Quantification Protocol for the Substitution of Bitumen Binder in Hot Mix Asphalt Production and Usage

Alberta Offset System Protocol Review

December 11, 2008

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Presentation Outline

- Process Overview
- Definitions
- Applicability Criteria
- Project and Baseline Conditions
  - Process Flow Diagrams
- Consistency With Alberta Offset System Criteria
- Flexibility Mechanisms
- Quantification Approach & Sample Calculation
- Questions

Definitions

Hot Mix Asphalt

- The mixture of binder and aggregate produced at the hot mix facility for paving. j2
- The mix ratio will depend on desired performance properties for paving and may vary at each hot mix facility and for each project

Binder

- A waterproof adhesive that binds the aggregate together.
- Bitumen + SEAM

Slide 3

j2 add CCAR
jamie, 08/12/2008

Definitions

Bitumen

- A petroleum based liquid asphalt product, produced from the heavy crude oil refining process. j3

SEAM

- Solid sulphur product composed of carbon black, sulphur, and small quantities of plasticizer and H_2S scavenger additives. May also contain wax additives.

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j3 add CCAR

jamie, 08/12/2008

Process Overview

Initiating Entity: Shell Sulphur Solutions (SEAM)

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Seed Documents:

- US EPA AP-42 Section 11.1: Paving Operations
- US EPA Emission Inventory Improvement Program: Asphalt Paving
- EC / CCME Multi-Pollutant Emission Reduction Analysis Foundation for the Hot Mix Asphalt Sector
- AOS Road Resurfacing Protocol

Technical Review:

- Limited technical review conducted during draft preparation
- Technical Stakeholder Review Session held Nov 3, 2008

Slide 5

j1 add CCAR

jamie, 08/12/2008

Applicability Criteria

The protocol applies to:

- Hot mix asphalt facilities substituting a proportion of the bitumen binder used in conventional hot mix asphalt for a solid sulphur product
  - i.e. Sulphur Extended Asphalt Modifier (SEAM) or similar product
- Implemented at existing or new facilities
- Note that approval from the relevant government authority is required prior to the use of such products

The protocol **does not** apply to:

- Substitution of other products in hot mix asphalt
- Hot mix asphalt produced at plants regulated under Alberta's SGER

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Project Condition

Project Condition:

- The use of SEAM as a substitute for bitumen binder.
  - Mix formulation / temperature may vary between projects
- Quantification of GHG emissions is based on the mix temperature and tonnes of bitumen and aggregate displaced by SEAM

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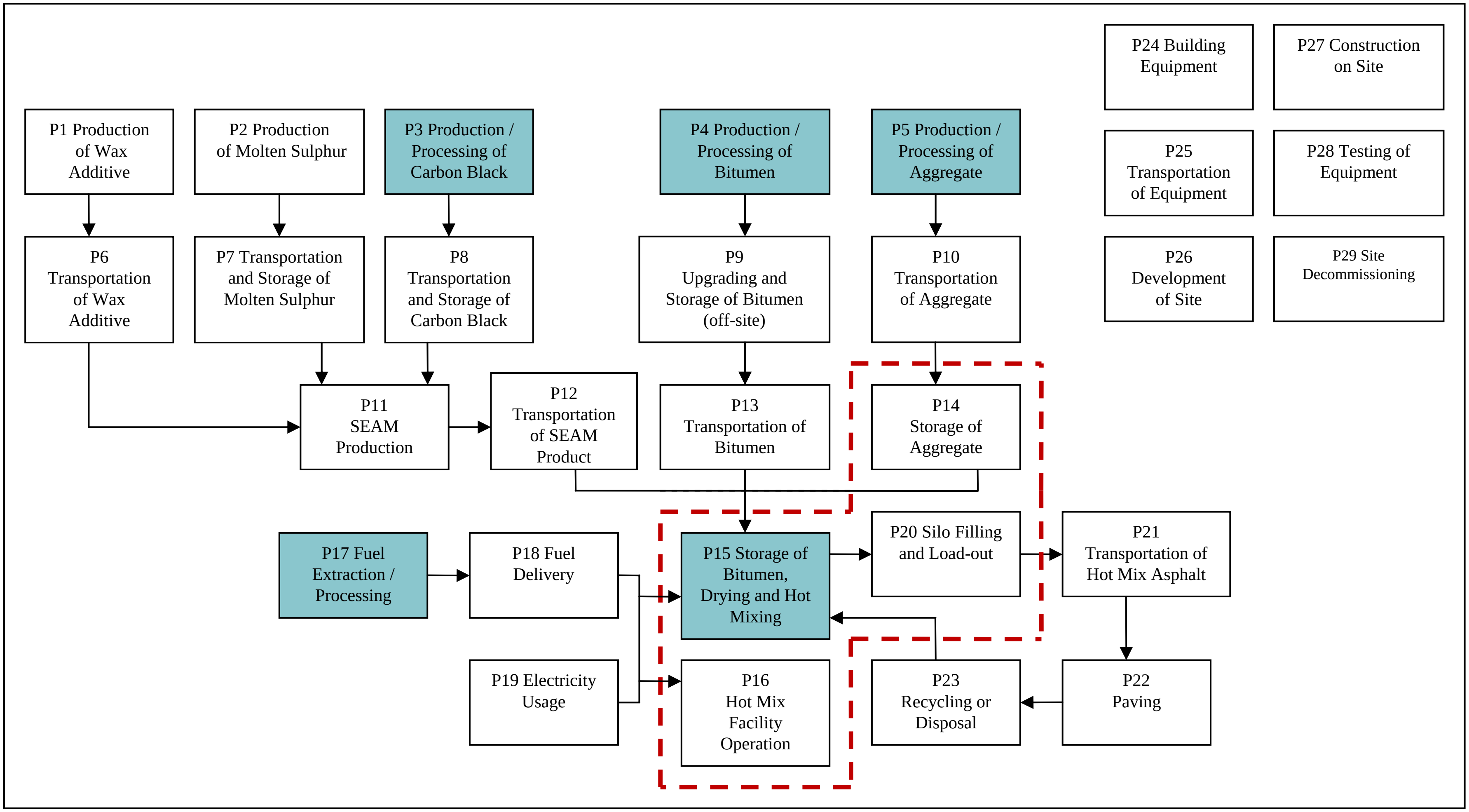
Process Flow Diagram for the Project Condition



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Baseline Condition

<u>Baseline Condition:</u>

- Production and usage of conventional hot mix asphalt
- GHG emissions from:
  - The production of an equivalent mass of aggregate and volume of bitumen now displaced by SEAM
  - Fuel required to dry aggregate and heat components to required temperatures for hot mixing

Baseline Condition

Baseline Condition:

- Performance Based Approach
  - Assessment of the baseline scenario based on the ‘emissions profile of a typical hot mix facility’ in terms of fuel consumption and fugitive emissions.
    - Direct measurement of quantity of hot mix asphalt produced
    - Default values for composition / temperature
    - Production, handling and stack emissions: Emission factors
    - Fuel consumption: Heat equation + Manufacturer specifications

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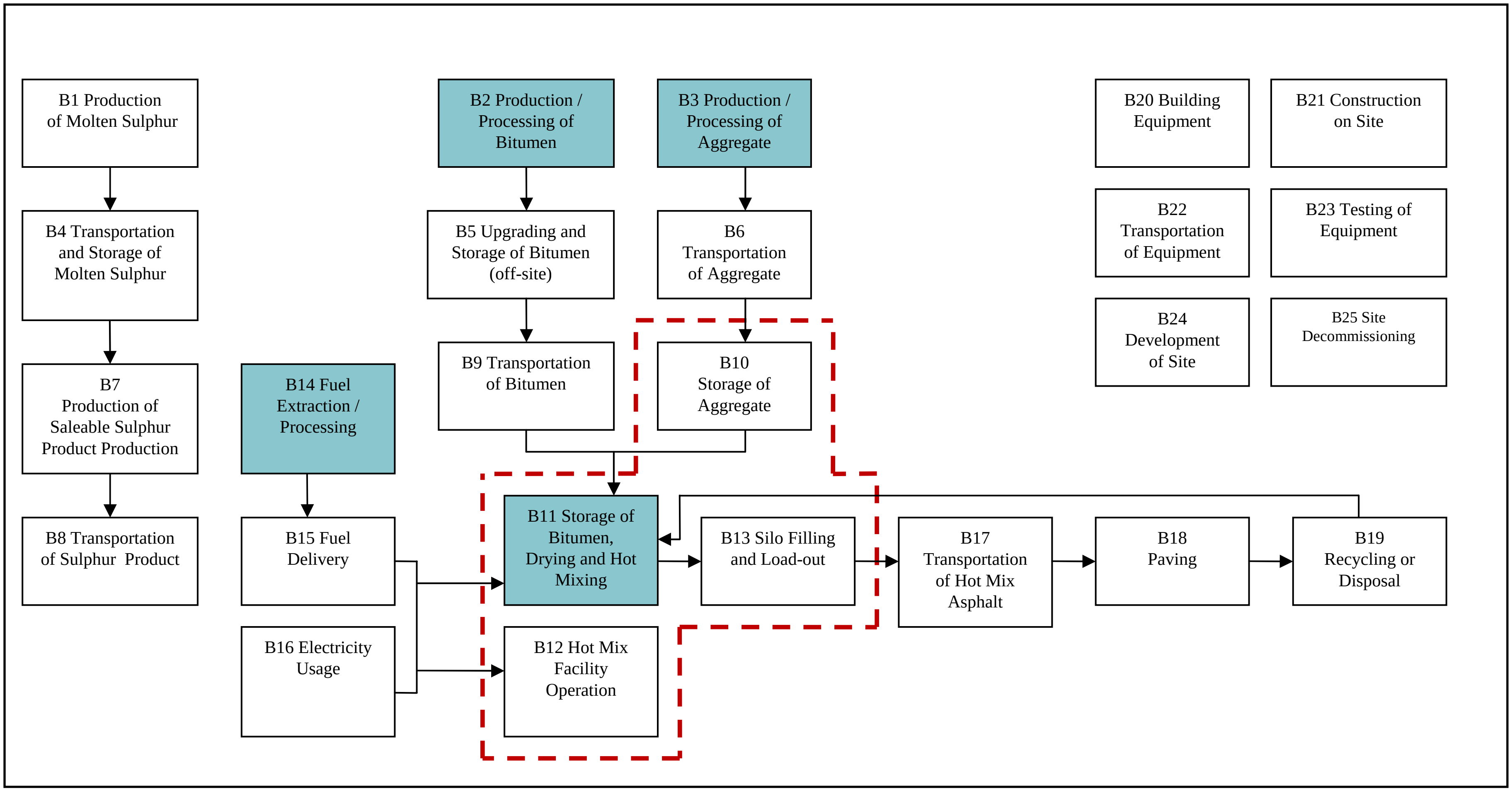
Process Flow Diagram for the Baseline Condition



AB Offset System Eligibility Criteria

Real:

- Baseline condition represents paving mix composition / temperature prior to project implementation based on common industry practice
- Use of SEAM decreases:
  - The overall requirements for bitumen and aggregate
  - Hot mix asphalt production temperature

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AB Offset System Eligibility Criteria

Quantifiable:

- Quantification based on the measurement and monitoring of the tonnes of SEAM, bitumen and aggregate used and mixing temperature. Suitable data / equations exist to quantify emissions.

Not Required By Law / Counted Once:

- SEAM used at hot mix facilities designated as LFE's ineligible for offsets
- No requirements regulating energy efficiency / fuel consumption or GHG emissions
- Multiple proponents may be interested in obtaining offsets: Proof of ownership required

Flexibility Mechanisms

Primary Flexibility Mechanisms:

- Use of site-specific historical mix formulation data (instead of default values) if records are available. Values must be applicable to the type of road being paved.

- Use of site-specific stack emission testing data to calculate methane emission factors (under SS's P16 and B11) for conventional and SEAM hot mix asphalt. Testing must monitor stack emissions and not both mixing / ducted emissions from fuel combustion.

Flexibility Mechanisms

Primary Flexibility Mechanisms:

- Emissions from paving (SS's B19 and P22) may be included if further sampling and characterization of emissions is conducted and / or appropriate data, calculation methodologies, etc. become available.
- Use of other site specific emission factors

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Quantification Approach

$$\text{Emission Reduction} = \text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}}$$

$$\textbf{GHG Emissions}_{\textbf{Baseline}} = \text{Emissions}_{\text{Fuel Extraction / Processing}} + \text{Emissions}_{\text{Asphalt Production}} + \text{Emissions}_{\text{Aggregate Production}} + \text{Emissions}_{\text{Hot Mixing}}$$

$$\textbf{GHG Emissions}_{\textbf{Project}} = \text{Emissions}_{\text{Fuel Extraction / Processing}} + \text{Emissions}_{\text{Carbon Black Production}} + \text{Emissions}_{\text{Asphalt Production}} + \text{Emissions}_{\text{Aggregate Production}} + \text{Emissions}_{\text{Hot Mixing}}$$

Sample Calculation

$$\text{Emission Reduction} = \text{Emissions}_{\text{Baseline}} - \text{Emissions}_{\text{Project}}$$

SSR	Activity Data	GHG Emissions
Baseline Condition	100,000 tonnes hot mix asphalt produced in Project Condition Major Highway Mix Temperature = 145 C Natural gas burner 4% Aggregate moisture content	7,548 tonnes CO2e
Project Condition	Mix Temperature = 135 C	6,585 tonnes CO2e
Net GHG Reduction		963 tonnes CO2e

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Questions?

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