

VVM history and milestones¹

- 1979** VVM concept conceived by WHO. Success with Cold Chain Monitors at higher levels of the cold chain prompted interest in a vial indicator to extend monitoring to the periphery.
- Product development on a VVM for measles vaccine began at PATH using a PTS (p-toluenesulfonate) chemical licensed with permission from Allied Corporation.
- 1980** Connaught Laboratories conducted testing of early VVM prototypes (based on PTS technology).
- 1981** VVM design field trials conducted by PATH in Mexico and Philippines.
- 1982-1985** Measles VVM prototypes (based on PTS technology) produced and refined by PATH.
- Validation field trials conducted by WHO, PATH, and MOHs in Argentina, Brazil, Egypt, Kenya, Nepal, Pakistan, Peru, Philippines, Yemen and Zimbabwe.
- 1986-1987** The PTS manufacturing process was improved and PATH developed a format for use on vaccine cartons.
- 1986-1989** Introductory field trials of the measles VVM and carton indicator (PTS technology) were conducted by WHO, MOHs, and PATH in Indonesia, Kenya, Sierra Leone, Thailand and Zambia.
- 1988** PATH (under USAID funding) identified a new core technology for VVMs (using diacetylene polymers), owned by LifeLines Technology, Inc., that overcame constraints of the PTS technology that included:
- reaction rate too slow for use with oral polio vaccine
 - dermal toxicology issues, and
 - printing difficulties.
- 1989** PATH began work with LifeLines to adapt and produce VVMs using their core technology.
- 1990-1991** Design field trials were conducted by PATH with HEATmarker™ VVMs in Bangladesh, Bolivia, Cameroon, Indonesia, Kenya, Sierra Leone, Thailand and U.S.
- 1990** VVMs were discussed at a Technology Introduction Panel meeting at UNICEF New York.
- WHO and PATH representatives met with 8 vaccine producers to discuss the feasibility of integrating VVM labeling into their products.
- HEATmarker™ prototypes were sent to 8 vaccine companies for evaluation.
- 1991** Albert Browne, Ltd. (UK) emerged with a competitive VVM technology for evaluation and began discussions with WHO and PATH.
- Meeting held at UNICEF New York during which WHO requested UNICEF to include VVMs for OPV in the 1992-1994 EPI vaccine tender.
- “Live” HEATmarker™ VVMs were sent to WHO, Connaught, Evans Biologicals, Human Institute, Institute of Immunology, Interexport, MAIMEX, Pasteur Merieux, Sclavo, SmithKleine Biologicals, Swiss Serum and PAHO for evaluation.
- 1992** Independent laboratory evaluation of LifeLines HEATmarker™ VVMs for OPV completed by Strasburger and Siegel laboratory.
- Zimbabwe study completed by PATH and MOH on the impact of VVMs on measles vaccine discard rates due to heat exposure. (1992).



photo: umit kartoglu, salalah, sultanate of oman

¹ All companies by trade name and products by brand name mentioned in this document are solely for the historical facts. WHO in no means endorses any of these.

- UNICEF included a clause in the 1992-1994 vaccine tender notifying manufacturers that they would request labeling with VVMs prior to 1994.
- 1993** Albert Browne developed prototype VVMs for evaluation, but indicators had a slow initial color change and did not meet specifications.
- Lifelines developed the capability to print VVMs on vial labels for liquid vaccines to overcome vaccine manufacturer resistance to purchase of labeling equipment for a separate VVM label.
- 1994** 3M (US) and Bowater (UK) emerged as potential VVM suppliers.
- The Technical Network for Logistics in Health (Technet) consultation recommended that VVMs be included on all vaccines, beginning with OPV.
- The UNICEF tender for 1994-1995 requested quotations for VVMs on measles and OPV, but only a few manufacturers provided such quotes.
- WHO, UNICEF, and OPV manufacturers met and determined that all OPV would include VVMs beginning in January 1996, with pilot introduction beginning in April 1995.
- 1995** Pilot introduction of VVMs in Tanzania and Vietnam by WHO and MOHs.
- WHO released official specifications for VVMs for OPV.
- 1996** 3M released a public statement that they would supply VVMs on OPV supplied via UNICEF.
- Reexam (formerly Bowater) withdrew from further VVM development due to inability to make a viable product.
- CCL Label (US) emerged as a potential VVM supplier.
- India imported OPV with VVMs for NIDs and after the experience issued an official request to WHO for assistance in supplying VVMs on locally produced OPV.
- All OPV procured by UNICEF included VVMs from this year onward from 5 suppliers.
- PAHO refused to purchase OPV with VVMs.
- SAGE released a statement in support of VVM introduction that is published in the Weekly Epidemiological Record, 30 August 1996.
- Meeting held at WHO Geneva with UNICEF, OPV suppliers, Lifelines, 3M, WHO, and PATH to discuss VVM introduction on OPV.
- 1997** UNICEF sent a questionnaire to 50 countries to determine whether they had any difficulties with VVM introduction.
- VVM impact studies completed by WHO during NIDs in Kenya, Nepal, Tanzania and Turkey,
- 1998** 3M discontinued work on VVMs due to inability to produce product at a competitive price.
- CCL Label submitted VVM prototypes to a WHO independent laboratory for evaluation, but they did not meet specifications.
- Consumer Association Research and Testing Centre (UK) began validation of HEATmarker™ VVM2 samples under a WHO contract.
- In-depth VVM impact study completed in Bhutan by WHO.
- The Technical Network for Logistics in Health (Technet) formally recommended that VVMs be introduced for all vaccines as soon as possible.
- A meeting on the introduction of VVMs on all EPI vaccines was held at WHO Geneva and attended by WHO, UNICEF, PATH, USAID, Lifelines, and 3M.
- PATH, CCL Labeling Equipment, Lifelines and a pharmaceutical company conducted a collaborative cap labeling demonstration project to demonstrate feasibility to vaccine suppliers, WHO, and UNICEF.
- WHO sent a letter to all WHO pre-qualified vaccine producers requesting feedback on VVM specifications.
- 1999** CCL Label confirmed interest (in letter to UNICEF) in further VVM development.
- Sensitech (US) expresses interest to WHO regarding VVM development.

- WHO and UNICEF issued a joint policy statement advocating the use of VVMs on all vaccines.
- At a pre-tender meeting in Copenhagen, UNICEF announced that VVMs would be included on all vaccines in the 2000 tender.
- WHO updated VVM specifications to make them relevant for all vaccine types.
- 2000** Consumer Association Research and Testing Centre (UK) finalized the conformity test of HEATmarker™ VVM2 samples.
- Precision Measurements and Instruments Corporation (US) began conformity tests of 3 other HEATmarker™ VVM types (VVM7, VVM14, and VVM30) under a WHO contract.
- VVMs were also included among the minimum requirements for vaccines in the RFP for GAVI for under-used vaccines, related products and contributions.
- 2001** Precision Measurements and Instruments Corporation (U.S.) completed conformity tests of HEATmarker™ VVM2, VVM14, and VVM30.
- Only three UNICEF vaccine suppliers Japan BCG, Pasteur Dakar, and Chiron fully complied with the VVM attachment for vaccines other than OPV.
- UNICEF solicited documentation from vaccine suppliers on all issues limiting their ability to provide VVMs on vaccines and WHO provided UNICEF with a document addressing each technical concern raised.
- JICA ordered measles vaccine with VVMs from Chiron and donated it to Vietnam.
- 2002** Impact study being conducted in Vietnam by MOH and WHO with VVMs on measles vaccine.
- WHO revised the current VVM specifications (E6/IN5) and test procedures (E6/PROC5).
- One more UNICEF supplier LG Chemical Inc. Ltd. fully complied with the VVM attachment for vaccines other than OPV.
- WHO sent a letter to all WHO pre-qualified vaccine producers requesting feedback on revised VVM specifications and test procedures.
- WHO published the "Getting started with vaccine vial monitors" manual.
- Technical review of VVM implementation at WHO Geneva, 27 March 2002.
- 2003** WHO holds a regional meeting with vaccine manufacturers in New Delhi to accelerate expansion of VVMs beyond OPV.
- PATH assists Indonesia MOH to conduct a cold chain study to remove icepacks to prevent freezing and reinforce usefulness of VVM in freeze prevention.
- UNICEF SD issues a new tender for 2004-2006 and includes VVMs among the minimum standards for all vaccine purchases.
- Global Training Network on Vaccine Management (GTN/VM) develops training materials for VVM.
- In its first meeting of the year, GAVI Board recommends immediate intensive action by appropriate GAVI partners to accelerate the implementation of VVMs, consistent with ensuring vaccine security.
- Immunization Focus, published by GAVI issues an article on VVM implementation questioning why don't all vaccine carry a VVM.
- 2004** WHO presents study findings on the use of cold water packs to prevent freeze damage and accelerate VVM implementation in TechNet21 Antalya global consultation.
- WHO changes the VVM nomenclature from ABCD to VVM 2, 7, 14 and 30.
- Six more vaccine manufacturers introduce VVMs on all their vaccine products.
- WHO GTN/VM develops VVM card game and vaccine management board game to be used as interactive training tools.
- 2005** Two more vaccine manufacturers introduce VVM on all their products.
- 2006** WHO issues new Performance, Quality and Safety (PQS) product specifications and verification protocol for VVM.

UNICEF, PATH and USAID hold a cold chain workshop in Americas on vaccine freezing issues. Meeting brings heightened awareness of vaccine heat stability and an interest in adopting VVMs to reduce vaccine wastage and to enable out-of-cold chain strategies for vaccine storage and distribution.

2007

WHO celebrates VVM's 10 successful year of implementation since its introduction in 1996. Close to 2 billion units of VVMs are used on WHO prequalified vaccine products.