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Health and Environmental Risks in Using Nanotechnology

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Abstract: Since the beginning of humanity we have found ourselves constantly evolving to facilitate daily tasks and improve our quality of life although as we evolve we have been involved in diseases and complications that go hand in hand with the new discoveries.Thanks to science and technology we have progressed as a civilization in improving our quality of life, that is indisputable, but we have also suffered accidents and diseases along the way.Now that we are in the 21st century we are aware that nanotechnology has advantages and disadvantages without considering the risks to which we are exposed, as well as the environment and the health of the population, this being the subject of interest in documenting the health policies in the workplace.

Key words: nanotechnology; health; work risk

JEL codes: H75

1. Nanotechnology

Nanotechnology has become part of every human being's day-to-day life as we see applications in medicine, physics, chemistry, biology, computer science and engineering.

Nanotechnology is the science that manipulates materials on an atomic or molecular scale, in the order of one billionths of meter. Nanotechnological Materials Engineering (NEM) is used in food, cosmetics (including toothpaste and sun cream), medicines, fertilizers and household cleaning products, but there is no regulation (Arteaga Figueroa E. R., 2012), seeing Figure 1. They are also found in ice creams, they are added to substances that coat fruits and vegetables, and even in cans and bottles (Andrew Schneider, 2010).

We can define nanotechnology as the set of disciplines and techniques used in the design, synthesis, characterization and application of materials and devices, within which their smallest functional organizations are, at least in one of their dimensions, within the scale of the gauges, see Figure 2. Thus we understand a NANOMATERIAL as the billionth of a meter or what is the same the millionth of a millimeter as explained in the conceptual map[1].

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[1] Available online at: http://naukas.com/2010/11/22/la-nanotecnologia-y-sus-riesgos-para-la-salud-laboral.

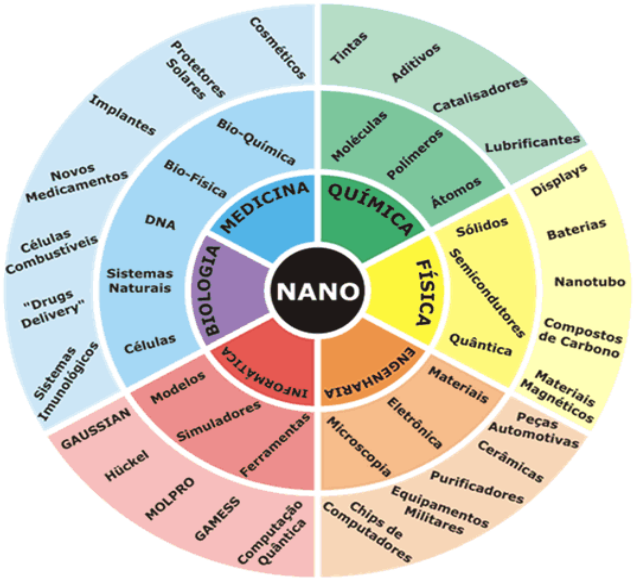

Figure 1 Schematic Representation of Areas the Technology

Source: http://nestorbbird.blogspot.es/1442253883/aplicaciones-de-la-nanotecnologia-en-la-agricultura-e-industria-alimentaria/

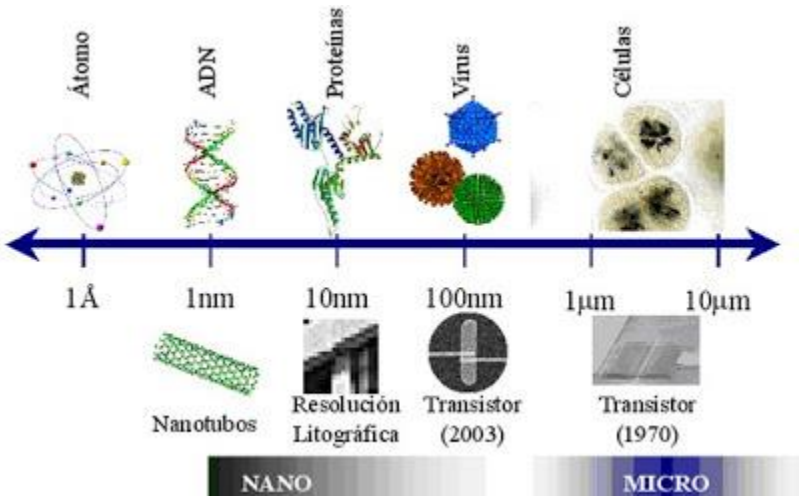

Figure 2 Nanometer Scale

Source: http://lonano.blogspot.mx/2010/01/definicion-y-caractaristicas-escala.html

2. Health Risks from Exposure to Nanoparticles

There are two types of exposure to nanoparticles:

1) Exposure to combustion processes
2) By exposure to the process of generating nanoobjects

a) The combustion process is phenomenons where the generation of smoke coexist (see Figure 3) is the result of incomplete combustion and consist of small particles, tars and gases, some are very dangerous due to their toxicity and others for their acidity. It also contains particles that can use cause cancer and others that are very small so they can be very hazardous to health, because they penetrate deep into the lungs and cause serious diseases.

When you expose yourself them without wanting to generate a nanoobject, rather than the individual is exposed to PUF particles. The PUF are ultra thin particles are involved in industrial processes such as thermal, combustion or mechanical, see Table 1 (WHO, 2009).

Figure 3 Smoke Resulting From the Burning of Bricks

Source: http://verdebandera.blogspot.com/2018/10/molestan-ladrilleras-nuevos.html

b) Exposure during manufacturing and intentional use of nanoobjects and nanomaterials: nanoparticles deliberately generated by nanotechnologies.

The properties of nanomaterials, such as surface, chemical composition, size, shape, have an important influence in their toxicological properties (Erro Urrutia J., 2011). Once the nanoparticles have been adsorbed, they are distributed by blood and lymphatic, reaching different organs, such as bones, kidneys, pancreas, spleen, liver and heart, in which they are held and exert their toxic effects that include damage in cell membranes, protein oxidation, genotoxicity, formation of reactive oxygen species and inflammation.

Therefore, these nanomaterials may be equal to or more harmful than non-nanoscale particles or fibres of the same material. This exhibition can be given during all stages of the manufacturing process (see Table 2).

Table 1 PUF Specification Box

Potential Sources of PUF Secondary Emotions	
Types of processes	Example of sources of emition
Thermal Processes	• Casting and refining of materials (steel, aluminum, iron, etc.). • Galvanized, etc. • Welding, metal cutting (laser, thermal, etc.), vulcanizing fumes, carbon black fumes. • Thermal surface treatments (laser, projection, thermal, etc.). • Application of resins, waxes, etc.
Mechanic Processes	• Machining. • Sanding. • Drilling. • Polished.
Combustion	• Diesel, gasoline or gas engine emissions. • Incineration plants, cremation. • Smoked food. • Gas heating.
Other	• Dust generated in the processes of handling paints, pigments, cement manufacturing, etc.

Source: Magazine Work Nursing, 2015

Table 2 Sources of Occupational Exposure to Nanomaterials

- Manufacture, maintenance, transfer, packaging and storage of products.
- Cleaning, maintenance and maintenance of facilities equipment.
- Waste Treatment
- Operation with nanomaterials (cuts, polishing, machining...).

Source: MagazineWork Nursing, 2015.

Table 3 Gain in Life Expectancy 2012

National. Lifetime life expectancy gains by five-year age groups by period and gender				
	1990-1999		1999-2012	
	Men	Women	Men	Women
Total	3.28	2.23	1.07	1.27
0-4	1.28	0.99	0.80	0.69
5-9	0.08	0.04	0.03	0.02
10-14	0.09	0.02	0.01	-0.01
15-19	0.11	0.02	-0.07	-0.02
20-24	0.13	0.03	-0.09	-0.01
25-29	0.15	0.04	-0.08	0.01
30-34	0.15	0.06	-0.04	0.03
35-39	0.14	0.07	0.00	0.04
40-44	0.14	0.09	0.04	0.05
45-49	0.16	0.11	0.08	0.06
50-54 55-59	0.17 0.16	0.12 0.12	0.09 0.09	0.07 0.07
60-64	0.14	0.11	0.06	0.07
65-69	0.11	0.10	0.06	0.05
70-74	0.08	0.07	0.04	0.04
75-79	0.06	0.06	0.02	0.02
80-84	0.05	0.06	0.01	0.01
85 +	0.09	0.14	0.01	0.01

Source: CONAPO, bases on Estimates of life expectancy gains 1900-1999 and 1999-2012

Bars placed in negative values, on the axis of life expectancy gains, express decreases in a specific age group, while those that are placed in positive values show gains.

3. Health Risks in the Use of Nanotechnology

As the benefits of nanomaterials and nanotechnologies, the risks they primarily cause to health are found. Studies show induced nanoparticle damage that collects DNA and brain damage, pulmonary dysfunction and bioaccumulation (according to which worms and other animals absorb, inhale and ingest nanoparticles and pass into the food chain). The properties of nanomaterials, such as surface area, chemical composition, size, shape or loud, have an important influence on their toxicological properties.Therefore, these nanomaterials may be equal to or more harmful than non-nanoscale particles or fibers of the same material (Secretaria de la Salud, 2007, p. 25).

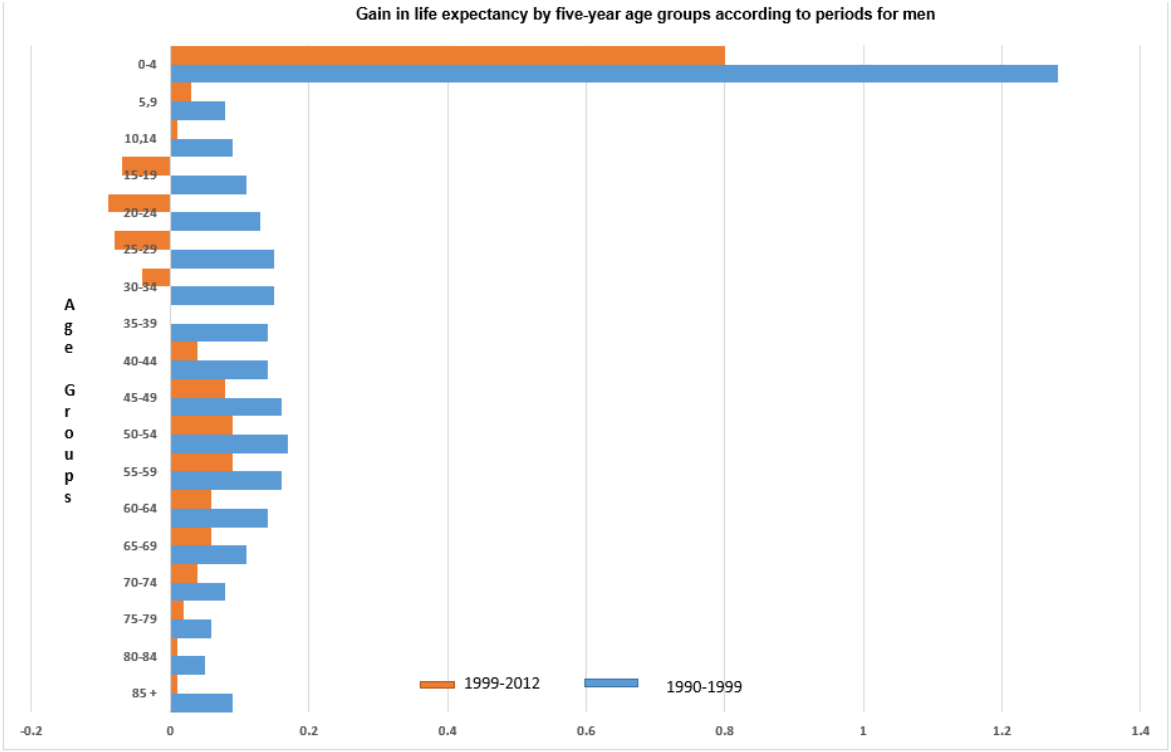

Figure 4 Life Expectancy Earnings by Five-Years Groups According to Period

Source: National Population Council CONAPO

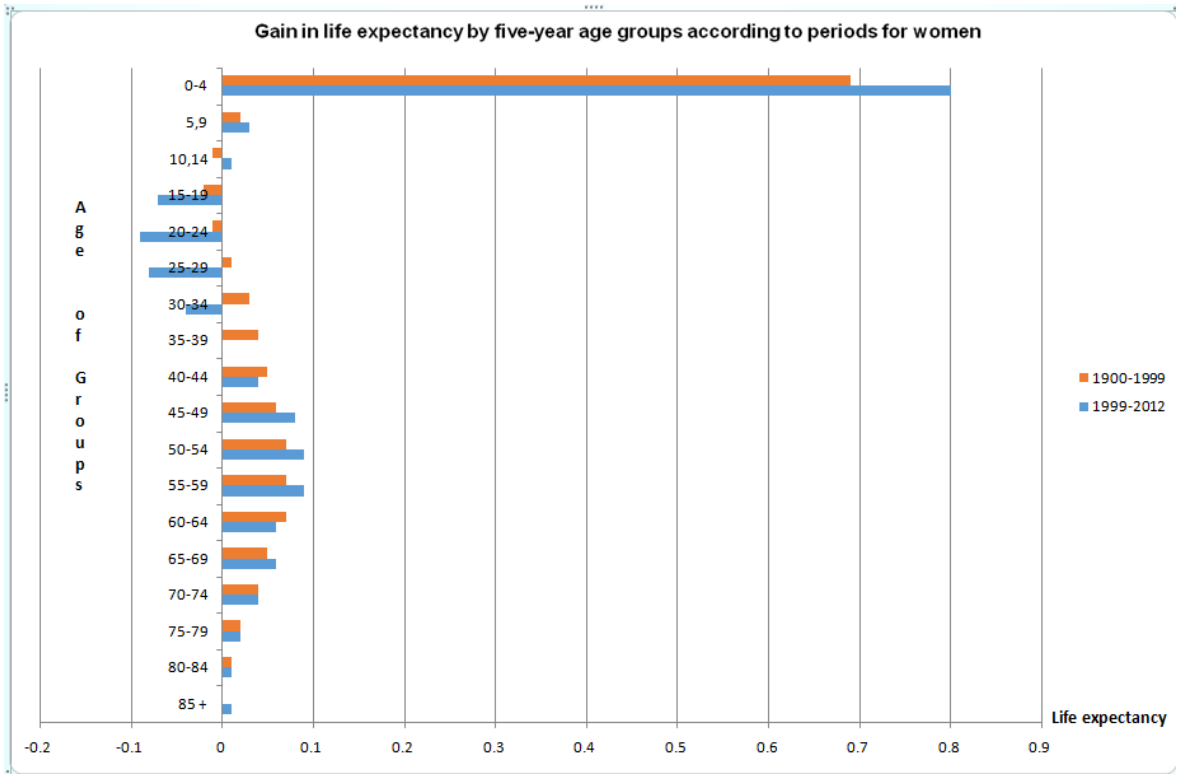

Figure 5 Life Expectancy Earnings by Five-Years Groups According to Period for Women

Source: National Population Council CONAPO

The most common route in way is the inhalation pathway, especially if it is a non-soluble material, although dermal and ingestion should not be ruled out.

The nanomaterials that are inhaled depending on their size is the place where they can be deposited most easily, these nanoparticles are deposited from the mouth, the nostrils through the larynx and pharynx including the bronchial treacherous region.

When we talk about dermal exposure to nanoparticles we mean the importance of size to achieve dermal absorption, according to the 2015 work nursing journal these must be 1000 nm in diameter to get penetrate through the hair follicles.

A 2010 British study confirmed that particles of the order 100 nm pose health risks, as they can access any part of the body, they can even penetrate the nucleus of cells where the DNA is located.

Other studies have pointed out that, in addition to the fact that certain nanomaterials could be effective as bactericidal agents for both positive and negative bacteria in a given crop, in growth and breathing of microbes (Epa, 2005, p. 59). Studies of Oberdörster et al. (2002, pp. 1531-1543; 2004, pp. 437-445) also argue that, based on studies with rats, carbon nanoparticles can enter directly from the nose into the olfactory lobes and into the brain, through the olfactory nerves (Secretaria de la Salud, 2006).

4. Where Nanometric Structured Materials Are Located

Currently large companies are dedicated to research and development to maintain a health in the trends of favoring a better image, companies such as loreal, ponds, Johnson and Johnson and mary kay is dedicated to the manufacture of skin care products Among them is facial care, body care, makeup, eyes, lips, facial cleansers, nails, hair, coloring and hair care (National Institute of Statistics, Geography and Information, 2008).

These companies have an area of research and continuous improvement to offer the best health care of users. Today many of the products have nanotechnology, what companies are looking for is to improve the quality of life of their customers with the best technologies[2].

Researchers from the Environmental Working Group, a Washington-based nonprofit, published its annual report saying that nearly half of the 500 most popular sunprotection products can actually increase the rate at which Malignant cells develop and spread skin cancer as they contain vitamin s and its derivatives, retinol and retinol palpitate.In addition, the FDA (In Mexico the organization in charge of regulating the health fields is COFEPRIS) has known the dangers of vitamin sunscreen since ordering a study 10 years ago, however it has done nothing to alert the public of what dangers.

The titanium dioxide/zinc oxide nanoparticles in sunscreen cause free radicals in skin cells, damaging DNA. (University of Oxford and University of Montreal).

Researchers from the Center for Biological and Environmental Nanotechnology (CBEN, Rice University, Houston) report to the US EPA that engineering nanoparticles accumulate in the organs of laboratory animals and are absorbed by cells. “We know that nanomaterials have been absorbed by cells, which trigger alarms, and if bacteria can take them then we have an entry point for nanomaterials in the food chain.” Dr. Mark Wiesner.

Researchers from the NASA/Johnson Space Center report that studies on the effects of nanotubes on the lungs of rats produced a more toxic response than quartz powder. Scientists at DuPont Haskell’s lab present varied, but still worrying, findings on nanotube toxicity. “The message is clear, people should take precautions, nanotubes

[2] Available online at: https://ww.estudiosdeldesarrollo.mx/obsertario/ob2/11.pdf.

can be highly toxic." Dr. Robert Hunter (NASA researcher).

The ETC group[3] publishes the first scientific literature study on nanoparticle toxicity by toxicologist Vyvyan Howard.Dr Howard concludes that the smaller the particle, the greater it's likely toxicity and that nanoparticles have several pathways in the body and through membranes such as the blood brain barrier. "Full hazard assessments must be carried out to establish the safety of particulate species before manufacturing is authorized, we are dealing with a potentially hazardous process."

Nature reports on the work of CBEN scientist Mason Tomson showing buckyballs can travel unhindered across the ground. "The team's unpublished studies show that nanoparticles could be easily absorbed by earthworms, possibly allowing them to climb the food chain and reach humans."

Research by Dr. Günter Oberdörster is published showing that the nanoparticles are able to move easily from the nasal passage to the brain. The nanotechnology revolution can design particles that are very different chemically from the ones we are exposed to, and that could have very different properties that made them more harmful. - Professor Ken Donaldson, University of Edinburgh.

Nanosafety researchers at the University of Beaver, Belgium, write in Nature that nanoparticles will require moving toxicity tests: "We consider that nanomaterial producers have a duty to provide the results of the tests of toxicity relevant to any new material, even some 'old' chemical agents may have to be reassessed if their physical condition is substantially different from what existed when they were initially evaluated."

At the first scientific conference on nanotixity, nanotox 2004, Dr. Vyvyan Howard has initial findings that gold nanoparticles can move through the placenta from mother to fetus.

Scientists at the University of California, San Diego discover that cadmium selenide nanoparticles (quantum dots) can decompose in the human body potentially causing cadmium poisoning. "This is probably something the [research] community doesn't want to hear."

Dra. Eva Oberdörster informs the American Chemical Society meeting that buckyballs cause brain damage in juvenile fish along with changes in gene function. They are also toxic to small crustaceans (water fleas). "Given the rapid onset of brain damage, it is important to continue testing and assess the risks and benefits of this new technology before use becomes even more widespread."

However, despite the series of studies that have been conducted on nanomaterials and their negative effects on the human organism, there are still no rules governing their use in food industry products. Providing regulation on nanotechnology in recent years, the FDA and EPA have allowed the proliferation of nanomaterials in consumer products[4].

5. Conclusions

This work described the context of what nanotechnology and nanomaterials involved in aspects of health and the environment, the great benefits and the disregards that flow in the human quality of life environment.

Recently innovation in the development of adding substances that inhibit epidemiologic, sufferings and consumerism issues.We are in an era in which we believe to take care of our health with hundreds of products without checking whether what it offers us or what this compound is actually beneficial to our organism, in

[3] Available online at: https://espanol.mercola.com/boletin-de-salud/nuevo-estudio-muestra-que-muchos-protectores-solares-aceleran-no-previenen-el-cancer.as.

[4] Available online at: https://www.scielo.org.mx/scielo.php?pid=S0187-01732012000300005&script=sci_arttext.

addition most of the time we have so little time that we do not have the city or to review the instructions for use, their restrictions or dates of caducity to use high-tech products in the right way and obtain the expected results.

References

Arteaga Figueroa E. R. (2012). *Nanotechnology in Latin America*, Autonomous University of Zacatecas. Zacatecas, México.

Anonymous (2015). "Nanotechnologies, nanoparticles and toxicity", *Magazine Work Nursing*, Association of Occupational Diseases Specialist, Madrid, Spain, available online at: https://dialnet.unirioja.es/servlet/revista?codigo=17816.

Erro Urrutia J. (2011). Safety and health in exposure to nanoparticles "For a safe development of nanoparticles. Riojano Institute of Occupational Health, Madrid, Spain.

Knaul F. M., Arreola-Ornelas H., Mendéz O., Lafortaine L. and Wong R. (2010). *Prevalencia de gasto catastróficos y empobrecedores por motivos de salud en México*, México, D.F.: Fundación Mexicana para la Salud, Documento de Trabajo.

National Institute of Statistics, Geography and Information/Secretary of Health (2008). *Deathsdatabase*, México, D. F. INEGI/Ssa.

OECD (2007). "Health at a glance 2007", OECD indicators. Paris: OECD,.

Secretaria de la Salud (2007). "Programa Nacional de Salud 2007-2012: Por un México sano: construyendo alianzas para una mejor salud", México, D.F.: Secretaria de Salud, p. 25.

Secretaria de la Salud (2006). "Dirección General de Información en Salud. Estimaciones con base en las proyecciones de la población de México 2005-2030", CONAPO, México, D.F., Secretaria de Salud.

World Health Organization (2009). *World Health Statics 2009*. Ginebra: WHO.

Zúñiga-Bahamon A. and Duque-Osorio J. F. (2007). "Nanotechnology: meaning, uses, benefits and risks", *Magazoine: Innovation and Science, National Nanotechnology Symposium*, Nano Forum Comibia, 26 And 27 october of 2007.

Available online at: https://noticiasdeabajo.wordpress.com/2012/01/07/no-existe-ningun-tipo-de-regulacion-sobre-la-incidencia-en-la-salud-del-uso-de-los-nanomateriales/.

Available online at: https://userwww.sfsu.edu/rone/Nanotech/nanobraindamage.htm

Available online at: https://www.researchgate.net/profile/Daniel-Cepedes3/publication/237473881_Ecoturismo_ambiente_y_Desarrollo_local_en_Monteverde/links/5701c3c208ae650a64f8c60b.pdf#page=34.

Available online at: https://www.publication.parliament.uk/pa/Id200910/Idselect/Idstech/22/22i.pdf.

Available online at: https://www.conapo.gob.mx/ES/CONAPO/Mortalidad.

Available online at: https://www.etcgroup.org/es.

Available online at: https://espanol.mercola.com/boletin-de-salud/nuevo-estudio-muestra-que-muchos-protectores-solares-aceleran-no-previenen-el-cancer.as.

Available online at: http://naukas.com/2010/11/22/la-nanotecnologia-y-sus-riesgos-para-la-salud-laboral.

Available online at: https://ww.estudiosdeldesarrollo.mx/obsertario/ob2/11.pdf.

Available online at: https://www.scielo.org.mx/scielo.php?pid=S0187-01732012000300005&script=sci_arttext.