Coal Handling Operations & Maintenance Safety Review – A Case Study

PRB Coal Users Group
Baltimore, Maryland
March 31, 2004

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David Liu
Kim Froats
Objectives

• Provide an overview of OPG & OPG’s fixed & bulk material handling systems

• Provide overview of the safety review of fixed coal & bulk material handling equipment conducted in 2002 - 2003

• Provide an overview of the OPG conveyor guarding initiative
Ontario Power Generation

- ~ Total installed capacity: 22,200 MW
  - Nuclear: 3 stations: 5,588 MW
  - Coal: 5 stations: 7,560 MW
  - Gas/Heavy Oil: 1 station: 2,140 MW
  - Hydroelectric: 65 stations (29 Ecologo™ certified): 6,923 MW
  - Wind: 3 locations: 9 MW
Coal Handling Operations & Maintenance Safety (CHOMS) Review

A review of the conventional safety risks associated with coal handling operations and maintenance at five large coal fired generating stations was conducted during 2002 - 2003. The review focused primarily on the fixed coal conveying systems from both an operation and maintenance perspective to reduce the risk of nip hazards.

A multi-disciplinary project team (aka SWAT) consisting of individuals with a safety, industrial hygiene and operations & maintenance background was formed to conduct the review.
A benchmarking study was initiated to determine best practices within the bulk materials handling industry. This benchmarking effort led to the development of an internal Safety Standard which was reviewed with the operating stations.

A station self-assessment was conducted in determining the stations' compliance with the requirements of the Standard, one of which included a risk assessment.
This self-assessment was followed up with a Project Team evaluation of stations' status in terms of the requirements of the Standard and their Action Plan to bring into compliance. Action Plans primarily dealing with upgrades to machine guarding of nip hazards, training, and operating & maintenance procedure improvements were made as a result of this review. The risk of nip hazards in the coal handling system of these five stations has been substantially reduced.

The sharing of this case information will assist other facilities involved in bulk material handling to develop programs, procedures and training to deal with risks associated with fixed bulk material conveying equipment.
Causal Factors

• Fatality – Nanticoke – October 15, 2002

  ▪ Conveyor Guarding
  ▪ Work Protection (Lock Out / Tag Out)
  ▪ Supervision
  ▪ Safe Work Planning
  ▪ Hazard Orientation
One of the Proposed Actions to one of the Investigation Recommendations from the October 15, 2002, Nanticoke Fatality was:

“Conduct a systematic, criteria based assessment of fixed coal handling equipment safety across all OPG coal fired plants”
US Annual Powered Conveyor Fatalities

- Primary and secondary source of injury:
- Powered conveyors only

<table>
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<tr>
<th>Year</th>
<th>Fatalities</th>
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<tbody>
<tr>
<td>2002</td>
<td>11</td>
</tr>
<tr>
<td>2001</td>
<td>29</td>
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<td>2000</td>
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<td>19</td>
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<tr>
<td>1998</td>
<td>24</td>
</tr>
<tr>
<td>1997</td>
<td>33</td>
</tr>
</tbody>
</table>
Machinery Fatal Occupational Injuries

Primary and Secondary Sources
- All United States - 2002

- Agricultural & gardening: 7%
- Construction, logging & mining: 17%
- Heating, cooling & cleaning: 7%
- Conveyors: 17%
- Cranes, derricks, hoists, elevators, jacks: 5%
- Metal & woodworking: 5%
- Special process: 5%
- Miscellaneous: 51%
Principle Causes of Fatal Conveyor Incidents

- **Equipment:**
  - Inadequate guarding
  - Defective guarding
  - Hazardous arrangement

- **People:**
  - Operating without authority
  - Operating in an unsafe manner
  - Making safety devices inoperative
  - Using unsafe equipment
  - Taking an unsafe position or posture
  - Working on moving equipment
  - Improper attitude
  - Lack of knowledge
“...insure a consistent approach is taken, and equal equal judgement applied, across EP-Fossil Stations when establishing measures to minimize the risks to employees and contractors associated with the operation of OPG coal handling equipment and facilities”.

Jim Twomey, SVP Electricity Production
November 10, 2002
Fossil Power Production
Fossil Stations
Goals of CHOMS Review

- Establish a standard for coal handling safety in Fossil Stations benchmarked to industry best practices.
- Managers will have site specific documented coal handling risk assessments and action plans as required.
- Action Plans will have been internally peer reviewed to insure a consistent approach is taken, and equal judgement applied, across EP- Fossil stations.
- Completion Report, documenting results and action plan.
- Process coordinated and completed in a timely manner.
It is a Big Operation:

- OPG has 32 km of conveying belts
- OPG has 236 conveying belts whose speed range from a very slow creep drive to 800 ft/min
- OPG has 428 transfer points
- OPG's conveying system moves 13.6 million tonnes of coal a year
- The power to move this bulk material is equivalent to 25,795 Horsepower (2 Great Lakes Ships!)
Nanticoke GS - 8 Units:
3,920 MW
Lambton GS - 4 units: 1,975 MW
Nanticoke
Steps in Process

- Establish Review team (SWAT)
- Determine relevant standards and industry best practices
- Update or revise existing information to yield an EP Standard for Coal Handling Equipment Operation and Maintenance
- Issue Standard to Fossil Stations and meet to discuss its application
- Fossil Stations assess Site Specific Hazards and Develop Plans
- Follow-up site visits by Review team members to review plans prior to implementation.
- Final Report Issued on results of program, including table of recommended future actions.
Review Model Overview

1. Event
2. Senior Management Agreement on Project
3. Benchmarking
4. Operational Expectations
5. Site Self Evaluations
6. Peer Review
7. Revised Station Action Plans
8. Management Review
Review Model Applied to Coal Handling Operations

Review (SWAT) Model

1. EVENT
   Problem Recognition
   Determination if problem is wide-spread throughout the Corporation

2. SR. MGMT AGREEMENT ON PROJECT
   Form Project Team, Terms of Reference
   Expertise, Leadership, Adequate Representation.
   Mgmt Commitment & Support (release of individuals and schedules)

3. BENCHMARKING
   • Literature Review, Internet Search, Document Review
   • Consult with Experts in the field
   • Teleconferences
   • Site Visits

Applied to Coal Handling Operations & Maintenance

1. EVENT - NANTICOKE FATALITY Oct, 15/02
   Fatality Investigation recommends Corporate Review
   Sponsored by Jim Twomey
   Led by Frank Chiarotto Nov 10/03

2. TERMS OF REFERENCE
   Drafted & Approved Nov/02
   Project Team Kick-off Nov 18/02

3. BENCHMARKING ACTIVITIES
   • ASME, ANSI, CSA, MSHS & Australian Standards Review
   • Discussion with MASHA, Inco, Dofasco, Stelco, Detroit Edison-St. Clair Nov 28-30/02
   • Initial Station visits to Nanticoke, Lambton & Lakeview
4. **Develop OPERATIONAL EXPECTATIONS (Standard)**
   - Review of Benchmarking to Industry Best Practices
   - Define specific expectations to reduce likelihood & consequence of adverse outcome
   - Define aspects of acceptable controls for people, hardware, equipment & environment
   - Incorporate Standard into Management System framework of Plan, Do, Check, Review
   - Incorporate a risk assessment process into the Standard
   - Station review and critique of Standard
   - Revise Standard as needed

5. **SITE SELF-EVALUATIONS**
   - Self-Evaluation against expectations (conduct an evaluation in comparison to Standard and the Risk Assessment)
   - Action Plans formulated to close gaps

4. **STANDARD DEVELOPED**
   - Adoption of criteria of 0.9 m guarding around pinch points
   - Formulated best thinking of various standards
   - consistent in approach with ASME, MSHA & MiOSHA: January 22, - Feb. 10/03
   - Station input and Feedback: Feb8 - 10/03

5. **SITE SELF-EVALUATIONS:**
   Nanticoke  Atikokan
   Thunder Bay Lakeview
   Lambton
   Feb 10 - 17, 2003

Applied Model cont’d

Review (SWAT) Model

Applied to Coal Handling Operations
Applied Model cont’d

Review (SWAT) Model

6. PEER REVIEW (SWAT)
   Internal and External expertise as needed
   Site Visits: Documentation Review, System
   Walk downs & Site Inspections, Interviews
   Review Findings

7. REVISED STATION ACTION PLANS
   • Budgeting & approval
   • Implementation of Action Plans
   • Review and verification of Action Plan completion
   • report on status

8. MONITOR
   MANAGEMENT REVIEW

Applied to
Coal Handling Operations

6. SITE PEER EVALUATIONS
   Nanticoke - Feb 17 - 21, 2003
   Thunder Bay - Feb.24 26, 2003
   Lakeview March 3 - 5, 2003
   Lambton March 10 - 14, 2003

7. REVIEW OF STATION ACTION PLANS
   • Final Report Development March 24-26/03
   • Finalization of Standard
   • Recommendations to Project Sponsor
   March 31, 2003

8. MONITOR
   MANAGEMENT REVIEW
Review (SWAT) Team

**Sponsor**
Jim Twomey

**Project Leader**
Frank Chiarotto

**Members**
David Liu, Nanticoke
Frank Bradacs, Lambton
Jim Miller, Thunder Bay/Atikokan
Dave McLeod, Lakeview
Kim Froats, Corporate Safety
Nick Ebli, Benetech (formerly DTE)
Gerry Champagne, Mines & Aggregates

Safety & Health Association
Team Experience

- Multi-disciplinary team
- Internal & External members
  - ~225 years of cumulative industrial experience
  - ~50 years of cumulative coal yard supervision
Activities & Associated Hazards to be Considered

- Machine Guarding
- Maintenance Activities
- Operational Activities
OPG’s EP Fossil Plant Coal Handling Review (SWAT) initiative is focussed on:

- Hazards created by all fixed material handling equipment including:
  - conveyors,
  - stacker reclaimers, stocking out towers,
  - transfer, and coal preparation equipment
  - other bulk materials

- Hazards involving OPG structures and operations.
Existing OPG policy, procedures, instructions

External Requirements:
- ASME B-20.1-2000
- Mines & Aggregates Safety Association - Conveyor Checklist
- Conveyor Equipment Manufacturers Association - Best Practices
- US Mines Health & Safety Administration
- Michigan OSHA
- Other relevant information
US Regulatory Requirements

- **General Industry:**
  - OHSA 1910.269 - Particularly: 1910.269(v)(11)
    - 1910.269(v)(11)(vii)-(xiv)
  - OHSA 1910.22
    - Also: OHSA 1910.211 to 1910.219
- **Construction:**
  - OHSA 1926.555
  - Rule 1403-1461
- **Marine Terminals:**
  - OHSA 1917.48
  
- **Safety and Health Regulations for Long Shoring**
  - OHSA 1918 (1918.64 – Powered Conveyors)
Benchmarking

- The SWAT Team met on a number of occasions at various sites to map out the process that would be applied to conducting benchmarking and the overall review process for conventional safety aspects of fixed coal and bulk material handling.
  - Standards Review: ASME, MSHA, MIOSHA, Australia
  - Station Procedure Review: All 5 coal fired Stations
- Four external firms who operate coal & bulk material handling systems in Ontario and Michigan were approached to participate in the benchmarking activity.
• The SWAT was charged with developing a new Operations and Maintenance Safety Standard for Fixed Coal and Bulk Material Handling Systems.

• The new standard shall be considered as part of the Operational Controls that are incorporated within the Safety Management System that is used by Electricity Production Coal Fired Fossil Stations.
• To establish the new standard, parameters had to be set; i.e. determine which elements to focus on

• The SWAT Benchmarking activity would have to measure where OPG stood relative to other organizations.
The Review (SWAT) undertook a benchmarking activity by visiting and evaluating 7 sites, which included:

- Three (3) OPG electricity production coal fired fossil stations. (2 coal, 1 limestone/gypsum)
- Four (4) other firms (Ontario and Michigan) (3 coal, 1 coke)
• In order to measure OPG against other organizations, a benchmarking tool had to be developed.
• **Definition:**

• **Benchmark** - something that serves as a standard by which others may be measured or judged.

Merriam – Webster Dictionary
Benchmarking

• Critical elements were identified
• A process to score each element was established
Benchmarking

• The critical elements used were as follows:

1. Conveyors Belts
2. Maintenance Programs
3. Emergency Response
4. Evaluations and Inspections
5. Tools and Equipment
6. Signage
7. Training
8. Lighting
9. Housekeeping
10. Access Walkways
11. Policies and Procedures
12. Pull Cords
13. Lockout / Tag out
14. Guarding

Fourteen (14) Elements in Total
Benchmarking

Methodology

– Team focus
– Critical element list
– Observations of physical conditions,
– Interviews
– Report of findings
– Analysis of findings
– Benchmarking template
– Final report
Benchmarking

• With all elements identified, a scoring mechanism was developed.

• Each element was scored in absolute terms on a scale of 1 to 5:
  1 = Unacceptable / Inadequate
  2 = Poor / Needs improvement
  3 = Good/Acceptable
  4 = Very Good
  5 = Outstanding/Excellent.

• Subjective Rating by each Team Member

• Results compiled by MASHA
The SWAT undertook a benchmarking activity by visiting and evaluating 7 sites, which included:

- Three (3) OPG electricity production coal fired fossil stations. (2 coal, 1 limestone/gypsum)
- Four (4) other firms (Ontario and Michigan) (3 coal, 1 coke)
• Templates were issued to each SWAT member for each field visit.

• The scoring was conducted individually and not as a group.

• This ensured anonymity and consistency for the scoring throughout the visits.
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<thead>
<tr>
<th>Location</th>
<th>Date</th>
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</table>

<table>
<thead>
<tr>
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<td>Actual Guarding</td>
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<tr>
<td>Pull Cord</td>
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<td>Policy / Procedures</td>
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<td>Housekeeping</td>
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<td>Lighting</td>
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<td>Training</td>
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<td>Maint. Program</td>
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<tr>
<td>Conveyors</td>
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A base matrix was set up to capture all the scoring and observations.

The matrix calculated the findings and standard deviations, and provided the data for the visual comparison graphs.
Benchmarking Activity

- Visited other firms involved in coal or bulk material handling:
  - Lake Erie Steel
  - Dofasco
  - Stelco - Hilton Works
  - Detroit Edison - St. Clair GS

- Discussions with Safety Professionals at:
  - Inco
  - Agrium
  - Other consultants
### Absolute Ratings on a Scale of 1 to 5

**Needs Improvement** < 3  
**Good** ≥ 3  

<table>
<thead>
<tr>
<th>Rating</th>
<th># of Elements</th>
<th>Elements</th>
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<tr>
<td>Needs Improvement</td>
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<td>guarding, signage, evaluations &amp; inspections, lighting, access walkways,</td>
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<tr>
<td></td>
<td></td>
<td>tools &amp; equipment</td>
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<tr>
<td>Good</td>
<td>8</td>
<td>Overall conveyors, housekeeping, pull cords, lock out / tag out, emergency response, maintenance, training and policies &amp; procedures</td>
</tr>
<tr>
<td>Very Good</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Outstanding</td>
<td>0</td>
<td></td>
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</tbody>
</table>
Benchmarking Data - Sum of Average Rankings Across 14 Elements

<table>
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<tr>
<th>Organization</th>
<th>Sum of Average Rankings</th>
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<td>Lambton</td>
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<td>Company A</td>
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<td>Nanticoke</td>
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<td>Company C</td>
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<tr>
<td>Lakeview</td>
<td>36.3</td>
</tr>
<tr>
<td>Company B</td>
<td>35.9</td>
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</table>
### OPG vs. Benchmarking Firms

<table>
<thead>
<tr>
<th>Element</th>
<th>Benchmark Firms</th>
<th>OPG</th>
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</thead>
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<tr>
<td>Conveyors</td>
<td>3.3</td>
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<tr>
<td>Maint Prog</td>
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<td>3.1</td>
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<tr>
<td>Lighting</td>
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<td>3.1</td>
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<td>Housekeeping</td>
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<td>Access walkways</td>
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<td>3.5</td>
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<td>Policy / Procedures</td>
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<td>Pull Cord</td>
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<td>3.0</td>
</tr>
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<td>Lockout / Tagging</td>
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<td>3.0</td>
</tr>
<tr>
<td>Actual Guarding</td>
<td>2.3</td>
<td>2.6</td>
</tr>
</tbody>
</table>

**Average Score**

- Benchmark Firms: [1.02, 3.04, 5.0]
- OPG: [2.0, 3.04, 5.0]
• With all elements identified, a scoring mechanism was developed.

• Each element was scored in absolute terms on a scale of 1 to 5:
  1 = Unacceptable / Inadequate
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  4 = Very Good
  5 = Outstanding/Excellent.

• Subjective Rating by each Team Member

• Results compiled by MASHA
Ontario Power Generation

Benchmarking Conclusions

The benchmarking activity showed that OPG Stations are generally similar to other firms in the management of safety for fixed coal and bulk material handling systems.

Some areas for improvement were highlighted.

These areas have been addressed in the new Standard.
EP Standard

- Clarification of expectations as it relates to conveyor safety and equipment guarding
- Based on H&S Management System concepts
- EP Standard integrates:
  - external standards & requirements
  - benchmarking information
  - OPG operating experience
Figure 1: Numerous Danger Points on a Standard Conveyor

- Loading Chute Skirt
- Vertical Bend Idlers
- Trough Idlers
- Dust Cover or Skirt
- Head Pulley
- Head Snub Pulley
- Drive Pulley
- Drive Snub Pulley
- Take-up Pulley
- Take-up Counter Weight
- Bend Pulley
- Impact Idlers
- Return Idlers (Below 8')
- Return Plough
- Tail Pulley

Critical Areas
Significant Risk Areas
Generic Risk Assessment for Coal & Bulk Materials Handling Equipment
Conveyor NIP Hazards

• NIP point: “a point at which a machine element moving in line meets a rotating element in such a manner that it is possible to nip, pinch, squeeze, or entrap a person or objects coming into contact with one of the two members. The same definition holds for the similar point with respect to two rotating parts or two converging parts in linear movement “

• ASME B20.1 – 2000 Safety Standard For Conveyors And Related Equipment
Critical NIP Points - 1

Unguarded Drive & Snub Pulley  Unguarded Tail Pulley
Critical NI P Points - 2

Unguarded Take Up Area

Unguarded Snub Pulley
Critical NIP Points - 3

Unguarded Tail Pulley

Unguarded Bend Pulley
Critical NIP Points - 4

Unguarded Head Pulley  Insufficient CWt Cage Height
Other Major NI P Points

Trough Roller has no guard rail

Insufficient Guarding @ Impact Idler
Other Major NI P Points

Return Pulley not guarded

Trough Idler not guarded at incline belt
Electricity Production (EP) Standard

- Standard developed from ASME B20.1, CSA Z 423-94, MSHA, MASHA & Queensland Government

- EP Standard will put OPG above North American coal industry standard & best practices once implemented

- Use 0.9 Meter (3 feet) as guideline to design and install guarding

- Use CSA 423-94 to determine mesh sizes
Inclined Conveyor Guarding

Require screen or solid steel guard for:

- Head & Tail pulleys, including snub pulleys
- Counter weight area
- Take-up pulley + horizontal take-up if accessible
- Return rollers/pulleys which is between 4’ – 8’ in height
- Impact idlers
- Drive coupling, chain or sheave

*Note: All screen panel either locked or mechanically fastened*
✓ All trough idlers need guardrail

✓ Mid rail along return idlers

✓ Safety net or cage for return idlers > 8’ if normally accessible from maintenance & operations personnel
Horizontal Conveyor Guarding

Require screen or solid steel guard for:

- Head & Tail pulleys, including snub pulleys
- Counter weight area
- Take-up pulley if accessible
- Return rollers/pulleys which is between 4’ – 8’ from walkway
- Impact idlers
- Guardrail on trough idler if situated < 4’
- Safety net required for return idler same condition as inclined conveyor
Typical Guarding on Conveyor

Figure 1 - Typical Horizontal Conveyor Screening and Guard Rail

- Manual Reset Switch (With Indicator)
- Pull Cord
- Idler Pulley
- Head Drive Pulley
- Snub Pulley
- Tension Pulley
- Barrier (Guardrail)
- Tail Pulley Guard
- Conveyor Belt Guard
- Guards for Take-up Pulleys
Pull cord – must be function properly, maximum span between switch and anchor point must not > 30 meter (~ 100’)

Pull cord must be maintained proper tension and flag/light must has bright colour

Safety Horn – Horn must be activated prior to belt start

Rollback must be in good working order
✓ Warning signs & Safety Labels must be posted at critical guarded areas
✓ EP Standard indicated to use Conveyor Equipment Manufacturer’s Association (CEMA) standard signage and labels
✓ EP Standard indicated minimum lighting requirement must be > 10 foot-candle
Typical Pull Cord

Return Rollers > 8’ have safety wire
Only trained and competent personnel are allowed to operate and maintain all conveyor equipment.

Do not ride on live conveyor nor crossing unapproved walkway underneath conveyor.

Do not use Tee or Dee handles tool for cleaning.

Do not wear loose clothing, jewellery, or long hair when working on live conveyor.

All maintenance and cleaning must be done with belt isolation, except the following:
If all critical NIP hazard areas are fully guarded by plate or screen or distance as per EP Standard
Greasing is allowed outside guarding area without isolation
Only trained and competent personnel are allowed to perform minor adjustment and belt-training. (Must use approved isolation procedure (AIP) or approved work protection procedure (AWPP)
Guard must be re-installed before conveyor return to service
Keep good housekeeping practice to clear major spillage or debris off walkway
Fire Separation door must be closed
Awareness of basic conveyor procedures

Of course that new bloke will be alright... only an idiot would put their hand near a conveyor while it's running!
Miscellaneous Guarding Issues

MAYBE BIGGER CONVEYOR GUARDS WOULD BE BETTER...
Where Regular Access to or past Nip Points is Required

Ensure guard is fixed to main conveyor framework. Configure to your situation.

Ensure arrangement has slots/holes cut out for drum adjustment. Watch out that the slots aren’t too big to allow access to the drum, and don’t forget the trip hazard created by the protruding threads!
Site Evaluations Schedule

• Stations to review Draft EP Standard and make suggestions for improvement or requests for clarification (Jan 2003)
• Stations to develop Safety Management Plans (Feb 2003)
• Review Team visited sites to assess Safety Management Plans
  ▪ Nanticoke Feb. 2003
  ▪ Thunder Bay Feb. 2003
  ▪ Atikokan Feb. 2003
  ▪ Lakeview Mar. 2003
  ▪ Lambton Mar. 2003
• Final Report & Wrap-up (April 2003)
PRB Coal Users Group

Significant Positive Findings

• The benchmarking activity showed that OPG Stations are generally similar to other firms in the management of safety related to fixed coal and bulk material handling systems.

• All Stations demonstrated a positive attitude and approach to safety evidenced through interviews conducted during site visits.

• All Stations demonstrated a good understanding of the requirements of the draft EP Operations and Maintenance Safety Standard for Fixed Coal and Bulk Materials Handling Systems.

• Stations have good Interim temporary guarding in place for most locations where it is needed.

• There was very good agreement between the Stations and the SWAT Team on the results of the Self-Assessment.

• All Stations follow the EP SEQ manual resulting in good contract administration in coal yard and bulk material handling areas.
This Review had re-defined and clarified the expectations (raised the bar), plus we have raised the awareness of staff on how to look at risk areas with the application of the Standard.

- This EP Standard has defined very clearly what is expected on life safety issues (where putting in a specified level of controls whether it be guarding or procedural is not an option).

There are gaps between the Standard and the current practices which needs to be addressed through the Station Action Plans.

The SWAT and Station self-assessments show that the stations, once given the standard, were quite good in identifying the risks compared to a third party (of OPG and external staff) knowledgeable in coal handling systems and practices.

- This is a positive finding… i.e. we have good people at the plants that are doing good things.
Opportunities for Improvement

HIGH PRIORITY
- Conveyor guarding
- Training

MEDIUM PRIORITY
- Fall Protection
- Safe Work Planning
- Tools
- Signage
- Rigging
- Housekeeping & Material Spillage
Photo-documentation

• EXAMPLES
Numerous Pinch Points
Atikokan

H
Reclaim
tail end
Lakeview

K2 Head

Nip Point easily accessible
No hand rails on inclined areas
Lack of lighting in some locations
Lakeview

G2 Counterweight

Nip hazard accessible at top and bottom
Lack of secondary restraint on counterweight
K1 & K2 Handrails required

Existing handrail

New guardrails required both sides of walkway
Example of good impact guarding

Lambton

L2 G
Impact Guarding
Nanticoke

Requires guarding
Nanticoke

Temporary Guarding at SR 1
Thunder Bay

Temporary Guarding

Tripper Floor additional guarding required
Thunder Bay

Crush Point between Trippers
Thunder Bay

K2 Tail
End Skirt box

Good guarding on skirt box

Additional guarding needed
Conveyor Guarding

Adherence to the new EP Standard will push conveyor guarding to a new position of higher degree of guarding and provide a lower level of risk.
EP Standard
Where Does It Take Us?

Cumulative Costs ($)

Risk

Costs - Millions ($)

## Estimate of Hardware Costs

<table>
<thead>
<tr>
<th>Station</th>
<th># of Belts</th>
<th>Estimated Costs ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nanticoke</td>
<td>114</td>
<td>4.50</td>
</tr>
<tr>
<td>Lambton</td>
<td>74</td>
<td>2.50</td>
</tr>
<tr>
<td>Thunder Bay</td>
<td>14</td>
<td>0.45</td>
</tr>
<tr>
<td>Lakeview</td>
<td>20</td>
<td>0.45</td>
</tr>
<tr>
<td>Atikokan</td>
<td>14</td>
<td>0.28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>236</strong></td>
<td><strong>8.2</strong></td>
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</tbody>
</table>
OUTCOMES

- **EP STANDARD:**
  - Conveyor guarding
  - Operation & Maintenance Procedures

- **EP TRAINING PACKAGE**

- **EP RISK ASSESSMENT & SELF-ASSESSMENT GUIDELINE**
  - Self-Assessment Tool
  - Checklists
Summary

- The SWAT process used is the right one with the right level of up-front review and site involvement.
- The SWAT process can be used and integrated with other evaluation methods for other conventional safety risks faced in OPG.
- Temporary Guarding has made the workplace as safe as possible, pending final engineering & installation of permanent guarding.
Station Action Plans have a clear path forward to bring the Station into compliance with the new EP Standard.

The new EP Standard raises the bar and will position OPG in the top quartile of firms using coal & bulk material handling equipment.

OPG has big systems and so permanent guarding fixes will take some time ~ end of 2005 with a preliminary cost of $8.2 million.
Summary

- Increased awareness by all stakeholders through additional training and communication
- EP Standard will ensure ongoing review and continuous improvement
Key “Learning's” for Other Organizations

- Review your current conveyor guarding status
- Review your current operations and maintenance procedures
Questions or Comments?
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