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National Institute for Occupational  
Safety and Health (NIOSH)  
1095 Willowdale Road

Centers for Disease Control  
and Prevention (CDC)

Morgantown, WV 26505-2888

{*FIRST NAME*} {*LAST NAME*}

{*ADDRESS*}

{*CITY*}, {*STATE*} {*ZIP CODE*}

{*TODAYS DATE*}

Dear Ms. / Mr. {*LAST NAME*}:

Thank you for participating in the industrial hygiene air sampling survey conducted by the National Institute for Occupational Safety and Health (NIOSH) at Umicore Thin Film Products in Providence, Rhode Island on {*TestDate(s)*}. Workers who participate in field surveys by wearing a sampler or monitoring device are given the opportunity to be informed of the results. Enclosed is a report of your personal air sampling results for respirable dust, indium, and tin.

During the personal air sampling, we collected the respirable dust from your breathing zone air during your work shift. We used a cyclone air sampler with a filter attached to an air sampling pump, which was attached to your belt. The filter was analyzed for respirable dust, indium, and tin according to the NIOSH Manual of Analytical Methods (NMAM) 0600 for respirable dust and 7303 for metals [NIOSH 2003]. Please note that although NIOSH measured these levels in air dust from your breathing zone, your personal inhaled exposure may be substantially reduced with use of a properly fitted respirator. On the following pages you will find some additional details about the compounds that we monitored in workplace air.

### **Explanation of Substances Measured in Air**

#### **Respirable Dust**

Respirable dust is a term to describe the small particles present in air—occurring from either natural forces (e.g., wind, volcanos), or from mechanical and man-made processes. Respirable dust can consist of minerals, metals, chemicals, and biological or organic compounds. At work, you may be exposed to

respirable dust if your job involves dust-generating processes. Some examples of these processes may be crushing, grinding, cutting, or sweeping.

Respirable dust particles are different than total dust particles because they are very small, usually less than 4 micrometers ( $\mu\text{m}$ ) in diameter. We are interested in respirable dust particles because they are small enough to get through the protective mechanisms of the nose and upper airways and reach the gas exchange region of the lungs.

There is no NIOSH recommended exposure limit for respirable dust. NIOSH recommendations are substance-specific, whereas a respirable dust measurement may include a variety of substances.

### **Indium**

Unlike respirable dust, indium is not common in outdoor air, soil, food, or water. It is important to note that the levels of indium reported in this study do not specify forms of indium such as indium oxide or indium tin oxide (ITO), which may be more toxic than other forms of indium.

The NIOSH recommended exposure limit for indium in air is 100 micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ) over the course of an 8-hour work shift. However, this NIOSH recommended exposure limit is for indium in total dust, which includes respirable dust and larger dust particles that are too big to get into lung tissue. The NIOSH recommended exposure limit was established long before the health effects of indium compounds in the ITO industry were discovered.

This NIOSH survey involved measurements of indium in respirable dust only.

Although there is no NIOSH recommendation for indium in respirable dust, there is a Japanese standard, which is 0.3 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ). The Japanese standard is not enforceable in the United States.

### **Tin**

Tin is also not common in outdoor air, soil, or water because it must be extracted from natural ores.

However, it is present in some consumer products such as food containers and in windows. You may be exposed to tin if your workplaces uses or manufactures tin. It is important to note that the levels of tin reported in this study do not specify forms of tin such as tin oxide or ITO.

Similar to indium, there is no NIOSH recommended exposure limit for tin in respirable dust. We have reported your air levels of measured respirable tin.

Again, thank you for your participation in this survey. Moving forward, we will continue to look at workplace factors and their effects on airborne exposures to guide future worker protection strategies. Your participation will also help us to look at these airborne levels and compare them to the blood tests and other medical testing we have conducted at Umicore, so that we may be able to learn more about the possible health effects of working with the materials used at Umicore Thin Film Products. We will continue to share any findings with Umicore as they become available. All reports are available to you as well, and you can request them by calling 1-800-232-2114 and asking for Dr. Cummings or Dr. Armstrong. Please also feel free to call if you have questions about your results.

Sincerely,

Jenna Armstrong PhD, MPH  
Industrial Hygienist

Kristin J. Cummings, MD, MPH  
Medical Officer  
Field Studies Branch  
Division of Respiratory Disease Studies

## Report of Personal Air Sampling Results

Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health  
1095 Willowdale Road  
Morgantown, WV 26505

Participant Name:

{FIRST NAME} {LAST NAME}

Department:

{DEPARTMENT NAME}

Test Date	Result $\mu\text{g}/\text{m}^3$	Department Range (Low-High) $\mu\text{g}/\text{m}^3$
<b>Respirable Dust</b>		
{TestDate(1)}	{ResultDust(1)} }	
{TestDate(2)}	{ResultDust(2)} }	{ResultDustDep(Low)}- {ResultDustDep(High)}
{TestDate(3)}	{ResultDust(3)} }	
<b>Respirable Indium</b>		
{TestDate(1)}	{ResultInd(1)}	
{TestDate(2)}	{ResultInd(2)}	{ResultIndDep(Low)}- {ResultIndDep(High)}
{TestDate(3)}	{ResultInd(3)}	
<b>Respirable Tin</b>		
{TestDate(1)}	{ResultTin(1)}	
{TestDate(2)}	{ResultTin(2)}	{ResultTinDep(Low)}- {ResultTinDep(High)}

{*TestDate*(3)}

{*ResultTin*(3)}