Pocket Detection Pouch (PDP): One Sample, Multiple Answers

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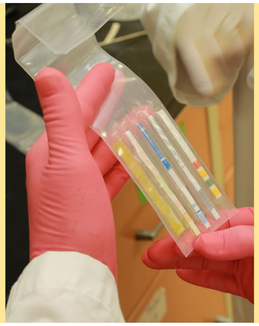
Abstract

The PDP is an inexpensive, size, weight and power (SWaP) minimal detection assay form factor designed for chemical, biological, radiationtoxin, pharmaceutical based agent (PBA), and drug detection. The PDP requires only one sample to give colorimetric "yes/no" answers for multiple agents in less than 10 minutes. It is self-contained, simple-to-use, requires minimal sample processing, no external power source, no specialized equipment, no cold chain logistics, and no proprietary equipment or software.

Rapid, Power-Free, Eye-Readable CBRNE ID in ONE Pouch

CHALLENGES:

- Size
- Weight
- Power
- Cost
- Supportability
- Sustainability
- Training requirements
- Disposal/decontamination
- Portability
- Maintenance
- Specialized equipment
- High replacement costs
- Obsolescence

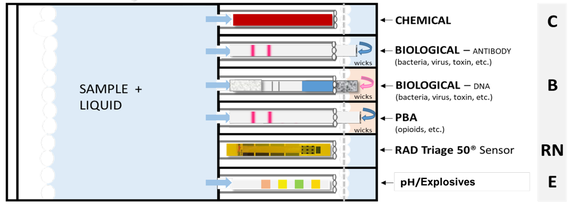


SOLUTION (PDP):

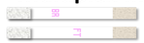
- The size of a credit card
- Weighs <1oz
- Requires NO POWER
- Inexpensive plastic pouch
- No special parts or materials
- Easy replacement
- Mass-producible
- Customizable to user needs
- Amenable to evolutionary improvements
- Reduced training requirement
- Easily disposable
- Designed by CCDC CBC scientists

Design

OUR VISION:
Full Orthogonal CBRNE Detection using one sample



Multiplex Immuno-Assays



- *one strip can test for multiple biologicals*
- *Letters represent agent present*
- *No reader required*

Color Change Radiation Assays

RAD Triage 50® Sensor (modified to fit bag)

RPA DNA Assays

Next Gen Chemical Paper

- *Rosetta*
- *Printables*

Results

Performance of Fentanyl and BWA PDP

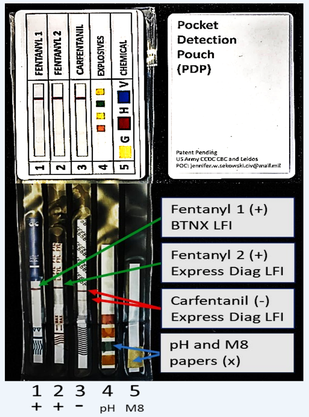


Figure 1. PDP results against LFIs for fentanyl, carfentanil, pH paper and M8 paper. Lanes 1 and 2 show positive results for the presence of fentanyl, whereas lane 3 shows sample is negative for carfentanil. Lanes 4 and 5 shows that sample is negative for explosives (pH neutral) and chemical agent.

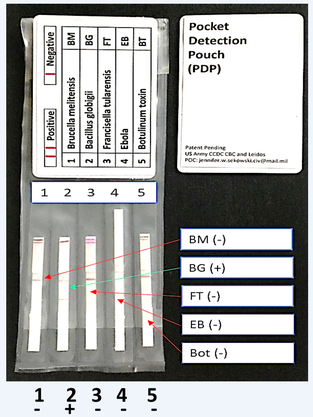


Figure 2. Simultaneous LFI assay results against bacteria and a bio toxin. 1.5 mL of antigen was tested using PDPs loaded with LFIs testing for five unique biological agents. In this image, a sample containing BG spores was added to the PDP.

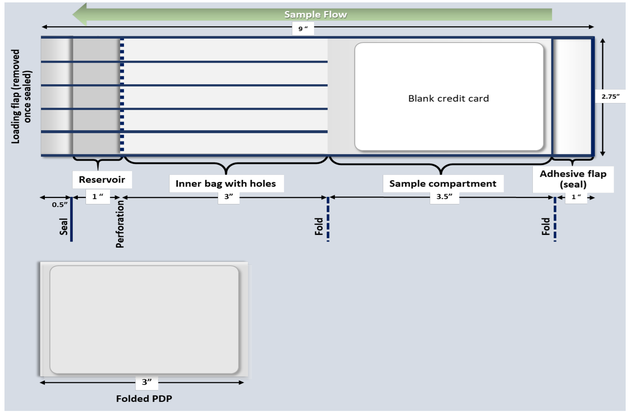
Designed to work with existing COTS Assays for:

- **Food Safety & Quality** — Detection of both chemical and pathogens in food and beverages
- **Plant Pathogens** — Blight, cancker, Erwinia, Pseudomonas spp., etc.
- **Insect Vectors** — Vector-Borne diseases (Lyme disease, malaria, etc.)
- **Pen-side Livestock Testing** — Cattle, avian, aqua culture, equine, etc.
- **Chemicals & Explosives** — Paper-based chemical detection such as pH, M8 and/or Rosetta papers
- **Bacteria, Viruses & Toxins** — Paired antigen/antibody and DNA-based detection = high confidence ID
- **Natural or Synthetic Narcotics, PBAs** — Opioids, cannabinoids, tranquilizers, etc.
- **Radiation Exposure Monitoring** — Colorimetric, acute gamma/xray dose monitoring

Warfighter Feedback Incorporated in Design

The PDP was well-received by the warfighters participating In DTRA's FY19 Chemical/ Biological Operational Analysis (CBOA) Technology Concept Feedback Tent

The PDP has incorporated design feedback from CCDC CBC Advanced CBRNE training team



Next Steps

1) Add PDP connection to Mano for wide-area surface sampling (Fig. 4)
2) Optimize lane flow performance & permanent sample sealing
3) Optimize bumper/filter area
4) Explore assay regulation design DNA isothermal amplification
5) Finalize process engineering /manufacturing plan

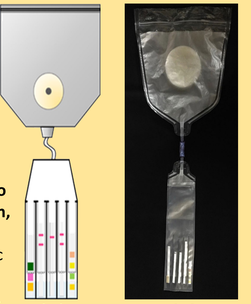


Figure 4. PDP-Mano connection, (A) schematic and (B) mock-up.

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