The use of electron paramagnetic resonance (EPR) technology for advancing sensory beer flavor stability predictions and brewery improvements

Laura Marques, Maydelin Hernandez Espinosa and William Andrews, Molson Technical Center, Molson Coors Brewing Company, Toronto, Canada; and Robert T. Foster II, Brewing, Research, Innovation, and Quality, MillerCoors, Golden Colorado

Introduction

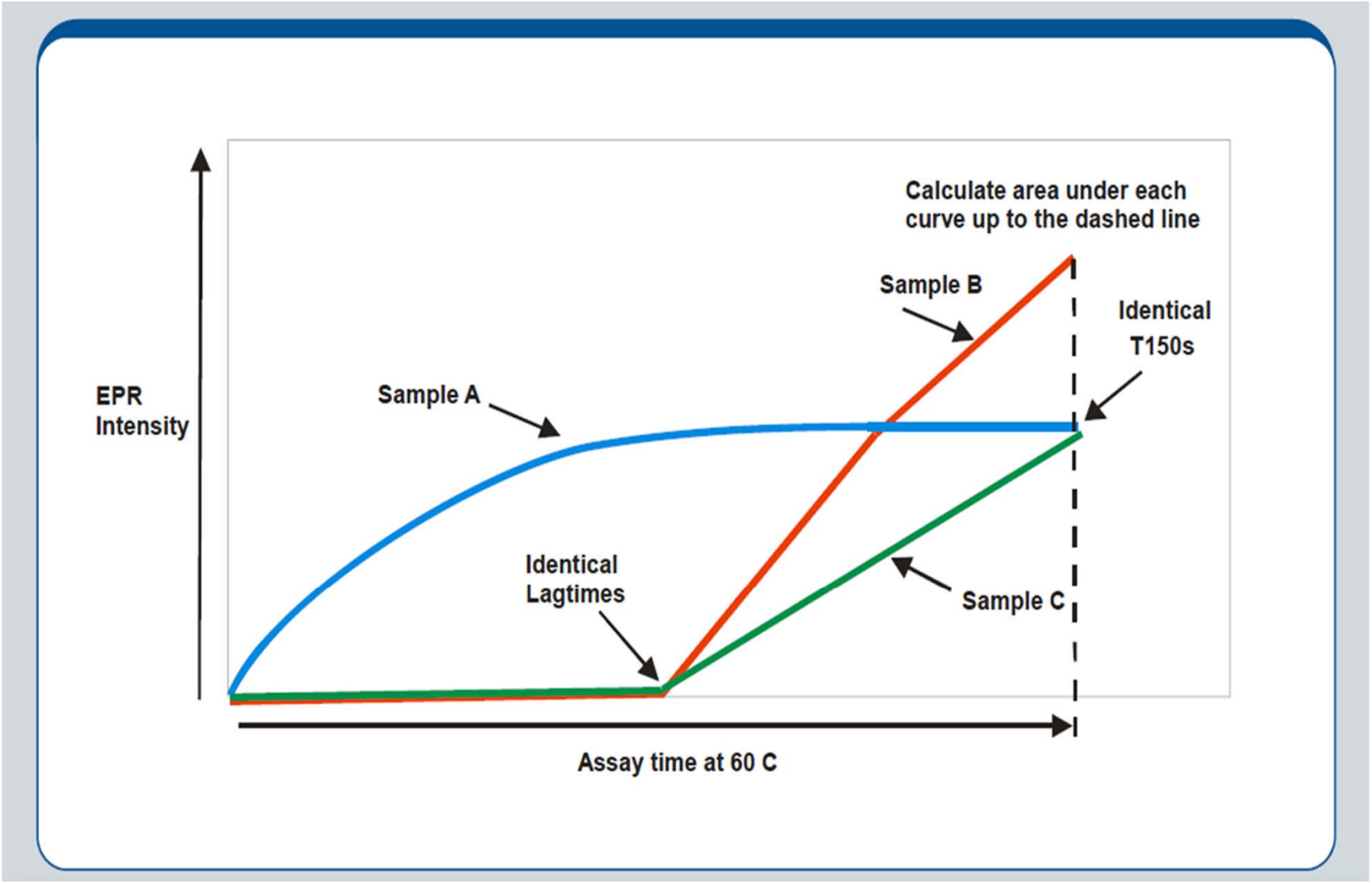
Maydelin Hernandez Espinosa – Presenter

- Using the new EPR Area metric to introduce a flavor stability improvement program @ Molson Coors
- Mitigation of trace metals
- Lowering Dissolved Oxygen
- Targeting SO2 range

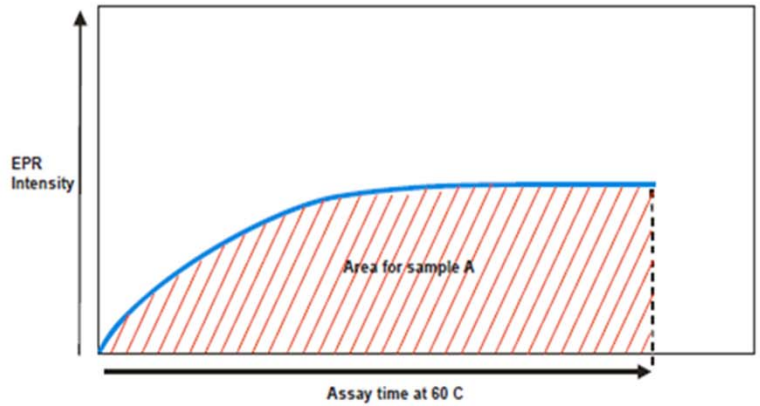
Laura Marques – Presenter

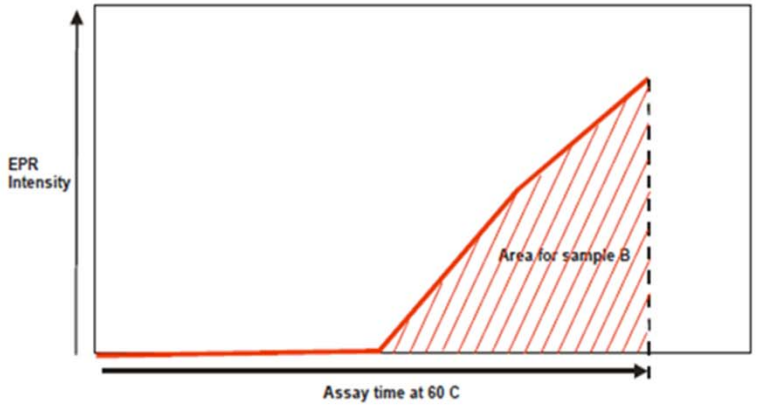
- Standardized Method for Forced Sensory Evaluation
- EPR Area Metric and Routine Sensory Analysis
- Seasonal Effects

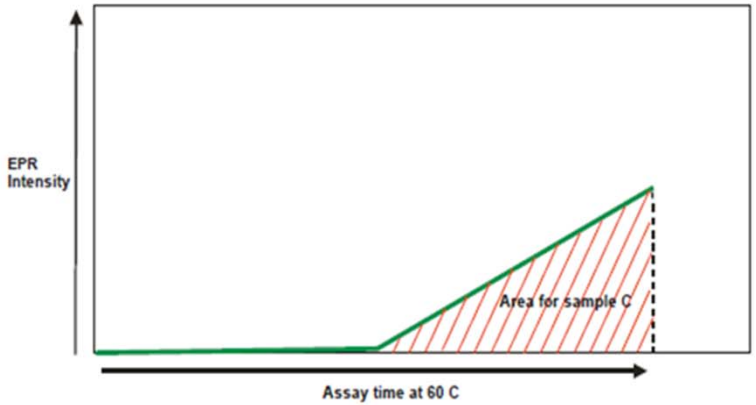
EPR Area Metric



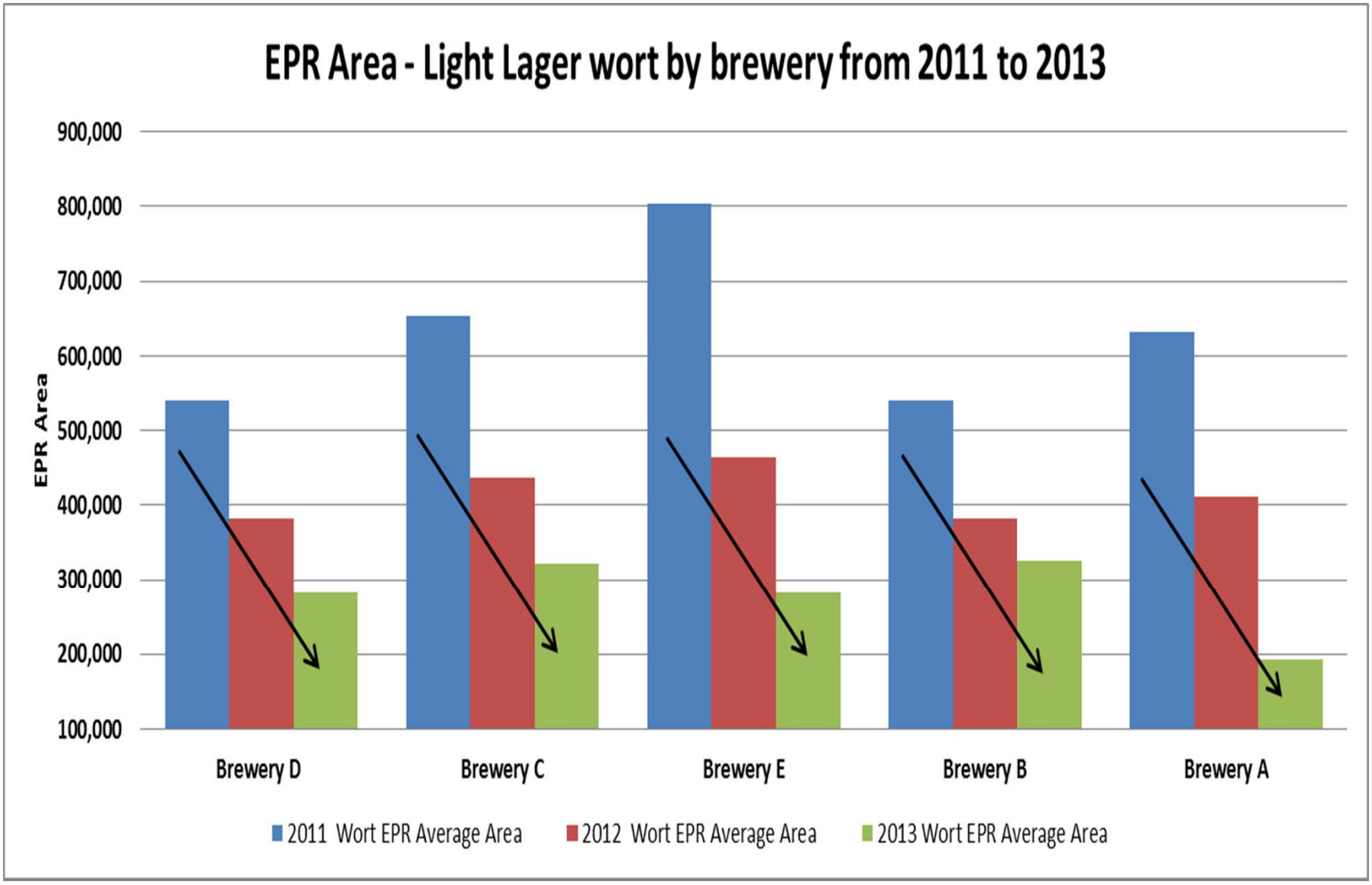
EPR Area Metric



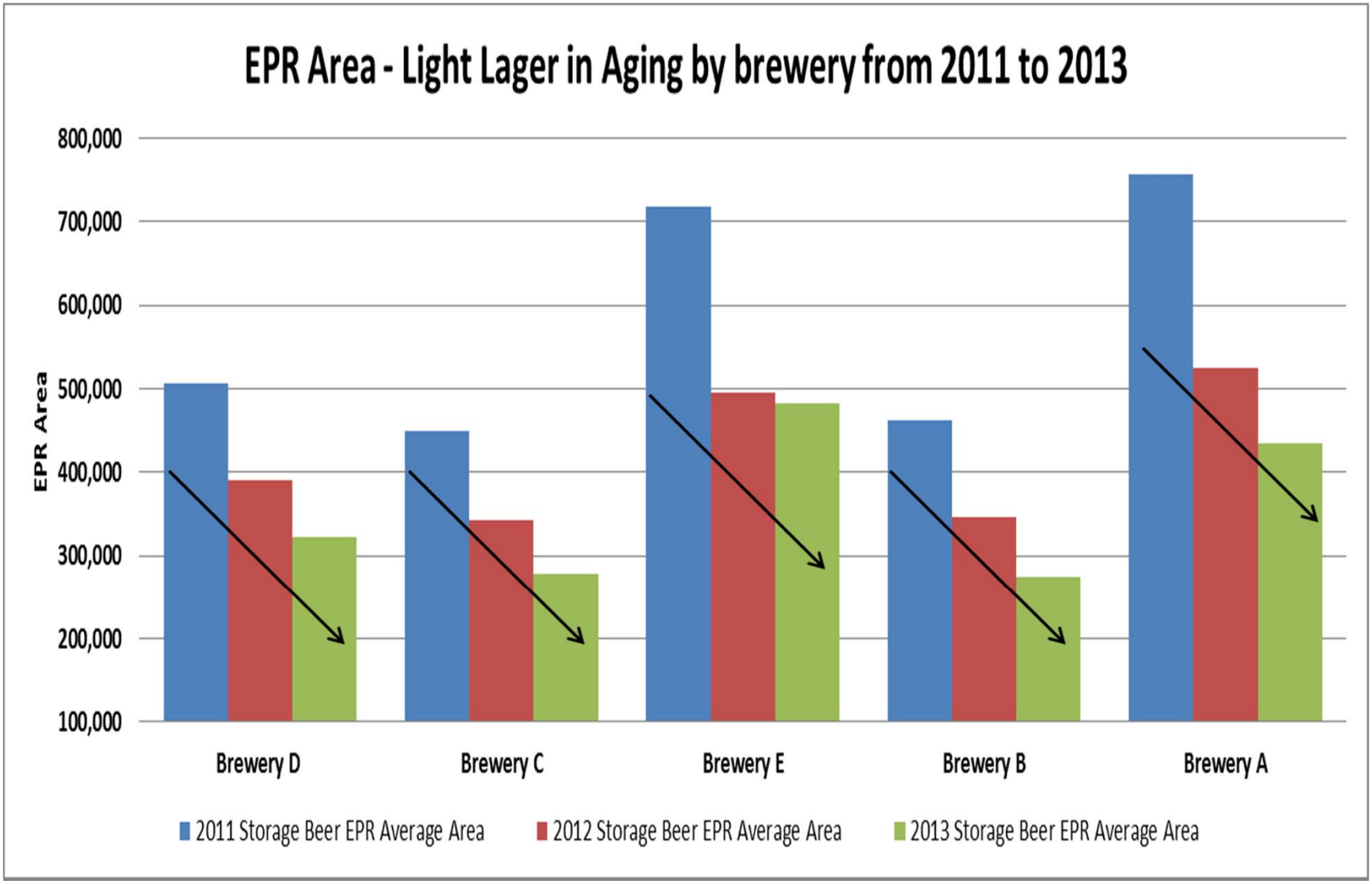




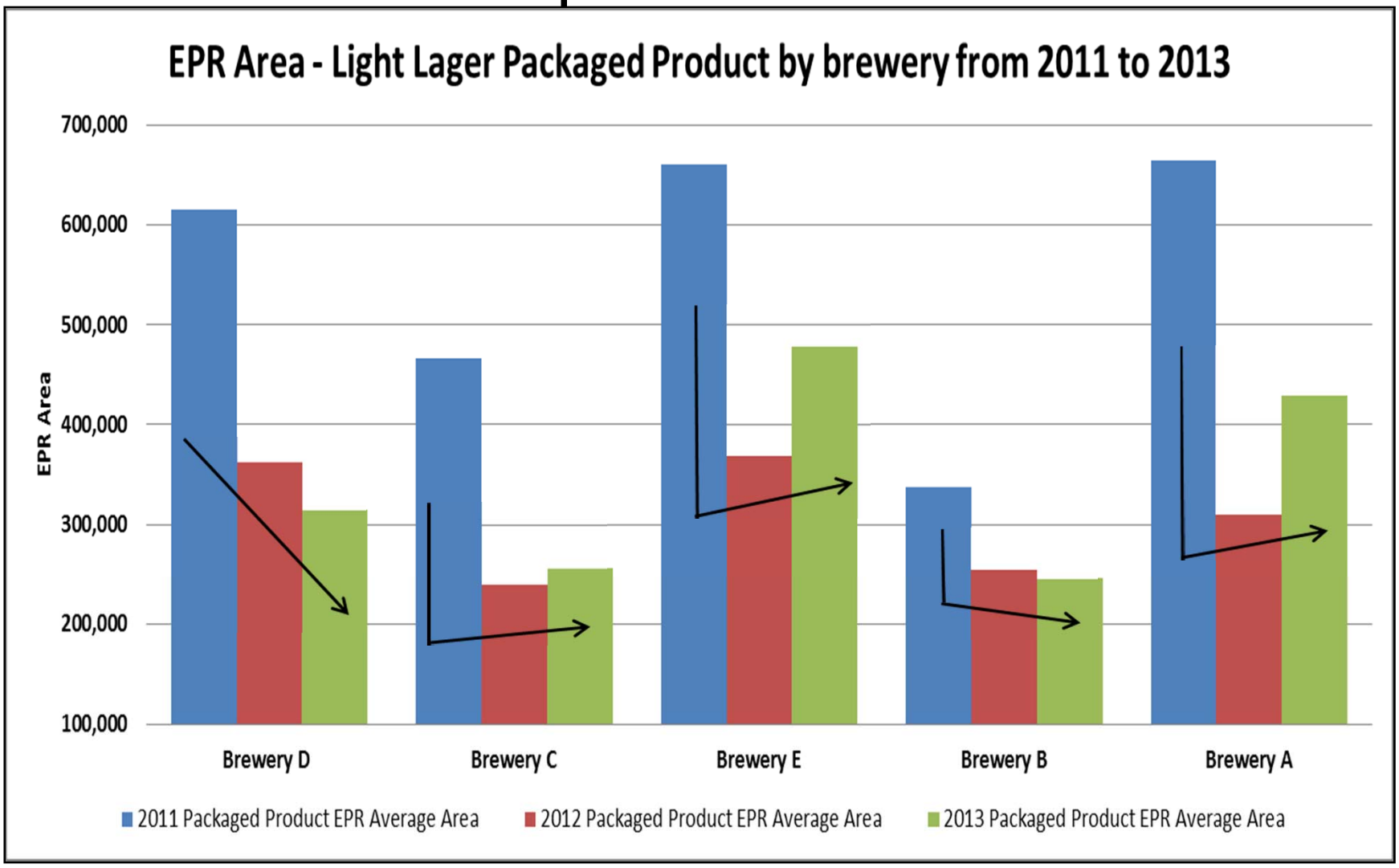
EPR Area Metric & Wort Improvements



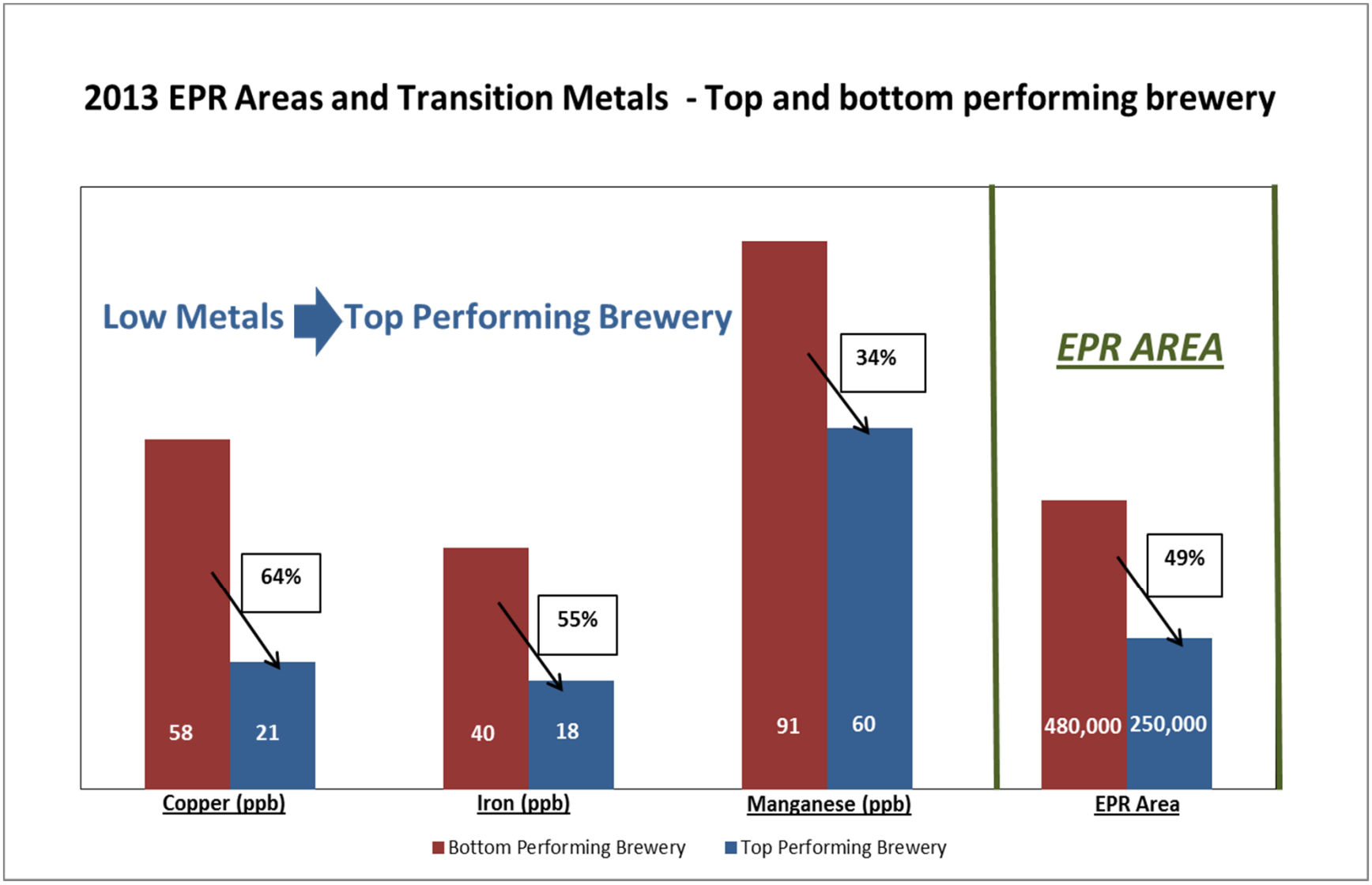
EPR Area Metric & Aging Improvements



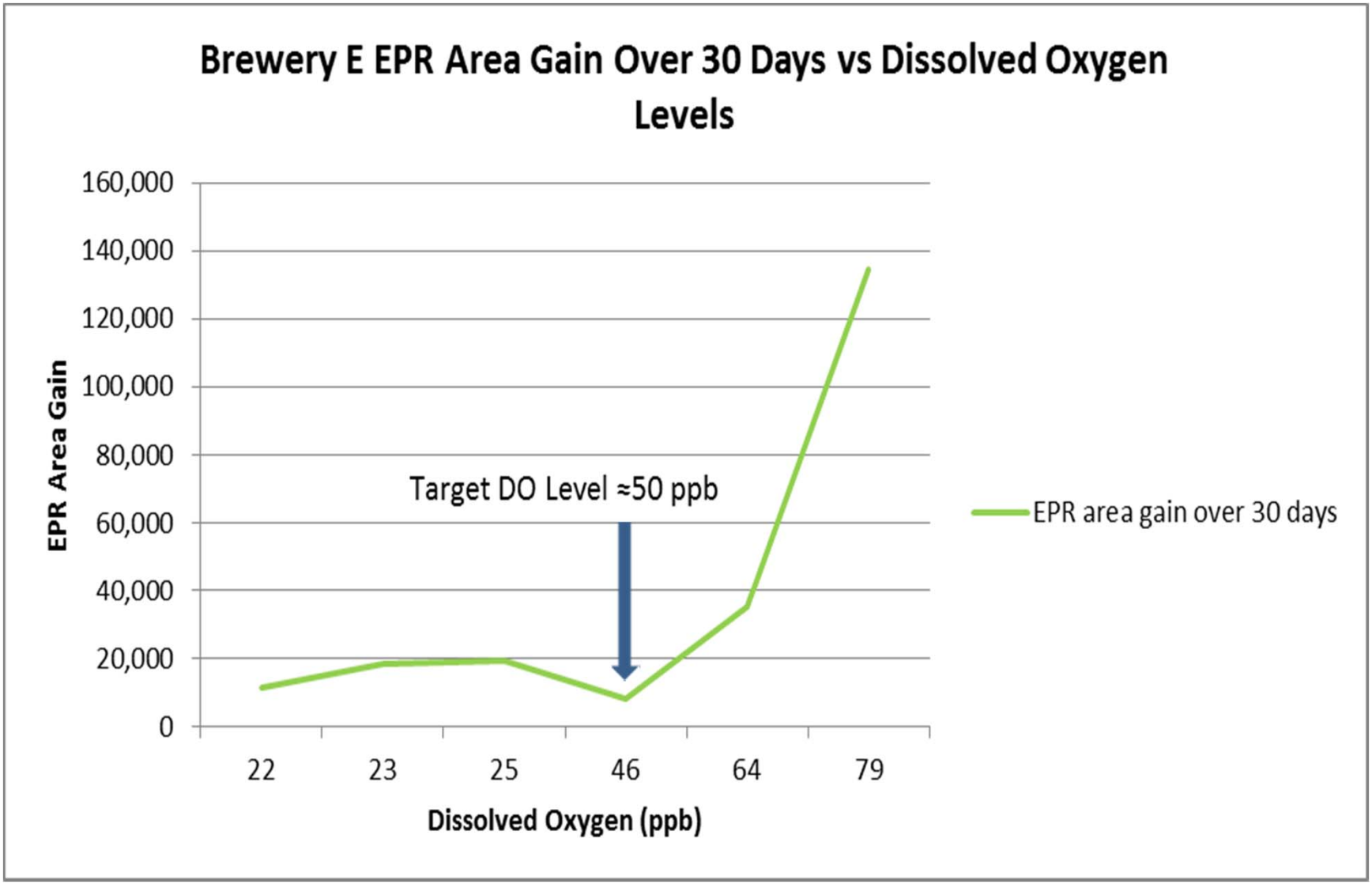
EPR Area Metric & Packaged Beer Improvements



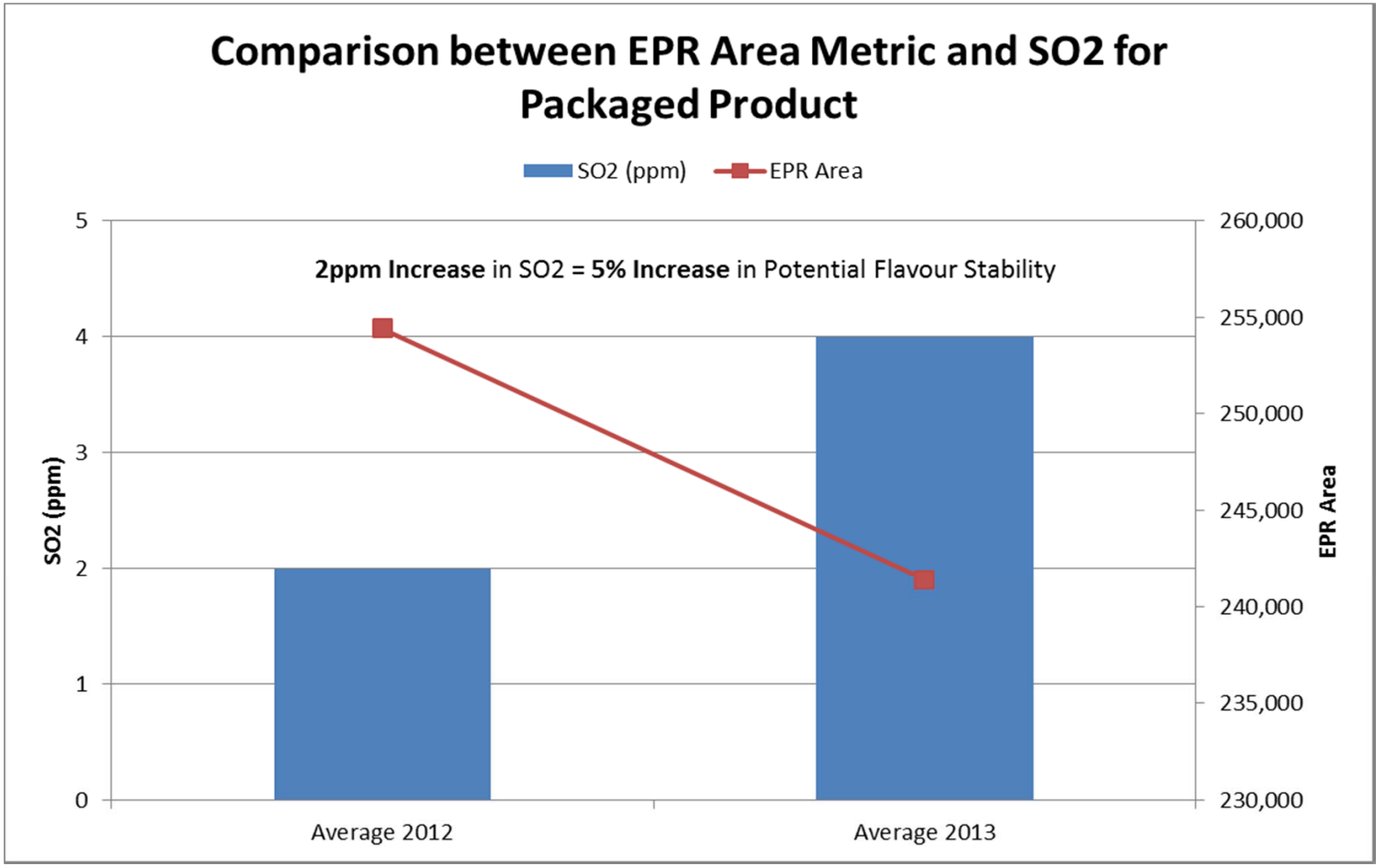
EPR Area & Metals



DO and EPR Area Gain over 30 Days



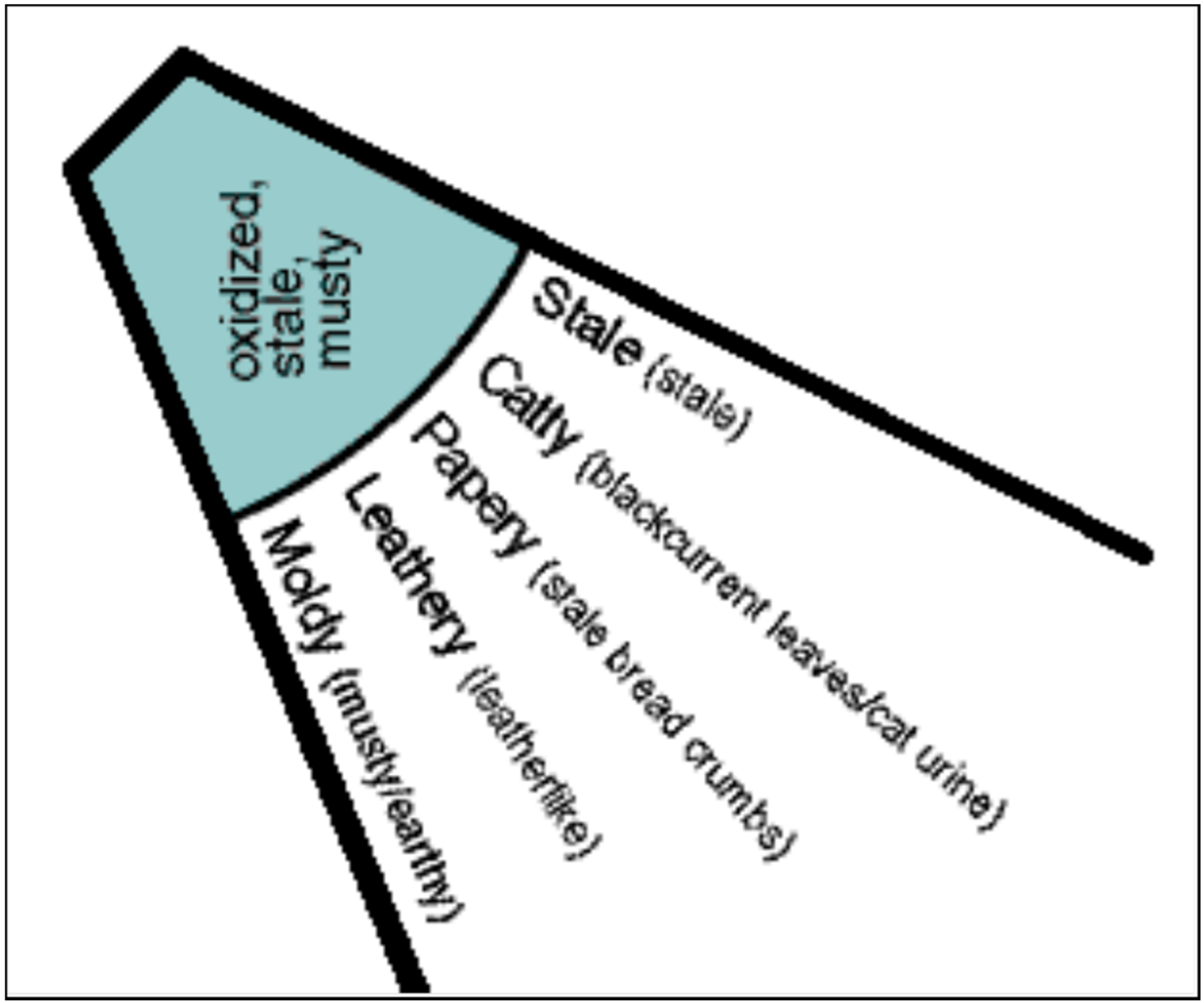
EPR Area Metric & SO2



Standardized Method for Forced Sensory Evaluation
EPR Area Metric and Routine Sensory Analysis

Laura Marques, Molson Technical Center, Molson Coors Brewing Company, Toronto, Canada

Beer Flavour Wheel



Forced Aging Method

EXPERIMENT DESIGN

- **Samples of fresh, standard lager, light and ale beers were incubated at 40^0C for 6 days (6 month shelf life).**

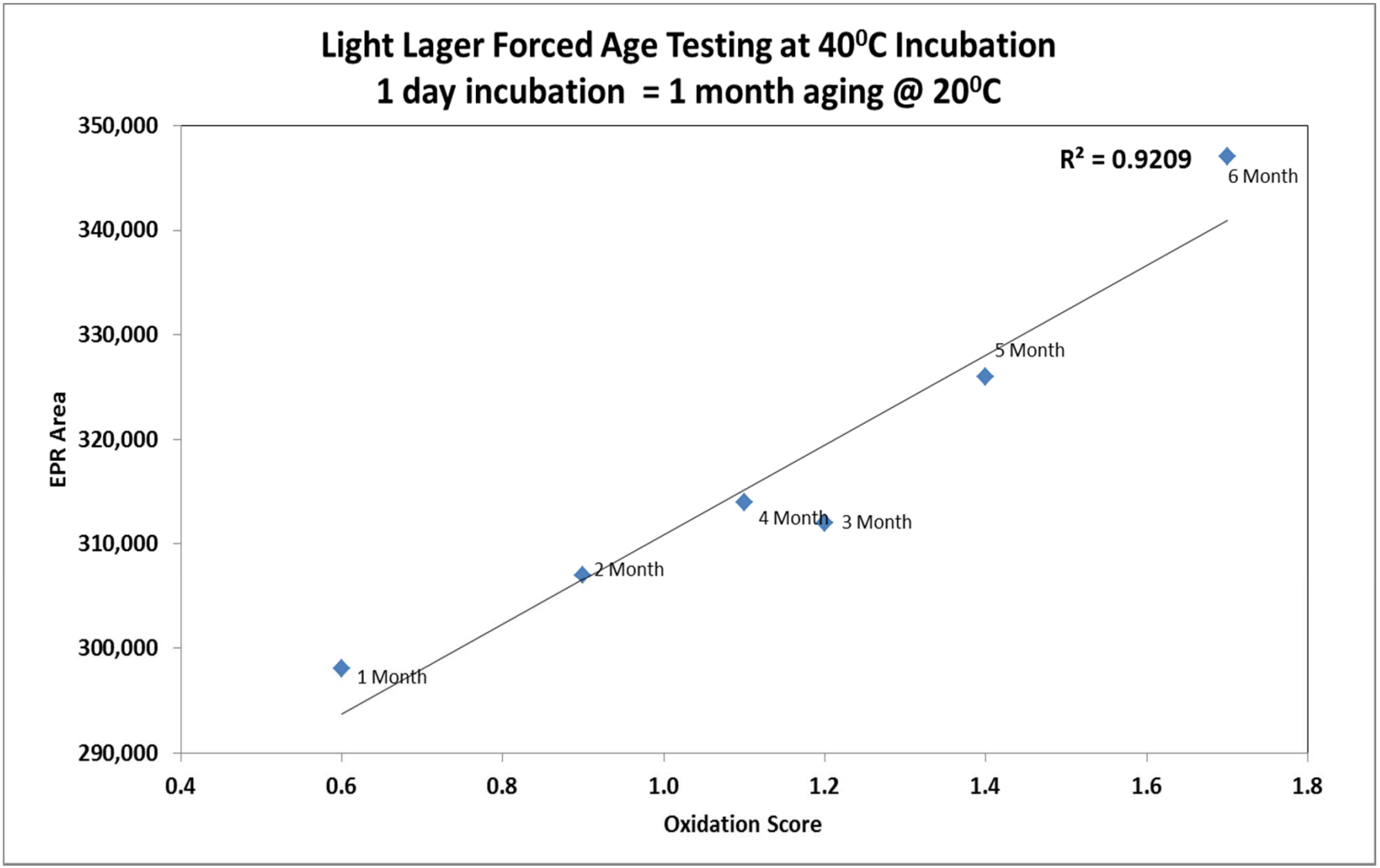
- **Samples removed at 24 hour intervals.**

- **Samples divided in two sets – 1st set analyzed by sensory evaluation and the 2nd set analyzed using EPR technology.**

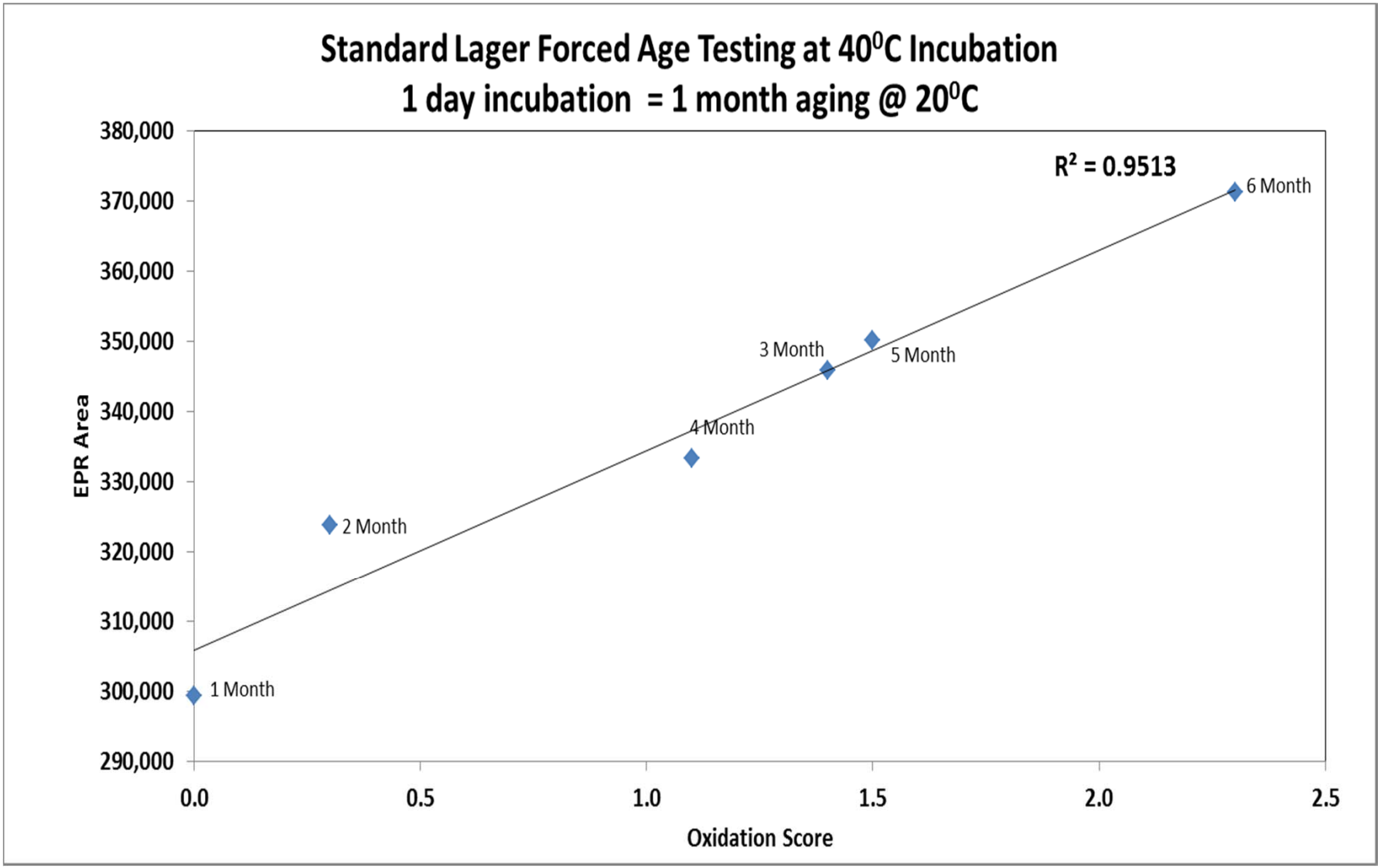
- **Evaluated EPR Area and Oxidation Score data.**

- ***One 24 hour time period at 40^0C of incubation equates to 30 days at ambient temperature (20^0C).***

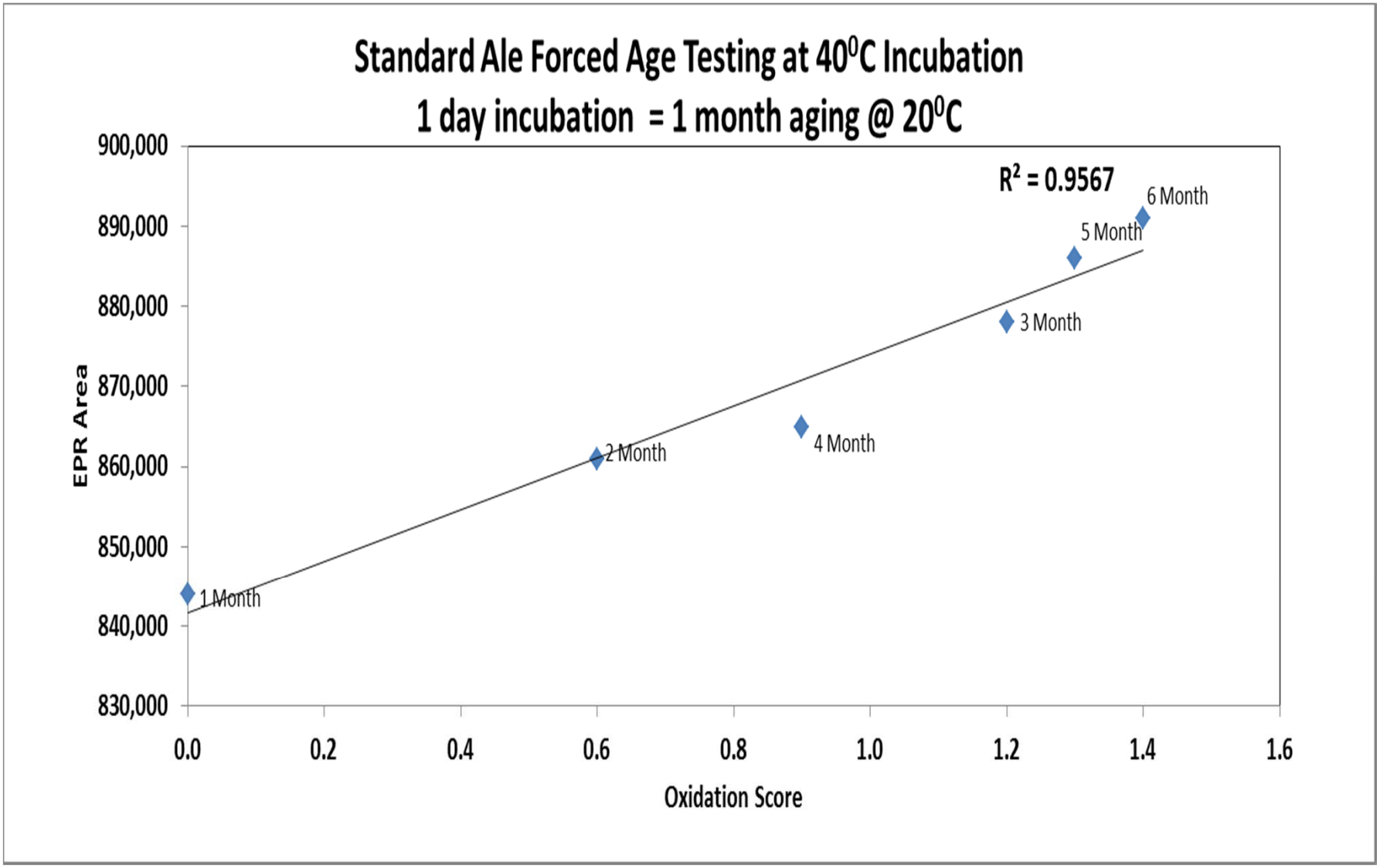
Forced Aging Method – Light Lager



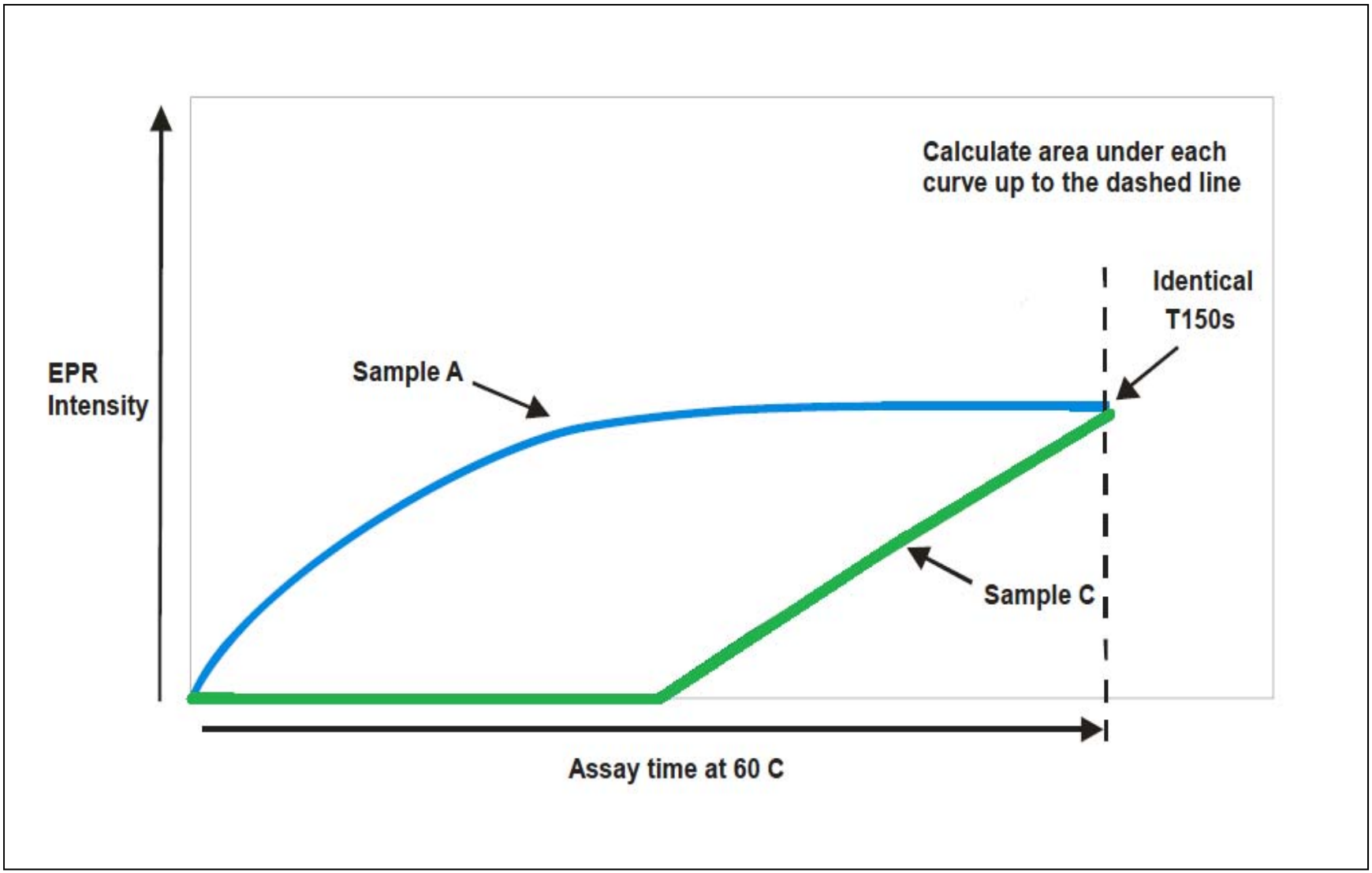
Forced Aging Method – Standard Lager



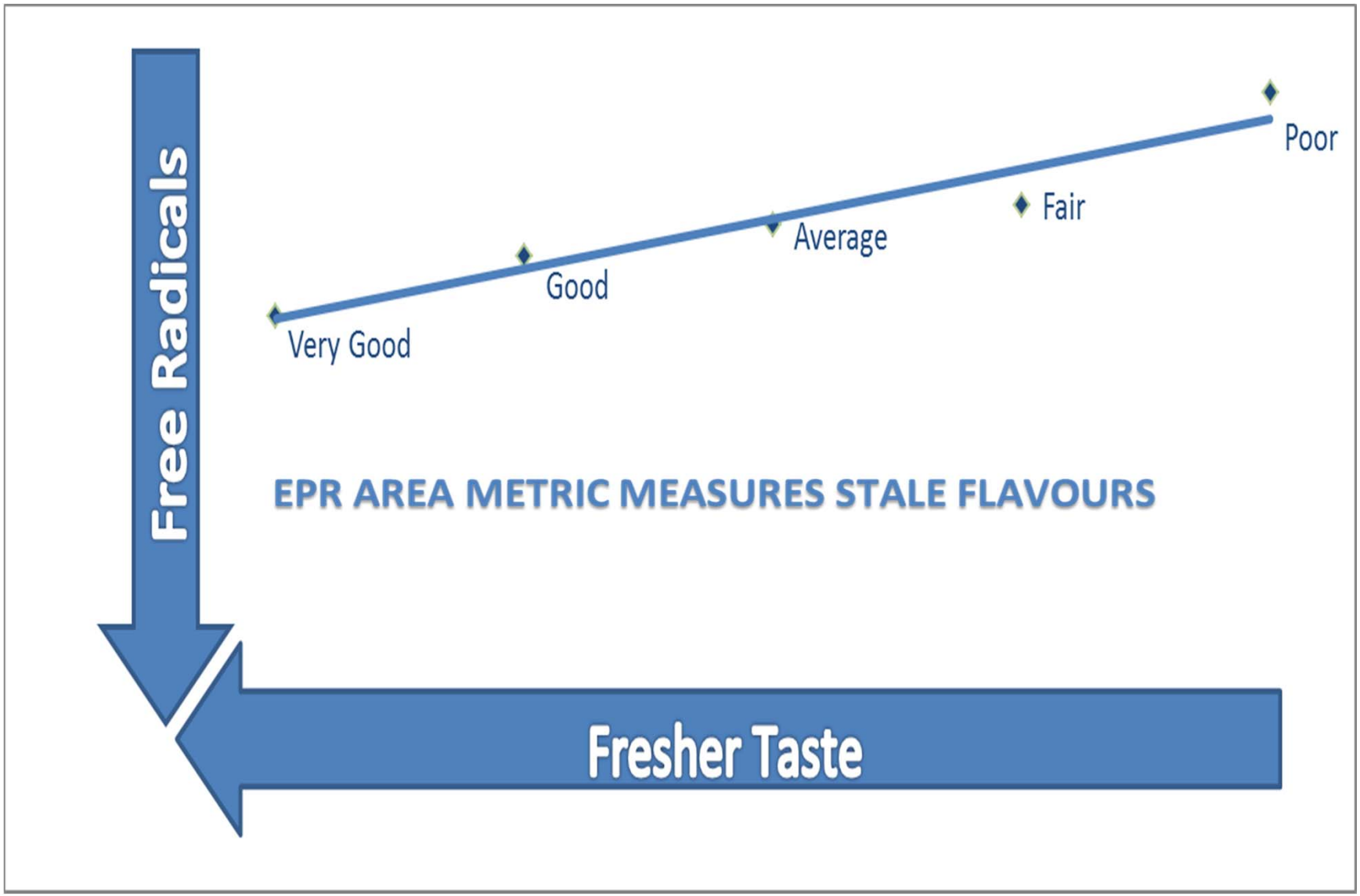
Forced Aging Method – Standard Ale



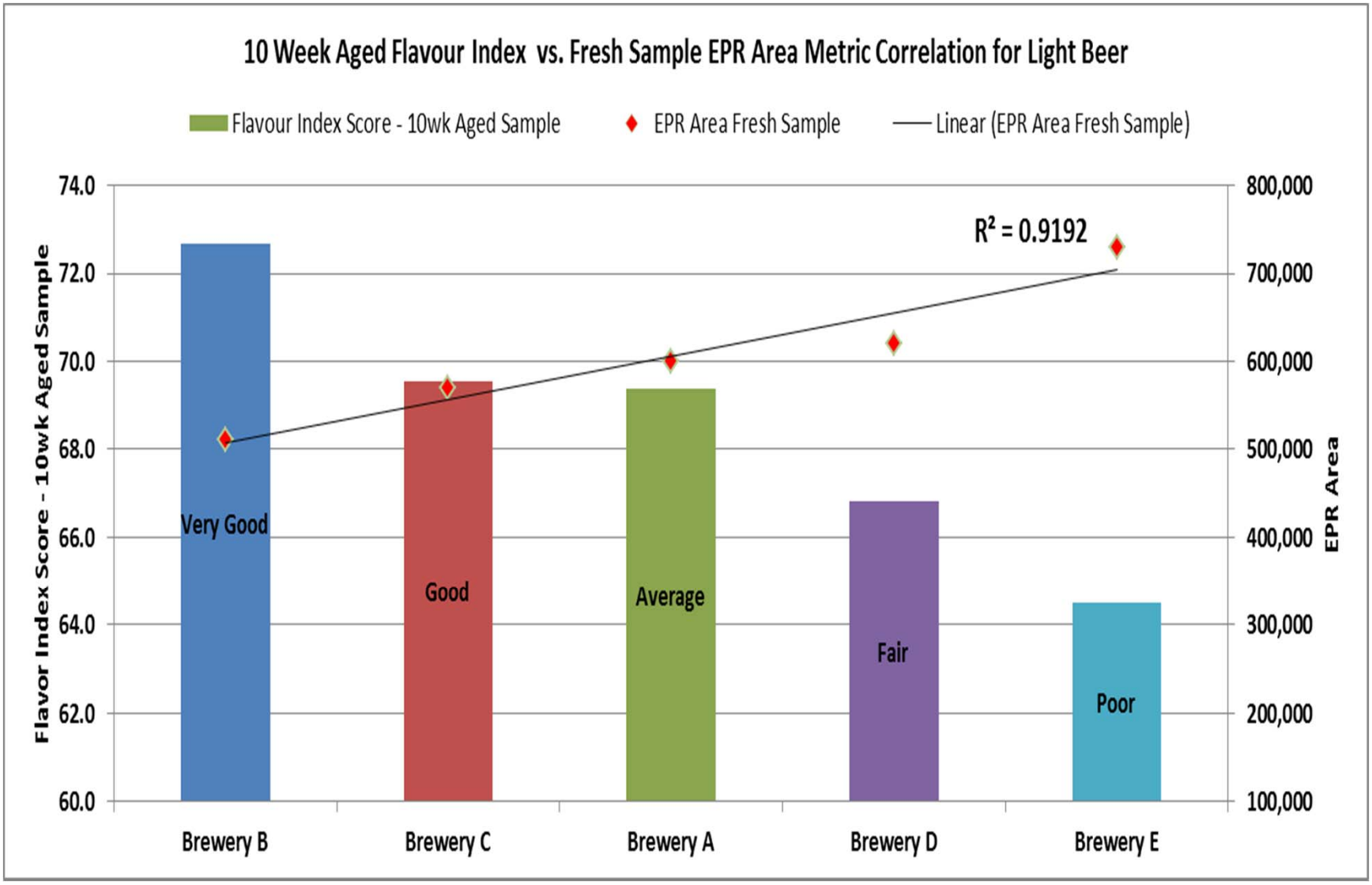
Forced Aging Method



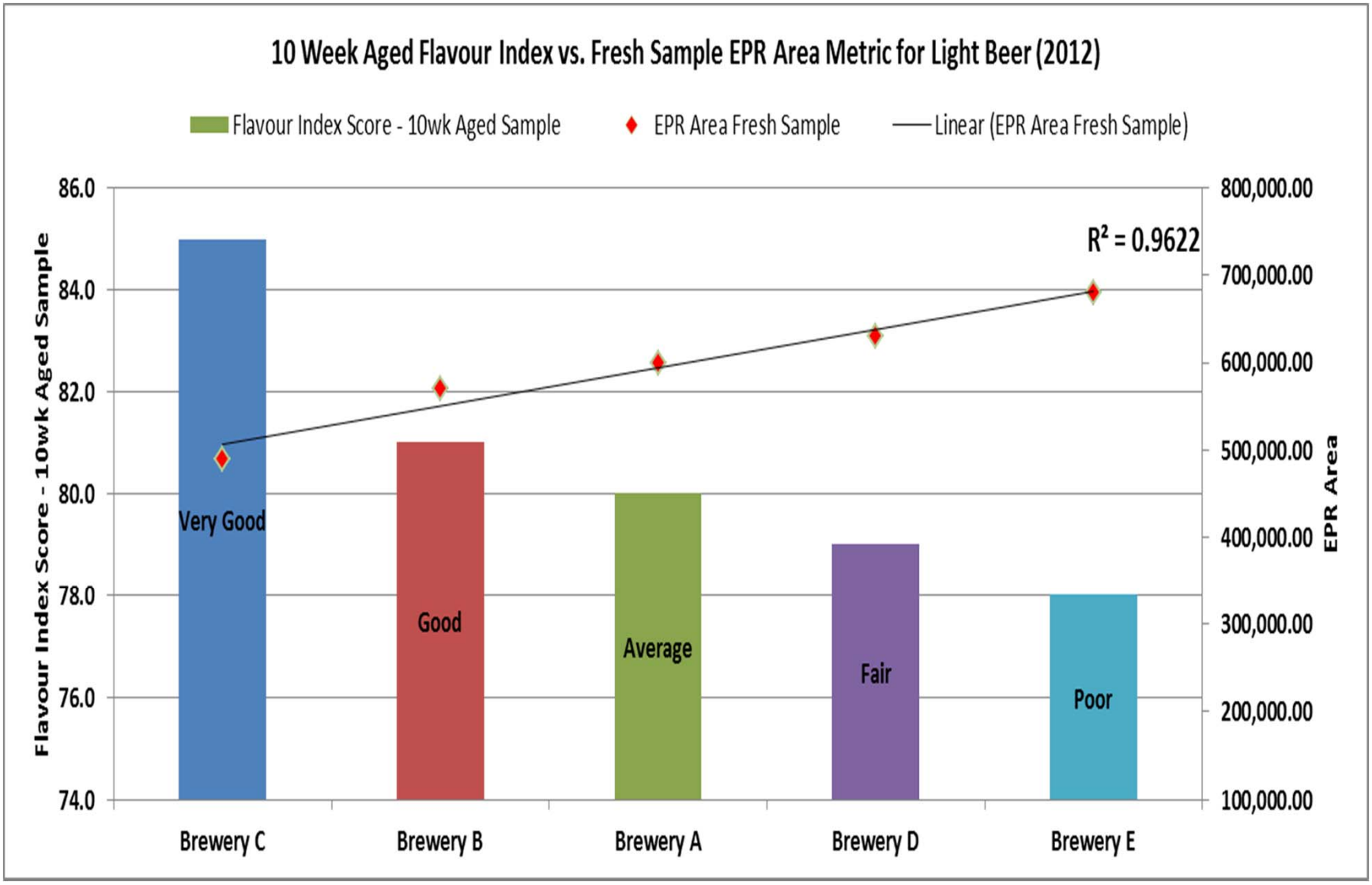
EPR Area Metric & Routine Sensory Analysis



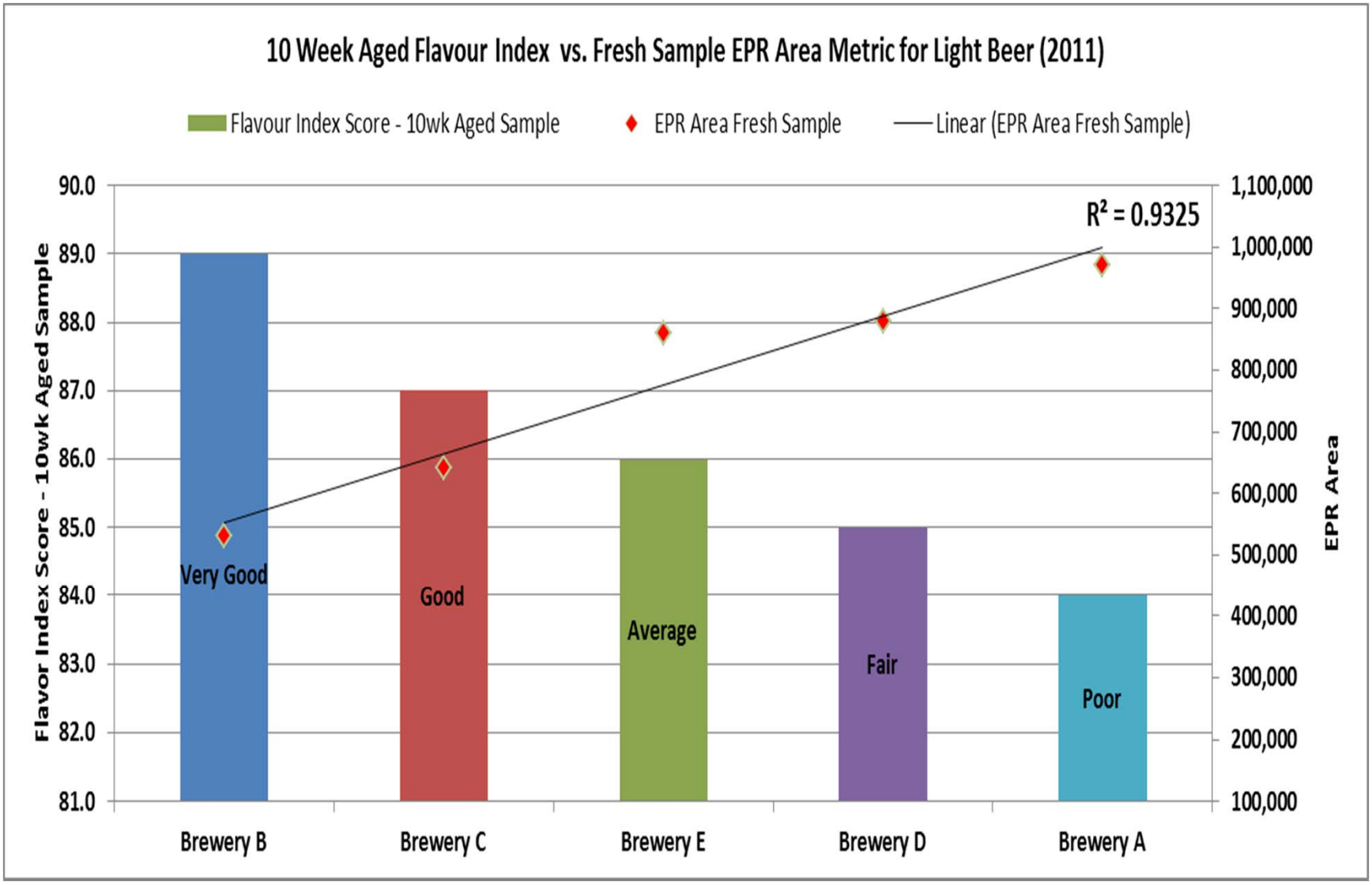
EPR Area Metric & Aged Flavour Analysis - 2013



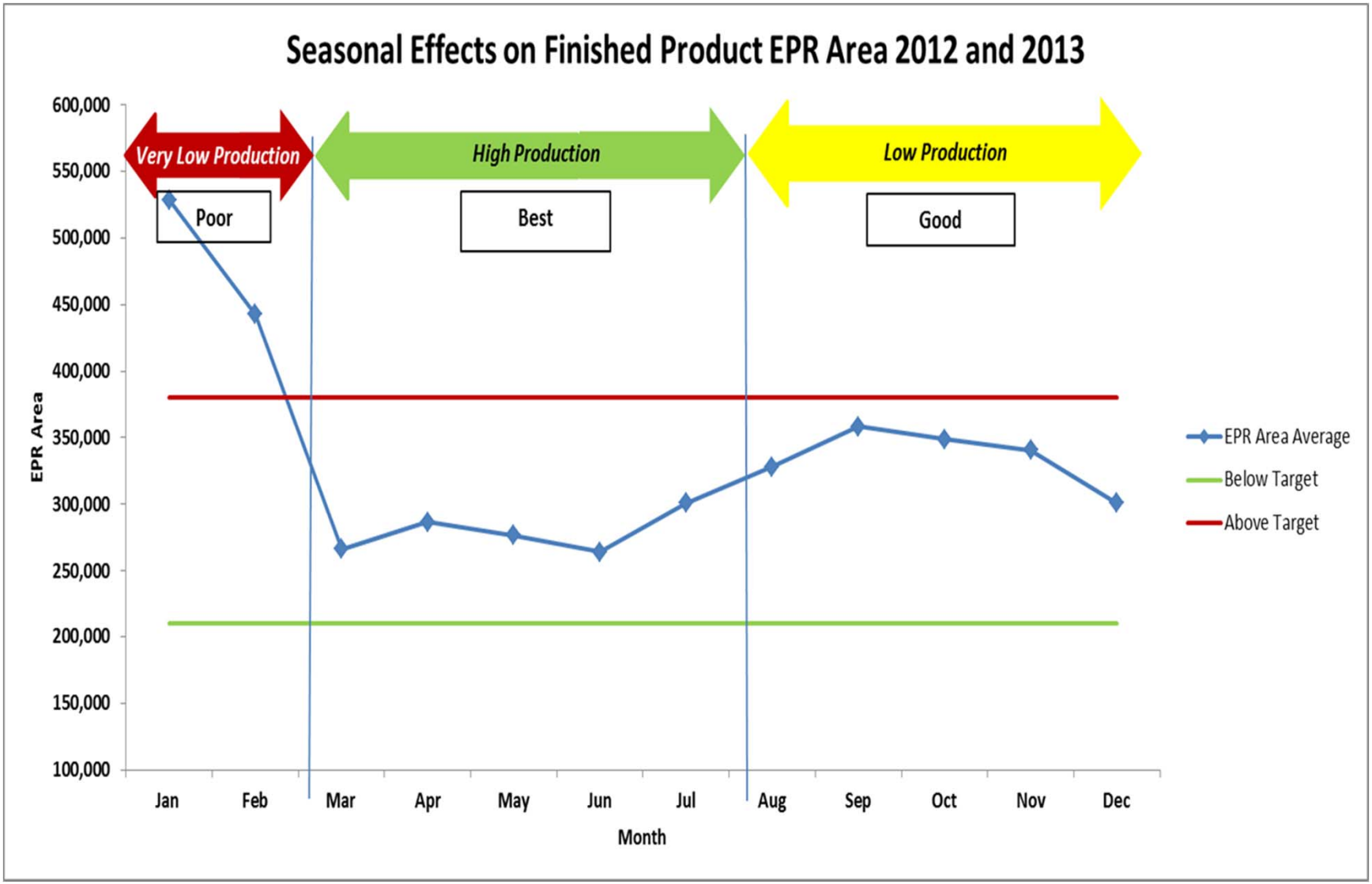
EPR Area Metric & Aged Flavour Analysis - 2012



EPR Area Metric & Aged Flavour Analysis - 2011



EPR and Seasonal Effects



Conclusions

- EPR Area allows for the implementation of a flavour stability improvement program across beer types from standard light, lager and ales.
- EPR Area Metric and the Sensory Aged Flavour Index are strongly related.
- EPR Area is the metric of the future – does not have all the variation of T150 and Lagtime.
- Reducing transition metals by an average of 50% has the potential to increase flavour stability by approximately 50%.

Conclusions (continued)

- DO levels greater than 50 ppb appear to have a negative effect on EPR area.
- SO2 levels between 4 – 7 ppm appear to increase potential flavour stability without changing the flavour profile.
- Flavour stability is at its best during peak brewing season when the brewing rate is high.
- When building a flavour stability improvement program, remember to target the high EPR area (oxidation) sampling points.

Acknowledgements

Thank you to Molson Coors Canada for permission to publish this work and to Bruker Bio-Spin Corporation and MillerCoors for technical assistance.