



Resource Conservation Division



For a successful shingle
recycling business

Working With Your
Environmental Regulators



Why talk about asbestos?

- It's why more post-consumer shingle recycling is not happening (recent Region VIII experience)
- End user (market) concern: our Colorado Department of Transportation has asked or commented in every conversation
- Successful businesses don't try to hide elephants
- Denver company. Never got on board with program, cohesive response, regulators knew he wasn't working with us, regulations help everyone



Why talk about shingle recycling?

- 1 million tons per year manufacturer scrap
- 10 million tons per year post-consumer shingles
- 50-400 years to decompose
- Bad news for landfills
- New asphalt binder is \$500/ton



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- Shingles clog up landfills
- Increased methane production, 10 times worse than CO₂ as a greenhouse gas
- Colorado: 240,000 tons/year dumped in landfills

Our Objective:

Keep Asphalt Shingles Out of the Landfill

Support Beneficial Re-Use



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Talking Shingle Recycling

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Building a successful shingle business

- DOT
- State recycling campaign
- Greenhouse gas emission reductions
- 1200 lbs of CO2 metric ton equivalent AVOIDED for each 1 ton of RAS used
- Open, tell the world, get awards, governor should know, state senators should know
- We are creating green jobs



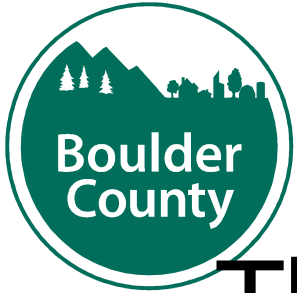
Why talk to your regulators about asbestos?

- Trying to avoid them doesn't work long-term
- Understanding the regs and speaking the language of the regulators is doable
- Get them to OK what you're doing
- Success: Roofers letter of agreement with OSHA/EPA, based on NESHAPS



Talking with our regulators in CO

- When first exploring shingle recycling
- Early conversations with CDOT
- CDPHE asbestos control unit
 - Grant funding
 - I sample per ton: BULK SAMPLING
 - Way beyond NESHAPS
 - Not sure he understood we were GRINDING



The problem with asbestos

- Airborne fiber
- DISEASE: asbestosis, lung cancer, GI cancer, mesothelioma
- Long latency periods, long time 15-40 years between exposure and disease
- Lawsuits. Johns Manville bankruptcy; EPA shingle ban thrown out of court; Shingle manufacturers have had legal issues with asbestos
- Over the past 30 years, 56 asbestos personal injury trusts have been established. The largest 26 of these paid \$10.9 billion to settle 2.4 million claims through 2008.
- Regulators worry about these kinds of facts
- It's reasonable to be concerned about public health



More about mesothelioma

- Lining of the lungs gets cancer
- No cure
- 40 year latency period
- Linked to low exposures (janitors in school buildings with asbestos insulation on boiler)



Challenges with asbestos regulators

- You need to know the regulations - their regulations
- Friable vs non-friable
 - Shingles are non-friable and we may be making them friable.



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Colorado Data

- Approximately 1 positive for every 100 samples
- 3 per roof, dropped to 1 per roof.
- Paint, caulk, tar
- Can be in actual shingle but we did not find in shingle



Thoughts about laboratories

- Lab in new hampshire, 24-hour turnaround, fed ex fees, because of our volume
- One coordinated state-wide testing program good for volume and coordination
- Great lab across town: too complicated for roofers. Courier service?
- How to get roofers to do it? Roofing company by roofing company. Required by collection points
- NAVLAP, AIHA



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CO experience

- Feb 2008 ideas, talking, grant proposal, talk with CDOT, CDPHE, roofers, CAPA
- 2009:
 - Asbestos testing, roofers test
 - Collection free
 - 2010 \$50 to dump a roof (\$100 at landfill)
 - Testing at collection points
 - One “shingle scavenger” gets shut down and leaves town with a shingle pile behind him



The Future

- AIR TESTING
- Compare our air results to AMBIENT levels (background levels in the environment)
- Grant funded shared project for AIR data during grinding: upwind and downwind
- TEM
- Get EPA asbestos experts to review our methodology
- If we find that shingle grinding not found to increase asbestos background levels, all things are possible



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Project Goals

- Environmental Benefit (waste reduction by working with Post-Consumer shingles)
- Better Roads?
- Cost savings
- Greenhouse Gas emissions avoided
- Help CDOT achieve recycling goals



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Reclaimed Asphalt Shingles

Asphalt 20%---40%

Stiffen Roadway Asphalt

Aggregate ≈≈≈30%

Good Stuff

Fiberglass or Paper Mat ≈≈≈30%

— No Harm if Well Dispersed



- 1997: Hailstorm goes through town
- Significant roofing work after the storm
- Shingles are brought to Marshall landfill
- Top three feet of landfill are shingles
- Because of all the shingles in the landfill, the Marshall Landfill reached its maximum capacity and had to be closed.



Case Study: The Marshall Landfill



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Status of Roofs to Roads Project

**2007-2009: Exploratory meetings,
literature review**

**2009 –2011: CDPHE funding, EPA funding,
funding through January 2012, research
focus**

Over twenty paving projects completed



Building a Broad Base of Support

- Colorado Department of Public Health, Pollution Prevention Advisory Board, Advanced Technology Grant
- Region 8 of the EPA
- Boulder County Resource Conservation Division
- Boulder Green Building Guild
- Colorado Department of Transportation
- Boulder County Transportation Department
- Colorado Asphalt Pavement Association
- Colorado Roofers Association
- Local asphalt companies: Asphalt Specialties, Brannan Sand and Gravel, list is growing
- Waste Management, Laramie County Landfill
- Nationally: shinglerecycling.org, Greenroads, FHWA, AASHTO standards, over 20 years of experience (1987)



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Collecting Shingles



Since Feb 2009, over
150,000 tons of
shingles collected

Collection currently
paused



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Processing Shingles

3-4 grinders in Colorado as of 1/2011

QA/QC needed

1/2" minus, asbestos testing, state regulation of recycling facilities





Creating Markets For Recycled Shingles

- CDOT Draft Protocol for Submittal of Non-Standard Mix Designs
- Public & Commercial Projects
- North 63rd St. Project
- Five or more paving projects including RAS in 2010
- Over ten projects in 2011, including one DOT project (Highway 36)
- Shingles are 20-30% asphalt
- New asphalt ~\$500/ton (September 2010)





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North 63rd Street Paving Project

April 2009



1 mile project

6" deep mill and overlay

300 tons of shingles used

Comparable lanes

Mix design available



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63rd Street Paving Project

July 2010



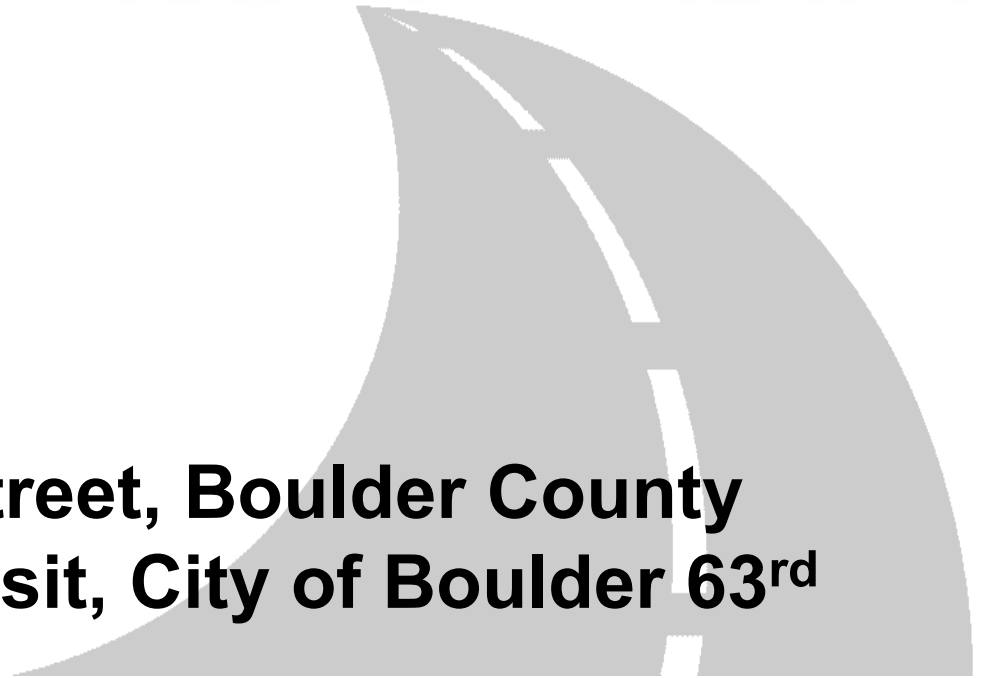
1 mile project

15" new construction

3 lifts, 10", 3", 2"

4% shingles, 600 tons used

Mix design available



Paving Projects

April 2009 North 63rd Street, Boulder County

July 2010 Special Transit, City of Boulder 63rd St, full replacement

August 2010 Boulder County Overlay

September 2010 City of Aurora Overlay

Red Rocks Park access road, overlay

2011: Colorado Springs, CDOT Highway 36 (Denver-Boulder) North Lane



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What We Learned:

It can be done

**All roads good so far (questions on
City of Aurora project)**

Shingle % in mix: 4-5%

Some issues in hot mix:

stiffness

pg grade

low temperature cracking



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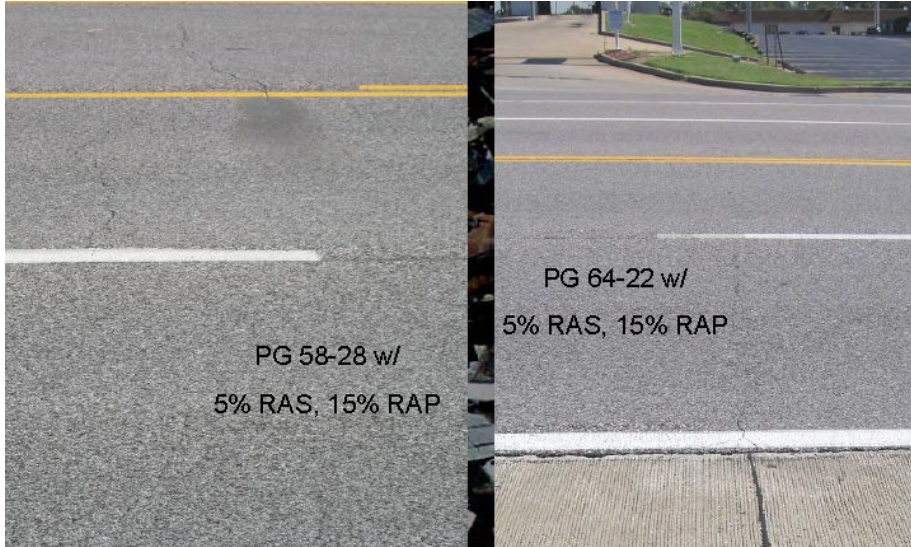


Shingle asphalt is a stiffer, oxidized, polymer-modified asphalt





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No reflective cracking



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Reduced Greenhouse Gas Emissions

110 lbs/ ton RAS



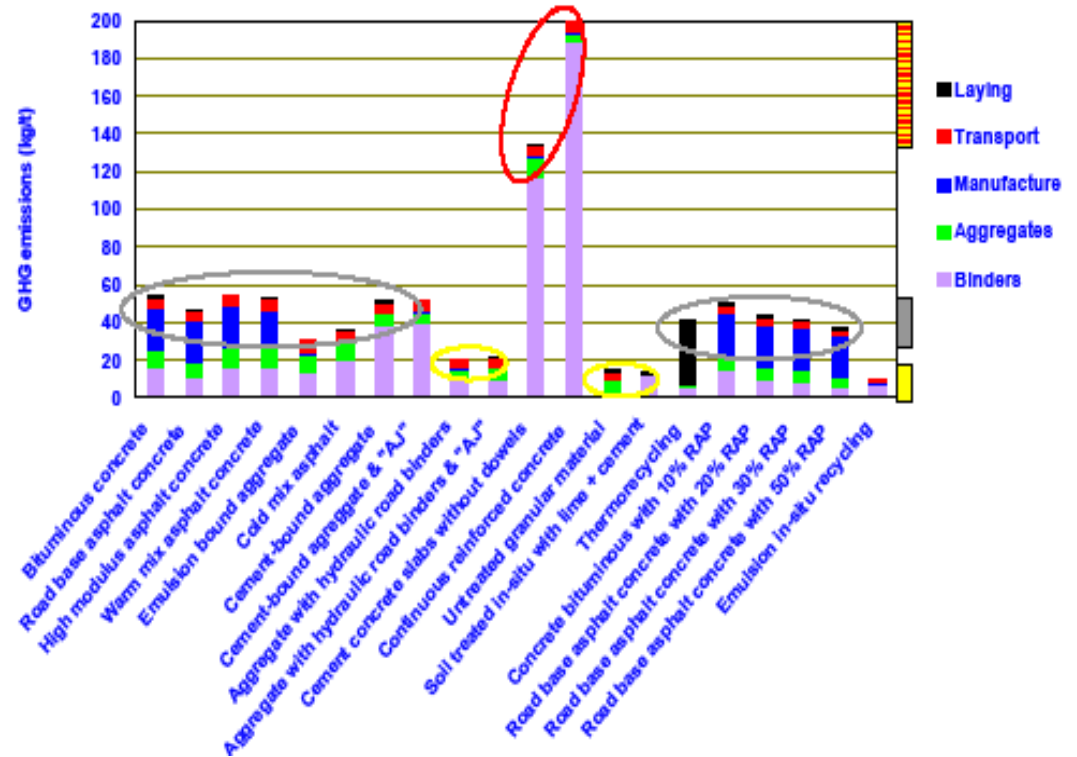
ENERGY CONSUMPTION & GREENHOUSE GAS EMISSIONS

Michel CHAPPAT
 Research and Development Director of
 COLAS Group
 Graduated engineer of University
 institution specializing in engineering
 Civil engineer
 DEA of Physics in Pierre and Marie Curie
 University, Paris

Julian BILAL
 Division Manager for Structures Design of
 COLAS group
 Graduated from Ecole Centrale in Nantes



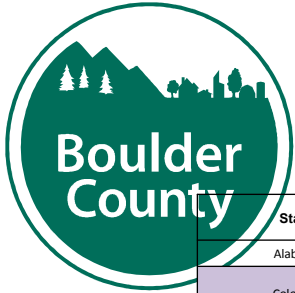
GHG emissions per tonne of laid material





What's next?

- Documentation of 2010 paving projects
 - Field/performance testing of projects
 - Boulder County non-destructive testing of North 63rd Street in 2011
- Ongoing research for 2011 projects
- Seek ongoing funding
- Experiment with more recycled materials: Ground Tire Rubber, Higher % RAP



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| State | Asbestos Samples | Asbestos Hits | 1% or Greater | Testing Frequency | Air Samples | |
|---------------|-----------------------|---------------|---------------|--|----------------|-------------------------------|
| Alabama | manufacture user only | | | | | |
| Colorado | > 1,000 | 10 | 8 | varies: 1/ton, 1/load, 1/50 tons, 1/100 tons, 1/500 tons | none available | data from feb 2009 to present |
| Florida | 16 | 0 | 0 | 1 per 6 tons | 0 | |
| Florida | 591 | 5 | 2 | 1 per every load | | old data |
| Iowa | 3850 | 7 | | every layer per every load | 1/clean | |
| Iowa | 90 | 0 | 0 | 1 per every 50 tons | 1/clean | |
| Iowa | 1791 | 0 | 0 | | | old data |
| Iowa | | | | | | talked |
| Maine | 146 | 4 | 2 | 1 per every load | | old data |
| Massachusetts | 60000 | 25 | 25 | 1 per every load | 0 | |
| Massachusetts | 2288 | 12 | | 1 per every load | | old data |
| Massachusetts | 6 | 1 | | 1 per every load | | old data |
| Massachusetts | 16154 | 401 | 401 | 1 per every load | | old data |
| Michigan | | | | | | left message |
| Michigan | | | | | | |
| Minnesota | 829 | | | | | |
| Minnesota | 206 | 1 | | 1 per every load | | |
| Minnesota | 43 | 0 | 0 | 2010/50 & 2011/250 | 0 | |
| Minnesota | 24 | 0 | 0 | 1 per every 50 tons | 0 | |
| Minnesota | 452 | 0 | 0 | 2010/50 & 2011/250 | | |
| Minnesota | 204 | 0 | 0 | 2010/50 | 0 | |
| Minnesota | | | | | | |
| Minnesota | | | | | | |
| Missouri | 45 | 0 | | | | old data |
| Missouri | | | | | | talked |
| Missouri | not required | | | | | |
| Nebraska | | | | | | left message |
| Oregon | 1600 | 3 | 0 | 1 per every load | 0 | |
| South Dakota | 150 | 0 | 0 | 2010/1 per load & 2011/1 per every 10 loads | 0 | |
| South Dakota | 33 | 0 | 0 | | 0 | |
| Texas | | | | | | talked |
| Texas | 250 | 0 | 0 | 1 per every 100 tons | 0 | |
| Virginia | 124 | 0 | 0 | 1 per every 100 tons | 0 | |
| Washington | 67 | 5 | 5 | | 0 | |
| Wisconsin | 23 | 0 | 0 | 2010/50 & 2011/100 post grind | | |
| Wisconsin | | | | | | left message |
| Wisconsin | 230 | 6 | | Bulk Post Grind Sample | | left message/old data |
| Wisconsin | 157 | 0 | 0 | 1 per every 100 tons | | |
| Wisconsin | 75 | 0 | 0 | Bulk Post Grind Sample | | old data |
| Wyoming | 200 | 0 | 0 | 1 per every load for first 400 tons | 0 | |
| | | | | | | talked |
| | | | | | | talked |



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Thank you!

For more information, contact
Jennifer Marie Shriver, CHMM
720-564-2243
JShriver@BoulderCounty.org



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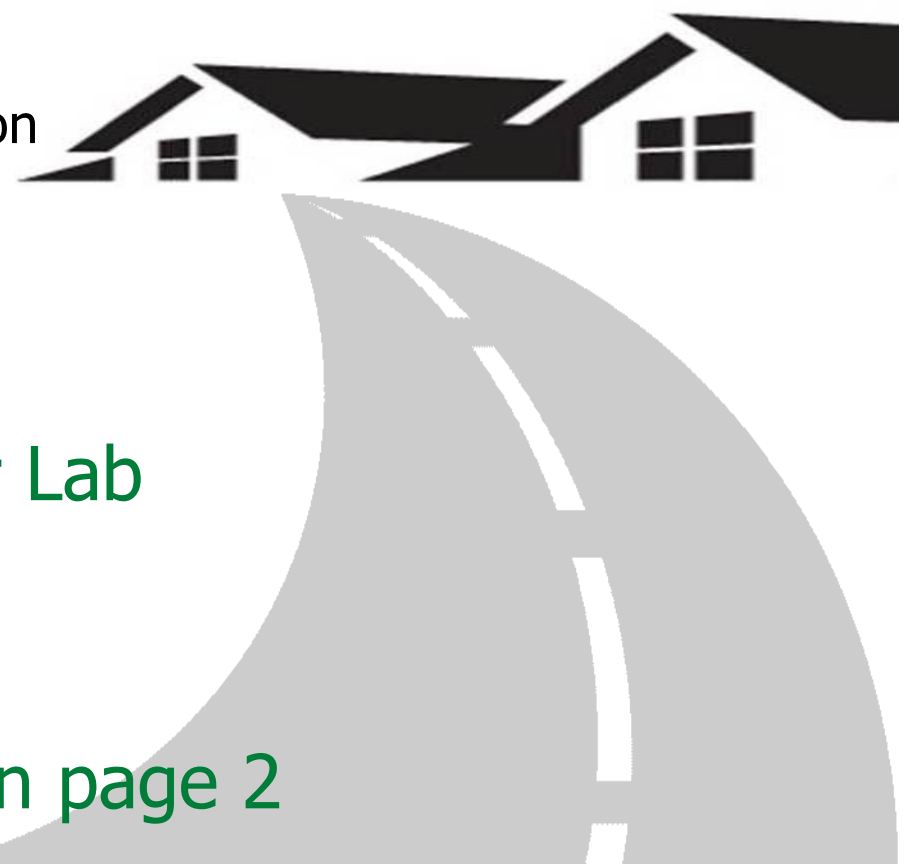
Roofer Outreach Program

Step 1. Attend Roofer Training

Step 2. Complete Roofer Questionnaire

Step 3. Gather Samples of Roofing
Material for Asbestos Testing

- Collect 3 samples per roof
- Samples are 1/2" x 1/2"
- Focus on caulk, tar, putty



Roofer Outreach Program

Step 4. Prepare Samples for Lab

Complete lab form

- Add your e-mail address on page 2
- Make each Sample Number Unique

Company Date Street # 1 A B, C
 2 A B, C
 3 A B, C



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Roofer Outreach Program LAB FORM

| URS CORPORATION | | | | | |
|--|--|--|--|--------------------------|--|
| Bulk Sample Chain Of Custody | | | | | |
| I wish to receive my preliminary results via: FAX <input type="checkbox"/> E-Mail <input checked="" type="checkbox"/> | | Laboratory Batch# | | | |
| URS CORPORATION | | Project Number: You create your own project # | | | |
| 5 Industrial Way | | Client: Your Name Here | | | |
| Salem, NH 03079 | | Location: Address of the roof to be recycled | | | |
| Tel # 603 893-0616 | | Project Manager: Company Name (your name) | | | |
| Fax# 603 893-6240 | | Turnaround Time (circle): | | 24 Hour 48 Hour Standard | |
| Type of Analysis: Bulk (PLM) <input checked="" type="checkbox"/> Air (PCM) <input type="checkbox"/> Lead (AA) <input type="checkbox"/> TEM <input type="checkbox"/> Point Count <input type="checkbox"/> | | | | | |
| Positive Stop Analysis? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> | | | | | |
| Samples Taken By: | | Date Samples Taken: | | | |
| Control Document 1016 10/05/06 Rev. 2 | | You create your own sample #. We suggest your company initials, (or your personal initials for homeowners, the day and month the sample was taken, the street number where the roof is located and add A to first sample, B to second and C to third and so on. For Example: R2R 0914 3205 A. | | | |
| Sample # | | Sample Description/Location | | | |
| R2R 0914 3205 A | | | | | |
| R2R 0914 3205 B | | | | | |
| R2R 0914 3205 C | | | | | |
| Relinquished By: | | Date: | | | |
| Company: | | Time: | | | |
| Relinquished By: | | Date: | | Received By: | |
| | | | | | |





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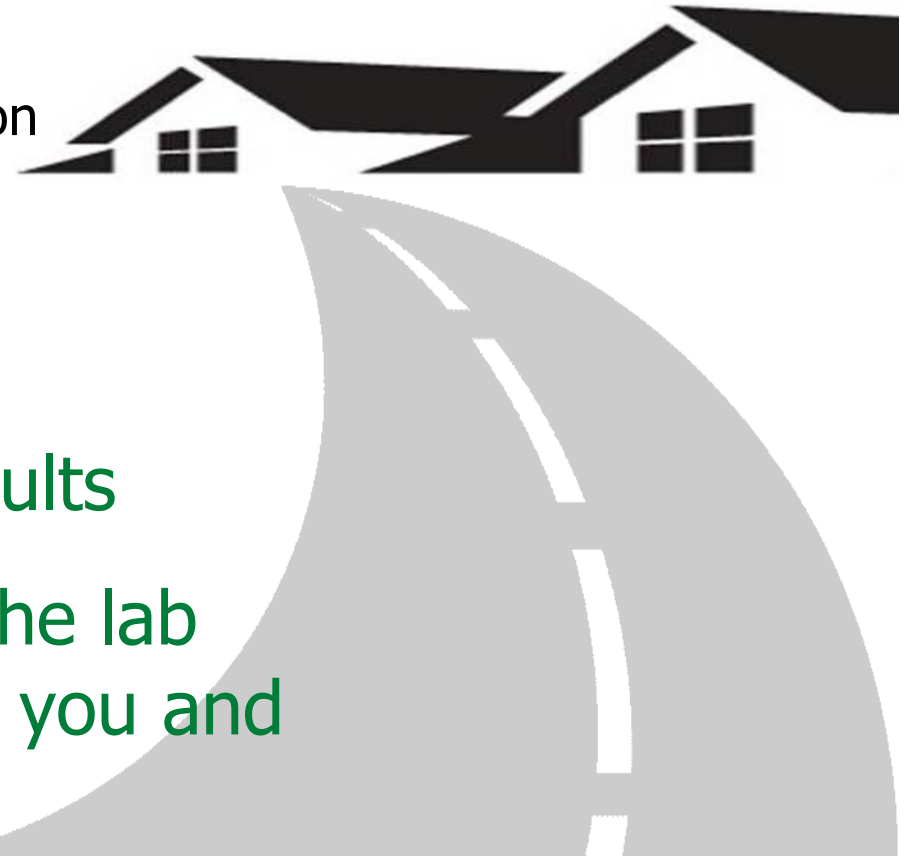
Roofer Outreach Program

Step 5. Send Samples to Lab

- Bring completed lab form
- Include samples of roofing material
- Overnight samples at any FedEx/Kinkos



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Step 6. Receive Lab Results

- Within 24 to 48 hours the lab will e-mail the results to you and Roofs to Roads.
- Shingles can go to recycling facility if asbestos results are negative or non-detect



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Roofer Outreach Program

Step 7. Tear off the roof

- Keep shingles separate
- No trash
- Wood, shingle wraps, metal are all recyclable





Roofer Outreach Program

Step 8. Shingles to Collection Point

- Clean, asbestos-free loads are accepted by the recycling facility.
- If the load is not clean, the collection point can refuse it!

Step 9. Enjoy the benefits

- Keep Colorado beautiful
- Decrease landfill use
- Save on tipping fees
- Build goodwill with your customers