar to the Proposed Action, the No Action Alternative would not offer any credible targets of opportunity for terrorists or saboteurs to inflict significant adverse impacts to human life, health, or safety.
- The No Action Alternative would not result in any foreseeable increase of GHG emissions and would not contribute to climate change or global warming. The RFHP would continue to operate as it has over the past three years and would constitute a 30-year minor increase in GHG emissions from the combustion of woody biomass fuel. The annual burning of 3,900 tons of woodchips, the maximum amount allowed under current air permits, would result in the release of approximately 6,630 metric tons per year of CO_2 equivalent emissions (see CO_2 emissions calculations in Appendix F). However, these emissions work to offset increases in the use of fossil fuel and the emissions of GHG associated with the lifecycle of natural gas.

4.0 SECONDARY/CUMULATIVE IMPACTS AND IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES

4.1 Cumulative and Secondary Impacts

Cumulative impacts result from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions. Secondary impacts are those caused by a proposed action, but that may occur later in time or farther removed in distance, relative to the primary impacts of the proposed action (40 CFR Section 1508.7).

The 2003 SWEA (DOE 2003) considered cumulative and secondary impacts of various pending and conceptual site development projects, and concluded that the incremental contribution to these cumulative and secondary impact areas would be insignificant. DOE (2003) also concluded that the No Action Alternative would not contribute to these impacts. The most important examples of cumulative and secondary impacts associated with the SWEA Proposed Action were as follows:

- Traffic congestion at the intersections along Denver West Marriott Boulevard;
- Regional and local air pollutant emissions;
- Noise impacts on Pleasant View neighborhoods;
- Development intensification;
- Increases in Lena Gulch stormwater flows;
- Habitat losses from development of natural areas;
- Demand for energy; and
- Beneficial impacts from improved alternative energy sources.

The Proposed Action that is the subject of this draft Supplemental EA was not considered in the SWEA (DOE 2003). However, the preceding list of cumulative and secondary impacts bounds those associated with this Proposed Action. In general, the impacts discussed below are considered cumulative and secondary impacts in light of DOE and NREL's current buildout at the STM site and the ongoing private development in the area.

Visual impacts. Construction and operation of the Proposed Action in this draft Supplemental EA would slightly modify the overall visual impression of the STM site by adding the proposed RFHP silo on developed land adjacent to the RFHP. The new development would be visually compatible with the STM site. Additionally, commercial development continues to occur adjacent to the STM site, altering the visual landscape from open space to offices and residential buildings.

Traffic congestion at the intersections along Denver West Marriott Boulevard. The estimated construction workforce for the proposed projects would not be large, nor would the proposed construction be long-term. Construction of the proposed RFHP silo would only require an estimated dozen workers for two to three months. No new workers would be hired to operate the RFHP and woodchip deliveries would not increase from levels analyzed in DOE/EA-1573.

Regional and local air pollutant emissions. The Denver metropolitan area became a nonattainment area for the federal O_3 standard on November 20, 2007. The RFHP silo's emissions would not be expected to have any meaningful impact on the plan to reduce ozone developed by the Colorado Air Pollution Control Division, along with the Regional Air Quality

Council and the North Front Range Metropolitan Planning Organization. Similarly, emissions from regional fuel sourcing would not have any meaningful impact on airsheds adjacent to or otherwise outside of the North Front Range Metropolitan airshed including Colorado Springs/Pueblo or Western Slope.

Noise impacts on Pleasant View neighborhoods. Noise generated during construction, from vehicle use on the site, and from the proposed RFHP silo operations is not expected to cause noise levels that would exceed any cumulative noise impact standard.

Development intensification. The Proposed Action includes development in Zone 4 (Central Campus), but it does not create unplanned development or present the potential to open up new off-site areas for development. The Proposed Action does not create improved access to real estate, reduce development restrictions, or substantially induce new development in unanticipated areas.

Increases in Lena Gulch stormwater flows. Stormwater flooding in Lena Gulch is created by an off-site channel constriction in Camp George West Park. The Proposed Action would not increase the impervious surface area on the STM site. There would be no cumulative impact on stormwater flow in Lena Gulch.

Habitat losses from development of natural areas. The Proposed Action would be in a previously developed area. There would be no development of natural areas and subsequent habitat loss.

Demand for energy and beneficial impacts from improved alternative energy sources. All projects requiring energy have incremental impacts related to energy, but very few offer the possibility of making a positive contribution toward renewable energy and energy efficiency. The Proposed Action is specifically intended to ensure the RFHP can operate at maximum efficiency and meet its original purpose and need put forth in DOE/EA-1573 of reducing the STM site's natural gas consumption.

4.2 Commitment of Resources and Short-Term Uses

The discussions in Sections 4.3 and 4.4 were presented in the SWEA and are directly applicable to the Proposed Action that is the subject of this draft Supplemental EA.

4.3 Irreversible/Irretrievable Commitment of Resources

An irreversible commitment of resources is defined as the loss of future options. The term applies primarily to the effects of using nonrenewable resources such as minerals or cultural resources, or to those factors such as soil productivity, that are renewable only over long periods. It could also apply to the loss of an experience as an indirect effect of a "permanent" change in the nature or character of the land. An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources. The amount of production foregone is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production.

The Proposed Action would have no irreversible impacts on the STM site because future options for using the site would remain open. A future decommissioning process could restore the site for alternative uses, ranging from natural open space to urban development. No loss of future options would occur.

The primary irretrievable impacts of the Proposed Action would involve the use of energy, labor, materials (e.g., concrete), and funds. There would not be conversion of lands from a natural condition through the construction of buildings and infrastructure. For these reasons, the incremental loss of biological and open space values would be insignificant. The direct losses of biological productivity and the use of natural resources from these impacts would be inconsequential, because the Proposed Action would involve the use of lands where biological value as habitat and open space values associated with aesthetic quality and recreation have already been compromised by facility development and operations.

4.4 The Relationship between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity

This section addresses the commitment of resources associated with the Proposed Action relative to the loss of long-term productivity associated with these commitments.

The Proposed Action would commit resources in the form of energy, labor, materials, funds, and land over 20 years or more. The justification for these commitments is described in Section 1.3, Purpose and Need. Long-term productivity associated with the site relates to open space values associated with aesthetic quality. The Proposed Action would be implemented at a site where substantial portions of the land are specifically reserved and preserved for these purposes. For these reasons, the incremental loss of open space values is balanced by the protections afforded to the long-term productivity of the site. Improved efficiency and increased use of renewable energy sources could substantially reduce the use of and reliance on imported fossil fuels.

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6.0 REFERENCES

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Appendix A. Scoping Letter and Distribution List

The U.S. Department of Energy (DOE) mailed the scoping letter shown on the next page to the agencies and organizations shown in the mailing list that follows the letter. In addition, DOE placed a notice in the Golden Transcript on May 26, 2011, which appears on page A-11.

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

MAY 25, 2011

DISTRIBUTION LIST

SUBJECT: NOTICE OF PUBLIC SCOPING - PROPOSED RENEWABLE FUEL HEAT PLANT IMPROVEMENTS AT THE NATIONAL RENEWABLE ENERGY LABORATORY SOUTH TABLE MOUNTAIN SITE, GOLDEN, CO (DOE/EA-1887)

The U.S. Department of Energy (DOE) is proposing to make improvements to the Renewable Fuel Heat Plant (RFHP) including construction and operation of a wood chip storage silo and associated material handling conveyances and utilization of regional wood sources. Details of the proposed project and its location are contained below.

Pursuant to the requirements of National Environmental Policy Act (NEPA), the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 CFR Parts 1500-1508), and DOE's implementing procedures for compliance with NEPA (10 CFR Part 1021), DOE is preparing a draft Supplemental Environmental Assessment (EA) to:

- Identify potential adverse environmental effects as well as ways to avoid, minimize or mitigate such effects should this proposed project be implemented;
- Evaluate viable alternatives to the proposed action, including a no action alternative;
- Describe the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- Characterize any irreversible and irretrievable commitments of resources that would be involved should this proposed project be implemented.

SITE BACKGROUND AND DESCRIPTION

The National Renewable Energy Laboratory (NREL) is the premier DOE national laboratory dedicated to the research, development, and deployment of renewable energy and energy efficiency technologies. As depicted in Figure 1, NREL is comprised of three main sites: 1) South Table Mountain (STM); 2) Denver West Office Park (DWOP); and 3) the National Wind Technology Center (NWTC). Other facilities include the Renewable Fuels and Lubricants (ReFUEL) Research Laboratory and Joyce Street facilities as well as the Golden Hill office site. Detail regarding NREL's mission and research programs is available on the NREL website at: http://www.nrel.gov.

The 327-acre STM site is located on the southeast side of South Table Mountain, north of Interstate 70 and west of the Interstate 70 and Denver West Boulevard interchange in unincorporated Jefferson County, near Golden, Colorado (Legal description: Township 3 S, Range 70 W, Section 36, and Township 4 S, Range 70 W, Section 1) (see Figure 1). Only a portion of the site, 136 acres, is available for development. A total of 177 acres is protected by a conservation easement and development of the remaining 14 acres is restricted by utility easements. The community of Pleasant View is adjacent to the southern border of the STM site. The STM site includes acreage on the South Table Mountain mesa top, slope, and toe, and was formerly part of the Colorado National Guard facility at Camp George West. There are currently seven laboratory buildings, a few small test facilities, and several support buildings on the site.

The RFHP is located on the STM site northeast of the Field Test Laboratory Building (see Figure 2) and has been in operation for two years. The RFHP was designed to reduce NREL's current STM site consumption of natural gas (i.e., a non-renewable resource) by an estimated 75 to 80 percent. Through the use of forest thinning and other wood waste, renewable resources replace most natural gas usage in the primary site heating boiler. The project showcases the viability of wood waste biomass fuels as an alternative to fossil fuel heating.

In July 2007, DOE issued the Final Environmental Assessment of Three Site Development Projects at the National Renewable Energy Laboratory South Table Mountain Site (DOE/EA-1573) and a Finding of No Significant Impact (FONSI). The 2007 Environmental Assessment tiered from the 2003 Final Site-Wide Environmental Assessment of the NREL STM Site (DOE/EA-1440) and, for some resource areas, provided updated descriptions of the existing environment at the STM site and impacts expected from the three proposed projects. The RFHP construction and operation was one of the three projects addressed in the 2007 Environmental Assessment (DOE/EA-1573).

The subject of this Supplemental EA includes the proposed action discussed below which would 1) increase the wood chip storage capacity to provide additional fuel supply for the RFHP, reducing the potential for a plant shut-down due to exhausted fuel supply; and 2) have a wider range of high-quality wood sources available for use. These contribute to the goal of supporting and advancing DOE's mission to increase the use of renewable fuels by reducing use of natural gas.

PROPOSED ACTION AND ALTERNATIVES

The following presents a summary of the Proposed Action and No Action alternative descriptions.

Proposed Action

The Proposed Action is to implement improvements to the RFHP, mainly the construction and operation of a concrete wood chip storage silo and associated material handling conveyances, and expanding the source area for wood supplies to include regional, as well as Front Range resources. The proposed silo would be about 20 feet in diameter on a 30-foot pad and about 75 feet tall, with a volume of about 520 cubic yards. A bucket elevator/chute would extend about 25 feet above the top of the proposed silo. The proposed location for this project is a paved, previously disturbed area immediately south of the existing RFHP facility and west of the central ephemeral channel (see Figure 2). This area was included in Zone 4 – Central Campus as part of the STM campus build-out analyzed in the July 2003 Final Site-Wide Environmental Assessment.

The evaluation of impacts will include an analysis of effects from expanding the source of the wood chip fuel to include other regional sources. Additional locations and suppliers would provide increased flexibility for the RFHP to receive high quality wood product in sufficient volumes.

Development of a Reasonable Range Of Alternatives

DOE is required to consider a reasonable range of alternatives to the proposed action during an environmental review. The definition of alternatives is governed by the "rule of reason". Reasonable alternatives are those that may be feasibly carried out based on environmental, technical, and economic factors.

The No Action Alternative will be addressed which would keep the RFHP in its current configuration, add no new silo, and maintain current fuel sourcing practices.

PROBABLE ENVIRONMENTAL EFFECTS/ISSUES SCOPED FOR THE ENVIRONMENTAL ASSESSMENT

The Supplemental EA will describe and analyze any primary, direct, induced, indirect and cumulative impacts of the Proposed Action and alternatives, and will identify possible mitigation measures to reduce or eliminate those impacts. Beneficial and adverse, on-site and off-site, construction, operation, and maintenance impacts will be discussed, as appropriate. The Supplemental EA will discuss impacts that may result to:

- Land Use and Planning
- Traffic and Circulation
- Air Quality
- Visual Quality/Aesthetics
- Water Resources
- Noise
- Accident Risk Analysis
- Intentional Destructive Acts

PUBLIC SCOPING

The DOE Golden Field Office will make this letter available to all interested federal, state, and local agencies to provide input on issues to be addressed in the Supplemental EA. Agencies are invited to identify the issues, within their statutory responsibilities that should be considered in the Supplemental EA. The general public is also invited to submit comments on the scope of the Supplemental EA.

No formal public scoping meeting is currently planned for this project. This letter as well as the draft Supplemental EA, when it is available, will be posted in the DOE Golden Field Office online reading room:
http://www.eere.energy.gov/golden/Reading_Room.aspx.

The DOE Golden Field Office welcomes your input throughout our NEPA Process. Please submit your written comments regarding this scoping document on or before **June 16, 2011**, to:

NREL NEPA Comments
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EHS Office, M.S. RSF 103
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We look forward to hearing from you.

Sincerely,

Lori Plummer

Lori Plummer, NEPA Compliance Officer
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Enclosures:

Figure 1. Regional Location of the STM Site
Figure 2. Location of the Proposed Wood Chip Storage Silo

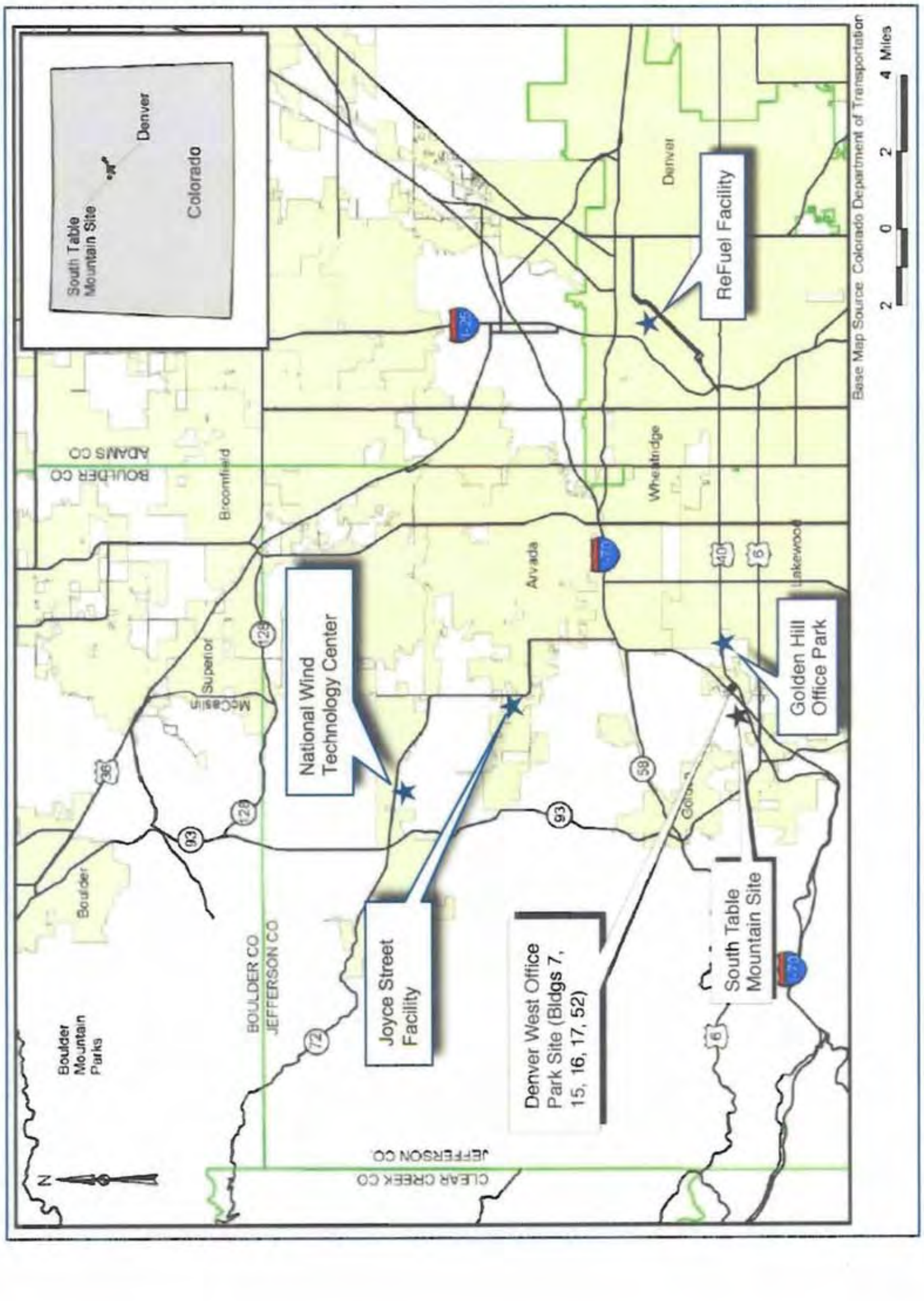

Figure 1. Regional Location of the STM Site

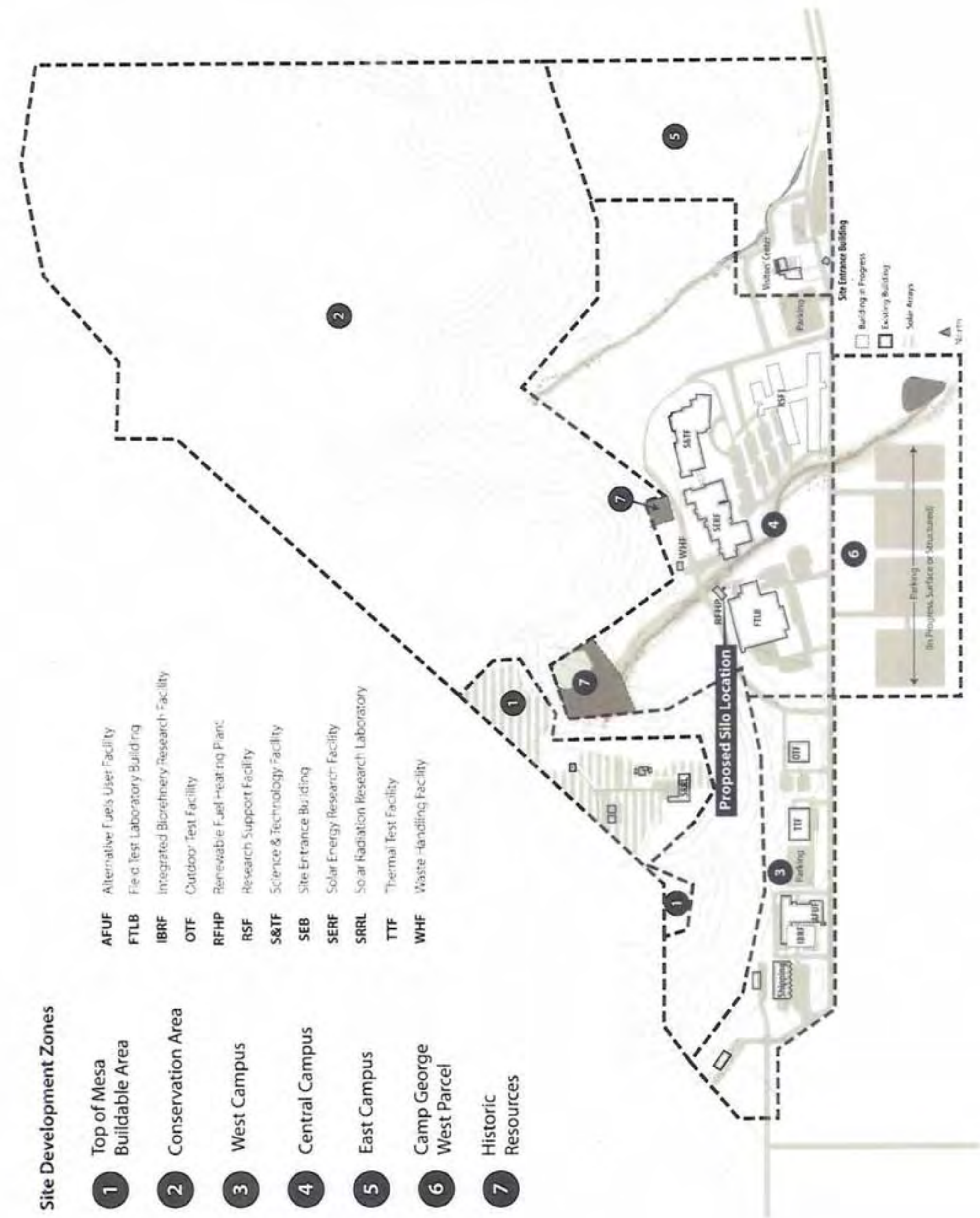

Figure 2. Location of the Proposed Wood Chip Storage Silo

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Sierra Club
Rocky Mountain Chapter
1536 Wynkoop St., Ste., 4th Floor
Denver, CO 80202

Ms. Penny Anderson
Western Resource Advocates
2260 Baseline Road, Ste. 200
Boulder, CO 80302

Mr. John Litz
Jeffco Open Space Foundation, Inc.
5855 Wadsworth Bypass
Building A, Ste. 100
Arvada, CO 80003

Mr. Mr. David Abelson
Rocky Flats Stewardship Council
PO Box 17670
Boulder, CO 80304

Mr. Preston Driggers
Table Mountains Conservation Fund
PO Box 16201
Golden, CO 80402-6004

Mr. TJ Brown
Colorado Environmental Coalition
1536 Wynkoop, 5C
Denver, CO 80202

Mr. Gary Wink
Golden Chamber of Commerce
1010 Washington Ave.
Golden, CO 80402

Notice of Scoping in Golden Transcript – May 26, 2011

GOLDEN TRANSCRIPT LEGAL NOTICES > MAY 26, 2011 > **PAGE C5**

NOTICE OF SCOPING

The U.S. Department of Energy (DOE), in compliance with the National Environmental Policy Act of 1969 (NEPA), will be preparing a Supplemental Environmental Assessment (DOE/EA-1887) to its Environmental Assessment of Three Site Development Projects at the National Renewable Energy Laboratory (NREL) South Table Mountain Site (DOE/EA-1573, July 2007). This Supplemental Environmental Assessment will analyze proposed modifications to the Renewable Fuel Heat Plant (RFHP) at the NREL South Table Mountain Site in Golden, Colorado including the construction and operation of a wood chip fuel storage silo and changes to the wood chip fuel supply. DOE is seeking public input on the proposed action and alternatives to be addressed in the Supplemental Environmental Assessment. The notice of scoping and description of the proposed project can be found at DOE's electronic information kiosk in the NREL Visitors Center and the DOE Golden Field Office public reading room website at: http://www.eere.energy.gov/golden/Reading_Room.aspx and click on "NREL Environmental and NEPA Documents."

The DOE Golden Field Office welcomes your input throughout the NEPA Process. DOE plans to complete the draft EA for public review in August 2011. Public scoping comments on the Supplemental Environmental Assessment will be accepted for a period of 21 days. Please submit your written comments regarding this proposed action by **June 16, 2011**, to:

NREL NEPA Comments
National Renewable Energy Laboratory,
EHS Office, M.S. RSF 103
1617 Cole Boulevard,
Golden, Colorado 80401-3393
Fax #: (303) 275-4002
E-mail: NREL.NEPA.Comments@nrel.gov

First Published May 26, 2011
Last Published June 2, 2011
Golden Transcript 06534758

Appendix B. Agency Consultation Correspondence

DOE to CO SHPO	September 30, 2011
CO SHPO to DOE	October 27, 2011
DOE to CO SHPO	November 23, 2011
CO SHPO to DOE	December 12, 2011

DOE to CO SHPO – September 30, 2011

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

September 30, 2011

Edward C. Nichols
State Historic Preservation Officer
History Colorado
Civic Center Plaza
1560 Broadway
Suite 400
Denver, CO 80202

Dear Mr. Nichols:

SUBJECT: INITIATION OF THE SECTION 106 CONSULTATION PROCESS FOR THE PROPOSED RENEWABLE FUEL HEAT PLANT IMPROVEMENTS, NATIONAL RENEWABLE ENERGY LABORATORY, SOUTH TABLE MOUNTAIN COMPLEX, GOLDEN, CO (DOE/EA-1887)

The U.S. Department of Energy (DOE) is initiating formal consultation pursuant to Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, and its associated implementing regulations codified at 36 CFR Part 800 while also coordinating with your office as required under the National Environmental Policy Act (NEPA) for the proposed improvements to the existing Renewable Fuel Heat Plant (RFHP). The RFHP is located at the National Renewable Energy Laboratory (NREL), South Table Mountain Complex (STM), City of Golden, County of Jefferson, State of Colorado (Figure 1 and Figure 2).

Background
The construction and operation of the RFHP was analyzed by DOE pursuant with NEPA in an Environmental Assessment (EA) document entitled *Final Environmental Assessment of Three Site Development Projects at the National Renewable Energy Laboratory South Table Mountain Site (DOE/EA-1573), July 2007 (available at http://www.eere.energy.gov/golden/NREL_Enviro_NEPA.aspx).* DOE issued a Finding of No Significant Impact (FONSI) for the EA on July 5, 2007, which determined that the RFHP could be constructed and operated without significant impacts.

During the EA process, DOE consulted with various agencies and stakeholders, including your office, as documented by DOE letters dated April 2, 2007 and May 7, 2007. Based upon results of the cultural resources inventory report submitted along with the May 7, 2007 correspondence, your office concurred with DOE's no historic properties affected determination on May 29, 2007.

Project Description

The original purpose of the RFHP was to replace 75 to 80 percent of the NREL STM campus's comfort heat natural gas consumption with renewable fuel as well as showcase the viability of woody biomass in this type of application. With the recent development of additional laboratory and support facilities, and relocation of significant number of personnel from offsite locations, additional fuel storage capacity is needed to ensure that RFHP can operate at maximum efficiency. In order to accomplish this, DOE is proposing to construct a silo to store the wood chips in a controlled environment. The proposed silo would be about 20 feet in diameter and about 75 feet tall, with a volume of about 520 cubic yards. The proposed silo would be constructed of concrete and placed on a 30-foot diameter pad. A bucket elevator/chute would extend about 25 feet above the top of the proposed silo. The proposed location for the silo is a paved, previously disturbed area immediately south of the existing RFHP facility and west of the central ephemeral channel (Figure 3).

At the beginning of construction existing asphalt would be removed from the site, an existing fire-suppression water line would be excavated and relocated, and the surrounding area would be surfaced with gravel as needed to accommodate construction vehicles and help prevent site erosion. Following site preparation, a circular 33-foot diameter foundation hole would be excavated to a depth of 10 feet. The excavation would result in about 320 cubic yards of material being unearthed. The contractor would remove 85 percent of the excavated material and dispose of it at an appropriate disposal facility outside the STM campus. The remainder of the excavated material would be used as backfill as necessary. The silo would be built on a spread footing or drilled caissons using either a backhoe or a truck-mounted drill rig. Footings or caissons would then be poured using a concrete pumper truck. The 30-foot pad would then be poured on top of the footings or caissons and would create the foundation for the silo.

The silo would be built using jump-form construction (i.e., the silo would be constructed by successively jumping and resetting the lower 4-foot course of forms on the top course of forms). The working platform would then be raised 4 feet to the top of the newly set course of forms to a position for the next concrete placement. Once the walls are completed, the platform would function as a working area for the roof construction or internal work. Bare areas surrounding the silo would be repaved with asphalt following construction.

After completion of the silo the bucket elevator, unloading augers, and conveyors would be constructed and installed on-site in an assembly area between the RFHP and Field Test Laboratory Building (FTLB) and west of the proposed silo location. Controls and equipment to integrate the silo machinery with the existing RFHP equipment would also be fabricated and installed. All equipment would be tested for proper operation and subject to NREL safety evaluation and approval. During construction equipment, supplies, and materials would be delivered as needed and removed from the site upon conclusion of specific tasks.

Undertaking

The proposed action of the construction and operation of the RFHP fuel storage silo and associated material handling conveyances meets the definition of an undertaking as defined in 36 CFR 800.16(y).

Area of Potential Effect

Consideration has been given to the potential for a range of effects in addition to direct effects that might result from the undertaking, including visual, auditory, socio-cultural, as well as indirect and secondary effects. DOE proposes an area of potential effect (APE) to include a 50-foot radius from the center of the proposed silo to account for the diameter of the silo as well as temporary construction areas (Figure 4). This would result in an APE of 7,850 square feet (0.18 acres) on previously disturbed land currently covered by impervious surfaces and would be completely within the original RFHP construction APE determined in 2007. Given the extensive development of the NREL STM campus and the surrounding area including Denver West Office Park, DOE does not propose to extend the APE boundaries beyond the area to be disturbed by construction activities for indirect visual impacts. Additionally, this area is highly urbanized and has elevated ambient noise from the Denver West Office Park, Colorado Mills Mall, Colfax Avenue, South Golden Road, and Interstate 70. Therefore, DOE does not propose to extend the APE beyond the area of disturbance for auditory impacts.

Identification of Historic Properties

Per 36 CFR 800.4, DOE is required to identify all properties listed, or eligible for listing in the National Register of Historic Places which may be affected by the proposed undertaking. The APE for this proposed undertaking has been previously surveyed at the Class III level by the following cultural resource inventory reports:

- A Class III Cultural Resources Inventory of the Proposed Renewable Fuel Heating Plant, Solar Technology Advancement Consortium, and Solar Electric Generation Project on the National Renewable Energy Laboratory's South Table Mountain Site, Jefferson County, Colorado (Rhodes 2007)

- Historic and Prehistoric Resources, South Table Mountain, Golden, Colorado (Nelson 1980).

Nelson recorded two features in the vicinity of the proposed APE that are currently listed on the National Register including the Colorado Amphitheater with an adjacent stone bridge spanning the natural drainage channel (5JF842) and the Ammunition Igloo (5JF843). Both of these features are associated with Camp George West Historic District, which is located south of the NREL STM campus. Nelson did record several other features in the vicinity of the amphitheater that were determined to be non-eligible. Rhodes did not identify any additional resources during the Class III cultural resources inventory of the APE for the original RFHP construction. The Ammunition Igloo is the nearest historic property to this proposed fuel storage silo, but is located beyond the proposed APE. The igloo is located 120 meters (394 feet) to the northeast. The amphitheater and the footbridge are located 350 meters (1,148 feet) up the drainage northwest of the proposed RFHP silo. Neither of these historic resources would be impacted by the proposed construction or operations of the RFHP silo.

Assessment of No Historic Properties Affected

DOE requests concurrence with a no historic properties affected determination. All previously recorded historic properties and non-eligible features are beyond the APE of this undertaking. Furthermore, the indirect visual impact of silo is minimal to the amphitheater, the igloo, or the Camp George West Historic District considering the rapid development of the NREL STM campus, the Denver West Office Park, Colorado Mills Mall, and the urbanization of the Lakewood/Golden area as shown in the attached photographic log. DOE therefore recommends a finding of no historic properties affected for this undertaking.

Again, we appreciate your continued coordination regarding projects at NREL, and we look forward in the successful completion of the Section 106 process with your office. Please feel free to contact Mr. Rob Smith of my office at 720-356-1576 or myself at 720-356-1568 if you have any questions regarding this project.

Sincerely,

Lori Gray

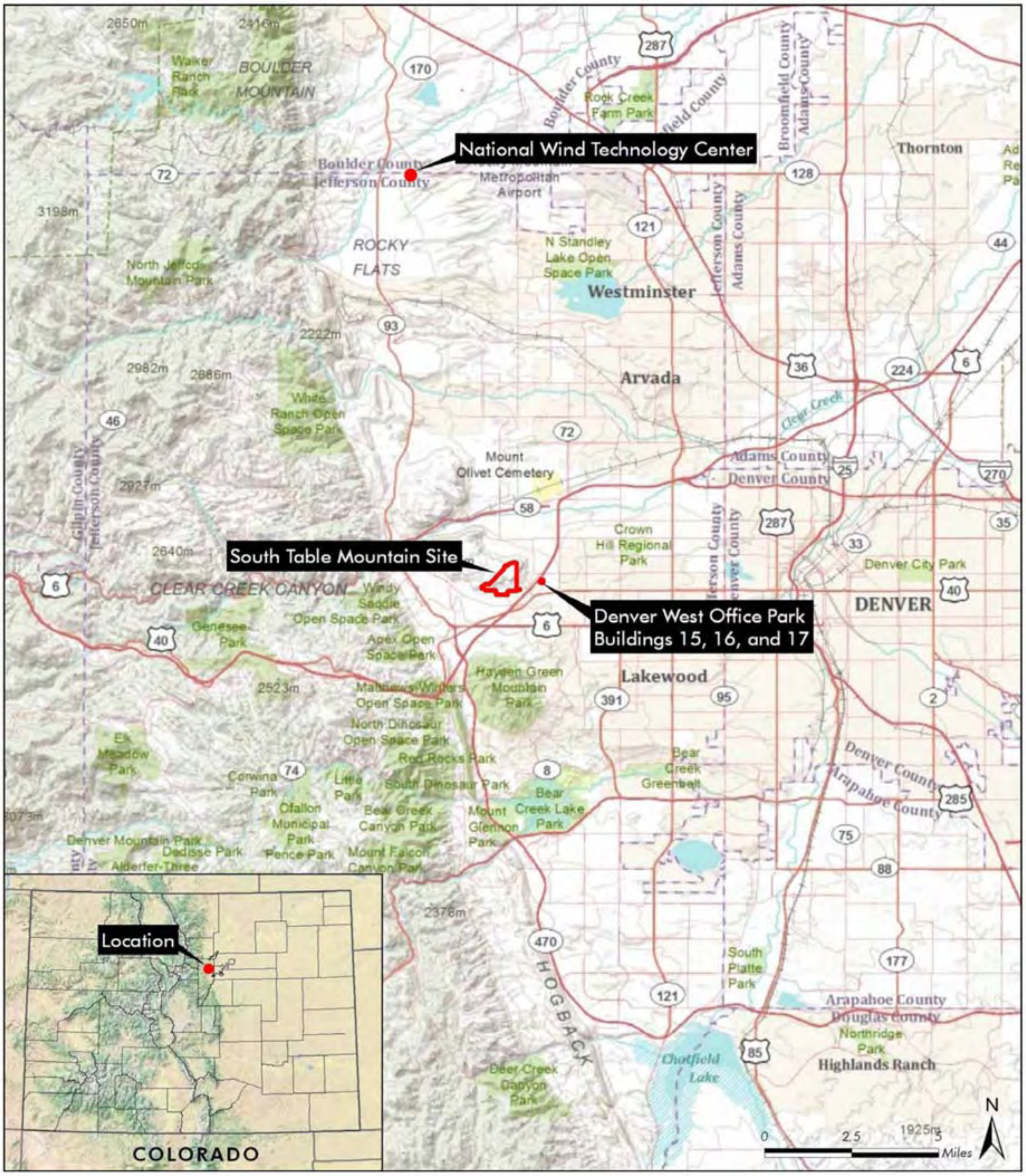
Lori Gray, CSP
NEPA Compliance Officer

LG/rvs

Cc:
Jefferson County Historical Commission
Jefferson County Historical Society
Golden Landmarks Association
Rob Smith, DOE
Tom Ryon, NREL

Enclosures: as stated

FIGURES



U.S. DEPARTMENT OF ENERGY
GOLDEN FIELD OFFICE

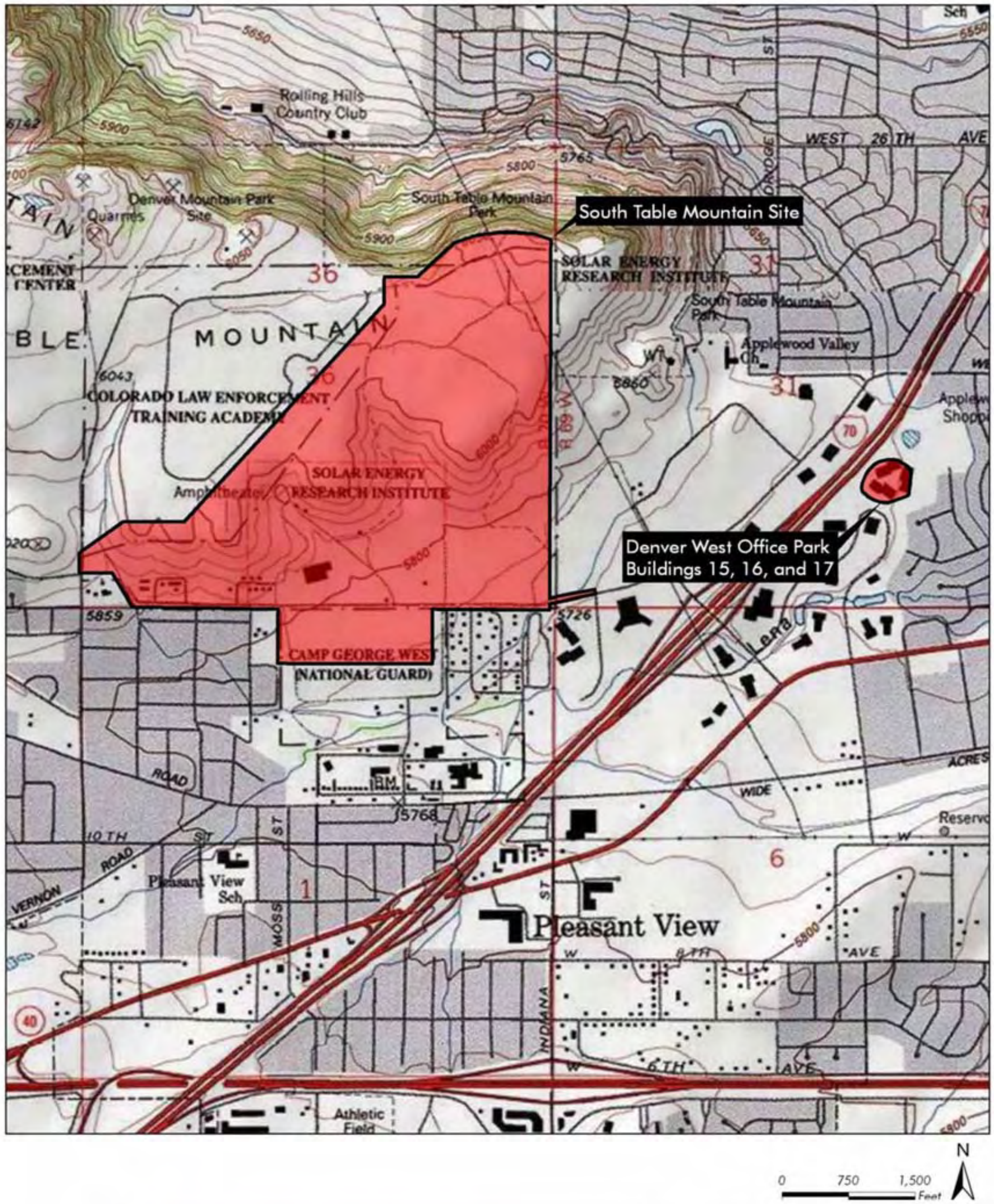
FIGURE 1

REGIONAL LOCATION OF THE SOUTH TABLE MOUNTAIN SITE

PROPOSED RFHP IMPROVEMENTS

NATIONAL RENEWABLE ENERGY LAB

GOLDEN, COLORADO



U.S. DEPARTMENT OF ENERGY
GOLDEN FIELD OFFICE

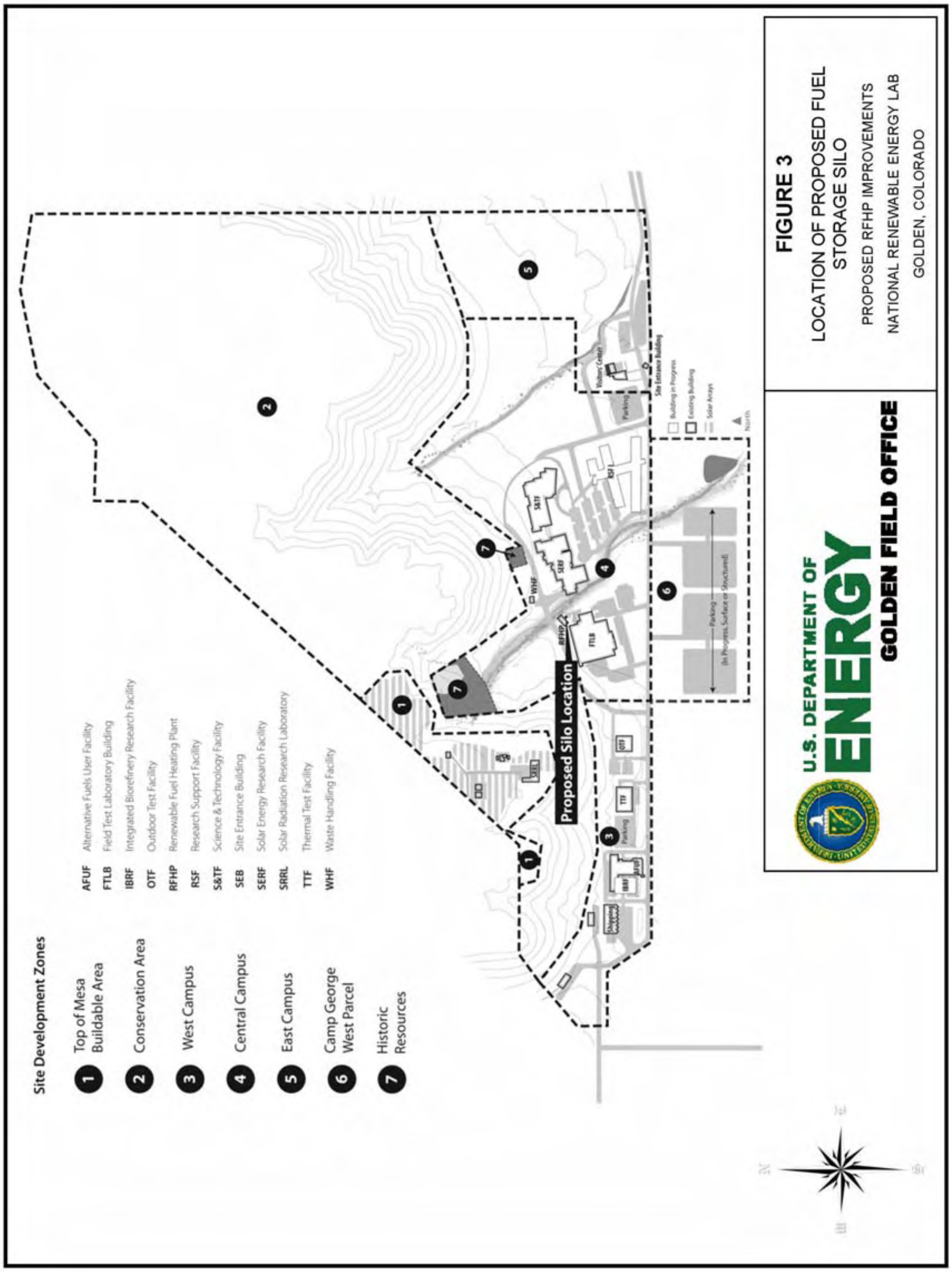
FIGURE 2

LOCAL SETTING OF THE SOUTH TABLE MOUNTAIN SITE

PROPOSED RFHP IMPROVEMENTS

NATIONAL RENEWABLE ENERGY LAB

GOLDEN, COLORADO


Site Development Zones
1 Top of Mesa Buildable Area
2 Conservation Area
3 West Campus
4 Central Campus
5 East Campus
6 Camp George West Parcel
7 Historic Resources
AFUF Alternative Fuels User Facility
FTLB Field Test Laboratory Building
IBRF Integrated Biorefinery Research Facility
OTF Outdoor Test Facility
RFHP Renewable Fuel Heating Plant
RSF Research Support Facility
S&TF Science & Technology Facility
SEB Site Entrance Building
SERF Solar Energy Research Facility
SRRL Solar Radiation Research Laboratory
TTF Thermal Test Facility
WHF Waste Handling Facility
Proposed Silo Location
FIGURE 3
LOCATION OF PROPOSED FUEL STORAGE SILO
PROPOSED RFHP IMPROVEMENTS
NATIONAL RENEWABLE ENERGY LAB
GOLDEN, COLORADO
U.S. DEPARTMENT OF ENERGY
GOLDEN FIELD OFFICE

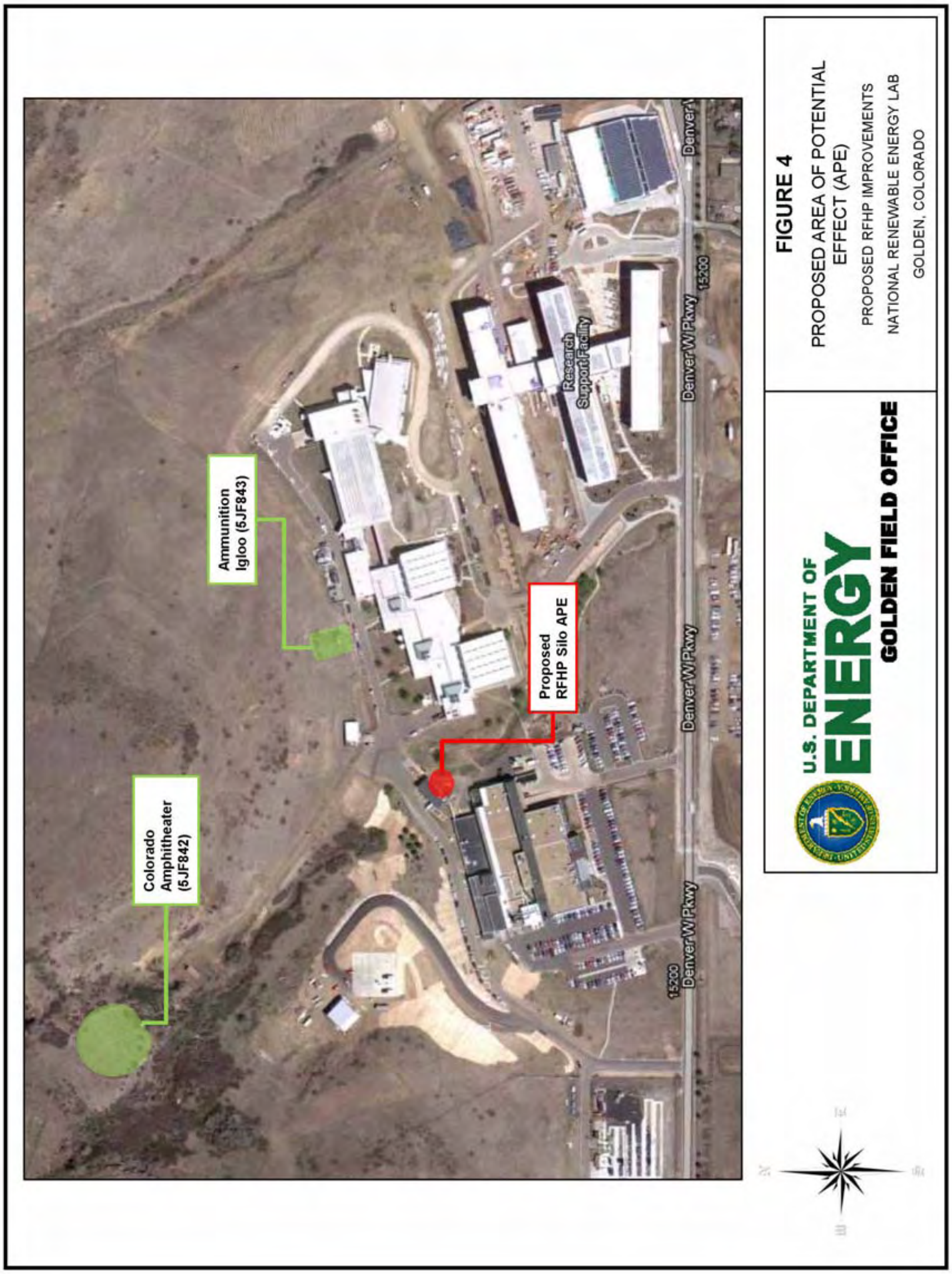


FIGURE 4
PROPOSED AREA OF POTENTIAL EFFECT (APE)
PROPOSED RFHP IMPROVEMENTS
NATIONAL RENEWABLE ENERGY LAB
GOLDEN, COLORADO
U.S. DEPARTMENT OF ENERGY
GOLDEN FIELD OFFICE
Colorado Amphitheater (5JF842)
Ammunition Igloo (5JF843)
Proposed RFHP Silo APE
Research Support Facility
Denver W Pkwy
15200

PHOTOGRAPHIC LOG

Photo 1. View from Ammunition Igloo to the southwest toward the RFHP.

Photo 2. View from Ammunition Igloo to the southwest toward the RFHP.

Photo 3. View from bottom of Colorado Amphitheater looking south southeast toward RFHP. The proposed silo would be behind the RFHP on its southeast corner and is obscured by the tree foliage.

Photo 4. View from middle of Colorado Amphitheater looking south southeast toward RFHP. Again from this prospective, the silo would be behind the RFHP on its southeast corner.

Photo 5. View from top of Colorado Amphitheater looking south southeast toward RFHP.

CO SHPO to DOE – October 27, 2011

HISTORY Colorado

October 27, 2011

Lori Gray
NEPA Compliance Officer
Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, CO 80401-3393

Re: Initiation of the Section 106 Consultation Process for the Proposed Renewable Fuel Heat Plat Improvements, National Renewable Energy Laboratory, South Table Mountain Complex, Golden, CO (DOE/EA-1887) (CHS #49170)

Dear Ms. Gray,

Thank you for your correspondence dated September 30, 2011 (received by our office on October 11, 2011) regarding the initiation of Section 106 consultation for the subject project.

Following our review of the documentation provided, we offer the following comments:

1. We are unable to concur with the U.S. Department of Energy (DOE) in their decision not to extend the area of potential effects (APE) boundary "beyond the area to be disturbed by construction activities for indirect visual impacts" as we maintain that the undertaking's APE should encompass "the geographic area or areas within which an undertaking may directly or indirectly cause alterations to the character or use of historic properties, if any such properties exist" (36 CFR 800.16(d)).
2. As you are aware, two historic properties listed on the National Register of Historic Places (NRHP) are located in close proximity to the proposed project. These properties include the Colorado Amphitheater (5JF842) and the Ammunition Igloo (5JF843). Both resources contribute to the significance of the Camp George West Historic District (5JF145).
3. Of these nearby properties, we are concerned how the proposed construction may affect the historic integrity of the Colorado Amphitheater. This resource is described as the second-largest, open air amphitheater in Colorado, is the only known example of an amphitheater associated with a military facility in the state, and was constructed by the Works Project Administration (WPA) from 1933-1935. The amphitheater is significant under Criterion A "for association with the public works project during the Great Depression of the 1930's and as part of Camp George West." Further, the resource was found significant under Criterion C for architecture as "an example of a type, period, and construction methods of public work projects." The researchers in 1992 found that the resource maintained six of the seven characteristics that qualify it for inclusion to the NRHP including "location, setting, feeling, association, design, and materials" per 36 CFR 60.4. Our office feels that the integrity of setting may be affected by this project.
4. The Colorado Amphitheater and associated footbridge are located in a draw directly upslope of the proposed silo location and this landform will afford visitors to the property unobstructed and direct sight-lines of the proposed silo. While photographs were provided showing the proposed silo location from the amphitheater, our office is not clear how the massing of this structure, measuring 20-ft in diameter and 100-ft in height (75-ft silo topped with a 25-ft bucket elevator/chute) relates to the existing built environment, thus we are unsure how the proposed project may affect the integrity of this historic property.

WWW.HISTORYCOLORADO.ORG

HISTORY COLORADO CENTER 1200 BROADWAY DENVER COLORADO 80203

5. We ask that DOE consider enlarging the APE to include indirect visual impacts on the Colorado Amphitheater. We request that DOE provide our office with design drawings showing the silo from the various vantage points within the amphitheater (similar to photographs 3 through 5 already submitted to our office) to better afford our office the opportunity to comment regarding possible indirect effects. We also request that DOE consider using colored concrete in silo construction to minimize the visual impact of this undertaking upon this resource.

Thank you for the opportunity to comment. If we may be of further assistance, please contact Mark Tobias, Section 106 Compliance Manager, at (303) 866-4674 or mark.tobias@state.co.us.

Sincerely,

for Edward C. Nichols
State Historic Preservation Officer
ECN/MAT

DOE to CO SHPO – November 23, 2011

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

November 23, 2011

Edward C. Nichols
State Historic Preservation Officer
History Colorado
Civic Center Plaza
1560 Broadway
Suite 400
Denver, CO 80202

Dear Mr. Nichols:

SUBJECT: CONTINUED SECTION 106 CONSULTATIONS FOR THE PROPOSED RENEWABLE FUEL HEAT PLANT IMPROVEMENTS, NATIONAL RENEWABLE ENERGY LABORATORY, SOUTH TABLE MOUNTAIN SITE, GOLDEN, CO (DOE/EA-1573-S-I) (CHS #49170)

Thank you for your correspondence dated October 27, 2011. Upon review of your comments and subsequent conversations between Mr. Mark Tobias of your office and Mr. Rob Smith of my office, the U.S. Department of Energy (DOE) has made revisions to our proposed Area of Potential Effect (APE) and the corresponding effect determination as discussed below. We are proposing no changes to the information provided in the Background, Project Description, and Undertaking sections of our letter dated September 30, 2011, which was received by your office on October 11, 2011.

AREA OF POTENTIAL EFFECT
Consideration has been given to the potential for a range of effects including direct effects that might result from the undertaking, including visual, auditory, socio-cultural, as well as indirect and secondary effects. The portion of the APE for direct effects from this undertaking would include the proposed silo, its 30-foot wide foundation and the immediate area south of the RFHP building, west of the drainage channel, and east of the Field Test Laboratory Building for temporary and permanent construction areas. This would encompass an area less than 10,000 square feet (0.23 acres) on previously disturbed land currently covered by impervious surfaces and would be within the original RFHP facility's APE determined in 2007.

Upon consideration of your October 27, 2011 comments, DOE proposes to extend the APE to the viewshed north of the RFHP with a 1,135-foot radius to account for potential indirect visual impacts to nearby historic properties. This revised proposed APE is presented in Figure 1 and would include a total area of 29.91 acres. DOE does not propose to modify the APE further for auditory impacts given the area is highly urbanized and has elevated ambient noise from the Denver West Office Park, Colorado Mills Mall, Colfax Avenue, South Golden Road, and especially Interstate 70.

IDENTIFICATION OF HISTORIC PROPERTIES
Per 36 CFR 800.4, DOE is required to identify all properties listed, or eligible for listing in the National Register of Historic Places which may be affected by the proposed undertaking. The APE for this proposed undertaking has been previously surveyed at the Class III level by the following cultural resource inventory reports:

- A Class III Cultural Resources Inventory of the Proposed Renewable Fuel Heating Plant, Solar Technology Advancement Consortium, and Solar Electric Generation Project on the National Renewable Energy Laboratory's South Table Mountain Site, Jefferson County, Colorado (Rhodes 2007)

- Historic and Prehistoric Resources, South Table Mountain, Golden, Colorado (Nelson 1980).

Nelson recorded two features within the proposed APE that are currently listed on the National Register including the Colorado Amphitheater with an adjacent stone bridge spanning the natural drainage channel (5JF842) and the Ammunition Igloo (5JF843). Both of these features are associated with Camp George West Historic District, which is located south of the NREL STM campus. Nelson did record several other features in the vicinity of the amphitheater that were determined to be non-eligible. Rhodes did not identify any additional resources during the Class III cultural resources inventory of the APE for the original RFHP construction. The Ammunition Igloo is the nearest historic property to this proposed fuel storage silo, and is located 120 meters (394 feet) to the northeast. The amphitheater and the footbridge are located 320 meters (1,050 feet) up the drainage northwest of the proposed RFHP silo. Neither of these historic resources would be directly impacted by the proposed construction or operations of the RFHP silo. However, DOE is considering the potential indirect visual impact that the silo would have on these features.

ASSESSMENT OF NO ADVERSE EFFECT
DOE requests concurrence with a finding of no adverse effect. All previously recorded historic properties and non-eligible features within the APE of this undertaking would not be directly affected by any of the construction or operation activities of this proposed action. Indirect visual impact of the silo does have the potential to affect the integrity of the NRHP inclusion characteristic of setting of the Colorado Amphitheatre. As discussed in the National Register Bulletin No. 15 *How to Apply the National Register Criterion for Evaluation* (U.S. Department of Interior 1995), the physical features that constitute the setting of a historic property can be either natural or manmade, and includes such elements as topographic features; vegetation; simple manmade features; and relationships between buildings and other features or open space.

Colorado Amphitheatre (5JF842)
As depicted in the attached photographic renderings of the proposed silo, the 25-foot tall bucket elevator atop of the silo has a relatively small massing and is visually indiscernible

at most distances. Therefore, the main consideration of indirect visual effect is the massing of the 75-foot tall, 20-foot wide silo body itself. The proposed silo location would be directly south of the existing RFHP building, thus the bottom 30 feet of the silo would be not be visible from the Amphitheatre as it is behind the RFHP building from this perspective. Therefore, only about 45 feet of the silo body would be visible. While DOE does not have renderings of the silo from the perspective of the Amphitheatre, the silo would be of similar massing (e.g. height and width) of the exhaust vent stack structures present on the Solar Energy Research Facility (SERF), which are annotated in Photos 2 and 3.

The potential indirect visual impact of the proposed silo to the Amphitheatre's integrity of setting would be further reduced by the vegetation present at the foot of the Amphitheatre as well as the vegetation associated with ephemeral drainage located between the Amphitheatre and the RFHP. As exhibited in Photos 1 thru 3, the foliage associated with this vegetation would obscure the RFHP and the proposed silo from several Amphitheatre vantage points. Furthermore, the proposed silo would not adversely affect the Amphitheatre's integrity of setting solely or cumulatively given the extensive built environment already visible from the Amphitheatre. This would include the former Colorado National Guard Building No. 110 (late 1960's or early 1970's structure built for the storage of ammunition and hazardous materials) and its associated fence located at the foot of the Amphitheatre, the NREL STM campus, the Denver West Office Park, Colorado Mills Mall, the Jefferson County Fairgrounds, and the urbanization of the Lakewood/Golden area as visible in the attached photographic log. Given these factors, DOE finds the indirect visual impact of the silo does not meet the criteria of adverse effect per 36 CFR 800.5(a)(1) to the Amphitheatre's integrity of setting.

Ammunition Igloo (5JF843)
The Ammunition Igloo is located at street level directly behind the main part of the NREL STM campus. Specifically, the Igloo is located directly across the service road to the north of the SERF. The construction of the SERF commenced in March 1992, prior to the Igloo's evaluation for eligibility to the NRHP. Therefore, the close proximity of the NREL STM campus and its built environment was considered in the original evaluation of the Igloo's integrity of setting. Subsequent Section 106 consultations for NREL STM campus improvements with your office in 2003, 2007, 2008, and 2009 concluded in either no effect or no adverse effect on the Igloo. The proposed RFHP silo would not directly impact or visually adversely impact the current integrity of setting of the Igloo given the silo's context in the existing built environment. Therefore, the DOE finds the indirect visual impact of the silo does not meet the criteria of adverse effect per 36 CFR 800.5(a)(1).

Silo Color
In your correspondence dated October 27, 2011, you requested that DOE consider using colored concrete in the proposed silo construction to minimize the visual impact of this undertaking on the Amphitheatre. Pursuant with the National Environmental Policy Act (NEPA) of 1969 and the DOE NEPA regulations (10 CFR 1021), DOE is analyzing this

proposed action in the form of an Environmental Assessment. Under the framework of NEPA, a federal agency must analyze their actions and their impact on the physical and human environment. One of the resource elements being analyzed for impact by this proposed action is aesthetics/visual impacts, and during the preliminary phase of this analysis DOE considered the utilization of colored concrete. Renderings were generated of the silo from several vantage points as well as with a natural gray concrete color and a tinted beige "sandstone" color. DOE found that the regular gray concrete color made the silo more imperceptible and moreover, better matched the existing color pallets presented in the NREL campus' existing built environment. The proposed silo would be similar to other existing built features on NREL STM campus, such as vent stacks or gas storage tanks, which are all either gray or white in color. Therefore, DOE is not proposing to use colored concrete for the silo at this time.

DOE requests concurrence with a finding of no adverse effect for the proposed undertaking. As always, we appreciate your continued coordination regarding projects at NREL, and we look forward in the successful completion of the Section 106 process with your office. Please feel free to contact Mr. Rob Smith of my office at 720-356-1576 or myself at 720-356-1568 if you have any questions regarding this project.

Sincerely,

Lori Gray

Lori Gray, CSP
NEPA Compliance Officer

LG/rvs

Cc:
Mark Tobias, Colorado SHPO
Rob Smith, DOE
Tom Ryon, NREL

Enclosures: as stated


Colorado
Amphitheater
(5JF842)
Ammunition
Igloo (5JF843)
Proposed
RFHP Silo
U.S. DEPARTMENT OF
ENERGY
GOLDEN FIELD OFFICE
FIGURE 1
PROPOSED AREA OF POTENTIAL
EFFECT (APE)
PROPOSED RFHP IMPROVEMENTS
NATIONAL RENEWABLE ENERGY LAB
GOLDEN, COLORADO

PHOTOGRAPHIC LOG

Photo 1. View from bottom of Colorado Amphitheater looking south southeast toward RFHP. The proposed silo would be behind the RFHP on its southeast corner and is obscured by the tree foliage.

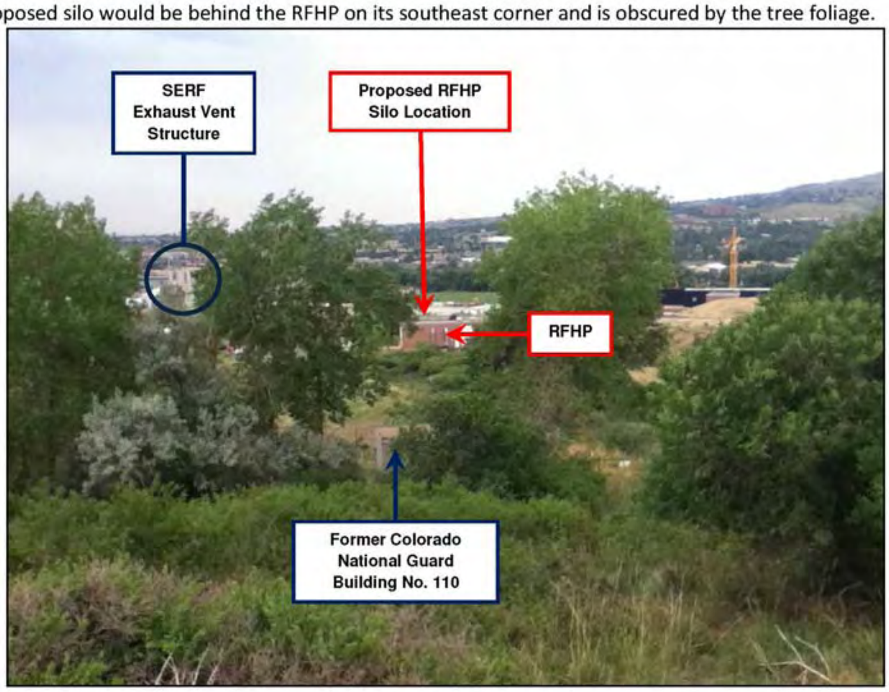


Photo 2. View from middle of Colorado Amphitheater looking south southeast toward RFHP. Again from this prospective, the silo would be behind the RFHP on its southeast corner. The silo would be similar to SERF exhaust vent structures in height and width.

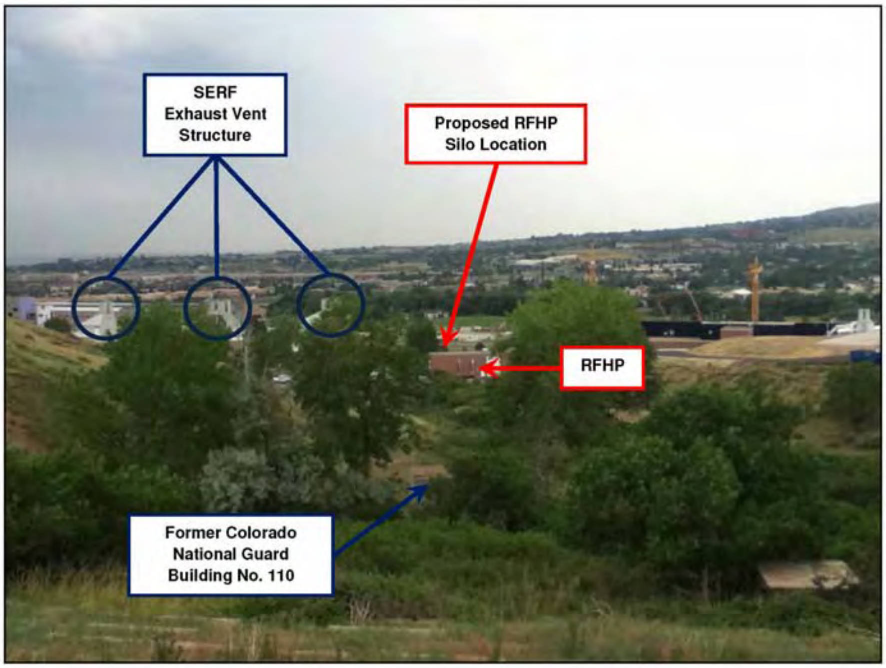


Photo 3. View from top of Colorado Amphitheater looking south southeast toward RFHP. Note the three SERF exhaust vent structures for reference. Also annotated is the former Colorado National Guard hazardous materials and ammunition facility (Building #110) at the foot of the Amphitheatre.

Photo 4. View from Ammunition Igloo to the southwest toward the RFHP.

Photo 5. View from Ammunition Igloo to the southwest toward the RFHP. From this perspective, the proposed RFHP silo would appear smaller than the existing exhaust vent structure on the Solar Energy Research Facility.

CO SHPO to DOE – November 23, 2011

HISTORY Colorado

December 9, 2011

Lori Gray
NEPA Compliance Officer
Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, CO 80401-3393

Re: Continued Section 106 Consultations for the Proposed Renewable Fuel Heat Plant Improvements, National Renewable Energy Laboratory, South Table Mountain Site, Golden, CO (DOE/EA-1573-S-I) (CHS #49170)

Dear Ms. Gray,

Thank you for your follow-up correspondence dated November 23, 2011 (received by our office on November 29, 2011) regarding continued Section 106 consultation for the subject project.

We certainly appreciate your consideration and revision to the area of potential effects (APE) to include both direct and indirect affects to nearby resources including the Colorado Amphitheater (5JF842) and the Ammunition Igloo (5JF843), both of which contribute to the significance of the Camp George West Historic District (5JF145). Based on the information provided within this most recent correspondence, in addition to a conversation with Mr. Rob Smith, Environmental Specialist with the Department of Energy on November 15, 2011, our office concurs that a finding of **no adverse effect** is appropriate for the proposed undertaking.

Please remember that the consultation process does involve other consulting parties such as local governments and Tribes, which as stipulated in 36 CFR 800.3 are required to be notified of the undertaking. Additional information provided by the local government, Tribes or other consulting parties may cause our office to re-evaluate our comments and recommendations.

Should unidentified archaeological resources be discovered in the course of the project, work must be interrupted until the resources have been evaluated in terms of the National Register of Historic Places eligibility criteria (36 CFR 60.4) in consultation with our office.

Thank you for the opportunity to comment. If we may be of further assistance, please contact Mark Tobias, Section 106 Compliance Manager, at (303) 866-4674 or mark.tobias@state.co.us.

Sincerely,

Edward C. Nichols
State Historic Preservation Officer
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Appendix C. Draft Supplemental EA Comment and Responses

Appendix D. Annual Average Daily Traffic (AADT) Along Representative Trucking Routes

Annual Average Daily Traffic (AADT) Along Representative Trucking Routes

Table D-1. 2010 AADT along representative trucking routes.

Major Transportation Routes and AADT Data Points	AADT	AADT Single Trucks	AADT Combination Trucks	Percent Trucks
U.S. 40 (Hayden to I-70)				
Hayden	5,300	250	290	10.1
Steamboat Springs	22,000	400	310	3.2
Muddy Pass (State Highway 14)	1,900	110	180	15.3
Kremmling (County Road 12)	2,900	120	290	14.2
Parshall	2500	150	280	16.8
Hot Sulphur Springs	2,900	140	290	14.8
Granby	6,600	200	260	6.9
Fraser	9,700	250	290	5.6
Winter Park	10,000	300	260	5.6
Empire Junction (west of I-70)	7,500	180	230	5.5
SH 9 (Kremmling toI-70)				
Kremmling	2,800	110	230	12.3
Green Mountain Reservoir	3,300	130	230	10.8
Silverthorne (northwest of I-70)	31,000	1,100	680	5.7
I-70 (New Castle to Golden)				
New Castle	19,000	440	1,800	11.9
Glenwood Springs	18,000	380	1,300	9.2
Eagle	21,000	760	2,100	13.7
Vail	25,000	700	2,000	10.7
Frisco	23,000	670	1,600	9.9
Eisenhower Tunnel	29,000	730	2,200	10.0
Georgetown	30,000	750	2,350	10.4
Idaho Springs	41,000	950	2,200	7.7
Golden	90,000	2,400	3,900	7.7
I-25 (Wyoming State Line to I-70)				
Wyoming State Line	17,000	350	2,150	14.7
Fort Collins	52,000	1,700	4,000	11.0
Loveland	60,000	2,000	4,500	10.8
Northglenn	137,000	5,100	7,000	8.8
I-25 at SH 36	175,000	6,300	8,800	8.6
I-25 at I-70	192,000	10,900	10,000	10.9
I-25 (Pueblo to C-470)				
Pueblo (SH 45)	34,000	1,050	1,550	7.6
Colorado Springs (North Gate Blvd.)	79,000	3,500	5,100	10.9
Castle Rock (SH 85)	70,000	2,700	3,800	9.3
C-470	162,000	6,300	6,000	7.6

SH 287 (Wyoming State Line to Fort Collins)				
Wyoming State Line	3,600	140	700	23.3
Fort Collins	22,000	730	810	7.0
SH 50 (Gunnison to I-25)				
Gunnison (CR 38)	9,700	210	310	5.4
Poncha Springs	7,100	360	480	11.8
Salida	9,400	330	460	8.4
Canon City	17,000	390	750	6.7
SH 115	10,000	190	430	6.2
I-25	32,000	770	1,000	5.6
SH 285 (Salida to C-470)				
Johnson Village	7,100	190	360	7.8
Fairplay	6,000	330	370	11.6
Jefferson	4,300	150	350	11.6
Grant	3,700	180	300	12.9
Bailey	7,800	190	480	8.6
Conifer	22,000	480	480	4.4
C-470	28,000	870	1,600	8.9
SH 24 (Buena Vista to Leadville)				
Buena Vista	9,000	250	240	5.5
Malta	3,900	90	130	5.5
Leadville	7,600	140	140	3.8
SH 91 (Leadville to I-70)				
Leadville	3,600	60	110	4.7
Copper Mountain	3,200	80	170	7.7
SH 24 (SH 285 to Colorado Springs)				
Hartsel	2,800	90	150	8.4
Lake George	3,700	110	170	7.8
Woodland Park	26,000	440	390	3.2
Manitou Springs	33,000	590	560	3.5

Source: CDOT 2010.

Appendix E. Potential Risks and Accidents Associated with the Proposed Action

Potential Risks and Accidents Associated with the Proposed Action

This appendix discusses risks and possible accidents in conjunction with the Proposed Action of making improvements to the RFHP consisting of construction and operation of a woodchip storage silo to increase the woodchip storage capacity; and utilization of regional wood sources. The analysis is organized according to the two components of the Proposed Action:

- **E.1 Woodchip Storage and Vertical Silos.** The information presented draws primarily from Nordic Innovation Centre (2008) and is based on the physical properties of biofuels in general with the recognition that woodchips are one specific form of biofuel. Storage in vertical silos and the known risks associated with vertical silos are also examined.
- **E.2 Regional Woodchip Fuel Sourcing Transportation.** These data include consideration of known woodchip fuel sources within the regional fuel source radius of 125-mile (201 km) from the STM site; accident-injury rates for Colorado routes; and fatality rates for Colorado routes.

The safety staff at National Renewable Energy Laboratory (NREL) would apply their Hazard Identification and Control Procedure (NREL 2011) throughout the design/build process to ensure that the safety features incorporated into the proposed Renewable Fuel Heat Plant (RFHP) silo would provide adequate protection to workers and the public during construction and operations. In accordance with the Hazard Identification and Control Procedure, if, during the design process, the proposed safety features were shown to be inadequate, design changes or new safety features would be specified and shown to provide adequate protection. Before the RFHP silo is used, its systems would be evaluated and readiness to operate them verified, in accordance with this procedure. Moreover, the Department of Energy, Golden Field Office, would provide independent oversight and verification reviews to ensure that NREL has met its commitments to identify, mitigate, and manage risk to an acceptable level.

E.1 Woodchip Storage and Vertical Silos

E.1.1 Background

Literature regarding the storage of woodchips is limited. Research has been conducted for other wood-handling industries (e.g., wood pulp and paper production), but in many cases this work is irrelevant to the storage of woodchips as a form of biofuel. Similarly, research exists for a wide range of biofuels (e.g., fresh or moist fuels, sawdust, and pellets), but is not present for a wide range of specifics for woodchips.

Biofuels are produced directly or indirectly from biomass. Solid biofuels are produced in different sizes and shapes originating from different raw materials. The physical properties (e.g., size, shape, moisture content, and type of raw material) influence the handling and storage properties of the fuel. This section presents some of the physical damage and deterioration to the quality of solid biofuels that can facilitate the risk of fire, explosion, and additional health risks. Given the wide range of biofuel types, it is important to acknowledge the specific nature of woodchips within the context of each section.

Once a fresh biomass is comminuted (size reduction by chipping or hogging) and piled, a number of biological, physical, and chemical processes take place. Respiration of plant cells and microbial growth are the main biological activities that occur soon after chip piling and lead to heat release inside the pile. Due to limited air passage inside the pile and the low conductivity of woody biomass, the heat accumulates and reaches about 140°F (60°C). At this temperature, most of the biological activities cease. Further heat development results from subsequent physical and chemical processes such as water transport and adsorption, hydrolysis, chemical oxidation, and charring. All of these processes can cause storage problems: dry matter loss, deterioration of fuel quality, and heat accumulation, which could ultimately lead to spontaneous ignition. Another problem that can be encountered (during storage and handling of fresh/moist wood fuel) is a potential health risk caused by the release of high concentrations of bacterial particles and fungal spores to the surrounding air, thus creating an unacceptable working environment (Nordic Innovation Centre 2008).

The effect of storage on fuel quality is decided by many factors related to the properties of stored material and storage method. The composition of the material (e.g., wood, foliage, and bark) affects the rate of biological degradation since it determines the availability of easily usable nutrients in the stored material. Needles and bark, for example, have more soluble nutrients and higher nitrogen content than stem wood, thus providing a better substrate for the rapid establishment of fungal and bacterial growth.

RFHP woodchips typically contain between 15 and 25 percent moisture. Due to the dry Colorado climate and the short residence time of approximately one week in the proposed RFHP silo, it is unlikely that any biological processes would continue to a sufficient degree to cause microbial growth leading to heat development or the growth of bacteria and fungus.

E.1.2 Risk of Fire and Explosion

Spontaneous Ignition

Solid biofuels are porous, often moist materials, which are prone to self-heating caused by microbiological activity, chemical oxidation, and physical processes as mentioned above. The outcome of the self-heating process is a balance between the heat production rate and the rate of heat dissipation. Thermodynamically, the larger the size of the storage, the greater the risk for spontaneous ignition.

Moist Fuels

Examples of fuels for which heat production from microbiological metabolism is important are wood chips, bark, and other solid biofuels with relatively high moisture content that are normally stored outdoors. Fungi and bacteria are dependent on moisture for degradation of the wood content.

Microbial growth results in a temperature increase in the stored fuel. Peak temperatures of microbial self-heating vary between 68°F and 176°F (20°C and 80°C), dependent on the type of microorganism (Kubler 1987). Chemical degradation normally starts to have some influence at 104°F (40°C), and at temperatures above 122°F (50°C) these processes will dominate the biological processes. It has been shown that oxidative processes are faster in wood containing higher amounts of lignin and that the presence of metals increases the oxidation rate (Kubler 1987). As the heat-producing processes proceed, heat is transported from the interior of the bulk toward the surface. The center of the bulk is drying and water is transported out from the center and condensing on the outside layers. The height of the pile and ambient temperature are factors that influence average moisture content and temperature during storage of sawmill residue. In particular, the shape of a chip pile affects the temperature rise more than the height of the pile because the shape will determine the ventilating chimney effect in the pile. The ventilation provides the oxygen needed by metabolic activity and cools the pile interior by convection (Jirjis 1995).

The main factors influencing the temperature in the stack are moisture content, moisture gradients, the size of the bulk, and density. Because of the moisture gradient, mixing fuels with different moisture content may lead to increased risk of self-ignition. Spontaneous ignition starts as pyrolysis (i.e., subjecting organic compounds to very high temperatures) in the interior of the stack in cases when the heat production exceeds the heat dissipation in bulk material. The spontaneous ignition results in flaming combustion in cases when the pyrolysis spreads to the surface of the stack (Nordic Innovation Centre 2008).

Available literature and studies do not exist specifically for woodchips. The information previously provided pertains mainly to moist (fresh) biofuels. RFHP woodchips would be derived primarily from dead trees and typically contain between 15 and 25 percent moisture. Due to the dry Colorado climate and the typical[1] (short) residence time of approximately one week in the proposed RFHP silo, it is unlikely that any biological processes would continue to a sufficient degree to facilitate spontaneous ignition.

Dry Fuels

Storage of dry wood fuels such as wood pellets and dry sawdust requires a protected environment to maintain the low moisture content and, in the case of pellets, the structure of the fuel. Thus, the storage conditions for these types of fuels are entirely different from the storage of moist fuels, and due to the low moisture content, the growth of microorganisms is limited.

Heat build-up occurs in large storages and sometimes in small piles of wood pellets stored at normal ambient temperatures. For wood pellets, the inclination for self-heating seems to vary between different qualities of pellets and self-heating is most problematic relatively shortly after production (Arshadi and Gref 2005). In storages of dry sawdust, heat production has been observed in cases when moist material has been mixed or added to the otherwise dry material.

Spontaneous ignition of dry wood fuels is a result of a chain of events in which a fuel that exhibits one or several heat producing processes is stored in such a large volume that a heat build-up occurs. The main risks from the self-heating process of a fuel stored in an enclosed structure as a silo are the following, in order of occurrence:

- Emission of asphyxiate (e.g., carbon monoxide (CO)) and irritating (e.g., aldehydes and terpenes) gases;
- Spontaneous ignition in the bulk material, resulting in emission of pyrolysis/combustion gases;
- Smoke gas and/or dust explosion can occur if, for example, the top compartment of a silo is approached in rescue work; and
- Surface fire and fire spread often as a result of an explosion (Nordic Innovation Centre 2008).

RFHP woodchips would not be compacted in a similar fashion to wood pellets and sawdust. In addition, RFHP woodchips would have a short residence time of approximately one week in the storage silo and it is unlikely that any biological processes would continue to a sufficient degree to facilitate spontaneous ignition. Operations would not include mixing moist material to the otherwise dry woodchips, thus eliminating the potential for additional heat production.

[1] A breakdown in equipment may require a 30-day shutdown for repairs. Given a 30-day residence time for the RFHP woodchips, the likelihood of spontaneous combustion would still be remote due to the low moisture content of the RFHP woodchips.

External Ignition Sources

External ignition sources include heat from conveyor friction, friction heat from screw feeder devices inside silos, local temperature-rise of electrical motors during overload, and lightning. Sparks, for example, from static electricity, rocky, or metallic material, and friction heat from rocky material, ferrous, and nonferrous metallic particles in fuel handling and processing may further act as an external ignition source. Also, fire pockets or hot spots in a fuel (truck) load may cause fire. As silos are generally the tallest structures in a given area, they may be susceptible to lighting strikes. Lightning rod protection systems can prevent damage to the structure, but damage and fire can still result if lightning strikes a facility's electrical system.

The *National Renewable Energy Lab Renewable Fuel Heating Plant (RFHP) Combustible Dust Hazard Investigation* (OHSM 2009) recommends modifications to the RFHP that would eliminate ignition sources within the fuel room, including instituting hot work procedures for the facility. Recommendations outlined in the OHSM (2009) investigation would also be implemented for the proposed RFHP silo where applicable.

Risk of Explosion

There is a risk for dust explosion when handling and processing dry biofuels in confined spaces. Particles of combustible materials mixed in air will burn with a speed that generally increases with decreasing particle size. After ignition of a dust cloud, the combustion rate can be very fast and the required ignition energy can be very small; and the result would be a dust explosion.

Wood dust may form an explosive mixture in low concentrations if there is oxygen available and an ignition source. The oxygen concentration of air present during normal handling operations is sufficient. The average particle size of explosive wood dust may be essentially larger compared to inhalable dust, although a smaller particle size generally increases the explosion risk.

Five elements are necessary to initiate a dust explosion, often referred to as the "Dust Explosion Pentagon" (OSHA 2009). The first three elements are those needed for a fire (i.e., the familiar "fire triangle") and are presented below. It is important to note that it is unlikely that there would be significant dust accumulation in the RFHP silo, as most of the dust producing activities (i.e., chipping, material handling, loading, and unloading) have occurred prior to woodchips entering the silo.

1. Combustible dust (fuel);
2. Ignition source (heat); and,
3. Oxygen in air (oxidizer).

An additional two elements must be present for a combustible dust explosion:

4. Dispersion of dust particles in sufficient quantity and concentration; and
5. Confinement of the dust cloud.

A dust explosion can be a separate event or the consequence of a fire or a fire gas explosion. A possible scenario is that a fire gas explosion in the top of a silo stirs up fine dust from the fuel bed and that the dust cloud is ignited by burning fuel, resulting in a secondary (dust) explosion.

RFHP woodchips are typically cleaner in nature and contain fewer contaminants and low levels of dust. Additionally, the woodchips would be offloaded from the delivery vehicle into the fuel storage pit as they are currently for RFHP operations. Then the woodchips would feed from the fuel storage pit into a conveyer proceeding through a gross sifter that removes debris including dust. Following this dust removal, the conveyer would move the woodchips into the silo bucket elevator.

The *National Renewable Energy Lab Renewable Fuel Heating Plant (RFHP) Combustible Dust Hazard Investigation* (OHSM 2009) recommends instituting measures to minimize dust accumulations within the facility. Recommendations outlined in the OHSM (2009) investigation would also be implemented for the proposed RFHP silo where applicable. In addition, both employee and contractor hazard awareness training would be enhanced.

Explosions and Potential Injury

The injury pattern following an explosion is partly random. The trauma that results from an explosion is a product of the composition and amount of the materials involved, the surrounding environment, the distance between the victim and the blast, and any shielding or protective barriers between the victim and the explosion (CDC 2011).

Trauma caused by explosions traditionally has been divided into the injury caused by the direct effect of the blast wave[2] (primary injuries); the effects caused by other objects that are accelerated by the explosive wave, (secondary injuries); the effects caused by movement of the victim (tertiary injuries); and miscellaneous effects caused by the explosion or explosives (CDC 2011).

E.1.3 Health Risks

Gas Emissions

Emissions of volatile content and degradation products can occur during storage and transport. Emission of monoterpenes from bark was found to be high immediately after building a pile of fresh bark, but declined within a few days to acceptable levels. Emissions from piles stored outdoors are normally diluted by surrounding air and, therefore, have limited effect. A greater risk for exposure to harmful emissions from stored biofuel comes from storage in enclosed spaces. Examples of such storages are cargo spaces in ships and storage in silos and other confined storages.

Emissions of aldehydes and terpenes have been found in bulk storages of wood pellets. Typical compounds found are hexanal, pentanal, and monoterpenes. Emission of CO has been seen from bulk storage of wood pellets at production plants (Svedberg 2004), storage in silos, and transportation in ships.

The proposed RFHP silo would be considered a confined space with prescribed safety measures in place before entry would be permitted. Any entry would be conducted with ventilation and air monitoring.

Molds and Other Microorganisms

Storage of wet solid biofuel, especially freshly chipped material, in a pile provides a favorable environment for the growth of many species of bacteria and fungi. The most common and

[2] The blast wave refers to an intense rise in pressure – often called "over pressure" that is created following an explosion. The pressure rises almost instantaneously in the ambient environment, then decays exponentially, and may have a short period of reduced barometric pressure following the overpressure. The peak pressure and the duration of the initial positive phase of the blast wave depend on the size of the explosion and the distance from the center of the detonation.

abundant colonizers of stored material are two groups of microorganisms: Actinomycetes (bacteria with a growth pattern similar to fungi) and molds that are fast-growing fungi. These microorganisms produce large numbers of microspores <0.2 inches (<5 mm) in diameter. These spores become airborne when the chips or straw are handled (e.g., shoveling, loading, and unloading at the heating plant). Due to their small size, the spores are easily inhalable and they can penetrate the respiratory system and cause allergic reactions. Allergic alveolitis is one of the lung diseases caused by the inhalation of mold dust (OSHA 2006). Handling moldy chips can lead to the release of high concentrations of spores to the air; therefore, using a protective mask is highly recommended.

Due to the dry Colorado climate and the short residence time of approximately one week in the proposed RFHP silo, it is unlikely that microbial growth would occur.

Organic Dust

Some dust is always present when handling especially dry fuels produced from biomass. The harmfulness of dust depends on chemical (and mineralogical) composition, dust concentration, and particle size and shape. Airborne small particles ($\lesssim$5 μm) are able to penetrate deep into lungs and may cause occupational respiratory diseases.

Bio-aerosols are usually defined as aerosols or particulate matter of microbial, plant, or animal origin that is often used synonymously with organic dust. Organic dust from biofuel consists of live and dead bacteria and fungi, and microbial components as endotoxins, peptido-glycans, enzymes, and β-glucans (Madsen 2004).

At biofuel plants the employees may be exposed to complex bio-aerosols (Madsen 2006) and a wide range of potential health effects have to be considered. Three major groups of diseases associated with bio-aerosol exposure can be distinguished: infectious diseases, respiratory diseases, and cancer. At biofuel plants mainly respiratory diseases have to be considered. Respiratory symptoms can range from acute mild conditions that initially hardly affect daily life, to severe chronic respiratory diseases (Doues 2002). The health effects of exposure to bio-aerosols depend on the exposure level, the bio-aerosol composition, and the person exposed.

All of the delivered woodchip fuel would be moved from the fuel pit to the proposed RFHP silo within a few hours following delivery. This would eliminate the additional woodchip handling and associated dust creation.[3] The proposed RFHP silo would in effect reduce worker exposure to dust in the RFHP, which would be consistent with recommendations outlined in the *National Renewable Energy Lab Renewable Fuel Heating Plant (RFHP) Combustible Dust Hazard Investigation* (OHSM 2009).

[3] The existing delivery dock configuration requires that the storage pit be nearly empty before the next truckload of woodchips can be offloaded, which places the fuel delivery schedule into a “just-in-time” configuration. Upon delivery, the woodchips are offloaded into the fuel pit. During offloading, the woodchips have a tendency to “cone up,” which requires additional handling with a tractor to evenly distribute them to make room for the next delivery.

E.1.4 Tower Silo Collapse

Two factors are generally involved in a tower silo collapse: silo filling and silo maintenance.

Silo Filling

Typically, distribution equipment malfunctions and silo filling may proceed with the operator unaware that the material being ensiled is piling up on one side of the silo. An uneven force is placed on one side of the silo. This force (pressure) translates to the opposite side of the silo as a reduced force or pressure. The result is the lightly loaded side of the silo begins to lift, eventually causing the silo to collapse.

The proposed RFHP silo would not rely on distribution equipment. A steep angle chute would discharge the woodchips into the center of the proposed RFHP silo; where gravity slumping would distribute the woodchips. The proposed RFHP silo would have adequate headspace for woodchip storage. The woodchips would be removed by a reclaim system that pulls the woodchips from the bottom of the fuel pile.

Silo Maintenance

Most of the problems with deterioration of conventional concrete tower silos are due to the attack of silage acids associated with moist plant material. When moist plant material is put into a silo, it goes through the ensiling process, which produces silage acids (principally lactic and acetic acids). These acids, when they come into contact with concrete silo walls, react with the Portland cement matrix that binds the aggregates. This results in a gradual decline in strength as the structure ages. In some cases, the strength will decrease to the point where the concrete can no longer perform its required function. In addition these same acids will corrode silo hoops, reinforcing steel, or hardware associated with the silo (Johnson 2008).

Silage acids cause deterioration to all types of concrete silos – cast-in-place (poured), pre-cast, and stave. The rate and severity of this deterioration depends on a number of factors such as the size of the silo, the moisture content of the ensiled material, and the amount of protection given to the concrete on a continuous basis.

Silage pressure has a large part to play in determining the rate and extent of acid deterioration. In any silo, the highest pressure is at the bottom of the wall. Larger silos produce higher pressures. This results in an increased squeezing effect on the ensiled mass, thereby creating even more free liquid and seepage. In addition, the silage liquids containing the acids are forced into the tiny pores in the concrete. Because of this, larger silos often suffer more acid deterioration than smaller silos. Ensiling higher moisture material leads to more fermentation, which in turn leads to a higher level of acid production. This results in accelerated concrete deterioration. Material placed into a tower silo creates vertical and horizontal loads or pressures. Acid attack is of concern and will eventually reduce the ability of the structure to carry these loads.

Due to the dry Colorado climate and the short residence time of approximately one week in the proposed RFHP silo, it is unlikely that any acid production associated with woodchip storage would occur.

Silo Destabilization

The general slope of the South Table Mountain (STM) site is toward the south/southeast, directing stormwater toward Lena Gulch both from the top of STM and the property below. Two primary drainages collect runoff from the top of STM within the STM site's boundary. These drainages, one of which is adjacent to the proposed silo, occasionally convey stormwater. It is possible that a significant runoff (stormwater) event or series of events could facilitate deterioration of the silo foundation, leading to eventual collapse.

Assuming a 30-year project lifespan, the probability (see below) of a 100-year flood is 0.26; the probability for a 500-year flood is 0.06. The proposed RFHP silo location is not within any 100-year or 500-year floodplain.

Probability = $1-(1-1/T)^N$, where N = the project's lifetime in years, and T is the return period of the event in years. The Annual probability of the event = 1/T. To illustrate, the probability that a 100-year storm event would occur in a given year is 0.01 [1/100]. The probability that the 100-year storm would occur during a project lifetime of 100 years is not 1.0 [100 x 0.01]. Rather, the probability is about 0.63 [$1-(1-1/100)^{100}$].

E.1.5 Summary

Table E-1 identifies the terminology used to define the annual probability of occurrence and characterize the likelihood of occurrence of the accidents analyzed in Section E-1 of this appendix. The accidents assessed range from "Remote" with an annual probability of occurrence between once in 100 and once in 10,000 per year, to "Extremely Remote" with an annual probability of occurrence between once in 10,000 and once in one million per year, or a probability of occurrence that cannot be distinguished from zero. No accidents or events were identified with an annual probability of occurrence ranging from "Frequent" to "Occasional."

Table E-1. Event probability classification table.

Level	Annual Probability	Likelihood
A	Frequent > 1.0	Likely to occur many times during the life cycle of the system (test/activity/operation)
B	Reasonably Probable 1.0 to 0.1	Likely to occur several times during the life cycle of the system
C	Occasional 0.01 to 0.1	Likely to occur sometime during the life cycle of the system
D	Remote 0.0001 to 0.01	Not likely to occur in the life cycle of the system, but possible
E	Extremely Remote 0.000001 to 0.0001	Probability of occurrence cannot be distinguished from zero
F	Not Reasonably Foreseeable <0.000001	Probability of occurrence not reasonably foreseeable

Accidents less frequent than once in one million years are not reasonably foreseeable and therefore have not been considered. Although formal calculations of the frequency of the accident scenarios were not made, as a rule of thumb a well-inspected and well-maintained engineered safety system would be expected to not perform its designed safety function about once in 100 to once in 10,000 actuations. A well-trained operator would be expected to not properly follow a procedure between once in 10 to once in 1,000 times. The exact frequency of mistakes is a function of the worker's environment and the complexity of the procedure.

Table E-2 divides potential consequences into four categories: Negligible, Marginal, Critical, and Catastrophic. The estimates presented in Table E-2 are based on NREL and DOE experience, general industry experience, published literature, and numeric calculations. In general, the consequence estimates are conservative; that is they overestimate the result.

Table E-2. Hazard consequence classification table.

Category	Description (Est. $ Lost)	Potential Consequences
I	Catastrophic (equipment loss > $1,000,000)	May cause death or system loss.
II	Critical ($100,000 to $1,000,000)	May cause severe injury or occupational illness, or minor system damage.
III	Marginal ($10,000 to $100,000)	May cause minor injury or occupational illness, or minor system damage.
IV	Negligible (< $10,000)	Will not result in injury, occupational illness, or system damage.

Table E-3 places each scenario described in Section E.1 in a bin on the risk matrix assuming that no safety features have been installed.

Table E-3. Risk profile for events without safety features.

	Annual Probability	Consequence	Risk
Spontaneous ignition	Remote	Critical	Low
External ignition	Remote	Critical	Low
Explosion	Remote	Catastrophic	Moderate
Gas emissions (health risk)	Remote	Catastrophic	Moderate
Molds	Remote	Catastrophic	Moderate
Organic dust	Remote	Catastrophic	Moderate
Collapse (from filling)	Extremely remote	Catastrophic	Low
Collapse (acid production)	Extremely remote	Catastrophic	Low
Collapse (destabilization)	Extremely remote	Catastrophic	Low

Table E-4 places each scenario described in Section E.1 in a bin in the risk matrix assuming that safety features have been installed. A comparison of the two tables shows that safety features are critical and that effective safety features can ensure the safety of workers and the public.

Table E-4. Risk profile for events with safety features.

	Annual Probability	Consequence	Risk
Spontaneous ignition	No additional review*	No additional review	No additional review
External ignition	No additional review	No additional review	No additional review
Explosion	Extremely remote	Catastrophic	Low
Gas emissions (health risk)	Extremely remote	Catastrophic	Low
Molds	Extremely remote	Catastrophic	Low
Organic dust	Extremely remote	Catastrophic	Low
Collapse (from filling)	No additional review	No additional review	No additional review
Collapse (acid production)	No additional review	No additional review	No additional review
Collapse (destabilization)	No additional review	No additional review	No additional review

*No additional review indicates that a risk rating was not determined separately for the event with safety features given that the annual probability, consequence, and risk would be the same as the risk profile presented without safety features.

In comparing Tables E-3 and E-4, it is evident that preventive, protective, and mitigative safety features lower the risk profile for the proposed RFHP silo. Table E-3 shows that in the absence of safety features, many scenarios are remote. With safety features in place (Table E-4), these scenarios become extremely remote.

E.1.6 Summary

Section E.1 has identified many possible events that could occur at the proposed RFHP silo and has analyzed in detail several of the more potential event sequences associated with the nature and quality of woodchips and their storage in vertical silos, as well as the known risks associated with vertical silos themselves. The analysis concludes that several events, although remote or extremely remote, have the potential for significant impacts and emphasizes the importance of incorporating effective safety features into the design. This analysis shows there is ample justification for using formal hazards analyses, as specified in the NREL Hazard Identification and Control Procedure, to guide the design process as it proceeds.

Table E-5 summarizes the accident scenarios assessed in Section E.1 in terms of their likelihood of their occurrence; and the predicted impact to the off-site public; the involved worker (individual working in the RFHP); the uninvolved workers that work elsewhere on the STM site; and the bystander that may be on the STM site near the RFHP.

Table E-5. Proposed RFHP silo accident consequence summary.

Accident Scenario	Likelihood of Occurrence	Impact to the Off-site Public	Impact to Involved Worker	Impact to Uninvolved Worker or Bystanders
Spontaneous or external ignition	Remote	Facility location and access would prevent any impacts to a member of the public.	Fire would do extensive damage to equipment and could lead to explosion (see below).	Fire would do extensive damage to equipment and could lead to explosion (see below).
Explosion	Extremely remote	Facility location and access would prevent any impacts to a member of the public.	Explosion would cause extensive damage to the equipment and the facility. Because the proposed RFHP silo would not be occupied and is physically separated from the RFHP building containing the control room, injuries to workers would not be anticipated.	Explosion would cause extensive damage to the equipment and the facility. Facility location and explosion could result in primary, secondary, or tertiary injuries to uninvolved workers or bystanders.
Health risks associated with exposure to gases, molds, and organic dust	Extremely remote	Facility location and access would prevent any impacts to a member of the public.	For unprotected workers, health effects would be anticipated. However, workers are trained in emergency response, and any response activities would include a risk assessment and incorporation of health and safety monitoring followed by proper selection and use of PPE to reduce the potential of permanent health effects.	Facility location and access would prevent any impacts to uninvolved workers or bystanders.
Collapse from filling or acid production	Extremely remote	Facility location and access would prevent any impacts to a member of the public.	Collapse would cause extensive damage to the equipment and the facility. Because the proposed RFHP silo would not be occupied and is physically separated from the RFHP building containing the control room, injuries to workers would not be anticipated.	Facility location and access would be unlikely to result in any impacts to uninvolved workers and bystanders.

E.2 Regional Woodchip Fuel Sourcing Transportation

This section presents data including consideration of known woodchip fuel sources within the regional fuel source radius of 125-mile (201 km) from the STM site; accident-injury rates for Colorado routes; and fatality rates for Colorado routes. The section discloses potential transportation risks and accidents associated with the proposed regional woodchip fuel sourcing.

E.2.1 Potential Accidents and Fatalities due to Regional Fuel Sourcing

Table E-6 lists the heavy truck mileage from various origination points to the STM site under the Proposed Action. These data include consideration of known woodchip fuel sources and some of the most distant origination points within the regional fuel source radius of 125-mile (201 km) from the STM site. The table indicates that the Proposed Action would require from 38,400 heavy truck miles (61,799 km) from a woodchip fuel source in Kremmling, Colorado to 76,800 heavy truck miles (123,598 km) from a woodchip fuel source in Gunnison, Colorado to the STM site.

Table E-6. Estimate of annual truck traffic from major origination points to the STM site.

Origination Point	One-Way Distance in miles (km)	Annual Travel in miles (km)†
Kremmling, Colorado	96 (155)	38,400 (61,799)
Hayden, Colorado	185 (298)	74,000 (119,092)
New Castle, Colorado	161 (259)	64,400 (103,642)
Gunnison, Colorado	192 (309)	76,800 (123,598)
Pueblo, Colorado	125 (201)	50,000 (80,467)
Cheyenne, Wyoming	110 (177)	44,000 (70,811)
Laramie, Wyoming	154 (248)	61,600 (99,136)

†Based on round-trip travel distance and 200 fuel deliveries annually.

Traffic Accident Injury Potential

The accident-injury rate for all vehicles along Colorado routes in 2004 was 69.3 per 100 million vehicle miles travelled (VMT) or 6.93×10^{-7} (0.000000693) per mile (CDOT 2008). Based on distance between Kremmling, Colorado and the STM site, there would be an estimated additional 0.027 injury due to accidents per year, or 1 injury due to an accident every 38 years. Based on the distance between Gunnison, Colorado and the STM site, there would be an estimated additional 0.053 injury due to accidents per year, or 1 injury due to an accident every 19 years. In other words, additional traffic-related injuries from operations for the Proposed Action would be unlikely over an expected facility life of 30 years.

Traffic Accident Fatality Potential

The fatality rate for all vehicles along Colorado routes in 2009 was 1.01 per 100 million VMT or 1.01×10^{-8} (0.00000001) per mile (CDOT 2011). Accident fatalities that involved large trucks (combination trucks) indicated that 6.1 percent of all fatalities in Colorado involved large trucks (DOT 2011). Therefore, the fatality rate for heavy trucks would be 6.1×10^{-10} (0.00000000061) per mile. Based on distance between Kremmling, Colorado and the STM site, there would be an estimated additional 0.000023 fatality per year, or 1 fatality every 43,478 years. Based on the distance between Gunnison, Colorado and the STM site, there would be an estimated additional 0.000047 fatality per year, or 1 fatality every 21,277 years. In other words, additional traffic-related fatalities from operations for the Proposed Action would be extremely unlikely over an expected facility life of 30 years.

E.3 References

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Appendix F. Calculations for Greenhouse Gas Emissions

Calculations for Greenhouse Gas Emissions

Table F-1. Total CO_2 emissions for silo construction activities.

Fuel Type	Fuel Use per Day (gallons)	Total Days	Total Fuel Use (gallons)	Total CO_2* Emissions (kilograms)	Total CO_2 Emissions (metric tons)
Caisson Drill Rig					
Diesel	30	2	60	606	0.606
JD Backhoe					
Diesel	20	4	80	808	0.808
2.5-Ton Truck					
Diesel	100	3	300	3,030	3.030
Concrete Delivery Truck					
Diesel	50	5	250	2,525	2.525
Concrete Pumper Truck					
Diesel	30	5	150	1,515	1.515
Hand Operated Compacter					
Gas	5	1	5	44	0.044
			Total	8,528	8.528

*Emissions = 10.1 kilograms per gallon of diesel fuel and 8.8 kilograms per gallon of gasoline.
Note: Run times (total of an 8-hour day) for construction equipment provided by NREL Project Engineer, gallons of fuel used based on 0.169 gallon/mile for highway and typical construction off-road equipment use.

Table F-2. RFHP CO_2 worst-case annual emissions.

Wood (US TPY)	Carbon (%)	Carbon (US TPY)	CO_2 (US TPY)	CO_2 (metric TPY)
3900	51	1989	7293	6630
1 molecular carbon = 1 molecular CO_2				
molecular wt carbon =			12	lb/lb-mole
molecular wt CO_2 =			44	lb/lb-mole
Molar ratio of CO_2 to carbon = 44 : 12 = 44 / 12 =				3.666667

Additional assumptions:
1. 100 percent carbon is converted to CO_2
2. 100 percent of volatile carbon compounds are converted to CO_2
3. Carbon content used is the average content of several types of coniferous trees
4. Carbon content includes fixed carbon and volatile carbon compounds

Table F-3. Greenhouse Gas Emissions from RHFP Regional Wood Sourcing Transportation.

ASSUMPTIONS											
Maximum Distance Per Trip (mi):	384	- round trip to Gunnison, Colorado									
Number of Trips per Year:	200										
Vehicle Type:	Diesel, Heavy-Duty (Combination Truck)										
Emission Control:	Advanced Emission Control (Model Year 1996 and Newer)										
Average Fuel Economy:	0.169	gal/mi	Table 4, EPA430-K-03-005								
Total Annual Miles Driven:	76,800										
Total Annual Diesel Consumed (Gal):	12,979										
EMISSION FACTORS											
Pollutant	Emission Factor		Unit	Source							
CO2	10.15		kg/gal	Table 5, EPA430-K-03-005							
N2O	0.0048		g/mi	Table 2, EPA430-K-03-005							
CH4	0.0051		g/mi	Table 2, EPA430-K-03-005							
ESTIMATED EMISSIONS											
	Estimated Emissions			*Unit Conversion*			*Global Warming Potential*				
Pollutant	Result	Unit		Result	Unit		GWP (CO2e)				
CO2	131738.9	kg		131.7389	CO2 TPY		1		131.7389		
N2O	368.64	g	x	0.000369	N2O TPY	x	310	=	0.114278		
CH4	391.68	g		0.000392	CH4 TPY		21		0.008225		
									TOTAL	**131.86**	**CO2e TPY**

Note: TPY = Metric Tons Per Year