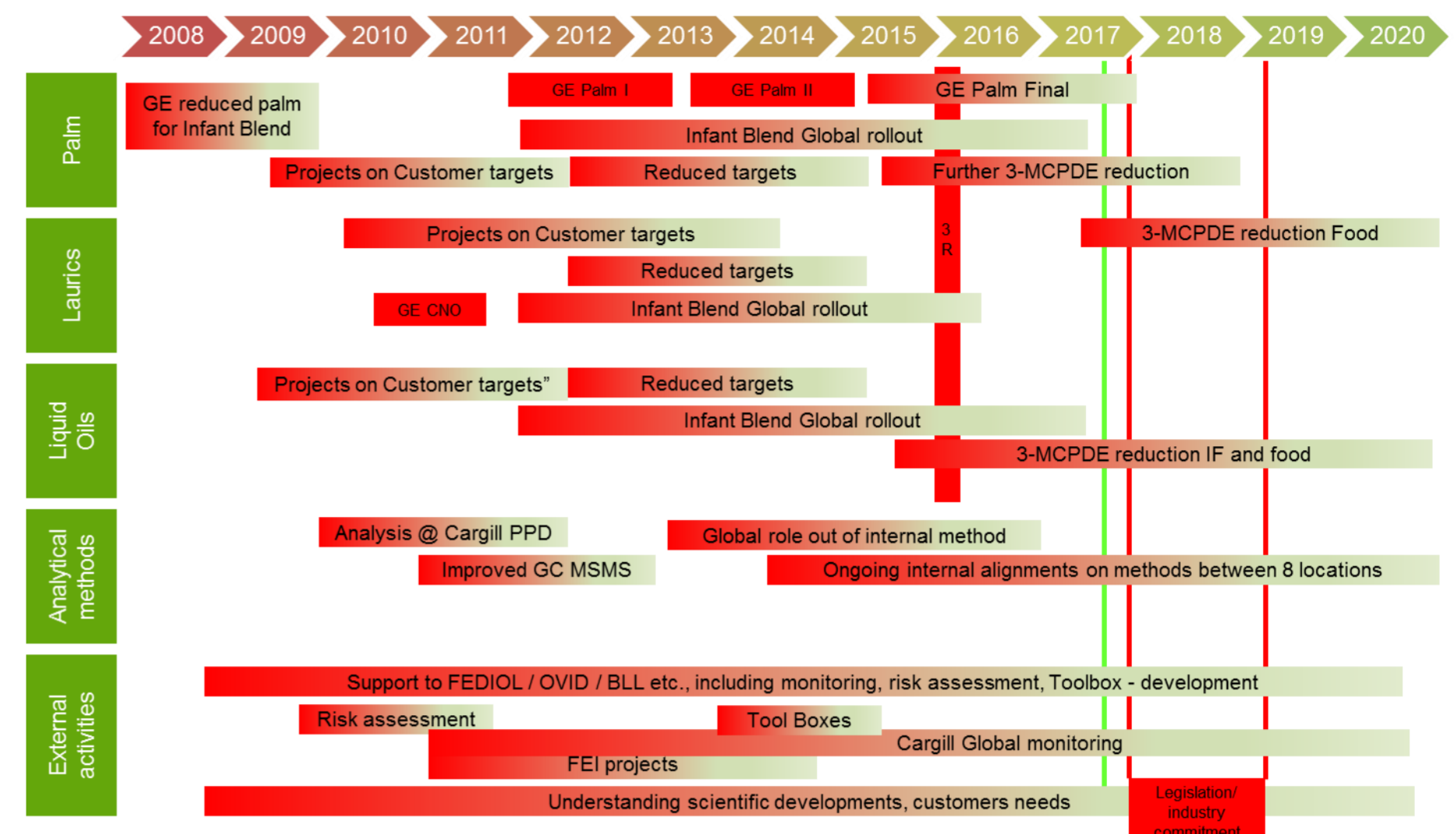


3-MCPDE and GE mitigation – a Journey for the Oil Refining Industry since 2007

F. Brüse, A. Menzel, K. Aue - Cargill – Global Edible Oil Solutions

Since the identification of the presence of MCPD esters (MCPDE) and glycidyl esters (GE) as a possible concern, considerable work has been done by scientific experts, industry and food authorities. Cargill has fully engaged in this work from its inception, as an active member of various vegetable oils and fats industry associations, such as FEDIOL and OVID. As visible also in project overview, the engagement did first target **Infant Food Blends, Palm Oil** and **GE**, but was soon extended also to Food, other oils and 3-MCPDE. This engagement encompassed understanding of the formation of these contaminants, development and testing of mitigation measures, and evaluation of analytical methods.

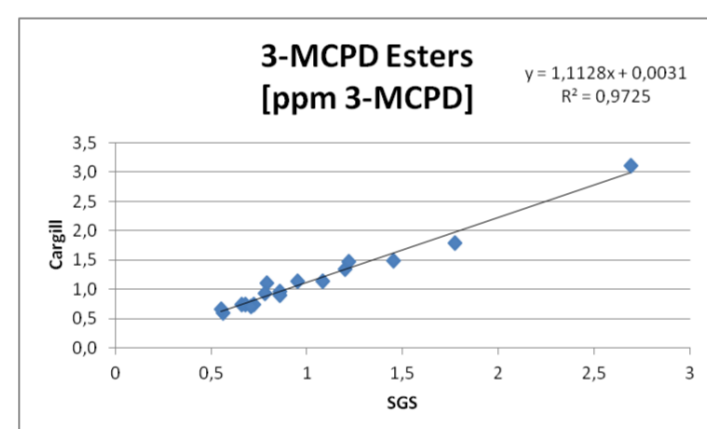
Project overview (most important activities)



A very important part of this work was and still is proper monitoring of production to evaluate mitigation options and exposure impact. Meantime there are **8 analysis locations** within Cargill globally, that enable the global Cargill monitoring effort. This is resulting in a **global database** for all locations and all straight oils, which is reviewed regularly to ensure early measures can be taken in case needed and to learn more effectively also from industrial scale. Method development and continuous improvement enabled implementation of **robust, and fast method** based on official AOCS / DGF methods, that also could be automatized.

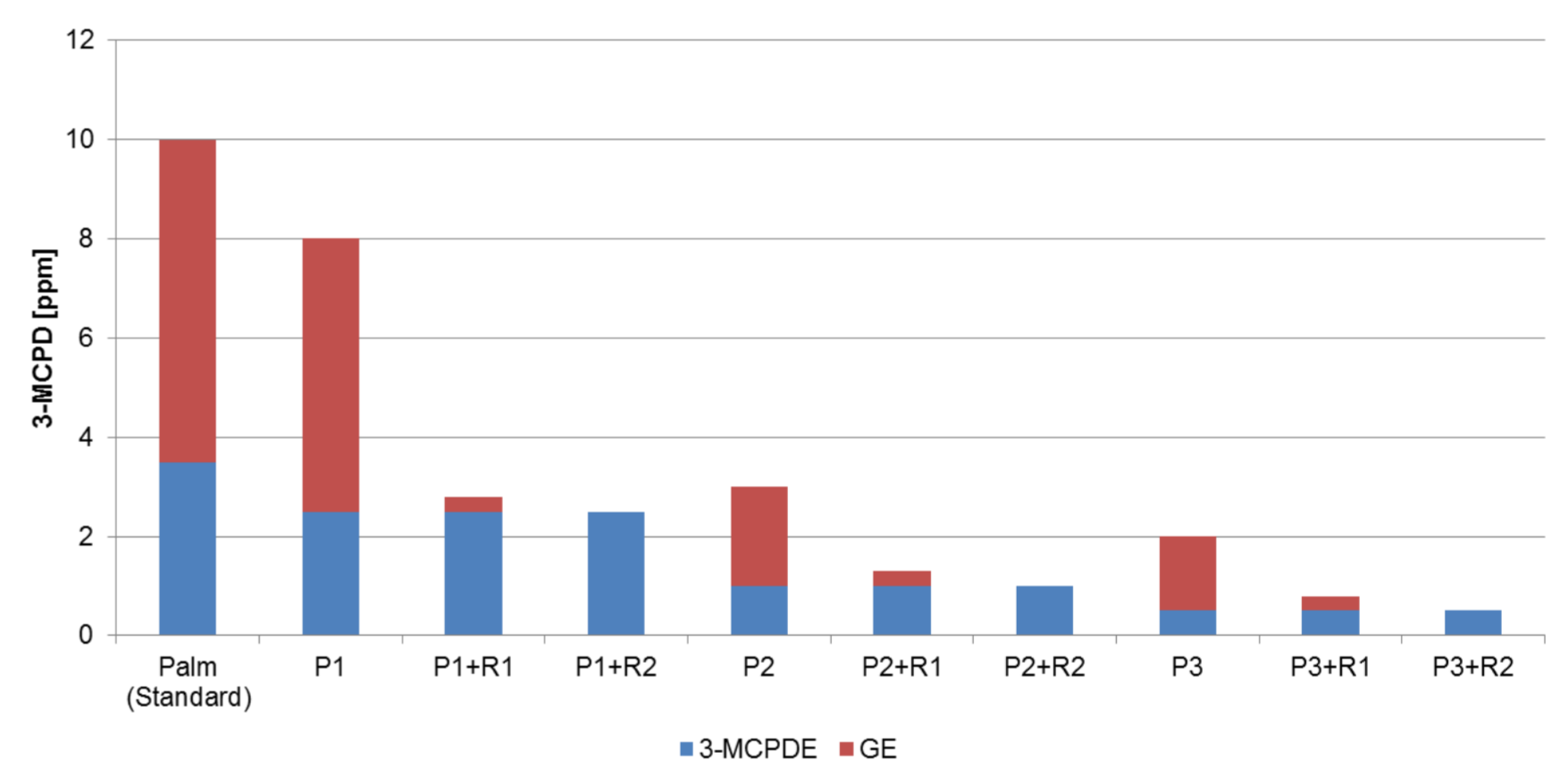
Analysis Method Development

- Method based on DGF Methods (AOCS 29c)
- Bleaching treatment allows for high area in GC MS
- Simple method that can be automatized
- Investment in resources and equipment in Port Klang (Malaysia), Nantong (China), New Castle (Australia), Maringue (Brazil), Izegem (Belgium), Botlek (Netherlands) and Hamburg (Germany) for implementation of the Cargill Method or alternative methods.



Reduction options during refining

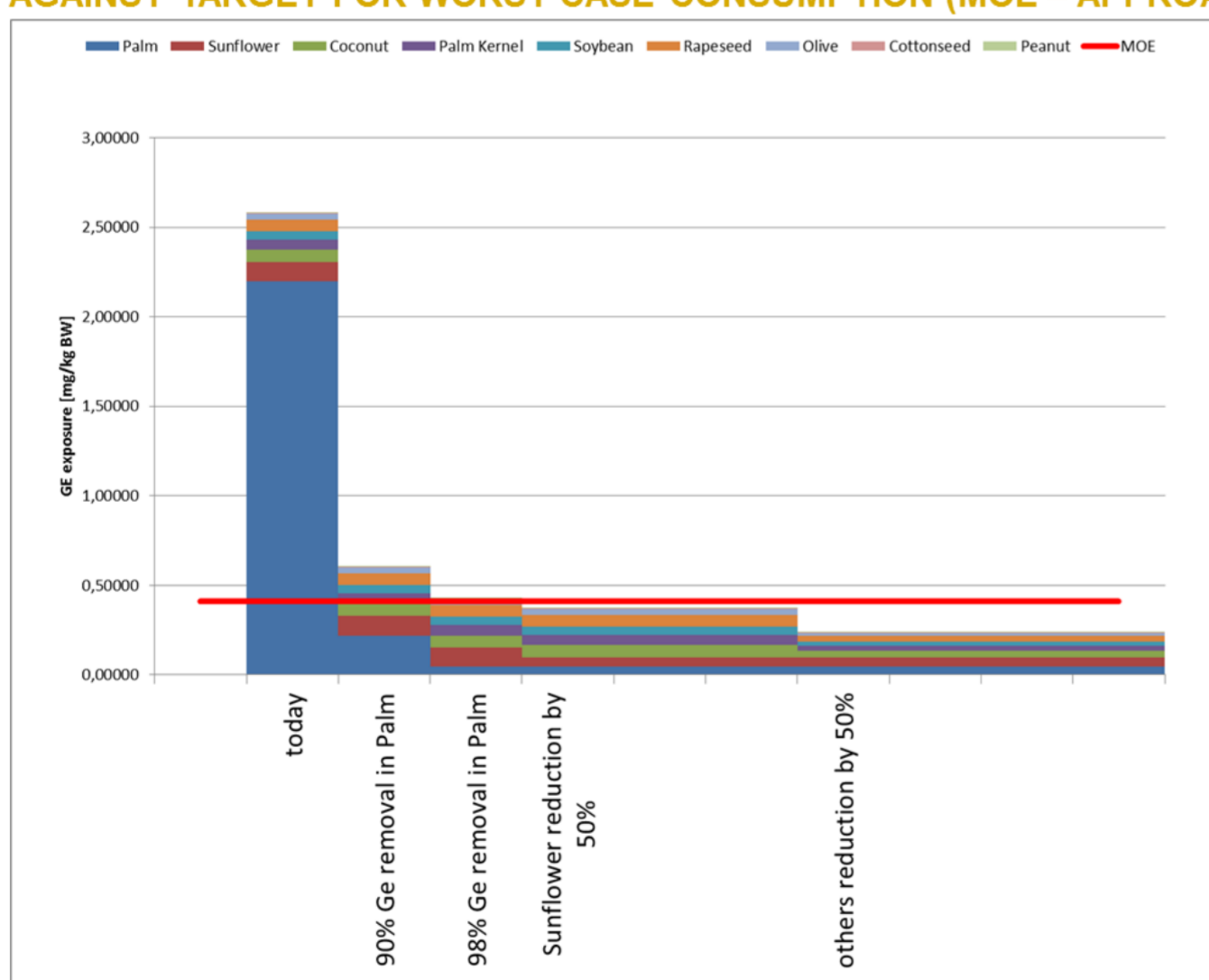
COMBINATIONS OF PREVENTION AND REMOVAL



Combination of prevention and removal required to achieve significant reduction of 3-MCPDE and GE.

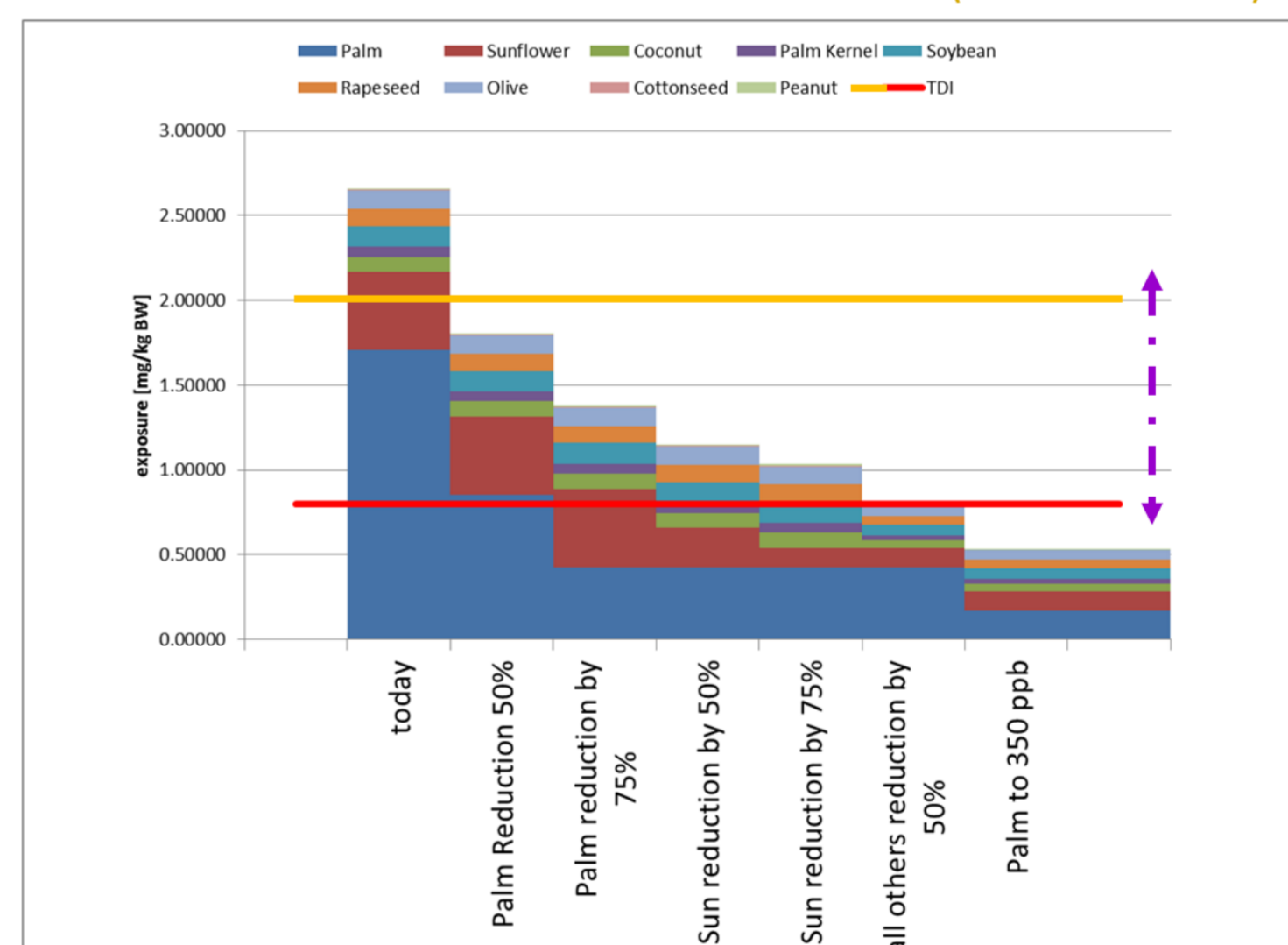
GE reduction theoretical roadmap

SHOWN AGAINST TARGET FOR WORST CASE CONSUMPTION (MOE – APPROACH)



3-MCPDE reduction theoretical roadmap

SHOWN AGAINST TARGET FOR WORST CASE CONSUMPTION (TDI – APPROACH)



The know-how developed from these Cargill activities was also used to support **BLL and FEDIOL tool-boxes** as well as FEI projects. Different types of mitigation tools have been developed having different reduction capabilities and consequences on oil quality, production capacity, cost structure or environmental impact. To enable very low levels of contaminants combinations of the various tools need to be applied. Implementation of mitigation technologies started focusing on infant food, and meanwhile is rolled out to food. Depending on the levels detected and the setup of the refineries, the mitigation measures can consist of various solutions ranging from continuous improvement activities to even high CAPEX solutions. **Cargill is committed to the highest standards of food safety and quality.**

