Effect of Seasonal Variation and Loading Rates on Organic Separation Efficiency in a Two-Stage Trommel Screen

Alireza Rajabpour, Ph.D. Candidate

Christian Felske, Ph.D., P.Eng.

Daryl McCartney, Ph.D., P.Eng.

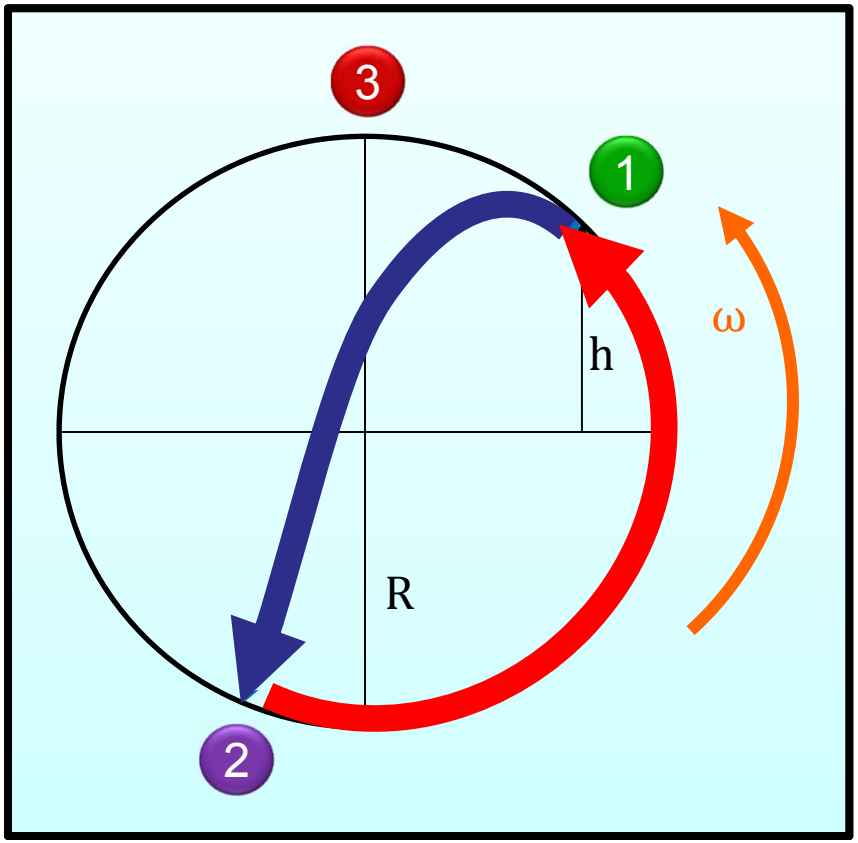
13 May, 2016
SWANA's Northern Lights Chapter Conference
Calgary, Alberta.

Edmonton Waste Management Centre of Excellence

UNIVERSITY OF ALBERTA

Rotary screen (trommel)

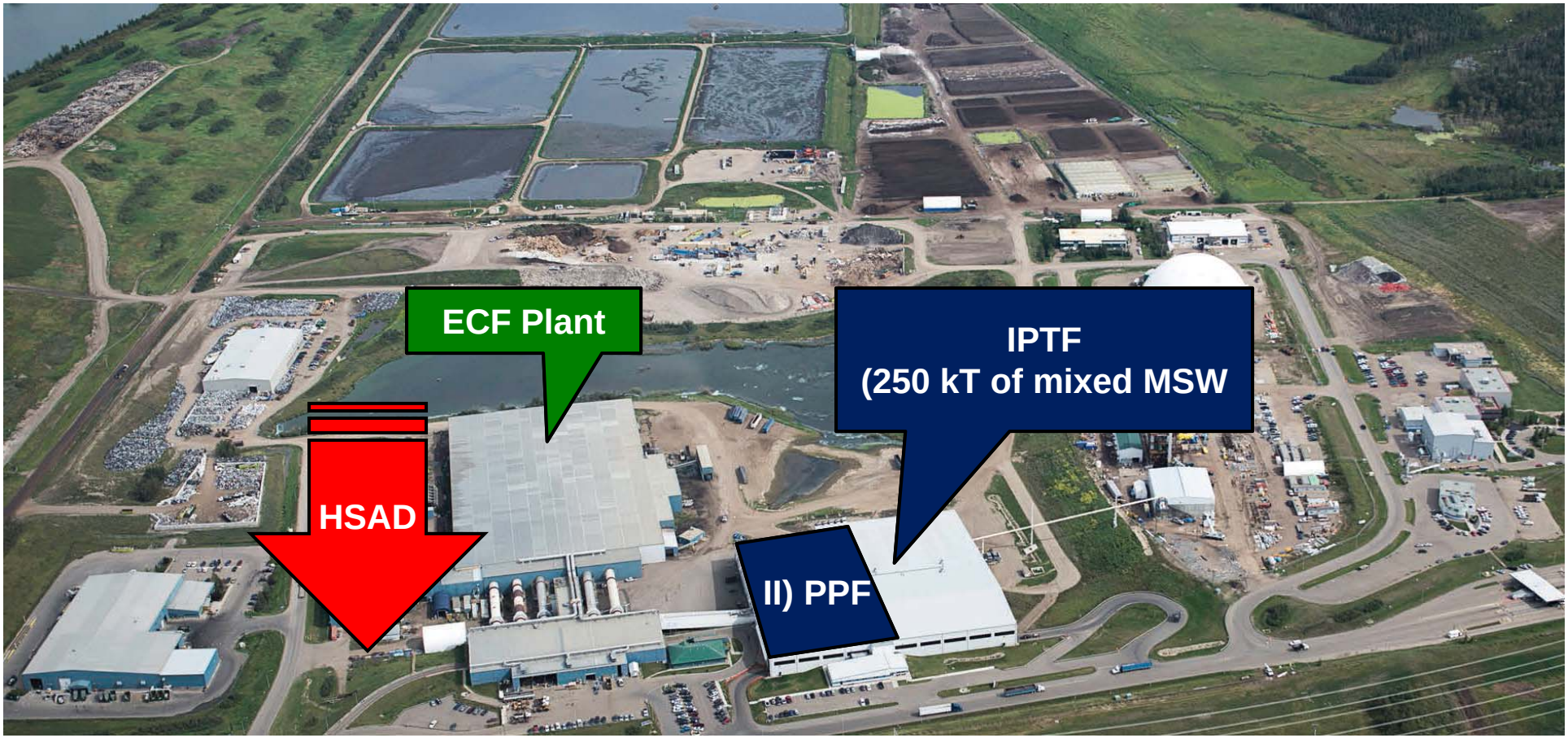
- Originally adapted from mineral processing
  - diameter; length; inclination angle; rotational velocity; shape and size of apertures; and feed rate
- Screening of organics or grits
- Final screening of compost



North American case studies

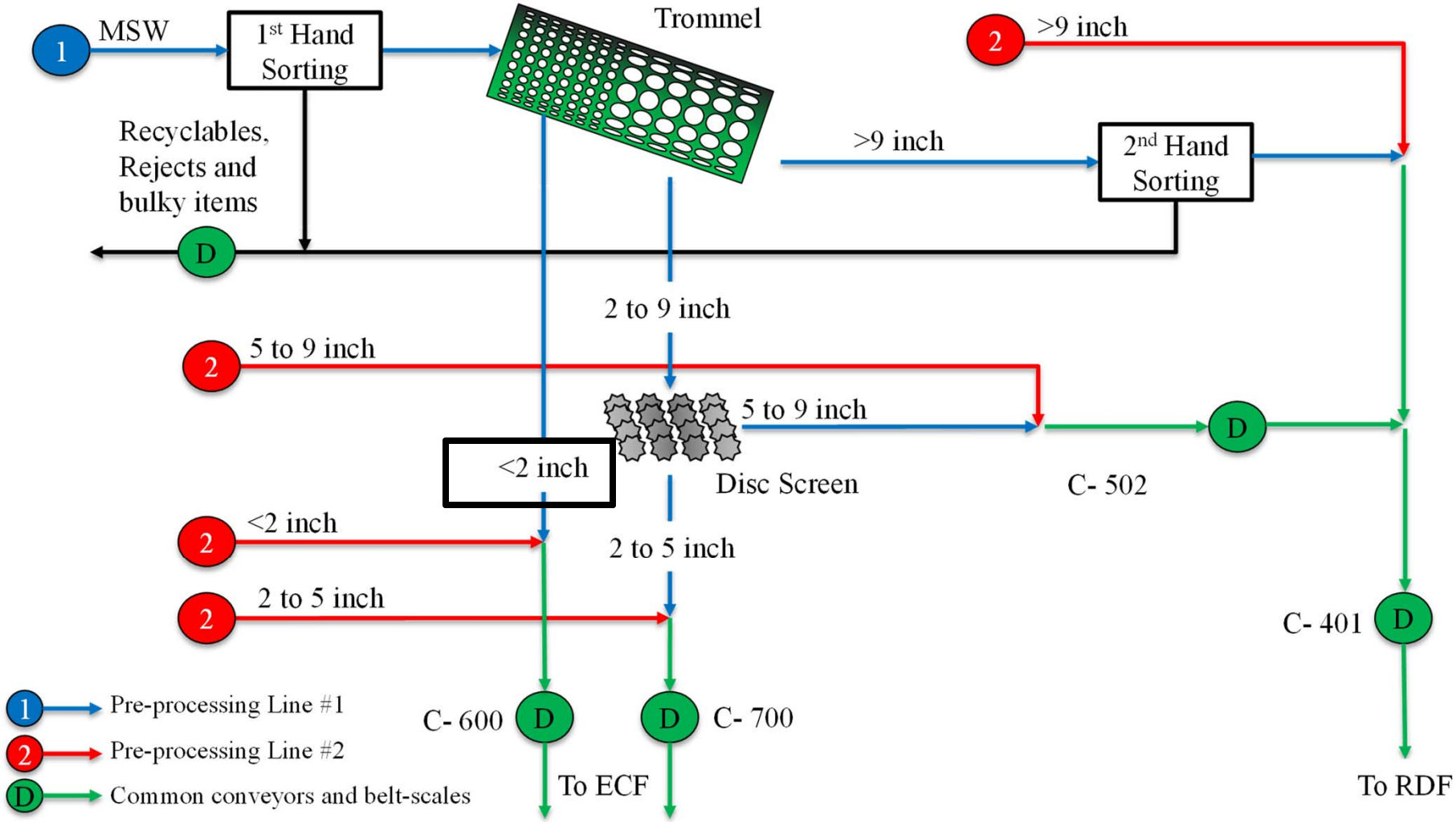
- Glaub et al., 1982: Berkeley, CA & New Orleans, LA
  - US Department of Energy
- Hannon et al., 1983, Baltimore, MA
  - No trend of trommel performance versus season of the year
- Numerical models:
  - Alter et al. 1980
  - Glaub et al, 1982
  - Stessel et al. 1991,1992 & 1996: Most promising model
    - Neglected effect of moisture content
    - Studied deliberately uniformly sized gravel

Edmonton Waste Management Centre (EWMC)

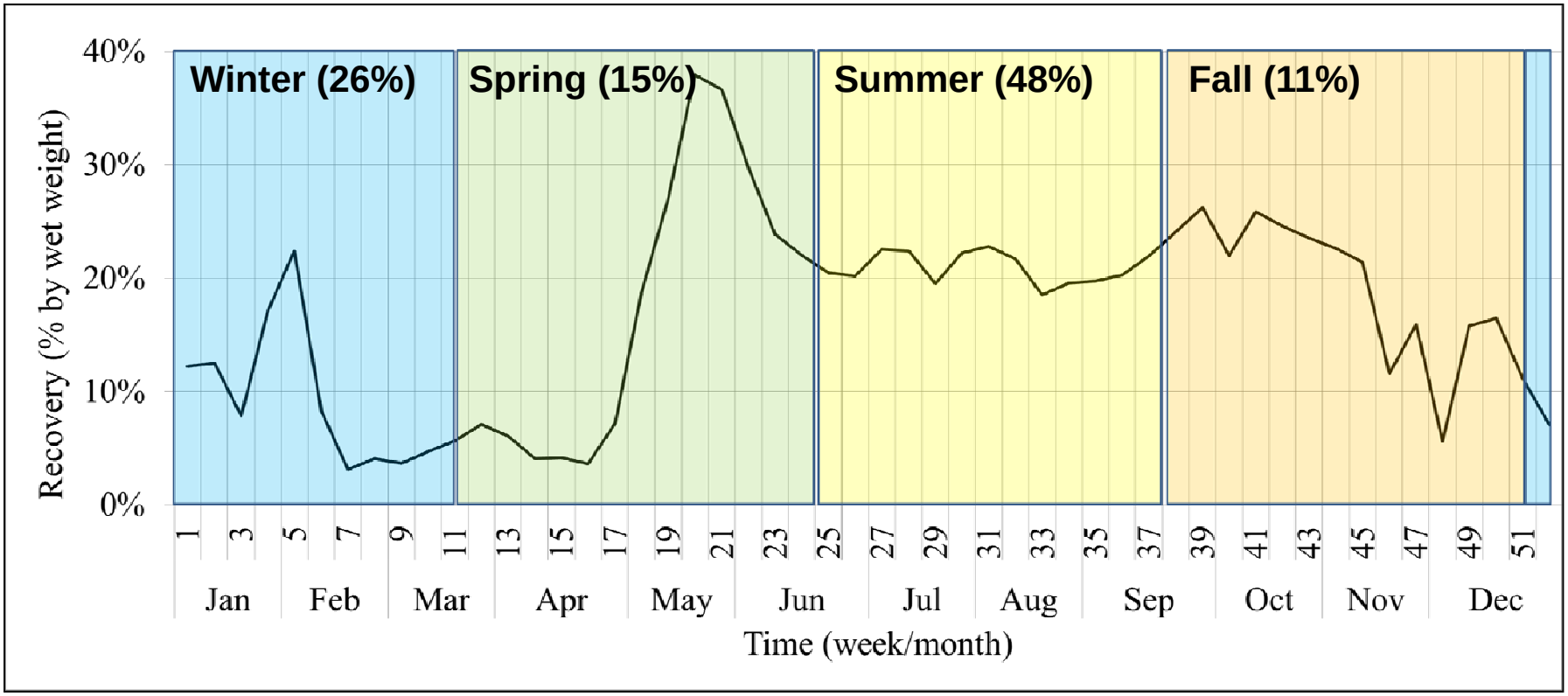


IPTF: Integrated Processing and Transfer Facility
PPF: Pre-Processing Facility
ECF: Edmonton Composting Facility
HSAD: High-Solids Anaerobic Digestion

Pre-processing flow diagram



Preliminary results: weekly variation of <2” in 2013



Objectives

- To assess the effects of seasonal variation on characteristics of MSW feedstock and screening of <2 inch waste stream (first unders).

- To quantify the impact of different feed rates on trommel performance.

Methodology (1): Trommel trials

- Trials events:
  - Low season-LS (January-March)
  - High Season-HS (June-July)
  - 4 hours trials
  - May (field data)

- Feed rate control:
  - Random sampling from the MSW pile resting on tip floor and weighing the grapple loads
  - Setting time intervals between waste loads
  - Feed rates: 40, <u>55</u>, 70 tph

Methodology (2): Data collection and sampling

- Data collection:
  - Cumulative weights of separated waste streams (every 15 minutes)
  - Operation downtimes

- Multiple sampling according to ASTM D5231:
  - First unders (<2″ WS): 15-kg
  - Second unders (2 to 9″ WS): 75-kg
  - Overs (>9″ WS): 20-kg

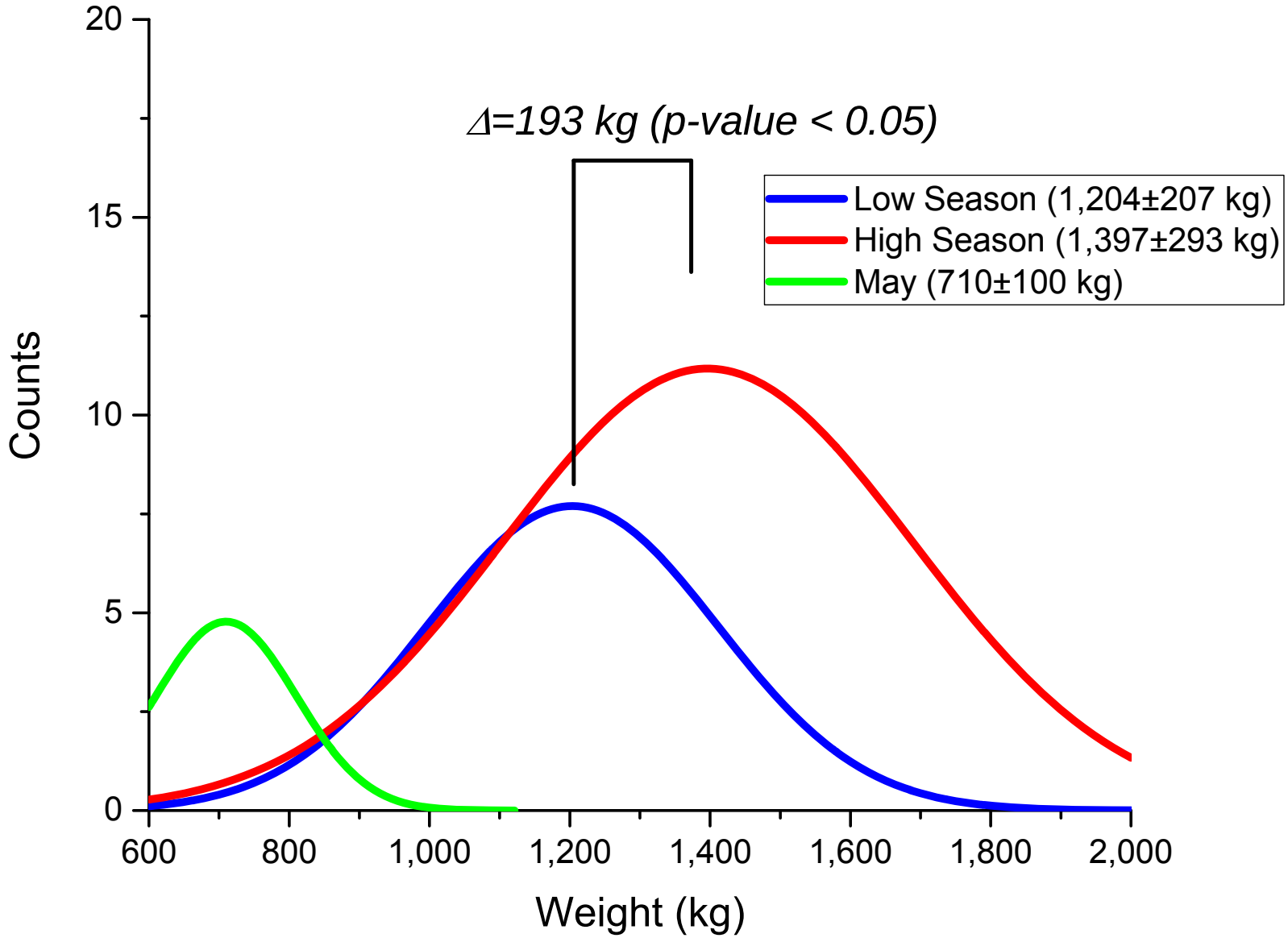
Methodology (3): Waste characterization

- Particle size distribution (PSD) analysis
  - Sieving through 9, 7, 6, 5, 3.5, 2, 1.4 and 0.6 inch sieves (if applicable).
  - Fitting the Rosin-Rammler PSD

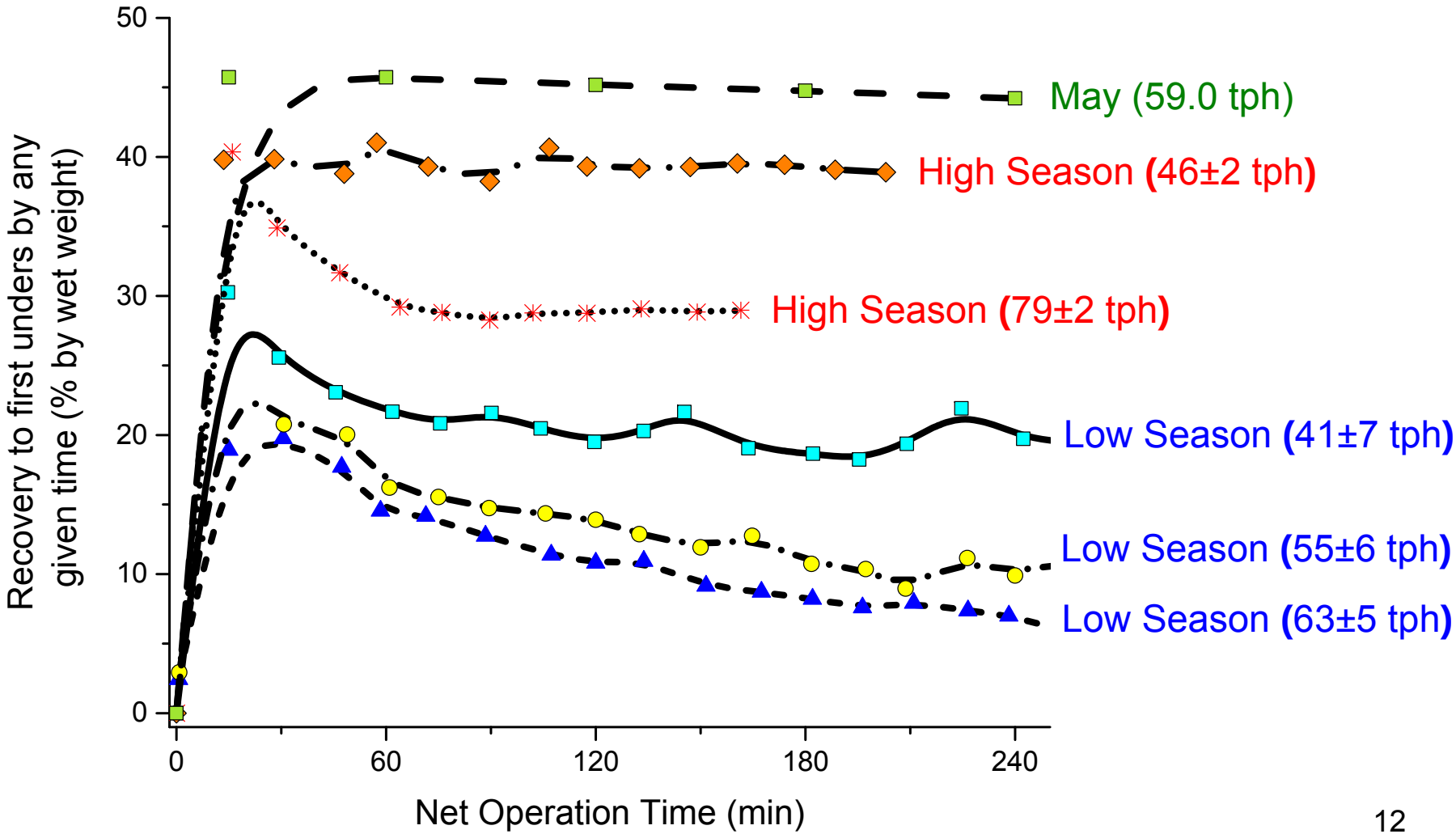
- Composition analysis:
  - Compostable: Yard waste + Food + Diapers & Napkins + Paper & cardboard

  - Contamination: Plastics + Combustibles + Glass + Non-combustibles.

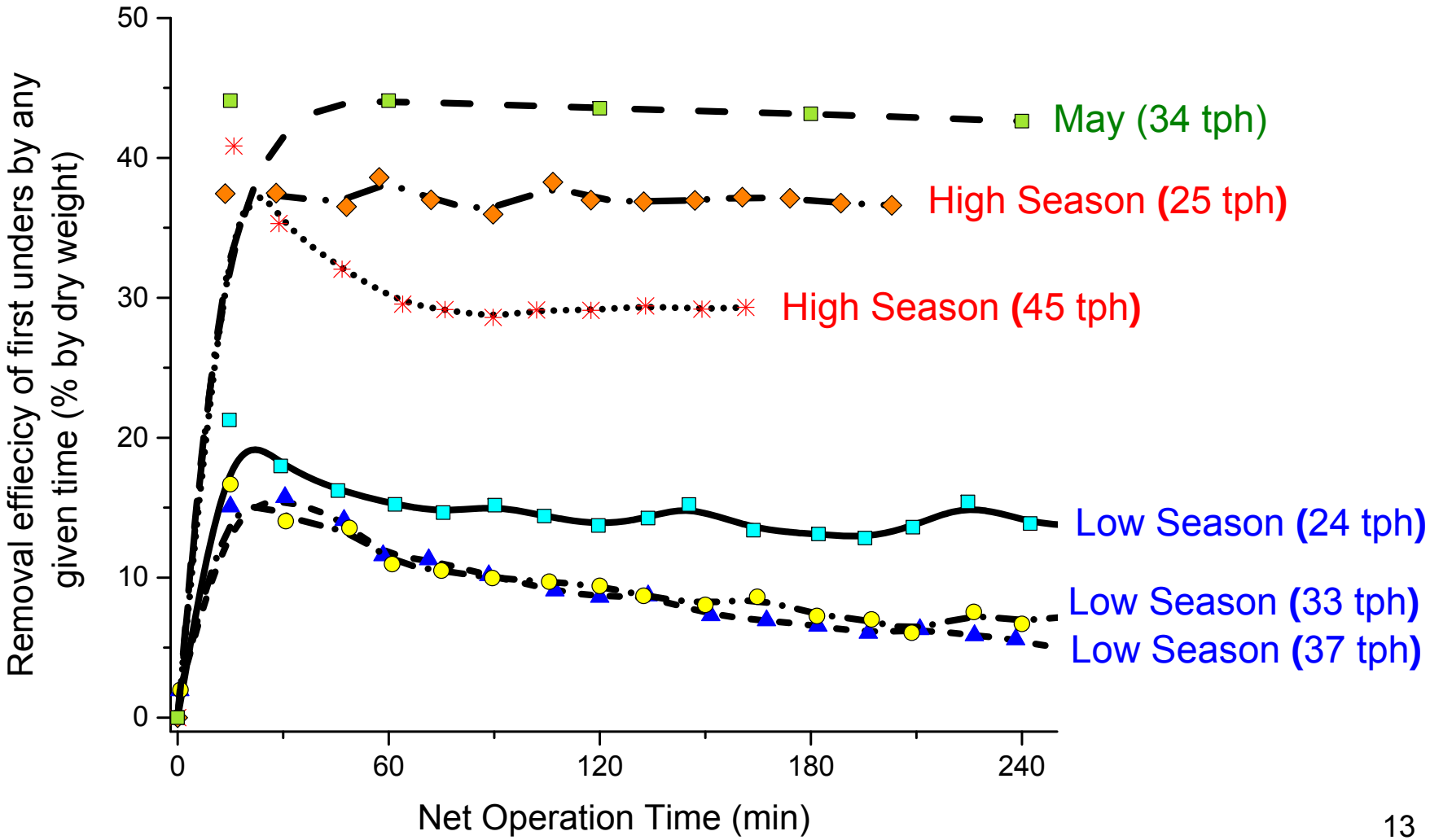
Normal distributions on weight of grapple load



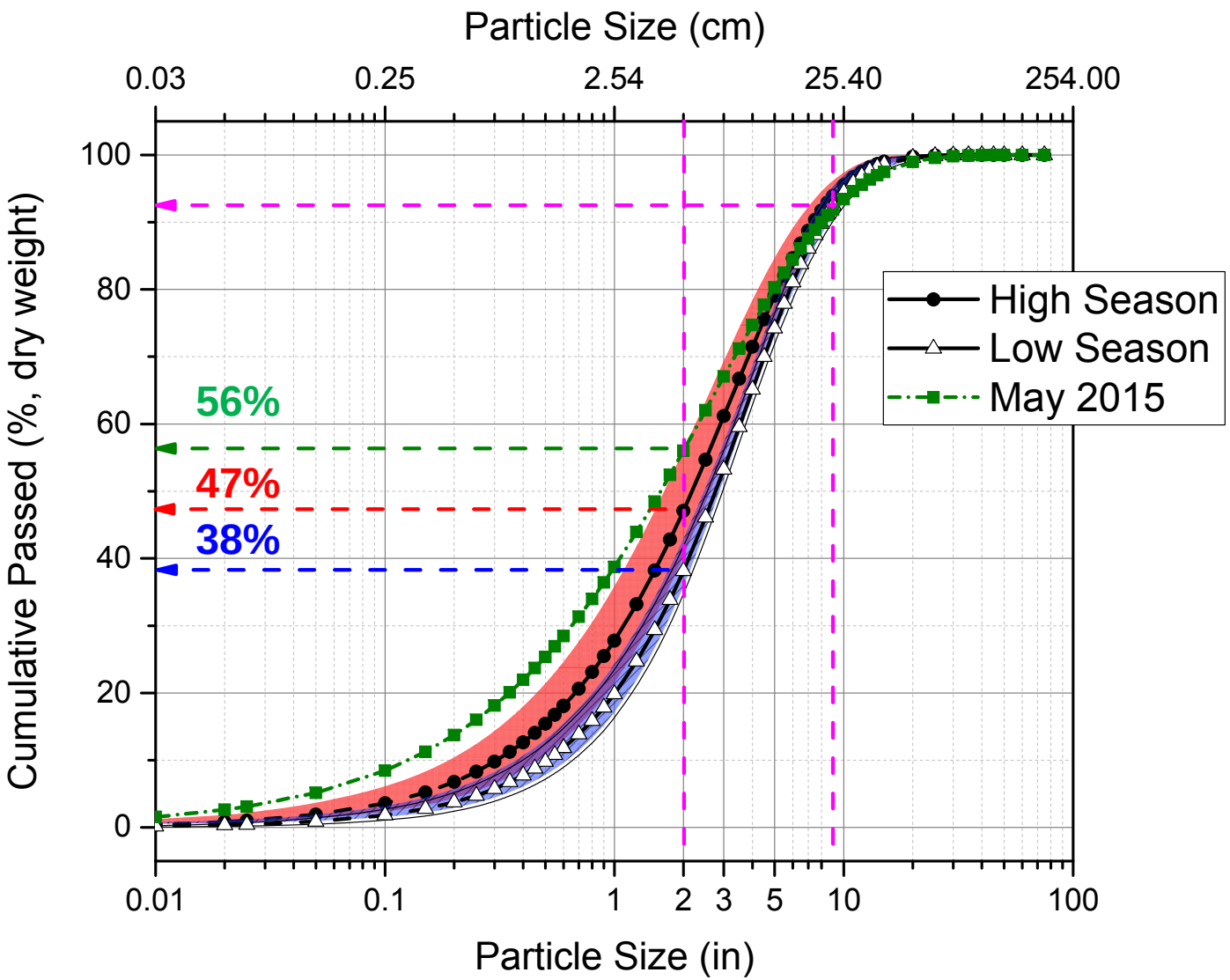
Recovery of <2” waste stream (wet basis)



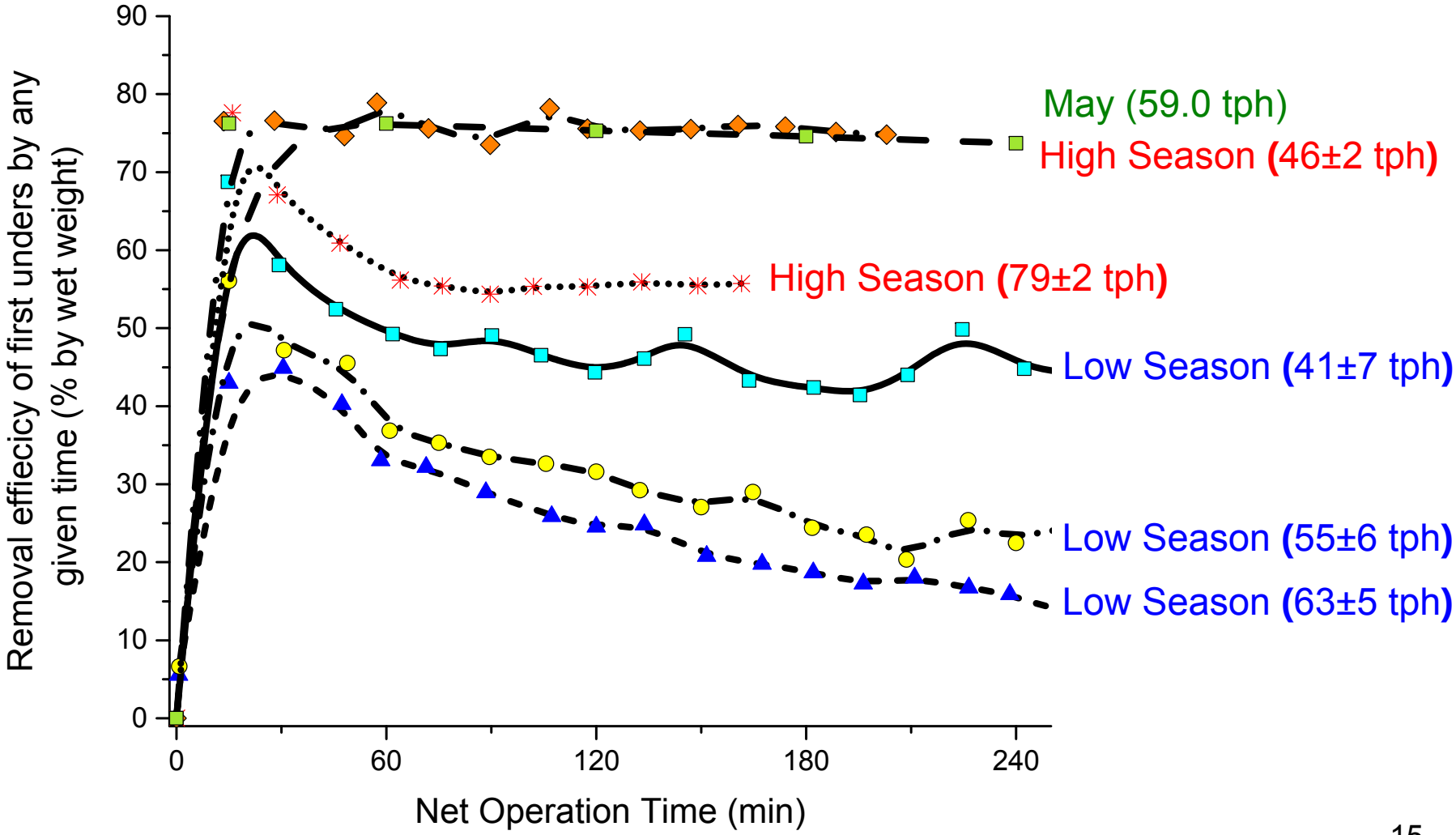
Recovery of <2” waste stream (dry basis)



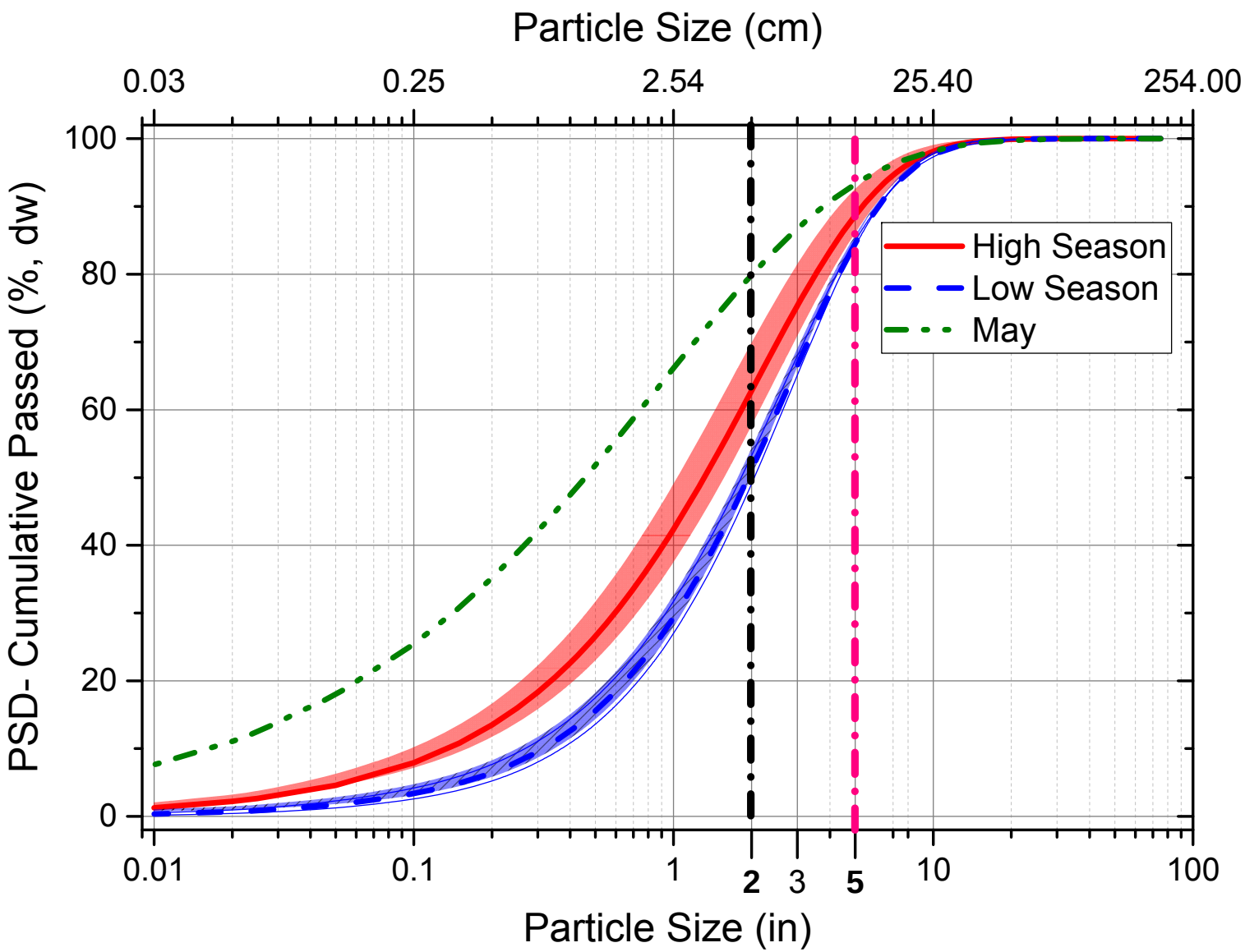
Rosin-Rammler PSD of combined feed in 2014-16



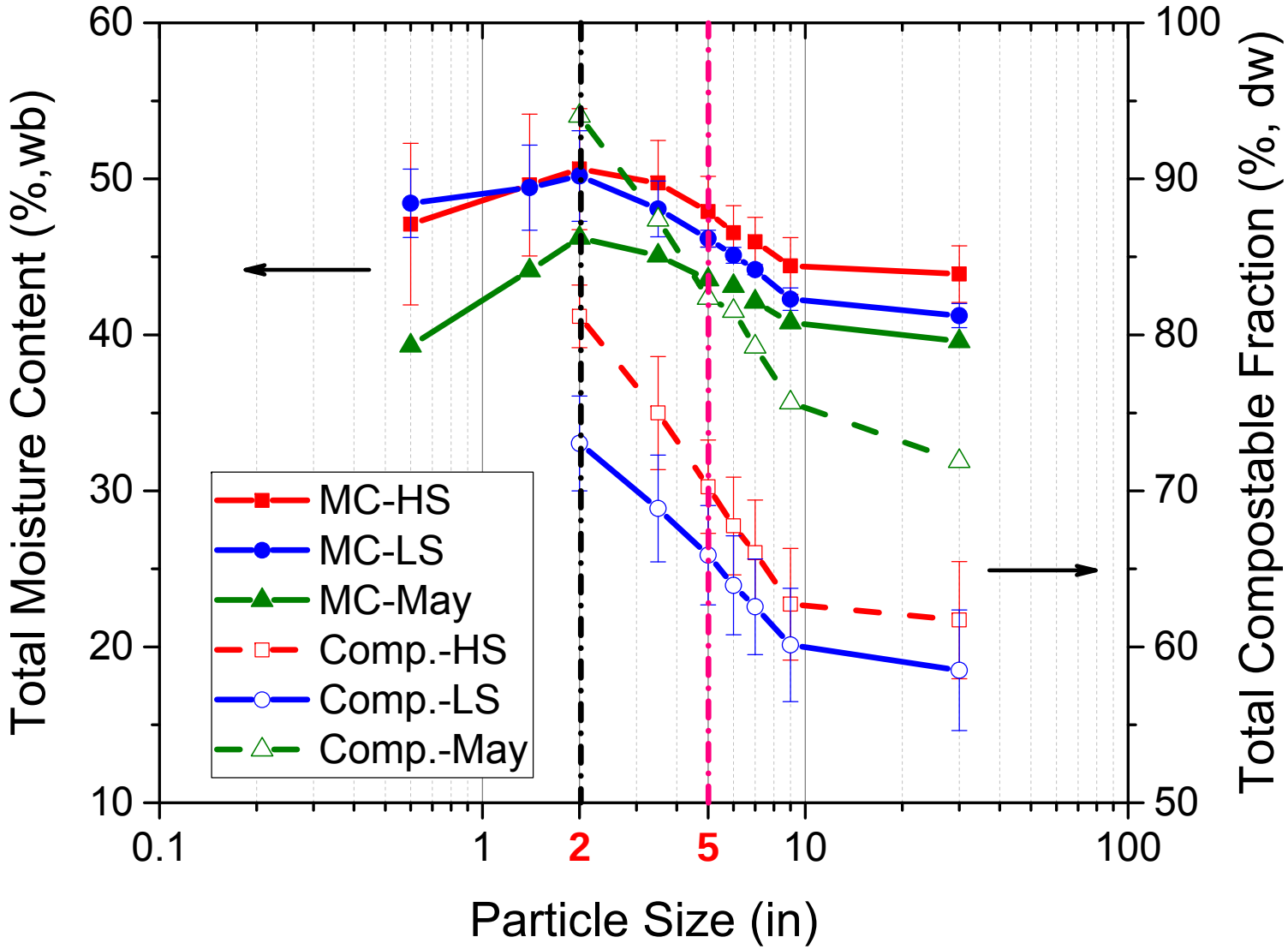
Removal efficiency of <2” waste stream



PSD of the compostable fraction in feed



Total moisture content and compostable fraction of particles smaller than or equal to any given size



Picture of <2 inch waste separated in March

Picture of <2 inch waste separated in June

Picture of <2 inch waste separated in May

Summary of conclusions

- Seasonal variation affected trommel performance via change of:
  - Waste composition, PSD and moisture content
  - May is just a transitional period (the driest and finest feedstock)

- Operation can be designed for high season, but low season conditions should also be considered
  - Low feed rate ⇨ higher and more consistent recovery of fines organics
  - Larger screens size ⇨ more contamination
  - Using other technologies (additional specifications)
  - Objective and priorities? ⇨ different scenarios (what ifs?)
- Wet basis vs. dry basis studies

Acknowledgements

THE CITY OF Edmonton

Edmonton Waste Management Centre of Excellence

UNIVERSITY OF ALBERTA
FACULTY OF GRADUATE STUDIES AND RESEARCH

suez

Thank You,

Questions?

Ali Rajabpour
E-mail: rajabpou@ualberta.ca