



Research Safety Summary - Required Reading

Logged in as Leslie Hook

RSS No	7728.10									
Status	Authorized									
Minor Revisions	None.									
Last Modified by	Wullschleger, Stan D (34406) on 8/18/2018 12:45:38 PM									
Notice	This information is current as of 8/20/2018 9:45:45 AM . The official copy of this Research Safety Summary is the online version. Before using a printed copy, you must verify that it is the most recent version. Any printed copies provided to individuals for the purpose of controlling work must be controlled in accordance with the Document Control subject area.									
Title	ESD Off-Site: Minnesota SPRUCE Experiment--Climate Change Response SFA									
Approvals/Authorizations	<table border="1"> <thead> <tr> <th>Date/Time</th> <th>Name</th> <th>Role</th> </tr> </thead> <tbody> <tr> <td>8/17/2018 3:22:00 PM</td> <td>Hanson, Paul J (29602)</td> <td>Group Leader</td> </tr> <tr> <td>8/18/2018 12:45:31 PM</td> <td>Wullschleger, Stan D (34406)</td> <td>Division Work Authority</td> </tr> </tbody> </table>	Date/Time	Name	Role	8/17/2018 3:22:00 PM	Hanson, Paul J (29602)	Group Leader	8/18/2018 12:45:31 PM	Wullschleger, Stan D (34406)	Division Work Authority
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Description Text	<p>[NOTE: The presence of Green Text in this RSS is indicative of substantive changes that have been made to the RSS since the last major version.]</p> <p>Experimental work under the Response SFA will focus on the identification of critical response functions for terrestrial organisms, communities, and ecosystems. Both direct and indirect effects of these experimental perturbations will be analyzed to develop and refine models needed for full Earth system analyses. Response SFA research will be organized around a climate change manipulation focusing on the combined response of multiple levels of warming at ambient or elevated CO₂ (eCO₂) levels.</p> <p>A more detailed discussion of the scientific goals/outcomes of the proposed work can be found in the expanded project description attachment and the project's website: http://mnspruce.ornl.gov/</p> <p>The experiment will provide a platform for testing mechanisms controlling vulnerability of organisms and ecosystems to important climate change variables (e.g., thresholds for organism decline or mortality, limitations to regeneration, biogeochemical limitations to productivity).</p> <p>The experiment will evaluate the response of existing biological communities to a range of warming levels from ambient to 8°C. The ambient, 4°C and 8°C warming treatments will also be conducted at eCO₂ (in the range of 800 to 900 ppm).</p> <p>The experiment will be conducted in a Picea mariana [black spruce] – Sphagnum spp. forest in northern Minnesota. This ecosystem located at the southern extent of the spatially expansive boreal peatland forests is considered to be especially vulnerable to climate change and to have important feedbacks on the atmosphere and climate.</p>									
Description File	Project Description.pdf									
Division	X042: Environmental Sciences Division									
Start Date	9/8/2009									
End Date	None.									
Authorization Period	One Year									
Account	None.									
General Notes	<p>A website has been developed for the SPRUCE Project providing tabs along the top of the page for items such as Project Description, Resources, Participants, Collaborations, etc. This site can be viewed at: http://mnspruce.ornl.gov. NOTE: A control copy of this RSS along with the ORNL annotated versions of the USFS JHA's can be found under the Collaborations tab for viewing by non-RSS collaborators.</p> <hr/> <p>Nearly all field work for this RSS will be performed at the Marcell Experiment Station in Minnesota managed by the United States Forest Service (USFS). RSS participants will read and understand Job Hazards Analyses (JHAs) required by the USFS to work at the site as part of the work control package:</p> <p>Field Work- Part 1 (USFS JHA annotated by ORNL)</p> <p>Field Work- Part 2 (USFS JHA annotated by ORNL)</p>									

Personal Safety (USFS JHA annotated by ORNL)

Weather (USFS JHA annotated by ORNL)

Dehydration (USFS JHA annotated by ORNL)

Soil Sampling (USFS JHA annotated by ORNL)

Insects (USFS JHA annotated by ORNL)

Ticks (USFS JHA annotated by ORNL)

Plants & Animals (USFS JHA annotated by ORNL)

Ladder Use (USFS JHA annotated by ORNL)

Be advised that nearly all Forest Service JHAs embedded in this RSS have been annotated by ORNL Subject Matter Experts (SMEs). The annotations have been made in order to document (1) certain Forest Service requirements that have been waived or (2) where some requirements for the ORNL participants have been clarified or established within this RSS instead.

Due to the remote nature of the work, First-Aid, CPR/AED, and Bloodborne Pathogen Training is suggested for all project participants. ESD Line Management encourages ORNL/UT-B Staff members to keep this training active and in their list of training certifications.

A daily pre-job safety briefing is highly recommended to discuss the goals, tasks, and associated hazards for the day's activities.

A pre-job briefing work aid has been developed for BSD/ESD field activities. While the use of the work aid is not mandatory, it is highly encouraged. Project task leaders may use the following job aid in performing the pre-job brief: https://portal05.ornl.gov/sites/eesd/ops_west/RSSDocuments/LinkedPDFs/BESD_START_Job_Safety_Briefing_Card_Rev_0.pdf It is intended to help field teams recognize and identify known or potential hazards posed by their field activities and the mitigating actions required to address the hazards. Situational awareness is emphasized and encouraged. Contact your Division Safety Officer or Safety Services Representative for assistance in using this work aid, as needed.

Work at the University of Minnesota: There will be periodic gas exchange work in reach-in growth chambers in Green Hall and in the Plant Growth Facilities Buildings at the University of Minnesota - St. Paul campus. There are minimal hazards associated with this work - hazards include potential excess noise from the growth chambers and use of electric extension cords to power the equipment. Participants working in these non-ORNL labs will follow requirements by the onsite laboratory manager, who has provided GFCI outlets for extension cords and ear plugs if desired. Liquid N may also be used and appropriate PPE is available and required. Participants will be proactive to identify other potential hazards and seek guidance from facility staff when needed, and will apply ORNL safety culture rigor if a situation arises that requires it.

General Attachments	RSS 7728 QEA FINAL (August 2018).pdf
Point of Contact	Cline, Steven R (35073)
Division Work Authority	Wullschleger, Stan D (34406)
Principal Investigator	Hanson, Paul J (29602);
PI Delegates	None.
Group Leaders	Hanson, Paul J (29602);
Participants	Bowling, Michael (924229); Brice, Deanne Jane (745282); Childs, Joanne (742253); Griffiths, Natalie A (976981); Guha, Anirban (3042977); Hanson, Paul J (29602); Hook, Leslie A (31797); Iversen, Colleen (905477); Krassovski, Misha B (924329); Latimer, John M (3028384); Lebreux, Steven J (3060410); Lowe, Kenneth Alan (34120); Malhotra, Avni (3044699); McLennan, David A (3045874); Nettles IV, William R (3013707); Norby, Richard J (27150); Oleheiser, Keith C (3021249); Pelletier, Dale A (901831); Phillips, Jana Randolph (746669); Riggs, Jeffery S (23528); Schadt, Christopher Warren (902616); Warren, Jeffrey (944146); Weston, David (924106); Wullschleger, Stan D (34406);
Required Reviewers	Childs, Joanne (742253) - <i>Lab Space Manager Reviewer (Not present at Team Meeting)</i> ; Childs, Steve Evans (34637) - <i>WSR review</i> ; Cline, Steven R (35073) - <i>Lead POC this Version</i> ; Hite, Anthony W (3066219) - <i>SSD Representative/QHSP</i> ; Loyd, Eric D (3056571) - <i>Alternate Pressure System SME</i> ; Mehlhorn, Tonia L (33447) - <i>EPO</i> ;
Optional Reviewers	Hanson, Paul J (29602) - <i>Optional GL Reviewer</i> ; Lower, Mark D (32815) - <i>Pressure Systems SME</i> ; Nettles IV, William R (3013707) - <i>Participant/Site Manager Reviewer (moved to optional since he provided offline comments)</i> ; Phillips, Jana Randolph (746669) - <i>Lab Space Manager & Participant Reviewer (attended Team Meeting)</i> ; Sabo, Karen A (966556) - <i>Optional Quality reviewer</i> ; Spears, Lucia L (34763) - <i>Transportation Safety Compliance and UAVs</i> ;
Lab Space Managers	Childs, Joanne (742253); Phillips, Jana Randolph (746669)
Locations	 Building 102GRAND, Room 01 - <i>SPRUCE Project Office (with a small, low hazard lab area)</i> ; Building 1506, Room 129B - <i>Lab work on samples</i>

from Minnesota; [Building 1521, Room 101](#) - Lab work on samples from Minnesota; [Building 1521, Room 102](#) - Lab work on samples from Minnesota; [Building 1521, Room 103](#) - Lab work on samples from Minnesota; [Field Work](#) - Work in Black Spruce - Sphagnum Bog; [Off-Site Work - S-1BOGT](#)

Nepa Documentation

NEPA Document Number 3627X. Following the preparation and review of an Environmental Assessment on the SPRUCE project, a Finding of No Significant Impact was found and approval to construct the system/experiment was granted.

[**Updated this Section Aug 2018**] All the planned lab work here at ORNL falls under the overall umbrella of Categorical Exclusions (CXs) for research and development activities per Division EPO/ECR. This Categorical Exclusion (CX) is currently available online at the NEPA Homepage: [Indoor Small- and Pilot-Scale Research and Development 3767X](#).

The site sampling & data collection activities in the field work currently covered by this RSS falls under the overall umbrella of Categorical Exclusions (CXs) for research and development activities per Division EPO/ECR. This Categorical Exclusion (CX) is currently available online at the NEPA Homepage: [Outdoor, Small- and Pilot-Scale Research and Development 3768X](#)

Consult EPO/ECR or POC if you feel any planned activities might fall outside of the scope of this CX.

Hazards

First This operation requires special controls to protect information (Classified Subject Areas, Export Control, Intellectual Property, or CRADAs).

Requirements:

[Agreement to Commercialize Technology \(ACT\) Projects](#)
[Cooperative Research and Development Agreements \(CRADAs\)](#)
[Export Control Compliance](#)
[Information Protection](#)
[Proprietary Information](#)

Hazard Notes:

[**July 2018-This Content relocated here from Previous Hazard Question by RSS System**]

Activities performed under this RSS may involve intellectual property. A very large amount of data is generated by this project.

Control Notes:

[**July 2018-This Content relocated here from Previous Hazard Question by RSS System**]

Participants must be aware of what constitutes intellectual property (IP) and how to handle it according to ORNL SBMS IP requirements, <https://sbms.ornl.gov/sbms/sbmsearch/SubjArea/Info/InfoSA.cfm>.

IP questions/concerns should be directed to the PI of this RSS.

Data management plans may be found on the project's website: <http://mnspruce.ornl.gov/>.

Locations:

All Locations

Attachments:

None.

5.1 This operation involves work on or near equipment with unguarded, [energized](#) electrical components.

Requirements:

[Electrical Safety](#)
[Lock/Tag/Verify](#)

Hazard Notes:

This question has been **marked to raise awareness** that participants of this RSS **are not permitted** to conduct work on unguarded electrical systems that are energized (or that have the potential to become energized) at >50 volts.

Control Notes:

At the SPRUCE site only authorized participants of RSS 11438 or properly trained F&O technicians (under their own F&O work controls) will conduct work on energized systems >50 volts, in order to perform zero energy checks as part of Lockout/Tagout (LOTO) processes.

NOTE: Any participants **directly WORKING ON** a de-energized system that requires the application of a personal lock must have completed the ORNL LOTO training and have been issued a personal locking device as per the SBMS LOTO subject area:
<https://sbms.ornl.gov/sbms/sbmsearch/subjarea/LOTO/sa.cfm>

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

None.

5.4 This operation involves exposure to one or more of the following electrical hazard sources:

- RF or sub RF;
- Significant electromagnetic (EM) fields;
- Direct current (DC) sources;
- Batteries, other than household batteries;
- Capacitors;
- Unguarded inductive systems that pose a hazard.

Requirements:

[Electrical Safety](#)

Hazard Notes:

Battery charging will be conducted within the field, at the SPRUCE office in Grand Rapids, and at the bog site workshop, because some instruments use deep cycle batteries and must be recharged.

Control Notes:

Several types of batteries and battery packs (i.e. sealed LI-COR batteries, mini-rhizotron batteries, etc.) will be charged in designated areas. Batteries will not be charged when frozen, as this increases the likelihood of fracturing the battery casing. Batteries that have visible signs of damage will not be connected to the charger and will be taken out of service for proper disposal. Manufacturer's instructions for charging/safety will be followed.

Note: PPE and other requirements for charging deep cycle batteries are posted at the charging station and can also be found within the following work-aid: https://portal05.ornl.gov/sites/eesd/ops_west/RSSDocuments/LinkedPDFs/Marine-Auto-ATV-BatteryCharging.pdf.

Minimum electrical safety training and qualification for persons working on or near unguarded electrical connections to batteries (>1000 watts short circuit available power) requires Electrical Worker (<50 Volts), Direct Current and Batteries. This includes connecting and disconnecting to/from a battery charger. Avoid short-circuiting the battery. Inspect the battery and associated cables/connections prior to servicing or handling the battery. Remove any conductive jewelry or other conductive articles that may come in contact with the battery posts, or exposed connections/conductors.

If question arise please contact the [Division Electrical Safety Officer \(DESO\)](#).

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

None.

5.5 This operation involves the operation of breakers, disconnects, starters or similar electrical equipment up to 600 volts with doors or covers on.

Requirements:

[Electrical Safety](#)

Hazard Notes:

Electrical breakers and/or disconnects may need to be actuated at the SPRUCE site by participants of this RSS. These breaker operations are only performed as needed for convenience and not to perform maintenance tasks via LOTO.

Control Notes:

Those participants operating breakers or disconnects must complete the ORNL LRN Breaker & Disconnect Training. Participants shall only operate breakers or disconnects with the doors/covers in place and shall not exceed the voltages outlined within their level of training. **Breaker & Disconnect Training alone does not allow participants to perform LOTO activities. LOTO activities may only be performed by the properly trained/qualified participants of RSS 11438 or properly trained F&O technicians (under their own F&O work controls).**

NOTE: Contact the SPRUCE site manager if you have been properly trained to operate breakers or disconnects at the site, but still have questions or concerns (such as identifying systems that may require a higher level of training to operate).

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

None.

- 5.6 This operation involves the potential for electrical shock or the release of other hazardous energy (consider mechanical as well as sources such as pneumatic, hydraulic, thermal, chemical, and pressurized fluids) other than as described elsewhere in this RSS.

Requirements:

[Electrical Safety](#)
[Occupational Hazard Controls](#)

Hazard Notes:

Static Discharges (Hazard Note): Walking on the decking (glass-reinforced Copolymer polypropylene, manufactured by TRUE DECK) of the boardwalk often results in static buildup. Participants are experiencing static discharge/shock when touching metallic objects.

Temporary Power Cords (Hazard Notes): Flexible power cords (i.e. equipment cords and extension cords) will be used at the site.

Control Notes:

Static Discharges (Control Notes): Participants are typically familiar with the feeling from static shocks after contact with door knobs, exiting cars, etc. The sensation from a static shock is a "burst" of energy that can be mildly painful, but the feeling dissipates almost instantly. In contrast, a shock from an alternating current (AC) source is identified as an unpleasant tingling or very fast pulsating sensation that persists as long as the person remains in contact with the energized part or until the AC source is turned off.

Participants are to use their own discretion to determine if a received shock is an **expected** static displacement, or **unexpected** contact with energized equipment. Should participants feel that they have contacted **unexpected** electrical energy, they shall stop work, inform others in the work area of the potential hazard, and immediately report the concern to the SPRUCE Principle Investigator, Ops support staff, or the ORNL LSS in order for verification and any follow-up actions or reporting to occur.

Temporary Power Cords (Control Notes): Flexible cords must be used in accordance with applicable requirements. Refer to: [SBMS Exhibit on Corded Equipment](#)

Flexible cords and cables shall be approved for conditions and locations of use (e.g. outdoors, in potentially wet or damp locations, etc.). Although some cords are listed for wet locations, their design does not permit a watertight plug connection. Extension cords

and/or power strips will not be daisy-chained; permanent wiring should be installed instead. Flexible cords may be used only in continuous lengths without splice.

Flexible cords must be of sufficient gauge in the American Wire Gauge (AWG) diameter, and be designed to support the amperage and voltage of the equipment being connected.

Ensure that flexible cords and cables are adequately protected if run through doorways, windows, or other pinch points. This can be achieved by using wood blocks to prevent windows or doors closing, schedule 80 UV-resistant PVC to run extension cords through, or protective ramps with cord compartments.

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

None.

7.1 This operation involves work conducted under the [OSHA Laboratory Standard](#).

Requirements:

[Chemical Safety](#)

Hazard Notes:

[Section updated/clarified Aug. 2018]

Work in ORNL Spaces: Some activities occur in laboratories to prepare and process samples before and after field-deployment. At the present time, all of the associated lab activities present no or very low hazards to the participants.

Work at the University of Minnesota: There will be periodic gas exchange work in reach-in growth chambers in Green Hall and in the Plant Growth Facilities Buildings at the University of Minnesota - St. Paul campus. There are minimal hazards associated with this work - hazards include potential excess noise from the growth chambers and use of electric extension cords to power the equipment.

Control Notes:

[Section updated/clarified Aug. 2018]

Work in ORNL Spaces: Work in the auxiliary spaces of at SPRUCE field site and at 102 Grand present no or very low hazards to the participants.

Lab activities for the Onsite ORNL labs that present more significant ESH hazards are covered by other authorized RSSs such as [RSS 4788](#) and [RSS 2524](#). All staff/guests performing activities covered by such "associated" RSSs must also be a listed participant of and adhere to the requirements of them.

All work in the on-site ORNL labs that controlled by the [ORNL Chemical Hygiene Plan \(CHP\)](#) require site specific training, and safety glasses with side shields as the minimum level of eye protection, unless official LSM signage (approved by POC/DSO) provides waivers to this requirement.

Work at the University of Minnesota: Participants working in these non-ORNL managed lab spaces will follow requirements by the onsite laboratory manager, who has provided GFCI outlets for extension cords and ear plugs if desired. Liquid N may also be used and appropriate PPE is available and required. Participants will be proactive to identify other potential hazards and seek guidance from facility staff when needed, and will apply ORNL safety culture rigor if a situation arises that requires it.

Locations:

Building 102GRAND, Room 01
Building 1506, Room 129B
Building 1521, Room 101
Building 1521, Room 102

Building 1521, Room 103
Off-Site Work

Attachments:

None.

7.2 This operation involves work conducted under the [OSHA Hazard Communication Program \(HAZCOM\)](#).

Requirements:

[Chemical Safety](#)

Hazard Notes:

Some chemicals (e.g. isopropyl alcohol, acetone, ethanol) shall be transported to and used within the field location, in non-laboratory settings.

Control Notes:

All participants working with chemicals in the field must be ORNL HAZCOM trained and be familiar with the materials (i.e., have access to and be aware of the product Safety Data Sheets (SDS's)).

To meet HAZCOM labeling requirements, secondary chemical containers (not used/stored in "labs") must be labeled with the identity of the hazardous chemical(s) and appropriate hazard warnings (via words or symbols) which provide at least general information regarding the physical and health hazards. This labeling requirement applies unless: the hazardous chemical(s) is only used by the person transferring the chemical from the primary container; the person that performed the transfer has constant control of the container; AND, the chemical is completely used within the work shift.

[Safety glasses with side shields and nitrile gloves will be used when handling and working with these chemicals.](#)

Locations:

Field Work
Off-Site Work

Attachments:

None.

7.7 This operation involves chemicals or wastes that are [flammable](#) or [combustible](#).

Requirements:

[Chemical Safety](#)
[Personal Protective Equipment](#)

Hazard Notes:

Gasoline will be transported to and used in the field for various uses (i.e. gas powered generator, ATV, etc.). Small amounts of isopropyl alcohol, acetone and ethanol will be transported to and used in the field for cleaning sampling tubing and instrumentation.

Propane air heating units are in use to warm the air inside the chambers. These propane heating units are supplied from a large propane tank located near the service road maintained behind a locked, fenced in area. From there, propane is delivered into the individual heating units of the chambers. The heating units themselves are located outside of the chamber and are ducted into the chamber to warm the ambient air.

Control Notes:

General Controls for Flammable & Combustible Liquid Storage:

Small amounts of flammable and combustible liquid storage (including waste) outside of approved storage devices is permitted in each offsite area that has been properly prepared for this type of work such as 102GRAND and the S-1 site trailer (i.e., up to 4 liters in general area/benchtops can be stored outside of a cabinet or refrigeration unit approved for such flammable/combustible liquid storage). More information and requirements for combustible and flammable storage and handling can be found in SBMS at: <https://sbms.ornl.gov/sbms/SBMSearch/SubjArea/chemsafe/ExhibitFlamCOMbust.cfm>

Control for flammable liquid handling: Safety glasses with side shields shall be worn when fueling equipment from portable containers. In addition, nitrile gloves will be worn when working with acetone, ethanol, etc. Refer to Question 15.1 regarding transportation issues for these items.

Controls Related to the Propane Distribution System:

No smoking will be permitted near the propane tank or experimental chambers/enclosures, and the area is posted to reflect this requirement.

See Section 11.1 for details on reporting and responding to potential propane leaks.

Note: Maintenance of the propane and/or heating system will be handled by appropriate ORNL personnel (i.e. the SPRUCE site manager), subcontractors, or the gas company/provider. Project staff will only be involved in setting and monitoring temperature control points.

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

None.

8.2 This operation generates hazardous waste.

Requirements:

[Environmental Management](#)
[Manage Waste and Excess Materials](#)

Hazard Notes:

Used magnesium perchlorate from the LiCor will be managed as a hazardous waste (oxidizer).

Control Notes:

Under the memorandum of understanding (MOU) with the USFS, all wastes generated at the field site or office location (102GRAND) will be managed by the USFS along with their hazardous waste products.

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

None.

8.11 This operation involves the use of quarantined soils, plants, or pests.

Requirements:

[Environmental Management](#)
[Move Soils, Plants or Plant Products, or Other Contaminated Equipment](#)

Hazard Notes:

This question has been marked to raise awareness that USDA or State quarantine restrictions change with time; for example, the neighboring county is currently quarantined for Emerald Ash Borer (August 2018).

Evaluation of local restrictions on the transportation of soils and plant materials to-and-from the research locations must be periodically evaluated.

Note: Precautions should be taken to avoid cross-contamination of "clean" soils with other quarantined soils.

Control Notes:

Marcell Experiment Station Soils: The research site north of Grand Rapids, MN currently has no known restrictions. We may bring back soils and leaf liter, and ultimately dispose of them, with no restrictions.

Locations:

Building 1506, Room 129B
Building 1521, Room 101
Building 1521, Room 102
Building 1521, Room 103
Field Work
Off-Site Work

Attachments:

None.

8.12 This operation generates excavated soils.

Requirements:

[Environmental Management](#)
[Excavation/Penetration](#)
[Manage Radiological Aspects of Excavated Soil](#)

Hazard Notes:

Manual soil coring/sampling will be performed on this project. Some of these cores into deep peat may be over 1 meter deep.

Equipment and/or utilities within the experimental areas where ORNL research sampling will take place have been installed either by the research staff, or by the direction of the research staff. Therefore, research staff have process knowledge of the underground equipment and utilities at the site.

Ground penetrations will also be made by research staff for the installation of various equipment/materials (i.e. probes, tubes, etc.).

Control Notes:

All of the soil coring/sampling to be performed will be performed off-site. As a result, ORNL's excavation/penetration requirements are not applicable.

It is the responsibility of the PI and RSS participants to ensure that any requirements of the USDA Forest Service facilities be met before any such sampling is performed in order to avoid buried utilities, etc. **If ground penetrations are to be made outside of the bog footprint where project knowledge cannot be applied, a Minnesota state required One-Call shall be made (1-800-252-1166) prior to conducting the work.**

Locations:

Field Work
Off-Site Work

Attachments:

None.

9.2 This operation involves exposure to moving or rotating parts, such as motors, shafts, pulleys, belts, or any other potential mechanical energy.

Requirements:

[Occupational Hazard Controls](#)

Hazard Notes:

ATUV Use (Hazard Notes): An all terrain utility vehicle (ATUV) will be used to access certain areas of the site and transport materials.

Tools (Hazard Notes): Some hand and portable power tools (e.g. drills, bow saws, etc.) may be used during work activities. There is often a need for Power tools to be used in non-standard applications for research purposes (e.g. taking large diameter peat cores with extended hole saws and cordless drills).

Control Notes:

ATUV Use (Control Notes): Workers riding in government vehicles (trucks and the ATUV) will use seat belts and obey all traffic rules.

A work-aid has been established to allow RSS participants to also use an ESD owned ATUV under this RSS. All required PPE, administrative controls and training documentation needed for this activity are embedded in the work-aid at: https://portal05.ornl.gov/sites/eesd/ops_west/RSSDocuments/LinkedPDFs/Polaris_Ranger_800_Work-Aid_and_Operator_Manual.pdf

NOTE: This ATUV has a removable snow blower attachment that will only be used by individuals trained and approved for its operation.

Tools (Control Notes): When using hand and portable power tools, users shall ensure that they have donned the proper PPE for the device being used and the task being performed (e.g. safety glasses with side shields where flying particles/debris are being generated or have to potential to be generated). Note: If there is a potential for injury to the face a face shield shall be used in combination with safety glasses.

Workers hands shall not contact any moving or rotating part of the equipment (such as when using a drill, saw, etc.). A safe working distance for the rest of the body shall be maintained from the moving or rotating parts of the equipment to prevent loose fitting clothing from contacting and being drawn into the moving parts. Operations staff should be consulted if uncertainty exists about proper use of any power tools or activities involving them.

Locations:

Field Work
Off-Site Work

Attachments:

None.

11.1 This operation involves the use of a High-Energy Pressure System(s).

Requirements:

[Compressed Gas Cylinders and Related Systems Design](#)
[Pressure System Safety](#)

Hazard Notes:

[New Section August 2018]

The propane CO2 distribution systems that are integral to the SPRUCE Project Infrastructure are considered as "High Energy Systems" per definitions in the Pressure System Safety Subject Area.

- The propane tank/system supplies propane to the air heating units to warm the air inside the chambers.
- The Large (60 ton) CO2 tanks are used to add pure CO2 into the experimental chambers

System leaks or malfunctions may occur with both distribution systems.

Finally, an additional potential hazard has been identified during CO2 induction operations, where under the certain environmental conditions (i.e. periods of little to no wind/air movement or exchange), there is a possibility for CO2 levels within the enclosures to elevate and potentially reach an unsafe level.

Control Notes:

[New Section August 2018]

Details of these Pressure Systems are being collected and maintained at the following locations:

Propane System: <https://portal05.ornl.gov/sites/eesd/ops/Lists/PressureSystems/DispForm.aspx?ID=199>

CO2 System: <https://portal05.ornl.gov/sites/eesd/ops/Lists/PressureSystems/DispForm.aspx?ID=198>.

The overall configuration and maintenance of these systems is the responsibility of the Site Manager Robert Nettles.

The only requirement/expectation of other project participants is to report potential leaks and/or system abnormalities as discussed below:

Propane Leak Detection and Emergency Response:

Most importantly if participants suspect a leak from the tanks or the piping system supplying the heating units (such as the smell of propane, a hissing sound, etc.) everyone is to immediately evacuate the area, notify the site manager, or the gas company/supplier (if the site manager is unavailable).

Please note that it is not uncommon to detect the odor of propane, or more accurately the odorant added to the propane (which is almost always ethyl mercaptan) when standing close to the make-up air units (MAU). If there is a unit that is not burning efficiently the smell of propane will be detected and the localized odor should be expected. Propane can also be detected in various areas around the site, depending on wind direction, after or during product delivery/tank refilling. In such instances this will not be a constant odor but rather intermittent as it dissipates into the ambient environment.

If someone detects a consistent odor significant enough to raise a concern that person must report that to the site manager or the gas company/supplier. An example would be a persistent propane smell that does not seem to be dissipating as normal. This could indicate a failure in the system or issues with the delivery process (i.e. ruptured valves, joints, pipes, blocked or inoperable vaporizers, failed gas valves in the MAUs, etc.).

If this type of situation arises it may be necessary for the site manager, or participants that have been given site specific training by the site manager to isolate or stop propane gas flow. This will involve closing the proper valve(s) to stop the gas flow to a particular enclosure, an entire dock section, or the entire site (depending upon the situation). If a valve is closed to stop gas flow an administrative hold tag shall be filled out and placed on that valve to inform others of the purpose of the shut down and to avoid inadvertent reactivation of the system. These tags will be kept in the emergency "go box" kept within the jobsite trailer. Again, the actuation of any valve must immediately be reported to the site manager or the gas company/supplier.

[Added August 2018] Click [HERE](#) to see photos of the propane shut off locations.

NOTE: During maintenance or repair of the system the trained site manager and gas company/supplier will use formal lockout/tagout (LOTO) procedures. The administrative control tag discussed above is only a temporary measure to be used by participants that actuate a valve during an actual emergency shut down.

CO2 Leak Detection and Emergency Response:

Those present at the site shall leave the area immediately should a known, unexpected release of CO2 from the large tank occur.

Similar to the propane discussion earlier, it may be necessary for the site manager, or participants that have been given site specific training by the site manager to isolate or stop CO2 flow. This will involve closing the proper valve(s) to a particular enclosure, an entire dock section, or the entire site (depending upon the situation). If a valve is closed to stop gas flow an administrative hold tag shall be filled out and placed on that valve to inform others of the purpose of the shut down and to avoid inadvertent reactivation of the system. These tags will be kept in the emergency "go box" kept within the jobsite trailer. Again, the actuation of any valve must immediately be reported to the site manager or the gas company/supplier.

Click [HERE](#) to see photos of the CO2 shut off locations.

NOTE: Be advised that should the SPRUCE site lose power, pressure could build up within the CO2 tanks resulting in the pressure relief valves operating. This may produce a loud sound and result in a rapid discharge of CO2. Participants should remain away from the tanks should the site lose power.

A monitoring system is in place that measures the amount of CO2 present within each enclosure (this monitoring system is part of the scientific measurements but in this instance will also serve as a safety monitoring system). The system can monitor CO2 levels no higher than 2,000ppm, therefore the set point for alarm activation will be 1,990ppm.

During a CO2 Alarm event the solenoid valve will close stopping flow of CO2 to the chamber. Alarm files have been written in the data and a flashing indicator beacon on the CO2 panel will activate. The Real Time Monitor and Control (RTMC) system will send out emails to make the operators aware of the problem or problems. System operators are select F&O I&C personnel and SPRUCE site manager(s). *NOTE: The data logger system does not look for CO2 alarms during the winter months when the CO2 treatments are turned off.*

There are 4 factors that will cause the CO2 shut off alarm to activate:

1. High concentration of CO2 inside the chamber >1990 PPM;
2. Low sample flow through the analyzer < 0.4 LPM;
3. No air flow in one or more of the MAU's;
4. Three (3) consecutive communication errors between the CO2 panel and the DAC panel.

Should the CO2 alarm system activate an audible alarm and flashing **RED** beacon (installed next to each individual enclosure at the site) will activate, and everyone within the enclosure shall immediately evacuate into open air and no one shall re-enter the enclosure until the alarm condition is cleared. The appropriate directions/information are posted at each beacon **INSIDE** and **OUTSIDE** of the enclosures.

In the case of a CO2 alarm the operator is required to manually reset the system by pressing the reset button. If there is a power outage the solenoid shuts automatically but no CO2 alarm is activated. The operator will be notified of the power outage via RTMC.

A preventative maintenance schedule has been developed to periodically (monthly) test/challenge the alarm system and associated controls. *NOTE: The PM schedule will only be called during the months when the CO2 treatment is being done.*

Locations:

Field Work
Off-Site Work

Attachments:

None.

11.2 This operation involves the use of a Moderate-Energy [Pressure System\(s\)](#).

Requirements:

[Compressed Gas Cylinders and Related Systems](#)
[Design](#)
[Pressure System Safety](#)

Hazard Notes:

[New Section August 2018]

Other potential gas cylinder pressure systems used to calibrate a variety of sensors and monitoring points within the SPRUCE infrastructure are considered as "moderate energy" pressure systems.

Control Notes:

[New Section August 2018]

A Pressure System Hazard Analysis has been conducted for these calibration set ups. The analysis is documented in the EESD Pressure System database and the details can be accessed at:

102 Grand Location: <https://portal05.ornl.gov/sites/eesd/ops/Lists/PressureSystems/DispForm.aspx?ID=201>

S1BOGT Trailer Location: <https://portal05.ornl.gov/sites/eesd/ops/Lists/PressureSystems/DispForm.aspx?ID=202>

If modifications to any pressure systems are needed, please contact a member of the EESD Operations Support team to ensure that the current hazard analysis is valid.

Locations:

Building 102GRAND, Room 01
Off-Site Work

Attachments:

None.

11.3 This operation involves other processes that might create a pressure hazard not categorized or considered as part of a High or Moderate-Energy system(s).

Requirements:

Compressed Gas Cylinders and Related Systems
Design
Pressure System Safety

Hazard Notes:

[Relocated from previously authorized version and Updated Aug. 2018]

Portable Pressure Chambers will be used to conduct plant moisture stress (PMS) measurements. PMS Instrument, Inc. Model 600D (40 bar), Model 610 (40 bar), Model 615 (40 bar), Model 615D (40 bar), and a Cavitation Chamber Instrument (the 100 bar configuration) will be used. These instruments are categorized as 'exempt' pressure systems but still has hazards/requirements for their proper use/handling. They are pressurized/operated by filling a portable tank with a nurse tank (standard size cylinder).

Control Notes:

[Relocated from previously authorized version and Updated July 2018]

NO PMS tanks or test chambers will ever be pressurized during transport to the field without ORNL Transportation & Packaging Management Organization (TMO) review & approval.

All participants using this instruments must be familiar with their use and follow manufacturer guidelines and operating instructions which can all be found at <http://pmsinstrument.com/>

All in-service regulators shall be receipt inspected and only field portable tanks having a hydrostatic acceptance test within the last 5 years will be used.

All cylinders not internal to the instruments, will be stored and used valve end up, with cylinders secured to prevent instability.

Portable tanks (secondary chemical containers) filled for use in the field must be properly labeled with identity of the hazardous chemical(s) and appropriate hazard warnings to meet Hazcom requirements UNLESS the following conditions exist:

- The contents will be used by only one person who has constant control over the container, and
- The person transfers the hazardous chemical from a labeled container; and, the transferred gas will be immediately used (i.e. during the work shift) by the person performing the transfer.

The documentation for exempting the PMS units from Pressure System Safety Subject area requirements can be found at: <https://portal05.ornl.gov/sites/eesd/ops/Lists/PressureSystems/DispForm.aspx?ID=108>. Please contact a member of the Ops Support team if modifications are needed to these systems.

Locations:

Field Work
Off-Site Work

Attachments:

None.

11.5 This operation involves hazards associated with the physical handling or storage of compressed gas cylinders.

Requirements:

Compressed Gas Cylinders and Related Systems

Hazard Notes:

Cylinders of compressed nitrogen, CO₂/air mixtures, and non-flammable CH₄ mixtures will be used both within the field and at the 102GRAND lease space.

Control Notes:

Labels on compressed gas cylinders will be checked to verify the stated contents prior to use. Cylinders will be secured and stored in an appropriate area until needed. Users will determine to the best of their ability that cylinders are not defective or leaking.

Regulators will be placed by trained personnel and will be inspected if their integrity is questioned.

Calibration gases will be maintained as a mixture containing concentrations within an ambient range (~1,000ppm CO₂; <100ppm CH₄).

NOTE: All requirements and guidance on compressed gas cylinder use can be found at:
https://sbms.ornl.gov/sbms/SBMSearch/subjarea/cgc/cgc_sa.cfm.

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

[RSS 7728 Nitrogen release worst case scenario 102Grand.pdf](#)

12.0 This operation involves sources of [thermal hazards](#), such as heaters, ovens, [cryogenics](#), or uninsulated steam lines.

Requirements:

[Conduct Exposure Assessments](#)
[Fire Protection, Prevention & Control](#)
[Occupational Hazard Controls](#)
[Personal Protective Equipment](#)
[Work with Cryogenics](#)

Hazard Notes:

Commercial drying ovens are used in the labs following field sampling campaigns, etc. Typical drying temperatures range from 60 to 105 °C.

[Updated Aug. 2018] Participants may use dry-ice to preserve samples and have need to access low temperature freezers, etc.

Control Notes:

Oven Controls:

- [Updated Aug. 2018] Protective thermal gloves or tongs shall be used to remove, handle, or manipulate the vessel where the contact temperature is greater than 60 degrees C.
- Follow any and all posted signage associated with ovens used.

-80C Freezer Contact Control:

[Updated Aug. 2018] Direct skin contact with objects stored in the ultra-cold (-80c) freezers or the inside structure of the freezers should be avoided. Cryo/ thermal gloves are available for use when extended handling time is required while inside the freezers or while removing items from the freezers. Gloves (cotton, leather or other material) that eliminate the direct contact and minimize temperature transfer between the objects being handled and the skin may be used when more dexterity is needed and handling time is minimal

Dry Ice Usage Controls:

1. Never store dry ice in an airtight container/use loose fitting lids to prevent pressure build-up
2. Do not touch dry ice with your skin! Use tongs, insulated (thick) gloves, and safety glasses with side shields when handling dry ice.
3. Use in a well ventilated area and keep the material away from your face/breathing zone.
4. See Transportation Section of RSS for both guidance and requirements for transporting and shipping dry ice.

Locations:

Building 102GRAND, Room 01
Building 1506, Room 129B
Building 1521, Room 101
Building 1521, Room 103

Field Work
Off-Site Work

Attachments:

None.

13.1 This operation involves sources of **excessive noise**. (E.g., such that you would have to shout at a distance of 3 feet to communicate to a co-worker, or louder than busy traffic.)

Requirements:

[Conduct Exposure Assessments](#)
[Hearing Conservation](#)

Hazard Notes:

Hearing protection may be required during the use of some types of equipment associated with this project (e.g. some hand/portable power tools; within close proximity of gas powered generators; while using some air driven/pneumatic/electric equipment such as the Bosch Hammer, etc.).

Control Notes:

Hearing protection is required for exposures in excess of 85 dbA. Hearing protection devices (HPDs) (i.e., earplugs or earmuffs) with a proper noise reduction rating (NRR) are required for the operator of the equipment that exceeds 85 dBA (e.g. chainsaws, weed eaters, snow blowers, etc.) during use.

Equipment with the potential to exceed 85 dBA should be evaluated by Safety Service Division using calibrated sound level meters. However, this may not be possible for all equipment due to their distance from ORNL, so it is recommended that participants err on the side of caution and use hearing protection when exposed to loud noises. While they cannot replace a calibrated sound level meter, smartphone-based sound level meter applications (apps), such as the NIOSH sound level meter for the iOS platform, can serve as a screening tool to determine if hearing protection should be worn. It is recommended that hearing protection be worn when the sound level meets or exceeds 82 decibels on the smartphone-based sound level meter app.

Participants of this RSS that use HPDs (either on a mandatory or voluntary basis) must understand their proper use and fit. Guidance is available at:

https://portal05.ornl.gov/sites/eesd/ops_west/RSSDocuments/LinkedPDFs/BSD_ESD_HPD_GUIDE.pdf

Personnel identified as having known or potential noise exposures exceeding the Occupational Exposure Limit of 85 dBA, 8-hour time-weighted average must be enrolled in the Hearing Conservation Program (HCP) and receive HCP training (initial and refresher as required). It is the supervisor's responsibility to enroll the worker in the HCP using the ORNL Medical Services Division Mandatory Enrollment Form (<https://portal06.ornl.gov/sites/hsd/Documents/pdfs/mandprog.pdf>). Consult your DSO for assistance.

Locations:

Field Work
Off-Site Work

Attachments:

None.

13.3 This operation involves **ergonomic hazards** (e.g., lifting, pulling/pushing, vibration, posture, repetitive motion, etc.).

Requirements:

[Apply Ergonomics Controls](#)
[Conduct Exposure Assessments](#)

Hazard Notes:

Potential Ergonomic Hazards Include:

- Carrying field equipment and sampling gear (tools, batteries, etc.) can present ergonomic hazards if loads are not carried properly, etc.
- Lifting the air driven and/or electric hammering devices (i.e. Bosch Hammer).
- Ergonomic hazards also exist due to tower climbing activities.

- Traveling on bog boardwalks when wet represents a plausible slipping and/or twisting hazard.

A particular ergonomic hazard unique to this site is lowering and raising of the extension platforms to access the center of the experimental plots. These platforms are fairly large and awkward to handle which presents a lifting, bending, and twisting concern (see attached photo).

Control Notes:

As outlined in several of the JHAs in the attached USFS package, participants should avoid awkward positions and should follow proper lifting and carrying techniques. Under extended field sampling situations, personnel should rotate job tasks to limit continuous actions, or take breaks as needed.

[Updated Section Aug. 2018] Tips for Lifting Heavy Items:

For material handling, use of mechanical devices such as hand trucks, dollies or carts is preferred and should be used whenever possible.

Manual material handling and lifting is strenuous; use of proper bending and lifting techniques are essential for injury prevention. When lifting, bend at the knees instead of at the waist and use the large, strong muscles of the legs instead of the small muscles of the back to lift items.

Participants should use proper lifting techniques when lifting any load, especially those approaching 30 lbs. and should seek assistance, even for lesser weights, depending on their personal capabilities and shape and size of the item to be lifted.

Refer to the "Manual Lifting Guideline: 30/50/30" which identifies key points for safe lifting:
<https://sbms.ornl.gov/sbms/sbmsearch/subjarea/MatHand/GuidelineManualLift.cfm>

In addition, a video review of safe lifting practices is available at:
<http://safetyfirst.ornl.gov/mmh.cfm>

Bog boardwalks are elevated above the surrounding saturated conditions to keep them dry. The installed boardwalks are textured to further limit the potential for slips, trips, twists, and falls when the boardwalks may be wet from precipitation. When the boardwalks are covered with snow in winter, special care including shoveling off the boardwalks should be taken to ensure their safe use.

A device known as a "kneeler" (see attached photos) allows participants to access equipment within the center of the enclosure without having to use the large platforms at all (elimination of the hazard).

When the platforms will have to be used, a new and updated design of the stands that hold the platforms in place have been developed that prevents the platform from sliding out of the stand during ascent and descent, even when standing at an angle.

These controls **have reduced** the ergonomic hazards associated with use of the platforms, **but if any person feels uncomfortable deploying the platforms by themselves, assistance by others should be requested.**

Locations:

Field Work
Off-Site Work

Attachments:

[Kneeler Photo 1.jpg](#)
[Kneeler Photo 2.jpg](#)
[SPRUCE Enclosure Platform Photo.jpg](#)

13.5 This operation involves work in **extreme climates** or temperatures.

Requirements:

[Conduct Exposure Assessments](#)
[Evaluate Temperature Extremes](#)

Hazard Notes:

Field work in hot and especially cold conditions. Work outdoors with potential for inclement and/or severe weather conditions.

Additionally, the potential for build up of snow/ice dams above the SPRUCE enclosures has been observed and is certainly an

overhead hazard to consider in the winter months.

Control Notes:

As outlined in several of the JHAs (e.g., "dehydration", "fieldwork", "snowshoe travel", "weather") located at the beginning of this RSS, participants must follow many controls to maximize their safety during severe weather events in northern Minnesota (heavy snow, thunderstorms, etc depending upon the time of year)

Participants working in the field need to be aware of heat and cold stress symptoms. For more information regarding extreme climates or temperatures see links below:

<http://www.osha.gov/Publications/osha3154.pdf>

<https://www.osha.gov/SLTC/emergencypreparedness/guides/cold.html>

Participants that perform work involving potential exposure to elevated temperatures must have the [Heat Stress Training](#) certification.

During inclement weather, if you can hear thunder or see lightning you are within the strike distance of the lightning. Stop your activities, evacuate the site and seek safe shelter immediately. Safe shelter may be obtained in a permanent structure or in a vehicle with windows closed. If there is not time to get to such protected areas, find a low-lying, open place that is a safe distance from trees, poles, or metal objects, or standing water that can conduct electricity. Get into and stay in a tucked position.

Additional ORNL Controls to supplement USFS JHAs:

- Wait thirty minutes after the last lightning strike before resuming field activities.
- Travel to and from hotel/lodging areas to the Marcell Experiment Station via rental vehicles or government vehicles may involve may require winter driver skills and practices that rarely needed in east Tennessee. Participants should keep heavy blankets and emergency supplies in vehicles during the winter periods.

Enclosure Snow/Ice Discussion: Since an engineered solution to the issue is not readily available, participants working at the site in the winter months need to remain vigilant to the presence of snow/ice overhead before entering/exiting enclosure doorways and are encouraged to remove it with proper tools or report it to Site Manager personnel.

Locations:

Field Work
Off-Site Work

Attachments:

None.

13.7 This operation involves [elevated work areas or platforms](#).

Requirements:

[Fall Protection](#)
[Ladders](#)
[Occupational Hazard Controls](#)
[Scaffolding and Aerial Lifts](#)

Hazard Notes:

To access instrumentation and trees it may be necessary to occasionally use a step ladder and/or extension ladder. The spongy surface of the bog may make the safe use of a ladder difficult.

Ladders may also be used (by ORNL staff and collaborators) within the plot enclosures to access instruments or equipment.

Articulated ladders will be used at the site to access trees, obtain samples, conduct measurements, etc. These ladders can be configured for use like a standard step or extension ladder, or can be positioned to span across the boardwalks and/or the drop down planks.

Each experimental plot/ring at the SPRUCE site has a tower in the center which is outfitted with environmental monitoring equipment (refer to attached picture). It will be necessary for certain participants to periodically climb the towers to install, repair, and/or replace these instruments.

Control Notes:

Ladder use in bogs must be supported by a solid surface and include a spotting individual to ensure that the ladder does not shift from its position on the solid board or walkway. Ladder users shall be familiar with the SBMS [Using Ladders Safety](#) procedure and the US Forest Service Ladder Use JHA provided previously.

Ladder users must also successfully complete the ORNL LRN Ladder Training before use.

All ORNL staff and project collaborators (non-ORNL staff) accessing instruments or equipment secured to the 18 foot structural member of the plot enclosures must follow the instructions listed within this work-aid: https://mnspruce.ornl.gov/sites/default/files/Extension_Ladder_Use_Within_SPRUCE_Enclosure_Work-Aid_20180809.pdf [**Updated August 2018**]

Use of the articulated ladders must be done in accordance with the associated work-aid found here: https://portal05.ornl.gov/sites/eesd/ops_west/RSSDocuments/LinkedPDFs/Articulated_Ladder_WorkAid_for_SPRUCE_Enclosures.pdf

Users of these ladders must have the ORNL LRN ladder training (just as with any other ladder) and must also receive hands-on/site specific training (as specified within the work-aid) by the PI and/or the PI delegate(s). A list of authorized users will be maintained at the SPRUCE site office.

Only trained and authorized participants shall climb the towers. Tower climbers will utilize the proper fall protection PPE specified and approved by the ORNL Fall Protection SME.

All tower climbing activities conducted at the SPRUCE site in Bovey, MN shall be done in accordance with the most current revision of the Fall Protection Plan. The plan can be found within the IDMS system at: https://recordsmgmt.ornl.gov/DMS_ORNL/View_Active.cfm?compnum=17371&Ask

ORNL Engineering has determined that the towers are climbable and has defined the maximum allowable weight of the climber (includes the weight of the employee, weight of tools, equipment employee will carry, clothing used by employee, PPE, etc.) to be **268 lbs**. The formal engineering calculations can be found at the following DAC number: DAC-STR-017143-A002.

Locations:

Field Work
Off-Site Work

Attachments:

[SPRUCE Tower Picture.jpg](#)

14.2 This operation involves work performed outside normal working hours (6am to 7pm).

Hazard Notes:

After hours work will be performed at both the SPRUCE field site and the 102GRAND office area.

Control Notes:

Refer to Question 16.0 for controls.

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

None.

15.1 This operation involves packaging or transporting chemicals, [hazardous materials](#), or [radiological materials](#) off site.

Requirements:

[Commercial Motor Vehicle](#)
[Off-Site Transportation](#)
[Package/Transport Nonhazardous, Hazardous, and Radioactive Materials Off-Site](#)

Hazard Notes:

Participants will have need to transport gasoline, compressed gas cylinders, [ethanol & other DOT hazardous items](#) to the off-site field locations.

At times, dry ice or samples packaged in dry ice may need to be transported or shipped while in Minnesota. Special controls apply when dry ice is transported or shipped **other than by vehicle**.

Control Notes:

Only project participants who have completed DOT Materials of Trade (MOT) training are permitted to transport hazardous chemicals by vehicle. The controlling subject area requires that such transport shall only occur in **government** vehicles and if material(s) being transported meet the MOT exception (applicable Packing group, volume limits, packed securely, properly labeled, etc), [but an approved ESD variance exists to allow rental vehicles to be used as needed](#). Gross Weight of all hazardous materials must be less than 440 lbs.

If you have not previously ascertained whether a particular chemical/volume fall within MOT limits, you must first verify with [Transportation Management \(TM\)](#).

Specifics Regarding Gasoline Transport:

The volume limits per container for Gasoline (DOT Class 3 flammable liquid, Packing Group II) is further reduced by other OSHA requirements such that the it must be transported in safety cans with capacities of 5 gallons or less.

[Added paragraph Aug. 2018] Specifics Regarding Gas Cylinder Transport:

In addition to the MOT weight limits and training, all cylinders must be transported upright, properly secured with valve protection cap in place (i.e., not with regulators attached).

Specifics Regarding Dry Ice Transport: If participants must prepare and ship samples and/or materials on dry ice for air transport from offsite locations, additional DOT function-specific training certifications are required in order to properly declare and [label](#) the package(s). Authorized individuals must possess the "IATA Dry Ice by Air Shipper " role in LRN.

NOTE: Transport of dry ice by vehicle is **not** DOT regulated. As a result, rental or government vehicles can be used, but be cautious if transporting dry ice inside vehicles compartments. One should have adequate ventilation of the vehicle compartment and should not recirculate the air in the vehicle.

Regardless of transportation mode, dry ice should be in closed coolers or other containers, but not sealed air-tight.

Locations:

Field Work
Off-Site Work

Attachments:

None.

16.0 This operation involves offsite work other than travel, office environments, and conferences.

Requirements:

[Export Control Compliance](#)
[Foreign Travel](#)

Hazard Notes:

Most field work will be performed in northern Minnesota on the Marcell Experimental Forest operated and maintained by the USDA Forest Service.

Hazards- unexpected emergency requiring outside assistance in a field situation and ensuring all parties understand the responsibility of the others.

Control Notes:

When working off-site, staff ensure they consider any special precautions that may be needed in unusual environments. Local work

control processes and health and safety requirements are followed when working at other facilities. (e.g. the SME-annotated JHAS attached in the general comments section)

At the off-site location, work conditions may be different from what was expected. If necessary, the resources of the Laboratory will still be available to you, e.g., your supervisor, subject matter experts (SME), ES&H support staff, and the Lab Shift Superintendent (LSS).

Participants should familiarize themselves with ORNL guidance related to offsite work available at: <https://sbms.ornl.gov/sbms/sbmsearch/subjarea/wppc/GuideOffsite.cfm>

Emergency Communication Requirements:

A) When in the field, a person will have access to (and know how to operate) some means (ie., operable phone, satellite phone, radio and contact #) for getting timely emergency help.

B) When an individual is doing field work alone, he or she will have created the situation that someone will

- a) know where the field worker is;
- b) know when the fieldworker should return from the field; and
- c) take appropriate search actions if the fieldworker does not return in a timely fashion.

First Aid and Injury Reporting:

A first aid kit and AED (automated external defibrillator) will be maintained at both the S-1 Bog Field Trailer and SPRUCE Office in Grand Rapids (102Grand). **Note however, that use of an AED by participants is completely voluntary.**

When working off-site, personnel must have the emergency services phone numbers for the location and the numbers for the site point of contact immediately available. When in remote locations, personnel should be aware of the route from the worksite to the nearest medical facility and/or method to summon emergency services to the site. While off-site, employees with an injury or illness report to the nearest medical facility for treatment.

- See attachment for directions to nearest medical facilities to the Marcell Experimental Forest.
- Participants should also become familiar enough with these directions so that they can adequately describe where they are located in the event that an accident/injury is severe enough to require the assistance of emergency service providers to respond.

An individual involved in a work-related injury or illness will immediately seek the appropriate level of medical care as required by the event. Within 2 hours of the event occurrence inform the supervisor for proper follow-up and reporting.

Employees with an injury or illness while on-site at ORNL report to the Health Services Division between the hours of 7:30 AM and 4:30 PM. After hours medical assistance is available by calling 911 on a land-line or the Laboratory Shift Superintendent (LSS) office at 865-574-6606.

Special Note: Due to the remote location, specialty clothing, PPE, drinking water, dry ice, shipping charges, etc. may also need to be procured via non-standard ORNL procurement Methods. Personal reimbursement may be possible if participants make purchases covered/discussed in the attached SBMS variance: <https://sbms.ornl.gov/sbms/variance/Related.cfm?VarianceID=1108>.

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

[Driving Directions--Bog_to Grand Rapids Hospital.pdf.pdf](#)

17.1 This work requires the project staff to prepare or modify engineering calculations, drawings or specifications that are to be traceable and on record. Engineering calculations, drawings or specifications must be traceable and on record if used for construction, fabrication, modification, installation, or acquisition of **engineered systems, structures, or components** and meet any of the following criteria:

- Have the potential to adversely affect the health and safety of staff, workers, the public, or the environment
- Failure could unacceptably impact program objectives
- Are currently recorded in the ORNL Engineering Files or Records
- Are or will be installed as an integral operating system in a new or existing UT-Battelle controlled facility

Requirements:

[Design](#)

Hazard Notes:

Engineered structures are present at the site (i.e. bog board walks, chamber structures, electrical and data infrastructure, gas lines, etc.).

Control Notes:

Research staff (i.e. RSS participants) **ARE NOT** responsible for the engineering designs and modifications of the structures associated with the SPRUCE project. All engineering designs, calculations, drawings, specifications, etc. have been and shall be conducted and maintained by the ORNL engineering department.

If there is an issue or concern identified by RSS participants at the site, relating to the engineered structures, research staff listed as participants will not attempt to correct these issues, but will refer back to Project Management to address the issue with ORNL engineering and/or the subcontractors maintaining the structures.

Locations:

Field Work
Off-Site Work

Attachments:

None.

18.6 This operation requires special controls to ensure integrity of information and processes such as project-specific calibrations, Quality Assurance Plans or Software Quality Assurance Plans.

Requirements:

[Calibration](#)
[Records Management](#)
[Software Quality Assurance](#)

Hazard Notes:

Li-Cor gas analyzer calibration procedures are used for this project.

Additional lab & field equipment calibration schedules have been defined to ensure data collection integrity. Calibration reports are maintained at the field site and ORNL campus.

Control Notes:

Li-Cor gas analyzer calibration procedure can be found at: https://recordsmgmt.ornl.gov/DMS_ORNL/View_Active.cfm?compnum=018618&Ask

Locations:

All Locations

Attachments:

None.

Last This operation involves hazards or risks not previously identified above. Questions to consider:

- What can go wrong (what keeps you up at night?)
- What measures or controls are in place to prevent that from happening?
- Consider how do (or which of) the most important controls depend on human actions or behavior. Where might an error or omission impair the effectiveness of an important control?
- Consider any change that has been made (process, equipment, etc) which could inadvertently increase risk in another area.
- Error precursors are conditions or attitudes that increase the chances of an error during the performance of a specific task by a particular individual. Are there precursors that, if reduced or eliminated, would make the controls more likely to be effective?

Hazard Notes:

Methane (Hazard Notes): Potential for methane emissions.

Head Injury (Hazard Notes): Possible head injury from instrumentation positioned near the ground.

Field Hazards (Hazard Notes): The fact that much of the work for this project is in the field presents many hazards that are not included in the standard RSS question set.

Examples: Possible contact with curious black bears, biting & stinging insects, ticks, slips/trips/falls, etc.

Dust Masks (Hazard Notes): Many of the field tasks embedded in the JHA package require or suggest use of dust masks, and some lab related activities (e.g soil grinding, etc) may present the need or desire for dust mask usage by participants.

Sharps (Hazard Notes): Syringes with needles will be used to extract water samples from the bog.

Cutting Tools (Hazard Notes): Cutting tools will be used within the field for general use purposes and in association with the PMS instrument.

Safety Vests (Hazard Notes): High visibility clothing may be required at certain times.

[ADDED Aug 2018] **Drone Use:** Drones (an unmanned aircraft System-UAS) may be operated by project staff for aerial photo activities, etc.

Control Notes:

Methane (Control Notes): High concentration methane emissions from stored, subsurface pockets of naturally generated methane represent a low probability, but possible combustion danger if released. The open nature of the field environment would adequately disperse such releases if they happen, but staff should avoid ignition sources that may potentially spark methane gas should adequate ambient levels occur.

Head Injury (Control Notes): While working in and around environmental instrumentation installed in the bog, staff should be aware of elevated hard and sharp surfaces or corners that might represent a possible source of head injuries. These circumstances are not common, but should be considered while working at the bog surface level in their vicinity.

Field Hazards (Control Notes): In general, Participants that work outside and off the roads will wear appropriate clothing and additional PPE as discussed and prescribed in the USFS JHAs (unless annotated otherwise in the JHAs and discussed in this RSS).

Safety glasses with side shields shall be mandatory where the potential for eye injury exists (i.e. Dry/dusty conditions, low lying vegetation and/or tree limbs, etc.) and shall be left to the discretion of the individual in all other circumstances. Use tinted lenses/sunglasses as need to reduce glare/eyestrain in bright conditions or when snow is on the ground.

High top rubber work boots shall be utilized by research staff members needing to enter directly into the bog itself; otherwise, sturdy, closed-toed shoes or work boots are sufficient. When work involves the potential for damage to the foot or toes (i.e. working with heavy equipment that could be dropped onto the foot) a safety-toed boot is required.

Long pants shall be mandatory. Long sleeve shirts are optional and will be left to the discretion of the individual where the potential for insect bites, contact with poisonous plants, and cuts/scrapes exists.

Workers should remain alert while walking in the field since slippery and uneven surfaces could cause slips, trips and falls. Always be aware of where your co-workers are and other activities going on around you. Plan route carefully to avoid most uneven ground. Ensure you can see where you are putting your feet before walking. Avoid working in poor light conditions. Do not jump over or off anything. If there is a drop or ditch that has to be negotiated, lower yourself slowly or use existing bridges, steps, or paths etc. When walking down hill, walk across the slope and not down the steepest path, keeping your weight on the back foot as much as possible - if you slip you should try to fall backwards, not forwards! Take special care on slippery rocks.

Bears: Avoid contact and wait for the bears to remove themselves from the research site.

Insects: As discussed and supplemented in the JHAs, biting and stinging insects (ticks, mosquitos, hornets, bees, etc.) may be encountered in the field. Participants can use insect repellents with DEET on their skin and clothes or Permethrin on their clothes only, following the product instructions. As field conditions warrant (seasonal), participants will inspect themselves for tick and mosquito bites after field activities and subsequent showering.

Snakes: Poisonous snakes are unlikely to be present at the site. If snakes are encountered, minimize contact with them. Do not attempt to handle the snake unless absolutely necessary to remove from the work area. Use remote handling devices when possible to remove the snake.

Dust Masks (Control Notes): Whether required or recommended for use, any dust mask used by RSS participants must be ORNL-

issued and only used by participants properly trained on the limitations of their use. See SBMS <https://sbms.ornl.gov/sbms/SBMSearch/SubjArea/RP/RPprocedure8.cfm>

Sharps (Control Notes): Needles shall not be directly recapped using two-handed operations. Instead use safer alternative methods (i.e. foam block technique, etc.) to avoid the potential for puncture/ needle sticks. Ensure all needles are recapped prior to walking around on the bog walkways. All sharps will be disposed of in appropriate sharps containers.

Cutting Tools (Control Notes): When using cutting tools with open blades participants must use these tools in a manner that keeps the cutting blade moving in a direction away from fingers, hands, and the body during cuts. A user should not walk with or transport a cutting tool, that is not being actively used, unless the blade is concealed (cut resistant container or blade cover, etc.). Use of ORNL approved "safer" cutting tools (as found within the hyperlink below) are strongly recommended.

Cut resistant gloves should be considered for all activities where cutting tools of any type are used.

For detailed information on cutting tool ratings see, <http://safetyfirst.ornl.gov/cpp/tools.cfm>

For detailed information on cut resistant gloves see, <http://safetyfirst.ornl.gov/cpp/gloves.cfm>

Razor blades, scalpels and other fixed blade or manually retractable blade knives will be disposed of in an approved sharps container. Extreme caution must be employed when changing blades on fixed or manually retractable blade knives.

Safety Vests (Control Notes): It is recommended that during large game hunting seasons, and certain construction activities participants wear a high visibility vest (i.e. blaze orange, high visibility green, etc.) to reduce the potential for being mistaken as an animal. Remember that the Marcell experiment site is public land.

[ADDED Aug 2018] Drone Use (Control Notes): Only select persons will be authorized to operate drones in accordance with a separate work control document. Project personnel, collaborators, or site visitors present should be alert of the overhead hazard should if there are informed of scheduled drone flights in case of an unplanned landing or equipment failure occurs.

Locations:

Building 102GRAND, Room 01
Field Work
Off-Site Work

Attachments:

None.