
# Recycled Asphalt Shingles in HMA and Other Applications

**A Presentation at the**
**80th Annual Meeting of the**
**Northeastern States Materials Engineers' Association**
**Wednesday, October 20, 2004**

**On Behalf of the Recycled Materials Resource Center,**
**University of New Hampshire**

**Presenter: Dan Krivit**
**Dan Krivit and Associates**

# RMRC Project 22

## By Mn/DOT and OEA

- *Overcoming the Barriers to Asphalt Shingle Recycling*
- Minnesota Department of Transportation (Mn/DOT)
- Minnesota Office of Environmental Assistance (OEA)

# RMRC Project 22

- April 13 – 14, 2003
  *Second Asphalt Shingles Recycling Forum*
- *http://www.projects.dot.state.mn.us/uofm/shingles/index.html*

# Who's in the audience today?

- State engineers
- Local county, city, town engineers
- Private operators:
  - HMA producers
  - Paving companies
  - Recyclers
- With shingling recycling experience
- Any attending April 2003 *Forum?*

# Multiple Applications

- HMA
- Aggregate base and sub base (unbound gravel)
- Dust control
- Cold patch
- Ground cover
- Fuel
- New shingles

# Summary Highlights

- History of experience:
  - State engineers
  - Private operators
- Substantial body of literature
- High quality HMA can be maintained *

# Resources

- Mn/DOT & RMRC handout packet
- *Forum* web page
- RMRC web page
- www.ShingleRecycling.org
- SWMCB web page
- OEA web page

# Summary Highlights

- QA/QC critical **
- Use in HMA can be very cost effective:
  - Cheaper alternative to landfilling
  - $0.50 to $3.30 per ton of HMA

# Summary Highlights

- Risk from asbestos can be managed

# RMRC Project 22

## By Mn/DOT and DKA *

- Review of past literature and demonstration projects
- Broad partnership / outreach
- New field demonstrations
- Environmental testing for asbestos
- *Forum* in April 2003
- Spec development

# Definitions

- *Manufacturer Asphalt Shingle Scrap*
- *Tear-Off Asphalt Shingle Scrap*
  (Private residential homes only *)
- *Recycled Asphalt Shingles*
  (Crushed & screened)

# Scrap and Product Quality Specs

- Free of debris / trash / foreign matter
- Tear-off scrap must be asphalt shingles only, **no nails**

# Recycled Asphalt Shingles in the Northeastern States

## DOT Specs and State Beneficial Use Determination (BUD) Licenses

### (Draft summary as of 10-19-04)

| State | State DOT Specs | State BUD License |
|---|---|---|
| CT | | Draft BUD License (M, T)<br>CT Dept. of Environmental Protection |
| ME | | ME BUD License (M, T)<br>ME Dept. of Environmental Protection |
| MA | Pilot underway | BUD License (M, T),<br>MA Dept. of Environmental Protection |
| NH | | BUD License (M, T) |
| NJ | NJDOT Spec (901.10)<br>5% manufacturer scrap only | |
| NY | | |
| PA | PADOT spec 5% manufacturer scrap,<br>Draft spec for tear-off scrap | |
| RI | | |
| VT | | BUD license,<br>VT Agency of Natural Resources |

| **Notes:** | |
|---|---|
| M: | Manufacturer scrap is allowed / recycled |
| T: | Tear-off waste is allowed / recycled |

# Recycled Asphalt Shingles in Other States

## DOT Specs and State Beneficial Use Determination (BUD) Licenses

### (Draft summary as of 10-19-04)

| State | State DOT Specs | State BUD License |
|---|---|---|
| | | |
| FL | Tear-off spec under development | |
| GA | 5% manufacturer or tear-off scrap | |
| IL | | |
| IN | 5% manufacturer scrap | |
| IA | | |
| MI | 50% recycled content[(1)] | |
| MN | 5% manufacturer scrap only | BUD permit by rule for both M and T |
| NC | 5% manufacturer scrap only | |
| OH | "certain percentage of recycled material" | |
| TX | manufacturer or tear-off scrap | |
| WA | | |

| **Notes:** | |
|---|---|
| M: | Manufacturer scrap is allowed / recycled |
| T: | Tear-off waste is allowed / recycled |

# Mn/DOT Specification

- Currently limited to manufacturer asphalt shingle scrap (MASS)
- Tear-off roofing shingles explicitly excluded (discussions underway)
- Certification process for assuring quality of supply

# Mn/DOT Spec

- Maximum 5%
- Considered a type of RAP:
  - 5% shingles + 25% RAP = 30% max RAP
- QA/QC standards apply (blending charts)

# Mn/DOT "Draft Spec on File"

- Gradation
  - 100% passing the ¾" sieve, and
  - 95% passing the #4 sieve
- Shingles stockpiled separately
- Pre-blending is prohibited
- Crushed & recycled shingles introduced with RAP at same time

# Mn/DOT Draft Spec on Files

(See SWMCB handouts of March 4, 2004)

- Certification from:
  - Manufacturer
  - Processor
- Sample for review
- List of pre-approved sources and processors from MN/DOT

**Scrap Shingle Certification Sheet**
***Manufacturer***

**S.P.No:_____ Project:_____**

**Manufacturer of Shingle Scrap:**

Name: _____

Address: _____

_____

Contact: _____

Phone: _____

We the undersigned, certify that a portion of the shingle scrap to be used on this project, wa directly from one of our manufacturing plants to the processor listed below and is shingle man waste material. We certify that this; material is not tear-off or re-roof material which has been p used. We also certify that the material supplied to the processor consisted of only organic and/or shingles and contains no asbestos or other hazardous material.

_____
Name of Processor Shingle Scrap Was Supplied To

_____
Address

_____
Manufacturer of Shingle Material Date

Date

**Scrap Shingle Certification Sheet**
***Processor***

S.P.No:_____ Project:_____

**Manufacturer of Shingle Scrap:**

Name: _____

Address: _____

_____

Contact: _____

Phone: _____

We the undersigned, certify that all of the shingle scrap to be used on this project came from manufacturing facility or facilities and is not tear-off or re-roof material. We certify that this shi material contains only shingles, not other material was added or introduced into this shingle scrap.

_____

_____

Processor of Shingle Material Date

**Note**: Processor must submit certification from all manufacturing facilities which provided or v shingle scrap material to be used on this project.

# Bituminous Roadways, Inc.

Inver Grove Heights, MN

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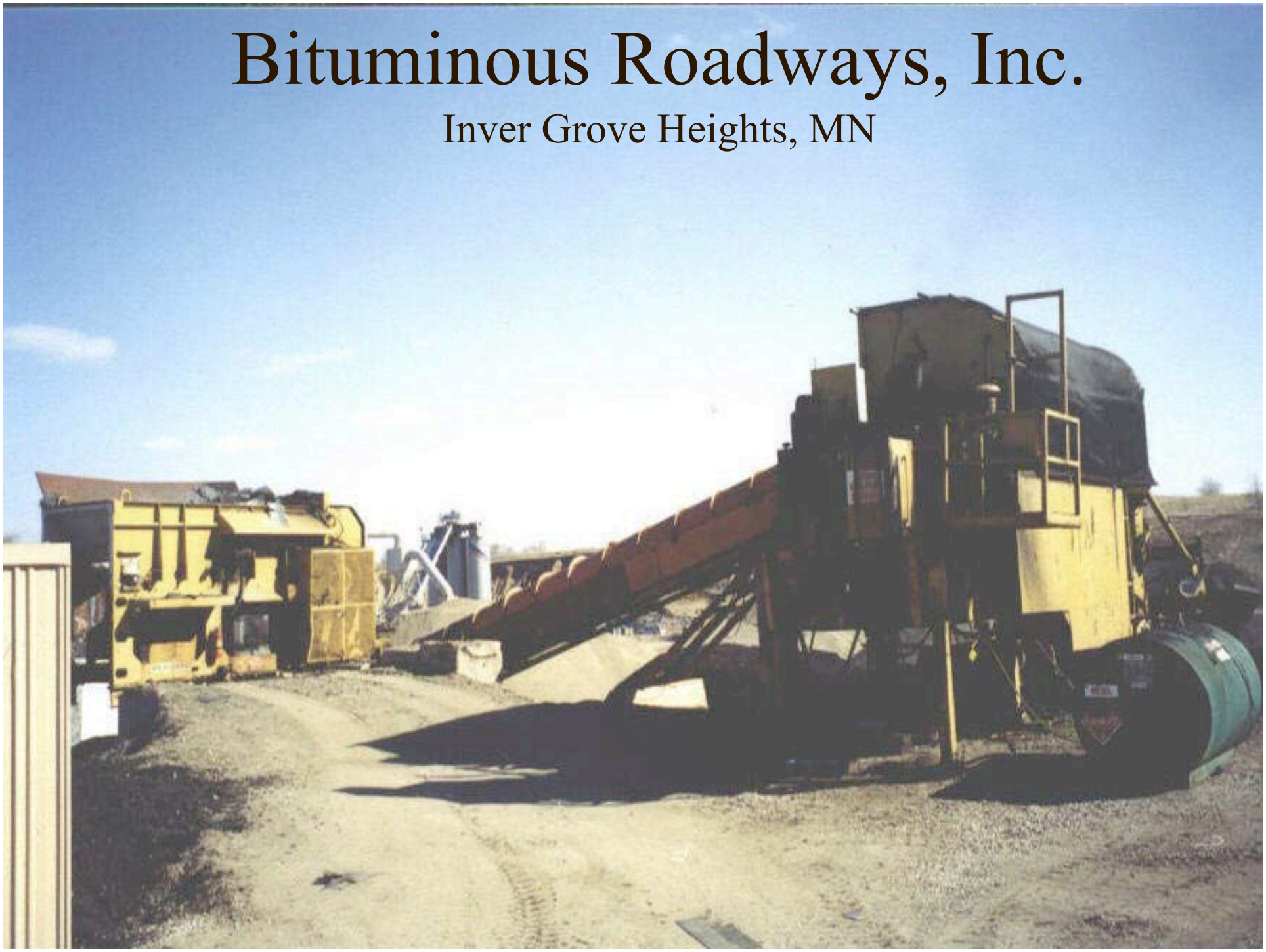
Inver Grove Heights, MN




Dust control demo

# Mn/DOT's Perspective on Shingle Recycling

March 4, 2004

Roger Olson,
Research Operations Engineer


Building upon ongoing research and development efforts by Mn/DOT, OEA and RMRC

# Shingle - History

- Mn/DOT tests
  (with University of Minnesota)
- Willard Munger Trail (1990)
- Hwy 25
  south of Mayer, MN (1991)
- Scott County Hwy 17
  south of Shakopee, MN (1991)

Roofing Shingles & Roads

DRIVING CHANGE

# Scrap Asphalt Shingles

- Mn/DOT's most recent specifications, Combined 2360 / 2350, allows 5% manufactured shingle scrap in hot mix
- Shingles considered as RAP
- At discretion of HMA producer

Roofing Shingles & Roads

DRIVING CHANGE

# Shingle Processing

- Can be added like recycled asphalt pavement (RAP)
- Steps include: grinding, sizing and grading
- Contaminants must be removed
- Certification of supply required
- Manufactured waste only at this time

Roofing Shingles & Roads

DRIVING CHANGE

# TH 25 Test Section
## (Since 1991)

Roofing Shingles & Roads

DRIVING CHANGE

# Test Results

| | Percent Shingles | PG Grade |
|---|---|---|
| TH 25 (control) | 0% | 73 - 20 |
| TH 25 (test #1) | 5% | 75 - 20 |
| TH 25 (test #2) | 7% | 79 - 15 |
| CSAH 17 (control) | 0% | 77 - 22 |
| CSAH 17 (test) | 10% | 75 - 24 |

Roofing Shingles & Roads

DRIVING CHANGE

# Ongoing Mn/DOT Shingle Project Co-Sponsored By:

- Minnesota Office of Environmental Assistance (OEA)
- Recycled Materials Resource Center (RMRC)

Roofing Shingles & Roads

DRIVING CHANGE

# For More Information

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Roofing Shingles & Roads

DRIVING CHANGE

# Recycled Asphalt Shingles


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# Hennepin County Mill & Overlay Project: France Avenue: Between 80th & 90th Streets

- Surface cracking on old bituminous pavement required mill & overlay repair

- Crews report “Traffic can use surface more quickly than normal mixes”

## Hennepin County

France Ave.

80th St. to 90th St.

Specified PG 58-28

Extraction Results:

SB 30% RAP, no Shingles:

PG 67.6-27.0

PG 68.1-27.9

NB 25% RAP, 5% Shingles:

PG 66.5-27.9

PG 67.6-28.4

- Increase the use of shingle-derived asphalt in county projects.

- Include shingle derived asphalt material as an alternative bid item in our annual bituminous contract.

# SWMCB Web Sites

- http://www.greenguardian.com/business/shinglerecycling.asp

And

- http://www.greenguardian.com/shinglerecycling/mapa_workshop.asp

# RMRC Project 13

## By Chesner Engineering

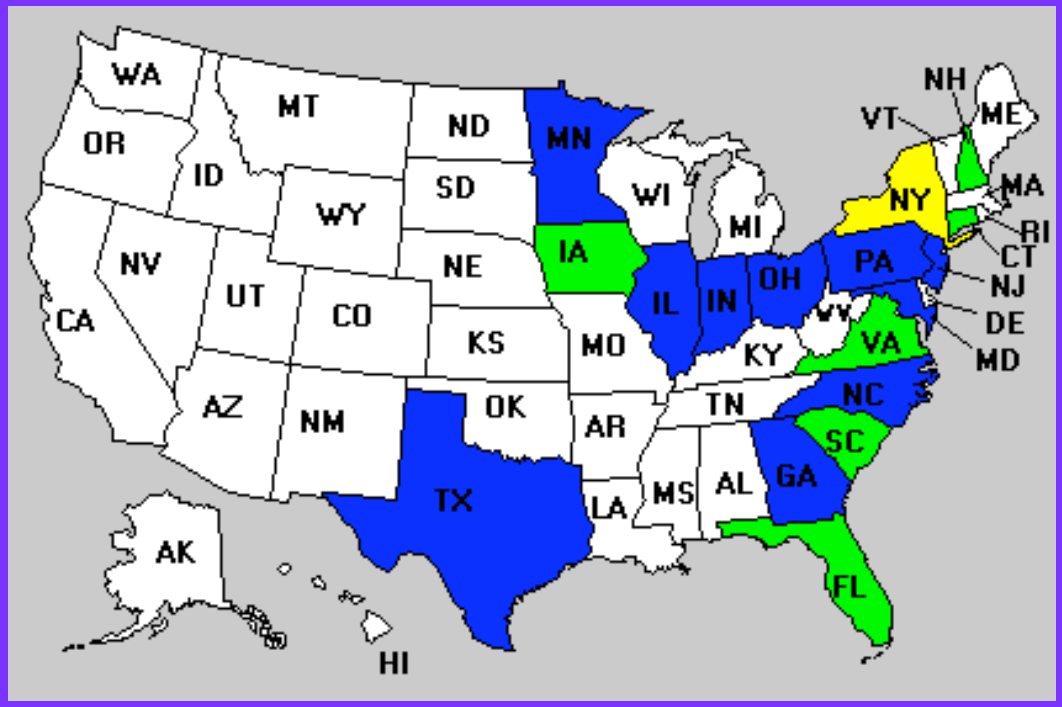
- Shingles have been used in HMA for over 15 years
- At least 10 states have a spec
- Draft AASHTO spec in process

# Recycled Asphalt Shingle as an Additive in Hot-Mix Asphalt

**RMRC Training Workshop for Northeast States**
**September 13-14, 2004**
**Manchester, New Hampshire**

Henry Justus

# States Using RAS (1999 data)




| | |
|---|---|
| Red | General Use |
| Pink | Alternate to Bidders |
| Blue | Case-by-case Approval |
| Green | Potential for Use |
| Yellow | Considered Questionable |
| Grey | Not Recommended |
| White | Not Yet Evaluated by State |

(Justus, September 2004)

# States Reporting Use of Recycled Asphalt Shingle in Hot-Mix Asphalt

- California*
- Florida
- Georgia
- Indiana
- Illinois
- Iowa
- Minnesota
- New Jersey
- North Carolina
- Pennsylvania
- Texas
- Wisconsin*
- Nova Scotia
- Ontario

(Justus, September 2004)

# Engineering Performance Advantages

- Reduce Need for Virgin Binder
- Add Fibrous Reinforcement
- Modify PG Grade Binder
  - High Temp Performance
  - Low Temp Performance
- Reduce Landfill Needs

(Justus, September 2004)

# Engineering Performance Disadvantages

- Hotter Mix Requirements
- Stiffer Mix
- Possible contamination

(Justus, September 2004)

# American Association of State and Highway Transportation Officials (AASHT0)

(Justus, September 2004)

# Specification - SOM Review

- Manufacturing and Post Consumer Shingle
- 100% passing the ? inch Sieve
- Maximum Addition Rate Contractor Option
- Gradation must meet the requirements of the mix design

(Justus, September 2004)

# AASHTO Specification-cont.

- RAS < 5% the PG of Virgin Binder dictated by the Climatic Conditions
- RAS > 5% the PG of the Virgin Binder established based on a virgin-shingle binder blending evaluation

(Justus, September 2004)

# AASHTO Specification- cont.

- **Deleterious Material- Maximum of 0.50% cumulative (metal, glass, paper, rubber, wood, nails, plastic, soil, brick, tars and other contaminating substances)**
- **Asbestos level established by the State or Federal Environmental Protection Agency**

(Justus, September 2004)

- NCHRP Rpt. 452 “Incorporation of RAP in the Superpave System”
- <15% RAP, no change in PG Grade
- >15% RAP, Assess the Effect of RAS on the Virgin Binder
- The Draft AASHTO specification recommends a similar approach.
- < 5% RAS, no change in PG Grade
- > 5% RAS, Assess the Effects of RAS on the Virgin Binder

(Justus, September 2004)

# AASHTO:
# Subcommittee on Materials

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# DKA / AES
# Fiber Tests

***RMRC Project:***

**Environmental Testing of Airborne Particles at**
**The Shingle Processing Plant**

**April 2003**

# Asphalt Shingle Recycling and Asbestos

- Concern
- Regulation
- Sampling
- Approval

Ruesch, April 2003

*Second Asphalt Shingles Recycling Forum*
*April 2003*

# Data

- Iowa (1791), no hits*
- Maine (118), no hits
- Mass (2288 composites), 11 hits < 1%, 1 - 2%
  - 69 tarpaper (2 < 5%, 2< 1%), 109 grind (2 < 1%)
- Florida (287), 2 hits > 1%
  - 17 grind
- Missouri (6), no hits
- Hawaii (100), 1 hit >1%
- Minnesota (156), no hits
- Minnesota (50 tarpaper), 1 hit - 2-5%
- We still want more data !
  - PLM & TEM correlation, Hits

Ruesch, April 2003

# Minnesota Approach

- Regulatory status under NESHAP

Single family

vs

Commercial & Institutional

- *Overcoming the Barriers to Asphalt Shingle Recycling, Environmental White Paper Report, MnDOT, 2002*

Ruesch, April 2003

# Model Sampling Protocol

- Visual Screening
  - Layers, composite, thick
- Specified Frequency
  - Incoming loads
- Grind
  - Per job
- Relationship w/ haulers, end markets
  - Contract, agreement, awareness, certify

Ruesch, April 2003

# Thank You


- Paul Ruesch, USEPA

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# Asbestos Risk

- Incidence of asbestos is extremely low:
- Average content was only:
  - 0.02% in 1963
  - 0.00016% in 1973

(NAHB, 1999)

# Summary Highlights

- Risk from asbestos is negligible to non-existent
- Two rounds of sampling for total:
  - Dust (1999)
  - Fibers (2002)
- Common sense and best management practices can help prevent employee exposure

# Air Fiber Sampling Rationale

- Used roofing shingles from private, ***single-family*** homes exempt from NESHAP
- Demonstration was limited to exempt material only
- Only site of new exposure is at the shingle recycling (e.g., grinding) site

# NESHAP ***Exempt*** Materials

- Homes under 5 units per building
- NOT commercial / institutional
- ***NOT facilities*** as defined by NESHAP
- No non-asphalt shingles
  (e.g., cementitious shingles, transite or other construction waste)

# OSHA Regulations

- U.S. Occupational Safety and Health Administration standards:
  - 1910 for general industry
  - 1926 for construction work
- Administered and enforced in Minnesota by the Minnesota Department of Labor and Industry

# Sampling Results

- PEL was not exceeded
- Peak (excursion) levels under standard
- Peak exposure during cleaning
- Worst case total ***fibers*** measured at 0.06 fibers per cubic centimeter (f/cc) of air
- Well within asbestos PEL

# Key Conclusions

1. Previous waste sampling indicates negligible asbestos in used asphalt roofing shingles
2. Asbestos is more likely from commercial roofing waste, mastic, caulk or felt
3. Any new exposure to asbestos would be at shingle recycling (e.g., grinding) operation
4. Private, residential, ***shingle family*** homes are ***exempt*** from NESHAP

# Key Conclusions

5. MN OSHA sampling in 1999 indicated total ***dust*** within PEL standards
6. AES sampling in 2002 indicated total ***fibers*** within PEL standards
7. Operators can reduce employee risk to dust and fiber exposure
8. Personal respirators are probably NOT necessary

# Recommendations – Supply Management

1. Limited supply during *Phase Three* demonstration to clean, ***NESHAP-exempt, asphalt shingles only***
2. Suppliers must certify incoming loads
3. Shingle recycler/asphalt producers must certify HMA derived from shingles as compliant with these requirements

# Recommendations – Dust Management

1. Shingle recycling operators should develop dust management and employee hazard prevention plans
2. Equipment manufacturers should consider development of shrouds and other dust control devices as options

# Thank you

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