

CPSC-I-14-0013  
INTERAGENCY AGREEMENT  
BETWEEN THE  
U.S. CONSUMER PRODUCT SAFETY COMMISSIONS  
AND THE  
ENGINEERING LABORATORY  
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY  
U.S. DEPARTMENT OF COMMERCE

1. TITLE

Characterization of Airborne Nanoparticles Released From Consumer Products and Development of Nanoparticle-Specific Models to Predict Consumer Exposure (Short Title – CPSC NIST Nanoparticle Exposure Models)

2. PURPOSE

This Interagency Agreement (IAG) establishes an agreement between the Consumer Product Safety Commission and Engineering Laboratory, National Institute of Standards and Technology (NIST), U.S. Department of Commerce, through which the Consumer Products 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. Protocols will also be developed to characterize releases from outdoor surface coatings. This work will provide methods and data to assess releases, as well as accumulation, of nanoparticles at the surfaces of these products, to assist in estimating occupant exposure, and to develop strategies to manage and mitigate these exposures.

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.

Under previous interagency agreements between CPSC and NIST, NIST developed benchtop experimental protocols to study the effects of abrasion on nanoparticle releases from flooring finishes and interior paint. Experiments were then conducted in which samples were subjected to a Taber abrasion test per ASTM D4060 under dry and wet abrasion conditions. The number concentration of released nanoparticles was subsequently measured, as well as the particle size distribution, morphology, and chemical composition of nanoparticles released into the air and left on the coated surfaces. The airborne measurements were conducted in a NIST-designed chamber in which the Taber abraser was operated. Since this work started, the use of both antimicrobials and nanoparticles has increased in paints and coatings for outdoor applications, where these materials are continuously subjected to mechanical forces (e.g., abrasion) and ultraviolet (UV) exposure. Because UV is known to cause degradation in polymer matrices, both chemical and mechanical properties of these materials would likely deteriorate with time in service. Therefore, this agreement will also investigate the combined effect of mechanical forces and UV radiation on nanoparticles or antimicrobials from exterior paints and coatings containing these nanomaterials used for decks and playground equipment.

#### 4. AUTHORITY

The authorities for this agreement are:

FOR CPSC:

CPSC'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 (including fire and flammability risks), 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:**

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)(3), which authorize NIST to develop a fundamental basis and methods for testing materials, mechanisms, structures, equipment, and systems, including those used by the Federal Government; to cooperate with other departments and agencies of the Federal Government, with industry, with State and local governments, with the governments of other nations and international organizations, and with private organizations in establishing standard practices, codes, specifications, and voluntary consensus standards; 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 \$600,000 to NIST as reimbursement for undertaking the activities contemplated by this agreement. This transfer is to be made in advance.

The funds will be allocated within NIST as follows:

<b>Indoor Air Quality and Ventilation Group</b>	
Labor, including all overhead	\$280K
Laboratory supplies and materials	\$20K
<b>Polymeric Materials Group</b>	
Labor, including all overhead	\$280K
Laboratory supplies and materials	\$20K

NIST performs all work for others on a best efforts basis.

No NIST contractors will perform work under this agreement. No students or U.S. citizens working under a NIST financial assistance award made under the authority of 15 U.S.C. Section 278g-1 will perform work under this agreement, and no employees or agents of recipients working under a NIST financial assistance award will perform work under this agreement.

NIST will be reimbursed for all actual costs incurred, and neither subsidize nor profit from the work done. NIST will make reasonable efforts to perform all work and deliver the services ordered at the costs stated in this agreement. If during the course of completing services under this agreement NIST foresees that the amount of funding transferred is insufficient to cover completion of the work to be performed, NIST will inform CPSC. CPSC will determine whether to: (1) transfer additional funds to NIST to complete the work covered by the agreement; (2) request that NIST cease work and

return any unexpended balance; or (3) modify the scope of the agreement such that NIST can complete the work with available funds. Any agreement to pay additional funds must be approved in a written modification to this agreement.

## 6. STATEMENT OF WORK

Work to be undertaken and deliverables to be provided:

### a. Development of Testing Plan

Based on the previous efforts funded by CPSC, NIST will develop a testing plan for the period covered based on the resources available under the funding agreement. This plan, to be developed in coordination with CPSC, will assess nanoparticles remaining on the sample surface after UV exposure only and after UV exposure followed by abrasion. Materials to be considered in developing this testing plan include water-borne polyurethane (PU) coating containing graphene oxide (GO). Research in the past five years has shown that GO, which can be produced in large quantities at low cost, has emerged as a promising class of nanomaterials. The testing plan will include exposures of samples in an UV environment at two relative humidity (RH) levels for various times, and abrading UV-exposed samples in air using a Taber abraser. In addition, the testing plan will consider airborne release of nanoparticles associated with spray cleaning products.

### b. Experimental Testing

Based on the Testing Plan developed under Task a, NIST will conduct the experimental testing described in this plan. The agreed upon materials and coatings will be tested to determine the nature of particles released during abrasion testing, including both those remaining on the material surfaces and those becoming airborne. These tests will involve the following measurements per the testing plan:

The procedures used in this experimental testing, as well as the results obtained, will be used to support the development of standard test methods under task c below.

### c. Standard Test Methods

NIST will draft test methods for potential submission to the ASTM approval process, including the following as defined in coordination within CPSC: characterization of nanoparticle release from nanocoatings exposed to UV followed by abrasion; and airborne release of nanoparticles in a chamber. These standards will be submitted to ASTM committee E56 Nanomaterials and subcommittee D22.05 Indoor Air Quality, respectively.

d. Model Development for Exposure Estimation

NIST will develop models to support improved estimates of indoor exposures to nanoparticles that are released due to occupant activities occurring indoors that induce surface abrasion. These models will be nanoparticle-specific in their consideration of the effects of particle size on deposition, sequestration, resuspension and other transport phenomena. To the degree currently possible, nanoparticle characteristics other than size will also be considered, such as coating, photo-reactivity and zeta potential. If possible, these models will be submitted to ASTM committee E56 Nanomaterials and subcommittee D22.05 Indoor Air Quality, or other subcommittee. This component may involve collaboration with staff from the Environmental Protection Agency (EPA).

e. Final Report

NIST will prepare a final report containing the results of tasks a through d above.

A status report will be delivered to CPSC by September 30, 2014.

f. SCHEDULE

**Months 1-2**

Identification of additional materials to be tested.

**Months 3-8**

Materials acquisition, sample preparation, benchtop and chamber experiments.

**Months 4-10**

Development of test methods for submission to ASTM

**Months 8-10**

Data analysis and development of indoor exposure calculation procedures

**Month 10-12.**

Preparation of final report

7. 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): 61000001 DUNS: 069287522 US; TAS: 61-0100

Treasury Code: 61140100 AMOUNT: \$600,000.00  
CPSC funding expiration date: 9/30/2014

ACCOUNTING DATA: 0100A14DSE 2014 2370400000 EXHR004000 255AO

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

Component	TAS	SP	ATA	AID	BPOA	EPOI	A	Main	Sub
NIST		013			X	4650	000		
CPSC		61			14	0100	000		

#### 8. DURATION OF AGREEMENT AND AMENDMENTS

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

#### 9. TERMINATION AND CANCELLATION CLAUSE

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

#### 10. SEVERABILITY

This service is non-severable. CPSC will not receive a benefit from the (work) if the entire project is not completed, and will realize the benefit when we receive the final project report from NIST.

#### 11. 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, it will be resolved in accordance with instructions provided in the Treasury Financial Manual (TFM) Volume 1, Part 2, Chapter 4700, Appendix 10, available at <http://www.fms.teas.gov/tfm/index.html>.

## 12. CONTACTS

The contacts of each party to this agreement are:

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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  
Consumer Product Safety Commission

BY:   
Donna Hutton

TITLE: Contracting Officer

DATE: 8/26/2014

Approved and Accepted for National  
Institute of Standards and Technology

BY:   
Jason Averill

TITLE: Acting Chief, Materials and  
Structural Systems Division

DATE: 8/26/14