



SAFE WORK PROCEDURE

SWP 18-05 Silo Fire Management Procedure

1. PURPOSE

To give clear instructions to site employees and Management personnel on the immediate and long-term actions related to the management of a fire or smolder in a silo.

2. SCOPE

To focus attention on the safety of all workers, the vessel and its contents. All efforts will be to suppress the exothermic event while safely evacuating the vessel of material all while isolating the exothermic event to the one location on the site.

3. PERSONAL PROTECTIVE EQUIPMENT REQUIRED

List all PPE required to complete the job safely

- | | |
|--|--|
| <input checked="" type="checkbox"/> Hard Hat | <input checked="" type="checkbox"/> Eye Protection |
| <input checked="" type="checkbox"/> Hi-Vis Apparel | <input checked="" type="checkbox"/> Hearing Protection |
| <input checked="" type="checkbox"/> Gloves | <input checked="" type="checkbox"/> Steel Toed Boots |
| <input type="checkbox"/> Respirator as required | <input type="checkbox"/> SABA as required |

4. OH&S REGULATION AND REFERANCE MATERIAL

Part 3 Division 3 - 115 General duties of employers
Henry Persson – Silo Fires handbook

5. DEFINITIONS

Atmospheric exposure;

- STEL – short term exposure limit: is the acceptable average exposure over a short period of time, usually 15 minutes as long as the time-weighted average is not exceeded.
- TWA – time weighted average: is the average exposure over a specified period, usually a nominal eight hours.
- IDLH – immediately dangerous to life or health: as exposure to airborne contaminants that is "likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment."

CN – Canadian National Railway of Canada

PBEC – Pacific BioEnergy Corporation

PGFD – Prince George Fire Department

6. PROCEDURE

- 6.1. If an exothermic event is discovered in a silo storage vessel, follow site procedures to conduct a controlled shut-down
 - 6.1.1. Safely shut down the plant
 - 6.1.2. Stop the infeeds to the silo
 - 6.1.3. Stop loading of railcars
- 6.2. Initiate a site evacuation
 - 6.2.1. Cease all contractor work and ensure all workers are accounted for
 - 6.2.2. Keep any contractors on stand-by in case extra manpower is required
- 6.3. Contact the following;
 - 6.3.1. Plant manager or designate
 - 6.3.1.1. The Plant Manager or designate will communicate to other corporate individuals
 - VP of Operations – to inform senior PBEC Management
 - Safety and Environment Manager – to assist with on-site safety, communication with regulatory officials
 - Production Manager – to coordinate shift coverage/scheduling
 - Maintenance Supervisor – to coordinate shift coverage/scheduling, contractor management
 - Maintenance Purchaser/Planner – to procure required supplies, contractor management
 - Logistics Manager – to coordinate CN switches as required, contact corporate logistics/sales
 - Corporate Controller – to communicate to insurance carriers
 - Woodlands Manager – to manage incoming loads of logs to the site, possibly to suspend log yard activities
 - Sales and Logistics Manager – to manage fibre deliveries to the site
 - 6.3.2. Emergency responders – Prince George Fire Department – PGFD – 911
 - 6.3.2.1. DO NOT HESITATE TO CALL. The Control Room Operator can call the PGFD as required.
 - 6.4. The Safety and Environment Manager is responsible for contacting Regulatory officials;
 - 6.4.1. Worksafe BC
 - 6.4.1.1. Chelsea Wilson – 250-617-0193 (cell) or 250-561-3724 (office)
 - 6.4.2. BC Ministry of Environment – by e-mail, environmentalcompliance@gov.bc.ca
- 6.5. Contractors will be contacted by their site contact
 - 6.5.1. Inform the company of the situation
 - 6.5.2. Work may need to be suspended depending on the nature and location of the work
- 6.6. Fibre/log delivery contractors will be notified of the situation by the Sales and Logistics Manager and the Woodlands Manager
 - 6.6.1. Deliveries may need to be suspended
- 6.7. Set up the Incident Command team as per the emergency response plan – ERP;
 - 6.7.1. Senior management representative – making the critical decisions

- 6.7.2. Management representatives – in charge of on site decisions
- 6.7.3. Safety/Environmental representative – communication with regulatory bodies, assisting in risk assessments of activities, providing support for any safety /environment concerns
- 6.8. Silo Fire external resource – contact an external resource to assist in the decision making process
 - 6.8.1. John Swann – (778) 281-1953, johns@pgonline.com , john.swaan@futuremetrics.com
 - 6.8.2. Henry Persson – Swedish Civil Contingencies Agency (MSB) SE-651 81 Karlstad Phone +46 (0)771-240 240 www.msb.se/en

NOTE: Do not open the vessel; the goal is to eliminate the introduction of oxygen to the exothermic source

NOTE: THE FOLLOWING NEEDS TO BE DONE, THE ORDER MAY NOT BE AS LISTED

- 6.9. Have clear communication with emergency responders as to the plan of approach;
 - 6.9.1. Have a copy of Henry Persson’s – Silo Fires handbook to give to the emergency responders.
 - 6.9.1.1. Have them review the handbook so they are educated on the proper method of approaching the silo smolder/fire
- 6.10. Determine what tpe of fire is in the silo
 - 6.10.1. Smolder – smoke is emmitting from the top
 - 6.10.2. Open flames – flames are visible coming out of the silo
 - 6.10.3. Is fire/smolder in the center of the silo – temperature monitors indicate high temperatures within the center or other area of the silo
- 6.11. Conduct an assessment to determine the access zone for workers
 - 6.11.1. Access the atmosphere using gas monitors to ensure the area is safe for human occupancy
 - 6.11.1.1. Oxygen levels are between 19% to 23%
 - 6.11.1.2. LEL is below 10%
 - 6.11.1.3. Carbon monoxide (CO) levels are below the exposure limits;
 - TWA: 25 ppm
 - STEL: 100 ppm
 - IDLH: 1200 ppm
 - 6.11.1.4. Carbon Dioxide (CO₂) levels are below the exposure limits;
 - TWA: 5000 ppm
 - STEL: 15000 ppm
 - IDLH: 40000 ppm
- 6.12. Close up the silo
 - 6.12.1. Stop silo roof fans which close the dampers at the top of the silo
 - 6.12.2. Do not put any more product into the silos
 - 6.12.3. Stop all fans blowing air into the silo
- 6.13. Call Nitrogen supplier – Praxair Services Canada Inc.
 - 6.13.1. Cylinders, Containers & Tanks, Transportation - Phone: 1-800-363–0042 (24 hrs)
 - 6.13.2. National Sales Manager – Scott Sawyshyn - 403-829-2789

- 6.13.3. Arrange for a B-train of nitrogen to be delivered to the site. One B-train load will last approximately 2 days so plan for additional shipments accordingly.
- 6.14. Measure the headspace gas and record every 20 minutes
 - 6.14.1. Keep a documented record of the results
- 6.15. Attempt to inert the smolder inside the vessel with nitrogen
 - 6.15.1. Avoid the use of carbon dioxide for the following reasons;
 - 6.15.1.1. As CO₂ vapourizes, this can create a hazardous atmosphere for area workers
 - 6.15.1.2. The inability to transfer the CO₂ effectively – vapourizer freezes up
- 6.16. Set up a TMVU – trailer mounted vapour unit
 - 6.16.1. Hook up the nitrogen lines to the piping inside the silo, or;
 - 6.16.2. Make up nitrogen probes with 1/16” holes spaced 1” apart along the entire length of the piping
 - 6.16.3. Insert nitrogen probes into the vessel radially as close to the bottom as possible
- 6.17. Initiate fire suppression activities depending on the following;
 - 6.17.1. Fire activity – active fire with flames vs. smoke emitting from vents
 - 6.17.2. Vessel level
 - 6.17.3. Ability to access the vessel safely
 - 6.17.4. On agreement of the incident command team
 - 6.17.5. The nature of the exothermic event – if the event is becoming more volatile
- 6.18. Set up site access control
 - 6.18.1. Site loader operator can complete these duties
 - 6.18.2. ALL who enter the site must sign in and sign out – no exceptions
 - 6.18.3. Limit access to the site to only one area
 - 6.18.4. If site resources are limited or the event will last several days, call a contractor to assist
 - 6.18.4.1. Paladin Security Prince George – (250) 562-1215
 - 6.18.4.2. Curtis-Elite Security & Electrical – (250) 614-8000
 - 6.18.4.3. GardaWorld – 1 855-464-2732
- 6.19. Incident Commander is to set up shift coverage with PGFD
 - 6.19.1. Depending on atmospheric levels, all work may require use of SCBA/SABA units
 - 6.19.2. This work can only be done by emergency responders trained in use of this equipment
- 6.20. Plan to empty the silo
 - 6.20.1. Contact a trucking company to transport the burnt pellets – 2 to 3 dump trucks required
 - 6.20.1.1. Giscome Contracting – (250) 562-2498
 - 6.20.1.2. K & I Enterprises – (250) 613-6531
 - 6.20.1.3. Teare Creek – (250) 562-8655
 - 6.20.2. Clear any railcars from the area
 - 6.20.3. Set up the transfer belts so they by-pass the shaker and the pellets can be loaded directly into a dump truck
 - 6.20.4. Set up spark suppression while loading pellets into the truck
 - 6.20.4.1. A manned fire hose to spray the pellets and suppress any embers/fire
 - 6.20.5. Transfer the contaminated pellet material to an area that is sealed (paved) and far enough away from any raw material storage piles
 - 6.20.5.1. Ensure that another manned fire hose is present while spreading out material

- 6.20.6. Store the material in a segregated pile
- 6.20.7. Monitor the material for smolders for at least 24 hours
- 6.21. Apply a blanket of foam to the top of the material inside the silo if possible
 - 6.21.1. Use an AR-AFFF Foam thru a high expansion device to create a medium expansion foam with a polymer layer to retard drain down and create a barrier to hold the nitrogen within the pellet storage silo
- 6.22. Set up area atmosphere monitoring to ensure it meets the exposure limits;
 - 6.22.1. O₂ = 19% to 23%
 - 6.22.2. CO = TWA: 25 ppm, STEL: 100 ppm
 - 6.22.3. CO₂ = TWA: 5000 ppm, STEL: 15000 ppm
 - 6.22.3.1. If atmospheric readings indicate any exceedance, all workers in the affected area MUST don SCBA or SABA to conduct any task
- ATTENTION: CO LEL = 12.5% (125000 ppm). Immediately evacuate the area if high levels of CO are detected, greater than 100000 pm or 10%**
- 6.23. Measure the atmosphere in the head-space of the vessel containing the exothermic event.
The goal is to keep the LEL below 10%, this reading will be used to manage the flow of nitrogen into the bottom of the vessel
 - 6.23.1. Use the water line from the deluge system on the side of the silo
 - 6.23.1.1. Attach a low flow suction on the pipe coupling – shop-vac
 - 6.23.1.2. Feed the discharge from suction into a small container (205 litre barrel)
 - 6.23.1.3. Put atmospheric monitoring probe in the small container
 - 6.23.1.4. Allow sufficient time for air to be drawn into the small container to get a reading of atmosphere inside the vessel with an exothermic event
- 6.24. Use thermal temperature readers to measure the external surface of the vessel at all levels, on all sides
 - 6.24.1. Use water on the outside of the vessel to aid in controlling temperature
- 6.25. Incident Comander to assign responsibility to an individual employee on each shift to monitor the smoke exiting the vessel
 - 6.25.1. Notify the Incident Comander if the colour changes from white to dark or visa versa
 - 6.25.2. Notify the Incident Comander if the volume is increasing or decreasing
- 6.26. Work with fire services team in efforts to managing the exothermic event – do not rush into any decision
- 6.27. Hold a safety start-up meeting at the start of each crew shift
 - 6.27.1. Develop safety plans for each task
 - 6.27.2. Include all workers in the discussions so everyone was involved in the plans
 - 6.27.3. With any task at hand, work with a sense of urgency, but do not proceed without conducting a proper hazard assessment and agreement from the incident command team
- 6.28. Inform everyone on site to refrain from using personal devices to capture pictures or videos
 - 6.28.1. Maintain appropriate shift schedules for all employees;
 - 6.28.2. Site hourly employees are not work beyond their regular working hours

6.28.3. Management members are to sign-in and out each day to ensure they are getting enough recovery time between shifts

6.28.4. Standard protocols from the BC labour laws are,

6.28.4.1. 8 hours of time off is required between each shift

6.28.4.2. A 32 hour continuous break is required 1/week

6.29. Once silo is empty

6.29.1. Conduct a thorough clean-up of all equipment and tools used for the event

6.29.2. Arrange to have the silo inspected for structural integrity

6.29.3. Configure the belt transfer system back to original specifications

7. COMMUNICATION METHOD

7.1. Daily toolbox meetings

7.2. E-mail conversations

7.3. Site radio use

7.4. Cell phone conversations including text messages

8. ASSOCIATED DOCUMENTS

8.1. Henry Persson – Silo Fires article

9. ORDER OF REVISIONS TABLE

Document Owner: Safety & Environment Manger Order of Revisions	Date	Author(s)
Created: August 9, 2018	August 2018	Darren Marutt

Acknowledgement Form

I have read and understand the Silo Fire Management Procedure SWP 18-05.

I further understand that should I have any questions or concerns related to this SWP, I am required to advise my Supervisor immediately.

Employee Name (Print)

Employee Signature

Supervisor Name (Print)

Supervisor Signature

Date