Agenda

• External vs. Internal Risk Communication
• Risk Communication Background
• Sources of Data and Methods
• Preliminary Findings
• Risk Communication in Tailings
• Future Work

End of pipe device in tailings discharge area.
External and Internal Risk Communication

• Typically external from an organization to the public

• Growing need for communication of risks from an organization to employees and contractors

• External communication tools can be applied to internal risk communication

Tailings discharge area.
• Risk = likelihood x consequence
• Loss is anything related to life, assets, environment, economy and productivity
"Risk communications is defined as any exchange of information concerning the existence, nature, form, severity or acceptability of health or environmental risks.

Strategic risk communications can be defined as a purposeful process of skillful interaction with stakeholders supported by appropriate information."

Peter Sandman’s Outrage Factors

- Voluntariness
- Controllability
- Familiarity
- Fairness
- Benefits
- Catastrophic potential
- Understanding
- Delayed effects
- Effects on children
- Effects on future generation
- Victim identify
- Dread
- Trust
- Media attention
- Incident history
- Uncertainty
- Reversibility
- Personal stake
- Ethical/moral nature
- Human vs. natural origin
### Peter Sandman’s Outrage Factors

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David and Joan Lynch School of Engineering Safety and Risk Management

University of Alberta
Peter Sandman’s Outrage Factors

• Voluntariness
  • Right to Refuse

• Controllability
  • Your job

• Familiarity
  • Normalization of risks

• Benefits
  • Livelihood

• Understanding
  • Over confident with task, experience or equipment

• Trust
  • Company will take care of you

• Incident history
  • Memory of an event or personal experience

Tailings discharge area.
Stakeholder Engagement

• Typically dominated by technical professionals who do not interface with hazards regularly

• To be successful there must be meaningful involvement from stakeholders

Driving through the tailings operations.
Sources of Data

• Energy Safety Canada (ESC) Tailings Hazard Inventory

• U of A Tailings Ground Hazards Assessment

• Interviews with frontline workers, supervisors, leadership and safety personnel

• Company incident databases specifically for tailings
ESC Methods

• ESC tailings safety experts toured oil sands sites to determine and prioritize hazards
• Concurrent study with ESC
• Using event tree and bow tie analysis to cluster hazards and identify controls

Trailing transport system and standing water after spring melt.
U of A Ground Hazard Inventory

- Geotechnical team from U of A conducted site tours to identify representative tailings storage and transport facilities at multiple oil sands operators
- Further analysis was completed to identify hazards, precursory events and controls
- Database of work environment representative facilities created
- Database of common ground hazards created
Interviews

- Interviewed over 130 frontline workers, safety advisors, supervisors, leadership and contractors at multiple oil sands operators
- Determined what hazards the workers are seeing
- Stakeholder collaboration
- Using Qualitative Data Analysis software (NVIVO) to determine emergent themes
Tailings Incident Database

- **Incident**: an unplanned and undesired event
- Incident reports from the past 5 years relating to tailings
- Clustered data to determine themes
- Comparing incident data to interview responses

*Tailings pond and tailings transportation system.*
Preliminary Findings

• 21% of hazards in the tailings incident database are related to ground hazards

• 83% of workers identified at least one of these ground hazards in their interview

• 17% of workers did not identify any ground hazards
Why Do Hazards Remain Unrecognized?

• Workers have a difficult time identifying hazards in dynamic, complex environments (Jeelani et al. 2017)
• Hazards are not associated with the primary task
• Unexpected hazards
• Visually unperceivable hazards
• Multiple hazards associated with one task
• Unknown potential hazards
Goal of Tailings Risk Communication

• Decrease feelings of familiarity, controllability and voluntariness
• Increase personal experience with an outcome
• Facilitate stakeholder involvement
How Do We Communicate Tailings Risks?

• In field training and mentoring were mentioned by 53% of interviewees

• Traditional training methods alone are “not sufficient to identify hazards” (October 2018 Interview) and “don’t stick as much” (October 2018 Interview)

• Tailings specific training for employees and contractors

Bulldozer in tailings discharge area in the steam.
<table>
<thead>
<tr>
<th>Hazard</th>
<th>Manifestation</th>
<th>Temporal Factors</th>
<th>Controls</th>
</tr>
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<td>Soft Ground</td>
<td>Poor/Untrafficable roads, flooded cells, overpoured cells, spills and uncontrolled releases, drainage problems, water coming up through ground</td>
<td>Heavy rain, spring thaw, winter conditions: ice, snow covered ground, steam, reduced daylight hours</td>
<td>Operating Procedures &amp; Training</td>
</tr>
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<td>Erosion Features</td>
<td>Washouts, erosion gullies, cell berm breach, cracks in the benches and berms, cuts in the cells</td>
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<tr>
<td>Differential Settlement</td>
<td>Uneven ground, sink holes, ground instability, cave-in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope Instability</td>
<td>Sloughing/failures of the benches and berms surrounding the tailings discharge areas and tailings ponds</td>
<td></td>
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</tbody>
</table>
Soft Ground: wet conditions

Roads in the tailings operations.
Stuck Equipment: summer conditions

Bulldozer in the tailings discharge area.
Bulldozer in tailings discharge area in the steam during winter operations.
Erosion: “cuts” in cell
Pipeline Leaks and Failures

Leaking main line tailings pipeline.

Damaged tailings pipe removed from service.
Erosion
Erosion
Leaking friction fit pipe in tailings discharge area.
Other Recommendations

- Formal mentor programs with training for coaches
- Job specific hazard identification tools where “fresh ink” is added
- Include workers and contractors in the discussion
- Complete hazard identification as a group

Excavator working in the tailings operations.
Future Work

• Continue analysis of datasets to determine similarities and dissimilarities

• Create Tailings specific training, best practices and operating procedures

• Could lead to best practices in the petroleum and mining industries more broadly

Tailings discharge area.
Thank you to our collaborators

- Canadian Dewatering
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- Ketek
- Owl Moon Environmental Inc.
- Rough Rider International Limited
- Suncor Energy
- Syncrude Canada Limited
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