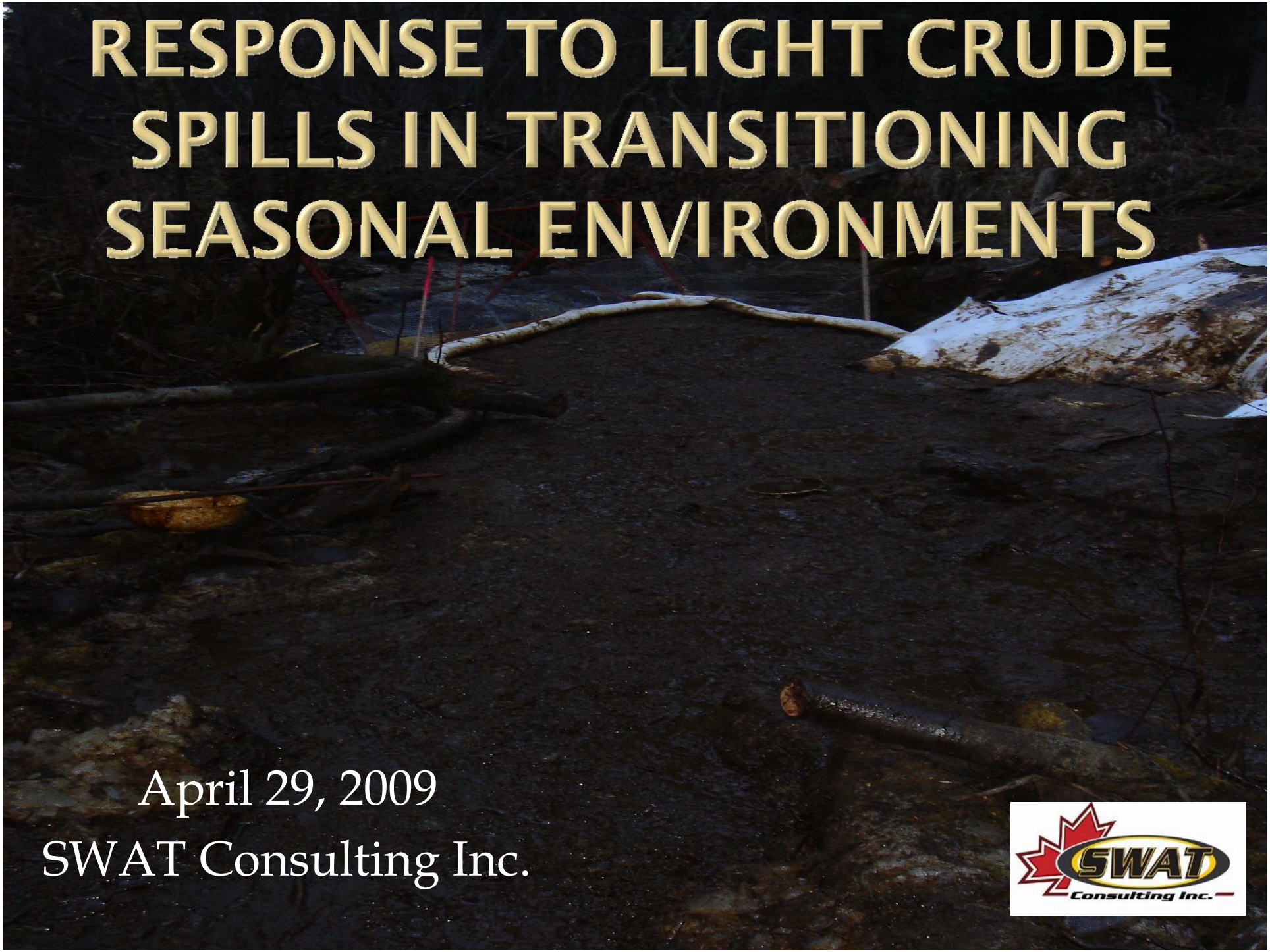
RESPONSE TO LIGHT CRUDE SPILLS IN TRANSITIONING SEASONAL ENVIRONMENTS



April 29, 2009

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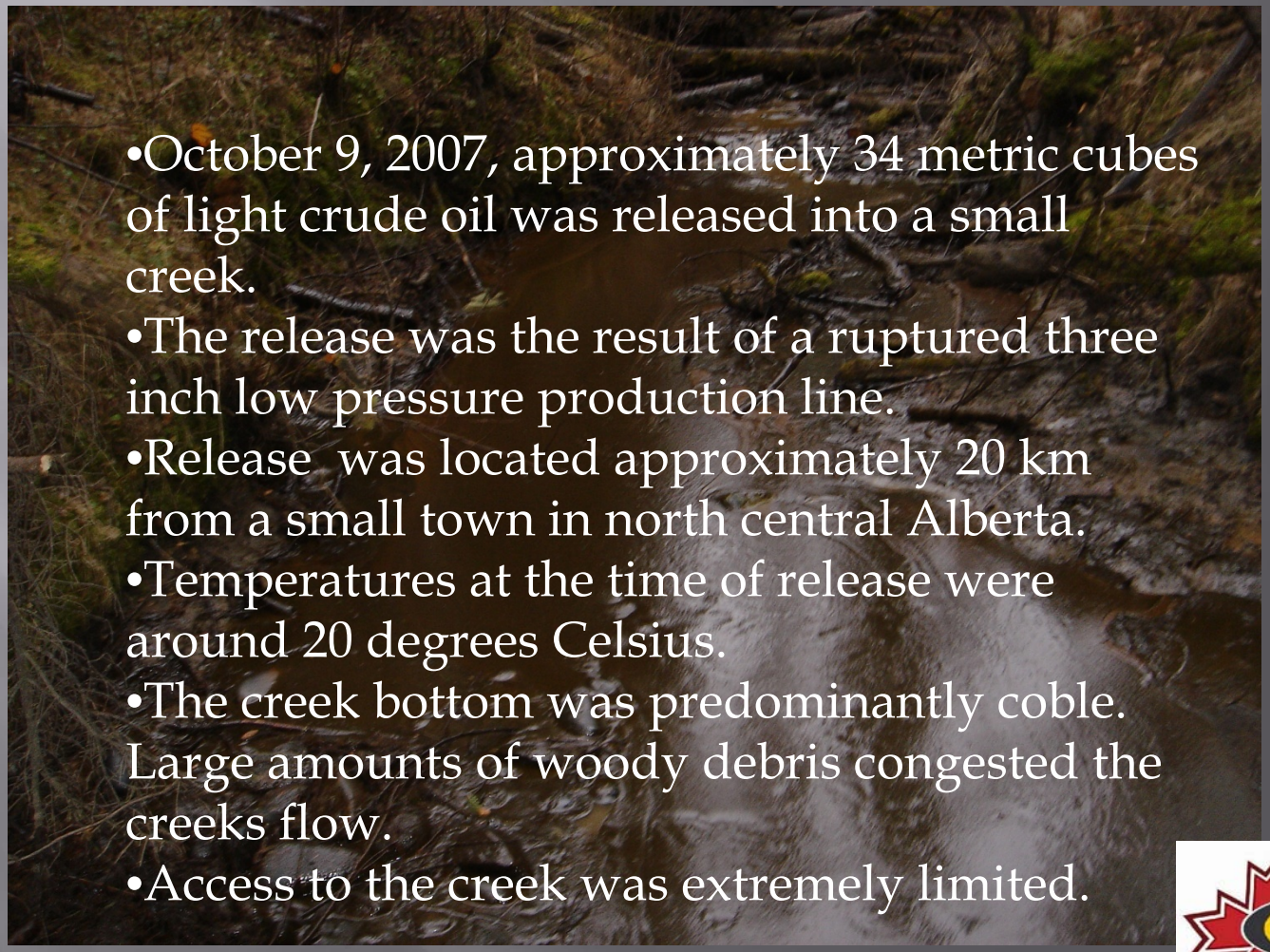
Release Details



- October 9, 2007, approximately 34 metric cubes of light crude oil was released into a small creek.
- The release was the result of a ruptured three inch low pressure production line.
- Release was located approximately 20 km from a small town in north central Alberta.
- Temperatures at the time of release were around 20 degrees Celsius.
- The creek bottom was predominantly coble. Large amounts of woody debris congested the creeks flow.
- Access to the creek was extremely limited.

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Response Phases

- Phase 1 – Initial Release : October 9, 2007- October 23, 2007
  - Install containment
  - Begin product recovery
- Phase 2 – Containment and Recovery : October 23, 2007 – November 26, 2007
  - Upgrade existing containment
  - Removal of bulk product/impacted debris
  - Transitioning to low impact containment
- Phase 3 – Winter monitoring: November 26, 2007 – April 28, 2008
  - Monitor and maintain spill site and containment

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Response Phases

- Phase 4 – Shoreline clean up: April 28, 2008 – May 31, 2008
- Maintain containment
- Assess impacted shoreline
- Remove impacted vegetation and debris
- Spot treat impacted soil and sediment
- Phase 5 – Removal of weirs and remaining equipment.
- Reclamation of work area and access.
- Final inspection before site closure

Phase 1 Initial Release

- Construct road into staging area
- Installation of initial containment including three earthen underflow weirs, straw bales and sorbent booms.
- Begin recovery of free product utilizing vac trucks.
- Begin removal of impacted woody debris
- Crews removed beaver damn

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Phase 1 – Construction of Access and Staging Area

Phase 1 – Initial Containment Earthen Underflow Weir

Phase 1 –Removal of Impacted Debris

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Phase – 2 Containment/Bulk product Removal

- Upgrade Existing Containment
- Build access along creek
- Removal of bulk product/impacted debris
- Transition to low impact weirs
- Burn impacted woody debris

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Phase 2 – Upgrade Existing Containment

Phase 2 – Upgrade Existing Containment

Phase 2 – Upgrade Existing Containment

Phase 2- Pushing Access Road

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Phase 2- Flushing Product Off of Rocks

Phase 2- Ice Buildup

- As product was flushed down stream ice and debris began to form congestion points. This prevented the product from reaching our primary recovery areas.

Phase 2 – Break Creek Into Manageable Segments

- Installation of control points every 100 meters prevented congestion at random points. This allowed us to have centralized recovery points with good access.

Phase 2 – Removal of Bulk Product

Phase 2 – Removal of Bulk Product

Phase 2 – Removal of Impacted Debris

Phase 2 – Removal of Impacted Debris

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Phase 2 – Burn Impacted Woody debris

Phase 2 – Transition to Low Impact Weirs

Phase 2 – Transition to Low Impact Weirs

Phase 2 - Decontamination

Phase 3 – Winter Monitoring

- Monitor creek
- Monitor containment
- Maintain containment

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Phase 3 – Site Monitoring

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Phase 3 – Site Monitoring

Phase 3 – Containment Maintenance

Phase 4 – Shoreline Clean up

- Maintenance of containment
- Recovery of debris and stranded sheen
- Removal of impacted vegetation
- Treatment of impacted soils and sediment

Phase 4 – Runoff Management

Phase 4 Maintenance of Containment

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Phase 4 Maintenance of Containment

Phase 4 – Recovery of Impacted Debris and Stranded Sheen

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Phase 4 – Removal of Impacted Vegitation

Phase 4 – Treatment of Impacted Soils and Sediment

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Phase 5 - Closure

- Removal and disposal of remaining impacted material
- Removal of weirs and other remaining equipment
- Reclamation of the work area
- Reclamation of access road
- Final inspection for site closure.

Phase 5 - Removal of Impacted Material

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Phase 5 - Removal of Impacted Material

Phase 5 - Reclamation

Phase 5 - Reclamation

Phase 5 – Shore Line Assessment

Phase 5 – Shoreline Clean Up

Phase 5 – Shore Line Assessment

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Phase 5 – Shoreline Clean Up

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Phase 5 – Shore Line Assessment

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Phase 5 – Shoreline Clean Up

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Learnings - Positive

- Making a call to get the correct personnel on the site – reduced costs, confidence with the regulatory agencies, managed the site.
- Support from client.
- Pre-fabricated weirs – full containment within run off with no breeching. The earthen weir washed out.
- Making an access along side the creek – easier mobilization to work sites and ease of product and debris removal.

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Learnings - Positive

- Managing impacted woody debris on-site – reduced trucking and tipping fees, re-used bags (this was effective but could have been done quicker)
- On site decontamination was very effective.
- Response documentation.
- Safety – only two reportable incident for the personnel hours and vehicle km.

Learnings

- Beaver dam removal :
  - Increased the size of the spill.
  - Created a pressure wave stranding product on shoreline.
  - Reduced water levels; stranding product within the undercut banks.
  - Increased duration of spill; snow fall impeded response objectives.
- Hauling water:
  - Increased costs.
  - Increased workload at disposal site.

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Learnings

- Inverted weir not built correctly:
  - Resulting in water hauling and product moving downstream
  - Required a larger retention pond.
- Not enough control points:
- Access:
  - Initial response crews did not have adequate access along the creek.

Learnings

- Timber removal during creek clearing first couple weeks:
  - To much timber was removed increasing timeframe, bags to be removed, disposed of or burnt.
- Waste Segregation
  - PPE was placed within timber bags; time to remove.
- Response personnel continuity was weak:
  - Different personnel on a daily basis leads to inefficient use of time.
- Knowledge gaps with response personnel:
  - Initial response personnel were not fully aware of the basics of spill response.

Learnings

- No early communication with regulatory personnel:
  - Lack of communication implies someone is hiding something.
- Not being able to procure the correct resources in a timely manner:
  - Down time waiting for outside personnel and equipment.

Learnings

- Communications:
  - Cell phone and radio coverage was intermittent on the creek.
- Safety:
  - Initial response crews did not have access to the correct PPE.
- Sample turn around times:
  - Constant waiting on lab work.

Q & A

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