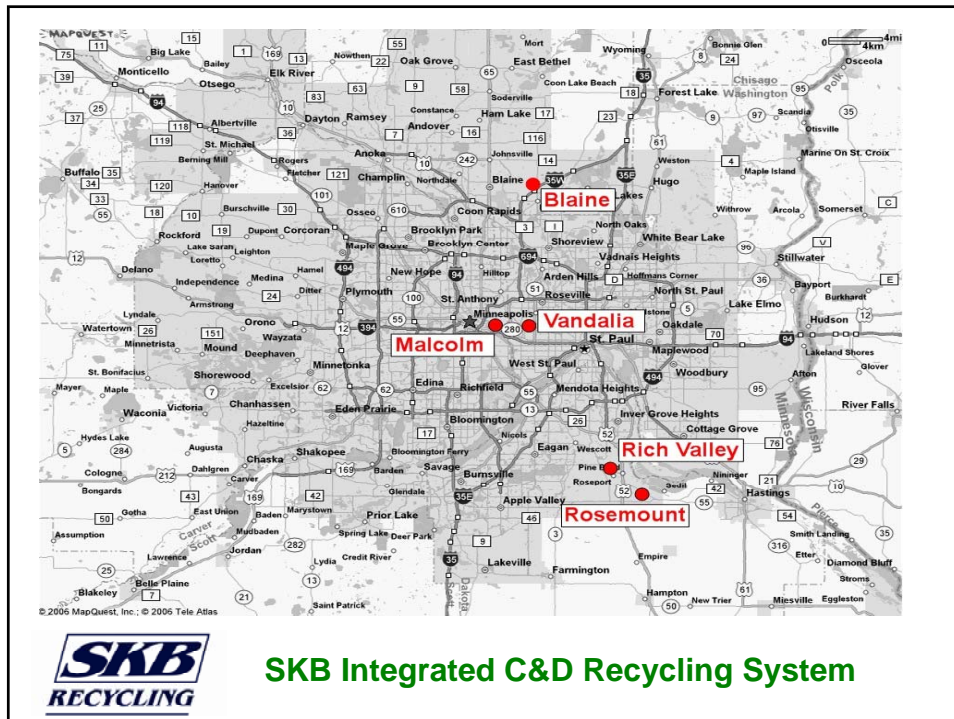




SKB Recycling, LLC
C&D Recycling Forum 2010
Asphalt Shingle Recycling
October 4, 2010





SKB Rosemount Industrial & C&D Waste Facility



SKB Rosemount C&D Recycling



SKB Rosemount C&D Recycling



SKB Malcolm C&D Recycling



SKB Blaine C&D Recycling



SKB Vandalia Concrete & Asphalt Recycling



Materials Recycled/Recovered

- Metals (Ferrous & Non-ferrous)
- Concrete and Asphalt
- Wood for Biomass Fuel
- Tear-off Shingles
- Vinyl Siding
- Cardboard
- C&D Fines as ADC



Tear-off Shingle Processing





Minnesota's Shingle Recycling History

- 1980's: Some preliminary ventures between shingle manufacturers and asphalt pavement producers. Primarily Manufacturer Shingle Scrap (MASS)
- Early 1990's: Field and lab research conducted by MnDOT and MPCA (previously OEA).
- 1996: MnDOT establishes first "provisional" specification for Manufacturer Shingle Scrap (MASS).



Minnesota's Shingle Recycling History

- **2003: MnDOT makes MASS spec “permissive”.**
- **2002-2008: SWMCB sponsors a series of end market development studies for Tear-off Shingle Scrap (TOSS).**
- **2007: MnDOT adopts provisional spec for use of TOSS in pilot projects.**



Minnesota's Shingle Recycling History

- **2008: MPCA funds lab study series conducted by MnDOT.**
- **2008: Wisconsin DOT adopts permissive spec for use of TOSS.**
- **Feb 2009: Industry, SWMCB gather legislative support to encourage MnDOT to adopt a spec for TOSS. MnDOT agrees to expedite spec development.**



Minnesota's Shingle Recycling History

- **May 2009: MPCA and MnDOT adopt shingle processing protocol and provisional spec for TOSS.**
- **Dec 2009: MnDOT converts provisional spec to a permissive spec for TOSS.**
- **Aug 2010: Industry, MPCA and MnDOT discuss revisions to protocol and spec that are likely to occur later this year and go into effect for the 2011 construction season.**



Tear-off Shingle MnDOT Requirements

- **Gradation: 100% passing 1/2" and 90% passing #4. Less than 0.5% deleterious by weight.**
- **Mix: Maximum of 5% shingles. Mix must contain minimum of 70% virgin binder.**
- **Shingle processor must certify that product meets specifications and approved asbestos testing plan.**



MPCA Approved Shingle Processing Plan

- Only permitted Solid Waste Facilities may process shingle waste. Must remove other waste materials including tar paper.
- Asbestos testing:
 - Sample from random load for every 50 tons of shingles.
 - Multi-layer and NESHAP—every load, every layer must be sampled.



Probable Revisions to MN Requirements

- Tar paper OK.
- Asbestos sampling frequency increased to once for every 250 incoming tons.
- Will consider increasing deleterious percentage to 1.5%.



Tear Off Shingle Recycling

- MPCA Approved Recycling Plan
- Source of Shingles
- Sort Line
- Labor
- Grinder
- Screen
- Loader(s)



Delivery of Shingle Waste



Asbestos Sampling Piles



Manual Pre-Sort

Tear Off Shingle Presort



- Remove Large Items
 - Wood
 - Metal
- Remove Trash



Removed Clean Wood



Removed Trash



Shingle Sorting Line



Feed Pre-processed Shingles



Negative Pick Sorting Line



Negative Pick Sorting Line

Tear Off Shingles Sorting

- Labor Intensive
- Equipment Intensive
- Slow





Stacking Conveyor

Pure Processed Shingles



- 100 % Shingles
- No Wood
- No Metal
- No Tar Paper
- No Wrappers



Tear-off Shingle Grinding



Peterson 6700 Grinder

Critical Factors

- Infeed Rate
- RPM
- Grate Size
- Rotor Temperature
- Wear



Peterson 6700



Wear Parts



- Hammers
- Anvil
- Grates



Hardfacing

- Every 40 hrs of Productive Operation
- Hammers
- Anvil
- Compression Roller
- Wear Liners



Temperature Control



Screening Ground Shingles



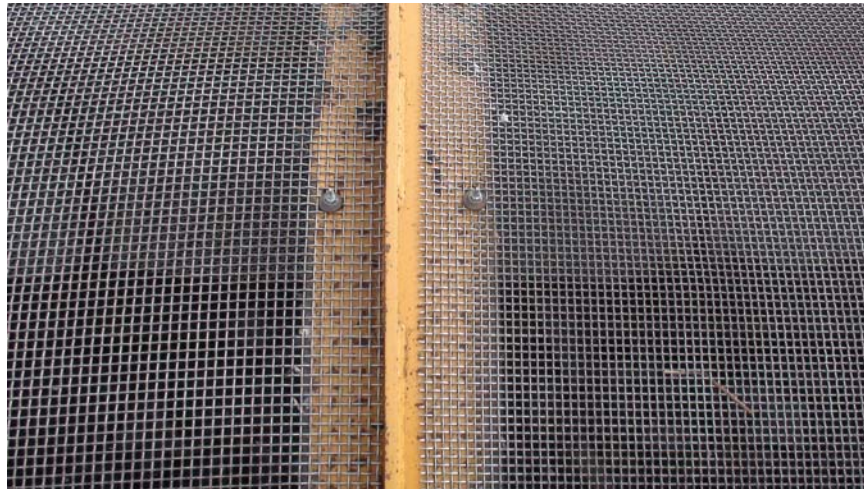
Critical Factors

- Feed Rate
- RPM
- Screen Size
- Screen Shape
- Wind
- Temperature





Wildcat 626 Trommel Screen



Adjust Screen Size to Spec



“Overs” Return Feed



Finished Product

Sieve Analysis



End User – Asphalt Pavement Plant



Screening Mixed TOSS & RAP



Mixing Drum



Roofs to Roads

Economics of Shingle Recycling:

- Cost of virgin asphalt
- Market of related products (RAP)
- Tipping fee for shingles
- Capital costs





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