CPSC-I-11-0010

INTERAGENCY AGREEMENT
BETWEEN THE
U.S. CONSUMER PRODUCT SAFETY COMMISSION
AND THE
ENGINEERING LABORATORY
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

For the development of testing and measurement protocols for determining the quantities and properties of nanoparticles released from flooring finishes and interior paints, and their subsequent airborne concentrations; essential methods and data to assess the release as well as accumulation of nanoparticles at the surfaces of these products that will assist in estimating occupant exposure and developing strategies to manage and mitigate these exposures.

1. TITLE

Characterization of Airborne Nanoparticles Released From Consumer Products

2. PARTIES AND PURPOSE

This Interagency Agreement (IAG) establishes an agreement between the U.S. Consumer Product Safety Commission (CPSC) and Engineering Laboratory, National Institute of Standards and Technology (NIST), U.S. Department of Commerce, through which the Consumer Product Safety Commission will pay NIST for development of testing and measurement protocols for determining the quantities and properties of nanoparticles released from flooring finishes and interior paints, and their subsequent airborne concentrations; essential methods and data to assess the release as well as accumulation of nanoparticles at the surfaces of these products that will assist in estimating occupant exposure and developing strategies to manage and mitigate these exposures. No guest researchers will be utilized in the work carried out at NIST. CPSC staff will, if available, participate in this research and be trained by NIST staff.

3. BACKGROUND

Polymer coatings are commonly used to protect, enhance, or decorate wood, plastic and metal products used in homes and other buildings, including flooring finishes and interior paints. However, the coatings and the surfaces they are applied to are subject to scratching, abrasion, and chipping during manufacture, shipping and use. Nanoparticles (particles having at least one dimension smaller than 100 nanometers) are increasingly being added to coating formulations to prevent such damage as well as to enhance properties such as microbial and mildew resistance.

Because of their small size and large surface area, nanomaterials may exhibit different physical, chemical, and transport behaviors in the human body and the environment. Research in recent years has indicated that nanoparticles may be potentially harmful to human health and the environment. Such concerns could present roadblocks to innovation and commercialization of nanotechnology.

Current research on the health effects of nanoparticles is focused on human and environmental exposure during manufacturing. However, the release of nanoparticles from flooring finishes, interior paints and other products over their service life, and the resulting exposure of building occupants, potentially poses greater risks than those encountered during manufacture. This is true because: 1) the population of general building occupants is much larger than those involved only in manufacturing; 2) the amount of surface area of interior walls and floorings in residential and commercial buildings is enormous, and 3) the human exposure to these particles is continuous over the entire service life of the nanoparticle-containing products. Flooring products are of particular concern for young children who spend more time on the floor and, therefore, have greater opportunities for exposure. In addition to airborne nanoparticles, nanoparticles that are accumulated on surfaces may potentially pose a health hazard. Despite such serious potential risks, little information is available on the in-service release, surface accumulation, transport, and

exposure of nanoparticles from flooring finishes and interior paints. The lack of such data severely hinders the ability to intelligently assess and manage the potential harmful effects of nanoparticle release from these large-volume sources.

4. AUTHORITY

The authorities for this agreement are:

FOR CPSC:

CPCS's programmatic authority includes Section 29(d) of the Consumer Product Safety Act, (15 U.S.C. 2078(d)) which states that The Commission shall, to the maximum extent practicable, utilize the resources and facilities of the National Bureau of Standards {now the National Institute of Standards and Technology}, on a reimbursable basis, to perform research and analyses related to risks of injury associated with consumer products, to develop test methods, to conduct studies and investigations, and to provide technical advice and assistance in connection with the functions of the Commission.

FOR NIST:

This funding is proper pursuant to the NIST Organic Act. 15 U.S.C. §§ 273, 275a, and 278b, which collectively authorize NIST to exercise its functions for other Federal agencies and to be reimbursed or advanced funds based on the actual costs or fixed prices or costs.

NIST possesses programmatic authority to conduct the requested work pursuant to 15 U.S.C. §§272(b)(8), (b)(10), and (b)(11) and (c)(8), which authorize NIST to develop fundamental methods for testing equipment and systems; to cooperate with other departments and agencies of the Federal Government in establishing standard practices, codes, specifications and voluntary consensus standards; and to advise government and industry on scientific and technical problems; and study and develop fundamental scientific understanding and improved measurement, analysis, synthesis, processing, and fabrication methods for chemical substances and compounds, ferrous and nonferrous metals, and all traditional and advanced materials, including processes of degradation.

5. COST AND TRANSFER OF FUNDS

The U.S. Consumer Product Safety Commission will transfer $500,000 to NIST as reimbursement for undertaking the activities contemplated by this agreement. This transfer is to be made in advance. Funding will be split between 731.04 Polymeric Materials Group $350,000 and 732.05 Indoor Air Quality and Ventilation Group $150,000. NIST may purchase consumable laboratory/miscellaneous supplies to support work done under this agreement. Reusable equipment (e.g., sampling devices) should be returned to CPSC.

6. STATEMENT OF WORK

Work to be undertaken and deliverables to be provided:

1. Product Assessment

   NIST will perform a critical assessment of flooring finishes and interior paints to determine which products include nanoparticles in their formulation and in what form. This assessment will be based on publicly available product literature, as well as discussions with individuals in the relevant industry sectors. The result of this assessment will provide candidate materials for subsequent testing.

2. Protocol Development

   NIST will develop experimental protocols to support the testing of flooring finishes and interior paints. These protocols will include sample preparation, and both bench scale and chamber tests of materials undergoing abrasion, airborne nanoparticle release measurements, and characterization of released nanoparticles as well as those accumulated on the material surface.

3. Benchtop Experiments on Flooring Finishes and Interior Paints

   A representative model UV-cured polyurethane floor finish free of pigments or additives and a typical acrylic latex paint will be selected and purchased by NIST (with results reported blindly) for the flooring finish and interior paint, respectively. Information should be available to CPSC staff if requested. Nanosilica (SiO_2 nanoparticles), which are increasingly used for improving scratch resistance of polymeric coatings, will be added at 1.5 % mass loading (based on solid mass of the polymer) to the polyurethane finish and latex interior paint. The nanoparticle-containing polyurethane and acrylic latex will be applied to hardwood floor and dry wall panels, respectively, and cured according to manufacturer's instructions to provide coated film thickness of between 0.150 to 0.200 mm. Coated panels will be cured per manufacturer's recommendations. After conditioning under ambient environmental conditions, coated samples will be ready for the abrasion experiments.

   To study the effect of mechanical abrasion on the release of nanoparticles from flooring and interior paint, test panels will be subjected to the Taber abrasion test (ASTM Standard Test Method D 4060-95, 2007), which is an established method for studying the abrasion resistance of polymer coated surfaces. This test simulates typical mechanical abrasion, such as sliding, rubbing, and walking. It requires the use of a standard Taber abraser, an abrasive wheel, and a vacuum pick-up assembly. To avoid contamination, all aluminum abrading wheels will be used for this study. The effects of three abrading parameters: speed, number of cycles, and applied load or contact pressure on the particle

number concentration, particle size distribution, morphology, and chemical composition of nanoparticles released into the air and left on the coated surfaces will be studied. Airborne nanoparticles will be sampled and analyzed using the experimental setup shown in Fig.1. A particle analyzer is placed between the abrasion operation and the vacuum (provided by the Taber abrader instrument). The particle analyzer is capable of measuring real time particle size distribution and concentration. Released particles will be deposited on filters, which will then be analyzed by field emission scanning electron microscopy (FE-SEM) and transmission electron microscopy (TEM) to assess morphology, size, and state of aggregation of released nanoparticles. An electronic nanoaerosol sampler (NAS) will be also used in parallel with the particle analyzer to collect the released particles for further morphological and chemical composition analyses. The measurements will be made for each testing condition (i.e., each experimental treatment).

Chemical composition of nanoparticles released by abrasion will be analyzed by a number of analytical techniques, including transmission Fourier transform infrared spectroscopy (t-FTIR), X-ray photoelectron spectroscopy (XPS), energy-dispersive X-ray spectroscopy (EDX), and inductively-coupled plasma atomic emission spectroscopy (ICP-AES). Thermogravimetric analysis (TGA) and (ICP-AES) technique will be used to determine the relative nanoparticle fraction of the released particles (which include polymer material and inorganic particles).

Surface sensitive techniques including XPS, TEM, FE-SEM, and atomic force microscopy (AFM) techniques will be employed to image or/and map nanoparticles accumulated on the surface of abraded panels as a function of abrasion parameters. ICP-AES will be used to quantify the amount of nanoparticles on the coated surfaces. NIST has successfully developed a reliable technique based on ICP-AES to quantify at the part per billion level the amount of SiO_2 nanoparticles accumulated on the polymer surface after weathering.

Loose particles on the tested panel surface as a function of abrasion parameters will be measured using a procedure developed by CSPC. The quantity of loose particles will be determined using appropriate microscopic techniques described above.

4. Chamber Measurements of Airborne Nanoparticle

Additional measurements of nanoparticle release from the study materials will be conducted in a 30 m2 environmental chamber. These tests will involve subjecting the materials to the abrasion protocol within the chamber and then measuring the resulting airborne particle concentrations over time. Airborne nanoparticle concentrations over a size range of 3 nm to 100 nm will be measured using a scanning mobility particle sizer (SMPS) consisting of an electrostatic classifier, a nanodifferential mobility analyzer and a water-based condensation particle counter.

5. Analysis and Reporting

The benchtop test results will be analyzed and a report will be prepared. The first year report will contain: 1) critical assessment of products, 2) a reproducible abrasion test method for generating particles from flooring finish and interior paints, 3) experimental protocols and analyses, 4) data about the concentration, size distribution and chemical composition of released nanoparticles, 5) data on the concentration and morphology of nanoparticles that are exposed or accumulated on the coated surface under different abrading conditions, and 6) preliminary data on the airborne particle concentrations and distribution. The report will also present a strategy for assessing the nature and environmental availability of nanoparticles in consumer products.

A status report will be due on September 30, 2011.

7. SCHEDULE – Year 1

Months 1-2
Assessment of the use of nanoparticles in commercial flooring and interior paint products

Months 3-5
Test method and protocol development
Materials acquisition, safety assessment, sample preparation, instrumentation setup, and nanoparticle characterization protocols.

Months 6-8
Bench scale experiments on flooring finishes

Months 9-11
Bench scale experiments on interior paints

Months 8-11
Chamber experiments
Analysis of experimental results
Report on product assessment and results of bench scale tests

Month 12. Report of Year 1 research.

8. FUNDING AND ACCOUNTING DATA

The transfer of funds shall be from CPSC to NIST through the On-Line Payment Collection (OPAC) system using the following accounting data:

Transfer From: CPSC BETC: DISB Taxpayer ID Number (TIN): 520978750
Agency Location Code (ALC): 61-00-0001 DUNS: 069287522 US

Treasury Code: 6110100 AMOUNT: $ 500,000.00 ACCOUNTING DATA: 0100A11DPS 2011 2370400000 EXHR004000 255D0

To: NIST BETC:COLL Taxpayer ID Number (TIN): 530-20-5706 Agency Location Code (ALC): 13-06-0001 DUNS: 929956050 US Treasury Code: 13X4650 Treasury Account Symbol (TAS)/Appropriation Code: NIST: 13 X 4650

9. DURATION OF AGREEMENT AND AMENDMENTS

This agreement will become effective when signed by the parties. The agreement will terminate 12 months from the date of acceptance, but may be amended at any time by mutual written consent of the parties.

10. TERMINATION AND CANCELLATION CLAUSE

Any party may terminate this agreement by providing 60 days written notice to the other party. If the Consumer Product Safety Commission terminates the agreement, NIST is authorized to collect costs incurred prior to cancellation of the order.

11. DISCLOSURE OF INFORMATION

To the extent permitted by law, NIST shall submit to the Consumer Product Safety Commission (CPSC) any report, manuscript, presentation or other document containing the results of work performed under this Agreement, before such document is published or otherwise disclosed to the public, to assure compliance with Section 6(b) of the Consumer Product Safety Act (15 U.S.C. 2055(b)), Commission regulations (16 C.F.R. Part 1101), and a Commission directive (Order 1450.2). These provisions restrict disclosure of information that (1) permits the public to identify particular consumer products or (2) reflects on the safety of a class of consumer products. Prior submission allows the CPSC staff to review the information and comply with applicable restrictions. CPSC should be advised of NIST's desire to submit or publish an abstract or report as soon as possible. NIST will consider in good faith any comments or suggested edits by the CPSC. NIST retains sole authority to determine the content, style and mode of publication of any work created by NIST employees however NIST agrees to be bound by any legal restrictions as set forth above. If the CPSC objects to the publication of a NIST work where CPSC paid for the underlying work described in the publication, NIST will agree to resolve the issue with CPSC.

12. RESOLUTION OF DISAGREEMENTS

Should disagreements arise on the interpretation of the provisions of this agreement or amendments and/or revisions thereto, that cannot be resolved at the operating level, the area(s) of disagreement shall be stated in writing by each party and presented to the other party for consideration. If agreement or interpretation is not reached within 30 days, the parties shall forward the written presentation of the disagreement to respective higher officials for appropriate resolution.

If a dispute related to funding remains unresolved for more than 30 calendar days after the parties have engaged in an escalation of the dispute, resolved in accordance with instructions provided in the Treasury Financial Manual (TFM) Volumn I, Part 2, Chapter 4700, Appendix 10, available at http://www.fms.treas.golv/tfm/index.html.

13. CONTACTS

The contacts of each party to this agreement are:

a. NIST ADMINISTRATIVE CONTACT

Ami A. Carbaugh
Administrative Officer Div 731
National Institute of Standards and Technology
100 Bureau Drive, MS 8602
Gaithersburg, MD 20899-8602
301-975-6746
301-975-4032 FAX
Ami.carbaugh@nist.gov

b. CPSC PROJECT OFFICER

Treye Thomas, Ph.D.
U.S. Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814
301-504-7738
301-504-0079 FAX
tthomas@cpsc.gov

c. CPSC PAYMENT OFFICE

CPSC Accounts Payable Branch, AMZ-160
PO Box 25710
Oklahoma City, OK 73125

d. AGENCY PAYMENT OFFICER

Debbie Young, Agency Payment Officer
Enterprise Service Center
Office of Financial Operations
Federal Aviation Administration
P.O. Box 25710
Oklahoma City, OK 73125
Telephone: 405-954-7467
Email: 9-AMC-AMZ-CPSC-Accounts-Payable@faa.gov

The parties agree that if there is a change regarding the information in this section, the party making the change will notify the other party in writing of such change.

Approved and Accepted for National Institute of Standards and Technology

BY: _____

TITLE: Deputy Chief, MCRD

DATE: 8/10/2011

Approved and Accepted for Consumer Product Safety Commission

BY: _____
Donna Hutton

TITLE: Contracting Officer

DATE: 8/10/2011