

NRC-CANADA METROLOGY IN SUPPORT OF HEALTH

THROUGH THE PANDEMIC AND BEYOND

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Presentation at SIM WMD2021 event

21st May 2021

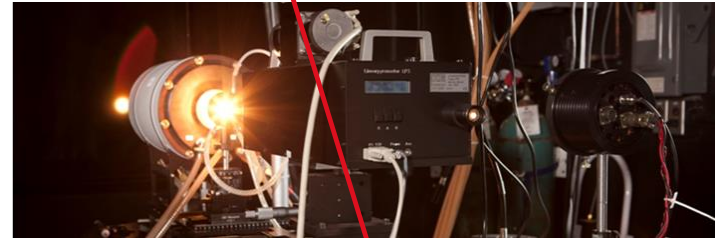


NATIONAL RESEARCH COUNCIL CANADA

The Metrology Research Centre at the NRC

MISSION – Canada's NMI

METROLOGY executes the NRC mandate to conduct research and provide metrology services, enabling both product and process innovation in areas where *precise and reliable measurements are critical to success.*

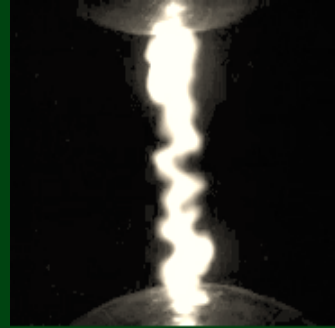


Success not limited to economic advantage

Measurement for Health – there's a lot more than you might think!



Radiation therapy



Electrical power measurements



Sterilization of medical goods



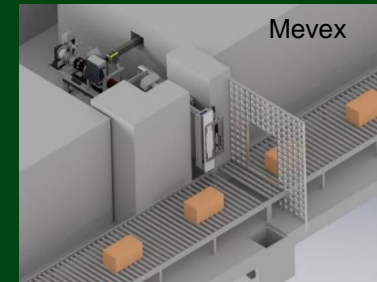
Characterization of healthcare products







Acoustics & ultrasonics



Time.....well, for everything!



Some highlights of the last year

-  **The pandemic has presented challenges that were both unexpected and, at times, overwhelming**
-  **Many NMIs and DIs responded to address scientific, technical and social policy issues around the impact of COVID-19**
-  **But at the same time, society did not go into complete lockdown. Other measurements were still required, many for critical health needs**
-  **This presentation will cover three types of activity that the NRC has carried out since the beginning of the COVID-19 pandemic in early 2020**

CONTINUING

required before, during and after

RESPONDING

modified activities for the pandemic

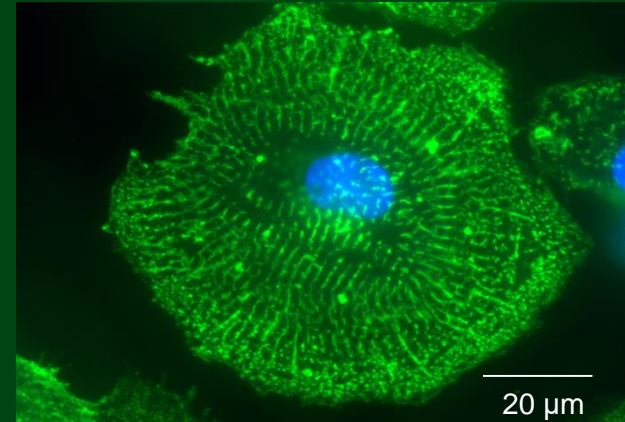
INITIATING

completely new directions to address
unexpected needs

CONTINUING

Mechanobiological drug analysis using AFMs

- Induced-pluripotent stem cell-derived cardiomyocytes are spontaneous beating cells
- New AFM method established on an integrated fluorescence microscopy platform - structural and dynamic changes of the cellular system can be monitored simultaneously.
- Potential complementary pre-screening method during drug development and nanomaterial safety and risk assessment studies
- Early treatment behavior can be captured – before cytotoxicity occurs



Toxins in algal food supplements



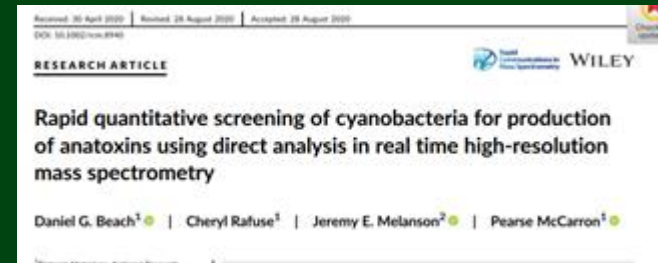
Secondary metabolites produced by marine and freshwater algae present ongoing risks to human health through contamination of food and water.







A core activity of the Bio-Toxin Metrology group is characterization of novel toxins and production of algal toxin certified reference materials (CRMs)

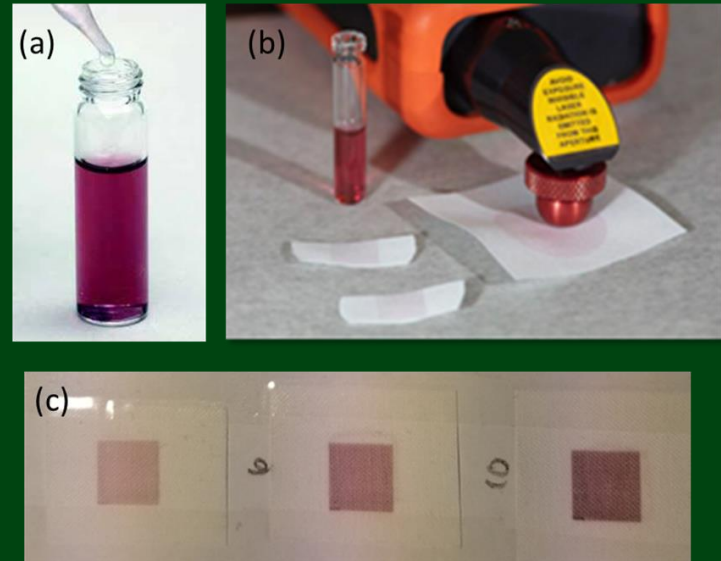


New focus on toxins for health food products prepared using cyanobacteria or 'blue-green algae'



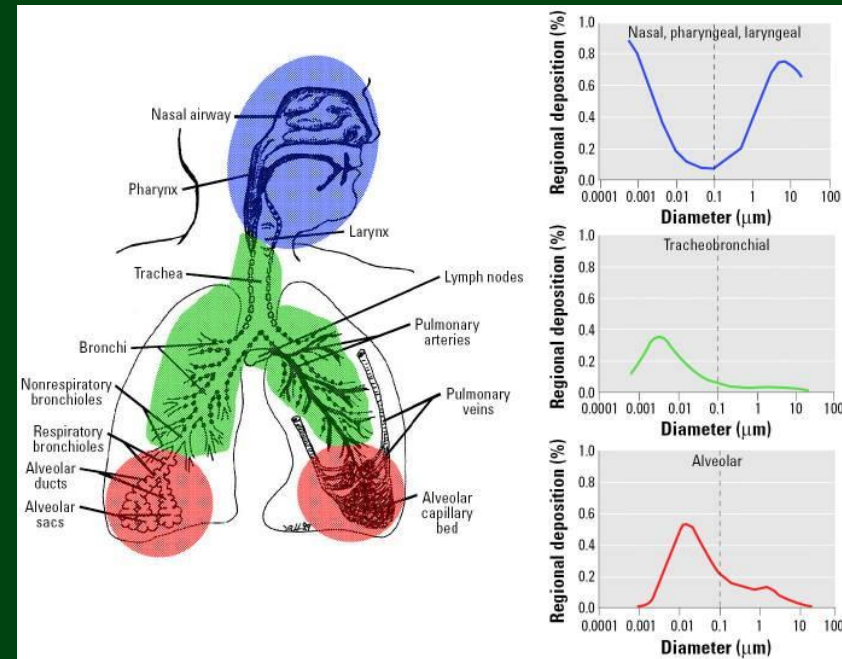
Opioids – another killer than crosses national boundaries

-  Opioid overdose has emerged as a public health crisis in recent years and its impact has accelerated during the pandemic.
-  Surface Enhanced Raman Spectroscopy (SERS) can be used for the detection and identification of Opioids.
-  NRC has developed cost effective inkjet-printed SERS sensors that are designed for the detection, identification of narcotics and opioids.
-  Can be used in the field for rapid sensing

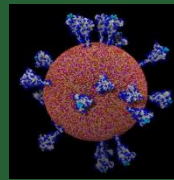


Fossil fuels and breathing

- Black carbon (BC) emissions from transportation sources such as diesel engines are classified as carcinogenic to humans
- These BC particles are readily inhaled and deposit deep into the lung and translocate across the blood membrane barrier to other organs
- NRC is investigating measures to mitigate the emissions from hard-to-decarbonize transportation sectors such as aviation and marine



RESPONDING



SARS-CoV-2 Spike protein reference material



National Research
Council Canada

Conseil national de
recherches Canada

Certificate of Analysis

Reference Material

SMT1-1

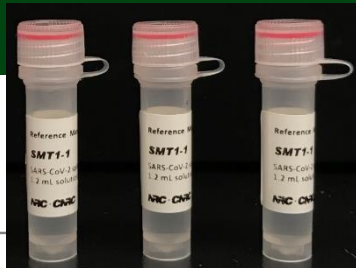
SARS-CoV-2 Spike Glycoprotein Reference Material

Table 1: Reference values and expanded uncertainties ($k = 2$, 95 % CI) for SMT1-1

Substance	Molar concentration $\mu\text{mol/L}$	Mass fraction mg/g	Mass concentration mg/mL
SARS-CoV-2 spike protein (a,b) ¹	5.68 ± 0.20	0.807 ± 0.026	0.813 ± 0.028
SARS-CoV-2 spike glycoprotein (a,b) ²	5.68 ± 0.20	1.020 ± 0.076	1.028 ± 0.076

¹SARS-CoV-2 spike protein sequence only ($143\,192 \pm 1\text{ g/mol}$), the glycan molar mass is not included for calculations.

²SARS-CoV-2 spike glycoprotein total molar mass ($181\,000 \pm 12\,000\text{ g/mol}$), which includes the best estimate of the glycan molar mass.



The SARS-Cov-2 spike protein is the primary antigen targeted by antibodies, and can be detected in samples of infected patients after becoming dislodged from the virus.



Antigen tests have great potential for rapid and inexpensive test kits that could be used for point-of-care diagnostics



This reference material can serve as a positive control for antigen tests and can also serve as a standardized source of reagent in antibody tests and vaccine research

Launched January 2021

Evaluating thermal imager performance for COVID temperature screening

Rapid symptom evaluation can increase safety in workplaces and public arenas

Thermal imaging offers a fast and remote assessment method

NRC Metrology has started a project with a Canadian thermal imaging manufacturer to evaluate accuracy and stability of an infrared camera targeted at measuring body temperature



INITIATING

Future planning: Government of Canada invests \$126 million in NRC vaccine production facility



Need to develop flexible and adaptable workforces capable of transitioning to new areas of research in emergencies

Require long-term investments to be prepared for the next pandemic or longer term crises such as climate change.



Metrology will play a key role in supporting these long term initiatives at NRC, and highlights the need for measurement science in chemistry and biology.

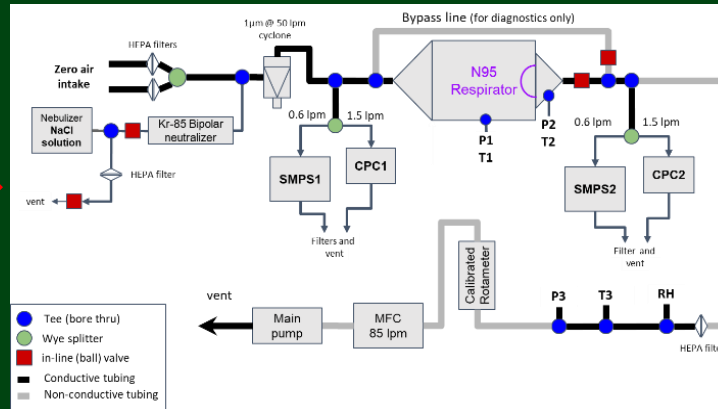
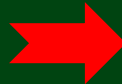
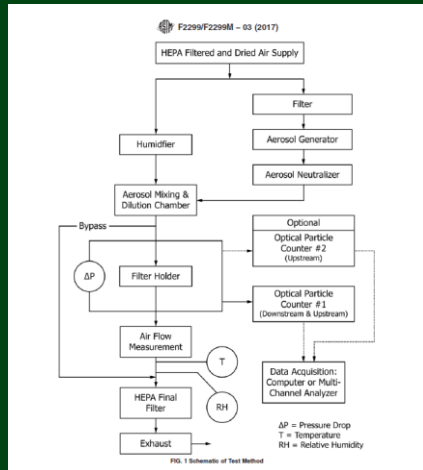
Particle Filtration Efficiency Measurement of PPE for Canada: Urgent Response to the COVID-19 Pandemic

Canadian PPE Landscape as of March 30th, 2020

- Canadian Regulator (Health Canada) recognizes **only NIOSH** certification for respirators
- **No domestic** manufacturing of N-95 respirators
- **No domestic** testing capacity for PFE (NIOSH for Respirators or ASTM for Surgical Masks)
- **Orders for >100 Million respirators placed** by Federal Procurement, plane loads of PPE arriving in Canada within weeks

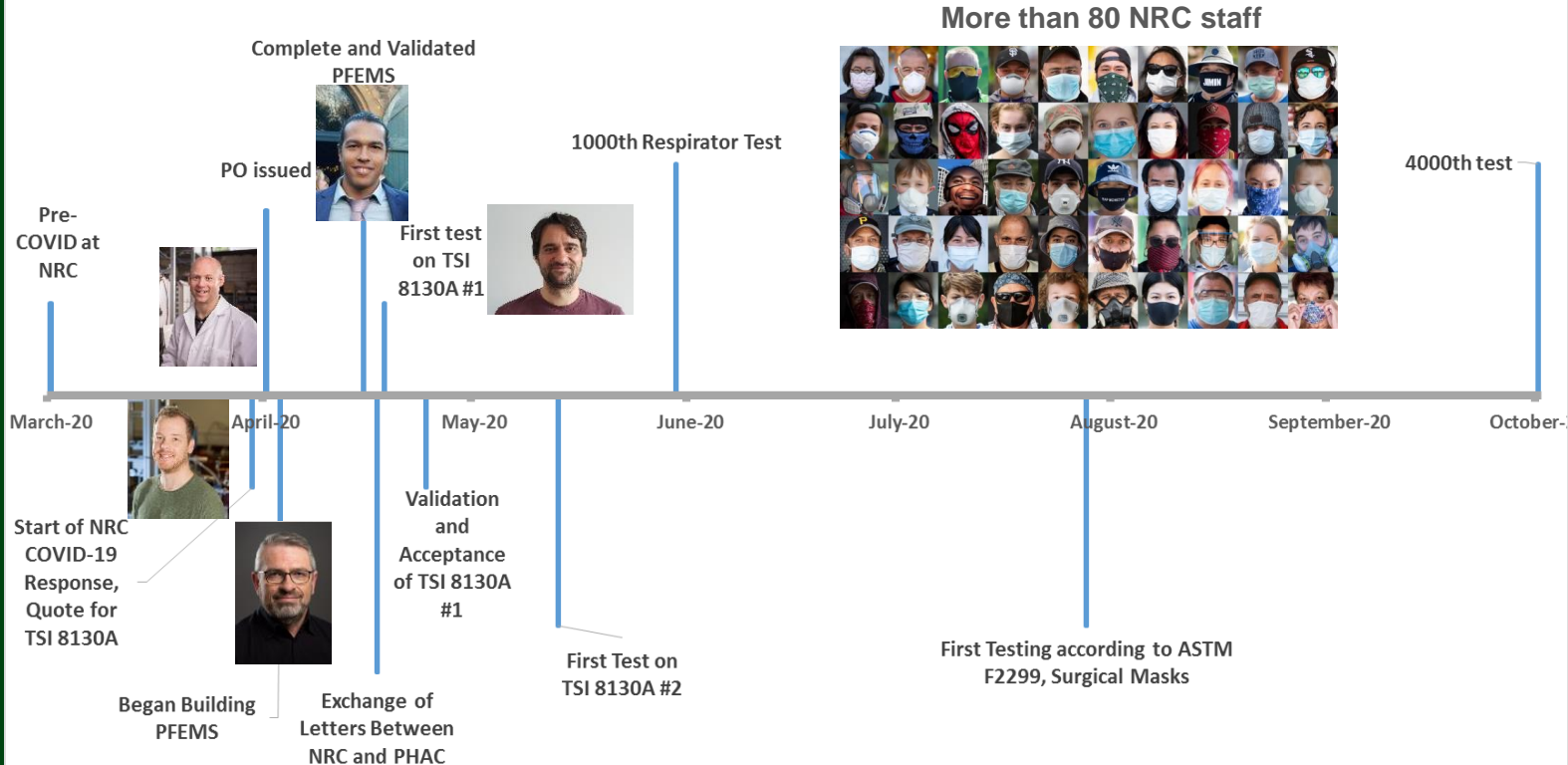
Two-prong approach to PPE testing

1. Emergency procurement of standard test equipment for N95-type respirator filtration efficiency test according to NIOSH standard
2. In house development and validation of similarly capable instrument assembled from existing laboratory equipment



Achieved in a matter of weeks!

PFE Testing and Development Timeline

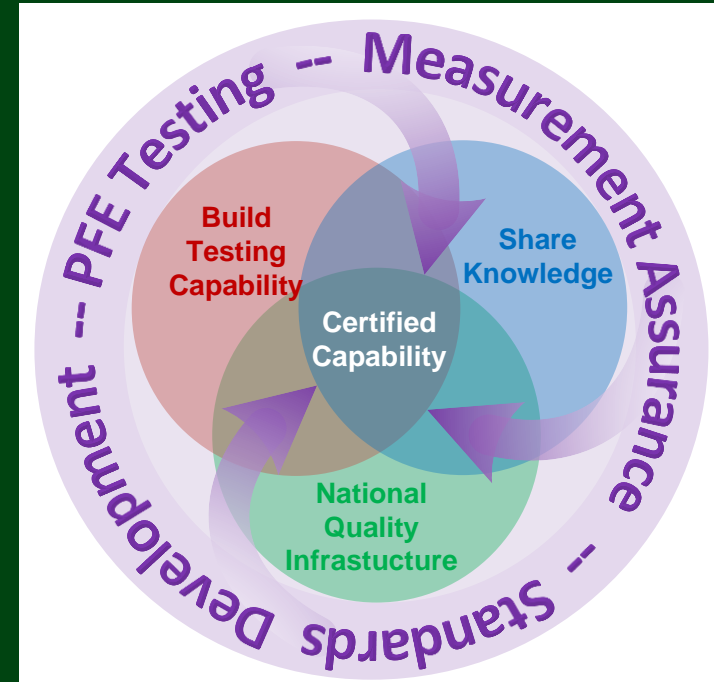


Results and impact of testing

- Enabled decision making on supply of approximately **120 Million respirators**, 60 Million passing
- Early high failure rate impacted procurement practices, better product generally received since
- Supported over a dozen new domestic manufacturers of raw material and respirators

Going beyond measurements

- **Building Testing Capability**
Implementation of testing & key outcomes
- **Sharing knowledge**
Dissemination of know-how and capability
- **National Network Support**
Certified capability – part of a national quality infrastructure



SUMMARY

Metrology is about measurement, right?

METROLOGY executes the NRC mandate to conduct research and provide metrology services, enabling both product and process innovation in areas where *precise and reliable measurements are critical to success*.



**Metrology is more
than impersonal
measurement**

**It's about people
doing great work
for people**

THANK YOU



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