Memorandum

Teck Highland Valley Copper Partnership
P.O. Box 1500
Logan Lake, BC Canada V0K 1W0

+1 250 523 2443 Tel
+1 250 523 3242 Fax
www.teck.com

Teck

November 24, 2014

Minutes and Outcomes for Tabletop Tests of Emergency Preparedness and Response Plans (EPRPs) for Teck Highland Valley Copper (HVC) Tailings Dams, 17 & 18 October 2014

Attendees:

Name	Organization & Title	October 17, 2014	October 18, 2014
Allyson Herman	HVC – Coordinator, Tailings & Water Management	Yes	Yes
Casey Bates	ERM – Senior Scientist (Facilitator)	Yes	Yes
Leroy Caillier	HVC – Dam Inspector	Yes	Yes
Josh Hancock	ERM – Senior Project Manager at ERM (Facilitator)	Yes	Yes
Jason Tomlin	Thompson Nicola Regional District – Emergency Services Supervisor	Yes	No
Mike Knauff	Emergency Management British Columbia Regional Manager	Yes	No
Ross Billy	HVC – Senior Supervisor Tailings	Yes	Yes
Chris Fleming	HVC – Superintendent Tailings & Water Management	Yes	Yes
Mario Costa	HVC – EHSC Manager	Yes	No
Chris Dechert	HVC – General Manager	Yes	Yes
Mathieu Veillette	HVC – Senior Geotechnical Engineer	Yes	Yes
Nick Frenks	HVC – Manager Maintenance	Yes	No
Russ Porterfield	HVC – Planning Foreman, Mill	Yes	Yes
Randy Carey	HVC – Mill Operations Senior Foreman	Yes	Yes
Al Soneff	HVC – Shift Supervisor, Protective Services	Yes	Yes
Gerry Wong	HVC – Senior Safety Coordinator	Yes	Yes
John Arnold	HVC – Superintendent Safety and Loss Control	Yes	Yes
Neil Singh	Klohn Crippen Berger – Project Manager	Yes	Yes
Jamie Verheyen	HVC – Senior Supervisor, Mine Operations	Yes	Yes

Name	Organization & Title	October 17, 2014	October 18, 2014
Michael Cyr	AMEC – Consultant	Yes	Yes
Andrew Witte	AMEC – Consultant	Yes	Yes
Ian Haskell	HVC – Field Supervisor	Yes	Yes
Dave Falcon	HVC – Senior Environmental Coordinator	Yes	Yes
Mark Nelson	ERM – Consultant (Observer/Recorder)	Yes	Yes
Dennis Redford	Senior Emergency Response Officer – Ministry of Environment	Yes (AM only)	No

Location and Time: Coast Hotel, Kamloops. 8am to 4pm, 17 October 2014 & 8am to 2:30pm, October 18, 2014.

Meeting Safety Share

- Skin cancer risks and use of sun protection (Day 1 - October 17)
- Tripping hazard around projector equipment (Day 1 - October 17)
- Chainsaw use safety (Day 1 - October 17)
- Asbestos in the home (Day 2 – October 18)

Objective

- Use hypothetical dam breach and/or flood scenarios to test the emergency preparedness and response plans (EPRPs) for Teck Highland Valley Copper's (HVC's) Tailings Storage Facilities (TSFs).
    - EPRPs must be completed and tested consistent with the Canadian Dam Association (CDA) Dam Safety Guidelines as required by Notification of Chief Inspector's Orders, 18 August 2014: *Tailings Dams: Independent Review of Dam Safety and Consequence Classification*

Agenda - Overall

- Introductions
- Overview and Purpose
- Recent Tailings Dam Breaches Worldwide
- Review of Previous Tabletop Exercises & 2012 Functional Test
    - July 2011 – Highland L-L Dam
    - July 2012 – Highland L-L Dam
    - October 2013 – Trojan Dam
    - May 2014 – All High-consequence and Above Dams at HVC
    - November 2012 – Highland L-L Dam Functional Test
- Overview of HVC EPRP Structure for TSFs and Water Storage Facilities(WSFs)
- Tabletop Exercises (one dam at a time)
- Review of Draft Findings and Corrective Actions
        - Dam-specific Findings
        - Findings Applicable to all Dams/EPRPs

Agenda – For each dam

- Document Review: 2014 working drafts of Section 8 *Emergency Preparedness and Response Plan* (EPRP) from the following HVC Operations, Maintenance and Surveillance (OMS) Manuals:
    - *Highland Tailings Storage Facility*
    - *Highmont Tailings Storage Facility*
    - *Bethlehem Tailings Storage Facility*
- Tabletop Exercise
- Considerations & Discussion
- Review of Findings and Potential Corrective Actions

Tabletop Exercises of Emergency Preparedness and Response Plans Performed during Two-day Session

Day One:

- Highmont Dam North (Highmont TSF)
- Trojan Dam (Bethlehem TSF)
- Bethlehem Dam No. 1 / Bethlehem Main (Bethlehem TSF)

Day Two:

- Highland L-L Dam (Highland TSF)
- Highland H-H Dam and 24 Mile Lake (Highland TSF)
- Highmont Dam South (Highmont TSF)
- Bose Lake Dam (Bethlehem TSF)

Presentation: *Tabletop Tests of HVC Emergency Preparedness and Response Plans (EPRPs). For HVC Tailings Dams Classified as High, Very High, or Extreme October 17-18, 2014*

Handouts: 2014 working drafts of Section 7 *Surveillance* and Section 8 *Emergency Preparedness and Response* Plan from the following HVC Operations, Maintenance and Surveillance OMSs:

- *Highland Tailings Storage Facility*
- *Highmont Tailings Storage Facility*
- *Bethlehem Tailings Storage Facility*

Visuals Aids: Primary PowerPoint presentation on primary display screen. *Highland Valley Copper GIS Application* on secondary display screen.

Supplemental Information:

Appendix I: EPRP Tabletop Session Photos

Appendix II: FUNCTIONAL TEST OF EMERGENCY RESPONSE PLAN FOR HIGHLAND L-L DAM SUMMARY OF NOTES AND FINDINGS (Prepared for November 20 debrief meeting) Date: 2012-Nov-15

Appendix III: Meeting Minutes from EPRP Tabletop Exercises for HVC Tailings/Water Storage Facilities, 7 & 8 May, 2014.

Meeting Minutes:

Day One – 17 October 2014

Time	Slide #	Comment
08:11		Meeting kickoff and safety moments.
08:23		Overall agenda for the two-day meeting and agenda for each dam reviewed.
08:26		Tailings dams to be reviewed. • Highmont Dam North (Highmont TSF) • Trojan Dam (Bethlehem TSF) • Bethlehem Dam No. 1 / Bethlehem Main (Bethlehem TSF) • Highland L-L Dam (Highland TSF) • Highland H-H Dam and 24 Mile Lake (Highland TSF) • Highmont Dam South (Highmont TSF) • Bose Lake Dam (Bethlehem TSF) (Highmont East not being covered because of *Significant* rating.)
08:30		Statement of confidentiality provided by General Manager.
08:38		EPRP testing required by Chief Inspector's Orders released after Mt Polley incident, but group is also here because of proactive nature of HVC. CDA guidelines are industry standard and not regulatory.
		This session serves as the next step in meeting CDA guidelines on testing EPRPs, which can range from simple reviews up to full-scale function tests that include onsite evacuations. • Observation: Include downstream community to provide a more realistic test environment; perhaps part of a future test. EPRP tests help develop program maturity and reinforce social license to operate.
08:46		In line with HVC's commitment for continual improvement as part of the Tailings Management System, HVC has voluntarily chosen to hold this session.
		Different types of scenarios will be performed during this session (i.e., dam-related emergencies may not always result in hypothetical dam breach). Currently EPRP feeds into HVC and Teck Crisis Management Program.
08:53	20	How can we leverage HVC's overall Emergency Response Plan (ERP) Structure for TSFs/WSFs to streamline the planning process for each dam individually?
08:54	21	Owner responsibilities for TSFs and WSFs.
		Hard copies of Section 7 *Surveillance* and Section 8 *Emergency Preparedness and Response* from Highland, Highmont and Bethlehem OMS manuals will be provided to participants for use during discussion of hypothetical scenarios.
08:59	24	Definition of dangerous occurrence. What is a Dangerous Occurrence? (Mines Code 1.7.3) • Slumping, sliding, cracking or bulging of a dam, dyke, impoundment • Unexpected seepage or appearance of springs on the outer face of the dam or dyke • Loss of adequate freeboard • Washout or significant erosion of the dam • Anything that may adversely affect the integrity of the dam

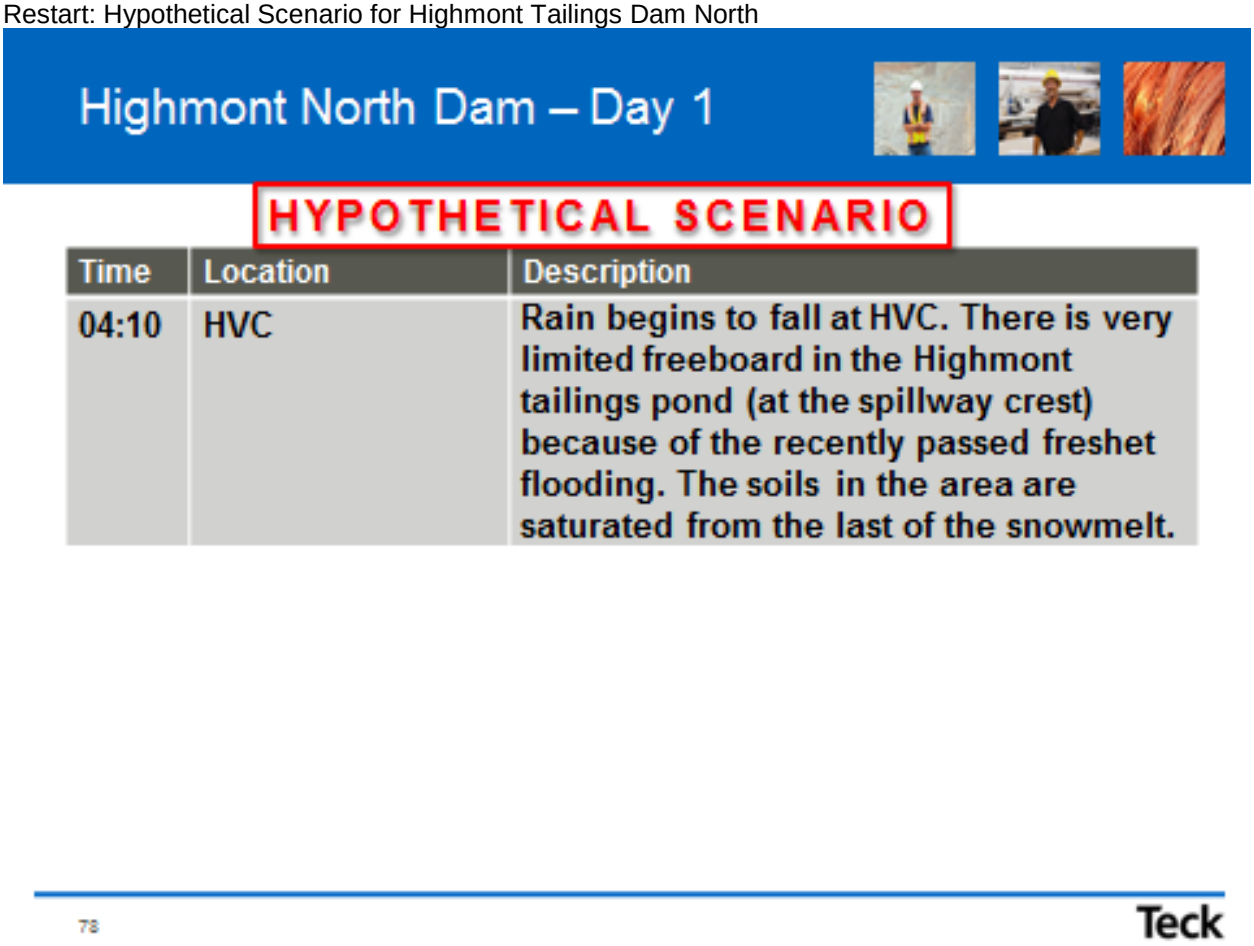
Time	Slide #	Comment
09:03	27	Sunny-day and Rainy-day (flood-induced) failures defined. Types of Failures Modeled in Inundation & Dam Break Studies (CDA, 2007): • Sunny- day failure: This is a sudden dam failure that occurs during normal operations. It may be caused by internal erosion, piping, mis-operation leading to overtopping or another event. • Flood-induced (Rainy-day) failure: This is a dam failure resulting from a natural flood of a magnitude that is greater than what the dam can safely pass.
	29	Potential corrective actions from session will be reviewed by HVC senior management and prioritized. Approved items will be put into SiteLine.
09:25	32	Recent Tailings Dam Breaches Worldwide.
09:31	44	Review of Previous Tabletop Exercises & 2012 Functional Test.
09:40	48	Trojan Pond and Dam 2013 EPRP test.
		Questions from participants: • What assurances are there that the OMS given to the RCMP read/understand the manual? o Observation: Should the RCMP be included in the dam training sessions? ▪ This is very important for first responders. • Brazil used military after recent dam breach, is there a base near HVC? • There should be a process to keep EPRP alive, to keep it in people's mind. o Comment from facilitator: ▪ Every year the emergency phone fan-out is checked. After recent test it was updated quickly to include MOT etc.
09:51	50	May 2014 EPRP tabletop tests were performed for all high-consequence or above tailings and water storage facilities at HVC.
	52	Comment from facilitator: Most findings from May 2014 sessions were minor but could take some time to implement.
	54	Comment from participant: • Observation: Consider developing in GIS a layer with muster areas. o Include access points that need to be blocked and include residential areas at risk (for use by security and ERT). o Perhaps use a web map option? • Observation: Have a check box over each residence to say when it was contacted.
10:04	56	Functional Test: Highland L-L Dam - November 15, 2012.
	57	Extensive group discussion about incident command structure and making sure that the command structure functions.

Time	Slide #	Comment
10:45	60	Restart after break. Information relevant to personnel that work on or around the Highland L-L Dam was extracted from the Highland TSF OMS Manual and communicated to all employees (approximately 180 total) during 2014 Dam Safety Course. Group reviewed Section 7 of the Highmont OMS Manual. Comment from participant: • In Alert Level 1 of Alert Level Rankings Table in OMS, clarify overtopping is not an Alert Level 1 but Alert Level 3. • Question from participant: does L-L Dam have an Alert Level 2 because of its proximity to Spences Bridge? o Discussion; Alert Level 2 generally corresponds to pre-evacuation, Level 3 to evacuation.
11:08	62	Begin review with group of Section 8 of the Highmont OMS.
	64	Comments on incident command matrix: • Observation: Regarding reference to crisis management manual – there are two manuals (HVC and Teck), so specify. • Observation: KCB as Engineer of Record and First Nations are not included in incident command diagram but are included in call out procedure. • TNRD finds it useful to have a call with all stakeholders at the start of an incident to make sure everyone is aware of the situation. • Observation: In the Highmont OMS manual the incident command diagram includes Spences Bridge. o The general figure should be refined for each OMS manual to be site-specific.
	65	Comments on Emergency Reporting Procedure (fan out): • Observation: Perhaps split between manuals to be catchment specific (Logan Lake vs Spences Bridge)? o If the call out is going to be generalized then the hardcopy posting can be generic and the detailed call-out can be specific to each OMS. • Observation: BC Hydro and Fortis may need to be included on the primary call-out as part of HVC crisis call-out by Protective Services. o This needs to be checked and perhaps explicitly assign calling duties and remove duplicate calls.
11:32	67	Comment from a participant: • How frequent are large scale tests done (e.g., tsunami)? o Annual? o What is best practice? • Observation: Could BC Shake Out be coordinated with a functional test?
12:00		Lunch

Observation: Indicates gap or potential opportunity for improvement

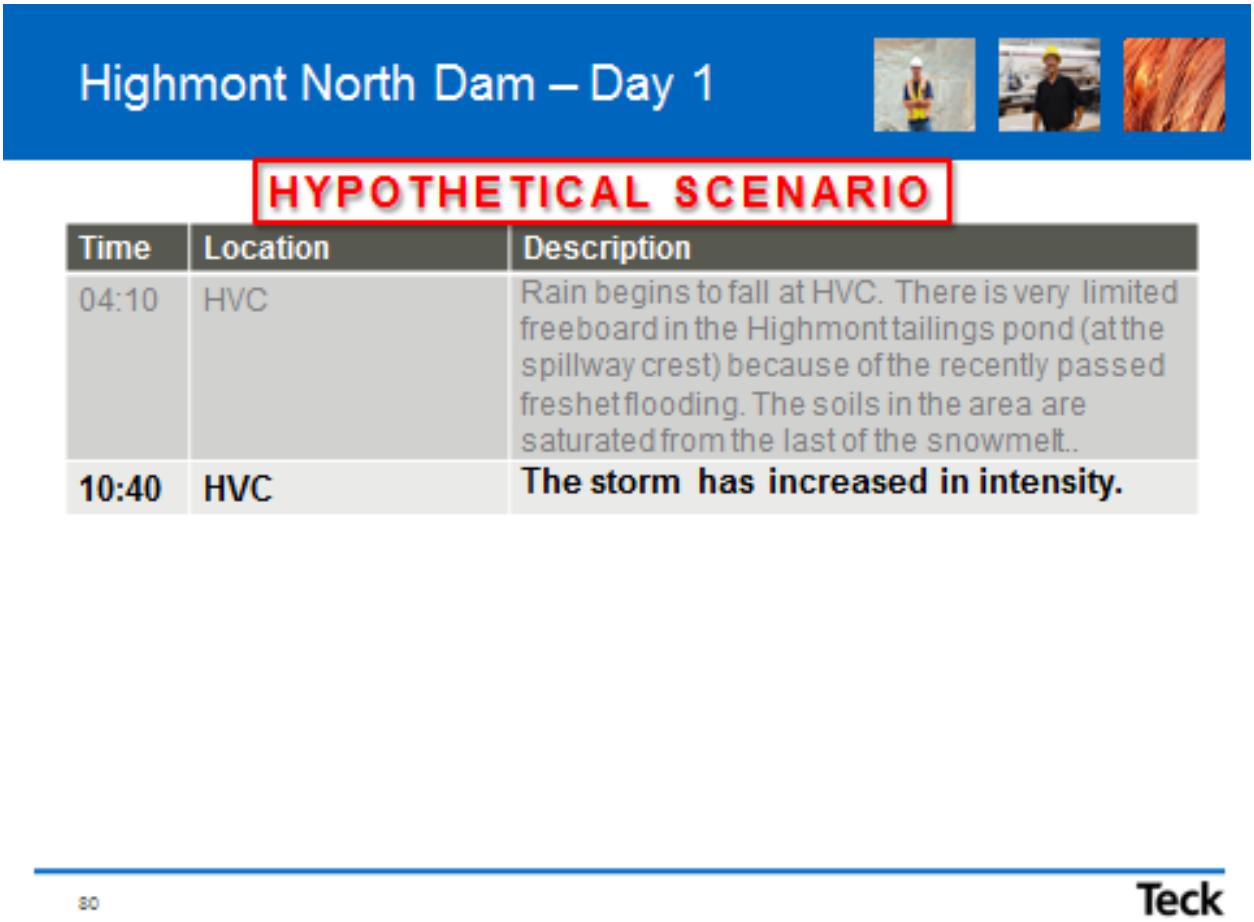
Day One – October 17, 2014

EPRP Test #1: Highmont Tailings Dam North (Highmont Tailings Storage Facility)
12:34
Restart: Hypothetical Scenario for Highmont Tailings Dam North



12:42
Response actions and general comments:

- Hypothetical scenario assumption: spillway is open to max already.
- Contact Superintendent Tailings and Water Management.
- What is capacity of spillway, what can be used to control rate or rise?
- Declare an alert (Alert Level 1?);
    - Gather facts – rate of rise etc.
    - Discuss escalating water levels.
        - Is there an inflow that could be diverted?
        - What is the allowable freeboard?
- There is complex terminology around multiple spillway terms and freeboard terms; this would happen in reality.
    - Step one is to go and look at the spillway and gather the fact as fast as possible.
- Ministry has weekly call during freshet to discuss snow pack and possible melt and river forecast.



Response actions and general comments:

- Continue monitoring of spillway capacity:
    - Is the channel clear, and is downstream infrastructure ready?
- It is key that General Manager is always getting updated info as things progress.
    - This allows for shutting down of some areas and remobilizing equipment if needed.

Highmont North Dam – Day 1

HYPOTHETICAL SCENARIO

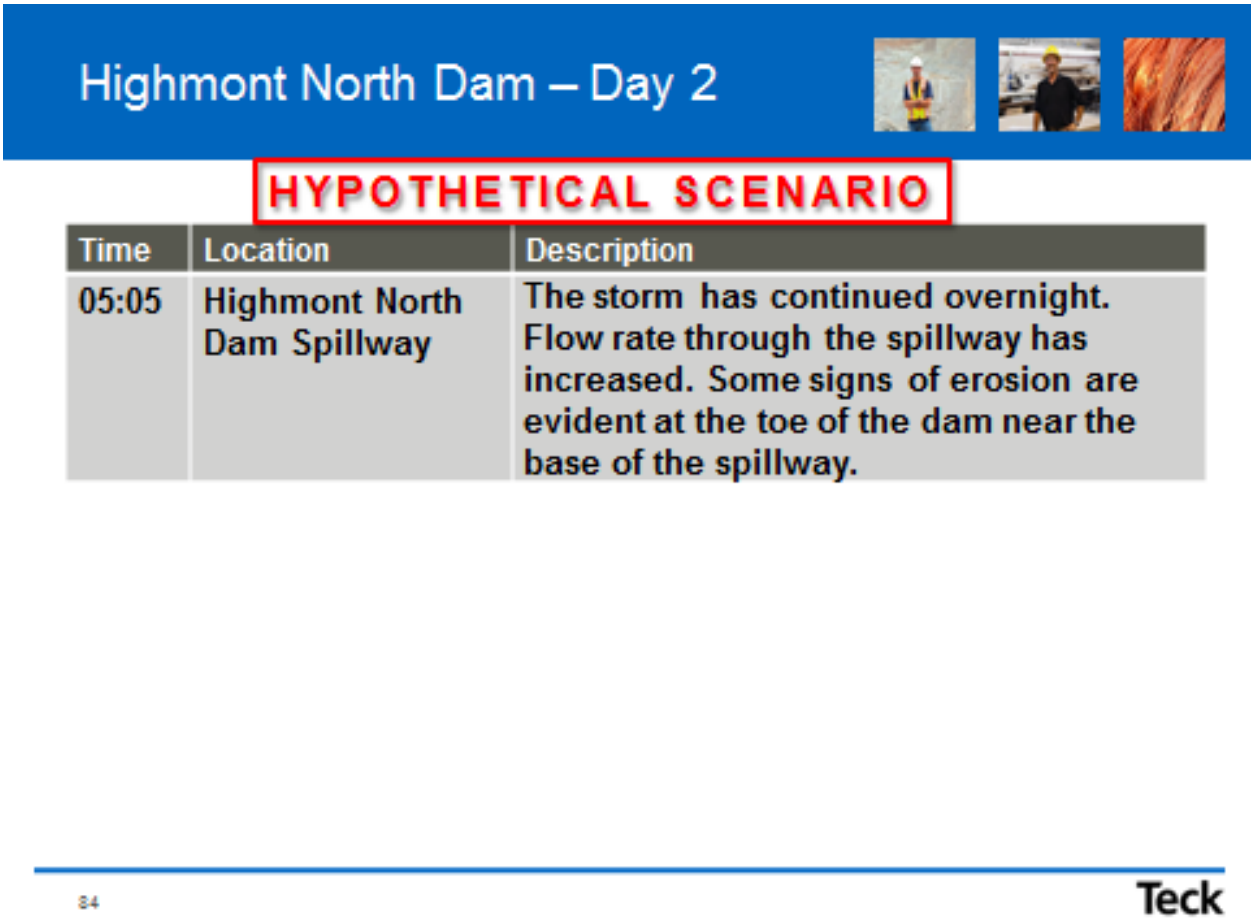
Time	Location	Description
04:10	HVC	Rain begins to fall at HVC. There is very limited freeboard in the Highmont tailings pond (at the spillway crest) because of the recently passed freshet flooding. The soils in the area are saturated from the last of the snowmelt.
10:40	HVC	The storm has increased in intensity.
17:10	**Highmont North Dam Spillway**	**Flow has begun to pass out of the Highmont tailings pond at the spillway crest, at approximately 5 m^3/s.**

82

Teck

Response actions and general comments:

- Still at Alert Level 1 (monitoring):
  - drive up and check S pond pumps,
  - read piezometers,
  - check what is pumping,
  - check staff gauges.
- Superintendent Tailings and Water Management noted that at 4:10 (scenario time) soils were saturated, therefore this is considered a worst case scenario.
- This is considered non-compliant discharge to environment.
  - Due to higher Mo, Cu, SO_4 any discharge from Highmont likely would have an environmental effect.
- Observation: Use GoldSim model check water volumes and make predictions prior to freshet.
- Observation: Keep pond levels as low as possible prior to freshet (end of February).
- Discussion: In Rainy-day the incremental effects are smaller.

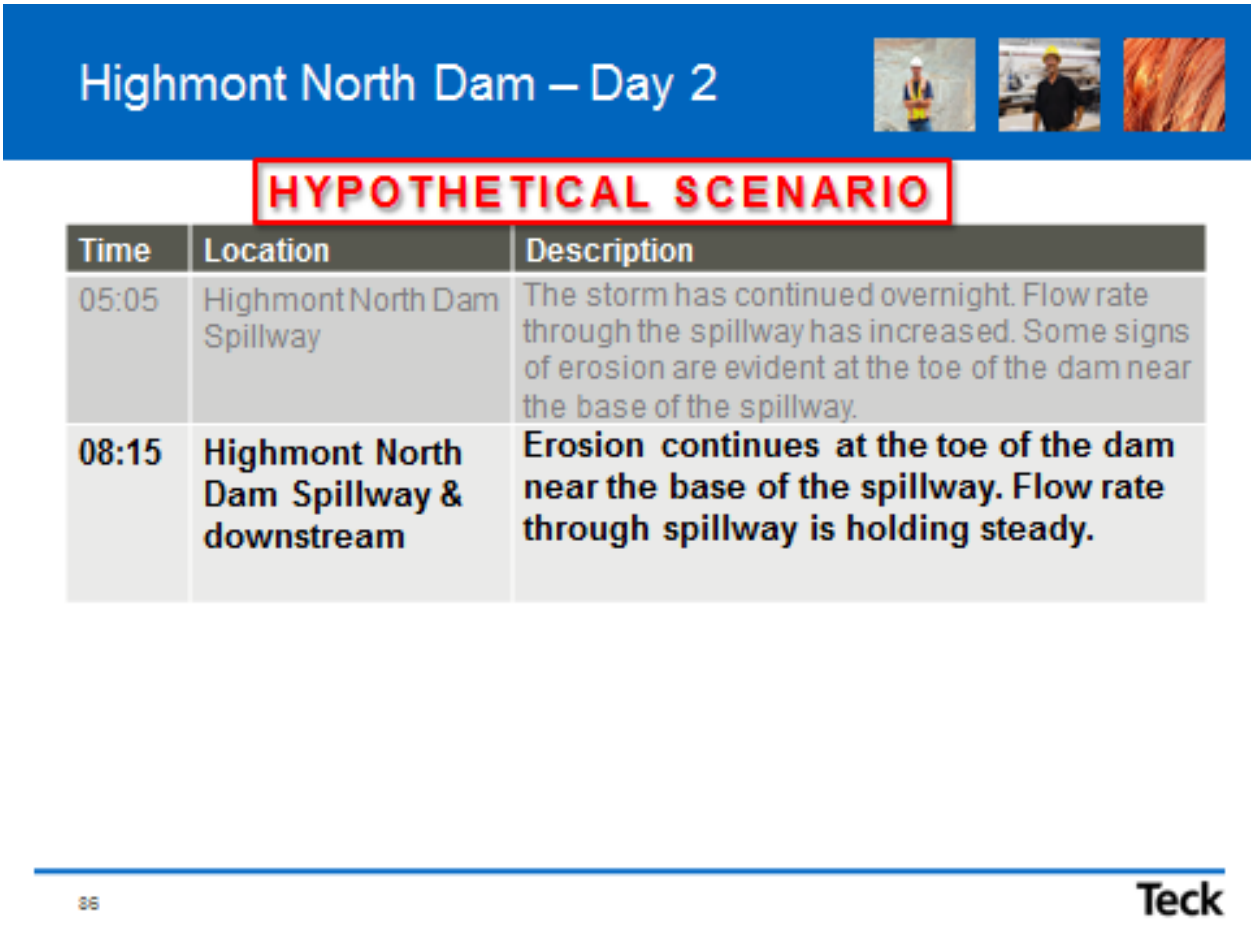


13:07

Question from facilitator: What would happen overnight if spillway continues to run and rain continues?

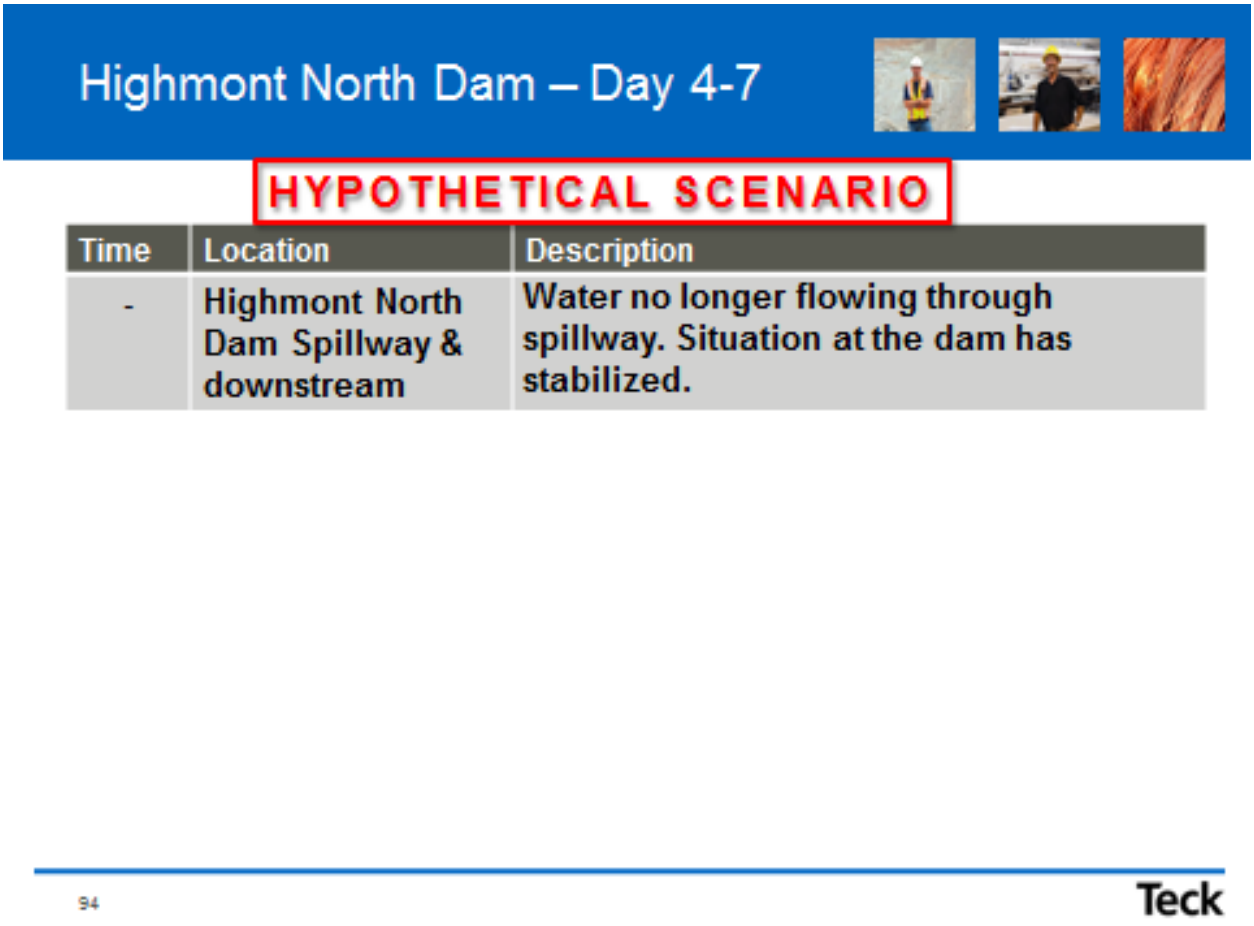
Response actions and general comments:

- Perhaps start hauling rock in preparation … but would you do this if the spillway was performing as expected.
- Water management committee that meets many times a day to check facts and come to decisions that could result in mobilizing equipment.
- General Manager needs info and then makes decisions based on probability of continuation of rain or increasing flow through spillway.
- Split up core group to dedicate people for dealing with a future problem.
- At least by this point it is now an Alert Level 2.



Response actions and general comments:

- Safety assessment put largest possible equipment there with rock, drop rock and riprap to plug holes.
- Can you close spillway gate to do some preparation work to sure up toe of dam?
- Trigger with government would probably have already happened as this would be a regional storm.
- Will this impact downstream water quality?
    - There might still be PR-necessary due to turbidity from storm.
- Can you lower the level of Mamit before this point?
    - However, HVC does not control Mamit Lake.
- When you see erosion perhaps plug spillway because Highmont can hold 3 times Probable Maximum Flood (PMF).



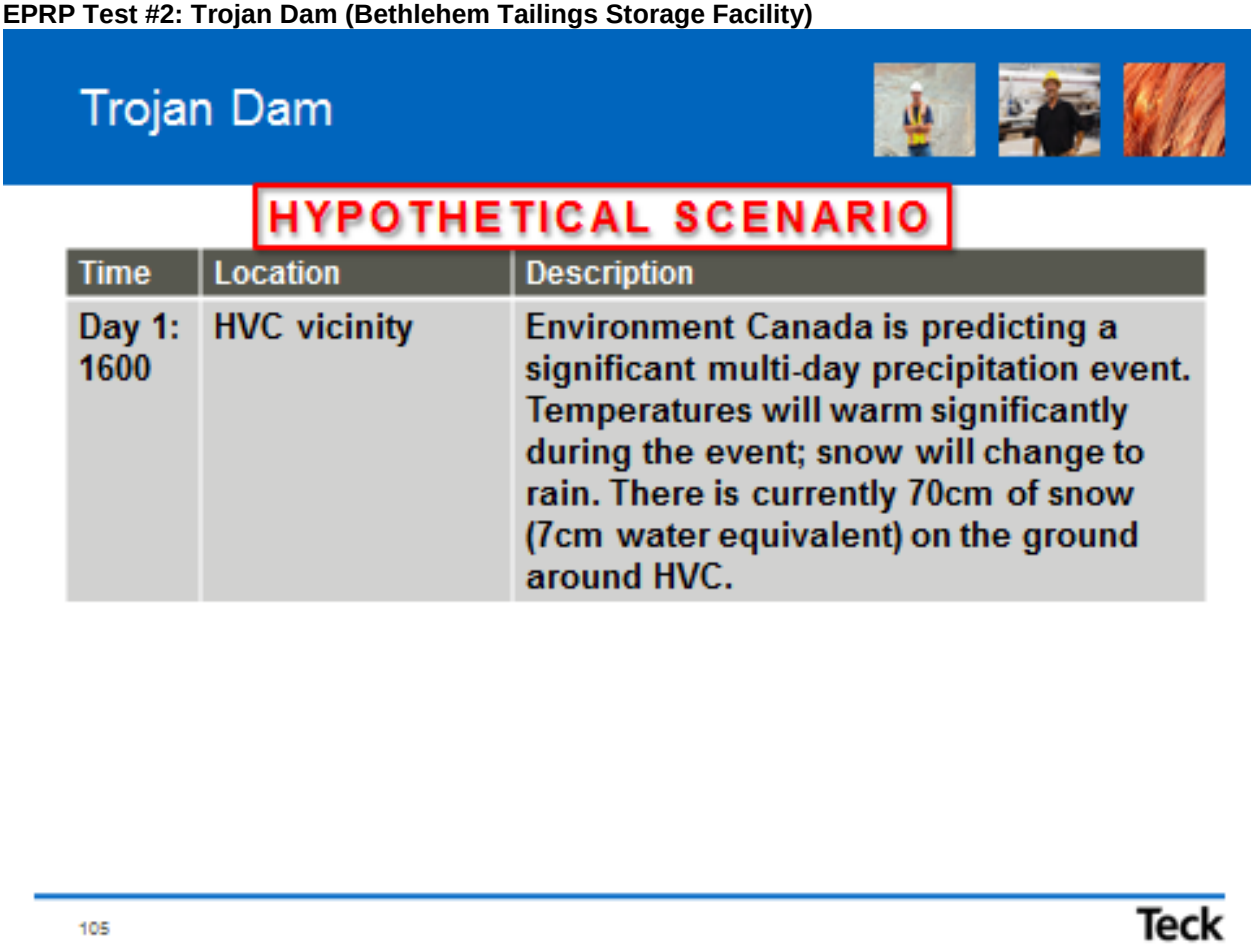
Response actions and general comments:

- Alert state is still active until criteria are met to not be in alert.
- Question from participant: What is the trigger to no longer be in alert?
- Need inspections of toe, emergency repairs are not long term.
    - Still monitoring piezometer.
- Trigger post event investigation – continuous improvement based on root cause.
- Observation: Understanding the rate of change is critical to making decisions on slower moving situation.

Observation: Indicates gap or potential opportunity for improvement

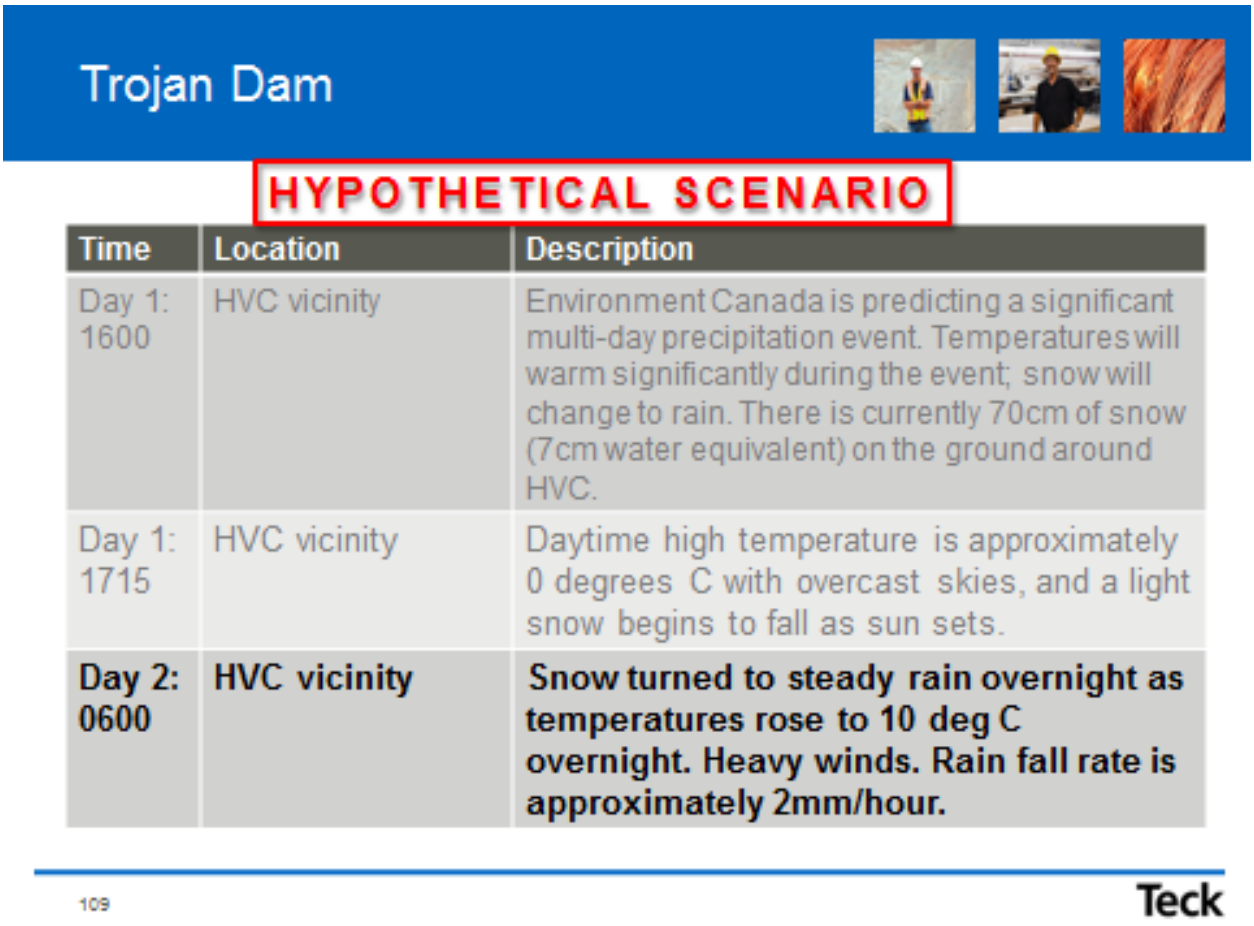
Day One – October 17, 2014

EPRP Test #2: Trojan Dam (Bethlehem Tailings Storage Facility)



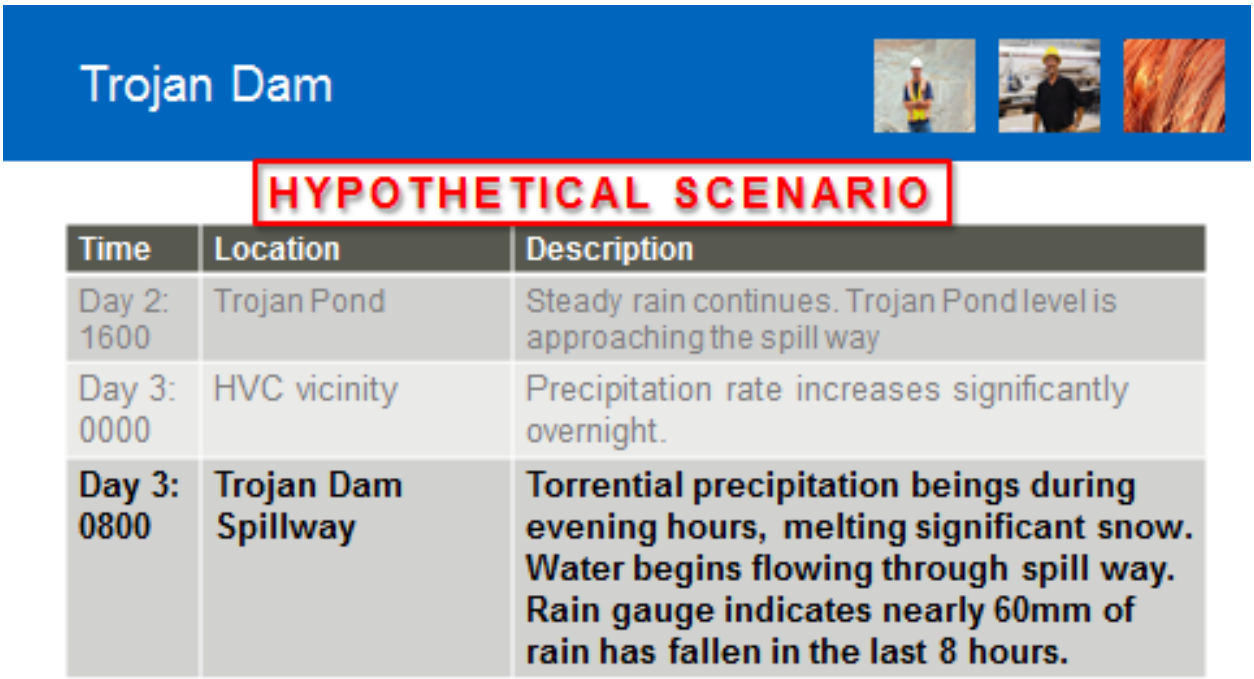
Trojan Dam hypothetical scenario. Opening slide 105. Response actions and general comments:

- Drive along Trojan Diversion.
- Start pumps.
- Check access roads and culverts.
    - Roads have been plowed because public access to Bose Lake.



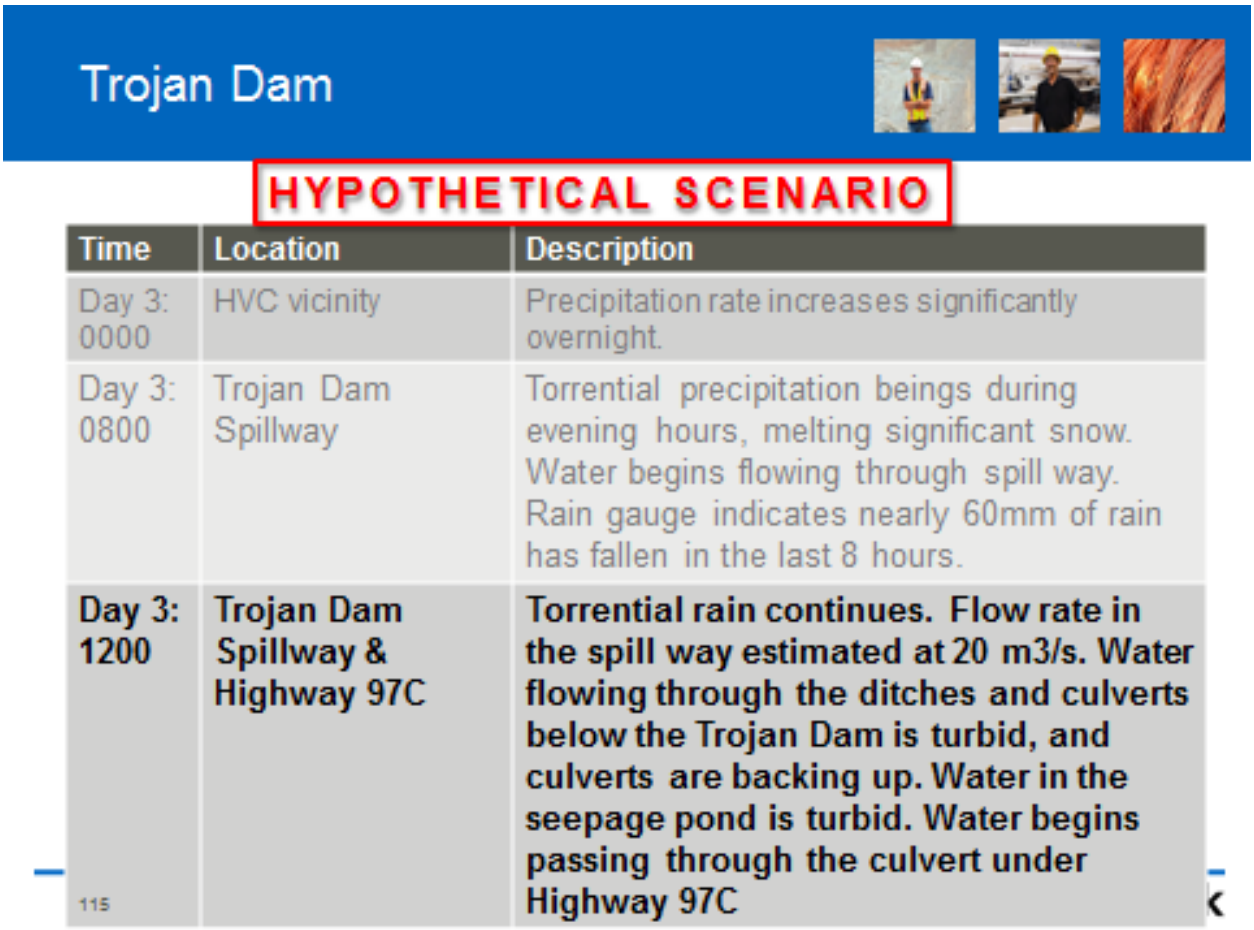
Response actions and general comments:

- Currently at Alert Level 1.
- Inspect all dams.
- Expecting warm winds to kill snowpack; rainfall will continue.
- Haul roads might be shut down.
- Block access to Bethlehem except with special authorization, also go into Bose Lake and check for recreational users and check back access.
    - Coordinate with government to facilitate closure.
- Monitoring levels in ponds.
- Check pumps and lines.



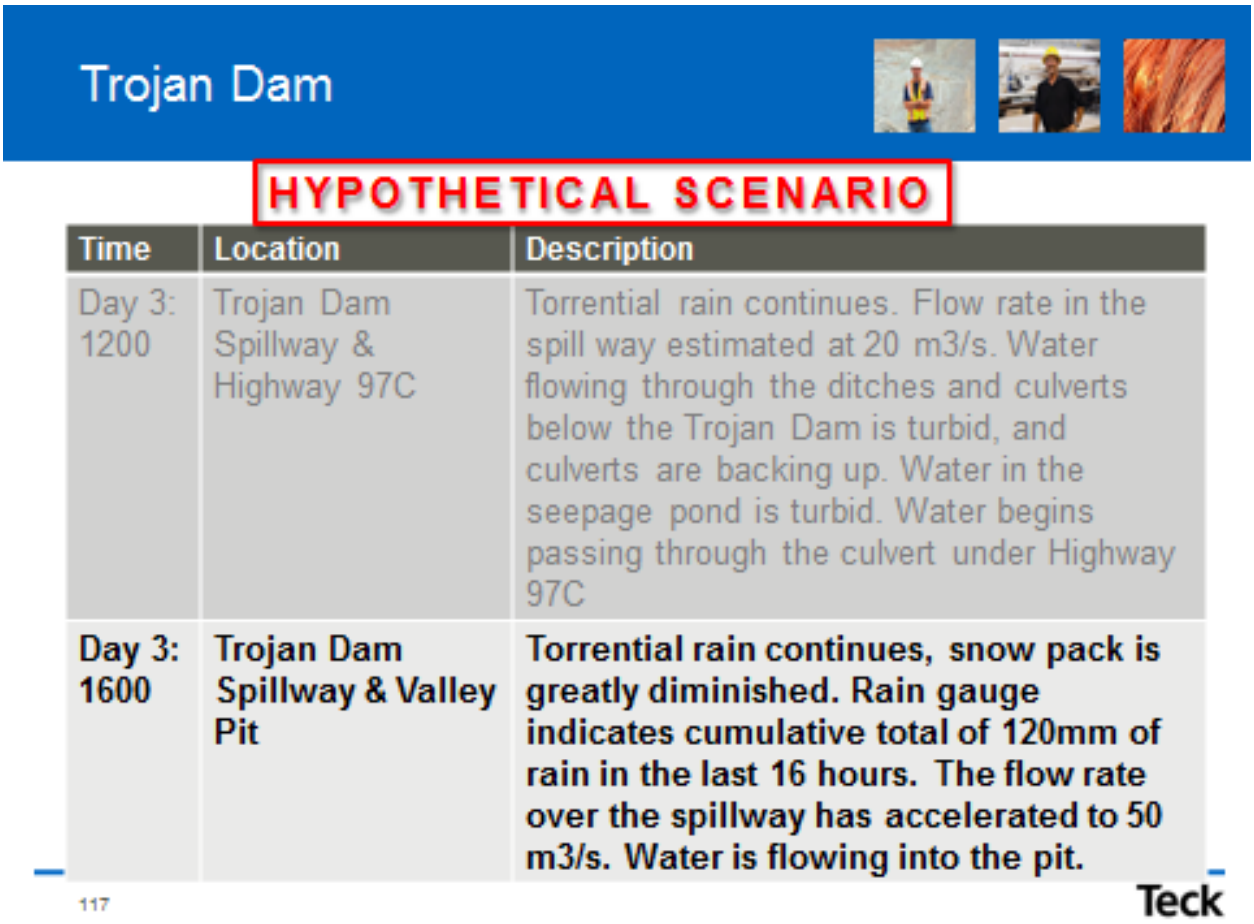
Response actions and general comments:

- Water is running past Lubeland and runs into Valley Pit along south wall.
- Alert Level 3 declared.
- Evacuate the pit – senior pit foreman call, but likely to be unanimous, estimated to take about 30 minutes.
    - By about 08:30 pit is evacuated using the second ramp out using the west wall.
    - Set up a blockade so nobody can use the ramps to get back in.
- Shut down 97C – contact RCMP, (Ministry of Transportation and Infrastructure) MoTI and advise; however, HVC would park equipment on highway as blockade because of imminent threat to life.
- Senior foreman on shift could shut down the Mill if required.
- Water level at Trojan has auto level detection.



Response actions and general comments:

- Design capacity of spillway is ~50m3/s.
- Observation: OMS could include acceptable staff gauge readings and a flow rate curve based off water elevation.
- Spillway with sandbags needs monitoring in case of erosion.
- Need to be monitoring Trojan Dam.
- Observation: Investigate some design changes to end of spillway to prevent erosion.
- Turbidity might be cloudy storm water – check piezometers (perhaps too dangerous).
- Repairing the spillway might be too unsafe due to dangerous conditions on roads.
- Piezometers are manual so there might be no way to safely check them.



Response actions and general comments:

- Could the trees upstream of the culvert block it?
- Could water be diverted down into the pit and then divert along the south wall ramp.
- Lubeland would probably be destroyed?
    - Failure of slopes upstream of Lubeland – big environmental risk.
- Priority would be to preserve life and, if possible, to preserve infrastructure.
- Call night shift and tell them to stay home because of emergency situation.
- Power line between pit and Trojan would probably be knocked out.

Trojan Dam

HYPOTHETICAL SCENARIO

Time	Location	Description
Day 3: 1800	Trojan Dam Spillway & Valley Pit	Torrential rain continues. Rain gauge indicates 140mm of rain in last 18 hours. Darkness falls. Water level in pit rises to 800 masl.
Day 4: 0600	**Trojan Dam Spillway & Valley Pit**	**Precipitation rate has slowed but not stopped. Snow pack is essentially gone. Rain gauge indicates that 180mm of rain fell during the 24-hour Day 3 period. Water level in the pit is currently 825 masl. Rain is currently falling at 15mm/hour. Water is flowing through the spill way at 20 m3/s.**

123 Teck

Response actions and general comments:

- Consider trying to preserve spillway, continue monitoring.
- Scenario assumption: Dam is not compromised.
- Get a helicopter in the air and check on condition of dams.
    - Observation: Is use of drones possible?
- Or drive over back way through Bose Lake.

Response actions and general comments:

- It is assumed that HVC have lost shovels and trucks.
- HVC would likely need to spend many months dewatering and evaluating pit stability.

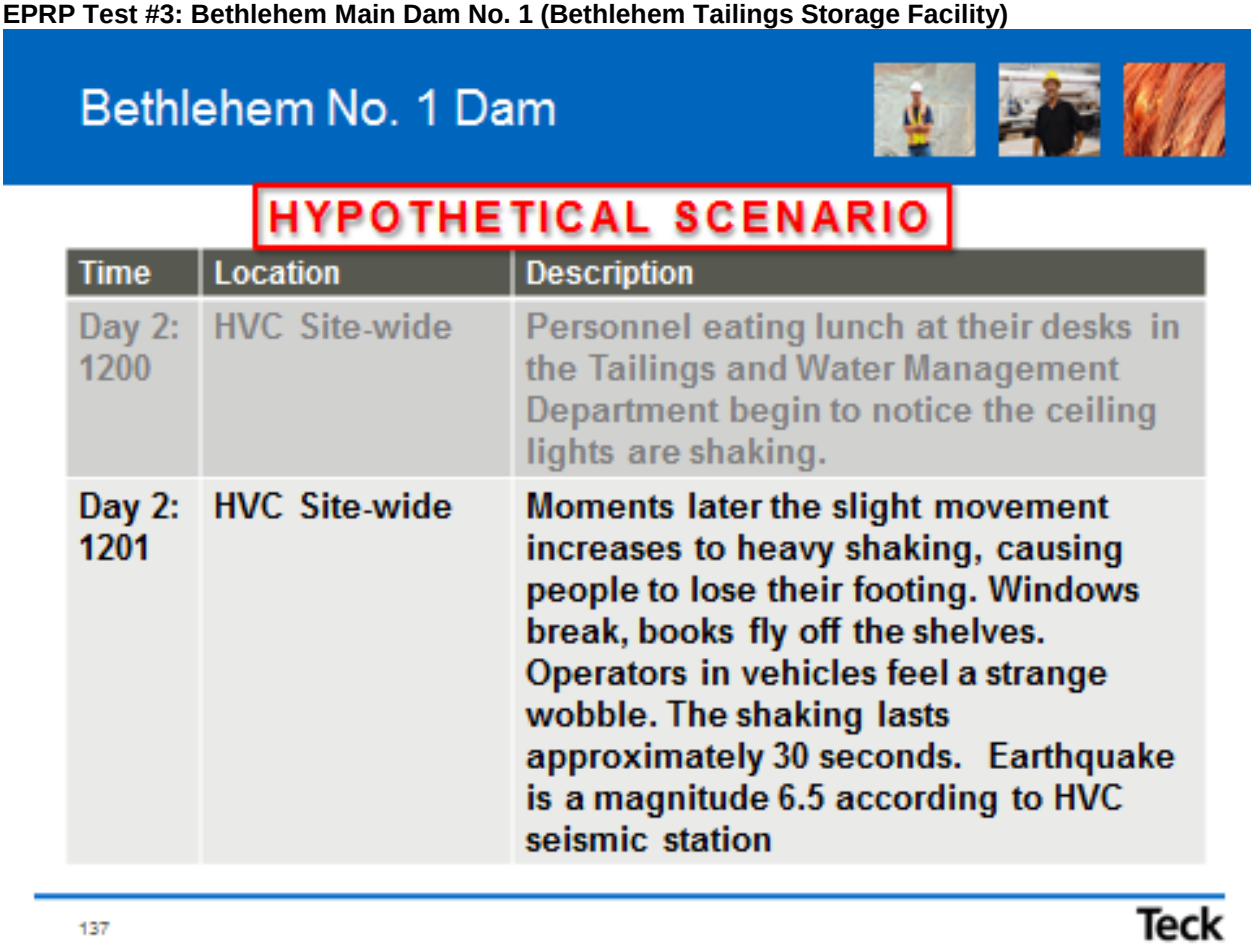
Revisions and potential areas for improvement related to Trojan Dam scenario:

- What are ideal pond water levels in winter and prior to freshet?
    - Using GoldSim to provide ranges of pond levels.
- Circulate a weather alert to members of the organization that might deal with water levels etc.
- Can you divert the spillway flow away from the pit, perhaps to Witches Brook?
- Would it be economic to consider repumping and opening up the mine again?

Observation: Indicates gap or potential opportunity for improvement

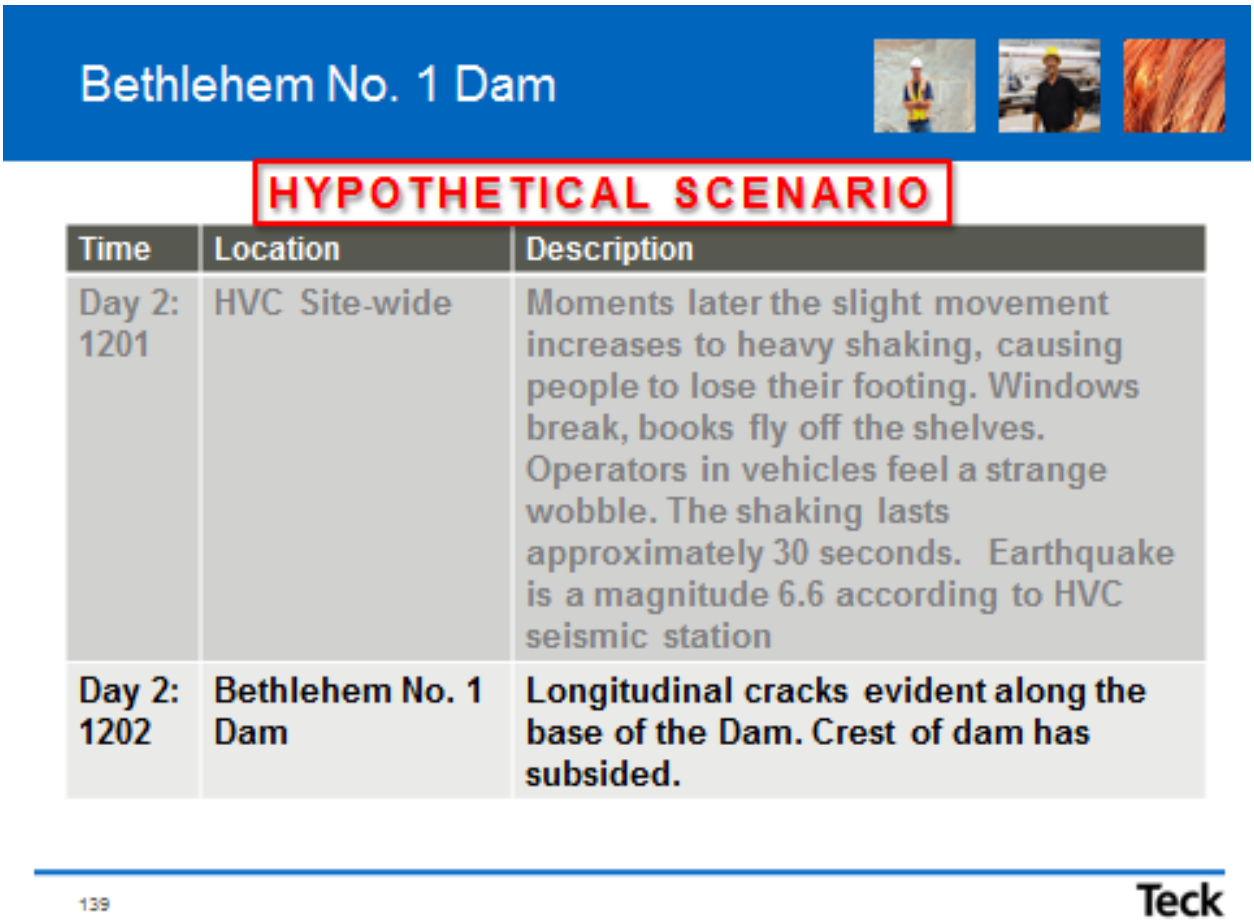
Day One – October 17, 2014

EPRP Test #3: Bethlehem Main Dam No. 1 (Bethlehem Tailings Storage Facility)



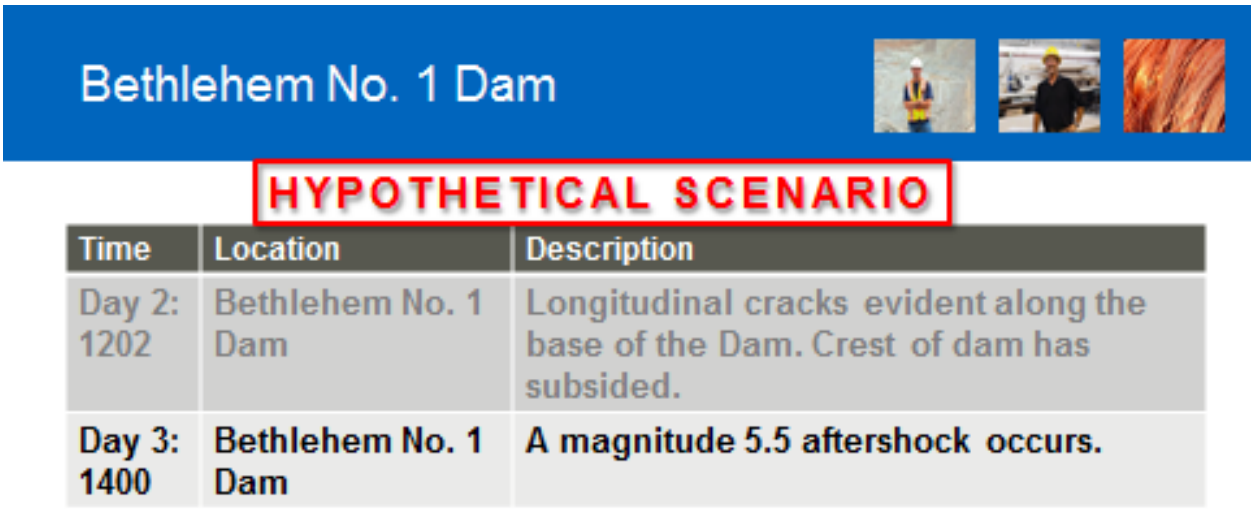
Bethlehem Main hypothetical scenario.
Response actions and general comments:

- Duck and cover.
- Site-wide count – trigger a site-wide evacuation, shut down entire site, most things shut down automatically.
- Dispatch should have a site-wide recall.
- Pit has a radar every 6min that should see changes in shape.



Response actions and general comments:

- Hypothetical scenario: After muster station roll call, 10 minutes after primary shake.
- Most people cannot go back in building; car keys are in dry meaning people cannot get home.
    - Put everyone in a single location and start releasing people.
- Set up a triage for social issues– communication to/from families.
- Look for obvious hazards in infrastructure; use satellite phones etc. to call night shift etc.
- Do broken windows etc. mean people cannot go in buildings?
- Helicopters might be locked down for government work.
- Start checking dams, walking or looking from truck from abutments.
- Safety of employees is primary.
- Dams have manual inclinometers.
- A crack found in the dam would be considered a large issue.



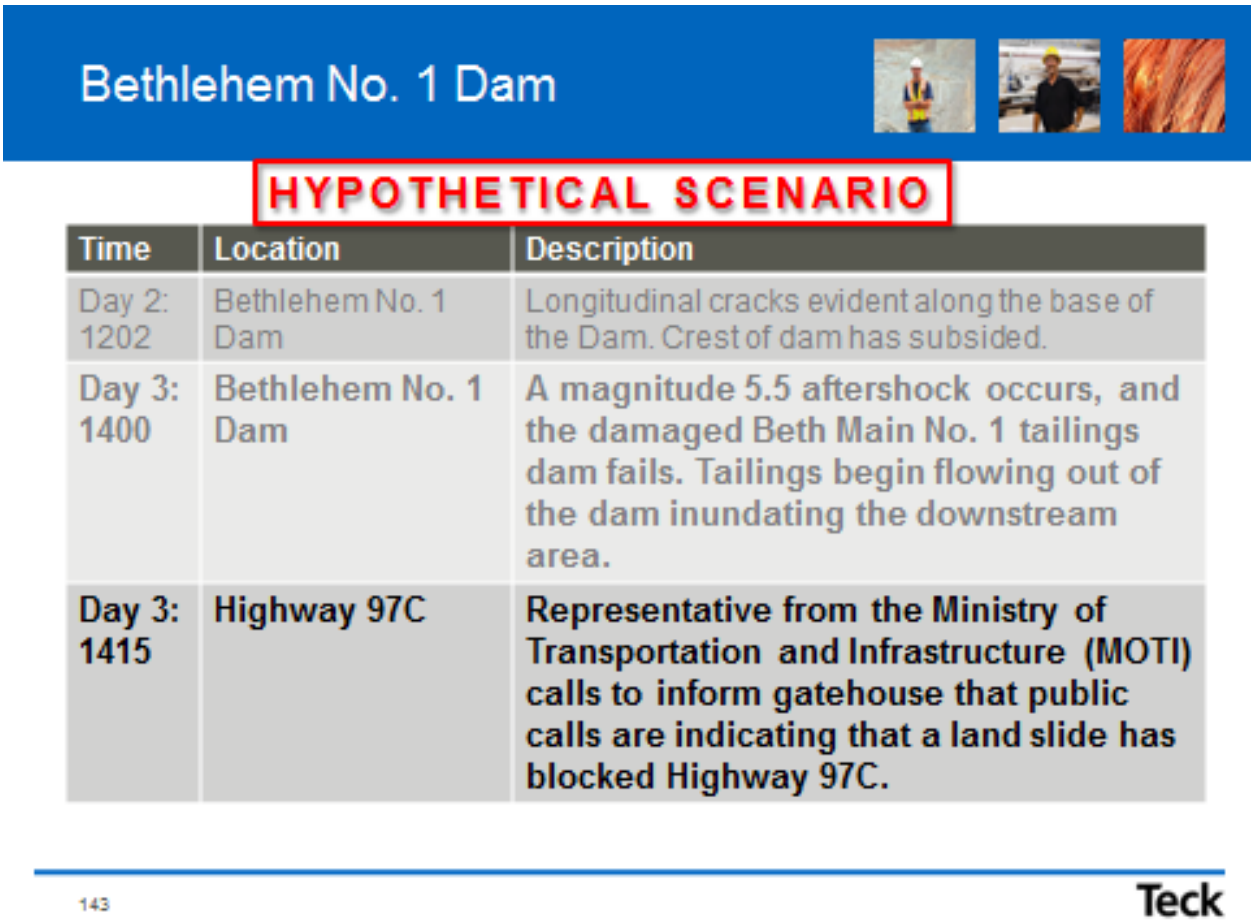
Response actions and general comments:

Prior to Day 2 of hypothetical scenario:

- From helicopter you might be able to see sand boils and evidence of liquefaction
- Close public road to Bose Lake.
- Check pond level in Bethlehem Main impoundment.
- Would it be safe to go back into the pit to retrieve prisms and radar to assess slope stability?

Day 2 of hypothetical scenario:

- Most of the shift would be back at mine, fixing buildings and Bethlehem Main.
- Geotech etc. checking pumps – this would take several days to complete.
- Planning sessions would take place to determine which areas of the mine might be safe to work in.
- Hypothetical scenario: Aftershock happens.



Response actions and general comments:

- Send crews both directions to check where the landslide might be

Bethlehem No. 1 Dam

HYPOTHETICAL SCENARIO

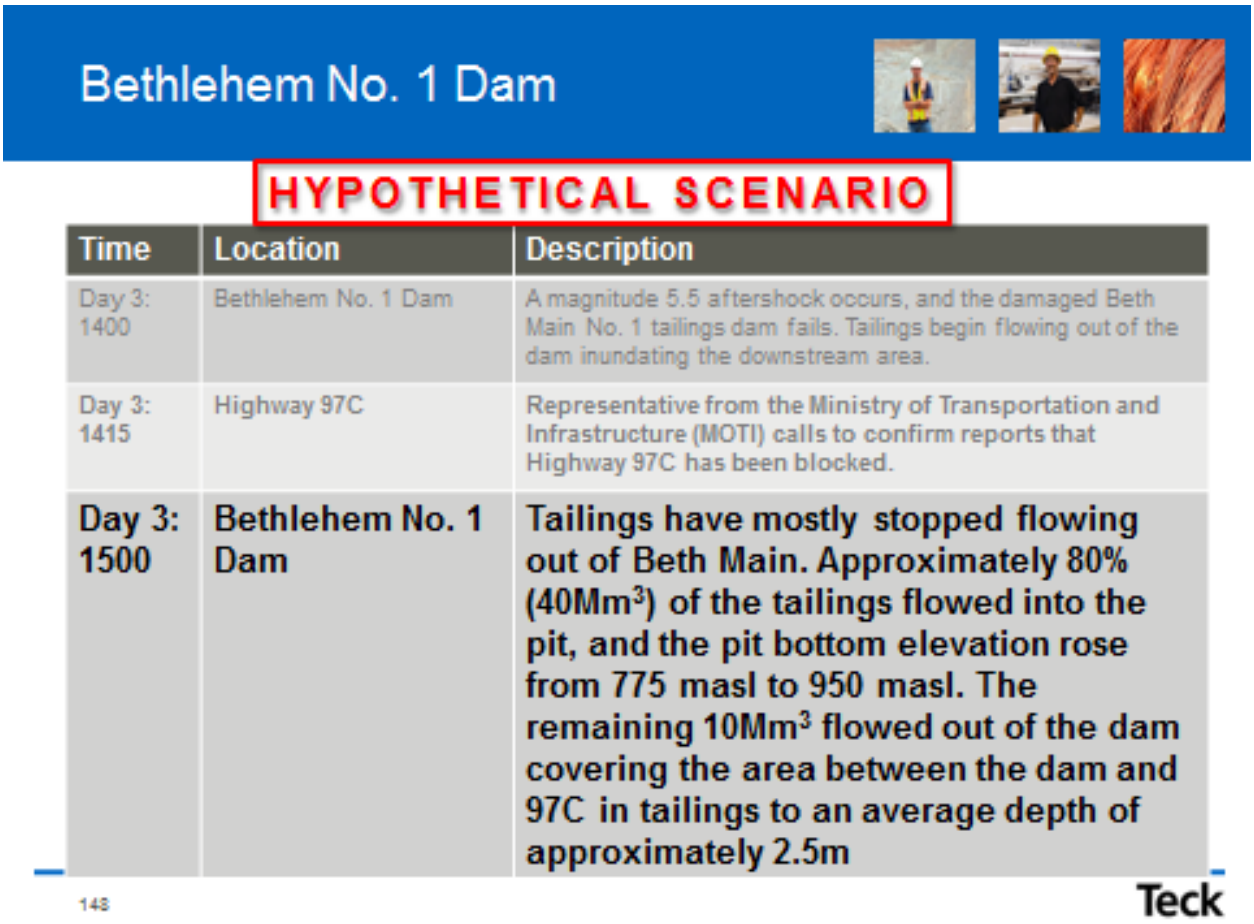
Time	Location	Description
Day 2: 1202	Bethlehem No. 1 Dam	Longitudinal cracks evident along the base of the Dam. Crest of dam has subsided.
Day 3: 1420	**Bethlehem No. 1 Dam**	**Workers investigating the landslide at Highway 97C observe that the Beth Main No. 1 tailings dam has been breached, and tailings are flowing out of the dam, inundating the downstream area, and crossing Highway 97C towards the pit and Witches Brook**

145

Teck

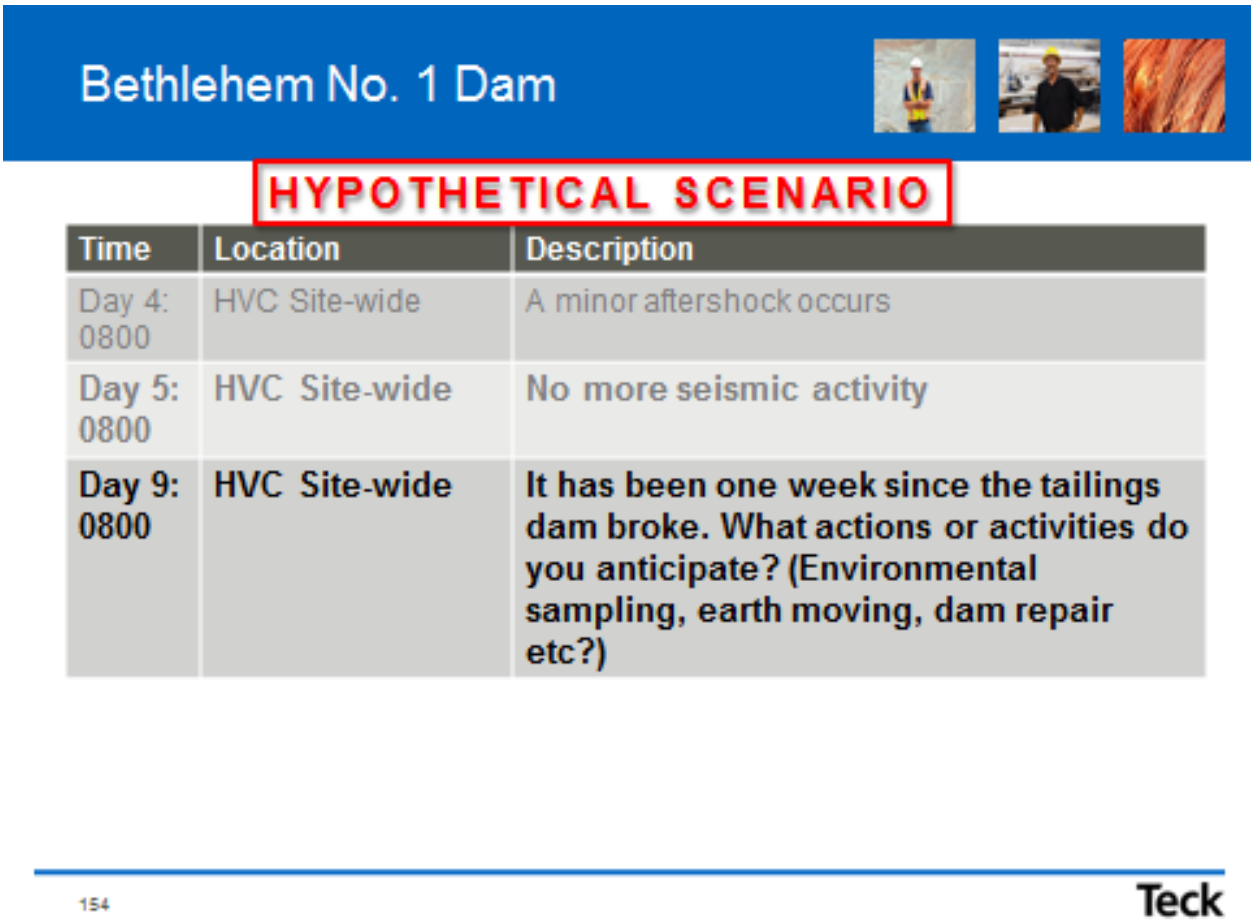
Response actions and general comments:

- Evacuate the pit again.
- Probably most people are at the muster stations, only people out are investigating the landslide.



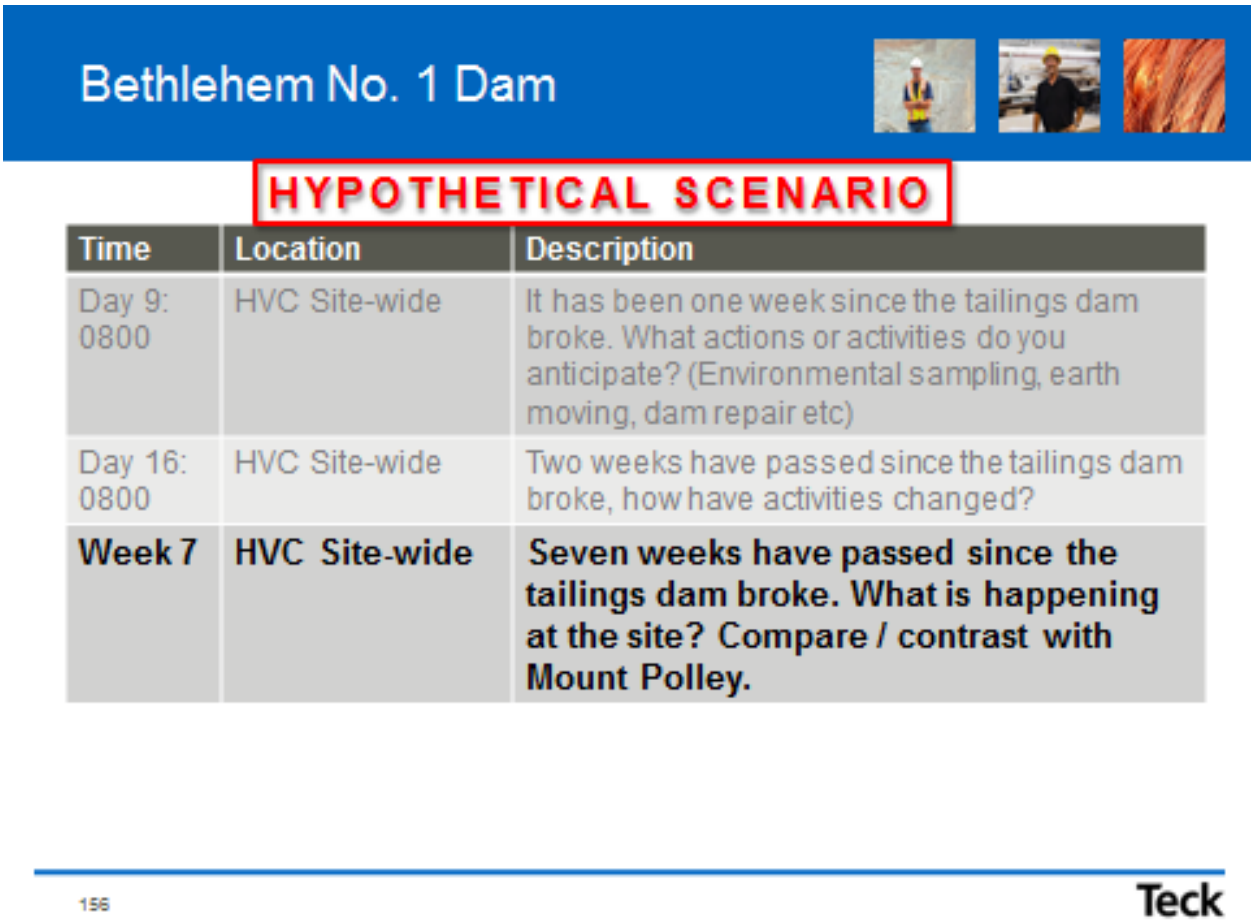
Response actions and general comments:

- Was Witches Brook impacted?



Response actions and general comments:

- Would there be a possibility to recover the tailings?
    - Comment: This priority could be last thing on list.
- Secure area around Bethlehem Main.
- Perform environmental sampling.
- Evaluate safety of personnel through inspections of buildings and dams.



Response actions and general comments:

- Containment of Bethlehem Main.
- Restore site utilities.
- Continual monitoring of the dams – install prisms.
- Would it be possible to pump out the tailings?
- Social license could make restarting very difficult, if even financially possible, PR consultations would be very intensive.

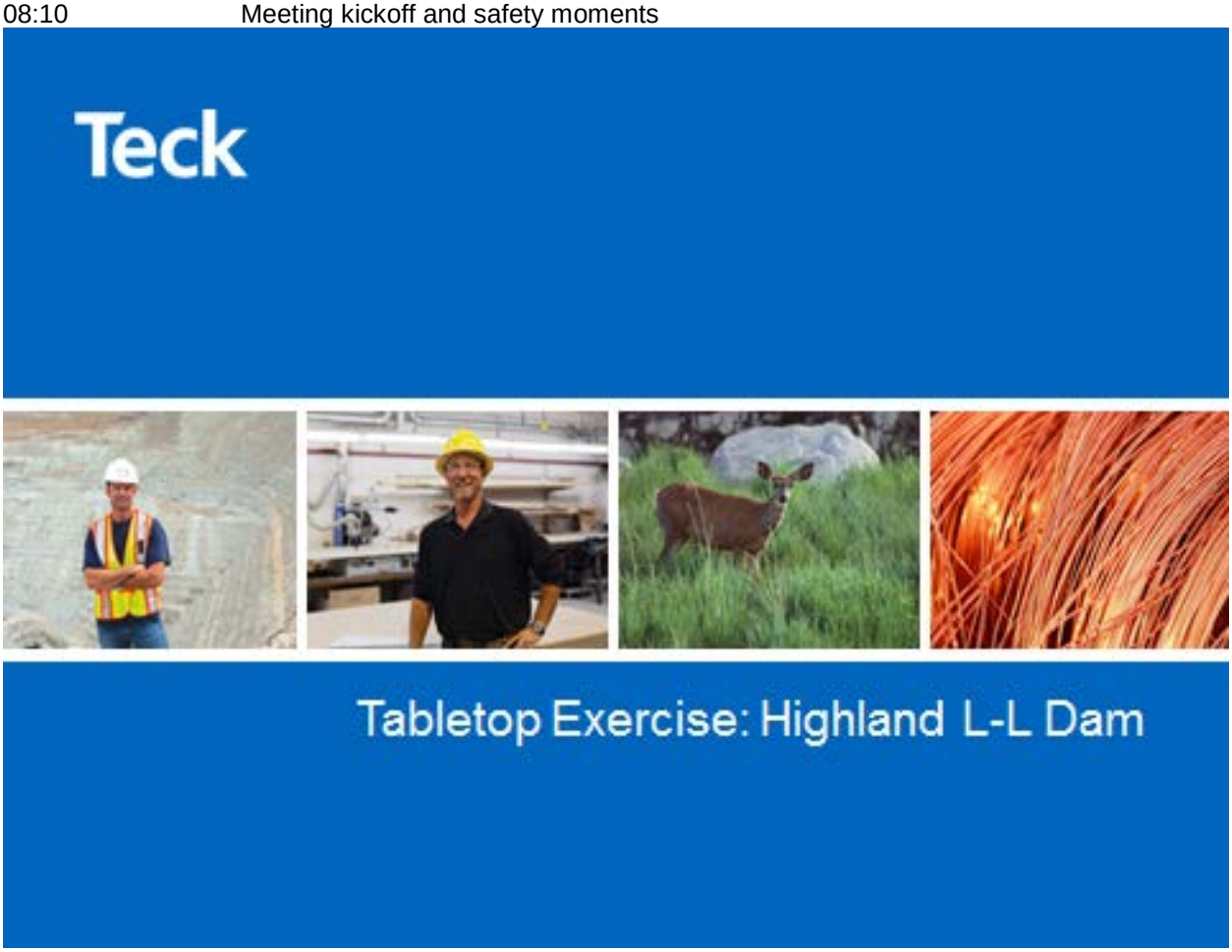
16:00: Closing comments and end of Session Day 1.

Observation: Indicates gap or potential opportunity for improvement

Day Two – October 17, 2014

EPRP Test #4: Highland L-L Dam (Highland Tailings Storage Facility)

08:10 Meeting kickoff and safety moments



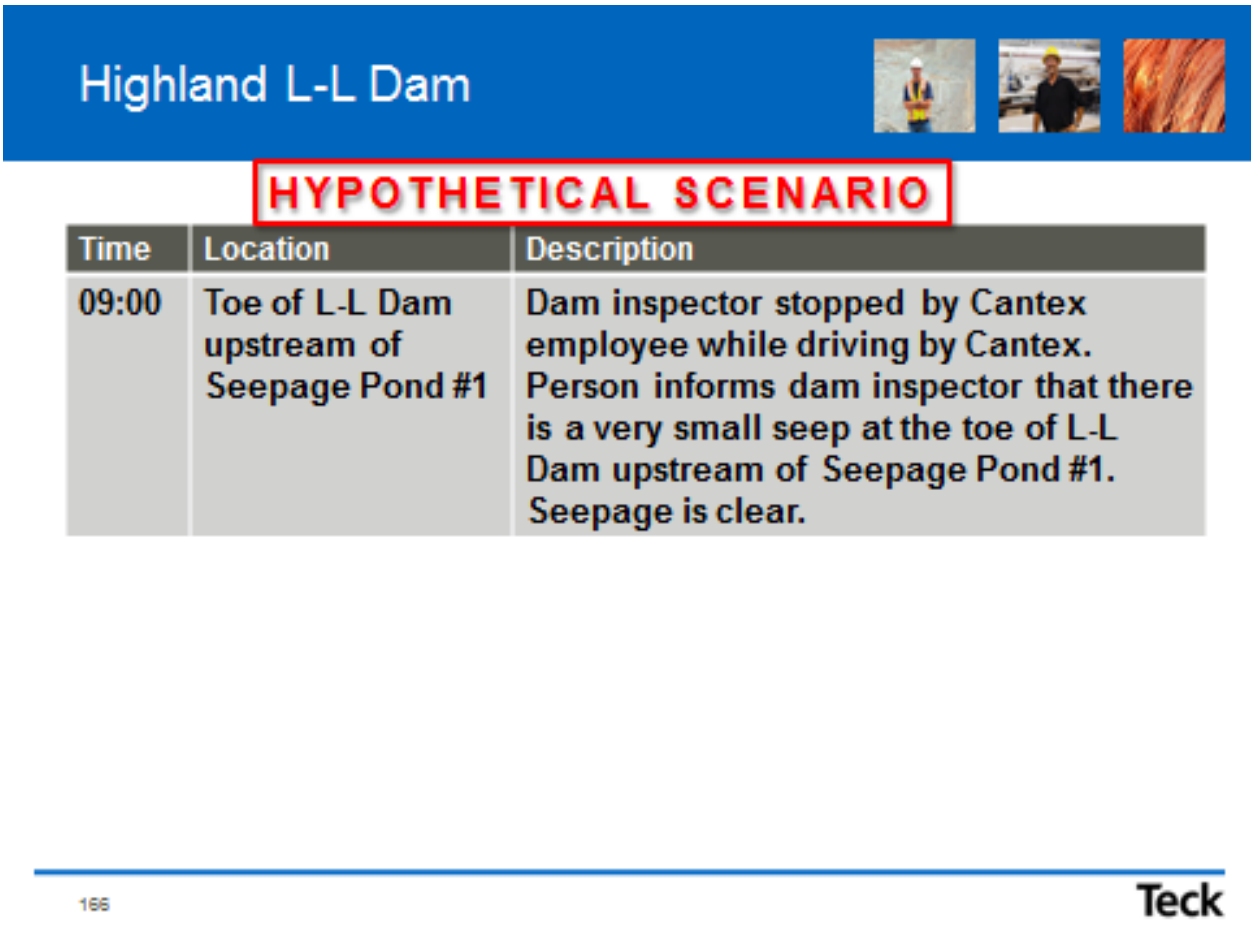
Tabletop Exercise: Highland L-L Dam

Neil Singh, Klohn Crippen Berger (KCB) project manager gave the following overview about the Highland TSF and potential effects of inundation:

- Overview on the different generations of the inundation studies performed for the Highland L-L Dam.
    - After draft in 2012 KCB extended the scope of the inundation study.
- There are antecedent flood conditions in the inundation studies – this means that the incremental effect in sunny day scenario is worst case.
    - Rainy-day incremental flooding scenario is not as bad incremental sunny day.
- Similar volumes would be released in 1279m and 1269m scenarios as the depth of the breach is comparable.
- A significant backwater exists in tributaries and the Thompson River.
- Assumption is that about 10% of the solids in the TSF would be evacuated at the same time as pond evacuation – the pond outflow cuts down into tailings so when it is done the tailings erosion is mostly done.
    - There could still be a 1-2km slide of tailings through the breach.
- Modeling of Sunny day breach due to piping resulted in a large breach because it is assumed that

the piping would occur at the top of the starter dam.

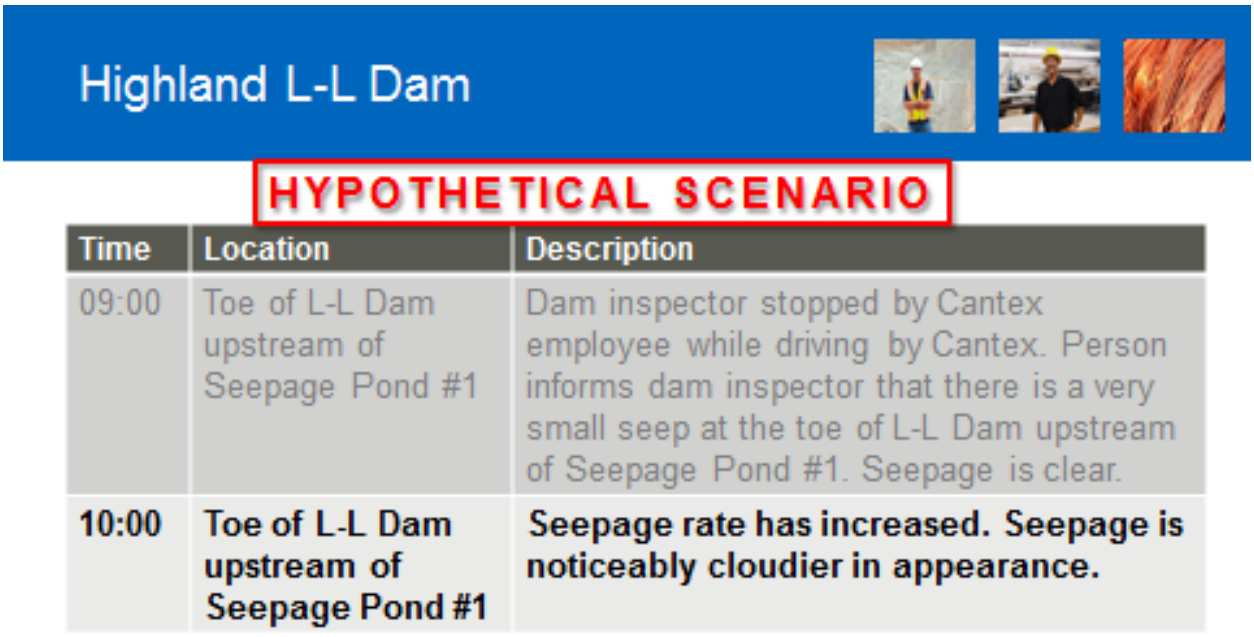
- What if there is a landslide as dam breach occurs?
    - This could result in a second wave of tailings when it breaches.
- Discussion on a center pond or raising L-L above H-H dams.
- Noncommittal discussion on how this might affect closure and safety factors.



Response actions and general comments:

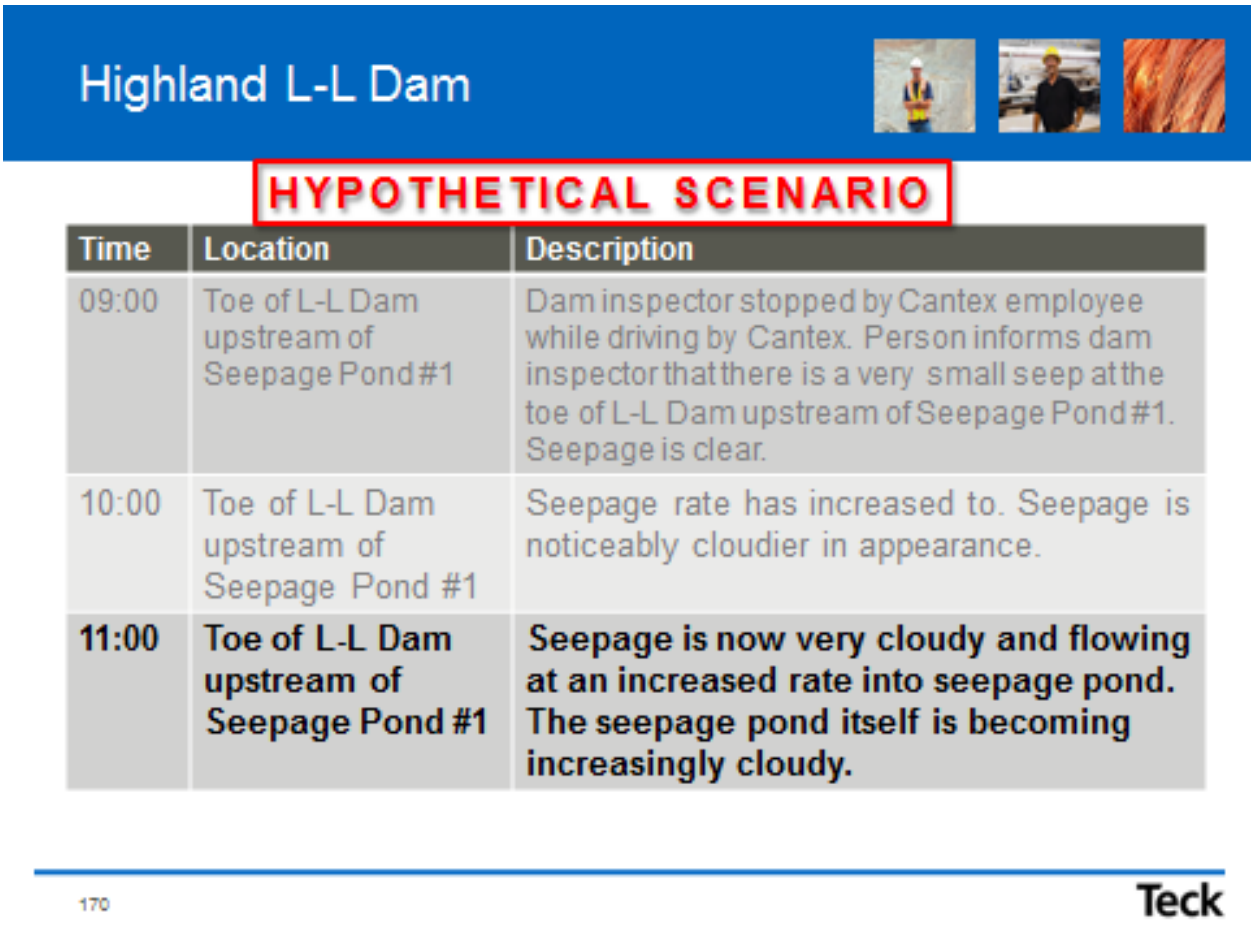
- Dam inspector would stop and collect a KCB representative and conduct inspection.
    - Go to the weir and look at flow rate, typically 800-1400L/min.
    - Can compare the current to historical weekly data (here is a data logger in all 3 weirs).
- Due to the natural fluctuations, a weekly weir inspection might not notice the increase in rate.
- Dam inspector would contact Field Supervisor and Superintendent Tailings and Water Management.
- Superintendent Tailings and Water Management would contact Security, General Manager, EHSC Manager, and operations and maintenance mangers.
    - The likelihood is that this would escalate up to Alert Level 1.
    - EOR would be contacted in Vancouver and provided with photos with maps.
        - KCB would evaluate need to change instrumentation Alert Levels from Yellow to Red (Alert Level 1 to Alert Level 3).
- EOR would ask for piezometer and toe inspections readings.
    - Every year KCB looks at piezometers and reviews stability analysis; look at stability and safety factor and issue yellow-red alerts, yellow is anomalous but no major problem, red is major safety concern.
- Earlier in 2014 there was a yellow alert on a piezometer –
    - Re-checked and looked at surrounding area, confirming the values were correct.
        - Realised that the piezometer alert level had not been updated to consider dam construction; once alert level was updated the alert was downgraded.

- If the seepage phenomenon is easily explained then it may not be a worry, if it cannot be explained then activate Alert Level 1;
    - Group discussion: some confusion about when to escalate and contact General Manager, but he would like to be contacted sooner rather than later.
- Observation: Update Alert Level 1 call-out update to include General Manager.



Response actions and general comments:

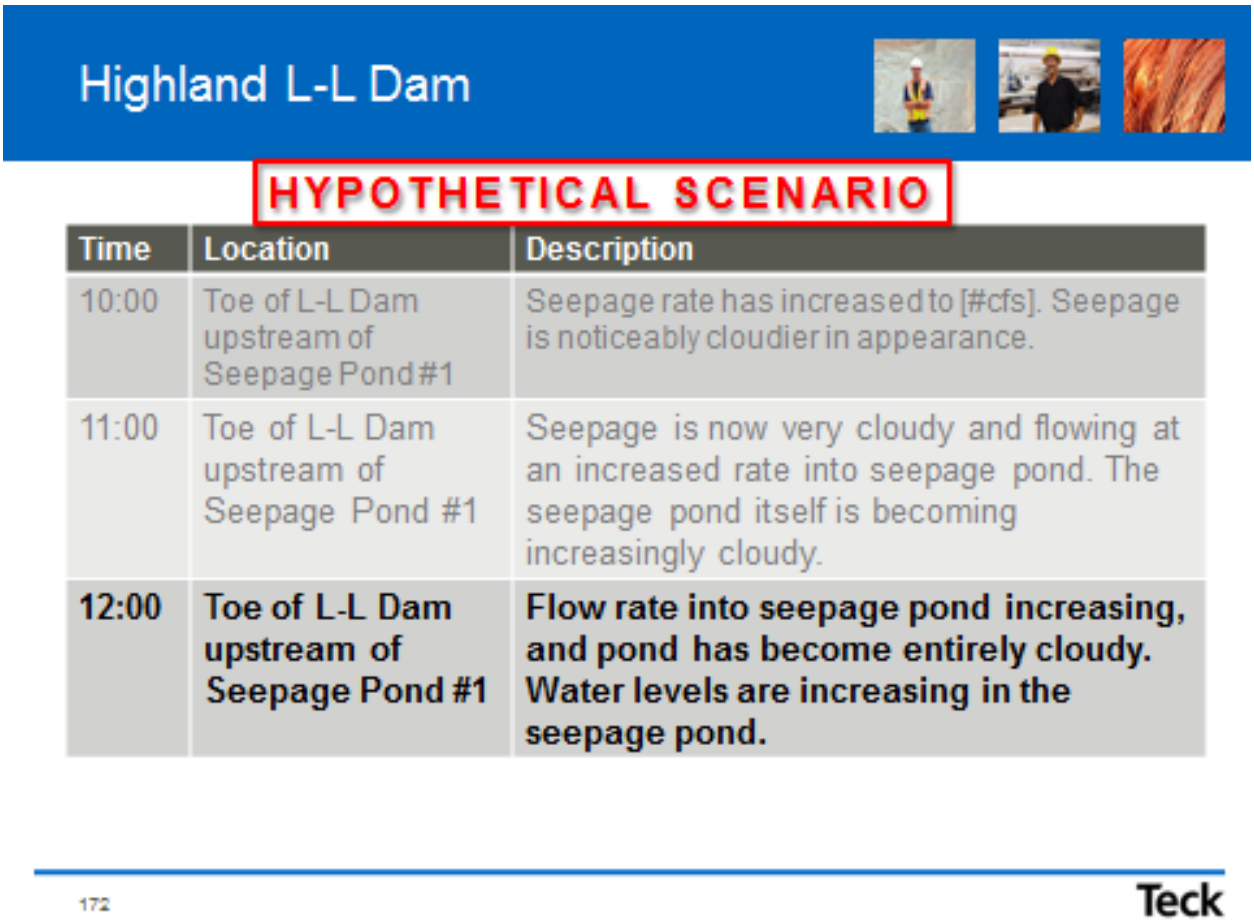
- Assign personnel to monitor closely if cloudy seepage is present.
    - If flow rate/appearance indicates increased concern.
- Mobilizing invert filter material, could attempt to mitigate the situation.
    - Get trucks moving sand and gravel to the location.
- Considerations: Shut off tailings lines? Pump to 24 Mile Lake?
- Err on the side of safety, therefore start to evacuate the dam in a controlled manner – this is like an Alert Level 2 with elements of Alert Level 3.
    - Convene crisis committee and orderly evacuation.
- Suggested a head count, due to radio dead zones – people on dam top can communicate with bottom of dam.
- General Manager agrees with comment from participant to initiate pre-evacuation communications and to contact Teck Corporate.



Response actions and general comments:

- Until this point in the scenario KCB probably still at site reading piezometers and other instrumentation.
    - Non-essential personnel are removed;
    - Security would be posting a rescue/monitoring team on standby for KCB crews.
    - There are camera feeds of the dam that can be remotely viewed.
- Between 10am and 11am scenario time:
    - Dump sand on problem area
    - Cantex to dump and move some of the stockpiles from the base
    - Mine from buttress if necessary to place on seep (place sand as quickly as possible).
- Point raised that dependent on location of situation heavy equipment would not be able to make it without a road; it could take a day to make a road.
- Observation: Could there be bags of material prepared in case of emergency situation?
- At this point evacuate all personnel off dam.
- Entire site is shut down – full blown Alert Level 3.
- The Mill can be shut down in an hour, at 10am start shutting down
- Crisis management is up and running in Vancouver;
    - Teck Corporate would likely send additional resources;
    - Consider hiring helicopters to block access, attempt to block air access;
    - EOR would still be in Vancouver and notifying KCB management and review board
- Observation: Is there an external GIS server?
- Observation: Can KCB Project Manager be hooked into cameras at dam?

- Observation: Has it been addressed that Superintendent Tailings and Water Management has authority to shut down the Mill at Alert Level 1?
    - The junior foreman needs to either find the senior or makes the call.
    - Give presentation and make sure that the mill foreman knows that in abnormal situations General Manager or designate can make the call.
        - There is always someone in the control room that can contact foreman/supervisor on the floor. The mill chain of command is overruled.



09:37

Response actions and general comments:

- Pre-evacuation by 10am.
- Evacuation by 11am.

Highland L-L Dam

HYPOTHETICAL SCENARIO

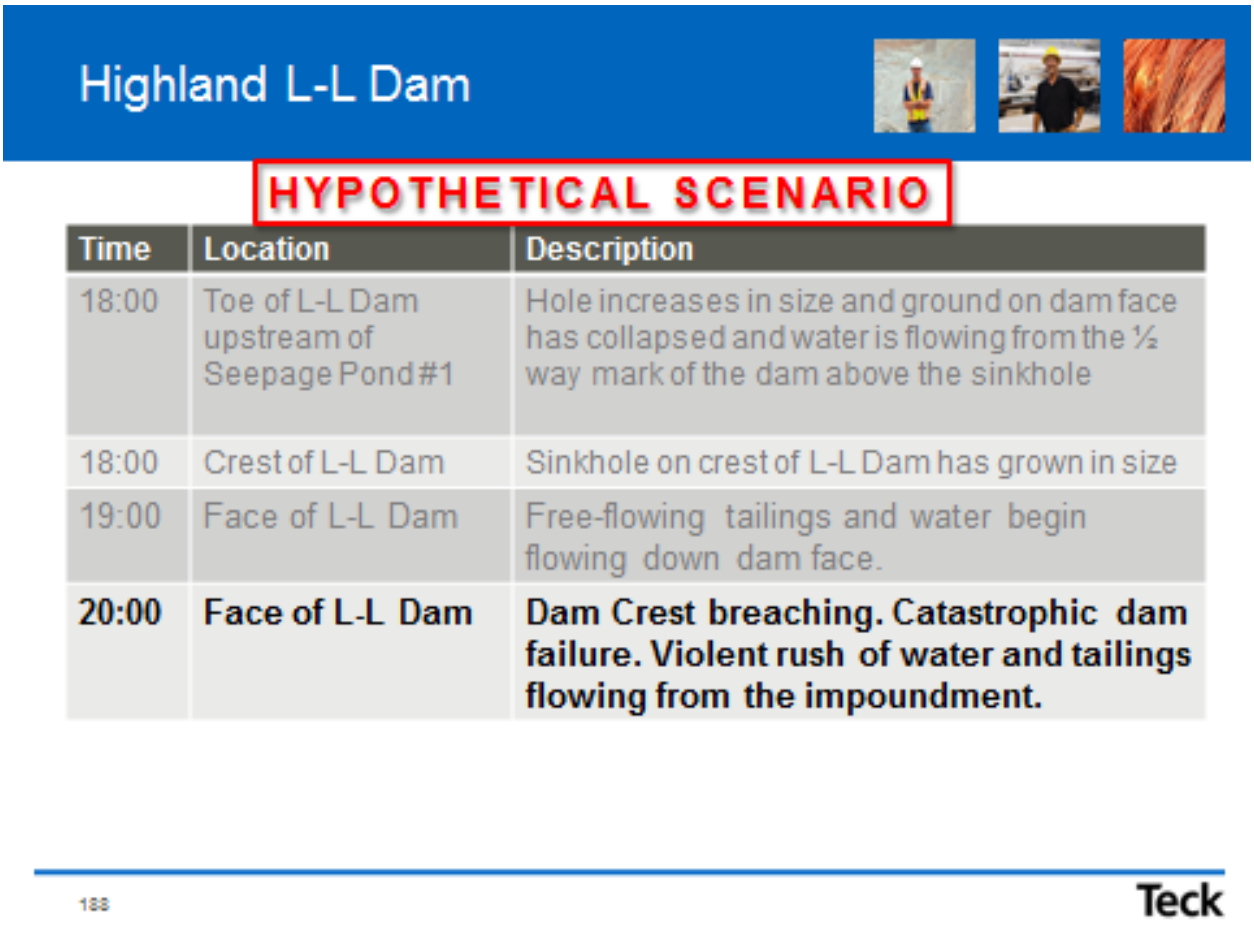
Time	Location	Description
15:00	Toe of L-L Dam upstream of Seepage Pond #1	A hole develops at the top of the saturated area. Muddy water flows at an ever increasing rate out of the base of the saturated area. Seepage ponds are overtopping and muddy water has entered Pukaist Creek.
16:00	Toe of L-L Dam upstream of Seepage Pond #1	Muddy water continues to flow at an ever increasing rate out of the base of the saturated area. Seepage ponds are overtopping and muddy water has entered Pukaist Creek.
17:00	**Crest of L-L Dam**	**Sinkhole evident on crest of L-L Dam**

182

Teck

Response actions and general comments:

- Discussion of sirens or other call-out procedures (e.g. robo-calling cell phones).
    - Community meeting consensus was no phone system – they want an audible alarm.
- Observation: Teck needs to pursue the how to alert people.
- Spences Bridge etc. to be called and get the word out.
- Did an inventory of residential properties get developed?
    - Updated L-L Dam inundation study includes summary of population and structures at risk.
- Sign in/out list is available at security segregated by location of work.
    - For HVC personnel, the supervisors should know location of personnel.
- Spatsum area new protocols have been tested: there is a new lock and gate, new sign out procedure, new hard phone line (not connected to lights), cell phone now works there.
- Observation: Add lights to the hardline at Spatsum.



Response actions and general comments:

- Although we said pull everyone at 11, depending on situation there might be people on scene until 3/4pm scenario time trying to cover seep or build internal containment dam.
- Observation: Is there possibility of placing 100-200 large, filled bags under cover for emergency?
- Downstream tank traps might not be effective as they are too small to break the flow of a breach.
- Observation: Is there a method of slowing the breach water down?
    - Any method would require permitting a new dam.
- Light the dam with mobile Cantex lights or flares.

Highland L-L Dam

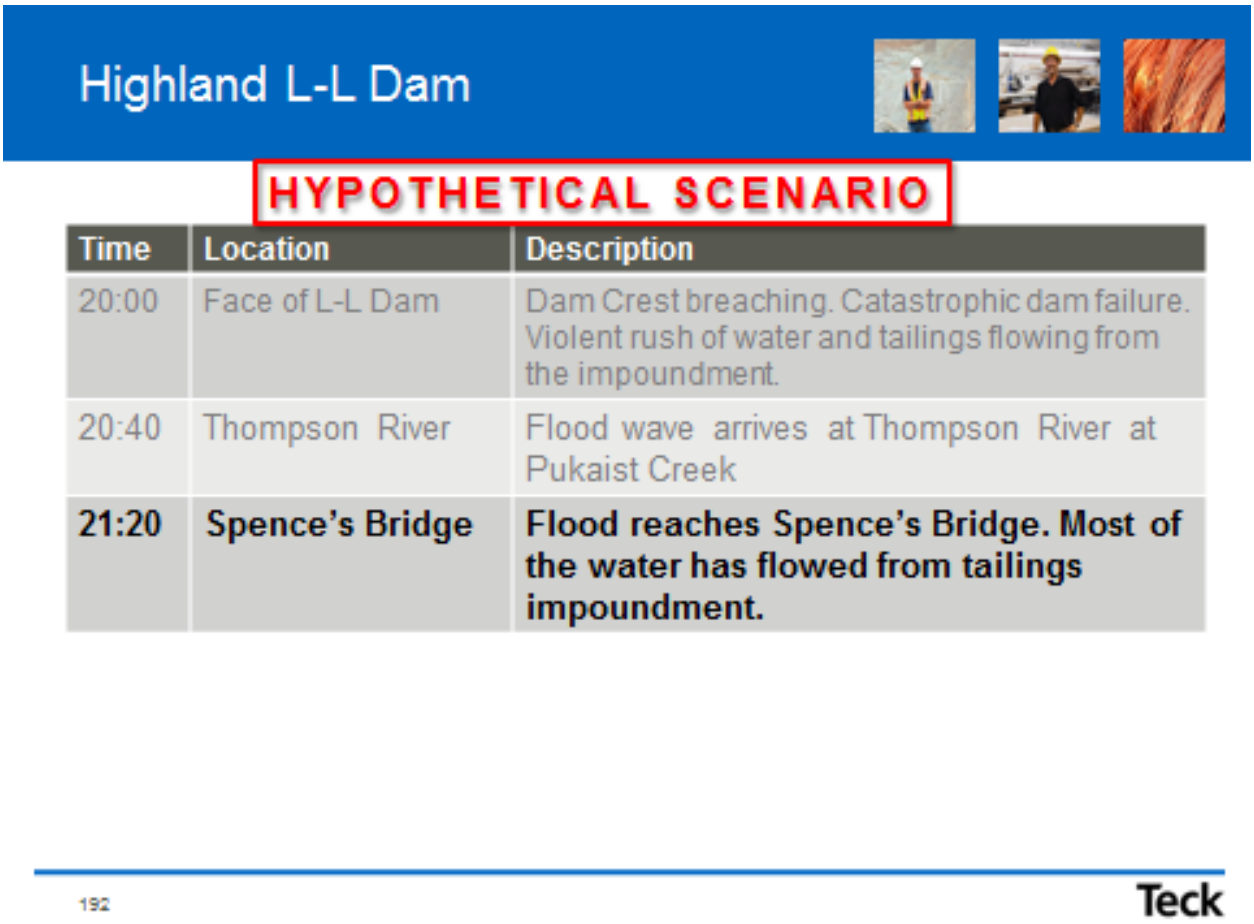
HYPOTHETICAL SCENARIO

Time	Location	Description
19:00	Face of L-L Dam	Free-flowing tailings and water begin flowing down dam face.
20:00	Face of L-L Dam	Dam Crest breaching. Catastrophic dam failure. Violent rush of water and tailings flowing from the impoundment.
20:40	**Thompson River**	**Flood wave arrives at Thompson River at Pukaist Creek**

190

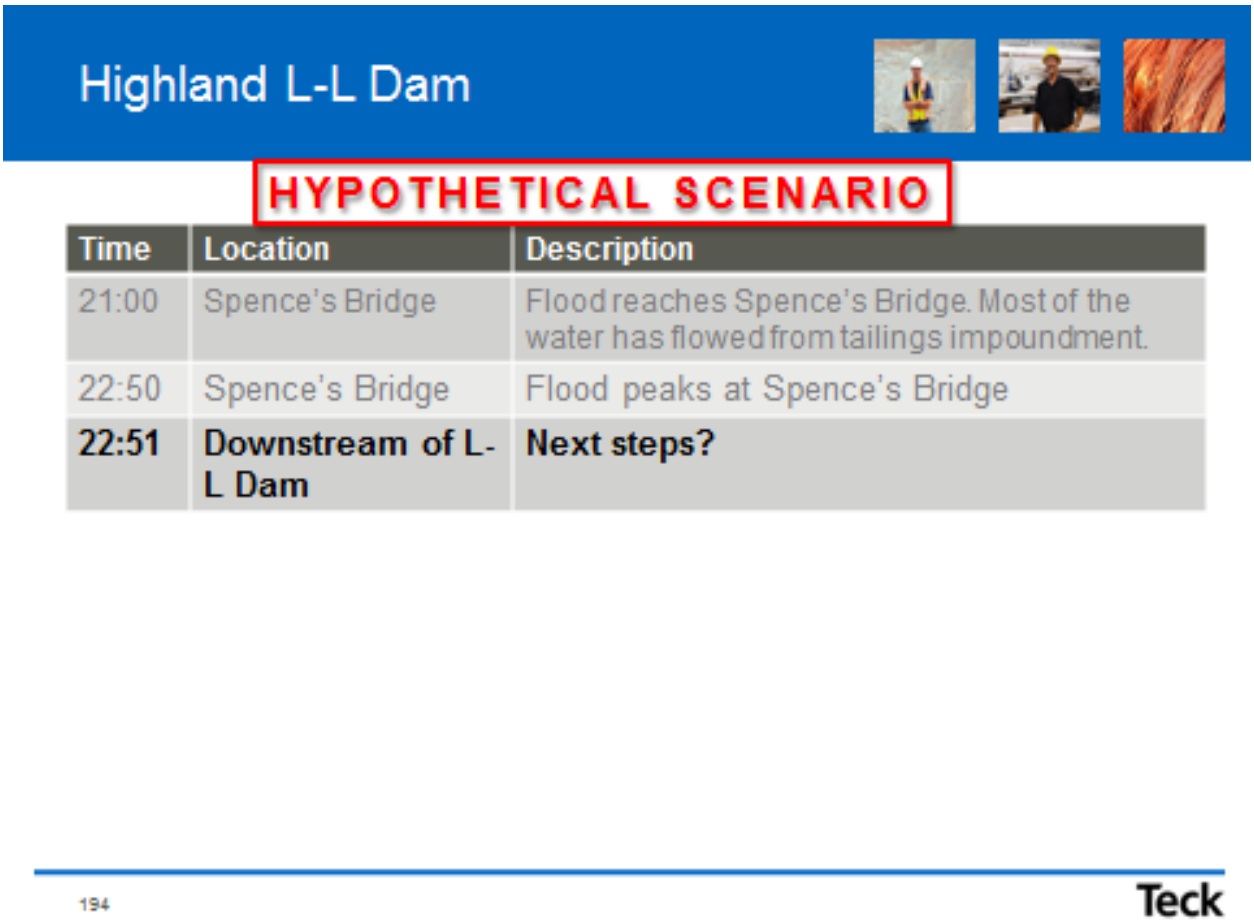
Teck

10:24



Response actions and general comments:

- Railways would have to be shut down well in advance – could have large ripple effect on CN and CP rail tracks.
- Observation: Evaluate cost sharing of warning sirens near rail tracks.
- Observation: Is there a list of junctions or other method of telling CP and CN where they should evacuate/not use?
- Crisis management team would have contacted MOT or TNRD etc. by ~11am to clear highway.
- Is TNRD capable of mobilizing all the persons affected/evacuated?
- Observation: Check with TNRD about direction of evacuation and the safe high points.
- Observation: Does TNRD have in their containers flash lights etc. to aid to search and rescue?



Response actions and general comments:

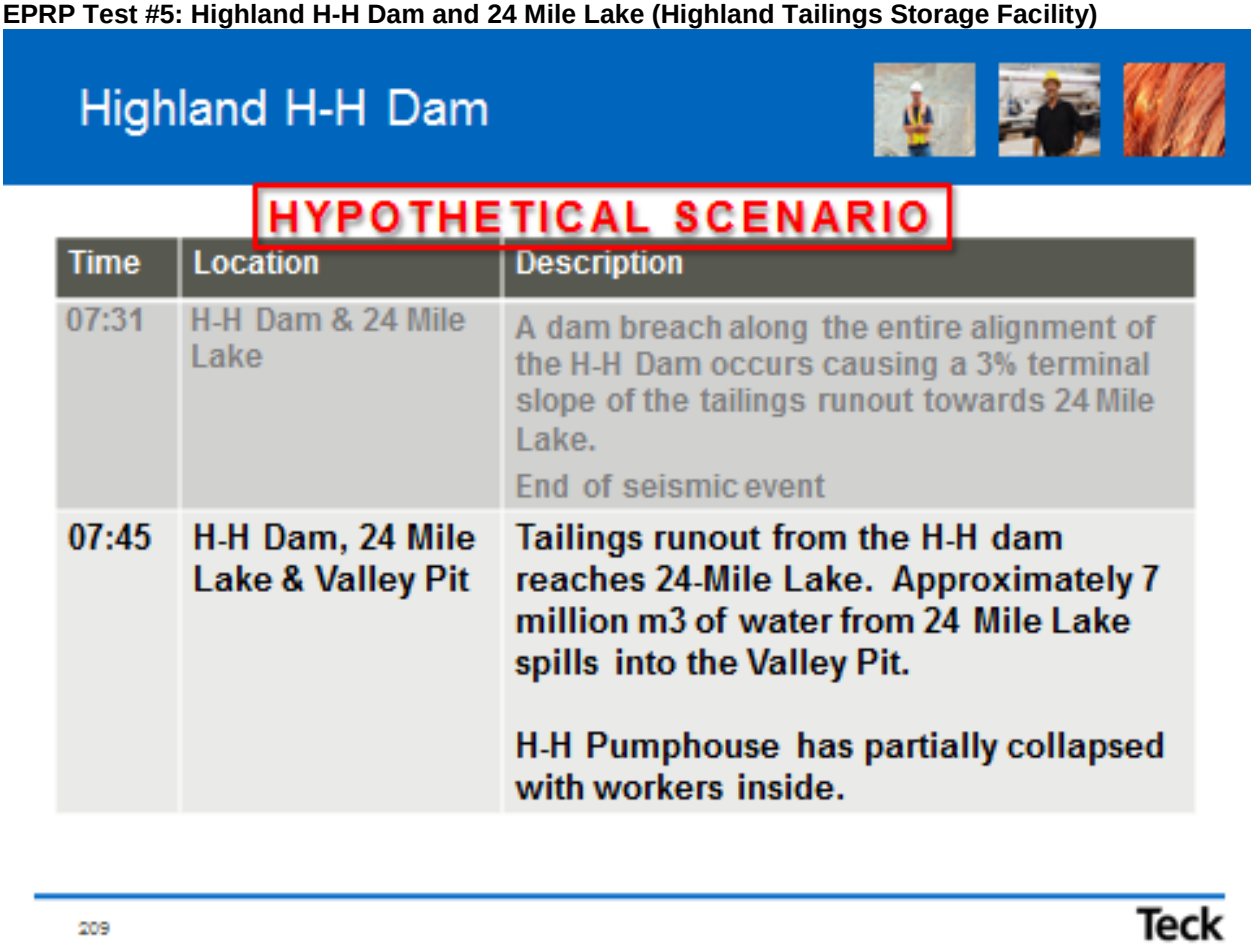
- Crisis management continues.
- Water sampling efforts would continue.
- Investigate further potential damage ongoing.

10:45 Break

Observation: Indicates gap or potential opportunity for improvement

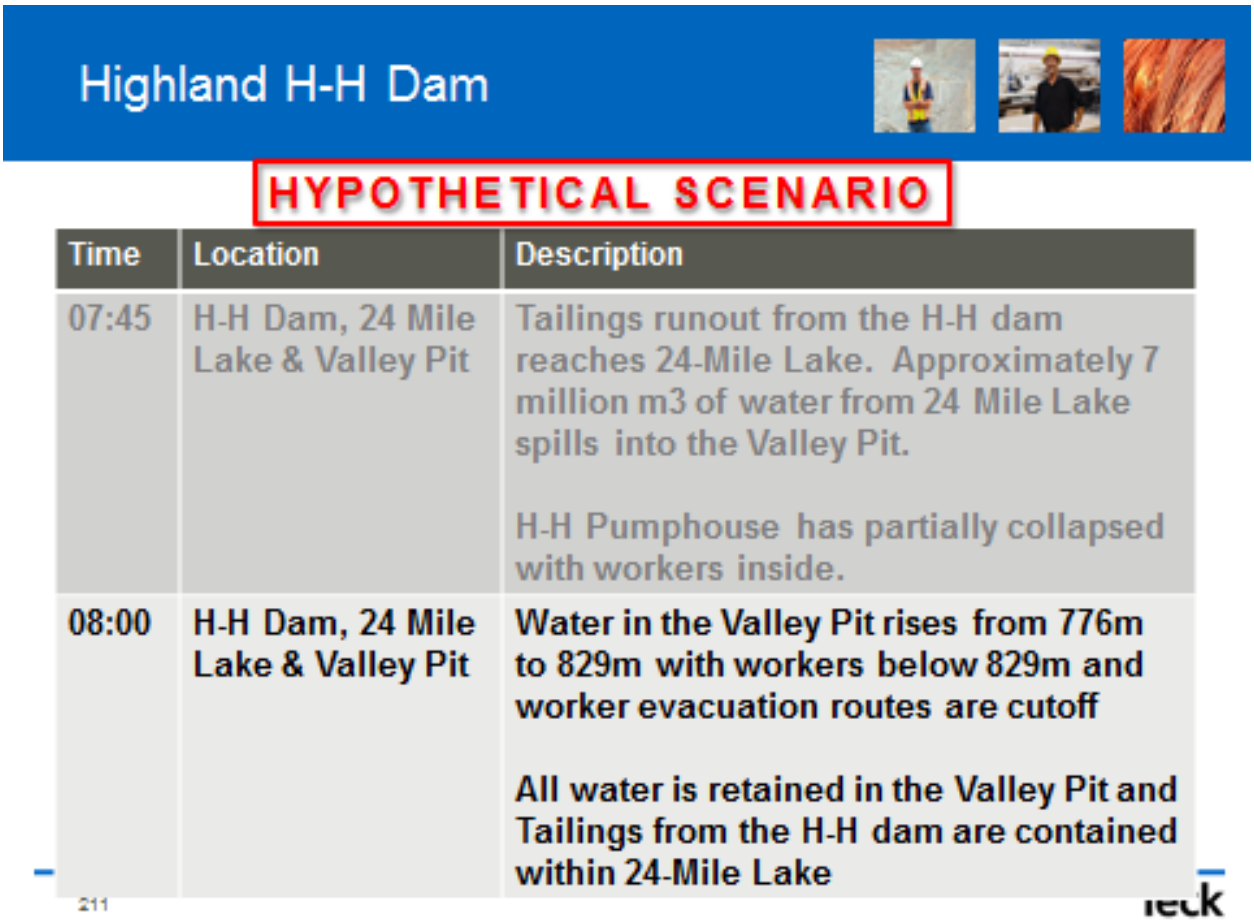
Day Two – October 17, 2014

EPRP Test #5: Highland H-H Dam and 24 Mile Lake (Highland Tailings Storage Facility)



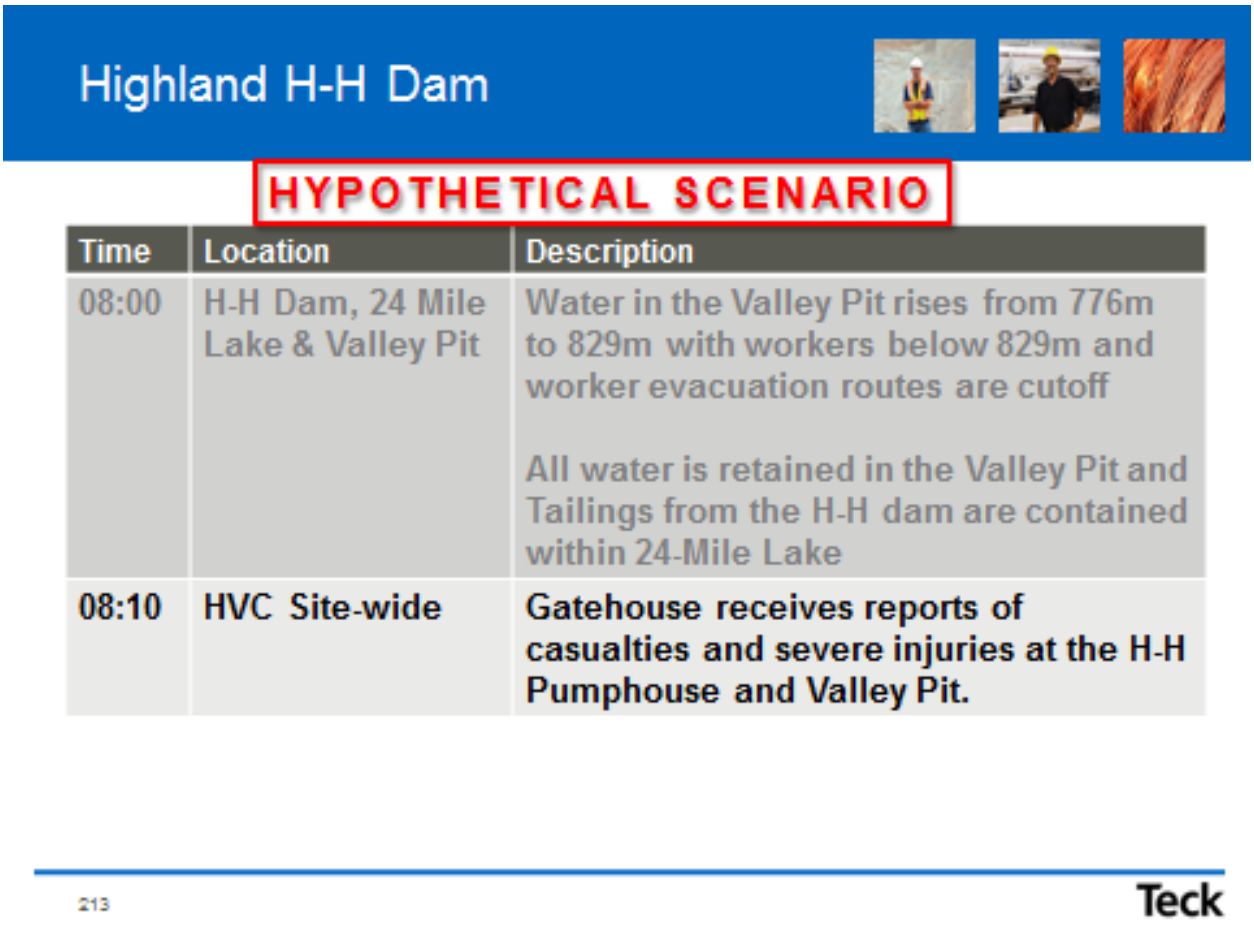
11:00
H-H Dam Scenario.
Response actions and general comments:

- Shut down mill and evacuate the pit as soon as possible after earthquake.
- Evacuate to muster points.
- Pit personnel will be channeled and moved in a direction away from harm
    - Would they know what the safest direction is?
- Hypothetical scenario: Material is flowing into 24 Mile Lake and displacing water towards Valley Pit.



Response actions and general comments:

- There is almost no equipment near the pump house.
- Is there enough transportation to get out of the pit along the south side?
    - The designated muster station may not make sense as it is across the path of the 24 Mile Lake egress route.
- The reservoir line needs to be shut down.
- Pit egress will be underway due to earthquake and going to the usual muster stations.
- Observation: Establish new south side muster station.
- A rush of water down the north ramp may erode buttress and result in wall failure.
- If people are stranded on a bench, how can they be kept alive prior to rescue (days)?
- If radios are up, get to an overlook and radio in observations and direct first responders.
- If splitting Emergency Response Team (ERT) there would be one incident commander and designated sub-commanders.
- There is a helicopter landing zone near the main office.
    - There is no jet fuel on site.
- Radio procedure: If ERT is paged then there is supposed to be radio silence.



Response actions and general comments:

- As a result of confirmed casualties (due to hypothetical scenario), the Crisis Management Team would start to think about grief counselling and getting the BC Ambulance into site.
- Teck Vancouver would be instigating One Voice to handle PR but there is no way to stop communication of individuals.

Response actions and general comments:

- Observation: What is the authority of TNRD with regards to helicopters?
    - There are some custom man baskets that HVC used to build the stockpile domes that could be used to evacuate people.
- Observation: Establish new muster area on south side of the Valley Pit, perhaps near crusher?
- Observation: Keep 24 Mile Lake water levels low.
    - There is a draft Standard Operating Procedure (SOP) that lists ~1Mm3 as the target, currently the lake is below the target level.
- Having well understood evacuation routes is essential, especially within.
- Observation: Do we know where the best observation points are?
    - ArcGIS has the functionality to create these 3D visibility maps.

12:00: Lunch

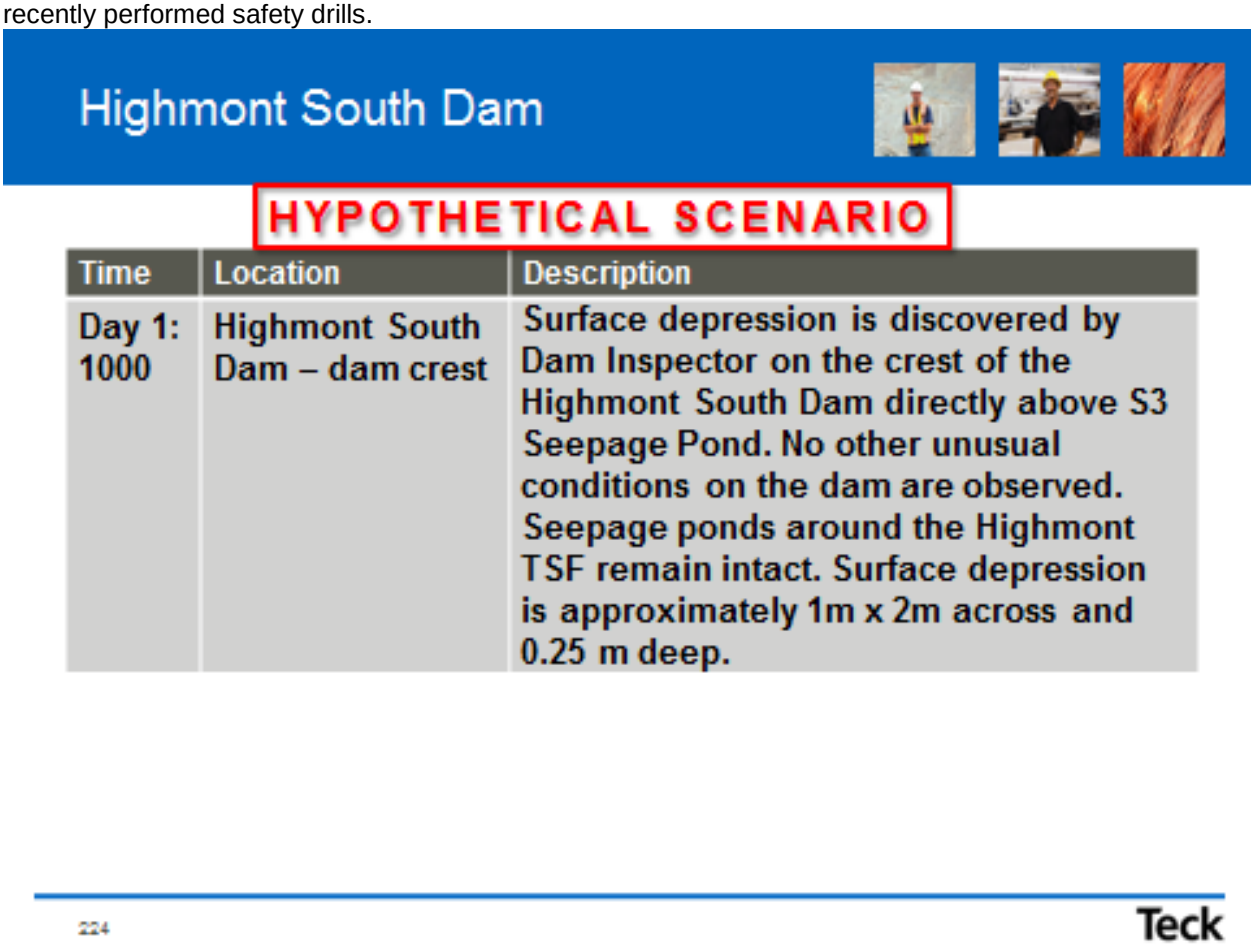
Observation: Indicates gap or potential opportunity for improvement

Day Two – October 17, 2014

EPRP Test #6: Highmont Dam South (Highmont Tailings Storage Facility)

12:36

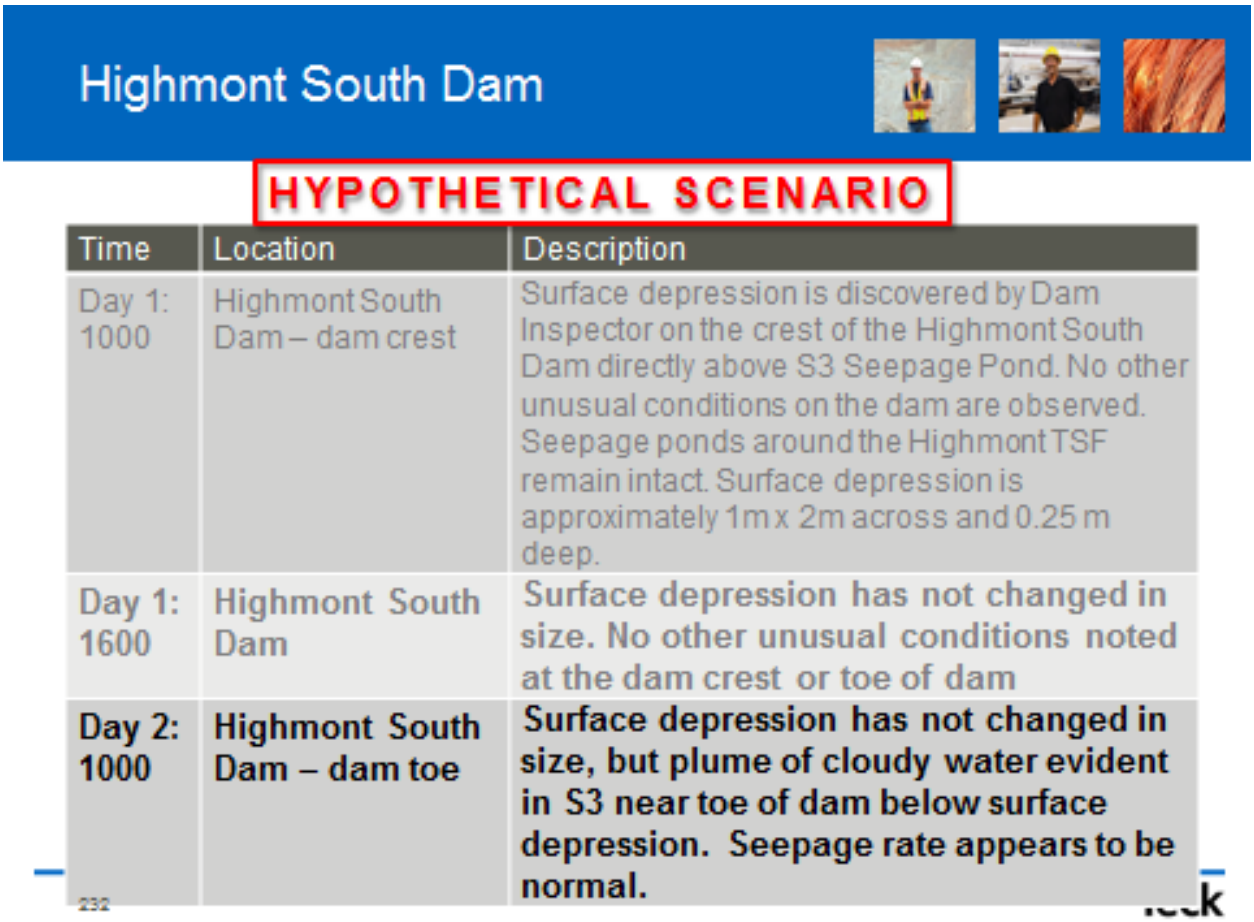
Resume session. ERM facilitator Josh Hancock shares earthquake safety moment about ERM offices that recently performed safety drills.



Highmont South Dam Hypothetical Scenario.

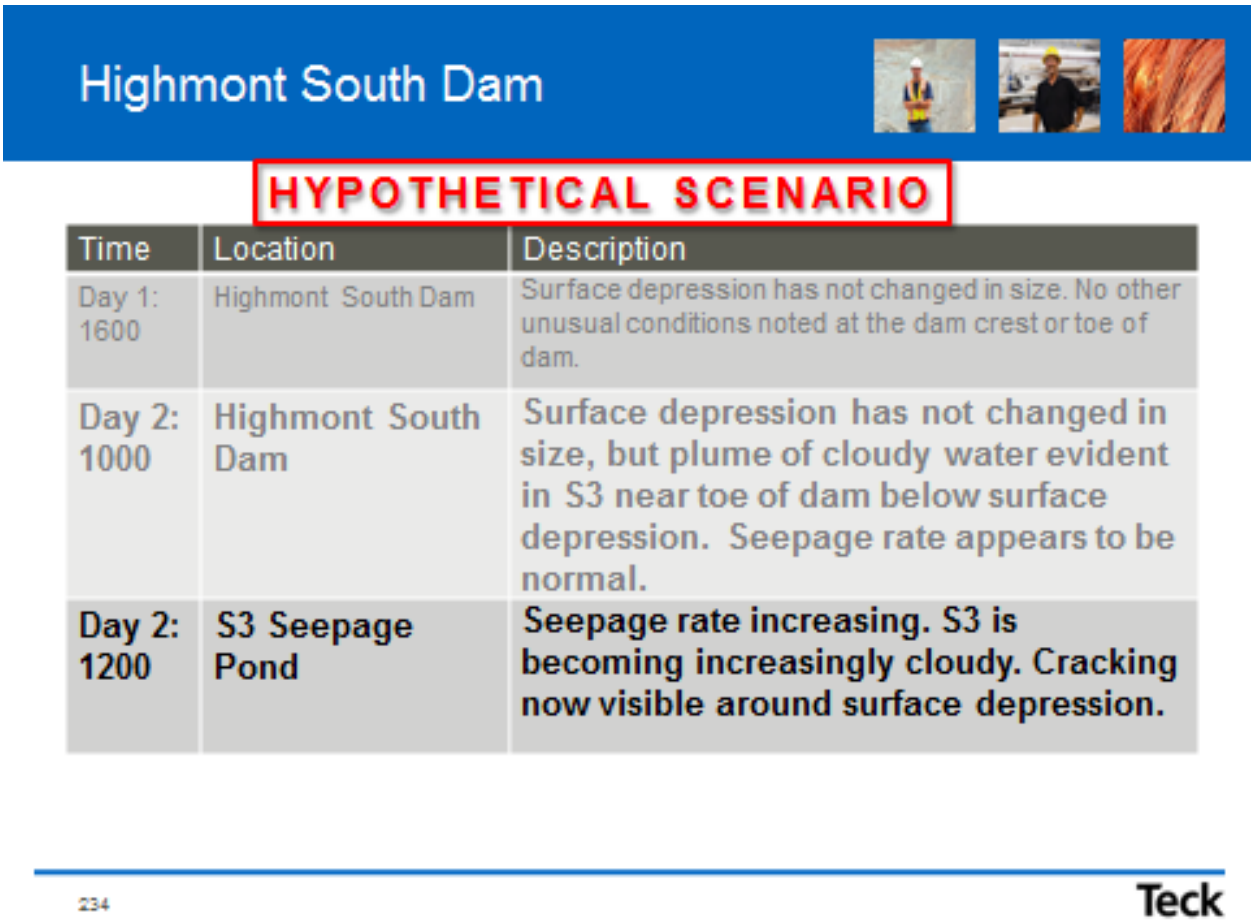
Response actions and general comments:

- Dam inspector would take notes and pictures, share observations with Superintendent Tailings and Water Management, and then call KCB engineers.



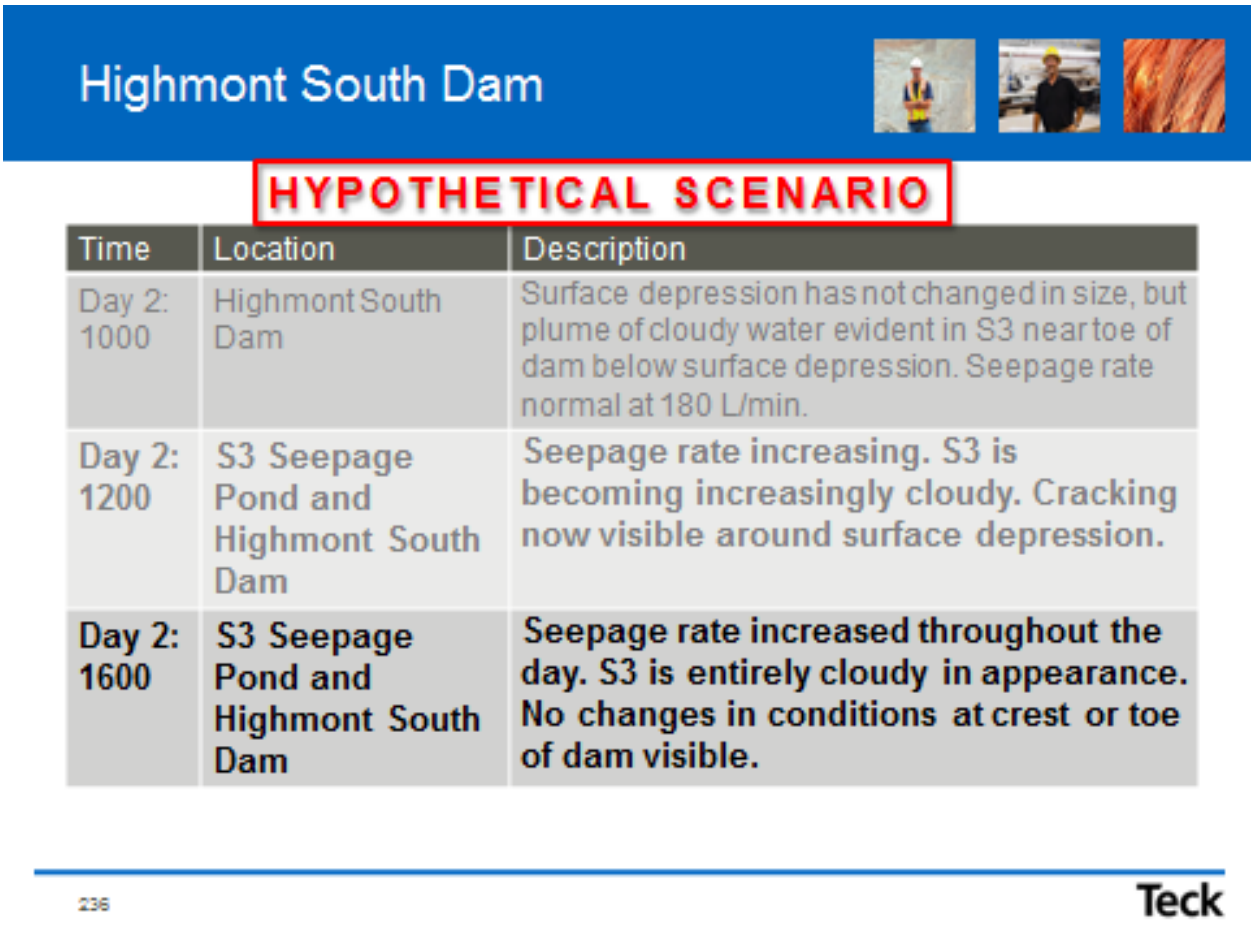
Response actions and general comments:

- Monitoring continues, situation considered Alert Level 1, potentially Alert Level 2 depending on circumstances.
- No weir currently in place but plan to install one in future.
    - Currently there are bucket tests to estimate seepage rates (usually 100L/min).
- Cloudy seepage is a trigger.
- There is a gravel pit nearby which could be used to create inverted filter.



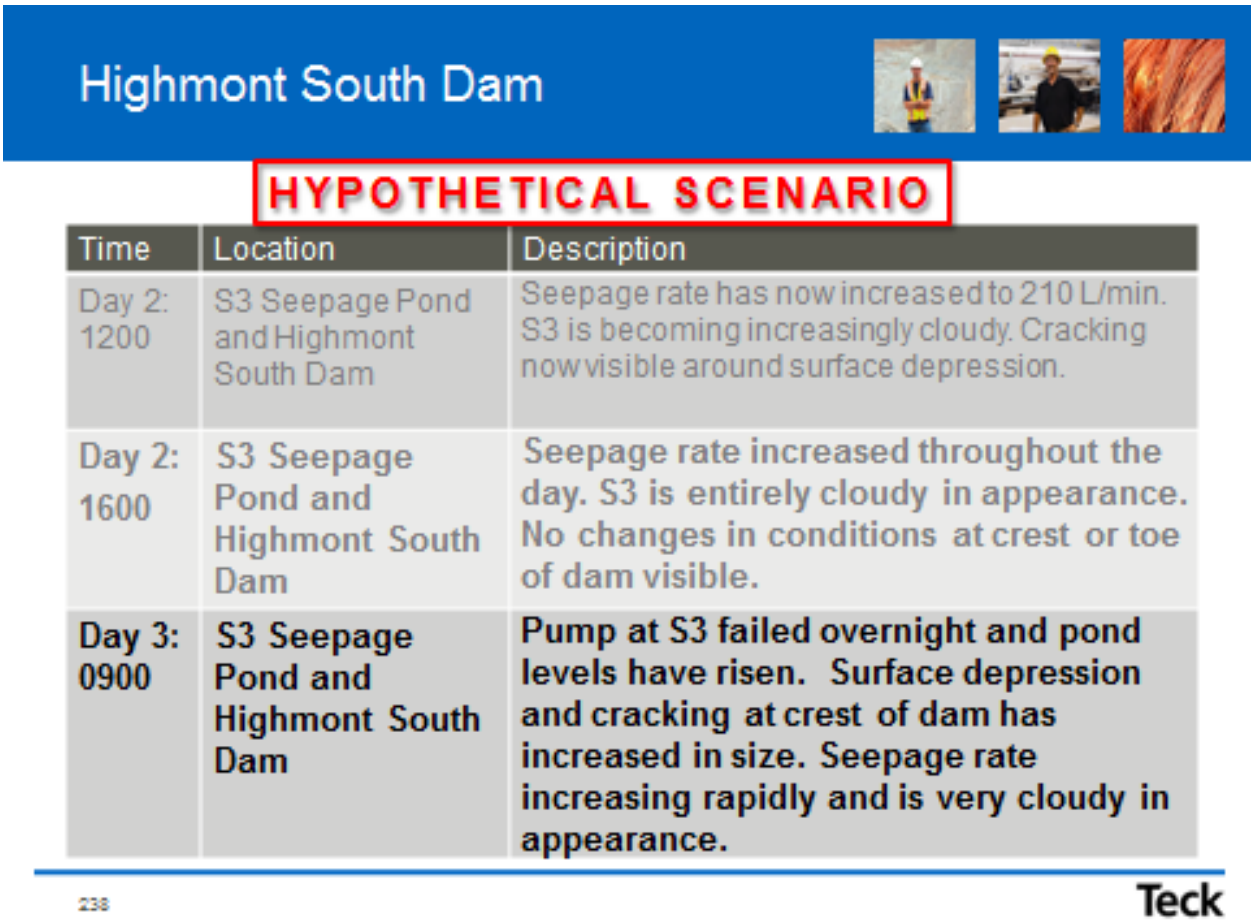
Response actions and general comments:

- At Alert Level 2, maybe progressing to Level 3 with time.
- Liaising with cattle drivers.
- Evacuate the recreational people when Alert Level 2 declared (10am-12pm scenario time).
- No option to pump out the main pond of Highmont due to restricted access under muddy conditions.
- The real danger to Mamit is the burbot fish species.
- Mamit Lake has enough freeboard so that a breach would result in only a 10cm rise.
- Commence pumping from S3 Seepage Pond into S1 Seepage Pond.



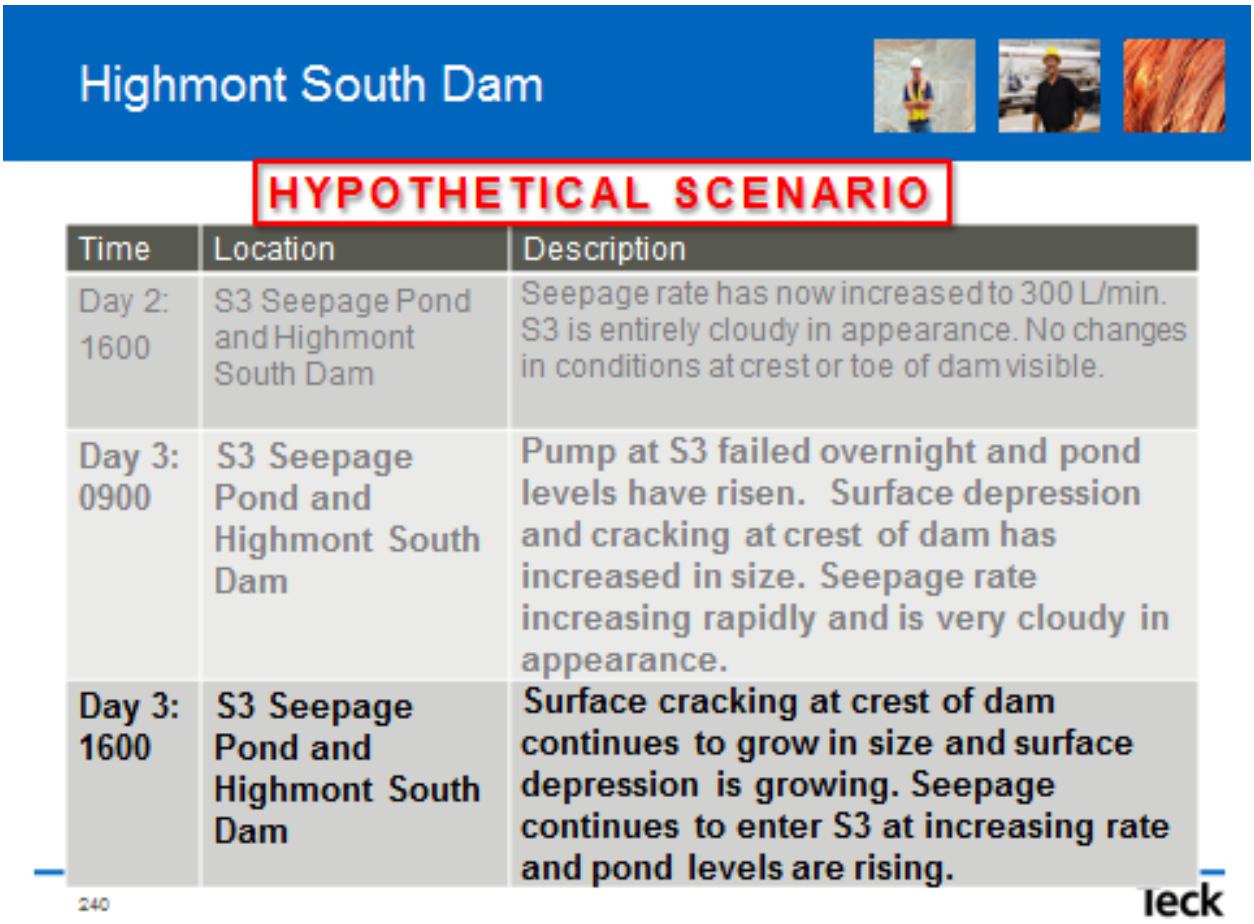
Response actions and general comments:

- Currently, S3 Seepage Pond has a till berm across the spillway so therefore there is no potential for a controlled spill.
- Most HVC operations would continue under hypothetical scenario.
- Ensure that recreational users are evacuated.
- Commence hauling rock to the scene.
- Ensure that there are observers present 24 hours.



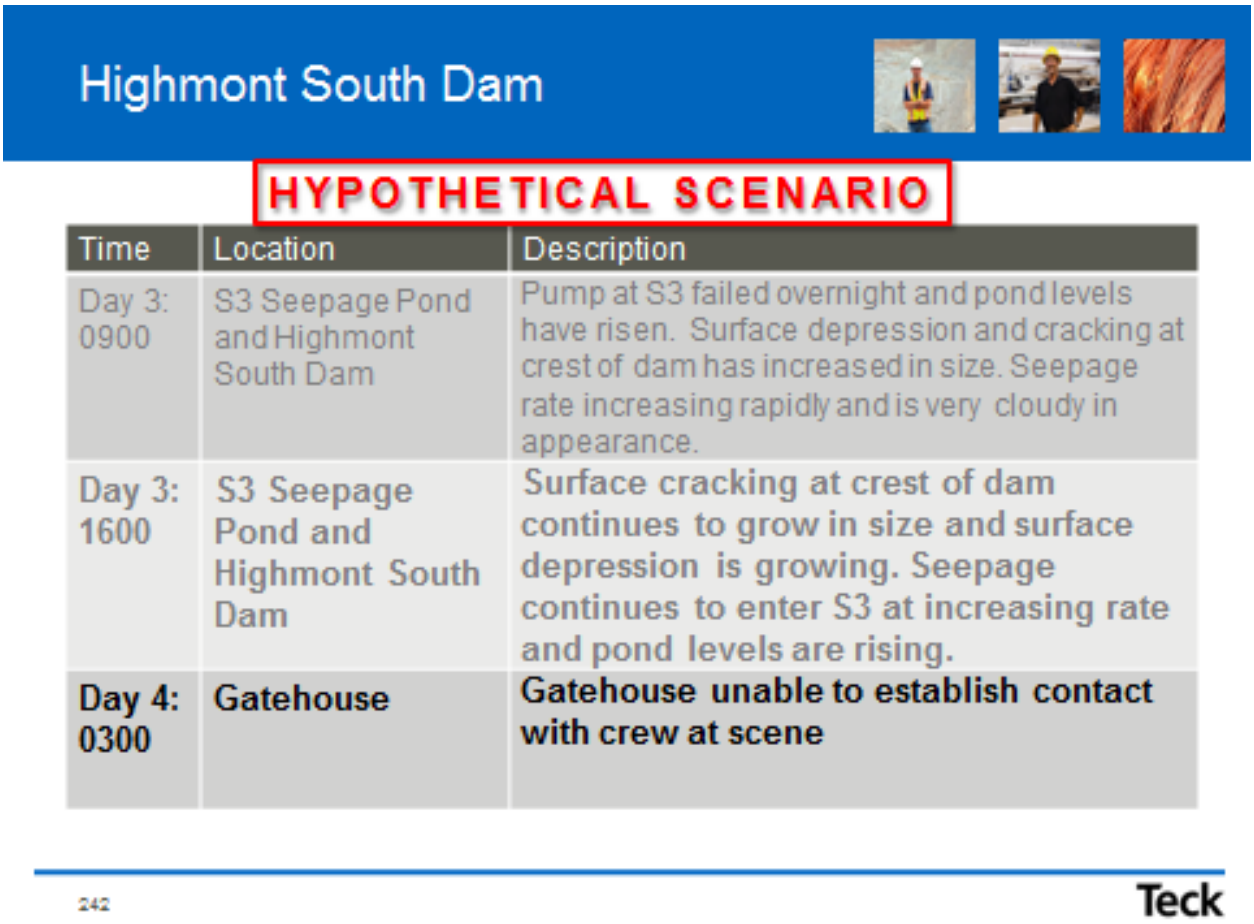
Response actions and general comments:

- Added a trash pump or two with a fuel tank.
- Could be possible to drive up spillway, but do not use the southeast side as the ground is muddy, use north access.
- Evaluate blocking road and notifying ATV users and logging trucks.
- Observation: Update call-out to include people south of Highmont:
    - First Nations in charge of Mamit, Watson Engineering should be on the list due to sensitivities around Mamit Lake and First Nation, FLNRO, logging companies, Ministry Forest, Snow mobile clubs, RCMP at Logan Lake and Merritt, Logan Lake Search and Rescue.



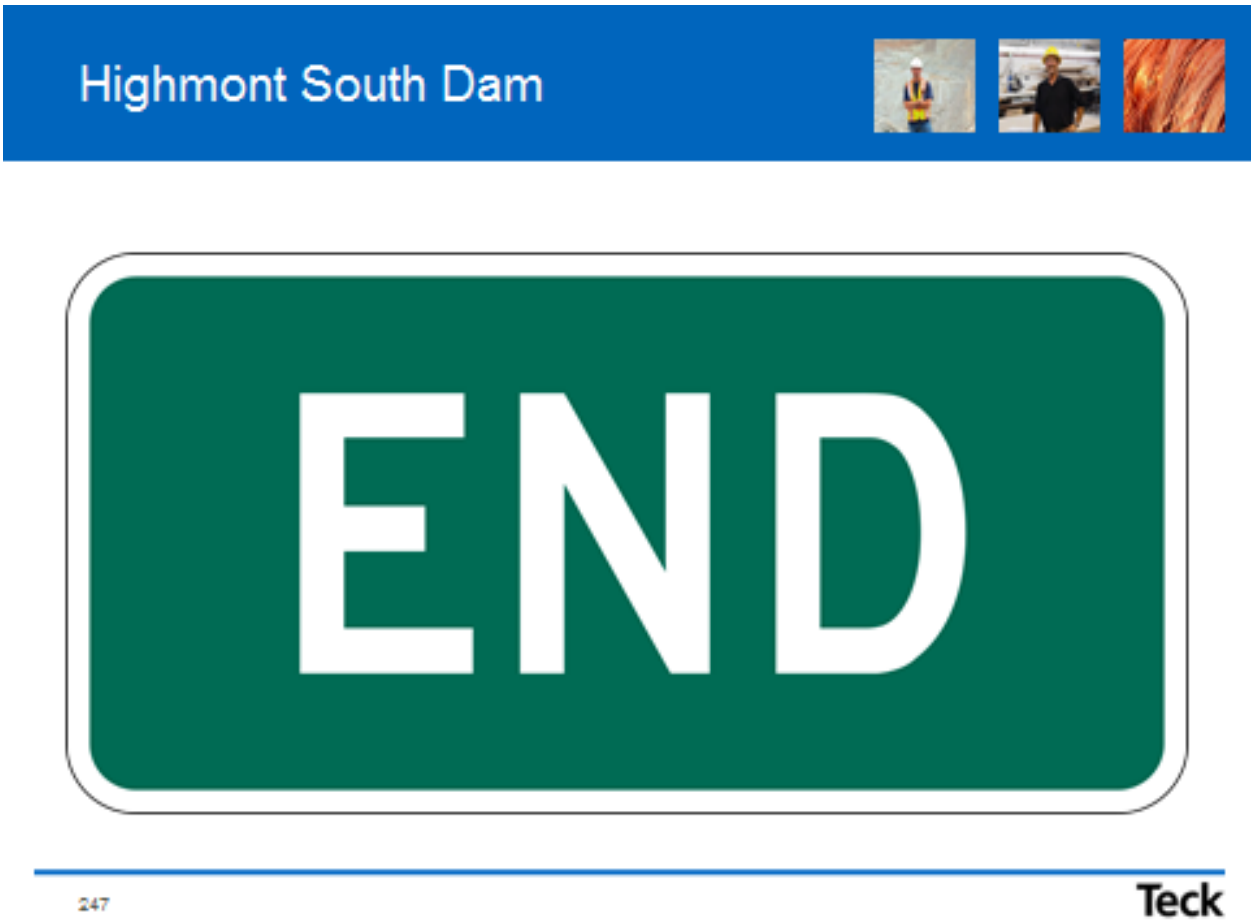
Response actions and general comments:

- All personnel removed from scene due to deteriorating conditions at the dam.



Response actions and general comments:

- Radio coverage and cell phone is good in Highmont TSF area.
- Protective Services would send 2 people up there to check on crew on-scene that had not made contact.
- Continue monitoring S1 Seepage Pond and S2 Seepage Pond to make sure that they are not being overwhelmed.



Hypothetical scenario: Dam stabilizes and there is no further deterioration.
Response actions and general comments:

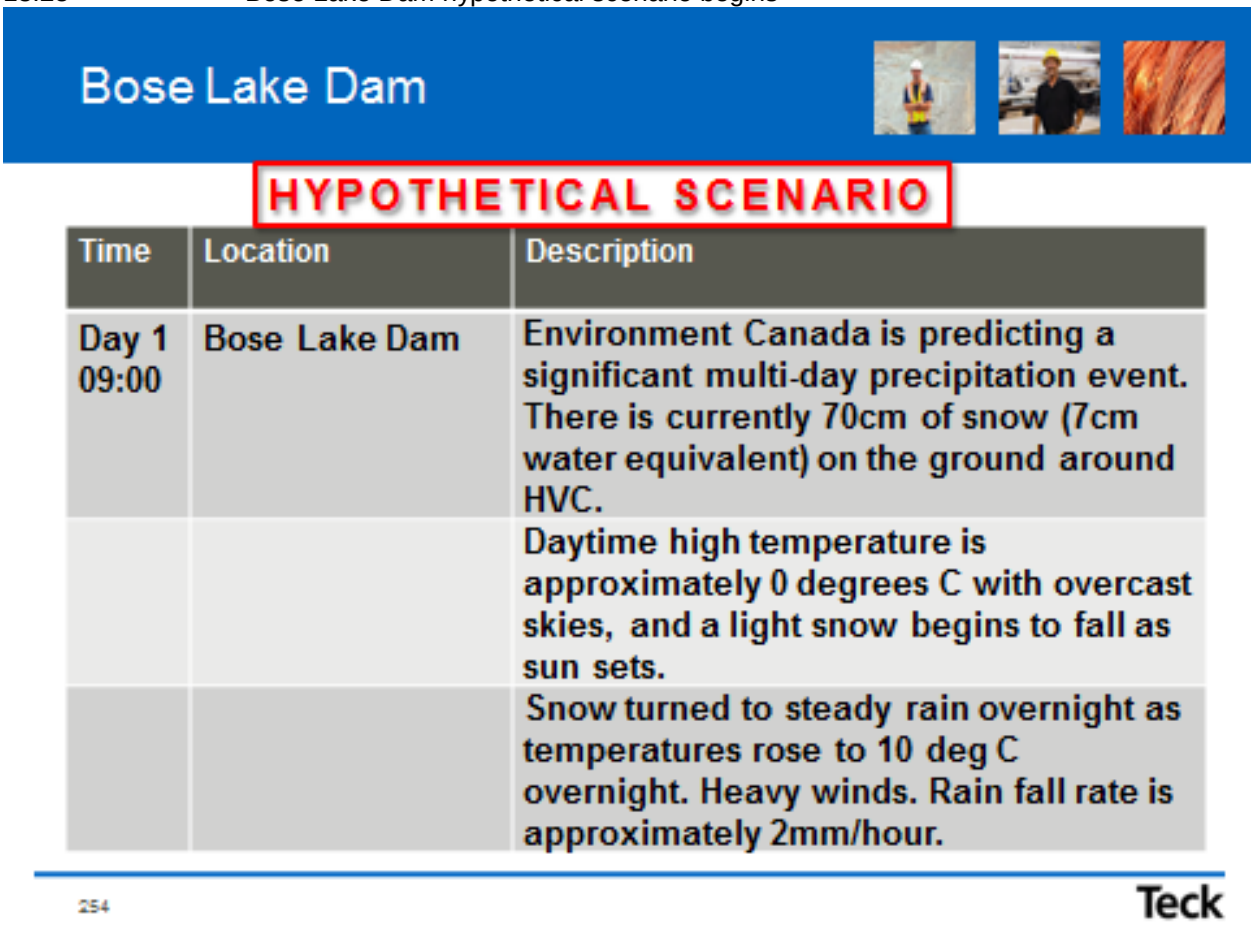
- Inspections, reviews, fixing/remediation.
- This would be considered an environmental incident because the rockfill dam is considered stable and is piping sand through.
- Spillways can be used to release water from ponds

13:15: Break
Observation: Indicates gap or potential opportunity for improvement

Day Two – October 17, 2014

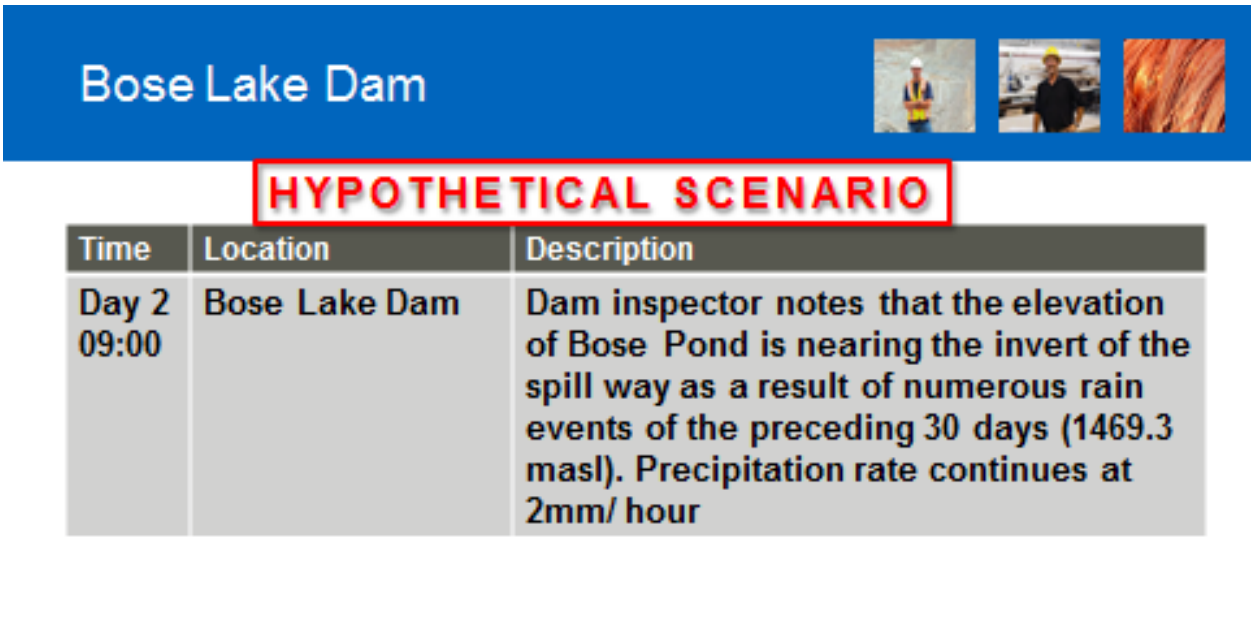
EPRP Test #7: Bose Lake Dam (Bethlehem Tailings Storage Facility)

13:25 Bose Lake Dam hypothetical scenario begins



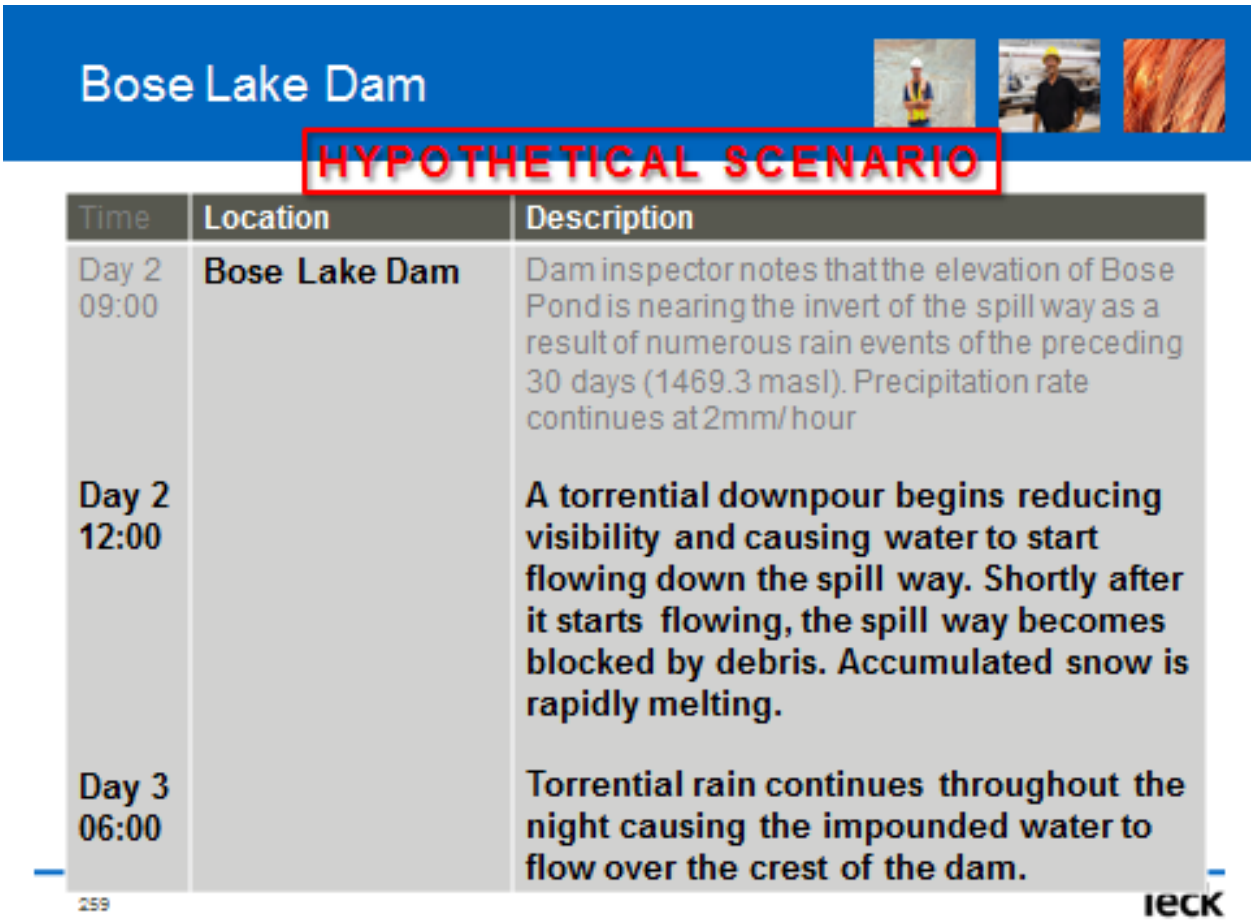
Response actions and general comments:

- Preparation activities: evaluate spillway capacities, look at inflow and outflow rates, continue inspections, road is usually plowed to the crest, can use argo or equivalent to continue inspection on dam.
- Manually read electronic piezometer on dam crest.
- Convene committee for high rainfall events.



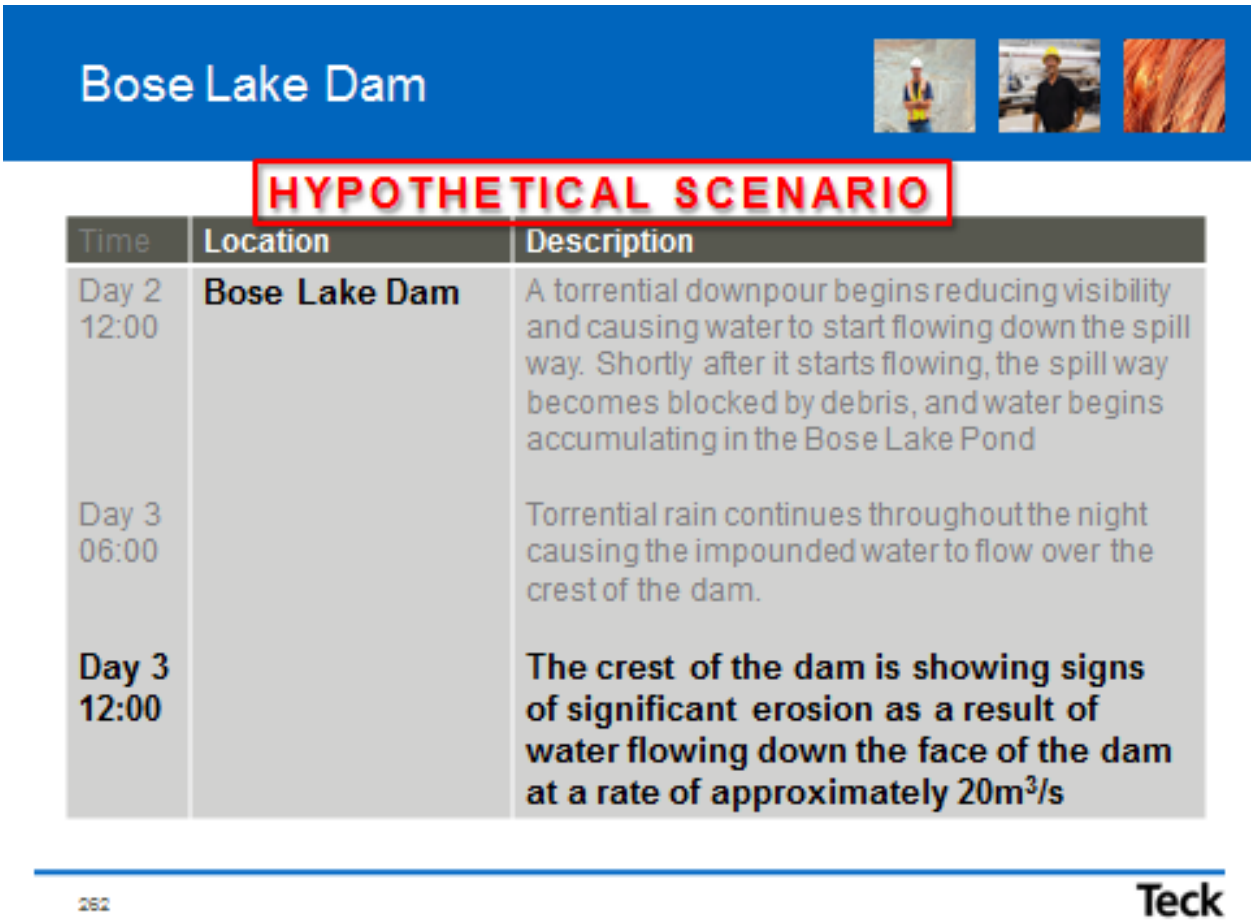
Response actions and general comments:

- Contact driver and ensure safety, rescue if needed.
- Spillway is now blocked and the storm is coming in a few hours.
- Mobilize heavy equipment up to the north side and re-establish the spillway.
- Move to Alert Level 2 because water level has reached invert of spillway, additional rain is anticipated and the spillway has been blocked, therefore:
    - Make sure that there is no erosion of dam etc.
- Take action to pump Bethlehem Pond No. 2 down.
- This would be considered a non-compliant environmental spill.
    - Water quality might be affected downstream (heading to Mamit Creek).
- Where does Axe Creek flow to?
- There could be recreational users using the downstream using area (snow--mobiling or ice fishing).
    - Bullhorn or equivalent might work to make contact.



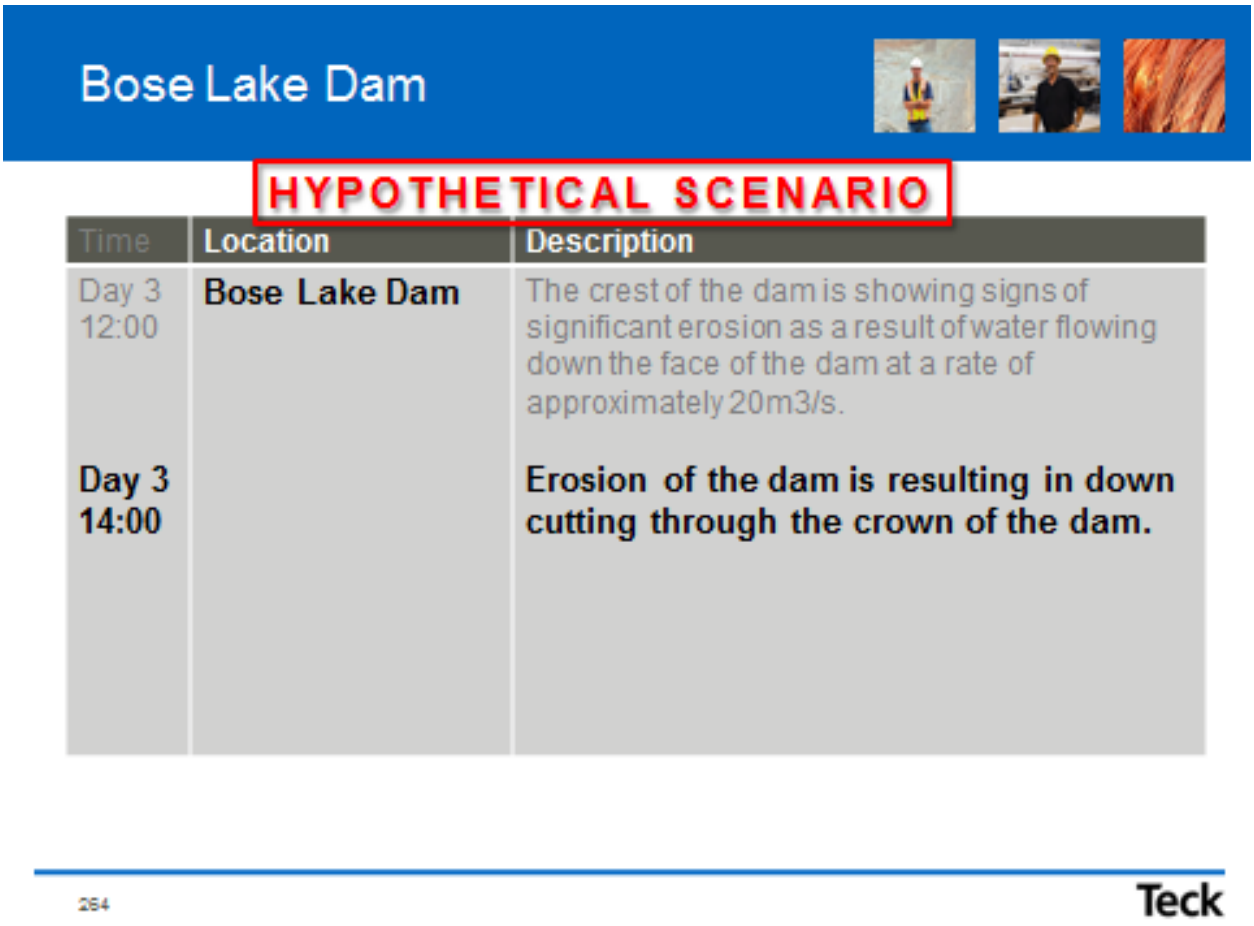
Response actions and general comments:

- Alert Level 3 declared because of overtopping the dam in this hypothetical scenario.
- The call out list was already contacted at Alert Level 2.
    - RCMP etc. are alerted.
- Water overtopping will head down Axe Creek and heading down to Mamit.
    - Call Ministry of Environment inform them there was a spill.
- Incremental affect likely minimal because Axe Creek would already be flooding under natural conditions.



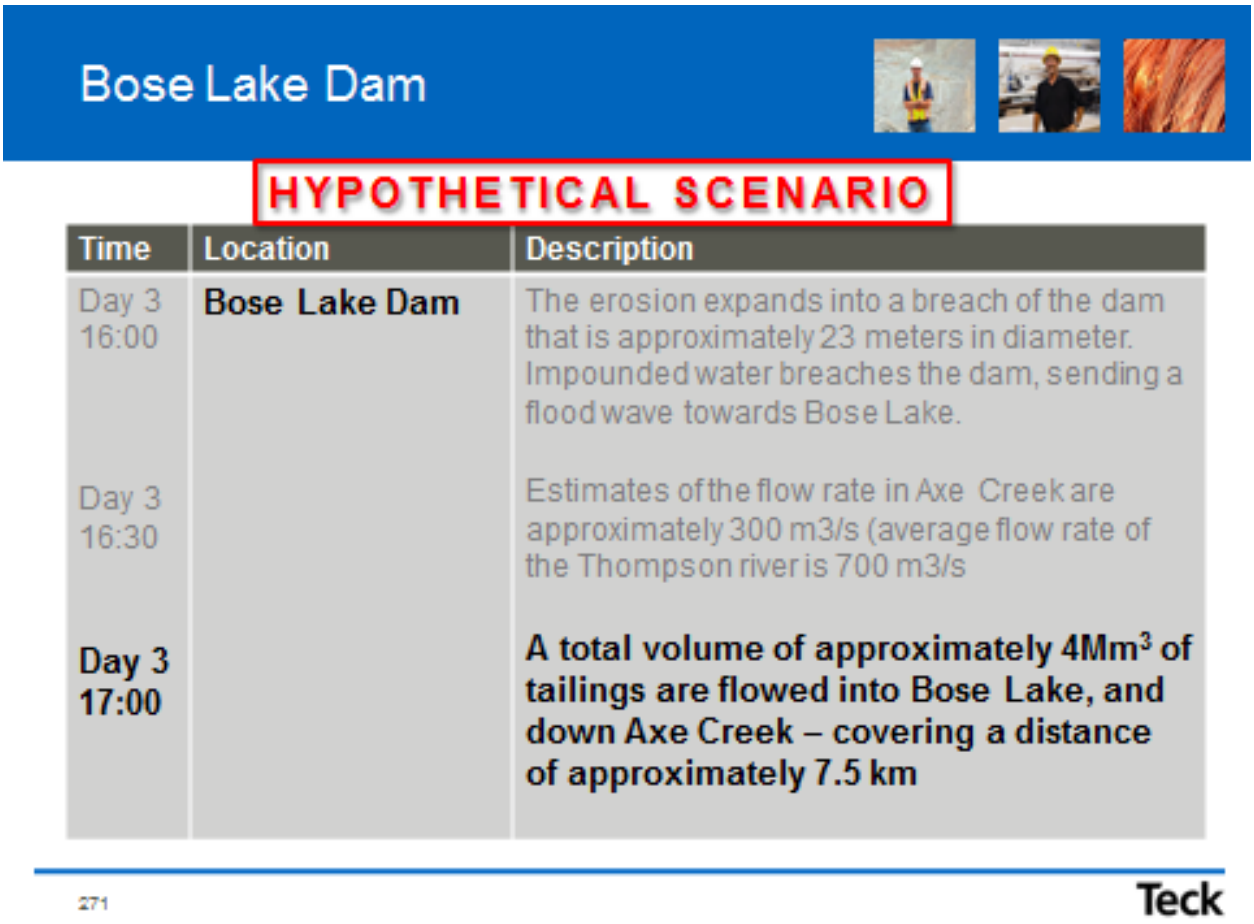
Response actions and general comments:

- Take no action at dam and keep personnel out of harm's way.



Response actions and general comments:

- Monitor situation if possible, however once everyone is notified the focus would probably be to inspect/monitor other higher risk dams (e.g., LL Dam)
- The best mitigation would be to check spillways etc. ahead of schedule.
- Observation: Consider developing procedure for high rainfall events – shut down pit, check spillways, communicate with the public.



Response actions and general comments:

- Observation: Currently no storage curve for Bethlehem No. 2, no estimate regarding total tailings release volume.
- Bose Lake Dam and Bethlehem Main are too far away for there to be a threat from failure of Bethlehem No. 2.
- Environmental monitoring plan would be ongoing, perhaps habitat reclamation or compensation.

Session closing comments by Chris Fleming, Superintendent Tailings and Water Management.
14:30: Closing comments and end of Session Day 2.
Observation: Indicates gap or potential opportunity for improvement

Summary of Meeting Outcomes

- Overall structure of Section 7 *Surveillance* and Section 8 *Emergency Preparedness and Response Plan (EPRP)* from the Highmont Tailings Storage Facility OMS Manuals reviewed in detail prior to first hypothetical scenario;
- For each HVC tailings dam, a hypothetical dam safety emergency scenario was presented to the group to discuss potential actions taken in response to hypothetical scenario;
- The ERP was activated by participants for each hypothetical scenario in response to emergency conditions presented;
- The overall structure of HVCs EPRPs works well to establish a clear incident command structure under a variety of dam-safety conditions; and
- Corrective actions deemed actionable by HVC to improve EPRPs are summarized below.

Summary Observations and Potential Corrective Actions:

The following table summarizes observations and potential corrective actions resulting from the EPRP tabletop tests. Observations are defined as potential gaps or opportunities for improvement. Observations originate from comments made by EPRP test session participants. Observations deemed actionable by HVC senior management are included below. Actions listed below are draft pending final approval by HVC senior management.

Facility	Observations	Potential Corrective Action
-	Previous EPRP tests scenarios did not account for time taken to notify and evacuate affected communities	Include community notification as part of a separate test after internal tests have been completed
-	RCMP and other first responders may not have read or understood HVC's EPRPs	Inclusion of external first responders in second or third phase tests
-	References to the Crisis Management Manual do not always specify which manual (HVC or Teck) should be used	Correctly identify which of the two manuals (HVC or Teck) is being referenced
-	Incident command diagram (used for illustrative purposes in EPRP) does not contain Engineer of Record (EOR) or First Nations	Adjust the Incident Command Organization Response Matrix diagram to reference EOR and First Nations
All High or Above Consequence Tailings Dams	Emergency Reporting Procedure (fan-out) contains L-L Dam specific information and might be confusing to use for other facilities	Generate specific call-out response procedures (fan-outs) for each tailings dam classified as high or higher consequence
-	BC Hydro and Fortis BC may not be on general HVC call-out procedure	Check the site-wide call-out procedure used for general emergencies and consider adding add BC Hydro and Fortis BC to TSF call-out if necessary
-	Most HVC tailings dams have cameras that can be remotely viewed	EOR would benefit greatly from access to remote viewable cameras
-	Junior foremen at mill may not know that Superintendent Tailings and Water Management has authority to shut down the Mill or order evacuations if there is an emergency	Additional training should be provided to mill and operations personnel to ensure they know that in a TSF or dam safety emergency, the chain of command changes

Facility	Observations	Potential Corrective Action
All High or Above Consequence Tailings Dams	Understanding the maximum initial pond volumes allowable to accommodate Probable Maximum Flood (PMF) at freshet is critical to preparing for high magnitude events	Prediction of worst case melt conditions could be undertaken prior to freshet using the GoldSim water balance model
All High or Above Consequence Tailings Dams	Understanding the rate of change in ponds and spillways was identified as critical to aiding the Crisis Management Team	Installation of staff gauges and remotely downloadable data loggers in critical spillways and ponds prior to an event would provide information without putting employees in harm's way Calculation of flow rating curves prior to an event. Staff gauge readings could be used as criteria for advancing from Alert Level 1 to 2 to 3
All High or Above Consequence Tailings Dams	Communication about weather conditions and forecasts is important for all HVC departments that deal with water quantities	When a weather alert is issued for the region it should be forwarded to all members of the organization that deal with water levels
All High or Above Consequence Tailings Dams	Multiple follow-up actions may be required after high rainfall events.	Consider developing procedure for high rainfall events – (e.g. shut down Valley Pit, check spillways, communicate with the public, etc.)
All High or Above Consequence Tailings Dams	Opportunities exist to develop response mechanisms for combating piping incidents	Investigate the cost/benefit of having materials on standby to combat piping incidents. Develop a toolkit of best practice ideas to combat piping in the event that it is suspected.
All High or Above Consequence Tailings Dams	Safe and effective observation points to aid Emergency Response Team (ERT) are not known for all HVC tailings dams	Use 3D Analyst in ArcGIS to determine approximately 10 good observation sites per piece of major infrastructure (e.g. dams and pits). Include locations in ERT GIS layer. This will allow ERT member to send observers to appropriate locations
All High or Above Consequence Tailings Dams	100-200 large, filled bags of crush would be useful to help in development of an inverse filter or capping a piping event	Consider the most convenient location for storing, under cover, 100-200 bags of crushed material
All High or Above Consequence Tailings Dams	Participants stated that General Manager would be contacted in the event of an Alert Level 1. Consider formalizing this on the Emergency Reporting Procedure.	Update Alert Level 1 call-out update to include General Manager.
Bethlehem Trojan Dam	Lubeland may be impacted by water running down spillway from Trojan Dam	Consider including the notification of Lubeland at the same time as the Valley Pit if an evacuation order is given by the pit foreman. Integrate Valley Pit and Lubeland evacuation into Bethlehem EPRP

Facility	Observations	Potential Corrective Action
Bethlehem Trojan Dam	Base of spillway was noted as being sand with rip-rap	Investigate need to perform design changes to shape of spillway to place the end of the spillway in more solid ground. Alternatively, reinforce the corner and end of the spillway to reduce risk of erosion.
Bethlehem Trojan Dam	The spillway empties into the Valley Pit	Investigate if a portion of the spillway be diverted away from the pit
Highmont South Dam	Bucket tests are used to estimate the flow rate from the seepage ponds at Highmont TSF	Installation of a weir could be beneficial to measure fluctuations in seepage flow rates with greater accuracy
Highland H-H Dam	Risk of flooding the Valley Pit increases with increasing volume of water stored in 24 Mile Lake	Finalize 24 Mile Lake water management procedure (an operational maximum of 1 Mm3 is recommended)
Highland H-H Dam	Formalization of new muster area on south side of the Valley Pit should be considered	Evaluate the need to establish new muster area on south side of the Valley Pit, perhaps near crusher
Highland L-L Dam	Methods of communication with communities downstream of L-L Dam was not fully understood	Undertake additional investigations to determine preferred methods of alerting downstream communities
Highland L-L Dam	If warning sirens are to be installed to warn downstream residents, consider the possibility of collaborating with rail companies	Evaluate collaboration and cost sharing opportunities of warning sirens near rail tracks.
Highland L-L Dam	The Spatsum Pumphouse can be very noisy and the phone may not be heard	Consider adding a flashing light to the phone line to ensure that personnel working at Spatsum Pumphouse know that the phone is ringing
Highland L-L Dam	In the event of a potential breach of the L-L Dam, reducing the water velocity would allow for significant deposition of suspended tailings material	Is there a method that could be employed to slow the water down sufficiently to drop a portion of the suspended tailings? Consider contacting ministry to determine in the construction of structures downstream of L-L Dam would require permitting and how intensive this process might be.
Highland L-L Dam	Direction people should take during an evacuation was unclear	Coordinate with TNRD about the best evacuation routes and identify safe high points to wait out the flood

Appendix I: EPRP Tabletop Session Photos

Appendix I: EPRP Tabletop Session Photos

Day One of Two: October 17, 2014

Appendix I: EPRP Tabletop Session Photos

Day One of Two: October 17, 2014

Appendix I: EPRP Tabletop Session Photos

Day One of Two: October 17, 2014

Appendix I: EPRP Tabletop Session Photos

Day One of Two: October 17, 2014

Appendix I: EPRP Tabletop Session Photos

Day One of Two: October 17, 2014

Appendix I: EPRP Tabletop Session Photos

Day Two of Two: October 18, 2014

Appendix I: EPRP Tabletop Session Photos

Day Two of Two: October 18, 2014

Appendix I: EPRP Tabletop Session Photos

Day Two of Two: October 18, 2014

Appendix I: EPRP Tabletop Session Photos

Day Two of Two: October 18, 2014

Appendix II:

Functional Test of Emergency Response Plan for Highland L-L Dam

Summary of Notes and Findings (Prepared for November 20 debrief meeting) Date: 2012-Nov-15

Teck Highland Valley Copper Partnership
P.O. Box 1500
Logan Lake, BC Canada V0K 1W0

+1 250 523 2443 Tel
+1 250 523 3242 Fax
www.teck.com

Teck

FUNCTIONAL TEST OF EMERGENCY RESPONSE PLAN FOR HIGHLAND L-L DAM

SUMMARY OF NOTES AND FINDINGS (Prepared for November 20 debrief meeting)

Date: 2012-Nov-15

Time: 9:00 – 11:10am (approximate)

Subject: Summary of notes and findings for functional test (performed November 15, 2012) of Emergency Response Plan for Highland Tailings Storage Facility. Content provided by personnel that observed/facilitated the scenario.

Locations of activity: Highland L-L Dam (Cyclone House, Highway/North Muster Area and Hillside/South Muster Area), Crisis Room (Admin Boardroom), Gatehouse, ERT Training Trailer. Crisis Management Team corresponded with Teck Corporate, but feedback from Teck Corporate has not been included here.

Scenario summary: Catastrophic dam failure of Highland L-L Dam due to piping from internal erosion. One heavy equipment operator and machine engulfed by flow of tailings and water, treated as a fatality.

Purpose: This emergency/crisis simulation was designed to test: 1) the effectiveness of the L-L Dam Evacuation Procedure and the response of HVC personnel and contractors under mandatory evacuation, 2) the response of the Emergency Response Team (ERT), 3) the response of the Crisis Management Team (CMT) and Gatehouse (GH), 4) the overall effectiveness of the updated Emergency Response Plan (ERP) for the Highland L-L Dam, and 5) how well the ERP feeds into HVC's Crisis Management Program.

Teck Highland Valley Copper Partnership
P.O. Box 1500
Logan Lake, BC Canada V0K 1W0

+1 250 523 2443 Tel
+1 250 523 3242 Fax
www.teck.com

Facilitators and participants with duties to respond (does not include HVC personnel and contractors):

Role Title (Involvement in Test)	Location During Test
General Manager (Responder, Crisis Management Team)	Crisis Room
Supt. Tailings & Water Management (Observer and Facilitator)	Crisis Room
Senior Civil Technologist (Overall Scenario Facilitator)	Cyclone House
Coop Student (Observer)	Cyclone House
Senior Env. Coordinator (Observer)	Crisis Room, Gatehouse, ERT Training Room
Dam Construction Supervisor (Tailings & Water Mgmt. Dept. Person in Charge)	L-L Dam
Senior Design Draftsperson (Observer)	L-L Dam (with Dam Construction Supervisor)
Superintendent Safety and Loss Control (Responder, Crisis Management Team)	Crisis Room
Senior Safety Coordinator (Facilitator)	Gatehouse
Security/Protective Services Personnel	Gatehouse
Senior Safety Coordinator (Facilitator)	ERT Training Trailer
ERT Member (Responder – ERT Incident Commander)	ERT Training Trailer
ERT Members (Responders)	ERT Training Trailer
Consultant, OASIS/ERM (Observer)	Emergency Response Team Training Trailer
CMT Members (Responders)	Crisis Room
Teck Crisis Team Members (Responders)	Teck Corporate

Teck Highland Valley Copper Partnership
P.O. Box 1500
Logan Lake, BC Canada V0K 1W0

+1 250 523 2443 Tel
+1 250 523 3242 Fax
www.teck.com

Timeline of events*:

Time	Events or Actions Taken
	PHASE I – Emergency Response Plan Activation Evacuation of L-L Dam
0857	Senior Civil Technologist calls for Radio Silence on Ch. 7 and introduces test of Emergency Response Plan and Evacuation Procedure for the L-L Dam
0900	Cyclone House Operator(CHO) calls Dam Construction Supervisor and designated alternate for Tailings and Water Mgmt. to inform him of increased seepage coming from the toe of the L-L Dam
0902	Dam Construction Supervisor announced after his investigation of dam that it is a Level 2 Emergency and that evacuation of the L-L Dam area is mandatory
0903	Dam Construction Supervisor informs security of situation and announces mandatory evacuation again on Ch. 7
0909	ERT rescuers en route to muster areas at each end of dam
0916	Security acting as incident command until ERT IC arrives
0921	ERT calls security to request road closures, ERT unable to make radio contact with Spatsum Pumphouse
0924	ERT assumes IC of Highway/North side muster area
0925	ERT assumes IC of Hillside/South side muster area
0931	ERT IC reports full breach of Highland L-L Dam
0936	Senior Safety Coordinator gets called on radio directly from Dam Construction Supervisor who reports that a cat operator is missing
0943	Dam Construction Supervisor reports that it is a yellow cat, #485, a Cantex owned machine that is missing
0945	Dam Construction Supervisor announces that all personnel are accounted for at muster areas (except for missing cat operator)
0947	ERT IC requests for a helicopter to assist with search for cat operator
0950	Call for bus to be sent to Highway side muster
0952	Senior Civil Technologist announces that test is complete (end of Phase I)
	PHASE II – Ongoing Crisis Management Activities
0955	IC calls for crew change request
0958	Call from Teck Corporate, transferred to Crisis Management
1000	Call from media
1003	Incident Commander calls to discontinue search for missing cat operator
1007	“Face-to-face” between IC and Ambulance driver describing cat operator as unresponsive
1012	Incident Commander steps out of room (to contact coroner)
1023	Incident Commander calls for taxis to relieve ERT members, calls for guard at Calling lake road
1048	New Incident Commander (on B crew) takes over
1110	Phase II complete

Teck Highland Valley Copper Partnership
P.O. Box 1500
Logan Lake, BC Canada V0K 1W0

+1 250 523 2443 Tel
+1 250 523 3242 Fax
www.teck.com

Teck

*For more detailed timelines see notes provided by observers/participants in the Appendices. Minor discrepancies may exist between times listed above and the notes in the Appendices due to differences between the observers.

Summary of issues for consideration that may require corrective action (duplicate and/or related findings have been grouped together):

Signage, Muster Areas and Accountability

- Proper standard signage at muster areas
- Knowledge of muster area locations by HVC personnel
    - 2 HVC electricians didn't know where muster areas were – *they had not taken the Dam Training Course!*
- Signage for entire tailings line (highway standards)
- Develop plans to divide ERT evenly between two sides of the dam
- Names? Hillside/Highway side doesn't work & ERT does not want North/South
    - Once SS Tailings line is operational → Tailings/Highway Side
- Needed at muster areas: emergency equipment, lights, delineators, road closed signs, etc.
- Better system for accountability for non-ERT HVC personnel (needs to be an HVC employee checklist)
    - Sign-in/sign-out at North & South
    - Assign one HVC foreman to keep track of personnel at L-L & Spatsum (sign-in at morning meetings or on a board in Mill Shops)
    - Plan for accountability needs to be more systematic
    - List from Security worked very well for contractors

Contractors

- Cantex gathered at meeting places before evacuating (took them AT LEAST 22 minutes to get to the muster area)
    - People in Cantex office were told to go outside and wait → start walking!
- Cantex had full accountability of their employees in only two minutes once at the muster areas
- Other contractors also had full accountability of their staff completed efficiently

Radio

- Surface Water pumphouse had no radio contact, gland water did not either
- Very difficult to monitor all 3 radio channels (7, 12, 16)
- Surface Water pumphouse had no radio contact, gland water did not either

Teck Highland Valley Copper Partnership
P.O. Box 1500
Logan Lake, BC Canada V0K 1W0
+1 250 523 2443 Tel
+1 250 523 3242 Fax
www.teck.com

- Repeater issues – most radios cut out around 9:20 for a few minutes
- Spatsum did not hear evacuation announcements
    - Spatsum was not accounted for when evacuation was complete – miscommunication because ERT thought Spatsum was accounted for
    - "Spatsum Package" from security in the future (Cell phone, keys, etc.)
- Require another base station for CH12 (already has one for CH7 and CH16)
- Require multiple base stations in truck too
- Assigned portable radios – have 1 or 2 assigned to CHO instead of individual people

Communication

- Very difficult to hear participants in Vancouver CMT room – multiple voicing making it difficult to understand the questions being asked
- Would be good for each person to identify themselves prior to speaking
- Difficult in CMT room to hear with the radios and other communication going on in the background - a separate room for conversations with the Vancouver CMT may be the solution
- Use military time in our references
- Should have shared desktop with Vancouver so that CMT could have presented a map of the Spence's Bridge area
- International callers unable to reach CMT direct line at HVC
- Take time on radio communication
    - Wait a moment after pressing button
    - Talk slow and clearly

Emergency Contact

- Phone list for Vancouver office difficult to find in Crisis Manual
- L-L evacuation phone list was correct but HVC-wide phone list was outdated or numbers were hard to find
- Larger print

Other

- Somebody with technical knowledge should be called to the CMT to assist with equipment
- Consider doing scenario simulations during Tailings Management Workshops as a training activity
    - Include CMT in Dam Training Course or develop streamlined course for them

Teck Highland Valley Copper Partnership
P.O. Box 1500
Logan Lake, BC Canada V0K 1W0

+1 250 523 2443 Tel
+1 250 523 3242 Fax
www.teck.com

- Crucial to have Tailings and Water Management person with CMT to explain the technical side of dam failure

Scenario-related Issues (for consideration when planning future test scenarios)

- Consider a timeline chart on the wall or computer screen so that all had the same information/references
- Would have been useful to have ERT IC at the L-L Dam
- Protective Services personnel at each muster area were never informed to change from "observers" to "responders"

Notes/findings compiled by: Consultant, OASIS/ERM

Appendix III: Meeting Minutes from EPRP Tabletop Exercises for HVC Tailings/Water Storage Facilities, 7 & 8 May, 2014

Memorandum

Teck Highland Valley Copper Partnership
P.O. Box 1500
Logan Lake, BC Canada V0K 1W0

+1 250 523 2443 Tel
+1 250 523 3242 Fax
www.teck.com

Teck

To: All Listed **Date:** 7 & 8 May 2014
From: Sarah Cooke, Casey Bates

Subject: Meeting Minutes from EPRP Tabletop Exercises for HVC Tailings/Water Storage Facilities

Present: Dave Falcon, Chris Fleming, Ian Haskell, Nick Elynuik, Jamie Verheyen, Ross Billy, Chris Anderson, Steve Hippisley, Brett Gulliver, Kirby Humphrey, Sarah Cooke, Casey Bates (ERM – facilitator), Andy Small (AMEC), Farhat Shah (Klohn Crippen Berger)

Location: Coast Hotel, Kamloops, 8am to 4pm.

Meeting Safety Share

Home fire alarms, home fire escape plans

- Day 1: Three of five home fire deaths between 2007 and 2011 resulted from fires in properties without working smoke alarms.
- Day 2: Make a home escape plan. Know at least two ways out of every room, if possible. Teach children to escape on their own.

Purpose

- To perform a Tabletop Exercise for each dam with a consequence classification of High or above. This will lead to discussions on potential inundation effects in the event of a catastrophic dam breach, evaluation of the ERPs for each dam and any improvements that could be made, and will help determine how well the HVC emergency response/crisis management program prepares personnel to respond to dam-related emergencies.

- *How can we leverage HVC's overall Emergency Response Plan (ERP) Structure for TSFs/WSFs to streamline the planning process for each dam individually?*

Summary

- Tabletop Exercise: A tabletop exercise involves key personnel discussing simulated scenarios in an informal setting. Tabletop exercises can be used to assess plans, policies, and procedures (*FEMA Federal Guidelines for Dam Safety - Emergency Action Planning for Dams, July 2013).*

- According to CDA Dam Safety Guidelines (2007), ERP tests are an integral part of emergency preparedness, ensure that the documents and training are adequate, range from limited tabletop exercises to full-scale simulations, should involve operations staff/downstream agencies/and stakeholders, and requires that each responding agency has adequate plans and trained staff to deal with any emergency in their jurisdiction.

Agenda - Overall

- Introductions
- Overview and Purpose
- Review of Previous Tabletop Exercises & 2012 Functional Test
- Overview of HVC Emergency Response Plan (ERP) Structure for Tailings and Water Storage Facilities
    - Tabletop Exercises (one dam at a time)
- Review of Draft Findings and Corrective Actions
    - Dam-specific findings
    - Findings applicable to all dams/ERPs

Agenda – For each dam

- Document Review
    - Emergency Preparedness and Response Plan (ERP) from applicable OMS Manual (Section 8)
    - Overview Maps
    - Inundation Maps (when available)

All corrective actions and recommendations for improvement recorded during this session will be considered DRAFT until reviewed by HVC senior management.

Complete agenda and list of dams reviewed available in the associated presentation: "*Tabletop Exercise of HVC Emergency Response Plans (ERPs). For HVC Dams Classified as High, Very High, or Extreme May 7-8, 2014"*

Draft Findings and Corrective Actions:

Facility	Finding	Potential Corrective Action
Raw Water Reservoir	Drop in water levels at Raw Water Reservoir could go unnoticed for some time.	Consider installation of surveillance cameras at Raw Water Reservoir when wireless mesh has been installed onsite.
Raw Water Reservoir	Raw Water Reservoir is a bottleneck for the copper production process at HVC and is critical for the operation of the mine.	Consider developing a risk assessment/contingency plan for Raw Water Reservoir.
Raw Water Reservoir	Raw Water Reservoir is a bottleneck for the copper production process at HVC and is critical for the operation of the mine.	Evaluate the need to perform a Failure Mode and Effect Analysis (FMEA) for the Raw Water Reservoir.
Raw Water Reservoir	Access to North Dyke or East Dyke of Raw Water Reservoir may not be possible under current conditions or during a rainy-day scenario.	Perform a feasibility assessment to create access to toe of North Dyke or East Dyke of Raw Water Reservoir under normal and rainy-day conditions. Also consider creating permanent stockpile of materials in the vicinity of the North Dyke or East Dyke in the event that repairs are needed on the dykes.
Raw Water Reservoir	Reservoir line is vulnerable to damage by equipment.	Consider mandating inspections of vulnerable areas of the reservoir pipeline and include description of activities in the OMS manual. Improve signage in higher-risk areas to notify operators of pipelines in the area.

Facility	Finding	Potential Corrective Action
H-H Dam	Highland TSF OMS Manual does not include information about evacuation of the H-H pumphouse and activation of the alarms.	Formalize a muster point for the H-H Pumphouse uphill from H-H Dam, off of Highway 97C near the H-H gate. Place appropriate signage at the muster location. Include relevant information in the Highland TSF OMS Manual. Also formalize location of muster area at south end of H-H Dam.
H-H Dam	Highland TSF OMS Manual does not include information about evacuation of the H-H pumphouse and activation of the alarms.	Include in the Highland TSF OMS Manual information about activation of the H-H Pumphouse alarm system in the event of an emergency at the H-H Dam.
H-H Dam	Recent event at H-H Dam resulted in water levels that approached minimum freeboard requirement.	Consider installation of surveillance cameras around H-H Dam and H-H Pumphouse when wireless mesh has been installed onsite.
Calling Lake and Laura Lake	OMS Manual could be improved to better reflect how HVC would respond to an emergency at Laura Lake or Calling Lake.	Update OMS manual to clarify that Emergency Response Team response to Calling Lake would be limited due to its remote location. Include in OMS manual that HVC crisis management response would be activated to handle media inquiries, internal/external communications, etc.
Calling Lake and Laura Lake	Description of site access in the event of an emergency at Laura Lake or Calling Lake should be improved in OMS Manual. Access would be from Calling Lake direction because road from L-L Dam area could be impacted.	Include in OMS Manual a description of how to access Laura Lake and Calling Lake in the event of a dam breach at either dam.
Bethlehem TSF	Evacuation of the Valley Pit is not currently considered in the ERP for the Trojan Dam or Beth Main Dam.	Integrate the Valley Pit evacuation procedure into the ERP for the Bethlehem TSF OMS Manual as appropriate and consider other areas where HVC personnel work that could be within the inundation zone (e.g. Lubeland).
Bethlehem TSF	OMS Manual could be improved to better reflect how HVC would respond to an emergency at Trojan Dam or Beth Main Dam that could have an effect on Highway 97C.	Update ERP description of response to include blocking of the Highway from the west by Cantex or HVC personnel at the Dam. Verify with RCMP that Highway 97C could be blocked at Logan Lake and Ashcroft.
Bose Lake	OMS Manual could be improved to better reflect how HVC would respond to an emergency at Bose Lake Dam.	Include in OMS Manual ERP a description of ERT response that would be required because of the public campsite below the dam.
Bose Lake	An unusual condition or emergency situation at the Bose Lake Dam could go unnoticed for a long period of time.	Consider adding signage at the Bose Lake Dam with contact information for HVC Protective Services. Evaluate feasibility of installation a surveillance camera at the Bose Lake Dam.
Highmont S1 & S3	OMS Manual could be improved to better reflect how HVC would respond to an emergency at Highmont S1 & S3 Ponds.	Include in OMS Manual ERP information specific to Highmont S1 & S3 and consider describing that crisis management would be initiated, but ERT would likely not because consequence rating relates to potential environmental damage rather than loss of life.
Highmont S3	Effects of dam breach on Billy Lake not known.	Consider performing an evaluation of Billy Lake to determine if adequate freeboard is maintained to contain water from S3 in the unlikely event of a dam breach.
Highmont TSF Dams	OMS Manual could be improved to better reflect preventive actions that could be taken in the event of	Consider including in the Highmont TSF OMS manual ERP the potential preventive action of lowering water level in Mamit Lake in the unlikely

Facility	Finding	Potential Corrective Action
	an emergency at the Highmont TSF.	event that a failure of the Highmont TSF looks imminent.
Highmont TSF	OMS Manual could be improved to better reflect numerous impoundments in the area and the appropriate response for each.	Include in Highmont TSF OMS Manual ERP a complete description of impoundments at the facility and describe and response requirements unique to each facility.
All High-consequence or Above Dams	Many ERT members may not know how to access many of HVC's dams.	Consider integrating site visits to dams into the regular training for the HVC Emergency Response Team (ERT).
All Significant-consequence or Above Dams	Many ERT members may not know how to access many of HVC's dams.	Develop a site-wide map for use by HVC ERT that shows all HVC dams and potential inundation zones for each dam.
All Significant-consequence or Above Dams	Many HVC personnel may not know how to access nearest muster location.	Safety and Loss Control Department to complete site-wide map of named muster locations to be included in all HVC vehicles.
All Significant-consequence or Above Dams	Not all OMS manuals include detailed maps that outline location and access to HVC dams.	Add to each OMS manual an overview map that details access to the site and improve supporting text in OMS manuals.
All HVC Dams	Currently not well understood which HVC dams would be a priority for ongoing monitoring or remedial action in a triage situation.	Consider developing a triage plan for HVC dams to determine response priorities in the event of a site-wide emergency (e.g. seismic event or heavy flooding).
Annual Tailings Management Training Course	Current Dam Safety course structure focuses only on emergency response at the L-L Dam.	Consider breaking the audience into two groups and perform simple tabletop exercises for the Raw Water Reservoir and Trojan Dam.
All OMS Manuals	Emergency Reporting Procedure (call-out) for Tailings Storage Facilities and Water Storage Facilities is too detailed for the general user.	Consider isolating the Emergency Reporting Procedure to the ERP within the OMS Manuals and develop a simple call-out approach applicable to general personnel (i.e. notify supervisor, Protective Services or the Superintendent Tailings and Water Management in the event of an unusual condition at a dam).
Emergency Response Plan for TSFs and WSFs	Opportunity may exist to streamline ERP planning process by developing a single site-wide ERP for all HVC TSFs and WSFs.	Evaluate the opportunities and challenges associated with the development of a single site-wide ERP and determine next steps.
Tailings Lines	Standard operating procedures may not exist for performing work around tailings lines.	Evaluate the need for SOPs for performing work around tailings lines and refer to SOPs in HVC OMS manuals.