Biodiesel and Renewable Diesel Workgroup

July 8, 2008
Sacramento, CA

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UCDAVIS
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UC Berkeley/Davis Agenda

- **Overview and update on the Multimedia assessment**
  - **Tier I report review comments and revisions**
  - **Tier II and Tier III efforts**
  - **Methods for impact assessment**
  - **Experimental plan for Tier II evaluation of biodiesel**
  - **Fuel and additive components**
- **Other issues**
  - **Coordinating with air-emissions measurements**
  - **Sample analyses (who, where and how?)**
  - **Tier II and Tier III timelines**

Tiered Approach Refresher

Tier 1 Preliminary Review

- Define framework and approach
- Identify information needs and gaps
- Peer review

Tier 2 Multimedia Risk Assessment Design Review

- Experimental design developed and submitted
- Design peer reviewed, feedback provided for Tier 3

Tier 3 Final Multimedia Risk Review

- Final report is used as the basis for recommendations submitted to the Environmental Policy Council
- Final report is peer reviewed

Tier I Report Review and Revisions

- Comments received
  - ARB
  - DTSC
  - OEHHA (Winder ATEB)
  - OEHHA (Marty)
  - SWRCB
- Comments tend to be favorable and constructive
- No major revisions requested
- Revised Tier I report in preparation
- Response to each comment being prepared
- End of Comments?

Tier II:
Risk Assessment Design Review Elements

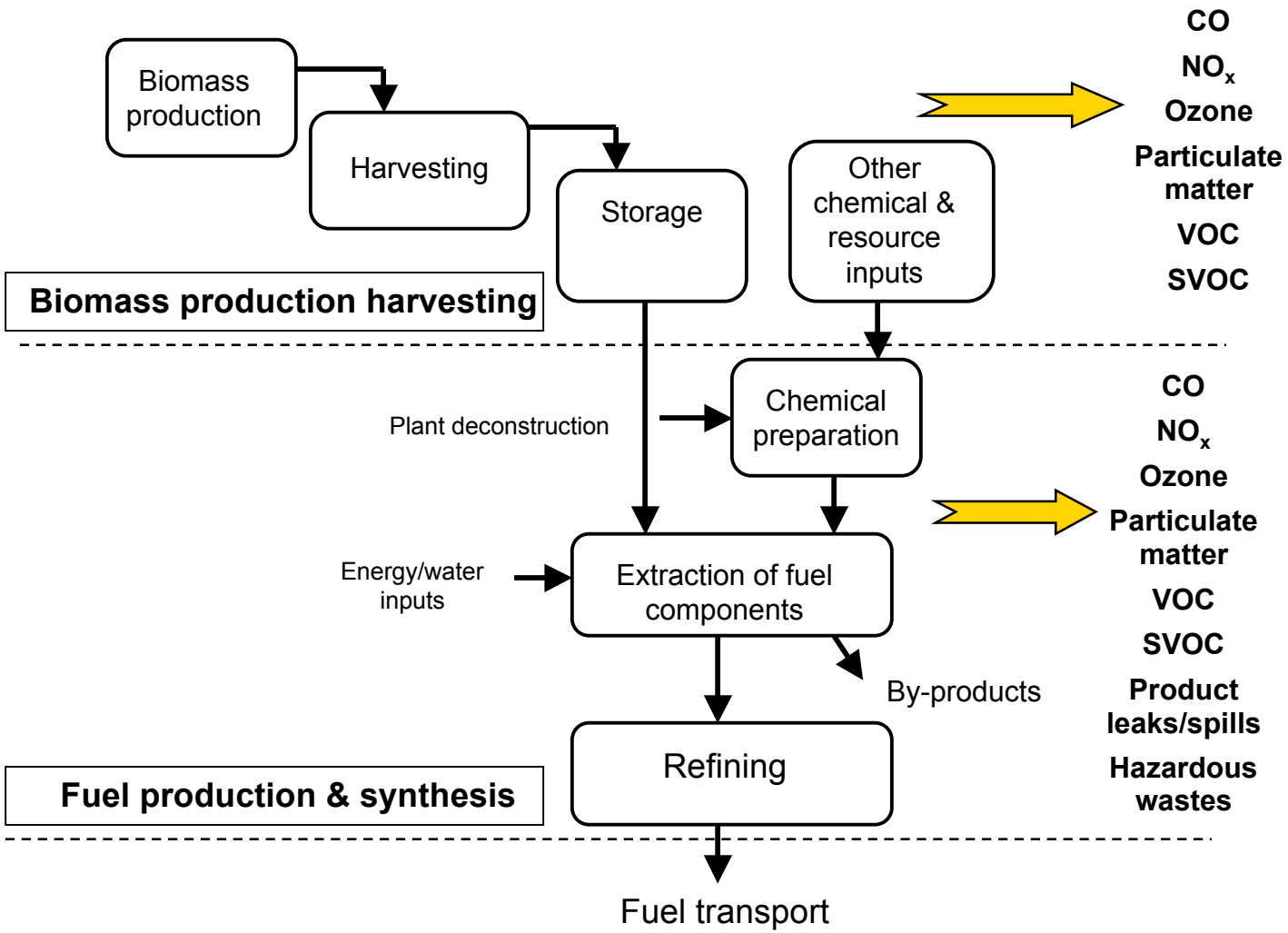
Proponent provides:

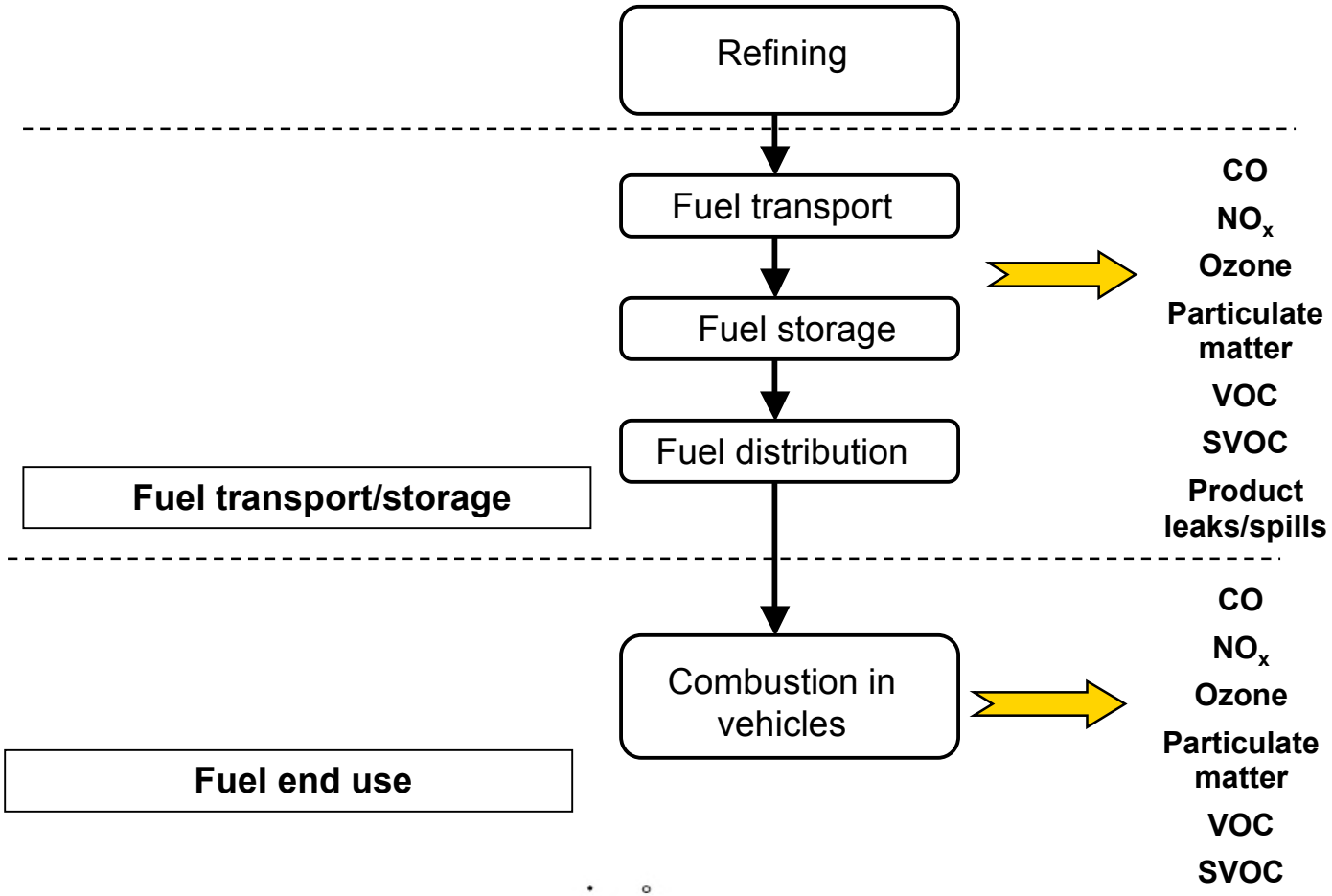
- **Proposed Experimental Design for Risk Assessment**
  - **Scope and Data**
  - **Comparisons to agreed upon base fuel**
  - **How Will Knowledge Gaps be Addressed**
  - **Methodology to be Used During Analysis**
  - **Fate and Transport Conceptual Models**
  - **Description of Planned Experiments**

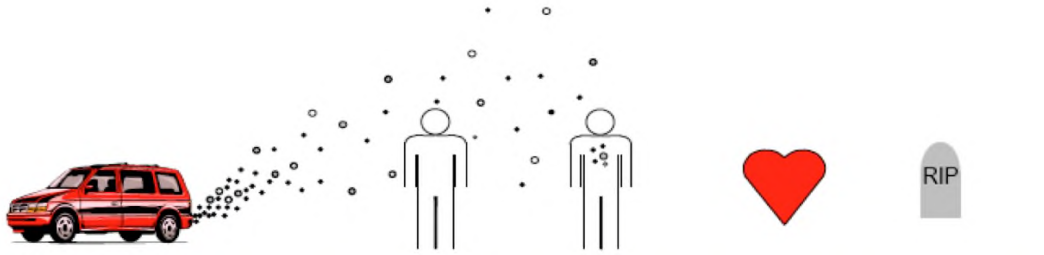
Multimedia Working Group and Peer Review Before Moving to Tier III

Methods for Impact Assessment

- **Life-Cycle Approach**
  - **Biomass production and harvesting or feedstock collection**
  - **Fuel production**
  - **Fuel transprot and distribution**
  - **Fuel combustion**
- **Pollutant releases at each life stage**
- **Transport and fate**
- **Exposure and dose**
- **Toxicology and risk**


Biomass production
Harvesting
Storage
Other chemical & resource inputs
CO
NOx
Ozone
Particulate matter
VOC
SVOC
Biomass production harvesting
Plant deconstruction
Chemical preparation
Energy/water inputs
Extraction of fuel components
By-products
Refining
Fuel production & synthesis
Fuel transport

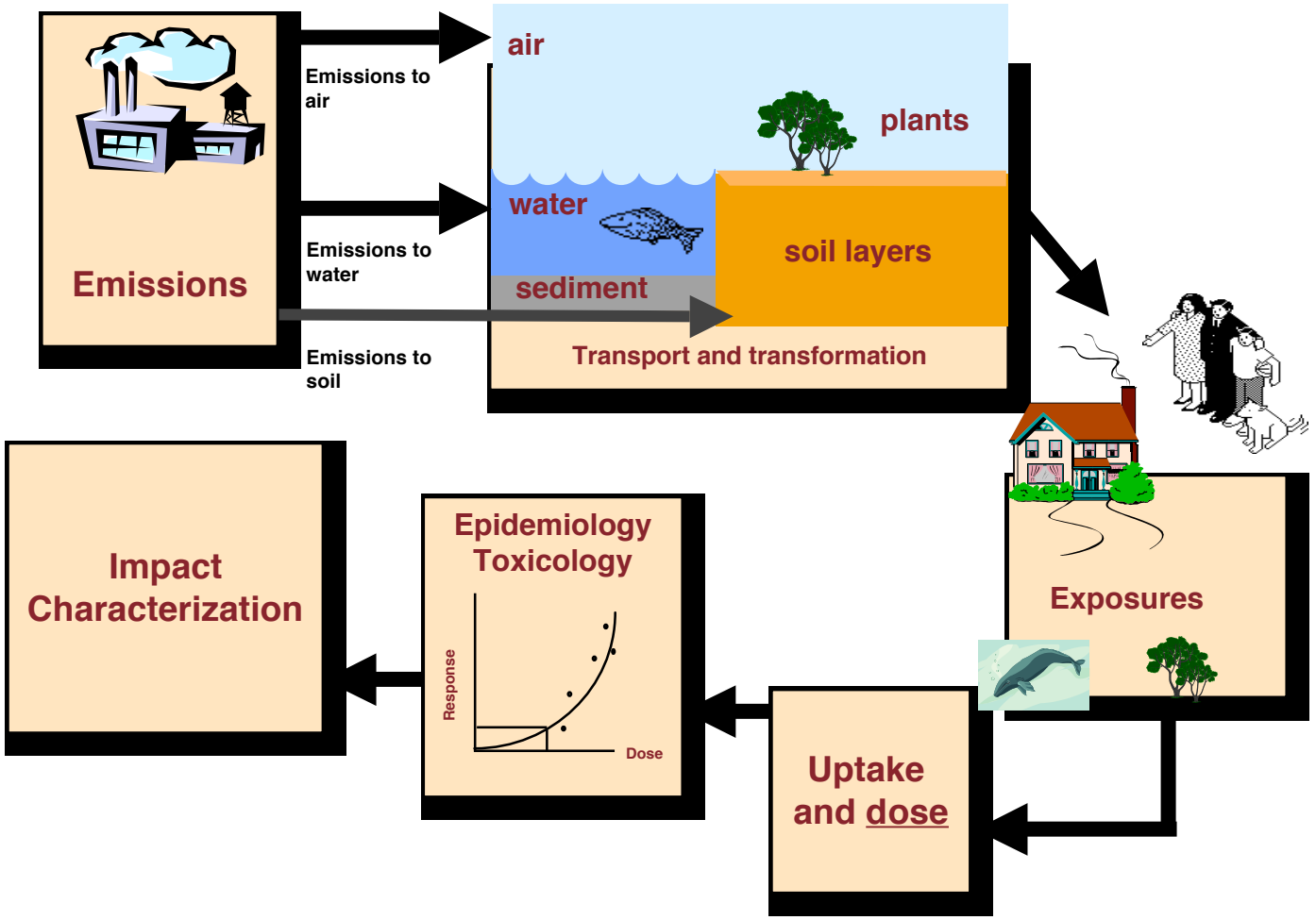




emissions → concentration → exposure → intake → dose → health effects

Graphic courtesy of
Julian Marshall
University of Minnesota

Human Health and Ecosystem Impact



Life Cycle Impact

Disability adjusted life years (DALYs)

Potential disease burden

Biofuel production & location

Biodiesel from:
- **Waste oil**
- **Plant oil**

Renewable diesel from:
- **Plant oil**
- **Other sources**

Emissions [kg per joule fuel processed]

1) Aldeyhdes
2) US EPA Criteria Pollutants (PM2.5, CO, etc.)
3) Other Air Toxics (e.g., PAHs)
4) Hazardous wastes

Pollutant intake based on release scenario/location

DALYs per joule biofuel processed

Urban

Rural

Total DALYs

Total DALYs

DALYs per joule conventional diesel processed

Experimental Plan for Tier II Evaluation of Biodiesel

- (Ant Farm)
  Migration and Distribution of CARB#2 Diesel and Biodiesel in the Vadose Zone
- Batch Leaching Experiments
- Microcosm Experiments
- Aquatic toxicity testing
- Copper Strip Testing

Experimental Plan for Tier II Evaluation of Biodiesel

Fuel Preparation	Experiments				
CARB #2 Diesel	A, M, B, C				
Soy B100	M,B		A	A	
Tallow B100	M,B		A	A	
Soy B20	M, B, C	M,C, B	A,M,C	A	C, M
Tallow B20	M, B, C	M,C, B	A,M,C	A	C, M
Additive Used →	Reference: No Additive	Antioxidant	Biocide	Cold Flow	NOx Reducer

Legend:

Ant farm	A	Microcosm	M
Batch	B	Copper Strip	C

Fuel and Additive Components

- **Antioxidants**
  - **Example antioxidant composition**
    - Butyl acetate (123-86-4) 30%
    - diethylene glycol monobutyl ether (112-34-5) 30%
    - 2-tert-butylhydroquinone (1948-33-0) 20%
    - citric acid (77-92-9) 5%
  - **Treatment concentration: 400 ppm pre-blended in B100 biodiesel**
- **Biocide**
  - **Example antioxidant composition**
    - Magnesium nitrate (10377-60-3) 1-2.5%
    - 5-chloro-2-methyl-2H-isothiazol-3-one (26172-55-4) 1-3.0%
    - 2-Methyl-4-isothiazolin-3-one (2682-20-4) 0.3 - 0.4%
    - Magnesium Chloride (7786-30-3) 1.00%
    - Dipropylene glycol (Mixed isomers) (25265-71-8) 88 - 90.0%
    - Water 6.00%
  - **Treatment concentration: 100 ppm in final mixture regardless of diesel/biodiesel ratio**

Fuel and Additive Components

- **Cold Flow Improver**
  - **For ULSD/Biodiesel Blends: Example composition**
    - Petroleum Naptha (265-198-5) 50 to 59.9%
    - Napthalene (91-20-3) 6%
    - Trimethylbenzene (247-099-9) 1 to 4.9%
    - 1,2,4-Trimethylbenzene (247-099-9) 1%
  - **Treatment concentrations: Varies up to 1500 ppm**
- **Cold Flow Improver for B100:**
    - Toluene (108-88-3) 2%
    - Copolymer Ester TBD
  - **Treatment concentration: 3000 ppm but varies**
- **NOx Reduction**
  - **New vehicles will likely use devices that inject urea into exhaust**
  - **For older vehicles: Example NOx reducer**
    - 2-Ethylhexyl Nitrate (27247-96-7) 45%
    - Toluene (108-88-3) and/or alternative 45 to 55%
  - **Treatment concentration: On the order of 3000 ppm**

Other Issues

- Coordinating with air-emissions measurements
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