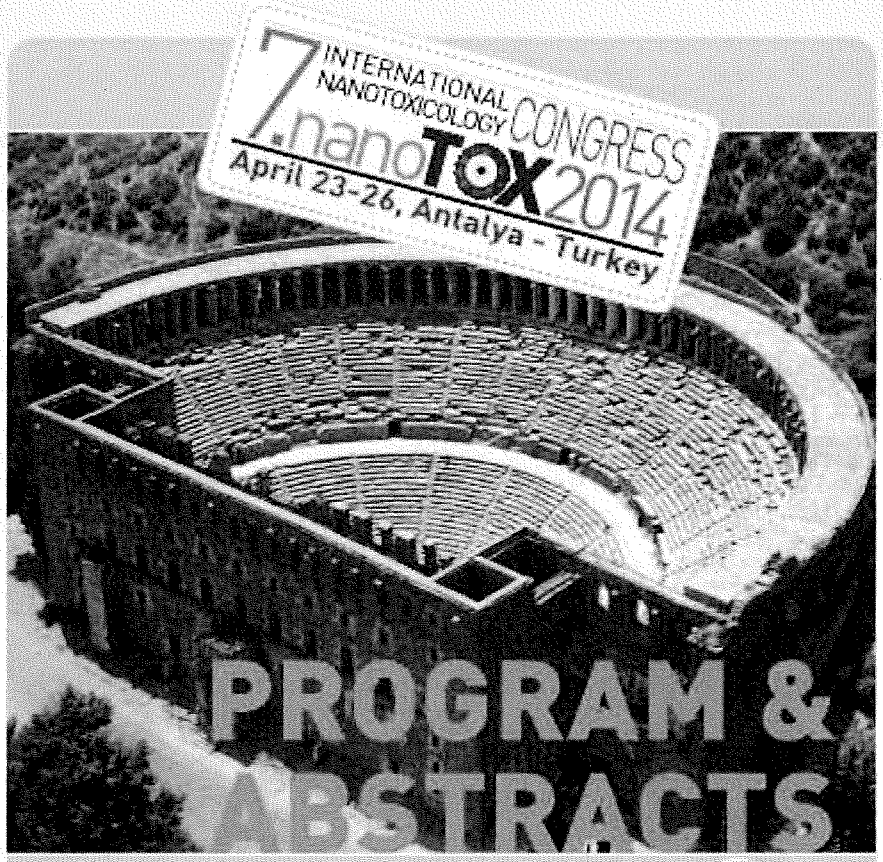

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ICPMS. Inductively-coupled plasma optical emission spectrometry was used to measure total Zn concentrations (all isotopes). Levels of a key, acute-phase, inflammatory protein, serum amyloid A2 (SAA2) in blood, and whole-genome transcriptional profiling on livers from each group, provided an indication of short-term biological response.

Increased concentrations of 68Zn were found in major organs of treated virgin mice, livers of treated pregnant mice, and foetal livers of treated dams, compared with controls. Levels of 68Zn in organs of virgin mice treated with the nano sunscreen were significantly higher than in mice exposed to the bulk sunscreen, consistent with observations for blood from the human study. Importantly, however, no accumulation of total Zn was observed despite the relative increase in the 68Zn isotope. This suggests that normal homeostatic mechanisms maintained total Zn levels, even under conditions of high absorption of 68Zn from 68ZnO sunscreen. The elevation of levels of SAA2 and activation of inflammatory gene pathways, irrespective of the presence of ZnO particles, was suggestive of a formulation-mediated inflammatory response in the liver.

Acknowledgements: This work has been supported by CSIRO's Advanced Materials Transformational Capability Platform (Nanosafety). *[1] B. Gulson, M. McCall, M. Korsch, L. Gomez, P. Casey, Y. Oytam, A. Taylor, M. McCulloch, J. Trotter, L. Kinsley, G. Greenoak, "Small amounts of zinc from zinc oxide particles in sunscreens applied outdoors are absorbed through human skin", Toxicol. Sci., vol. 118, pp. 140-149, 2010., [2] F. Larner, B. Gulson, M. McCall, Y. Oytam, M. Rehkämper, "An inter-laboratory comparison of high precision stable isotope ratio measurements for nanoparticle tracing in biological samples", J. Anal. A. Spectrom., 2014 Advance Article, [3] M.J. Osmond-McLeod, Y. Oytam, J.K. Kirby, L. Gomez-Fernandez, B. Baxter, M.J. McCall, "Dermal absorption and short-term biological impact in hairless mice from sunscreens containing zinc oxide nano- or larger particles", Nanotoxicology, 2013 (e-publish ahead of print)*

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A novel human exposure system for nanoparticle tracking and oxidative stress assessment

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Inhaled NPs can affect health by direct interaction with lung cells and through transfer to other organs. Negative effects are expected from catalytically active NPs that can generate oxidative stress, which can damage cells and launch a cascade of effects, contributing to acute and chronic diseases. The aims of our current study are 1) to better understand the extent inhaled NPs translocate into the circulation and are excreted into urine and 2) the potential of these NPs to induce oxidative stress markers in the lung lining fluid, followed by an increase in such markers in circulation and urine. We will use an open label, controlled, randomized human volunteer study. Subjects will be assigned to one of two exposure groups, each consisting of 10 healthy volunteers. Volunteers will inhale, during 40 minute exposure durations, either aerosolized medical-grade superparamagnetic iron oxide nanoparticles (SPIONs), or reactive tobacco-smoke NPs as a positive control for the oxidative stress response. Each volunteer will participate in three experiments; each at a different exposure level. Biological liquids (exhaled breath condensate, blood and urine) will be collected at several time points before after the exposure. This study will be the first ever controlled human inhalation study to aerosolized medical iron oxide nanoparticles. Due to the uncertainty that remains in regards to the kinetics of oxidative stress response of inhaled iron oxide nanoparticles, matched with widespread occupational exposure to these particles, this study will provide salient safety information for workers worldwide. The developed methodology will further allow for a non-invasive evaluation of the inhaled NPs target dose and will assess the pathways for circulatory translocation of inhaled NPs.

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Reproductive and Developmental toxicity of Silver Nanoparticles

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Silver nanoparticles (Ag-NPs) are widely applied in several products due to their unique physicochemical properties as well as bactericidal effects. The extensive application of Ag-NPs has raised concerns about their potential toxicity. The evaluation of toxicity of Ag-NPs in some previous studies has revealed the adverse effects of these NPs on living organisms. However, very little is known about the potential toxicity of Ag-NPs on dams and offspring during the prenatal exposure. In the present study, reproductive/ developmental