Second Asphalt Shingles Recycling Forum

How “The Beneficial Use of Asphalt Shingles” Got Licensed in Maine

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Maine Department of Environmental Protection
Beneficial Use of Solid Wastes

www.state.me.us/dep/rwm/rules
From This......
To this......
Maine

1.3 million people (40th)
30,995 square miles (39th)
2 commercial landfills

Tipping fee
$85+ ton
Exemptions

• Exempted numerous beneficial use of materials which pose little, if any, risk from all licensing by the Department

• Landscaping materials
• inert fill
• processed oil contaminated soil in and under pavement
• some clean ash materials
• some clean dredge materials
• most paper products
Additional Exemptions

• Also:

• Recycled and processed asphalt pavement and concrete

• some whole tire uses

• some materials which are reused in a manufacturing process
Beneficial Use General Standards

A. If intended to be used as a raw material substitute in manufacturing, the beneficially used secondary material must perform as an acceptable substitute for the material it is replacing.

B. If the secondary material is intended to be beneficially used as a product, it must meet or exceed the applicable generally accepted product specifications and standards for that product.

C. The beneficial use will not pollute any waters of the state, contaminate the ambient air, constitute a hazard to health or welfare or create a nuisance.
Also the use must be kept out of the water.

A beneficial use activity may not be located in, on, or over any protected natural resource or be located adjacent to and operated in such a manner that material or soil may be washed into any protected natural resource unless approved pursuant to 38 M.R.S.A. Section 480-A et seq.

From Chapter 418.3.E “General Standards for Beneficial Use”
 Permit By Rule Uses

- Easy to license
- 20 day turnaround
- Public notice
- Very limited risk
- Licensed the usage site

- Examples
- Tire Chips as a drainage material
- Tire Chips in lightweight fill applications
Reduced Procedure Licensing

• More concerns about total risk usually by means of exposure for the usage
• Public notice required
• Still a relatively easy license to get

• Examples
• Additional dredge materials
• Some ash materials in road construction materials
• Some ash in flowable fills
Full Beneficial Use License

- If the constituents of concern meet the de minimus risk standards of Appendix A, no risk assessment required
- Public notice required
- More involved review

- Examples
  - C&D as a bio-mass boiler fuel
  - uses of ground sheetrock
  - uses for foundry sands, various ashes, dredged materials, etc.
Beneficial Use with Risk Assessment

- Exceed the concentration levels allowed as a *de minimus* risk in Appendix A
- Public notice required
- Risk management required to minimize total risk

- Shingles
- Other ashes
- Other uses of oil contaminated soils
- Other fuels
**De Minimus Risk Standards**

- ILCR of $5 \times 10^{-6}$
- HI < 1/2
- Units are in mg/kg or parts per million
- Most restrictive pathway of exposure used (dermal, ingestion, inhalation, etc.)

- Based on 1/2 of the Clean Up Standard for the Department’s Hazardous Waste Sites ILCR of $1 \times 10^{-5}$ and HI< 1, Residential Use
- Based on EPA 3 Risk Based Concentrations adjusted for typical Maine exposure.
So just what is in asphalt shingles to worry about?

- Asbestos?
- Metals?
- Carcinogenic PAHs?
- Pathways of exposure?
Asbestos

- Sampled during the first year of operation from 1994-1995. $25 +/- per sample.
- In residential samples, 0 hits of 118 samples
- EPA approved methodology, 600/M4-82-020 Polarized Light Microscopy.
- During the grinding process, air monitoring [utilizing EPA Level II method] utilized with no hits.
- Commercial rolled roofing still being tested.
Asbestos Conclusion

- Not likely to occur in Residential Shingles
- More likely to be found in rolled roofing for commercial uses

- All loads to be visually inspected
- Commercial materials tested
- Monitoring and random sampling
Metals mg/kg

- In Ground Shingles
  - **Arsenic** 5.6
  - Barium 63.4
  - Cadmium < 1.09
  - Chromium 26.7
  - Lead 81.4
  - Mercury 0.17
  - Selenium < 1.1
  - Silver < 1.63

- Appendix A Standards
  - **5.375**
  - 5.375
  - 2000
  - 10
  - 47.5
  - 375
  - 1.2
  - 6.25
  - 42.5
cPAHs ug/kg or ppb

- Benz[a] anthracene
- Benzo[b]fluoranthene
- Benzo[k]fluoranthene
  → Benzo[a]pyrene
  → Dibenz[ah]anthracene
- Chrysene
- Indeno[1,2,3-cd]pyrene

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cPAHs

• The combined toxicity of the cPAHs is driven by the ratio of Benzo[a]pyrene to the toxicity of all of the other cPAHs by a factor of $5/7.6 = 0.66$

• Therefore, a factor of $0.66 \ [\text{BaP/cPAHs}] \times$ the BaP concentration was used to limit the total combined toxicity of all of the cPAHs.
Pathways of Exposure

- No Leaching
- Inhalation at the processing facility
- Ingestion

To Reduce Risk

- Hard Surface which includes hot asphalt mix and cold patch
- Spray bars at the processing facility
- 50% shingles as a maximum concentration
- Limit the shingle fines
- Limit the max area in a residential setting
What is Driving the Ingestion Risk?

**Benzo[a]pyrene**
- Arsenic
- all other cPAHs
- Amount of *fines*
- Total *area of the use* in a residential setting
- % of *shingles* in the final mix

**30 times** the risk standard

**High Cancer Slope Factor**
- Adds *1/3 to total toxicity*
- Limit fines to *15% max*
- Assumed to be *25%* of total yard available for ingestion

**50/50 mix** is maximum
Critical Pathway of Exposure

- Residential Use as a not hard surface
- Ingestion by children  [200 mg/day x 6 years]
- Ingestion by adults  [100 mg/day x 30 years]
- Amount of material in a yard = Ac= 25%
- Fc = fraction contaminated = 50% x 15%
- 143 days per year of exposure
- 15% fines (passing a #100 screen, 150 um)
Secondary Road
Residential Driveway
Subdivision Roads
Risk Calculation

• **Risk** = constituents of concern x toxicity x dose

• **EPC** = maximum exposure point concentration within final product

• **Fraction Contaminated** = $F_c = \% \text{ of shingles } \times \text{ the } \% \text{ of fines } = 50\% \text{ ground shingles } \times 15\% \text{ fines}$

• **Ac** = area contaminated = 25% of “yard”
These are the license limit CRS has to meet on an annual reporting basis:

- Max EPC [BaP] = $38.7 \text{ mg/kg} = 0.66 \times 1.1 \text{ mg/kg}$
  (50% shingles x 15% fines x 25% of yard)

- Max EPC [As] = $71.6 \text{ mg/kg}$

  Appendix A Std. = $5.375 \text{ mg/kg}$

  $Ac \times Fc_\text{ } = 0.25 \times 0.075$
Condition of Approval:

• As part of the facility annual report, the applicant continues to annually monitor the concentrations of Benzo[a]pyrene and of the RCRA 8 metals in the final mixtures within products for Beneficial Use to ensure the concentration are at or less than levels evaluated within the assessment of risk. The maximum concentration level for Benzo[a]pyrene is 38.7 mg/kg.
Commercial Recycling Inc.
Solid Waste Processing Facility
#S-021243-WK-A-N

- Virgin Oil Petroleum Contaminated Soils and Non-Virgin Petroleum Contaminated Soils
- Various Inert Fill Material
- Recycled Asphalt Pavement
- Various Non Haz Bottom Ash
- Shingles/Drywall/Porcelain/Glass/Coal Flyash
- 15-20,000 tons per year of shingles
- In compliance with all permits, no NOVs
Hard Surface Paving
Cold Patch
jack’s patch™
Applying Recycled Shingle Cold Patch
Hot Batch Asphalt
Parking Lot