Permeation Research Update and PPE Virtual Center

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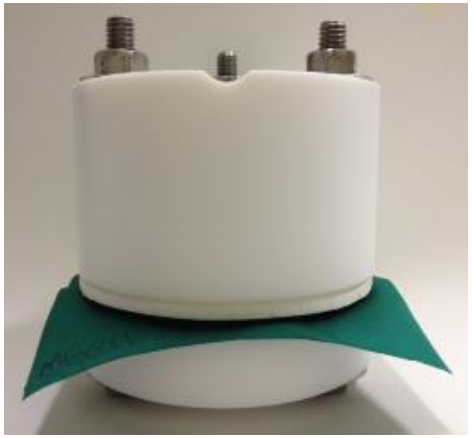
Permeation Research Update

Objective

- Develop a test method to measure permeation of active ingredients in pesticide formulations. Test method would allow evaluation of:
  - ISO 27065 Level 3 materials for whole-body garments and accessories such as apron and headgear
  - Develop performance requirements for gloves used by pesticide operators

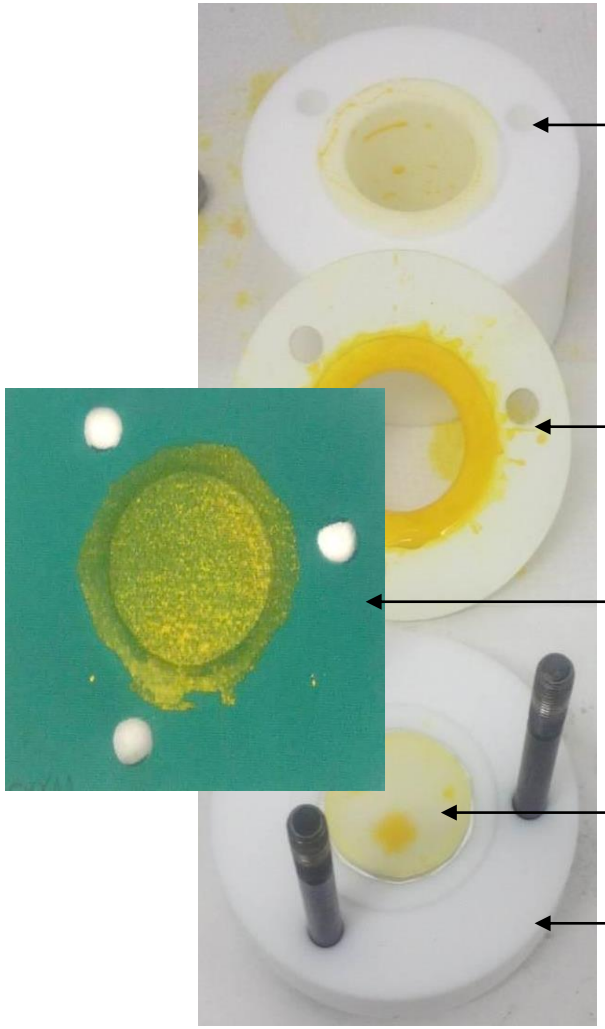
A collaborative approach was used for this study. Resources and expertise was leveraged to develop the new method.

Permeation Test Cell Assembly



Side view

Top view



E – cylinder

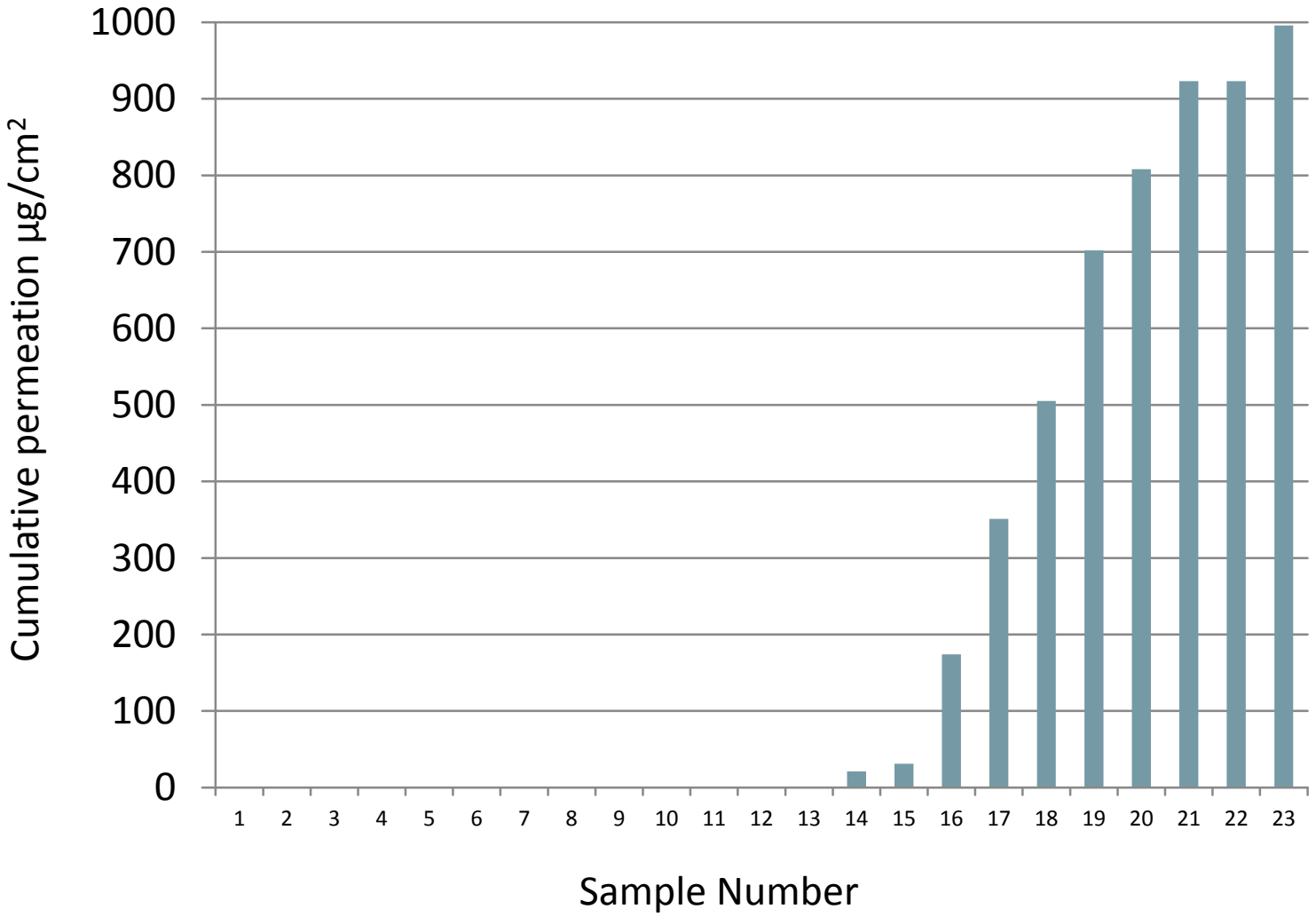
D – gasket

C – sample placed over collection disc

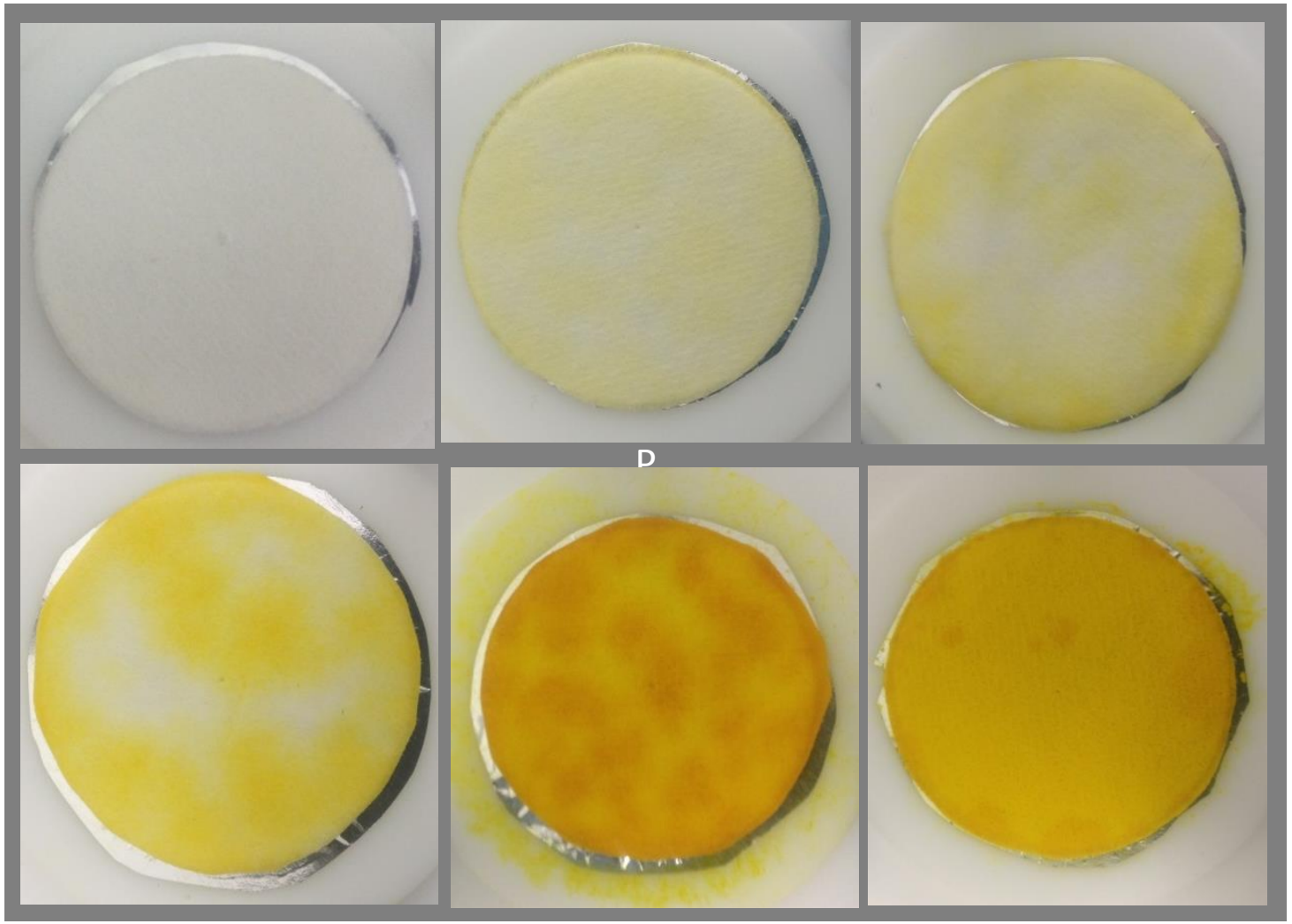
B – collection disc centered on the base

A – cell base

Permeation Through "Chemical Resistant" Materials



Permeation through “chemical resistant” materials



Glove Research

- In the United States, glove selection categories (A-H) are based on the breakthrough time of carrier solvent.
  - Selection Category Type
  - Active Ingredient
  - Type of Formulation

Carrier Solvent	Selection Category Type
No solvent or aqueous solvent	A
Ketones	B
Alcohols	C
Acetates	D
Aliphatic Petroleum Distillates	E
Aromatic petroleum Distillates < 40%	F
Aromatic petroleum Distillates > 40%	G
Halogenated Hydrocarbons	H

Formulation Selection

- **Category A** – **Eight formulations** selected to determine if waterproof
  can be a criteria for Level 1 gloves.

- **Category B** – Requires use of barrier laminate or butyl rubber gloves. **One formulation** selected since most gloves cannot be used for this category.

- Categories C and E – No formulations selected as nitrile and neoprene work well for these categories.

- Category D – No formulation was select for Category D since acetate is used in very few formulations.

- **Categories G** and **H** – require use of barrier laminate or Viton® gloves. Therefore, **two formulations** were selected for G and one for H. Data for these formulations would be used to determine if Level 3 is required.

Glove Materials

- **Six** disposable and **seven** reusable gloves made of materials listed on the EPA Chemical Resistance Category Selection Chart were used for the study.
- A 12 mil PVC glove was used as ≤14 mil glove with no lining was not available.
- Viton® was not used due to the cost and high resistance to chemicals.

Glove Materials

		Thickness	
Type	**Material**	**Mil**	**mm**
Disposable	Natural Rubber	5	0.13
Disposable	Polyethylene	˜1	˜0.025
Disposable	PVC	5	0.13
Disposable	Nitrile	4	0.10
Disposable	Nitrile	8	0.20
Disposable	Neoprene	5	0.13
Reusable	Natural Rubber	18	0.46
Reusable	PVC	12	0.30
Reusable	Nitrile	15	0.38
Reusable	Neoprene	24	0.61
Reusable	Butyl	7	0.18
Reusable	Butyl	13	0.33
Reusable	Barrier Laminate	3	0.08

Result Highlights

Research is still ongoing. The following highlights are based on data obtained to date.

- Confirms that other ingredients in the product affect permeation of active ingredient.
- The active ingredient permeates through thinner gloves; the amount of permeation is considerably lower. Need to work with risk assessors to determine minimum limit.
- For PVC, the amount permeated was consistently higher for the thicker glove. Permeation is based on glove composition and thickness; higher thickness does not always equate to lower permeation.
- Category G and H may not require use of only barrier laminate or Viton® gloves.

The International Center for Personal Protective Equipment

University of Maryland Eastern Shore

Overview

- Neutral entity established by University of Maryland Eastern Shore to advance research and outreach activities through partnerships with other institutions and organizations.
- ICPPE will play an important role in establishing linkages and networks with
  - scientists
  - policy makers
  - educators
  - private industry
  - other stakeholders

Rationale

- Harness a global network of expertise
- Coordinate international research activities
- Leverage limited resources

….use research and standards to solve PPE issues at the “local” level.

Coordination of International Consortium Activities

- In 2014 an International Consortium was established.
- The Consortium consists of researchers and stakeholders with the shared interest of improving PPE available to protect pesticide operators and re-entry workers.
- ICPPE will coordinate the research activities undertaken as part of the Consortium.