SOLVAY

Progress beyond

Government Affairs

Cylinderized Phosphine Fumigation: supporting a valid alternative to Methyl Bromide

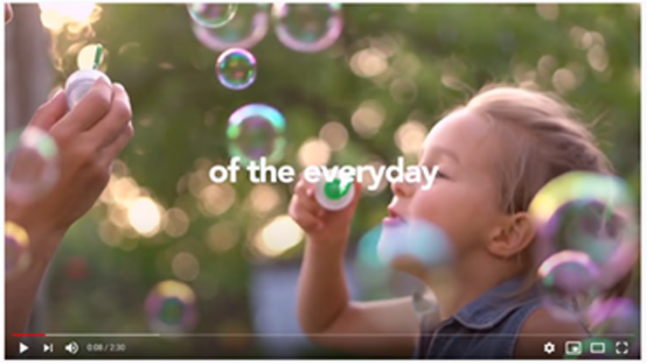
Presentation to Quarantine Regulators
May 2021

Solvay Today

We are a science company whose technologies bring benefits to many aspects of daily life.

Our innovative solutions contribute to safer, cleaner, and more sustainable products found in homes, food and consumer goods, planes, cars, batteries, smart devices, health care applications, water and air purification systems.

Our Group seeks to create sustainable shared value for all, notably through its Solvay One Planet plan crafted around three pillars: protecting the climate, preserving resources and fostering better life.



€8.9bn
Underlying net sales

€1.9bn
Underlying EBITDA

52%
Net sales sustainable solutions

23,000
Employees

64
Countries

110
Sites across the globe

*2020 figures

2030 Solvay One Planet Goals & Achievements 2020

10 ambitious external objectives to reduce our global impact (basis: 2018)

CLIMATE

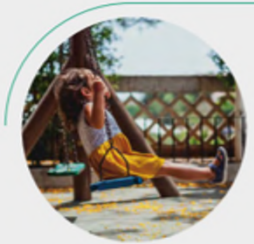
FIGHT AGAINST CLIMATE CRISIS

- Align greenhouse gas emissions with Paris Agreement and SBTi → Reduce by 26% (-2%/y)
- Phase out coal → Achieve 100%
- Reduce negative pressure on biodiversity → 30% reduction

RESOURCES

EMBED CIRCULAR BUSINESS

- Increase Sustainable Solutions revenues → Achieve 65% vs 50%
- Increase circularity → More than double
- Reduce non-recoverable industrial waste → 30% reduction
- Reduce intake of freshwater → 25% reduction



BETTER LIFE

IMPROVE QUALITY OF LIFE

- Safety is a priority → Aim for zero accident
- Accelerate Inclusion & Diversity → Parity in 2035 vs 24% for mid & senior management
- Extend maternity leave time and open it to co-parents → 16 weeks regardless of the gender in 2021

➔ Achievements within 2020 :

1 MT CO2 Reduction
28 projects (19 in operation)

#10 in Solar Power installed in USA

Recognition on biodiversity
Oct 1st, 2020
act4nature international

52% Sustainable solutions

CIRCULAR ECONOMY
+500 People trained
6 Joint program with ELLEN MACARTHUR FOUNDATION
6 Projects with customers

- 27% non-recoverable industrial waste since 2018

- 5% intake of fresh water since 2018

Extension of maternity leave time to 16 weeks and to all co-parents

Solvay Solidarity Fund

Financial support provided to **1,600 families**
€15 million gathered (to support employees and communities facing Covid-19)

Our markets


Aerospace


Agriculture


Automotive


Building & Construction


Consumer Goods


Electrical & Electronics


Energy Solutions


Environment


Feed industry


Food Industry


Healthcare


Industrial Applications


Mining


Oil & Gas

Our solutions for a better world

Agriculture

6% of our revenue

POST HARVEST CROP PROTECTION AGAINST PESTS :

PREVENTING GLOBAL BIOSECURITY RISKS AND HUGE FOOD LOSSES

➔ **POST HARVEST FUMIGATION IS LIMITED TO CONFINED SPACES, INVOLVES SMALL CHEMICALS VOLUME USAGE:**
silos, warehouses, containers, bulk shiploads in intercontinental trade. NO RELEASE IN OPEN SPACES

➔ **PREVENTING FOOD LOSSES REDUCES GLOBAL PRESSURE ON FOOD PRODUCTION**
According to various surveys, stored food losses due to pests range from 5% to up to 1/3 of total stored consignments

➔ **THEREBY REDUCING FERTILIZER AND OTHER CHEMICALS CONSUMPTION !**
Contribution to the CIRCULAR ECONOMY and CLIMATE CHANGE MITIGATION: urea based fertilizers emit GHG…

ONE APPLICATION : QUARANTINE & PRE SHIPMENT FUMIGATION

A critical activity monitored by the Montreal Protocol

➔ **Methyl Bromide still accepted**
despite Ozone Depletion impact

➔ **Solvay Alternative:**
Cylinderized Phosphine gas PH_3

METAL PHOSPHIDE AND CYLINDERIZED PHOSPHINE

2 DIFFERENT PHOSPHINE DELIVERING PRODUCTS

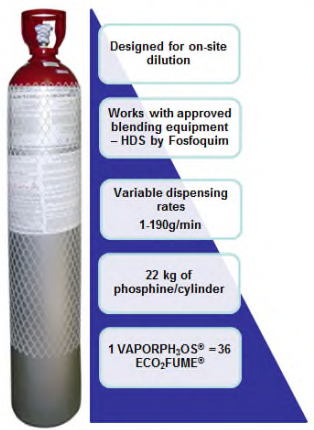
Aluminum/Magnesium Phosphide Tablets

- Cheap and perceived easy use by anyone
  Available on internet but…

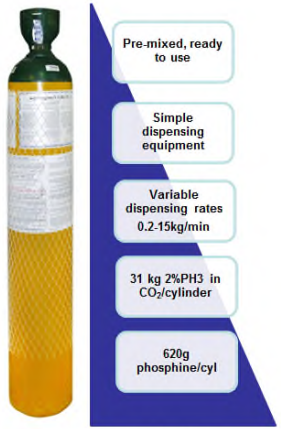
- Efficiency issues, especially in cold weather
- Leaves residues which damage fruits
- Costly removal of harmful metal dust residue
- Flammable in hot and humid conditions

DO NOT CONFUSE !!

SOLVAY Phosphine Fumigant Gas



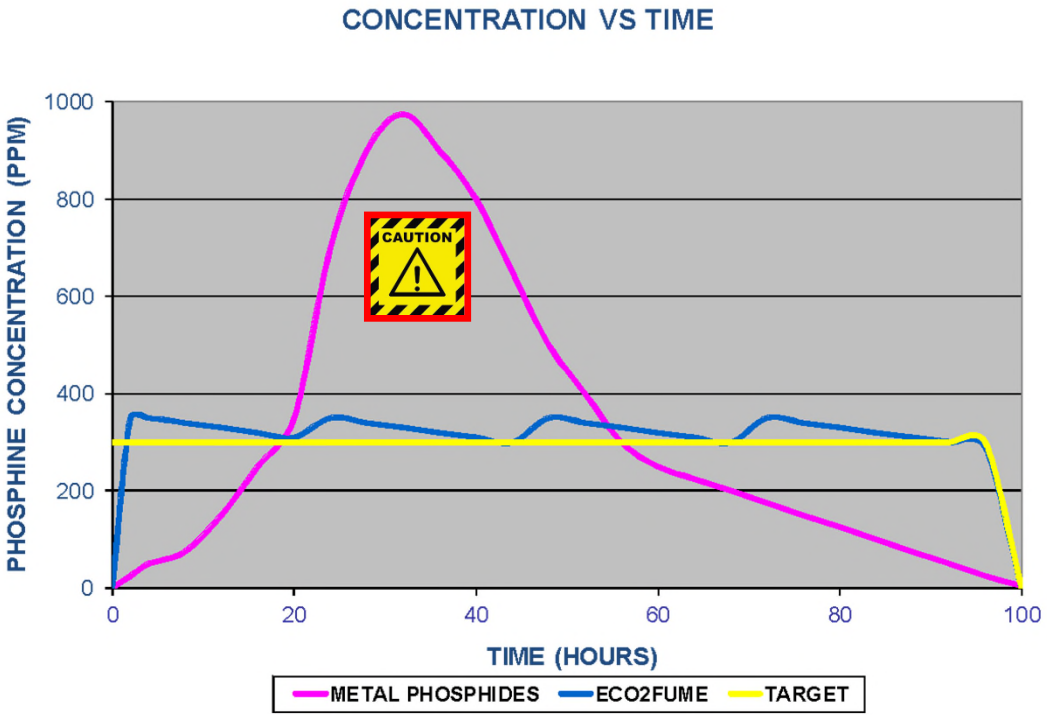
VAPORPH$_3$OS®
100% PH_3 for on-site dilution



ECO$_2$FUME®
2% PH_3 (wt.) in 98% CO_2

- Pure Phosphine PH_3 gas in reusable tanks
- Controlled sourcing: no parallel supplies
- Controlled fumigation atmosphere with Product Stewardship training
- No residue, no traces, no risks when used with dedicated equipment

EFFICIENCY COMPARISON WITH METAL PHOSPHIDE



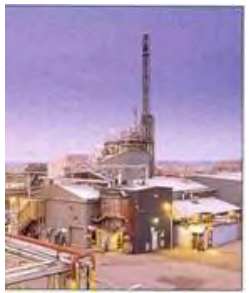
Narcosis :

Under too high fumigant gas concentration, some insects just stop breathing and can do so for days without dying. When fumigation ends, they simply come out of lethargy and proliferate. This is known as **Phosphine resistance**

With PH_3 **controlled dosage**, immediately reaching lethal dosage **avoids gas peaks, when pests survival cases are observed**

RESPONSIBLE CARE® AND PRODUCT STEWARDSHIP

Inception



Production

Transportation

Use

Refilled

- **Solvay implements Responsible Care initiatives and practices for all its businesses: responsible and ethical management of the health, safety and environmental aspects of our products from its inception through production to its ultimate use and disposal**
- **Product Stewardship trainings are conducted with Cylinderized Phosphine customers as standard practice, to ensure safe and effective use of our products. Essential requirement prior to shipping product.**

PHOSPHINE FUMIGATION APPROVED USES FOR QPS

- **$ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ are recognized as efficient, safe(*) and residue free fumigant for control of phosphine resistant insects on grains and oilseeds, insect pests in produce, buildings, chicken sheds (new application), cut flowers, logs…**

- **Approved in a growing list of countries for Quarantine and Pre-Shipment (QPS) application, to treat various commodities, food and non-food:**

  - South Korea: $ECO_2FUME^{®}$ approved replacement to methyl bromide for QPS treatment of cut flowers, nursery trees, pineapple, banana, pine wood, root, leafy and stem vegetables, rice grain and seeds
  - Indonesia: $ECO_2FUME^{®}$ approved as a primary fumigant for QPS treatment of rice, coffee, cacao, pineapple, mangosteen and tobacco.
  - PNG, Fiji: $ECO_2FUME^{®}$ approved as replacement to methyl bromide for QPS treatment of imported bulk rice, wheat and stock feeds and other bulk commodities as well as exported coffee beans.
  - Uruguay: $VAPORPH_3OS^{®}$ approved for QPS and in-transit fumigation of exported logs to China.
  - New Zealand: $VAPORPH_3OS^{®}$ for logs export under review by Ministry of Primary Industries
  - US citrus exports to Australia and S Korea: $VAPORPH_3OS^{®}$ approved in systems approach
  - Turkey: $ECO_2FUME^{®}$ approved as methyl bromide replacement for QPS of exported dried fruits.
  - Chile: $VAPORPH_3OS^{®}$ approved for QPS treatment of selected exported fruits and vegetables to the US, Japan, Mexico and other destinations
  - UAE, Oman and Egypt: $ECO_2FUME^{®}$ approved for QPS treatment of exported dates.
  - Sri Lanka: $ECO_2FUME^{®}$ approved for QPS treatment of exported mangoes, cucurbits, Ceylon tea, bitter gourd and imported rubber caps.
  - **Vietnam: $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ approved for DDGS grains exported from US**
  - Australia: $ECO_2FUME^{®}$ and $VAPORPH_3OS^{®}$ under approval process for Dark Beetle elimination for chicken sheds
    Newly established protocol for treatment of Khapra beetle under review of plant import quarantine team Australian DAWR
  - Thailand $ECO_2FUME^{®}$ under paid commercial trials for addressing Salmonella infestation on breeder house in a major chicken company
  - **Work in Progress in the EU towards registration in Belgium and Greece. This would allow massive use from Antwerp port**

(*) when used in accordance to the legal label in a given country

PHOSPHINE FUMIGATION PROTOCOLS FOR QPS

Commodity	Plant Pest Type	Phosphine Conc. (Min.)	Exposure Time	Temperature	Reference
Pineapple	Purple scale, Citrus mealy bug	1400 ppm	24 hours	5°C or higher	NPQS Korea 2015
Citrus	Queensland fruit fly (Bactrocera tyroni)	1400 ppm	48 hours	23 – 25°C	Williams 2000
Citrus	Citrus red scale	1500 ppm	48 hours	5°C	USDA ARS 2014
Mango	Fruit fly	1400 ppm	24 hours	26 - 33°C	NPQS Sri Lanka 2017
Bitter Gourd	Melon fly	1400 ppm	24 hours	26 - 33°C	NPQS Sri Lanka 2017
Cut Flowers (chrysanthemum, rose, lily)	Western flower thrips, two spotted spider mites, cotton aphids	1400 ppm	24 hours	8°C or higher	NPQS Korea 2015
Dracaena house plants	Purple scale, aphids, white fly, scales	1400 ppm	24 hours	15°C or higher	NPQS Korea 2015
Mushrooms	Lycoriella mali (sciacarid fly)	1400 ppm	24 hours	5°C or higher	NPQS Korea 2015
Timber pine Pine Nut pine	Pine weevil, white ant, Bursaphelenchus xylophilus, Monochamus alternatus, Monochamus saltuarius (nematodes)	2800 ppm	5 days	5°C or higher	NPQS Korea 2015
Pineapple	Planococcus minor (mealy bug)	200 ppm	7 hours	26 – 30°C	BIOTROP 2012
Mangosteen	Planococcus minor	200 ppm	7 hours	26 – 30°C	BIOTROP 2012
Orchids	Planococcus minor	200 ppm	7 hours	26 – 30°C	BIOTROP 2012
Dried Fruits	Ephestia Cautella Plodia Interpunctella	1000 ppm	24 hours	20 - 27°C	Ankara Univ. 2013
Dates	Ephestia Cautella Red flour beetle Saw toothed grain beetle	700 ppm 1000 ppm 1500 ppm	72 hours 48 hours 24 hours	30°C or higher	ARC Egypt 2013
Dried Distillers Grain with Solubles (DDGS)	Red flour beetle	750 ppm 750 ppm 750 ppm	3. days 4. days 5. days	>20°C 15 - 20°C 10 - 15°C	USDA ARS 2014
Export Logs	Longhorn beetle	3500 ppm	5 days	>20°C	Zhang et al 2007
Imported Rubber Caps	Black soldier fly	1000 ppm	24 hours	10°C or higher	NPQS Sri Lanka 2020
Export grains	Khapra beetle (*Trogoderma granarium*)	1000 ppm	3 days	25°C or higher	Univ. of Thessaly Greece 2020

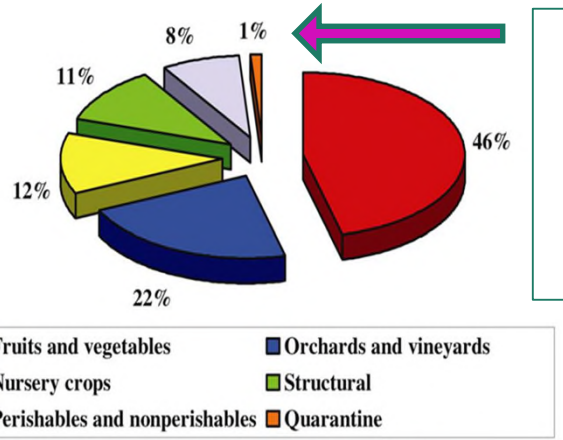
METHYL BROMIDE ODS FUMIGANT STILL IN USE

- **Methyl Bromide is an efficient fumigant but as an Ozone Depletion Potential material it was to be phased out following the Montreal Protocol.**
- **Methyl Bromide is a toxic material which poses other risks and harmful effects, in particular occupational neurologic effects upon prolonged exposure for fumigation employees** https://www.epa.gov/sites/production/files/2016-09/documents/methyl-bromide.pdf
- **Montreal Protocol Methyl Bromide phase out was effective but remains approved for QUARANTINE & PRE SHIPMENT (QPS) application since 1992 (Article 2H exception), following the absence of valid alternatives as considered at that time**

IN, CN, VN are large Methyl Bromide consumers !

MT/year	95~2000 yearly avg	2015~19 yearly avg	%
AU	348	789	127%
NZ	64	607	850%
CN	477	1,107	132%
IN	229	1,245	443%
JP	1,920	456	-76%
KR	838	455	-46%
ID	174	135	-23%
SG	66	53	-20%
MY	63	146	130%
TH	254	177	-30%
VN	320	910	184%
Total Asia	**6,604**	**6,485**	**-2%**

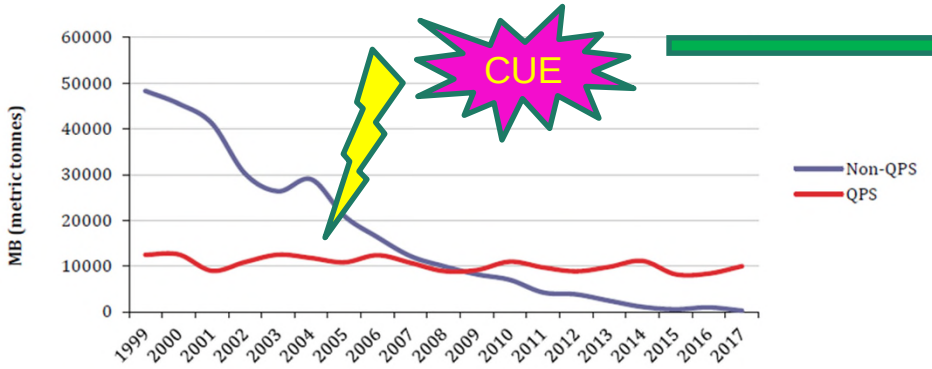
DATA: UNEP



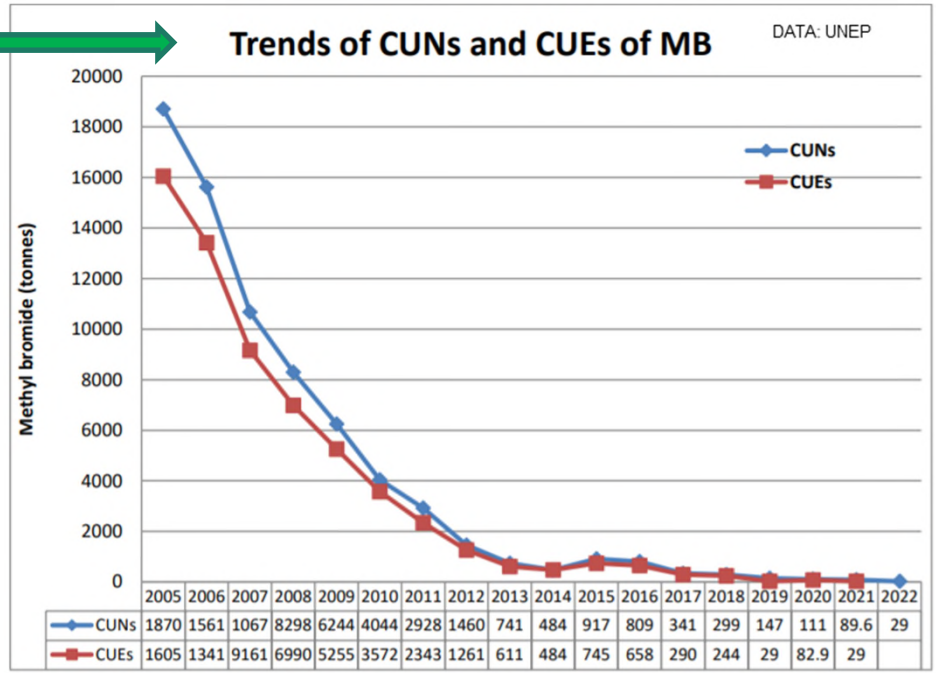
Distribution of global methyl bromide use among different applications during 1992 (51,68).

Fact : Methyl Bromide for QPS application was insignificant when the Montreal Protocol was implemented, but grew unnoticed since then, **thereby extending environmental impact**

NO PRESSURE TO REPLACE METHYL BROMIDE FOR QPS



Source: Ozone Secretariat data centre, 2018



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
CUNs	1870	1561	1067	8298	6244	4044	2928	1460	741	484	917	809	341	299	147	111	89.6	29
CUEs	1605	1341	9161	6990	5255	3572	2343	1261	611	484	745	658	290	244	29	82.9	29	

- **Despite recommendation to find alternatives, Methyl Bromide consumption for QPS has not decreased under Montreal Protocol. The Article 2H exception acts as a disincentive to conversion to alternatives**

- **In 2005, the Critical Use Exception mechanism was set up to accelerate full phase-out of non-QPS MB use, imposing case by case annual capped MB consumption, after review of potential alternatives.**

The CUE process encouraged innovation in valid new pest control techniques.
Non-QPS MB consumption almost disappeared by now

Submit QPS MB use to CUE Process

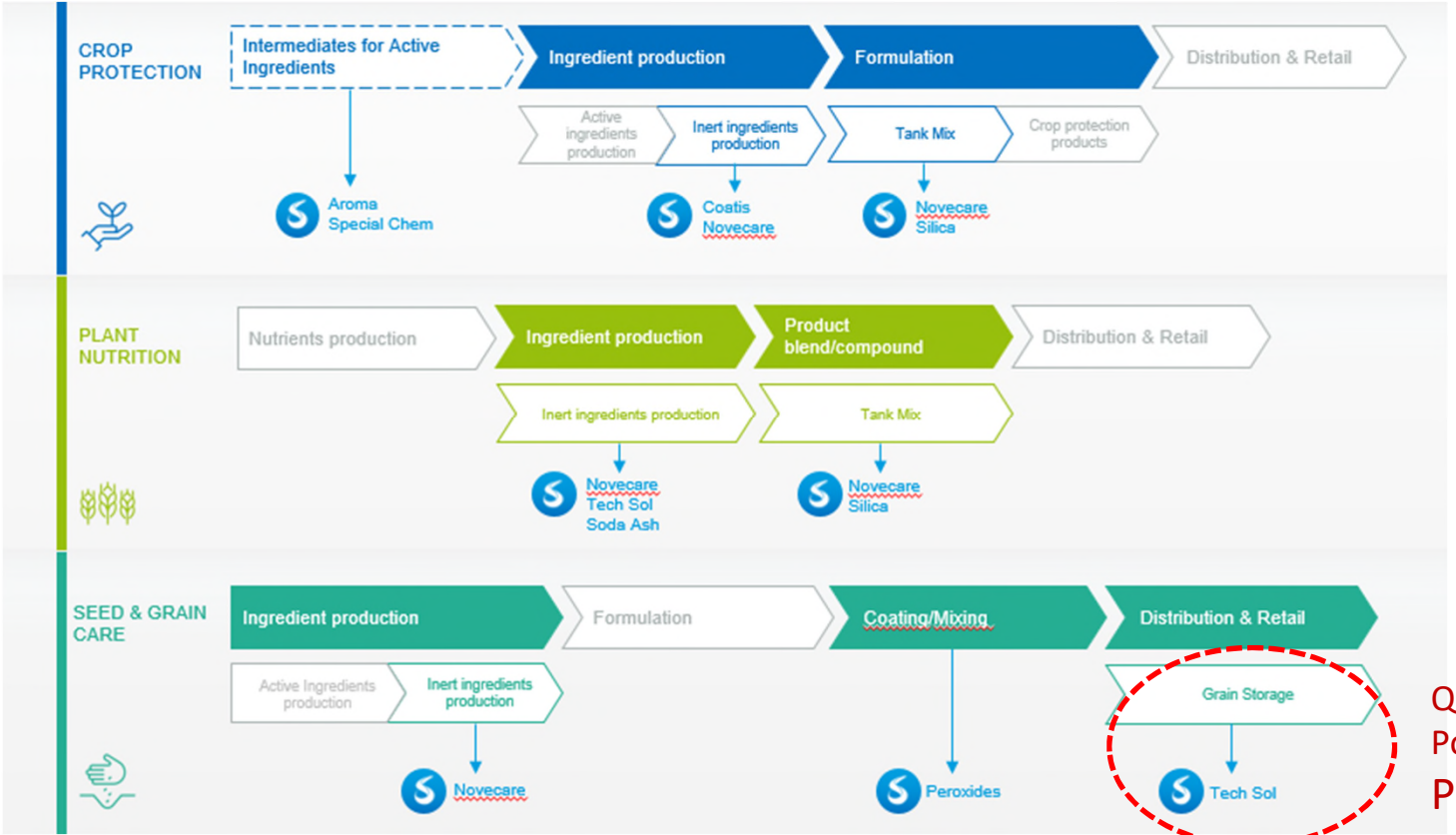
SUBMITTING QPS METHYL BROMIDE CONSUMPTION TO CUE ANNUAL REVIEW

- **Fact: since 1992, scientific progress in various techniques have been recognized as effective pest control methods for QPS, but have reached only limited deployment**
- **Fact: since 2010, the EU has fully banned Methyl Bromide use for QPS application, and have not faced any major pest crisis in this field since then**
- **Fact: meeting with various national biosecurity authorities reveal an interest for change, but the absence of strong incentive towards experimenting with alternatives due to Article 2H exception remains mainstream. Officially reporting QPS Methyl Bromide volume used appears only as a minor administrative burden**
- **Fact: efforts by Methyl Bromide proponents for QPS application to reduce Ozone Depletion emissions since then have been limited. Renewed efforts to be pushed from October 2020 will be costly. Besides, new questionable MB uses of QPS have recently been identified**
  (TEAP Progress report, May 2019)

➔ **After nearly 3 decades of status quo and considering the clear success realized for non-QPS uses, subjecting annual CUE review of potential alternative processes to QPS application would be the safest way to achieve real ODS elimination.**

Thank you.

AGRICULTURE : Solvay covering many areas



Quarantine & Pre Shipment
Post-harvest Fumigation:
Phosphine Gas PH_3

Choice towards Cylinderized Phosphine Fumigation