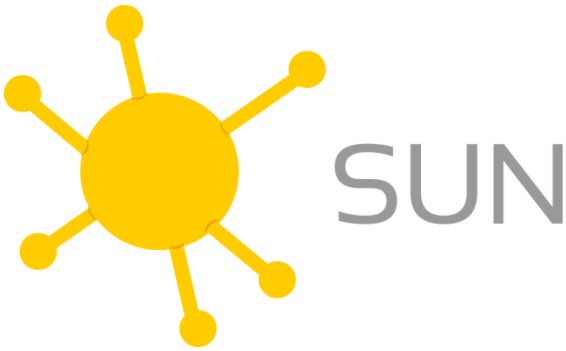

Deliverable report for

SUN

Sustainable Nanotechnologies

Grant Agreement Number 604305

Deliverable D 1.2
SUN Project Database

Due date of deliverable: 14/04/2017
Actual submission date: 18/04/2017

Lead beneficiary for this deliverable: Institute of Occupational Medicine – *IOM*

Dissemination Level:		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	X

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Description of task

Task 1.2 "Construct and maintain the SUN project database"
Involved partners: IOM, UNIVE, all participants
Responsible partner: IOM
Duration: Month 12 – 42

1. Status of this report

Deliverable D1.2 is the final report on Task 1.2 "Construct and maintain the SUN database". It accumulates and finalises the account of the work carried out by the task from months 12 to 42. It will also describe the interactions that members of the SUN consortium had with other projects to coordinate and harmonise the efforts to enable data exchange, template, ontology and database development. Earlier interim reports have provided information on progress on an incremental basis. This version of the deliverable has been composed as a final deliverable at month 42 of the project, updating the previous month 36 version which was submitted in October 2016.

2. Overall aims and objectives of Task 1.2

All multi-disciplinary projects of significant size require a database to store and maintain the data generated by the project. The database development of Task 1.2 within WP1 was assigned to gather & collate all relevant data generated by WPs, with completeness, quality-checked, catalogued and stored suitably in the SUN project database, the project's data repository. The SUN database has been implemented as a searchable operational project database to store and maintain data generated by the project. All the relevant SUN data has been catalogued in a consistent fashion with the aim of relating methods (e.g. characterisation, dispersion etc.) with experimental results. The implemented database provides facilities to search, query and retrieve selected project datasets.

In principle, available raw data is part of the project and all partners can have access to other participants' data. Any usage of the SUN data while SUN progressed (e.g. for publications) was sanctioned by the SB and agreed by the author of the data. Access to SUN data by third parties, during the project lifetime, is subject to the usual confidentiality agreement with the SB and the relevant authors. At the end of the project, the SUN database will be made available to the EC.

Whilst the database "as is" is available with this report at delivery time, it is here noted that with some earlier delays to the actual timetable of data generation and return in the project, and following considerable prompting, we expect a few data files are still due for return, and for some data aspects that may be beyond the official Project end date; from previous experience that data may continue to be received after that time. So, in the interests of completeness we will still endeavour to add this to the SUN repository. It is anticipated that facilitating and developing further the channels for data sharing, following publication embargoes etc, will also

continue beyond the official life of the SUN project, in other further developments, again as it has for some other projects. We certainly aim to continue to facilitate this in the interests of SUN, subsequent projects where practicable and for the NANO-EHS community more widely. For the latter, in the course of doing the SUN work we have had ongoing liaison, sharing and other interaction with the eNanoMapper project and the Nano Safety Cluster (NSC) particularly through activities in WG4, Database Interest Group, and these also are described.

3. Description of work and achievements

The previous 36 month progress report for the SUN project database deliverable included detailed coverage of key work up to that point, including overall database design, template development, data gathering and liaison activities, and data returns to date. It reviewed several tasks and activities that have continued to take place since then. Thus, as a cumulative deliverable, all of the relevant parts of these activities are included here, supplemented with further results of the continuing work and the details of final output and achievements.

In the first period our work on the SUN project database was mainly concerned with developing two key areas. Firstly, the development of data collection templates and related resources for use by the scientists in the different major data generating parts of the project, as well as plans for their distribution and collection. Secondly we also prepared an initial schema and operating system for the operational database to be used to catalogue and manage the data received in the course of data collection as the project proceeded. It is here acknowledged that both of these tasks benefitted from our prior experience and resources developed earlier in the FP7 projects e.g. NANOMMUNE, NANEX, ENPRA and MARINA, where these resources were adapted and further developed for SUN. This has been extremely useful, as it allowed the expenditure of work on these early development tasks to be relatively modest, knowing that in SUN the number of data donors, the greater diversity of different dataset types being generated, and the total to be collected overall would require significant efforts to be devoted to the data collection, collation and data management tasks.

In broad summary, having earlier established the foundations of our approach for this deliverable and the means of achieving it, in the interim practical database implementation work and actual project data collection has been on-going whilst some partners have completed, and others have been continuing to carry out experimentation and data generation activities. We have continued liaison with the relevant partners, and early in 2015 built on the earlier template formats where appropriate feedback or experimental or test developments have required this. This was just prior to a data procurement exercise (in summer 2015) that saw a cycle of WP1 circulating and reminding participants to fill data templates, for return as soon as possible to WP1. Data procured has been added to the database, and when ready will be forwarded for use by others in the project.

It is acknowledged here that the development of aspects of these resources and techniques (e.g. templates, database design and collection methods) has benefitted from and built upon

the foundations laid by prior experience and resources developed in the earlier FP7 projects, NANOMMUNE, NANEX, ENPRA and MARINA, although the diversity and variability of requirements in the SUN project were considerably more than in those earlier projects.

The sections that follow have been updated with the results of incremental and cumulative activities since the previous report. In this last period there has, as anticipated, been a marked increase in the more time-consuming practical data collection activities with ongoing data processing, management and database loading being carried out. Whilst the database design and structures are completed, and the vast bulk of relevant data has been returned by partners and added to the database, at time of writing we are aware that there are still small amounts of data in some areas of the project that is still being finalised. We are hopeful of receiving some of this data from some partners as the project closes and wherever possible we will endeavour to add that information to the database.

4. Project template development for data recording and curation

In order to assess requirements, plan for the SUN database and make it available for use by others, we have liaised with WP Leaders in an incremental fashion as the project has evolved and progressed. This has allowed us to build a more complete and up-to-date inventory of the data being produced or collected during the project as the work packages have evolved and developed. To help build up such an inventory initially, and to provide data collection materials, IOM have developed various data collection forms and templates, which have been distributed to the relevant WPs.

In the early stages of the project, these practical efforts necessarily concentrated on the characterisation (WP1), ecotoxicology (WP4) and toxicology (WP6) work packages, liaising and interacting with them during the development of their practical work. Subsequent liaison sought engagement with other WPs on Exposure and Release data and their relatively less structured and more qualitative types of data and information. The information provided allowed us to generate an overall inventory for SUN data with respect to the types of data to be generated, their expected formats, approximate volumes and anticipated timelines for data gathering and return. We have used this (regularly updated) information to periodically remind and follow up with the participants in order to obtain their data.

In terms of formal data template developments the most significant expenditure of effort in this respect has been on data requirements for the toxicology and ecotox areas of the project. WP1 has worked closely with members of WP6 on the development and use of data collection templates and recording forms for in-vitro and in-vivo results. In these areas we have, as planned, further developed materials and resources derived from earlier IOM FP7 toxicology templates. These templates were used to collect project data in ENPRA and MARINA, and they have been adapted and extended for SUN purposes. Specifically, in an intensive period of work the templates were adapted and rearranged for new assay types, with higher volumes of samples, and much altered data lay-outs than those encountered previously (with P26, KI, also

an eNanoMapper partner). These discussions and adaptations also allowed for the integration of efficient dose-response analysis in WP6 via the PROAST model (with P25 and P26, for in-vitro, and P16 for in-vivo), and training in the use of PROAST. (www.rivm.nl/en/Documents_and_publications/Scientific/Models/PROAST). It is worth noting that mutual benefit was derived from project interactions between SUN and NanoSolutions in this area, as well as later on with eNanoMapper. In addition, modified versions of the toxicology templates were developed for ecotox data, through liaison and input from WP4. WP1 also adjusted and supplied physicochemical characterisation data collection templates to UNIVE and VN for their results early on in the project. In the event, whilst the templates helped in data definitions, in this instance T1.2 extracted the data from the deliverable documents for the database.

Following alterations to project plans and experimental designs in some WPs, and related delays in results being made available, after year one WP1 prepared and distributed more general data collection forms for circulation to the Consortium. These were sent with accompanying explanatory information and guidance by email to the WP leader, or to the WP's nominated "Data Coordinator", a selected area expert on the data being produced. This was agreed through discussion with WP Leaders and candidate coordinators at the 1st SUN Annual Meeting (22 – 23 October 2014, Utrecht). Since then through further ongoing discussions with as many relevant partners as possible and assisted and motivated by UNIVE as project coordinator in WP1, we have continued data collection efforts on an ongoing basis, with mixed results in different WPs. As usual as the project progressed changes in substances, experimental designs and timetables delayed some data productions. Following further encouragement at the October 2015 meeting a revised data collection survey was distributed, and subsequently followed up periodically. This received further encouragement after the October 2016 meeting, and was followed up by further reminders to return data and information to WP1.2.

Regarding physical file handling, to improve on prior experience by encouraging greater standardisation and make like easier for all concerned, we also advocated more systematic naming convention for the template and data files to encourage the consistent use and identification of the files and their contents. This embeds the Work Package ID, Partner ID, ENM, End point-assay type, and Cell type into the file name. Users were strongly recommended to follow this pattern, and this has proven to be largely, though not universally, successfully adopted.

Appendix 1 shows the significant data collection templates and formats used in the project for data recording, collection and curation.

5. Data collection from SUN partners

WP1.2 has continued liaison with the relevant WP partners on an ongoing basis, establishing the general description and overview of their work programme i.e. studies, experiments,

assays, test method descriptions, SOPs, model development, results output and other generated SUN data. Data procured has been added to the SUN database.

The actual work in the data gathering tasks has been concerned with the following:

- Distribution of initial information gathering templates to identify and gather general work programme overview, ongoing collaboration and building inventory of data received from all Work Packages
- Further work on data collection templates and use by the scientists in the different data domains of the project, as well as continuing liaison for their distribution and collection
- Screening/validating for completeness and overall quality of data templates received
- Implementation of the database structure, user interface design and related development for the operational database being used to catalogue and manage datasets received as the project has proceeded.

To enhance the return of data to the repository the appointment of recognised "data coordinators" for WPs, in order to help liaise and take responsibility over the details of different data types and the transmission of results data has been very helpful and effective. Going forward it is a practice that should be applied in WPs of all data-generating projects, specified in good data management planning (in a Data Management Plan (DMP), as is now a requirement in H2020).

The support of the WP1 Project Coordinator to strongly encourage the data returns was also very helpful in providing necessary impetus with regard to the need for the partners to provide data. Such efforts continue in SUN, as there is still outstanding data to be returned and processed for the repository.

Overall, the approach we have adopted means that the data is collected, documented as far as possible based upon what is provided by SUN partners, and when ready made available for use or transfer to other parties. In earlier projects (NANOMMUNE, ENPRA, MARINA) we were mandated to forward datasets to the JRC - NanoHub database at the end of the project, so this is quite analogous to plans to forward suitable SUN data to an instance of the eNanoMapper database, following any data embargo period and the establishment of any necessary data sharing agreements, or other (legal) formalities required.

6. SUN database developments

In developing the SUN project database, WP1 has built upon and further developed techniques from earlier projects including those in ENPRA and MARINA, and as it was happening contemporaneously, has also included sharing of template materials and experience from the NANOSOLUTIONS project, as well as with the developers in the eNanoMapper project over the last three years. In order to address the wider data needs of SUN we have extended the domains of the earlier databases to cope with the greater diversity of data types found in SUN.

The result of these efforts is the "SUN Data Repository", including the database, relevant datasets, and related data management materials. The operational repository has been very well suited for ongoing project data management as it provides a catalogue and inventory that enables the collection, processing, and retrieval of project data, including:

- Experimental results on release, exposure, physicochemical properties of (Eco) toxicity, In-Vitro, In-Vivo and Exposure studies etc.
- Standard Operating Procedures (SOPs) and testing protocols.
- Standard database management and administration procedures including security, resilience and quality control.

In SUN, well before the advent of eNanoMapper and our interactions with it, our database strategy and plan was based on the earlier design, materials and experience of earlier projects (NANOMMUNE, ENPRA and MARINA), largely as a consequence of their success, and also in order to help achieve the task within the resources available, which were modest compared to the earlier projects, given the greater diversity of data types anticipated in SUN. Therefore, in brief, a similarly practical but necessarily "traditional" approach was planned, and has been followed. This has used the previous techniques and templates, with further adaptations, additions, and so on where necessary to adapt things to SUN purposes. The SUN repository database is populated with an inventory of project data, with details of all the datasets received, with links to the actual dataset and related documentation (SOP, or test method description form, etc.).

While we have been applying this basic database model efficiently for the SUN work, based upon earlier experience, it was also known that a very high proportion of the work would be expended in the practicalities of data collection and handling: in liaison and discussion with partners; agreeing and modifying templates for data capture where appropriate; suitably obtaining data (and chasing, reminding, etc.); checking, documenting and cataloguing the datasets from the various parties; all with considerable interaction with partners and frequently several iterations needed in order to achieve satisfactory final return of data. In addition, as they arose, interactions with other Nano-EHS community developments and the eNanoMapper project also required time and resource to execute.

A great deal of flexibility in the day to day approach to the database work in WP1 has been needed, although we have generally adhered to the principles of the WP1 database plan in order to facilitate as much data collection as possible within the available resources and to avoid unaffordable scope creep. We have repeatedly presented this approach, with schematics of the database methodology, in presentations to the MC, at project meetings, and in periodic reports, together with explanations of the reasons for this approach. However we have also naturally spent time and continued to interact with the wider generic data developments mentioned above, and other specific interactions with eNanoMapper developments as they have evolved, see outlined below. These interactions have similarly been outlined in our presentations and reports as the project has proceeded.

Strategically in SUN we adopted a similar general practical approach as that used in previous FP7 project data management, and build upon the foundation provided by our earlier MARINA (and other project's) work. We adapted, modified and tested assay templates with partners and also with eNanoMapper, which it was hoped could be the ultimate destination for much of this template data. With templates for data collection, we developed a very practical Operational Database to catalogue and collate together the SUN datasets and provide a simple and easy to use interface for their management, selection and retrieval, whilst at the same time maintaining the template format for provision to eNanoMapper. A schematic of the database operation is shown below in Figure 1 highlighting the main components and areas managed by the database and the aim of transferring appropriate datasets and documentation to eNanoMapper for upload.

The operational database is implemented as a Microsoft Access application for building and giving access to the main catalogue and uploaded study data, with the scientific results in template formats linked to the database records. This allows the database to document and track the data overall, and allows the template datasets to be readily provided to an eNanoMapper implementation. Once all of the data has been received and the database finalised, we will also publish a web-based version of the operational database, which will be available through the web link Sun.iom-world.co.uk. Ultimately this should be subsumed in an updated eNanoMapper database: we are collaborating with the more recent Horizon 2020 NanoReg2 (http://www.nanoreg2.eu) and caLIBRAte (http://www.nanocalibrate.eu/home) projects, aiming to transfer data to an updated eNanoMapper database implementation (see further in Sections 9 and 10 below).

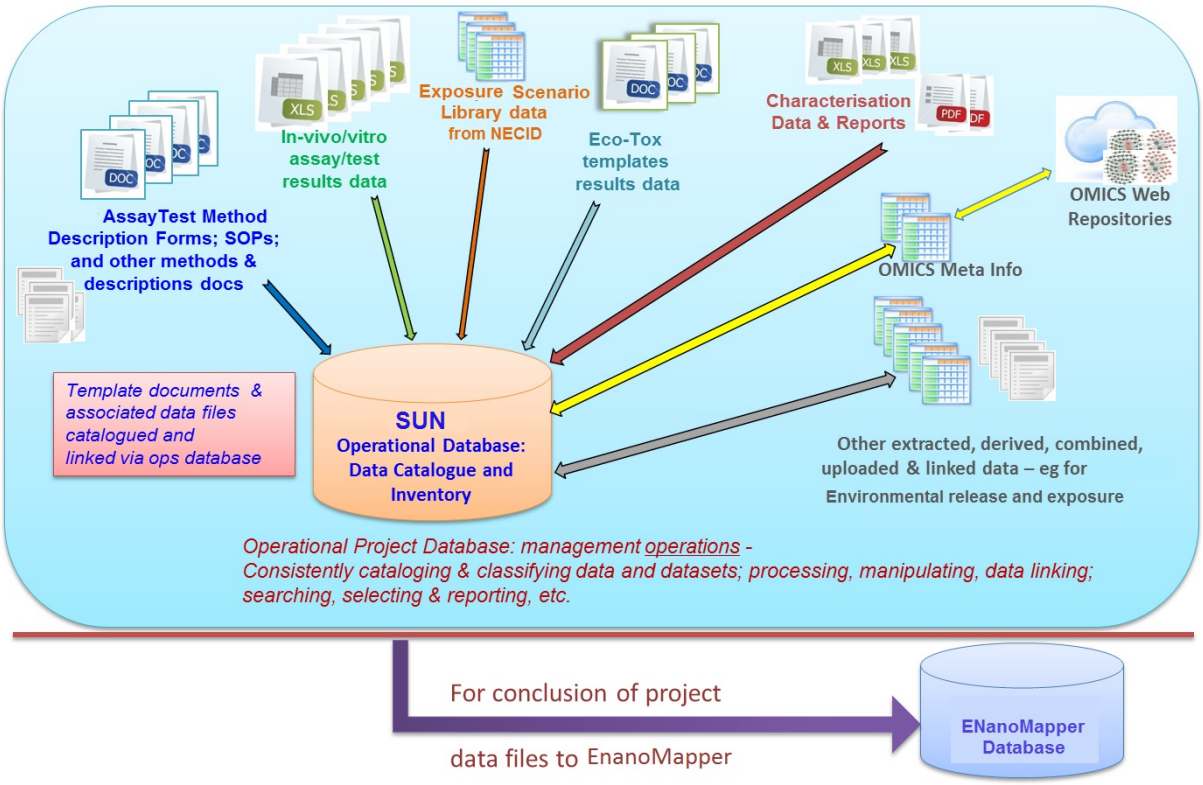


Figure 1: Schematic overview of content and operation of the database showing key data areas

In general the datasets have been incrementally added to the database as it has been received and screened. An interface to the catalogue and data was produced to allow a user to easily navigate the datasets and search and filter information for different areas. Figures 2, to 6 shows some example screen shots of the interface for the main menu, environmental release and exposure, ecotoxicology, occupational & consumer exposure and in-vitro toxicology data.

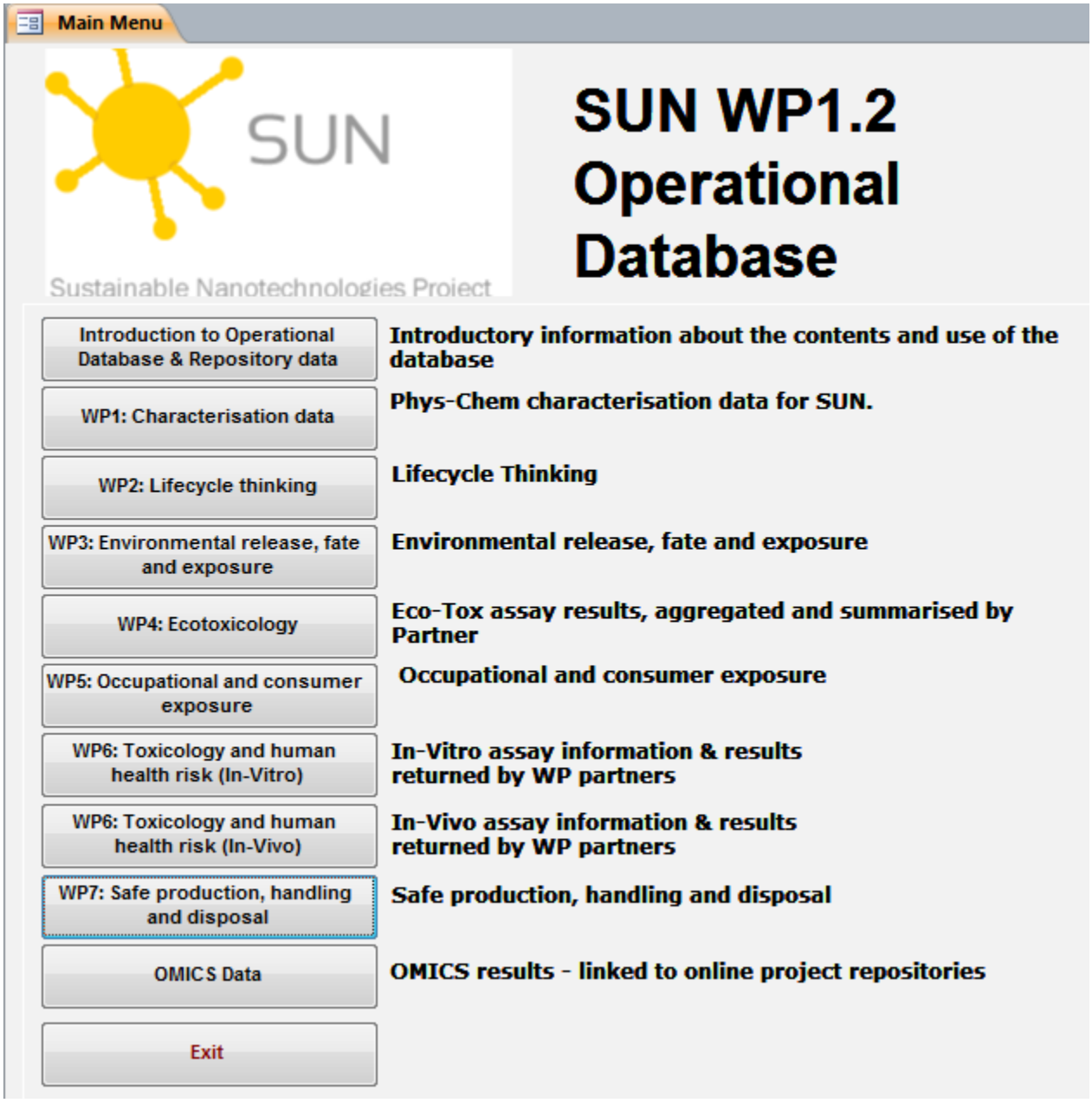


Figure 2: Opening menu of SUN Operational Database

SUN WP3 - Environmental release, fate and exposure

To sort or filter the records, right click on the column field to filter by and select your option e.g. 'Filter By Selection' or 'Sort asc/desc', etc
To remove current filter(s), right click on the column and select 'Remove filter / sort' (commands also available on Toolbar above)

ID	Partner	Task	Experiment Name	Key Aims and Objectives	Type of Output datasets	Approx Dates	Deliverable	Related data files
1	BASF	Task 3.2	Weathering of Fe2O3_PE_USE and PE_USE (protocol adapted from ISO 4892-2:2009-11)	Characterize the degradation of PE nanocomposite upon weathering.Quantify the release of Fe2O3 NOAA upon weathering.	Release rate (ie numerical data in mg.m-2)FTIR spectra (27)XRD diagrams (7)Crystallite sizeX-ray computed microtomography (4)	Start : 08/14 End : 12/16	D3.1	Release rates : 2015 02 26 ICP-MS Fe Lixi A&D Fe2O3_PE_USE FreeFe.xlsx 2015 06 15 ICP-MS Lixi Suntest A&D Fe2O3_PE_USE TotFe.xslx FTIR analysis: 2016 12 06 Fe2O3_PE spectres corriges.xlsx 2016 12 06 PE_USE spectres corriges.xslx 2016 10 10 OroPin_PE spectres corriges.xslx
2	RWTH	Task 3.3	Weathering of Fe2O3_PE and PE fragmented products	Compare weathering of bulk materials and fragmented productsProduce weathered fragmented product for use in other work packages	WFP massFTIR spectra (8)XRD diagrams (8)Crystallite sizes (12)	Start: 02/15 End: 04/15	D3.1	2016 12 06 FTIR FP weathering.xslx 2015 07 SUN_DRX FP_8w_12w.ppt
3	UNIVIE	Task 3.1	HNO3 dissolution and reductive dissolution of surface-available Fe in Fe2O3_PE_FOR and Fe2O3_PE_FP_USE	Define a reliable method to quantify surface-available Fe in lixiviates obtained from weathering experiments	Extraction yields (3)Surface available fraction (2)	Start: 01/15 End: 03/15	D3.2	2015 02 10 ICP-AES Fe Tests Extractions H2O + HNO3.xslx 2015 02 11-12 ICP-AES Fe Mineralisations MW290115.xslx 2015 02 12 ICP-AES Fe Extractions CBD 01 15.xslx
4	UNIVIE	Task 3.1	Mineralization of PE matrix	Validate method for quantification of total Fe released in the lixiviates of weathering experiments	Fe concentration in solids samples (3)	Start: 01/15 End: 02/15	D3.2	2015 02 11-12 ICP-AES Fe Mineralisations MW290115.xslx
5	UNIVIE	Task 3.1	Separation of CuO NOAA adsorbed in sediments	Validate a method for reliable extraction of CuO NOAA from sediments	Size distributionsCu recovery rates (6)	Start: 02/15 End: 07/15	D3.2	(CEINT) CuO Spiked Sediment Data.xslx
6	BASF	Task 3.2	Weathering of wood blocks coated with CuO_Acryl_FOR and Acryl_FOR (protocol adapted from EN 927-[illegible]	Characterize the degradation of CuO_paint upon weathering.Quantify the release of Cu upon weathering and determine [illegible]	Release rate (ie numerical data in mg.m-2)	Start: 04/15 End: 12/16	Data not reported under D3.1 due to delays in [illegible]	2015 09 ICP-MS Cu Ti - CuO_acryl Lixiviates.xslx

Figure 3: Example records of Environmental release and exposure data

SUN WP4 - Ecotoxicology Tests

To sort or filter the records, right click on the column field to filter by and select your option e.g. 'Filter By Selection' or 'Sort asc/desc', etc
To remove current filter(s), right click on the column and select 'Remove filter / sort' (commands also available on Toolbar above)

SID	Partner	ID	NM Substance	Lab name	Assay / End Point Name	CellType	CellTypeDesc	Assay File	TMDF File
1	INIA	P15	Cuo_1_np_syn	Department Of Environment	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP-ALAMAR_24w_longterm.xls	SUN-Ecotox-CLC-CuO-WP4_P15_Test_24w_longterm.do
2	INIA	P15	Cuo_1_np_syn	Department Of Environment	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP-CFDA_24w_longterm.xls	SUN-Ecotox-CLC-CuO-WP4_P15_Test_24w_longterm.do
3	INIA	P15	Cuo_1_np_syn	Department Of Environment	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP-NR_24w_longterm.xls	SUN-Ecotox-CLC-CuO-WP4_P15_Test_24w_longterm.do
4	INIA	P15	Cuso4 Salt	Department Of Environment	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuSO4-ALAMAR_24w_longterm.xls	
5	INIA	P15	Cuso4 Salt	Department Of Environment	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuSO4-CFDA_24w_longterm.xls	
6	INIA	P15	Cuso4 Salt	Department Of Environment	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuSO4-NR_24w_longterm.xls	
7	INIA	P15	Cuo_1_np_syn	Department Of Environment	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP-ALAMAR_96w_24h.xls	SUN-Ecotox-CLC-CuO-WP4_P15_Test.docx
8	INIA	P15	Cuo_1_np_syn	Department Of Environment	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP-CFDA_96w_24h.xls	SUN-Ecotox-CLC-CuO-WP4_P15_Test.docx
9	INIA	P15	Cuo_1_np_syn	Department Of Environment	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP-NR_96w_24h.xls	SUN-Ecotox-CLC-CuO-WP4_P15_Test.docx
10	INIA	P15	Cuso4 (ion Control)	Department Of Environment	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuSO4-ALAMAR_96w_24h.xls	
11	INIA	P15	Cuso4 (ion Control)	Department Of Environment	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuSO4-CFDA_96w_24h.xls	
12	INIA	P15	Cuso4 (ion Control)	Department Of Environment	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuSO4-NR_96w_24h.xls	
13	INIA	P15	Cuo_101_sol_bm_syn	Department Of Environment	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP_101-ALAMAR_96w_24h.xls	SUN-Ecotox-CLC-CuO_101-WP4_P15_Test.docx
14	INIA	P15	Cuo_101_sol_bm_syn	Department Of Environment	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP_101-CFDA_96w_24h.xls	SUN-Ecotox-CLC-CuO_101-WP4_P15_Test.docx
15	INIA	P15	Cuo_101_sol_bm_syn	Department Of Environment	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP_101-NR_96w_24h.xls	SUN-Ecotox-CLC-CuO_101-WP4_P15_Test.docx
19	INIA	P15	Cuo_102 _sol_bm_cit_syn	Department Of Environment	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP_102-ALAMAR_96w_24h.xls	SUN-Ecotox-CLC-CuO_102-WP4_P15_Test.docx
20	INIA	P15	Cuo_102 _sol_bm_cit_syn	Department Of Environment	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio)	SUN-ECOTOX-CellTestAssay_CLC-CuONP_102-CFDA_96w_24h.xls	SUN-Ecotox-CLC-CuO_102-WP4_P15_Test.docx

Figure 4: Example records of ecotoxicology data

SUN WP5 - Occupational and Consumer Exposure

To sort or filter the records, right click on the column field to filter by and select your option e.g. 'Filter By Selection' or 'Sort asc/desc', etc
To remove current filter(s), right click on the column and select 'Remove filter / sort' (commands also available on Toolbar above)

View all the Measurements | View all the Append Files

ID	ENM	Workers No	Activity	Location	Source Domain	Automation Level	Exp Situation	Exp Pattern	Activity Duration	Sample Type	Aactivity Desc	Segregation	General Ventilation	Distance	Product Name
1	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal		00:22:00	Personal	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	Catalyst
2	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal		00:22:00	Static	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	Catalyst
3	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal		00:22:00	Static	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	Catalyst
4	MWCNT	10 - 19 Workers	Transfer of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal	Occasional	00:07:00	Personal	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	Catalyst
5	MWCNT	10 - 19 Workers	Transfer of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal	Occasional	00:07:00	Static	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	Catalyst
6	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal	Occasional	00:03:00	Personal	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	metal-hydroxides
7	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal	Occasional	00:03:00	Personal	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	metal-hydroxides
8	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal	Occasional	00:03:00	Static	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	metal-hydroxides
9	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal	Occasional	00:03:00	Static	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	metal-hydroxides
10	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Manual without restrictions	Normal	Occasional	00:03:00	Static	Handling of the catalyst	None segregation	Mechanical ventilation -	0,5 m	metal-hydroxides
11	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Semi automatic	None		00:01:00	Personal	Handling of the catalyst	None segregation	None ventilationN	0,5 m	Carbon nanotubes
12	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Semi automatic	None		00:01:00	Personal	Handling of the catalyst	None segregation	None ventilationN	0,5 m	Carbon nanotubes
13	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Semi automatic	None		00:01:00	Personal	Handling of the catalyst	None segregation	None ventilationN	0,5 m	Carbon nanotubes
14	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Semi automatic	None		00:01:00	Personal	Handling of the catalyst	None segregation	None ventilationN	0,5 m	Carbon nanotubes
15	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Semi automatic	None		00:01:00	Personal	Handling of the catalyst	None segregation	None ventilationN	0,5 m	Carbon nanotubes
16	MWCNT	10 - 19 Workers	Falling of powders or granules	Area indoor	Handling and transfer of bulk	Semi automatic	None		00:01:00	Static	Handling of the catalyst	None segregation	None ventilationN	0,5 m	Carbon nanotubes

Figure 5: Example records of occupational & consumer exposure data

WP6: Toxicology and human health risk (In-Vitro) Assays

To sort or filter the records, right click on the column field to filter by and select your option e.g. 'Filter By Selection' or 'Sort asc/desc', etc
To remove current filter(s), right click on the column and select 'Remove filter / sort' (commands also available on Toolbar above)

SID	WP	Partner	NM Substance	Assay/End Point Type	ay Desc	Cell Type	Cell Line Desc	Assay Results File	Assay Test Method Description File
10	WP6	P25	Sls - Wp3 -	Fluorescence Measurement Of	Alamar Blue	C3a	Hepg2/c3a (atcc® Crl-10741™), Derivative Of	SUN_WP6_AlamarBlue_CuO_C3A.xlsx	NanSol-TMDF-WP6-HWU25-CellViability-AlamarBlue-C3A.doc
11	WP6	P25	Sls - Wp3 -	Fluorescence Measurement Of	Alamar Blue	C3a	Hepg2/c3a (atcc® Crl-10741™), Derivative Of	SUN_WP6_AlamarBlue_WCCo_C3A.xls	NanSol-TMDF-WP6-HWU25-CellViability-AlamarBlue-C3A.doc
18	WP6	P25	Sls - Wp3 -	Cocl2	Fluorescence Measurement Of	"fpg" Modified Alkaline Single	C3a	Hepg2/c3a (atcc® Crl-10741™), Derivative Of	CoCl2.xlsx
19	WP6	P25	Sls - Wp3 -	Cuo	Fluorescence Measurement Of	"fpg" Modified Alkaline Single	C3a	Hepg2/c3a (atcc® Crl-10741™), Derivative Of	CuO.xlsx
20	WP6	P25	Sls - Wp3 -	Cuso4	Fluorescence Measurement Of	"fpg" Modified Alkaline Single	C3a	Hepg2/c3a (atcc® Crl-10741™), Derivative Of	CuSo4.xlsx
22	WP6	P25	Sls - Wp3 -	Cuo, Wcco	Fluorescence Measurement Of	"fpg" Modified Alkaline Single	C3a	Hepg2/c3a (atcc® Crl-10741™), Derivative Of	interference.xlsx
23	WP6	P25	Sls - Wp3 -	Wcco	Fluorescence Measurement Of	"fpg" Modified Alkaline Single	C3a	Hepg2/c3a (atcc® Crl-10741™), Derivative Of	WCCo.xlsx
25	WP6	P26	Karolinska	Copper Oxide Nanoparticles	Cytotoxicity	Alamar Blue	Raw264.7	Mouse Macrophages	SUN_WP6_CuO_Raw264.7_AlamarBlue_Cytokine.xls	SUN-TMDF-WP6-P26-CellViability-AlamarBlue-RAW264.7.doc
34	WP6	P26	Karolinska	Fp7-sun Priority Pristine Nanomaterials	Luminex		RAW 264.7	Mouse peritoneal macrophages	FP7SUN_Luminex_RAW264.7_2016.xls	SUN-TMDF-WP6-CytokineMultiplex_Kl.doc
36	WP6	P26	Karolinska	Multi-walled Carbon Nanotubes	Cytotoxicity	Alamar Blue	Raw264.7	Mouse Macrophages	SUN_WP6_MWCNT_Raw264.7_AlamarBlue_24h.xls	SUN-TMDF-WP6-P26-CellViability-AlamarBlue-RAW264.7.doc
37	WP6	P26	Karolinska	Multi-walled Carbon Nanotubes	Cytotoxicity	Alamar Blue	Raw264.7	Mouse Macrophages	SUN_WP6_MWCNT_Raw264.7_AlamarBlue_48h.xls	SUN-TMDF-WP6-P26-CellViability-AlamarBlue-RAW264.7.doc
38	WP6	P26	Karolinska	Fe2o3 P Red 101	Cytotoxicity	Alamar Blue	Raw264.7	Mouse Macrophages	SUN_WP6_Pred101_Raw264.7_AlamarBlue.xls	SUN-TMDF-WP6-P26-CellViability-AlamarBlue-RAW264.7.doc
39	WP6	P26	Karolinska	Orgp Red 254	Cytotoxicity	Alamar Blue	Raw264.7	Mouse Macrophages	SUN_WP6_Pred254_Raw264.7_AlamarBlue.xls	SUN-TMDF-WP6-P26-CellViability-AlamarBlue-RAW264.7.doc
40	WP6	P26	Karolinska	Silicon Dioxide	Cytotoxicity	Alamar Blue	Raw264.7	Mouse Macrophages	SUN_WP6_SiO2_Raw264.7_AlamarBlue.xls	SUN-TMDF-WP6-P26-CellViability-AlamarBlue-RAW264.7.doc
41	WP6	P26	Karolinska	Tio2(in Acid Water)	Cytotoxicity	Alamar Blue	Raw264.7	Mouse Macrophages	SUN_WP6_TiO2 HCl_Raw264.7_AlamarBlue.xls	SUN-TMDF-WP6-P26-CellViability-AlamarBlue-RAW264.7.doc
42	WP6	P26	Karolinska	Tio2(in Monopropylene Glycol)	Cytotoxicity	Alamar Blue	Raw264.7	Mouse Macrophages	SUN_WP6_TiO2resin_Raw264.7_AlamarBlue.xls	SUN-TMDF-WP6-P26-CellViability-AlamarBlue-RAW264.7.doc

Figure 6: Example records of In-vitro assays.

7. Overview of data returns to WP1

After considerable interaction with the various work packages to obtain their data, particularly over the last 6 to 9 months of the project, a large number of datasets have been collected and added to the SUN database. This section summarises the data obtained by WP.

WP1: Case study value chains

SUN Characterisation PDF report of pristine nanomaterials for (Eco)toxicological testing (D1.4) data has been exported to Excel spreadsheets (Fig 7) and incorporated into the SUN operational database. An overall summary of primary characterization results is given in Table 1.

SUN - characterisation of pristine nanomaterials for (eco)toxicological testing

Introductory worksheet - Please treat this as read-only & do not alter the data in this spreadsheet file, which during the project is only for limited distribution to SUN partners, or approved others subject to confidentiality discussions and approval from project leader Danail Hristozov (danail.hristozov@unive.it).

Do not alter or update the data in this edition; if you discover any errors, or anomalies, or have data to be added, please inform peter.ritchie@iom-world.org & shahzad.rash

The data may be updated in the SUN project as work progresses, in which case an update will be issued when necessary.
This flexible spreadsheet format can be used, allowing different data items and formats to be viewed and used by partners in the course of work.

The key sheets and their contents to date are:
WorkSheets: (Use the link to move directly to the particular sheet)

Samples_List	Table 1. Details of each SUN sample, specifying material, SUN code, CAS-number and supplier.
Primar_Char_Summary	Table 2. Summary of primary characterization performed by each partner.
Primary_Char_Results_Summary	Table 3. Summary of primary characterization results
TEM_Primary_Size_Distribution	Table 4. Observation and measurement results of TEM primary size distribution.
TEM_Micrographs	Table 5. Representative TEM micrographs and measured particle size distributions for selected samples.
Crystallite_Size_Phases	Table 3. Summary of primary characterization results
Dispersability_Water_Biological	Table 6. Water and biological medium dispersibility results. The results in italic are calculatet by do not taking in account the peaks from the b
Z_Potential	Table 7: Z-potential results in UP water and Table 8: Z-potential results at pH7.
Photocatalytic_Activity	Table 9. Photocatalytic activity data indicated as photon efficiency.
Surface_Area_Pore_Size	Table 10. Surface area and pore size results. Pore size analysis method are reported in brackets (BJH: Barrett, Joyner, and Halenda; AVG: Avera
Average_Agglomeration_No	Table 11. AAN for water dispersions and Table 12. AAN for biological medium dispersions
Surface_Chemistry	Table 3. Summary of primary characterization results

Table 1: Summary of primary characterization results

	Tech-nique	Fe_2O_3_1_ NP_PROD	CuO_1_ NP_PROD	MWCNT_1_ NP_PROD	SiO_2_1_ NP_PROD	TiO_2 acid water_1_ NP_PROD	TiO_2 monopropylene glycol_1_ NP_PROD	WC+Co_1_ NP_PROD	OrgPig_1_ NP_PROD
Primary size distribution Min- Max (average) Mode (1st quartile .. 3rd quartile) [nm]	TEM	11-112 (37) 32 (28..43)	3-35 (12) 10 (9.2..14)	Ø: 4-16 (8) 7.4 (6.7..9.2) L: 575-3462 (1543) 1020 (920..1800)	3-27 (11) 9.5 (8..14)	1-15 (4) 3.2 (2.9..4.4)	1-5 (3) 2.8 (2.5..3.5)	23-1446 (170) 48 (69..280)	14-151 (43) 26.3 (29.8..49.8)
Shape	TEM	Irregular rounded particles	Semi-spherical particles	Bent and partially entangled multiwalled	Irregular polyhedrons and some spherical particles	Very small irregular polyhedrons and some spherical particles	Very small irregular polyhedrons	Irregular polyhedral particles and some semi-spherical with edges	Irregular polyhedrons and some small semi-spherical particles
Average crystallite size [nm]	XRD	40	9.3	*Not measurable*	*(JRC-IHCP) Synthetic amorphous silicon dioxide, impurities of Bohemite*	18 (43%) 6.8 (57%)	10.6 (14%) 3.2 (86%)	15.4	*No database available*
Crystallite phases (%)	XRD	Hematite 100%	Tenorite 100%	*(Nanogenotox) carbon nanotubes*	*(JRC-IHCP) 22 nm*	Main phases: Brookite and rutile; Third phase: a salt or an oxide	Mix of anatase, rutile and brookite	Tungsten carbide 100%	*No database available*

Dispersability in water: D_{50} [nm]; average agglomeration number (AAN)	DLS	177.3 ± 6.6; 39	139.5 ± 4.6; 346	*(JRC-IHCP) 175.9 ± 4.5; 2419*	*(ENPRA) 216; 6036*	85.9 ± 1.3; 19411	82.1 ± 4.8; 25117	182.8 ± 21.5; 31	137.3 ± 4.6; 41
Dispersability in modified MEM provided by the Heriot-Watt University: D_{50} [nm]; average agglomeration number (AAN)	DLS	148.2 ±2.2; 23	85.2±2.7; 77	*Not available*	*Not available*	60.0 ± 2.6; 6592	*Unstable sample*	315 ± 18; 159	84.4 ± 4.5; 9
Z-potential in UP water [mV]	ELS	+32.0 ± 0.7	+28.1 ± 0.6	*Unstable sample*	-37.6 ± 0.8	+39.3 ± 1.1	+32.9 ± 2.2	+7.1 ± 0.5	-20.8 ± 1.3
Isoelectric point [pH]	ELS	9.7	10.3	*Unstable sample*	1.8	*In progress*	*In progress*	<2	2.1
Photocatalysis: photon efficiency [unitless]	Methylene blue degradation	Not measurable (pigment)	1.5×10^{-4}	9.5×10^{-5}	1.3×10^{-4}	2.4×10^{-3}	2.4×10^{-3}	6.7×10^{-4}	Not measurable (pigment)
Specific Surface Area [$m^2 g^{-1}$]	BET	22.6 ± 0.1 30 (from producer)	47.0 ± 1.7	*From other EU project 339.3 ± 17.3*	*From other EU project 190.5 ± 4.0*	*Sample degradation during degassing*	*Sample degradation during degassing*	6.6 ± 0.4	94 *(from producer)*
Pore sizes [nm]	BET	65 *(from producer*	13.5 ± 1.6 (BJH) 23.0 ± 0.9 (AVG)	*Not available*	*Not available*	*Sample degradation during degassing*	*Sample degradation during degassing*	Non porous	80, 200 to 2×10^5 *(from producer*

Surface chemistry [atomic fraction]	XPS	*C 50.7 O 33.7 Fe 15.6 (from producer)*	Cu = 0.46±0.05 O = 0.47±0.05 C= 0.07±0.01	*Not available*	*(JRC-IHCP) O (72.1 at%), Si (25.0 at%) and C (2.9 at%) due to surface contamination.*	*In progress*	*In progress*	Co=0.08±0.01 W=0.05±0.01 O=0.31±0.03 C=0.56±0.05	***C 77.1 O 10.9 N 5.9 Cl 6.1 (from producer)***
Structure	FT-IR and/or RAMAN	Match with Fe_2O_3 database	Match with CuO database	*(ENPRA) High D/G bands ratio: high concentration of defects*	*Not available-*	*In progress*	*In progress*	Match with O-W-O bonds	Match with Organic Pigment Red 254 database
Chemical impurities [mg kg^{-1}]	ICP-MS	Cr: 32±2 Mass loss in TGA: -0.7% from 35°C to 800°C	Na: 505±30 Pb: 36±2 Ag: 13±4	Nanogenotox-1: Al: 42192±3352 Co: 1911±274 Fe: 3455±410; Nanogenotox-2: Al: 32627±13318 Co:1362±523 Fe: 2667±973	No element over 10	Si: 1143±137 Al: 4±1 Zn: 0.7±0.1	Ag: 3.6±0.02 Al: 2.8±0.6 As: 2.1±0.14 Zn: 1.3±0.08 Cu: 0.47±0.15 Co: 0.36±0.001 Cr: 0.002±0.001	Co: 83269±2213 Fe: 1654±38 Cr: 79±2 Cu: 14±2 Mo: 12.7±0.2 Mn: 10.6±0.5 Re: 6.6±0.2 Ta: 5.3±0.1	*No efficient sample digestion Mass loss in TGA: -2.9% from 35°C to 315°C*

WP2: Lifecycle thinking

Life cycle assessment (LCA) of selected Nano products and associated materials (D2.3) and Umberto NXT LCA - Impact Assessment Analysis LCIA raw data including charts & pivot tables (fig 9) have been attached and uploaded to the SUN operational database (fig 8).

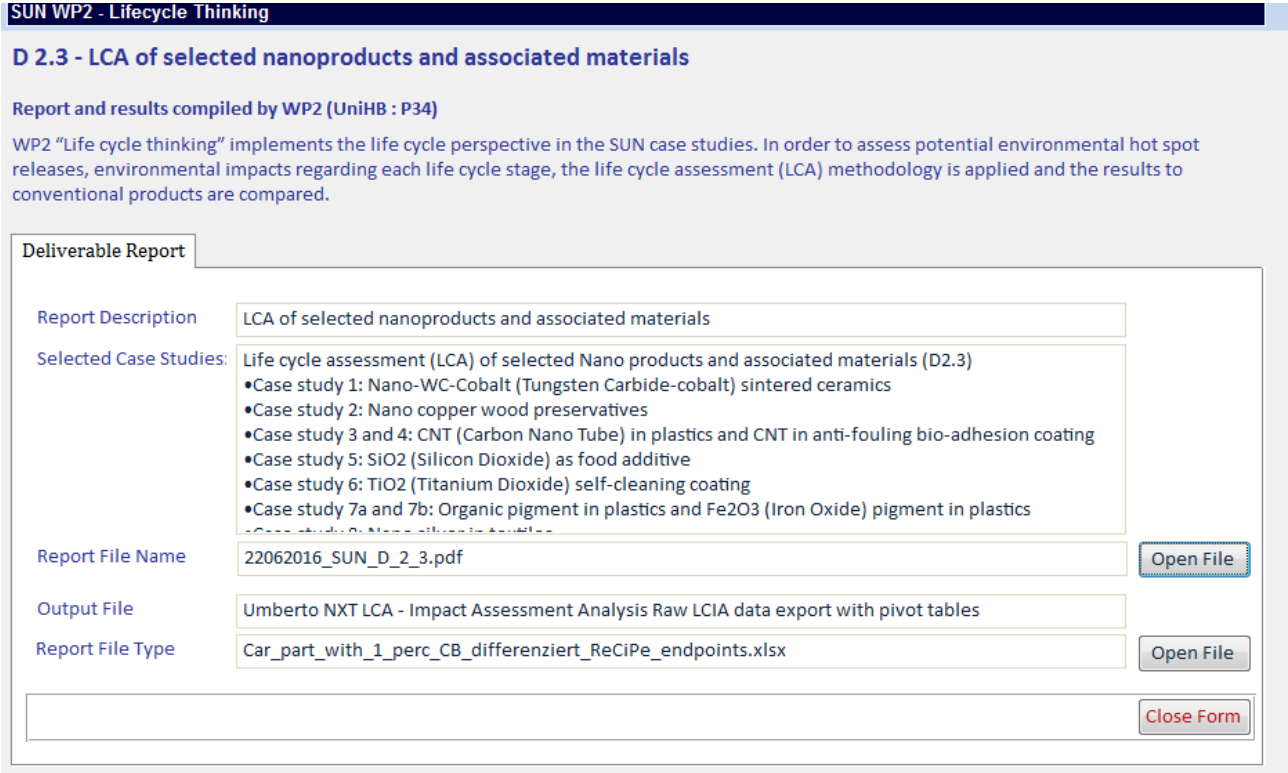


Figure 8: Life cycle assessment raw data and report

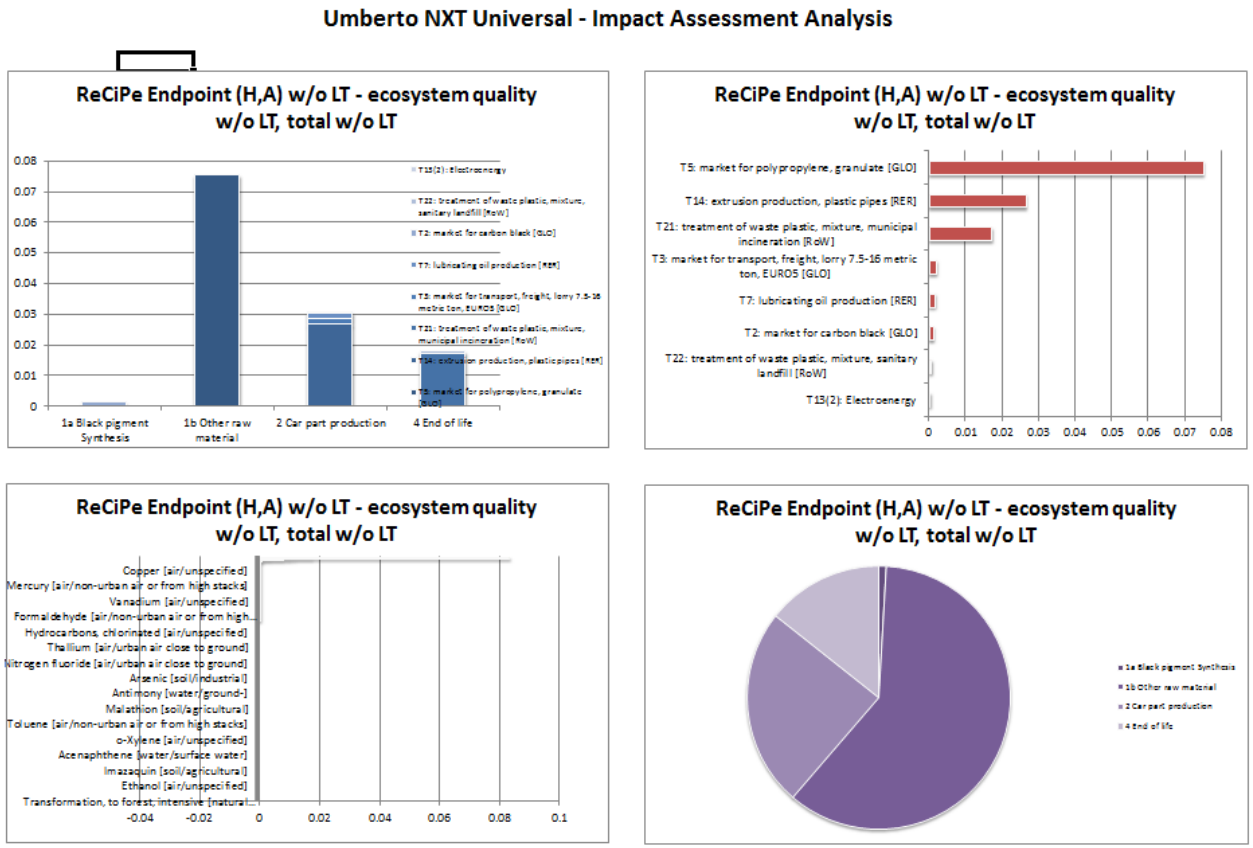


Figure 9: Umberto NXT LCA - Impact Assessment Analysis charts

WP3: Environmental release, fate and exposure

Table 2 summarises the data returns from WP3 partners, which have been catalogued and linked to the database, giving a current total of 28 datasets.

Table 2: Summary of environmental release and exposure data

Test Assay	*Objective*	*Task*	*Output Description*	*Approx. Date*	*Related Excel Files*	*SUN Deliverable*
Weathering of Fe2O3_PE_USE and PE_USE (protocol adapted from ISO 4892-2:2009-11)	*Characterize the degradation of PE nanocomposite upon weathering.Quantify the release of Fe2O3 NOAA upon weathering.*	*Task 3.2*	*Release rate (ie numerical data in mg.m-2)FTIR spectra (27)XRD diagrams (7)Crystallite sizeX-ray computed microtomography (4)*	*Start : 08/14 End : 12/16*	*Release rates : 2015 02 26 ICP-MS Fe Lixi A&D Fe2O3_PE_USE FreeFe.xlsx 2015 06 15 ICP-MS Lixi Suntest A&D Fe2O3_PE_USE TotFe.xslx FTIR analysis: 2016 12 06 Fe2O3_PE spectres corriges.xlsx 2016 12 06 PE_USE spectres corriges.xslx 2016 10 10 OrgPig_PE spectres corriges.xslx 2016 12 07 Peak Area analysis_Fe2O3_PE.xslx FIT_IR.xslx XD: 2015 03 05 Bilan DRX.ppt X-ray computed microtomogaphy : Fig_tomo_vf.jpg*	*D3.1*
Weathering of Fe2O3_PE and PE fragmented products	*Compare weathering of bulk materials and fragmented productsProduce weathered fragmented product for use in other work packages*	*Task 3.3*	*WFP massFTIR spectra (8)XRD diagrams (8)Crystallite sizes (12)*	*Start: 02/15 End: 04/15*	*2016 12 06 FTIR FP weathering.xslx 2015 07 SUN_DRX FP_8w_12w.ppt*	*D3.1*
HNO3 dissolution and reductive dissolution of	*Define a reliable method to quantify surface-available Fe in*	*Task 3.1*	*Extraction yields (3)Surface available fraction (2)*	*Start: 01/15 End: 03/15*	*2015 02 10 ICP-AES Fe Tests Extractions H2O + HNO3.xslx 2015 02 11-12 ICP-AES Fe Mineralisations*	*D3.2*

surface-available Fe in Fe2O3_PE_FOR and Fe2O3_PE_FP_USE	*lixiviates obtained from weathering experiments*				*MW290115.xslx 2015 02 12 ICP-AES Fe Extractions CBD 01 15.xslx*	
Mineralization of PE matrix	*Validate method for quantification of total Fe released in the lixiviates of weathering experiments*	*Task 3.1*	*Fe concentration in solids samples (3)*	*Start: 01/15 End: 02/15*	*2015 02 11-12 ICP-AES Fe Mineralisations MW290115.xslx*	*D3.2*
Separation of CuO NOAA adsorbed in sediments	*Validate a method for reliable extraction of CuO NOAA from sediments*	*Task 3.1*	*Size distributions Cu recovery rates (6)*	*Start: 02/15 End: 07/15*	*(CEINT) CuO Spiked Sediment Data.xslx*	*D3.2*
Weathering of wood blocks coated with CuO_Acryl_FOR and Acryl_FOR (protocol adapted from EN 927-6:2007)	*Characterize the degradation of CuO_paint upon weathering.Quantify the release of Cu upon weathering and determine under what form it is released.*	*Task 3.2*	*Release rate (ie numerical data in mg.m-2)*	*Start: 04/15 End: 12/16*	*2015 09 ICP-MS Cu Ti - CuO_acryl Lixiviates.xslx*	*Data not reported under D3.1 due to delays in paint production*
Weathering of wood blocks impregnated with CuAmine and CuCO3 (protocol adapted from EN 927-6:2007)	*Quantify the release of Cu and compare it with Cu releases from CuO enriched paint.*	*Task 3.2*	*Release rate (ie numerical data in mg.m-2)*	*Start:06/15 End: 12/16*	*2015 11 ICP-MS Cu Ti - Lixiviates CuAm-CuCO3.xslx*	*Data not reported under D3.1 due to delays in CuCO3 supplies*
Aging of CuO NOAA in Volvic water	*Batch study to evaluate possible transformation of CuO*	*Task 3.5*	*pH vs time (7)zeta potential vs time (7)Cu dissolution*	*Start: 06/15 End: 07/15*	*Aging of CuO NP Data Tables_LS.xslx*	*D3.4*

	NOAA in mesocosms experiments		*rate (3)*			
CuO_Acryl_FOR and Acryl_FOR milling	*Develop a method to produce suspensions fragmented products from acrylic and CuO paintsCharacterize the obtained FP suspensions*	*Task 3.3*	*Size distributions*	*Start: 06/15 End: 10/15*	*2015 07 Paint milling synthesis.xslx*	*D3.4 MS6*
Mesocosm experiments with CuO NOAA and CuO_Acryl_FP	*Determine environmental fate of CuO NOAA and CuO_paint FPs (=released NOAA)*	*Task 3.5*	*Cu concentration in different compartments (water, sediments, organisms)Cu distribution inside mesocosms systemsCu dissolution rateCuO NOAA biotransformation*	*Start: 10/15 End: 12/16*	*Cu concentrations and distribution: 2016 07 05 ICP-MS CE CuO.xslx 2016 09 12 ICP-MS Sed_CuO.xslx 2016 11 28 ICP-MS Mesocosmes CuO-Org.xslx Physico-chemical monitoring : Phys-chem parameters mesoCuO.tif*	*D3.4*
CS with CNT, Concentrations CS = Case Study	*Concentrations*	*Task 3.7*	*5 R files (*.Rda) Probability distributions simulations arranged in a matrix of 8 rows and 100,000 columns.*	*Start Date March 2016 September 2016*	*(*.RDA)*	*D3.7*
CS with Copper Oxide, Concentrations	*Concentrations*	*Task 3.7*	*4 R files (*.Rda) Probability distributions simulations*	*Start Date March 2016 September*	*(*.RDA)*	*D3.7*

			arranged in a matrix of 8 rows and 100,000 columns.	*2016*		
CS with DPP, Concentrations	*Concentrations*	*Task 3.7*	*5 R files (*.Rda) Probability distributions simulations arranged in a matrix of 8 rows and 100,000 columns.*	*Start Date March 2016 September 2016*	*(*.RDA)*	*D3.7*
CS with Iron Oxide, Concentrations	*Concentrations*	*Task 3.7*	*5 R files (*.Rda) Probability distributions simulations arranged in a matrix of 8 rows and 100,000 columns.*	*Start Date March 2016 September 2016*	*(*.RDA)*	*D3.7*
CS with Silica Dioxide Concentrations	*Concentrations*	*Task 3.7*	*5 R files (*.Rda) Probability distributions simulations arranged in a matrix of 8 rows and 100,000 columns.*	*Start Date March 2016 September 2016*	*(*.RDA)*	*D3.7*
Summary file	*Summary information of the data delivered.*	*Task 3.7*	*1 Excel file Summary statistics (mean values) of the distributions generated and description*	*Start Date March 2016 September 2016*	*Task_3_7_data_summary.xlsx*	*D3.7*

			on how to access to the R files.		
Production of 14C-MWCNT/PP and epoxy nanocomposites	*Embedding of 14C-MWCNT in PP and epoxy in order to produce composites comparable to the product used in the case studies*	*Task 3.2*	*Depiction of dispersion state of MWCNTs in PP and Epoxy*	*PP: 04/14-02/15 Epoxy: 07/15-10/15*	*D3.1*
Release of 14C-MWCNT/PP and epoxy fragments from radiated nanocomposites after mechanical treatment	*Measuring of release of radioactivity from composites (0, 30 and 90 d of radiation) after different levels of mechanical treatment (knocking, shaking in water, wiping)*	*Task 3.2*	*EXCEL Sheet with release data (in % of embedded 14C-MWCNTs)*	*PP: 02/15-06/15 Epoxy: 10/15-01/16*	*D3.1*
Release of 14C-MWCNT/PP and epoxy fragments from radiated nanocomposites in fresh and sea water	*Measuring of release of radioactivity from untreated & radiated composites in fresh and sea water at several time points (max. 210 d, 60 rpm)*	*Task 3.2*	*EXCEL Sheet with release data (in % of embedded 14C-MWCNTs)*	*PP: 07/15-02/16 Epoxy: 02/16-08/16*	
Release of 14C-MWCNT/PP and epoxy fragments from radiated nanocomposites in sediment (quartz	*Measuring of release of radioactivity from untreated & radiated composites in quartz sand at several time points (max. 100 d, 60*	*Task 3.2*	*EXCEL Sheet with release data (in % of embedded 14C-MWCNTs)*	*PP: 11/15-04/16 Epoxy: 02/16-06/16*	

sand)	*rpm)*				
Release of 14C-MWCNT/PP and epoxy fragments from radiated nanocomposites in soil (Refesol 02 A)	*Measuring of release of radioactivity from untreated & radiated composites in soil at 63 and 188 d, Mineralization of radioactivity*	*Task 3.2*	*EXCEL Sheet with release data (in % of embedded 14C-MWCNTs)*	*PP: 11/15-05/16 Epoxy: 01/16-07/16*	
Investigation of MWCNT/PP and epoxy composites and fragments via SEM and TEM after each release experiment	*Analysis of the shape of the released material (containing MWCNTs or free MWCNTs) and the surface of radiated nanocomposites after mechanical treatment and environmental media*	*Task 3.2*	*Depiction of released material and surfaces of the nanocomposites by means of SEM/TEM*	*PP: 05/15-06/16 Epoxy: 01/16-06/16*	
Production of MWCNT/PP and epoxy WFP from FP	*Weathering of FP by radiating fragmented products with simulated sunlight (90 d, 50 W/m²) to weathered fragmented product (WFP)*	*Task 3.3*		*PP: 04/15-08/15 Epoxy: 01/16-04/16*	
Release of Fe2O3 NOAA serving as pigments in polyethylene	*Measure dissolved and nanoparticulate iron released in water media and calculate leaching rates*	*Task 3.5*	*Type of datasets: tables reporting mass concentrations of dissolved iron and number concentrations of*	*01/15 – 11/15*	*170203_SUN_AgNP-dissolution.xlsx D3.4 Data_Inventory_UNIVIE.xlsx method_schematic.pdf*

			particulate iron; deliverable reports. Number of datasets: 2				
Release of CuO NOAA incorporated in antifungal paints (wood preservative coating)	*Measure dissolved and nanoparticulate copper released in water media and calculate leaching rates*	*Task 3.5*	*Type of datasets: tables reporting mass concentrations of dissolved copper and number concentrations of particulate copper; deliverable reports. Number of datasets: 2*	*01/15*	*–*	*170203_SUN_AgNP-dissolution.xlsx Data_Inventory_UNIVIE.xlsx method_schematic.pdf*	*D3.4*
Release of surface-available CNT NOAA incorporated in epoxy matrix	*Determine the amount of CNTs on the surface of the epoxy material*	*Task 3.5*	*Type of datasets: tables reporting mass concentrations of dissolved iron and cobalt; deliverable reports. Number of datasets: 2*	*01/16*	*–*	*170203_SUN_AgNP-dissolution.xlsx Data_Inventory_UNIVIE.xlsx method_schematic.pdf*	*D3.4*
Release of surface-available CNT NOAA incorporated in polypropylene matrix	*Determine the amount of CNTs on the surface of the PP material*	*Task 3.5*	*Type of datasets: tables reporting mass concentrations of dissolved iron and cobalt; deliverable reports. Number of datasets: 2*	*01/16*	*–*	*170203_SUN_AgNP-dissolution.xlsx Data_Inventory_UNIVIE.xlsx method_schematic.pdf*	*D3.4*
Release of surface	*Determine the amount*	*Task*	*Type of datasets:*	*01/16*	*–*	*170203_SUN_AgNP-dissolution.xlsx*	*D3.4*

available Fe2O3 NOAA serving as pigments in polyethylene	*of Fe2O3 nanoparticles on the surface of the PE material*	*3.5*	*tables reporting mass concentrations of dissolved iron; deliverable reports. Number of datasets: 2*	*04/16*	*Data_Inventory_UNIVIE.xlsx method_schematic.pdf*

WP4: Ecotoxicology

The ecotoxicology summary results files, with a variety of test types received, have been catalogued and linked to the database giving a current total of 187 tests and assay results datasets as shown in Table 3.

Table 3: Summary of WP 4 Ecotoxicology Test results returned and added to database

Substance Name	End Point	Cell Type	Cell Type Desc	Count
Cnt	Springtails Tests	F Candida	Folsomia Candida	1
Cocl2 Salt (ion Control)	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cocl2 Salt (ion Control)	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cocl2 Salt (ion Control)	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cocl2 Salt (ion Control)	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cocl2 Salt (ion Control)	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cocl2 Salt (ion Control)	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Copper Oxide Nanoparticles	Zebrafish Embryo Test	Zebrafish Embryos	Danio Rerio	3
Copper Sulphate	Zebrafish Embryo Test	Zebrafish Embryos	Danio Rerio	3
Cuo	Potential Ammonium Oxidation (iso 15685:2012)			8
Cuo	Springtails Tests	F Candida	Folsomia Candida	1
Cuo_1_np_pei Cuo_1_np_pvp; Cuo_1_np_citrate;	Multispecies Test		F. Candida, P. Minuta, H. Assimilis And M. Macrochaeta, H. Aculeifer, E. Crypticus	1

Substance Name	End Point	Cell Type	Cell Type Desc	Count
Cuo_1_np_ascorbate				
Cuo_1_np_syn	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_1_np_syn	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	2
Cuo_1_np_syn	Earthworm In Vitro Tests	Coelomocytes	Eisena Fetida	1
Cuo_1_np_syn	Earthworm Tests	E Fetida	Eisena Fetida	2
Cuo_1_np_syn	Lymanea Stagnalis Acute Lethal Tests	L. Stagnalis	Lymnaea Stagnalis	1
Cuo_1_np_syn	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	2
Cuo_1_np_syn	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	2
Cuo_1_np_syn	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	3
Cuo_1_np_syn	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	2
Cuo_1_np_syn	Multispecies Test		F. Candida, P. Minuta, H. Assimilis And M. Macrochaeta, H. Aculeifer, E. Crypticus	1
Cuo_101_sol_bm_syn	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_101_sol_bm_syn	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_101_sol_bm_syn	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_101_sol_bm_syn	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_101_sol_bm_syn	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_101_sol_bm_syn	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_102 _sol_bm_cit_syn	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_102 _sol_bm_cit_syn	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_102 _sol_bm_cit_syn	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_102 _sol_bm_cit_syn (modified With Citrate)	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_102 _sol_bm_cit_syn (modified With Citrate)	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_102 _sol_bm_cit_syn (modified With Citrate)	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_104_sol_bm_pei_syn (modified With Pei)	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1

Substance Name	End Point	Cell Type	Cell Type Desc	Count
Cuo_104_sol_bm_pei_syn (modified With Pei)	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_104_sol_bm_pei_syn (modified With Pei)	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_104_sol_bm_pei_syn (modified With Pei)	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_104_sol_bm_pei_syn (modified With Pei)	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_104_sol_bm_pei_syn (modified With Pei)	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_105_sol_bm_asc_syn (modified With Ascorbate)	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_105_sol_bm_asc_syn (modified With Ascorbate)	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_105_sol_bm_asc_syn (modified With Ascorbate)	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_105_sol_bm_asc_syn (modified With Ascorbate)	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuo_105_sol_bm_asc_syn (modified With Ascorbate)	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuo_105_sol_bm_asc_syn (modified With Ascorbate)	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuonm	Enchytraeus Crypticus	E Crypticus	Enchytraeus Crypticus	3
Cuonm	Enzyme Actitivy Patterns (iso/ts 22939:2010)			11
Cuonm	Microresptm			13
Cuonm	Potential Ammonium Oxidation (iso 15685:2012)			3
Cuo-nm	Potential Ammonium Oxidation (iso 15685:2012)			1
Cuo-np	Oecd Guideline 209			1

Substance Name	End Point	Cell Type	Cell Type Desc	Count
Cuso4	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuso4	Lymanea Stagnalis Acute Lethal Tests	L. Stagnalis	Lymnaea Stagnalis	1
Cuso4	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuso4	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuso4 (ion Control)	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuso4 (ion Control)	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuso4 (ion Control)	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuso4 Salt	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuso4 Salt	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuso4 Salt	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Cuso4 Salt (ion Control)	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuso4 Salt (ion Control)	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Cuso4 Salt (ion Control)	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Fe2o3	Oecd Guideline 209			1
Fe2o3_1_np_syn (pig Red101)	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Fe2o3_1_np_syn (pig Red101)	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Fe2o3_1_np_syn (pig Red101)	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Fe2o3p.red101	Potential Ammonium Oxidation (iso 15685:2012)			1
Fecl3 (ion Control)	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Fecl3 (ion Control)	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Fecl3 Salt (ion Control)	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Fecl3 Salt (ion Control)	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Fecl3 Salt (ion Control)	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Fecl3 Salt (ion Control)	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Feo2	Potential Ammonium Oxidation (iso 15685:2012)			1
Irgazin_pristine (org P.red 254)	Enchytraeus Crypticus	E Crypticus	Enchytraeus Crypticus	1

Substance Name	End Point	Cell Type	Cell Type Desc	Count
Irgazin_used (org Pig_1_pp_use_fp)	Enchytraeus Crypticus	E Crypticus	Enchytraeus Crypticus	1
Iron Oxide Pigment	Springtails Tests	F Candida	Folsomia Candida	1
Lp 17206	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Lp 17206	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Lp 17206	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Lp 17623	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Lp 17623	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Lp 17623	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Lp 17623	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Lp17206	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Lp17206	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Lp17206	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Lp17623	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Lp17623	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Mwcnt	Potential Ammonium Oxidation (iso 15685:2012)			1
Mwcnts_1_np_syn	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Mwcnts_1_np_syn	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Mwcnts_1_np_syn	Daphnia Magna Acute Lethal Tests	D. Magna	Daphnia Magna	1
Mwcnts_1_np_syn	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Mwcnts_1_np_syn	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Mwcnts_1_np_syn	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Mwcnts_1_np_syn	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Na2wo4 Salt (ion Control)	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Na2wo4 Salt (ion Control)	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Na2wo4 Salt (ion Control)	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Na2wo4 Salt (ion Control)	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Na2wo4 Salt (ion Control)	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1

Substance Name	End Point	Cell Type	Cell Type Desc	Count
Na2wo4 Salt (ion Control)	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Nm-403	Potential Ammonium Oxidation (iso 15685:2012)			1
Org P. Red254	Potential Ammonium Oxidation (iso 15685:2012)			1
Orgpig (irgazin)	Springtails Tests	F Candida	Folsomia Candida	1
Pigment_1_np_syn	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Pigment_1_np_syn	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Pigment_1_np_syn	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Pigment_1_np_syn (orgpig Red254)	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Pigment_1_np_syn (orgpig Red254)	Daphnia Magna Acute Lethal Tests	D. Magna	Daphnia Magna	1
Pigment_1_np_syn (orgpig Red254)	Lymanea Stagnalis Acute Lethal Tests	L. Stagnalis	Lymnaea Stagnalis	1
Pigment_1_np_syn (orgpig Red254)	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Pigment_1_np_syn (orgpig Red254)	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Pigred101 (fe2o3_1_np_syn)	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Pigred101 (fe2o3_1_np_syn)	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Pigred101 (fe2o3_1_np_syn)	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Ref 17206	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Ref 17206	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Ref 17206	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Ref 17623	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Ref 17623	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Ref 17623	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Ref 17623	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Ref17206	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Ref17206	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Ref17206	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Ref17623	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1

Substance Name	End Point	Cell Type	Cell Type Desc	Count
Ref17623	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Wcco	Oecd Guideline 209			1
Wcco	Potential Ammonium Oxidation (iso 15685:2012)			2
Wcco	Springtails Tests	F Candida	Folsomia Candida	1
Wcco_1_np_syn	Cell Membrane Integrity (cfda-am)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Wcco_1_np_syn	Cell Membrane Integrity (cfda-am)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Wcco_1_np_syn	Daphnia Magna Acute Lethal Tests	D. Magna	Daphnia Magna	1
Wcco_1_np_syn	Lysosomal Activity (neutral Red)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Wcco_1_np_syn	Lysosomal Activity (neutral Red)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1
Wcco_1_np_syn	Metabolic Activity (alamarblue)	Clc	Carp (cyprinus Carpio) Leukocyte Cell Line	1
Wcco_1_np_syn	Metabolic Activity (alamarblue)	Rtl-w1	Rainbow Trout Liver Cells-waterloo 1	1

WP5: Occupational and consumer exposure

NOAA inhalation, dermal and dermal-to-oral exposure measurements, process-specific release potentials and exposure protection measures data received from WP5 giving total of 96 measurements. The data have been exported from NECID database which was used by the partners to capture the data originally and included in the SUN Operational Database. Table 4 summarises the available exposure measurement data.

Table 4: Summary of WP5 exposure scenarios

Product Name	Activity	Source Domain	Sampling Specification	Count
Carbon nanotubes	Extruder	Hot processes	Personal	5
Carbon nanotubes	Extruder	Hot processes	Static	2

Product Name	Activity	Source Domain	Sampling Specification	Count
Carbon nanotubes	Falling of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Personal	15
Carbon nanotubes	Falling of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Static	7
Carbon nanotubes	Other solids	Hot processes		2
Carbon nanotubes	Other solids	Hot processes	Personal	16
Carbon nanotubes	Other solids	Hot processes	Static	2
Carbon nanotubes	Transfer of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Personal	22
Carbon nanotubes	Transfer of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Static	14
Catalyst	Falling of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Personal	1
Catalyst	Falling of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Static	2
Catalyst	Transfer of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Personal	1
Catalyst	Transfer of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Static	1
metal-hydroxides	Falling of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Personal	2
metal-hydroxides	Falling of powders or granules	Handling and transfer of bulk manufactured nanomaterial powders	Static	3

WP6: In-vitro toxicology data

Table 5 summarises the in-vitro data returns which have been catalogued and linked to the database, giving a current total of 17 tests and assay results datasets.

Table 5: Summary of WP 6 test results returned and added to the database

Substance Name	End Point	Cell Type	Assay Name	No of test result files
Cocl2	Fluorescence Measurement Of Extracellular Single Cell Dna (%) After Electrophoresis	C3a	"fpg" Modified Alkaline Single Cell Gel Electrophoresis (scge) Or "comet" Assay	1
Copper Oxide	Fluorescence Measurement Of Viable Cells	C3a	Alamar Blue	1
Copper Oxide Nanoparticles	Cytotoxicity	Raw264.7	Alamar Blue	1
Copper Oxide Nanoparticles	Short Term Inhalations Tudy (stis)		Toxicity Endpoints (test 1) As Well As Kinetic Endpoints/organ Burden Analysis (test 2)	3
Copper Oxide Nanoparticles (cuo)	Short Term Oral Tudy (stos)		Toxicity Endpoints	1
Coppercarbonate Nanoparticles (cuco3)	Short Term Oral Tudy (stos)		Toxicity Endpoints	1
Cuo	Fluorescence Measurement Of Extracellular Single Cell Dna (%) After Electrophoresis	C3a	"fpg" Modified Alkaline Single Cell Gel Electrophoresis (scge) Or "comet" Assay	1
Cuo Pei And Asc	Pulmonary Inflammatory After L Inhalation Of Nanomaterials			4
Cuo, Wcco	Fluorescence Measurement Of Extracellular Single Cell Dna (%) After Electrophoresis	C3a	"fpg" Modified Alkaline Single Cell Gel Electrophoresis (scge) Or "comet" Assay	1
Cuso4	Fluorescence Measurement Of Extracellular Single Cell Dna (%) After Electrophoresis	C3a	"fpg" Modified Alkaline Single Cell Gel Electrophoresis (scge) Or "comet" Assay	1
Fe2o3 P Red 101	Cytotoxicity	Raw264.7	Alamar Blue	1
Fine Tungsten Carbide With Cobalt Binder	Cytotoxicity	Raw264.7	Alamar Blue	1
Fp7-sun Priority Pristine Nanomaterials	Luminex	RAW 264.7		1
Multi-walled Carbon Nanotubes	Cytotoxicity	Raw264.7	Alamar Blue	2

Substance Name	End Point	Cell Type	Assay Name	No of test result files
Orgp Red 254	Cytotoxicity	Raw264.7	Alamar Blue	1
Silicon Dioxide	Cytotoxicity	Raw264.7	Alamar Blue	1
Tio2(in Acid Water)	Cytotoxicity	Raw264.7	Alamar Blue	1
Tio2(in Monopropylene Glycol)	Cytotoxicity	Raw264.7	Alamar Blue	1
Tungsten Carbide - Cobalt	Fluorescence Measurement Of Viable Cells	C3a	Alamar Blue	1
Wcco	Fluorescence Measurement Of Extracellular Single Cell Dna (%) After Electrophoresis	C3a	"fpg" Modified Alkaline Single Cell Gel Electrophoresis (scge) Or "comet" Assay	1

WP6: In-vivo toxicology data

Table 6 summarises the in-vitro data returns which have been catalogued and linked to the database, giving a current total of 9 tests and assay results datasets.

Table 6: Summary of WP6 In-vivo test results returned and added to the database

Substance Name	End Point	Animal Name	Animal Age	No of test result files
Copper Oxide Nanoparticles	Short Term Inhalations Tudy (stis)	Wistar Rats	10 Weeks In Experiment	3
Copper Oxide Nanoparticles (cuo)	Short Term Oral Tudy (stos)	Wistar Rats Rjhan:wi	9-10 Weeks At Start Of Experiment	1
Coppercarbonate Nanoparticles (cuco3)	Short Term Oral Tudy (stos)	Wistar Rats Rjhan:wi	9-10 Weeks At Start Of Experiment	1
Cuo Pei And Asc	Pulmonary Inflammatory After L Inhalation Of Nanomaterials	Rjhan:wi	10 Weeks (exposures)	4

WP7: Safe production, handling and disposal

For WP7 a data set from the electrochemical tests performed on Cu2 and CuO NPs added saline buffers and biological media and summary of relevant results of Phys-Chem characterization, for (eco)Tox tests is linked to the operational database as in figure 9.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
test condition	code	Capping agent	Disaggregation	Syn media	caratterizzazione					tox in vitro test results			
					DLS		Dissolution 1h	Dissolution 24h	pH	BMD20	IC50	LC50 95h	EC50 (30 days)
					Z-Ave (nm)	ZP (mV)	Cu^{2+} / Cu_{tot} (%	Cu^{2+} / Cu_{tot} (%)					
MilliQ Water 100mg Cu/L (37 °C for dissolution)	CuO_24	Pristine	US	water	330	34.9			6.4				
	CuO_91	Pristine	BM	water	301	35			6.8				
	CuO_112	PEI	BM	water	222	49.9			7.3				
	CuO_113	ASC	BM	water	697	-8.3			6.4				
	CuO_106	CIT	BM	buffer PO4	226	-26.6			7.9				
	CuO_101	Pristine	BM	buffer PO4	1093	-9.1	0.43	0.23	6.5				
	CuO_102	CIT	BM	buffer PO4	368	-18	2.31	2.47	6.5				
	CuO_103	PVP	BM	buffer PO4	797	-8.1	0.98	0.29	6.5				
	CuO_104	PEI	BM	buffer PO4	247	28.3	2.09	3.56	6.5				
	CuO_105	ASC	BM	buffer PO4	122	-17.4	2.6	2.49	6.4				
		CuCO3	BM	buffer PO4	180.57	35.5	0.21	0.28	5.9				
MEM 100mg Cu/L (37 °C for dissolution)	CuO_01	Pristine		added from powder						✓ HWU (Stone)			
	CuO_101	Pristine	BM	buffer PO4	47.2	-10.1	62.21	74.86	8.2	✓ HWU (Stone)			
	CuO_102	CIT	BM	buffer PO4	89.5	-10.5	43.39	69.04	8.2	✓ HWU (Stone)			
	CuO_103	PVP	BM	buffer PO4	43.8	-10.1	50.66	42.51	8.2	✓ HWU (Stone)			
	CuO_104	PEI	BM	buffer PO4	46.1	-10.5	34.97	53.8	8.2	✓ HWU (Stone)			
	CuO_105	ASC	BM	buffer PO4	51.6	-9.5	42.88	60.16	8.2	✓ HWU (Stone)			
		CuCO3	BM	buffer PO4									
DMEM 50mg Cu/L (37 °C for dissolution)	CuO_101	Pristine	BM	buffer PO4	55.1	-8.2	66.9	84.26	8.1	✓ KI (Bengt)	✓ KI (Bengt)		
	CuO_102	CIT	BM	buffer PO4	37.4	-9.7	67.21	83.64	7.9	✓ KI (Bengt)	✓ KI (Bengt)		
	CuO_103	PVP	BM	buffer PO4	52.9	-9.4	61.97	82.51	7.9	✓ KI (Bengt)	✓ KI (Bengt)		
	CuO_104	PEI	BM	buffer PO4	44.6	-10.1	61.97	82.51	7.9	✓ KI (Bengt)	✓ KI (Bengt)		
	CuO_105	ASC	BM	buffer PO4	72.8	-9.2	63.14	81.74	7.9	✓ KI (Bengt)	✓ KI (Bengt)		
OECD 50mg Cu/L (25 °C for dissolution)	$CuSO_4$			water								✓ HWU (Ricottone)	
	CuO_01	Pristine		added from powder								✓ HWU (Ricottone)	✓ HWU (Ricottone)
	CuO_101	Pristine	BM	buffer PO4	2364	-3.37	0.03	0.09	7.1			✓ HWU (Ricottone)	✓ HWU (Ricottone)
	CuO_102	CIT	BM	buffer PO4	1615	-10.6	1.28	1.37	6.4				
	CuO_103	PVP	BM	buffer PO4	2098	-6.69	0.04	0.01	7.3			✓ HWU (Ricottone)	✓ HWU (Ricottone)
	CuO_104	PEI	BM	buffer PO4	284	22.35	2.38	2.58	7.7				
	CuO_105	ASC	BM	buffer PO4	1719	-9.52	0.95	0.9	6.7			✓ HWU (Ricottone)	✓ HWU (Ricottone)
AFW 100mg Cu/L (25 °C for dissolution	CuO_101	Pristine	BM	buffer PO4	4244.5	-3.5	0	0.25					
	CuO_102	CIT	BM	buffer PO4	3890	-3.58	2.52	2.05					
	CuO_103	PVP	BM	buffer PO4	5964.5	1.64	0.02	0.1					
	CuO_104	PEI	BM	buffer PO4	2443.5	20.9	6.88	6.26					
	CuO_105	ASC	BM	buffer PO4	2142	-8.08	1.2	0.71					
AMW 100mg Cu/L (25 °C for	CuO_101	Pristine	BM	buffer PO4	4279.5	7.61	0.04	0.27					
	CuO_102	CIT	BM	buffer PO4	3395.5	4.53	3.07	2.41					
	CuO_103	PVP	BM	buffer PO4	5077.5	6.48	0.06	0.12					
	CuO_104	PEI	BM	buffer PO4	4918.5	10.08	3.15	7.41					

Figure 9: Summary of results of Phys-Chem characterization, for (eco) Tox

WP 4 OMICS Datasets

Given the voluminous nature of OMICS results files these tests stored their OMICS data in industry standard fashion in recognised formats in appropriate OMICS public repositories. These can be made accessible to permitted users. The NCBI repository is used to suitably catalogue and publish the Folsomia candida genome sequence datasets. This strategy is clearly more practical than attempting to attach huge volumes of data directly to the SUN Operational or the eNanoMapper databases, neither of which have the capacity or facilities to manage such voluminous datasets. In liaison with the omics data co-ordinator, we have obtained summary descriptive information and uploaded this to the Operational Database to provide basic information describing the datasets which are in turn hyperlinked to the appropriate project page and OMICS dataset resources in the on-line repository. This is demonstrated in figure 10.

SUN - OMICS

Folsomia candida strain:VU population Genome sequencing and assembly

Accession	PRJNA299291
Data Type	Genome sequencing and assembly
Scope	Monoisolate
Submission	Registration date: 20-Oct-2015
NCBI Portal	https://www.ncbi.nlm.nih.gov/bioproject/PRJNA299291/
UV Portal	http://collembolomics.nl/folsomia/portal/data/
Organism	Folsomia candida[Taxonomy ID: 158441] Eukaryota; Metazoa; Ecdysozoa; Arthropoda; Hexapoda; Collembola; Collembola; Entomobryomorpha; Isotomoidea; Isotomidae; Proisotominae; Folsomia; Folsomia candida

Enchytraeus crypticus strain:VU strain Transcriptome or Gene expression

Accession	PRJNA207507
Data Type	Transcriptome or Gene expression
Scope	Multiisolate
Submission	Registration date: 7-Jun-2013
NCBI Portal	https://www.ncbi.nlm.nih.gov/bioproject/PRJNA207507/
Organism	Enchytraeus crypticus[Taxonomy ID: 913645] Eukaryota; Metazoa; Lophotrochozoa; Annelida; Clitellata; Oligochaeta; Haplotaxida; Tubificina; Enchytraeidae; Enchytraeus; Enchytraeus crypticus

Close Form

Figure 10: external links to OMICS repositories

Folsomia candida genome sequence and related information can be found under Bioproject: PRJNA299291
https://www.ncbi.nlm.nih.gov/bioproject/PRJNA299291/
http://collembolomics.nl/folsomia/portal/data/

Files	Description
Fcan01.stats	*Folsomia candida* genome and annotation statistics
Fcan01_annotation.tsv	*Folsomia candida* annotation summary
Fcan01_proteins.fa.gz	*Folsomia candida* proteins
Fcan01_transcripts.fa.gz	*Folsomia candida* transcripts
Fcan01_assembly.fa.gz	*Folsomia candida* Assembly
Fcan01_genes.gff.gz	*Folsomia candida* genes (GFF)
Fcan01_repeats.gff.gz	*Folsomia candida* Repetitive sequences (GFF)
Fcan01_repeats.txt	*Folsomia candida* Repetitive sequences summary
Fcan01_swissprot.blastout	*Folsomia candida* blast results against SwissProt database
Fcan01_trembl.blastout	*Folsomia candida* blast results against TrEMBL database
Fcan01_interpro.tsv	*Folsomia candida* InterProScan results (TSV)
Fcan01_interpro.gff3	*Folsomia candida* InterProScan results (GFF)
Fcan01_mapping.bam	*Folsomia candida* Bowtie2 mapping (Illumina)
Fcan01_pacbio.bam	*Folsomia candida* mapping (PacBio)
Fcan01_VAR_filtered.vcf.gz	*Folsomia candida* variants (SNP/INDELs)
SRR935329_hisat2.bam	*Folsomia candida* HISAT2 transcriptome mapping (SRR935329)
SRR921597_hisat2.bam	*Folsomia candida* HISAT2 transcriptome mapping (SRR921597)

Transcript sequences used for bisulfite sequencing in Enchytraeus crypticus are deposited under: PRJNA207507
https://www.ncbi.nlm.nih.gov/bioproject/PRJNA207507/

8. Sharing of the operational SUN database

Notwithstanding other potential developments for data sharing in the near future with the eNanoMapper database via other projects as described in earlier sections and further below, it is anticipated that in future (as in other earlier projects, e.g. ENPRA and MARINA) the SUN operational database may be supplied to other interested third parties, subject to approval by the project coordinator and consortium and any appropriate confidentiality or other sharing agreements being made. This will be done with secure transit arrangements made in advance with any recipient, e.g. the files are only made available for transfer via an encrypted file format (in an encrypted zip file). In order to facilitate its use by others the database contains brief introductory information, available from the main menu, with contact details to obtain more information from WP1. In addition, introductory instructions for database users are also provided in a covering document.

9. Coordination activities with other projects

The SUN partners in WP1.2, initially following various achievements related to Nano-EHS phys-chem and toxicology data management, template development, and modelling have in recent years been closely involved in developments to harmonise and standardise the data, databases and methods to enhance the sharing and exchange of data in this field. This has been through work on FP7, and more lately H2020, projects, in the Nano-EHS community primarily via the Nano Safety Cluster (NSC), and beyond - e.g. via US-EU-CoR collaboration efforts. Such efforts aim to develop materials and methods so that Nano EHS project data will be able to conform as far as possible with emerging data standards for nanomaterials and Nano toxicology research, and associated database and ontology developments in the growing field of Nano Informatics. WP 1.2 partners have consistently been keen participants and significant contributors to these efforts in recent years.

We are also highly aware of and have been very actively and closely involved in recent years with the on-going collaborations and research – via connections with the NSC-WG4 (Database WG) and its active players in this field, via eNanoMapper members in the WG and the eNanoMapper coordinator via the Cluster and the US-EU CoR. We have also had other ongoing interactions on the exchange and update of our existing templates in the MODENA-COST action, and with other contemporary projects that have been examining: harmonisation, minimum information and data-definition standards for nanomaterials (phys-chem); ontologies; Nano-database design; and associated toxicology and exposure data formats, templates and handling and exchange processes. These projects include NanoPuzzles, MODERN, ongoing ISA-Tab-Nano developments, as well as in the context of information gathering and management the execution of a Nano-EHS database mapping exercise in PROSAFE. Naturally experiences and information flow to and from each of these research and development areas and projects in which we have been involved, including SUN, in mutually beneficial ways through cooperation, collaboration and sharing of knowledge and resources.

10. Coordination activities with eNanoMapper

WP1 T1.2 has been well aware of the FP7 eNanoMapper project and has positively interacted with it from first contact in 2014. ENanoMapper is developing a computational infrastructure for the management of toxicological data on engineered nanomaterials (ENMs) based on open standards, the development and use of appropriate ontologies and an interoperable design to enable a more effective, integrated approach to information sharing in nanotechnology EHS research. It has sought collaborators like SUN who are managing data in these fields. It is noted that some of the interactions and discussions we have had also had useful cross-over to the NANOSOLUTIONS project, as these also involved WP1 data management personnel contemporaneously to the SUN work.

Following initial contact we provided and discussed views on the “state of the art” in this field, in relation to the needs and a formal requirements analysis for nano-EHS data generators,

curators, managers and end users, with the eNanoMapper team. This was later followed-up with further interaction in a more in-depth interview (autumn 2014) and subsequently in many follow-up discussions with the eNanoMapper Project Coordinator and other eNanoMapper staff (principally EW and NJ) on ontology and database aspects many times over the last three years, particularly the last 18 months. Several similar and related discussions were also mediated by the US-EU-CoR, to which we also contributed.

SUN WP1 and eNanoMapper agreed interactions to help test developments, data formats and processes, with the aim of ultimately supplying (SUN) data to the idealised nano-EHS database when both were suitable for such an exchange. Initial priorities in this regard were for the exchange of phys-chem and (in-vitro) toxicology templates, and our involvement has undoubtedly contributed substantially to the data upload and exchange developments seen in eNanoMapper developments to date. We still aim to exploit these further, given a suitable eNanoMapper implementation for SUN being set up, and we are aware that hands-on training and guidance on their use has recently been made available.

We have interacted with eNanoMapper to develop, explore and assist in testing ideas, tools and solutions being developed, primarily in the areas of Nano-tox data, and to be able to access real case studies with toxicology and eco-toxicology datasets. We have had many positive interactions and discussion with the lead eNanoMapper database developer (NJ), particularly regarding the use and increasing harmonisation of data templates and formats. We had earlier anticipated making use in SUN of a far better developed and user friendly ISA-TAB-Nano based format and process for nano-EHS toxicology test data (and its related metadata, ontology features etc.), as a test of eNanoMapper developments. However, this has proven a far harder model to implement in practice, with the preference pro-tem to use our IOM or JRC derived templates for data capture. The ISA-TAB-Nano is only recently meditated in the eNanoMapper implementation as an output format, and essentially is without end-user friendly interface facilities for data-entry, and we have not been in a position to be able “retro-fit” such developments into the SUN repository

Related developments by eNanoMapper in this area to which we have contributed greatly (via our collaboration on nano-tox templates), have progressed significantly in eNanoMapper. We currently understand that further work to progress various aspects of this will continue and that this is now to be undertaken within the NanoReg2 project, in which members of SUN WP1 will participate as part of the “data solutions team”. It is proposed that instances of eNanoMapper database will be implemented as receptacles for data from other earlier projects, which will include SUN. We have also agreed with eNanoMapper (autumn 2016) that we will provide (at least a sample of) ecotox data in our templates (which ultimately are derived from our in-vitro tox templates) for testing and incorporation into the eNanoMapper database model.

In addition to the above discussions and developments in the integration of nano-exposure data into eNanoMapper have taken place within the last 12-18 months, involving initially eNanoMapper, SUN-WP1 and WP5 (exposure), and later also others from the NSC WG4 (database) and WG6 (exposure) and the NECID (Nano Exposure and Contextual Information Database) initiative. This has led to the integration of exposure data as an additional data

domain into the eNanoMapper model, and the extension of the eNanoMapper ontology for nano-exposure data, with the potential to integrate exposure data, (and ultimately full NECID exposure datasets), into eNanoMapper. We are aware that this has not been implemented in the enanoMapper database software yet but at a suitable point we aim to help test this by populating the implementation with SUN generated exposure data. Besides the NECID exposure data aspects we have also discussed with eNanoMapper the potential for integrating the IOM Nano Exposure Scenario Library approach (with pre-formatted templates and reports), as implemented earlier in MARINA and referenced in SUN, for more general exposure data management and this will progress in subsequent projects.

Whilst we have been able to collaborate and contribute to developments for the several data types above, despite the advances made to date the eNanoMapper database has of course needed to concentrate on certain data domains, so it cannot yet readily or simply accommodate all types of Nano-EHS data, including SUN data which it has not yet been designed or implemented to include. The prime example for SUN in this regard is in Environmental Release, Fate and Exposure data (WP3) and related nanomaterial lifecycle issues. Hence via WP1 the SUN coordinator has more recently initiated a new working group on this area (being mediated via NSC WG4 (databases)) to discuss and explore the possibilities for harmonising the recording and storage of such Release, Fate and Exposure data, and their future incorporation into an instance of eNanoMapper. Once implemented this would lead to the upload of such SUN data. Initially the working group principally includes SUN partners from WP1, and WP3, and eNanoMapper.

Noting formal presentations of aspects of all of the above work and collaboration, from WP1.2 IOM presented the database and management work of SUN (and other related efforts) in a presentation at a 2 day meeting on data harmonisation and knowledge infrastructure and framework for nano-EHS, (26/01/16, Brussels). Also IOM from WP1 was on the organising committee of the Nano-EHS EU-US Bilateral Workshops, 24-25 Oct, Rheinfelden, Germany, and presented on “Towards nano-ehs data harmonisation - template use experiences in recent FP7 projects and related initiatives”. The major contribution to developments from the SUN project (and others, including the various interactions noted above) was highlighted and gratefully acknowledged in the talk by the presenter. This also led to our connection to the currently ongoing development of a “Nano Informatics Roadmap”, and our being invited to be part of the Task Group to write it, in a collaborative effort between the NSC and US-EU-CoR. Again credit must be given to efforts and work on SUN that has helped enable our participation in this.

We will naturally continue to share and contribute to new and on-going developments in templates, other data curation materials and methods, database design and implementation, metadata and ontologies - more generally, participating in the expanding field of Nano Informatics development) with other similar H2020 projects, COST initiatives, eNanoMapper and other NSC WGs where appropriate. We intend to make as much of the SUN data available as possible to eNanoMapper for upload, either before conclusion of the project, or if that has been exceeded, then continuing under the auspices of one of the other ongoing developments

including NanoReg2 (http://www.nanoreg2.eu) or CaLIBRAte (http://www.nanocalibrate.eu/home) , for example.

11. Deviations from the Work plan

There are no deviations from the work plan with regard to database design or implementation in WP1. In addition to the original DoW we have as requested also actively contributed to wider developments in the field of Nano-EHS database developments, the NSC UE-EU-CoR, and interactions with eNanoMapper, and SUN resources contributed to this. As noted in the relevant sections above, due to problems and delays elsewhere in the project it is suggested that some small portions of outstanding data may still be returned to WP1, and with best endeavours WP1.2 will add this to the operational database.

12. Performance of the partners

Partners in WP1 have fulfilled their tasks in satisfactory time and quality.

13. Conclusions

Task 1.2 has successfully accomplished the design, implementation and population of the SUN data repository database. An extensive exercise was been carried out with Sun project partners to develop data templates and data collection, and to procure, collate and curate the scientific project data into a flexible and user-friendly operational database. This is immediately available from WP1, although at this final juncture we still await some minor additions to the datasets from partners due to delays out-with WP1's control. Thus the final (latest possible) updated SUN database will be made available to partners from the site Sun.iom-world.co.uk.

In addition we have significantly contributed to the wider development and harmonisation of Nano-EHS data, databases and nanoinformatics more generally through our interactions with the enanoMapper project itself, the NSC Database Working Group, and other related initiatives, which have, at least in part, been resourced through the SUN project.

We anticipated sharing SUN data more generally early on in the task, and as the work evolved, providing data to be uploaded to an instance of the "final" eNanoMapper database. We will make this data available, though as mentioned data sharing permissions, embargos etc. will need to be formalised and observed at appropriate levels in the short term. To advance this, we are currently involved in further related developments, having been contacted by the NANOREG2 and CaLIBRAte projects, aiming to supply them with final data from projects that we have data-managed (e.g. SUN, MARINA, NANOSOLUTIONS). From our discussions with these initiatives it is anticipated that effectively an instance of the eNanoMapper database, (or possibly a suitably partitioned and secured single instance) will be implemented to hold the

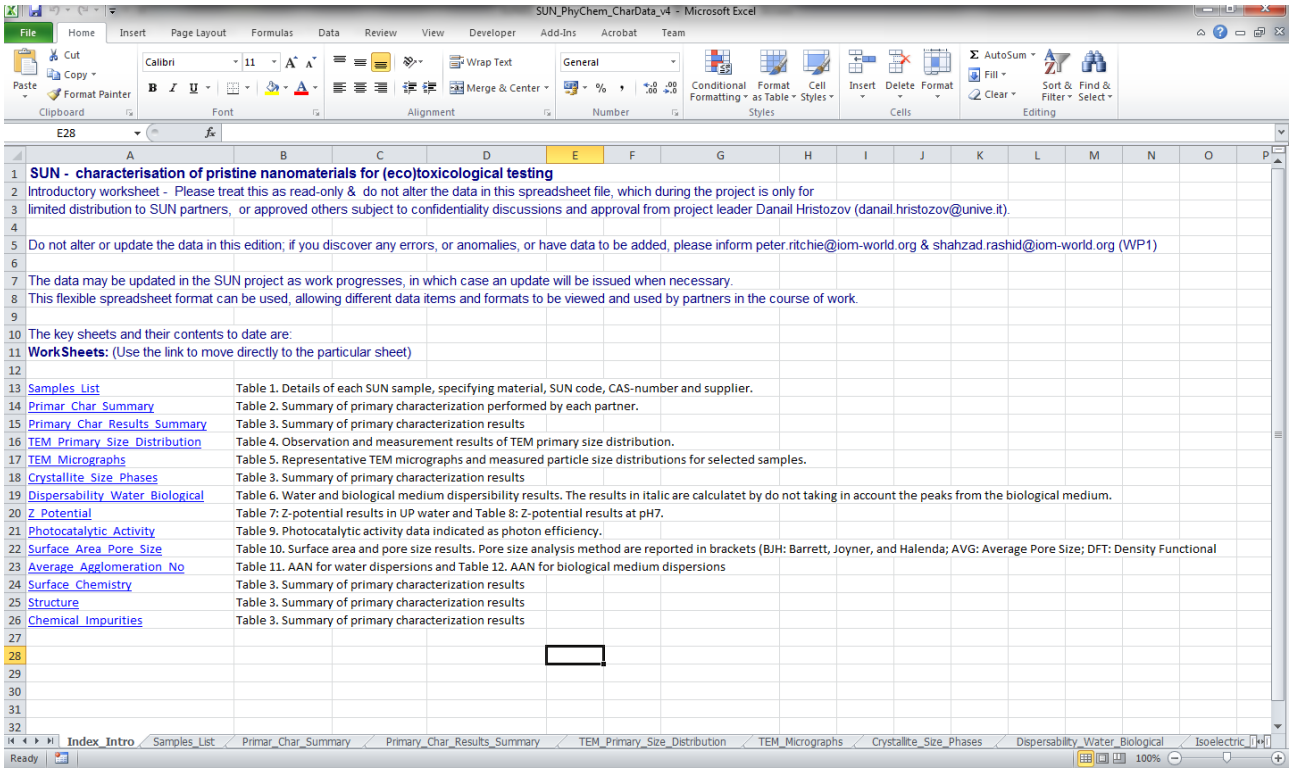
data from each donating project, including SUN, with selective approvals and permissions for use being managed by the database. As such the SUN instance would provide the ideal eNanoMapper formatted repository for the Sun data. We will in any case work collaboratively and cooperatively as we have done previously, to make sure that SUN data it is available for further use and exploitation by future projects and researchers.

More generally, as a further result of our work on SUN and related initiatives we will continue our community involvement to address issues around the continuing support, availability, accessibility and sustainability of FP7 and more recently H2020 data. (H2020 data now requires a mandatory Data Management Plan, and ideally the sustained availability of open data). As this has been well demonstrated by our involvement as part of the community, WP1 partners will continue to positively contribute to these developments and promote the availability and accessibility of project data through moves to establish and maintain the sustainability of such nano-EHS data resources. In this we will continue to acknowledge the contribution of the SUN project, in terms of experience gained and resources provided, to this and related developments in nanoinformatics.

Deliverable D1.2 "The SUN Project Database"

14. Appendices –key data template aspects of the operational database

Appendix 1: ENM characterisation data file



SUN - characterisation of pristine nanomaterials for (eco)toxicological testing

Introductory worksheet - Please treat this as read-only & do not alter the data in this spreadsheet file, which during the project is only for limited distribution to SUN partners, or approved others subject to confidentiality discussions and approval from project leader Danail Hristozov (danail.hristozov@unive.it).

Do not alter or update the data in this edition; if you discover any errors, or anomalies, or have data to be added, please inform peter.ritchie@iom-world.org & shahzad.rashid@iom-world.org (WP1)

The data may be updated in the SUN project as work progresses, in which case an update will be issued when necessary.
This flexible spreadsheet format can be used, allowing different data items and formats to be viewed and used by partners in the course of work.

The key sheets and their contents to date are:
WorkSheets: (Use the link to move directly to the particular sheet)

Samples_List	Table 1. Details of each SUN sample, specifying material, SUN code, CAS-number and supplier.
Primar_Char_Summary	Table 2. Summary of primary characterization performed by each partner.
Primary_Char_Results_Summary	Table 3. Summary of primary characterization results
TEM_Primary_Size_Distribution	Table 4. Observation and measurement results of TEM primary size distribution.
TEM_Micrographs	Table 5. Representative TEM micrographs and measured particle size distributions for selected samples.
Crystallite_Size_Phases	Table 3. Summary of primary characterization results
Dispersability_Water_Biological	Table 6. Water and biological medium dispersibility results. The results in italic are calculatet by do not taking in account the peaks from the biological medium.
Z_Potential	Table 7: Z-potential results in UP water and Table 8: Z-potential results at pH7.
Photocatalytic_Activity	Table 9. Photocatalytic activity data indicated as photon efficiency.
Surface_Area_Pore_Size	Table 10. Surface area and pore size results. Pore size analysis method are reported in brackets (BJH: Barrett, Joyner, and Halenda; AVG: Average Pore Size; DFT: Density Functional
Average_Agglomeration_No	Table 11. AAN for water dispersions and Table 12. AAN for biological medium dispersions
Surface_Chemistry	Table 3. Summary of primary characterization results
Structure	Table 3. Summary of primary characterization results
Chemical_Impurities	Table 3. Summary of primary characterization results

Appendix 2: Characterisation data summary

Table 3. Summary of primary characterization results

	Technique	Fe_2O_3_1_ NP_PROD	CuO_1_ NP_PROD	MWCNT_1_ NP_PROD	SiO_2_1_ NP_PROD	TiO_2 acid water_1_ NP_PROD	TiO_2 monopropylene glycol_1_ NP_PROD	WC+Co_1_ NP_PROD	OrgPig_1_ NP_PROD
Primary size distribution Min- Max (average) Mode (1st quartile .. 3rd quartile) [nm]	TEM	11-112 (37) 32 (28..43)	3-35 (12) 10 (9.2..14)	Ø: 4-16 (8) 7.4 (6.7..9.2) L: 575-3462 (1543) 1020 (920..1800)	3-27 (11) 9.5 (8..14)	1-15 (4) 3.2 (2.9..4.4)	1-5 (3) 2.8 (2.5..3.5)	23-1446 (170) 48 (69..280)	14-151 (43) 26.3 (29.8..49.8)
Shape	TEM	Irregular rounded particles	Semi-spherical particles	Bent and partially entangled multiwalled	Irregular polyhedrons and some spherical particles	Very small irregular polyhedrons and some spherical particles	Very small irregular polyhedrons	Irregular polyhedral particles and some semi-spherical with	Irregular polyhedrons and some small semi-spherical particles
Average crystallite size [nm]	XRD	40	9.3	*Not measurable*	*(JRC-IHCP) Synthetic amorphous silicon dioxide, impurities of Bohemite*	18 (43%) 6.8 (57%)	10.6 (14%) 3.2 (86%)	15.4	*No database available*
Crystallite phases (%)	XRD	Hematite 100%	Tenorite 100%	*(Nanogenotox) carbon nanotubes*	*(JRC-IHCP) 22 nm*	Main phases: Brookite and rutile; Third phase: a salt or an oxide	Mix of anatase, rutile and brookite	Tungsten carbide 100%	*No database available*
Dispersability in water: D_{50} [nm]: average agglomeration number (AAN)	DLS	177.3 ± 6.6; 39	139.5 ± 4.6; 346	*(JRC-IHCP) 175.9 ± 4.5; 2419*	*(ENPRA) 216; 6036*	85.9 ± 1.3; 19411	82.1 ± 4.8; 25117	182.8 ± 21.5; 31	137.3 ± 4.6; 41
Dispersability in modified MEM provided by the Heriot-Watt University: D_{50} [nm]: average agglomeration	DLS	148.2 ± 2.2; 23	85.2±2.7; 77	*Not available*	*Not available*	60.0 ± 2.6; 6592	*Unstable sample*	315 ± 18; 159	84.4 ± 4.5; 9
Z-potential in UP water [mV]	ELS	+32.0 ± 0.7	+28.1 ± 0.6	*Unstable sample*	-37.6 ± 0.8	+39.3 ± 1.1	+32.9 ± 2.2	+7.1 ± 0.5	-20.8 ± 1.3
Isoelectric point [pH]	ELS	9.7	10.3	*Unstable sample*	1.8	*In progress*	*In progress*	<2	2.1
Photocatalysis: photon efficiency [unitless]	Methylene blue degradation	Not measurable (pigment)	1.5×10^{-4}	9.5×10^{-5}	1.3×10^{-4}	2.4×10^{-5}	2.4×10^{-5}	6.7×10^{-4}	Not measurable (pigment)
Specific Surface Area [$m^2 g^{-1}$]	BET	22.6 ± 0.1 30 (from producer)	47.0 ± 1.7	*From other EU project 339.3 ± 17.3*	*From other EU project 190.5 ± 4.0*	*Sample degradation during degassing*	*Sample degradation during degassing*	6.6 ± 0.4	94 *(from producer)*
Pore sizes [nm]	BET	65 *(from producer*	13.5 ± 1.6 (BJH) 23.0 ± 0.9 (AVG)	*Not available*	*Not available*	*Sample degradation during degassing*	*Sample degradation during degassing*	Non porous	80, 200 to 2×10^5 *(from producer*
Surface chemistry [atomic fraction]	XPS	*C 50.7 O 33.7 Fe 15.6 (from producer)*	Cu = 0.46±0.05 O = 0.47±0.05 C=0.07±0.01	*Not available*	*(JRC-IHCP) O (72.1 at%), Si (25.0 at%) and C (2.9 at%) due to surface contamination*	*In progress*	*In progress*	Co=0.08±0.01 W=0.05±0.01 O=0.31±0.03 C=0.56±0.05	***C 77.1 O 10.9 N 5.9 Cl 6.1 (from producer)***

Index_Intro / Samples_List / Primar_Char_Summary / **Primary_Char_Results_Summary** / TEM_Primary_Size_Distribution / TEM_Micrographs / Crystallite_Si

Appendix 3: In-vitro test method description form

SUN TEST METHOD DESCRIPTION FORM

INFORMATION ON TEST METHOD AND PARTNER			
Name of test method	Cell viability: Alamar blue (resazurin) assay		
Acronym of test method	Citotoxicity: Alamar blue assay		
Proposer - Organisation	Organisation Name Heriot Watt University	WP ID WP6	Partner ID 25-HWU
Postal address	Heriot Watt University – Riccarton Campus School of Life Sciences John Muir Building EH14 4AS UK		
Name of contact person	Daniele Pantano		
Tel. no. of contact person	+		
Fax no. of contact person	+		
e-mail of contact person	dp163@hw.ac.uk		

WP11 - STUDY DATABASE ADMIN USE ONLY	
Received (Name/Date)	
Related data record files - (Excel Templates)	
Related NSNP characterisation file(s)	
Follow-up?	
DB Entry Notes	
Check completion (Name/Date)	
Document category	
Document ID	
Record ID	

Please be sure to complete all relevant sections as fully as possible

1. Describe the scientific and technical basis of the test method

- What biological/cellular model is the method based on?

  C3A (ATCC® CRL-10741™), derivative of Hep G2 (ATCC HB-8065)

- What biological endpoints/responses does this method address?

  Cell viability (mitochondrial enzyme activity)

- What specific mechanisms associated with the biological response are targeted?

  Assay measures the conversion of the oxidized form of Alamar Blue to the reduced form by mithocondrial enzyme activity by accepting electrons from NADPH, FADH, FMNH, NADH as well as from the cytochromes.

- What methods/techniques are used for endpoint/response determination?

  Conversion of resazurin (non-fluorescent indicator dye) to resorufin (bright red-fluorescent) via the reduction reactions of metabolically active cells. The redox reaction is accompanied by a shift in colour of the medium from indingo blue to fluorescent pink. The amount of fluorescence produced is proportional to the number of living cells.

- Was the method originally developed for a particular applicability domain (e.g. testing of a certain class of chemical)?

N/A

- Are there potential technical limitations of this method for testing nanomaterials?

Some nanoparticles interfere with the assay (interference test for each material is done during the assay)

2. Describe the role of the method in context of hazard assessment for human health

- How should the information/results derived from the method be interpreted in relation to an in vivo response/endpoint?

  N/A

- How could the information derived from the method be used to refine, reduce or replace an animal test, as specified in recognised testing standards and guidelines (e.g. OECD Test Guidelines)?

  The experiment gives a preliminary idea of the range of toxicity of the nanomaterial, this would help in planning the *in vivo* exposures both reducing sensibly the

amount of animals involved in the experiments and avoiding to use too high amount of NMs inducing obvious side effects in the models.

- What are specific limitations of this test in terms of predicting hazard to human health?

  Cell lines give a partial response in term of total toxic effect compared to an organisms because of the lack cellular-cellular specific interactions and tissue 3D structure with his histological characteristics.

- What other tests (in vitro, in vivo, in silico) would be required to compliment this method to give a better assessment of hazard, or prediction of an in vivo response?

  It is always a good procedure to include other cellular models that could be representative of different route of exposure/organs exposed. After that preliminary analysis, an *in vivo* confirmation is due for the lack in predictivity of the cellular models.

3. Describe the Standard Operating Procedure (SOP)

The SOP should be complete, self-contained and well presented. It should be described in sufficient detail to enable the method to be reliably and efficiently transferred between labs. The SOP should cover the following points:

- Details of the organisation who drafted the SOP and contact person
- Short description of the method and its scientific and technical basis
- Description of positive/negative controls
- Materials
  - Biological model (cells)
  - Technical equipment
  - Reagents, media and sera
- Preparation of media, solutions and controls
- Methods for cell maintenance and culturing
- Preparation of test substances
- Testing procedure
  - Plate format
  - Treatment of model/cells with test substance
  - Quality checks
  - Endpoint measurement
- Data analysis
- Test acceptance criteria
- Results reporting requirements
- Additional information
- References

Please attach the SOP as a separate document if appropriate, and / or give full link reference to the document on Project website version – please include version number

(if app) included

WP6-Toxicology and Human Health Risk FP-7 SUN Project

Attached as separate document in e-mail – eg also available on website at

4. Performance assessment of the method

- Describe the scope of the performance assessment study and how it was undertaken.

In vitro screening method

- What test substances were used for assessment purposes and what was the basis for their selection?

  Copper oxide nanoparticles, fine tungsten carbide with cobalt binder nanoparticles.

- What were the specific criteria used to judge/describe test method performance?

  Statistical analysis using Benchmark doses approach

- Was the study conducted under GLP, and/or did it adhere to a recognised quality system?

Yes

- What was the reliability of the assay in terms of intra-lab and inter-lab reproducibility

  Low standard deviation measured within three different experiments. No inter-lab testing.

- If the performance assessment included the comparison of in vitro and in vivo data, how well did the in vitro results correlate with the in vivo outcome?

N/A

ADDITIONAL INFORMATION – Expand on to further pages if required

5. Provide key references to patents and/or relevant publications	
1	
....	

6. Identify candidate laboratories that are sufficiently experienced to participate in a formal prevalidation or validation study	
1	N/A
...	

7. Add here any further information or particular attributes of this Assay/Test and associated datasets that will assist other WPs, or a potential third party making use of

Appendix 4: In-vitro tests data collection template

TEST CONDITIONS *In-Vitro Testing*	Please complete the details below as far as possible for ea While we must aim to standardise SUN toxicology data records a You may add additional items below where necessary for further in the notes area or adjacent to data tables, add annotations wh				
TEST and END POINT - GENERAL INFO					
SUN Work Package:	WP6				
SUN Partner ID:	HWU				
Test facility - Lab name etc:	SLS - WP3 - Cell Culture room				
Work conducted by:	Daniele Pantano		**email address:**	dp163@hw.ac.uk	
Test / Assay End-Point short description:	Fluorescence measurement of viable cells				
Assay:	Alamar Blue				
End-Point Outcome metric (ie % viability, %cell death etc):	O.D.				
SOP - Protocol Name:	SOPs_SUN Project				
Link to the SOP:					
Test start date (dd/mm/yyyy):	Expt1: 03/05/14	Expt2: 10/05/14	Expt3: 17/05/14		
Test end date (dd/mm/yyyy):	Expt1: 05/05/14	Expt2: 12/05/14	Expt3: 19/05/14		
TEST SUBSTANCE					
Substance name:	Copper Oxide				
Standard SUN Nanomaterial Code & Name:	CuO_NP_SYN				
Highest concentration used, inc units:	125	µg/ml			
DISPERSION					
Specify the standard dispersion protocol used: *(or otherwise specify the dispersion technique used)*	*see* 'SOPs_SUN Project'				
Dispersion agent?:	2% FBS in water				
Were additives used? If so, specify which & concentration:	N				
Dispersed in cell culture medium?:	only the subsequent diluition				
Serum concentration (%):	2%				
Was serum heat inactivated?:	Y				
Aids used to disperse - Y / N:	**Sonication-Bath:**	Y	**Sonication-tip**	N	**Vortexing**
Specify time-duration?:		16 mins.			
Energy (for sonication) :					
CELL LINE/TYPE					
Short-Name:	C3A				
Full specific name (note any line variants or related IDs):	HepG2/C3A (ATCC® CRL-10741™), derivative of Hep G2 (ATCC HB-8065)				
Supplier:	ATCC®				
CELL CULTURE CONDITIONS					
Medium (Supplier/Lot No.):	Minimum Essential Medium (MEM) - Sigma-Aldrich Co.				
Serum (Supplier/Lot No.):	Fetal bovine serum (FBS)				

PLATE DESIGN

expt 1	1	2	3	4	5	6	7	8	9	10	11	12
A	B	C_0B	C_1B	C_2B	C_3B	C_4B	C_5B	C_6B	C_7B	C_8B	C_9B	B
B	B	0.00	0.00	1.95	3.91	7.81	15.63	31.25	62.50	125.00	PC	B
C	B	0.00	0.00	1.95	3.91	7.81	15.63	31.25	62.50	125.00	PC	B
D	B	0.00	0.00	1.95	3.91	7.81	15.63	31.25	62.50	125.00	PC	B
E	B											B
F	B											B
G	B											B
H	B	$C_{10}B$	$C_{11}B$	$C_{12}B$	$C_{13}B$	$C_{14}B$	$C_{15}B$	$C_{16}B$	$C_{17}B$	$C_{18}B$	PCB	B

expt 2	1	2	3	4	5	6	7	8	9	10	11	12
A	B	C_0B	C_1B	C_2B	C_3B	C_4B	C_5B	C_6B	C_7B	C_8B	C_9B	B
B	B	0.00	2.81	3.52	4.40	5.50	6.87	8.59	10.74	13.42	16.78	B
C	B	0.00	2.81	3.52	4.40	5.50	6.87	8.59	10.74	13.42	16.78	B
D	B	0.00	2.81	3.52	4.40	5.50	6.87	8.59	10.74	13.42	16.78	B
E	B	20.97	26.21	32.77	40.96	51.20	64.00	80.00	100.00	125.00	PC	B
F	B	20.97	26.21	32.77	40.96	51.20	64.00	80.00	100.00	125.00	PC	B
G	B	20.97	26.21	32.77	40.96	51.20	64.00	80.00	100.00	125.00	PC	B
H	B	$C_{10}B$	$C_{11}B$	$C_{12}B$	$C_{13}B$	$C_{14}B$	$C_{15}B$	$C_{16}B$	$C_{17}B$	$C_{18}B$	PCB	B

expt 3	1	2	3	4	5	6	7	8	9	10	11	12
A	B	C_0B	C_1B	C_2B	C_3B	C_4B	C_5B	C_6B	C_7B	C_8B	C_9B	B
B	B	0.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	100.00	PC	B
C	B	0.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	100.00	PC	B
D	B	0.00	20.00	30.00	40.00	50.00	60.00	70.00	80.00	100.00	PC	B
E	B											B
F	B											B
G	B											B
H	B	$C_{10}B$	$C_{11}B$	$C_{12}B$	$C_{13}B$	$C_{14}B$	$C_{15}B$	$C_{16}B$	$C_{17}B$	$C_{18}B$	PCB	B

RAW DATA

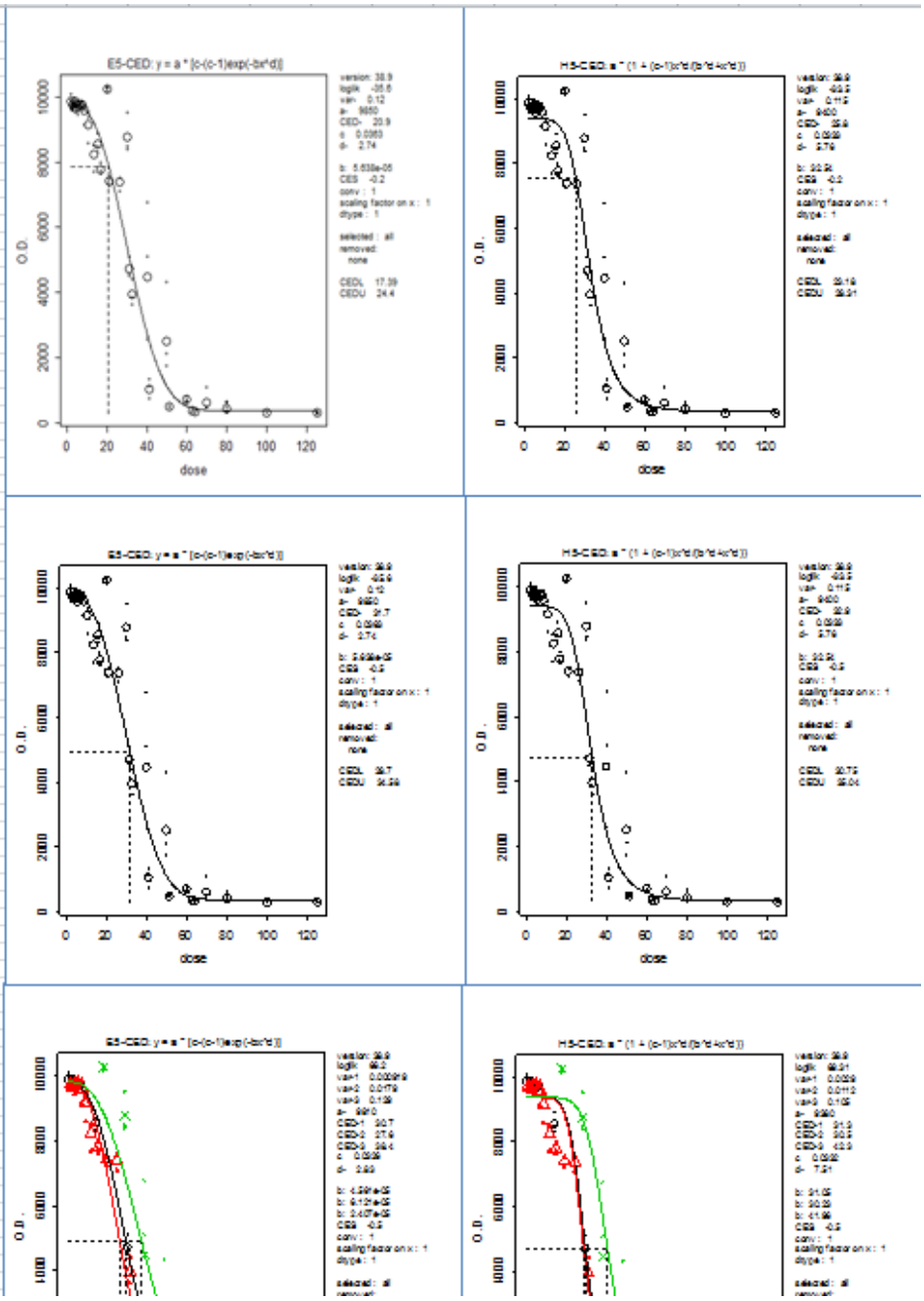
expt 1	1	2	3	4	5	6	7	8	9	10	11	12
A	346.238	329.7	333.1	331	337.951	333.44	336.452	335.764	331.089	329.626	327.76	330.843
B	**351.29**	**9856**	**10118**	**10100**	**9844.1**	**9861.1**	**8894.4**	**5103.4**	**352.7**	**318.092**	**325.43**	**327.64**
C	**352.07**	**9953**	**10064**	**9667**	**9931.5**	**9681.4**	**8303.9**	**4502**	**359.53**	**317.533**	**321.09**	**327.06**
D	**367.31**	**9976**	**10035**	**9905**	**9875.7**	**9656.1**	**8484.2**	**4577.9**	**376.57**	**322.273**	**326.4**	**329.65**
E												
F												
G												
H												

expt 2	1	2	3	4	5	6	7	8	9	10	11	12
A	347.09	339.41	352.93	347.09	374.32	357.64	359.54	352.14	359.74	341.03	361.11	341.54
B	**364.48**	**####**	**####**	**####**	**######**	**######**	**9818.45**	**9145.96**	**######**	**7699.21**	**######**	**351.56**
C	**357.91**	**####**	**####**	**####**	**######**	**######**	**######**	**######**	**9545.71**	**8533.66**	**######**	**343.54**
D	**378.38**	**####**	**####**	**####**	**9718.39**	**######**	**######**	**######**	**9361.55**	**8518.10**	**######**	**361.00**
E	**365.37**	**####**	**####**	**####**	**747.38**	**446.49**	**323.43**	**314.98**	**287.88**	**283.46**	*316.65*	**358.02**

C3A

C=0_MP_STM	BMDL zi	BMDL zi	BMDL zi	
xponential model	20.90	17.39	24.4	µg/ml
Hill model	25.80	23.18	28.31	µg/ml

C=0_MP_STM	BMD zi	BMDL zi	BMDU zi	
xponential model	31.70	28.7	34.58	µg/ml
Hill model	32.90	30.75	35.04	µg/ml



	A	B	C	D	E	F
1	copperoxide					
2	3					
3	0	1	1			
4	dose	O.D.	expt.			
5	1.95	10099.792	1			
6	1.95	9666.967	1			
7	1.95	9904.561	1			
8	3.91	9844.104	1			
9	3.91	9931.486	1			
10	3.91	9875.732	1			
11	7.81	9861.102	1			
12	7.81	9681.358	1			
13	7.81	9656.129	1			
14	15.62	8894.409	1			
15	15.62	8303.928	1			
16	15.62	8484.228	1			
17	31.25	5103.447	1			
18	31.25	4501.96	1			
19	31.25	4577.916	1			
20	62.5	352.697	1			
21	62.5	359.53	1			
22	62.5	376.572	1			
23	125	318.092	1			
24	125	317.533	1			
25	125	322.273	1			
26	2.8147	9718.707	2			
27	2.8147	9773.884	2			
28	2.8147	9735.42	2			
29	3.5184	9728.734	2			
30	3.5184	9669.268	2			
31	3.5184	9662.096	2			

Test Conditions | Raw data | **Raw data for PROAST**

Appendix 5: In-vivo tests data collection template

TEST CONDITIONS *In-Vivo Template*	Please complete the details below as far as possible for eac While we aim to to standardise SUN in-vivo toxicology data records as You can add additional items below where necessary for further replicat In the notes area or adjacent to data tables, add annotations where it w						
In-Vivo - TEST and END POINT - GENERAL INFO							
SUN Work Package:	WP06						
SUN Partner ID:	Pxxs - Ilse						
Test facility - Lab name etc:	RIVM - GZB						
Work conducted by:	RIVM+contract research animal faciliy Intravacc			**email address:**		wim.de.jong@rivm.nl ilse.gosens@rivm.nl	
Test / Assay End-Point short description: *(Enter full description in the covering TNDF - assay description form)*	Short term Oral tudy (STOS) toxicity endpoints						
End-Point Outcome metric(s) (viability, death etc): *(indicate how EP is derived)*	gross pathology: lung, liver, kidney, testis, brain, spleen, intestines and standard hematology Cu organ burdens: lung, liver, kidney, brain, spleen, testes, blood and bone marrow						
P - Protocol Name - ID (see project protocol ID list): *(and or add path/link to protocol on SUN server)*	Research protocol SUN_STOS for periodic report Z:\users\sun-project\Material\Protocols and Procedures				Internal report ICP-MS measurem Z:\users\sun-project\Material\Pr		
Test start date (dd/mm/yyyy):	04/01/2016						
Test end date (dd/mm/yyyy):	29-04-2016						
TEST SUBSTANCE							
Substance name:	Coppercarbonate nanoparticles (CuCO3)						
CAS No:	12069-69-1						
Standard SUN Nanomaterial Code & Name: *(See SUN Materials list)*	**CuCO3**						
Standard Ref material (eg JRC) name/code where app:	not applicable						
Highest concentration used, inc units:	128	mg/kg CuCO3.					
DISPERSION							
Specify the standard dispersion protocol used: *(or otherwise specify the dispersion technique used)*	Provided as liquid						
Dispersion agent:	Diluted Milli Q water						
Aids used to disperse - Y / N:	**Sonication-Bath:**	none	**Sonication-t**	NA	**Vortexi**	Y	**Stirring** Y
Specify time-duration?:							
Energy (for sonication) :							
ANIMAL AND STRAIN ETC							
Name:	Wistar rats RjHan:WI						
Supplier:	Janvier Labs						
Sex:	male						
Age:	9-10 weeks at start of experiment						
Average weight:	332 g at day 1 start exp						
TIMELINE							
Time points (hours - or specify any other units): *Alter or add as necessary*	2 5 day consecutive exposure days (gavage) day 1-2-3-4-5. . Sectioning 24 hours after final exp						
TREATMENT / DOSE CONCENTRATION							
Treatment dose range (mg/kg)	group 1	group 2	group 3	group 4	group 5	group 6	group 7
animals exposed to CuO	0	128	64	32	16	8	4
NOTES - including any deviations from SOP; other observations, variations etc. Add any information that will assist in the use and							
Please include information on the handling or coding of missing or null data							

Test conditions | Test data1 | Testdata1 annotations | NM_PhysChemCharact_in situ

TEST DATA toxicity results

CuCO3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
subst	nimal_n	group_n	lose_mg/k	ody_wt	da	autopsy_day	body_wt	lung_wt	adrenal_	heart_wt	testis_w	thymus_	liver_wt	spleen_	kidne
CuCO3	57	1	0	306	6	332	1.3922	0.0368	1.1767	3.4608	0.5282	12.9849	1.1013	2.31
CuCO3	58	1	0	327	6	357	1.6311	0.045	1.2399	3.4539	0.8288	14.2272	0.881	2.39
CuCO3	59	1	0	326	6	342	1.4147	0.0424	1.1564	3.4249	0.7524	13.0536	0.9549	2.12
CuCO3	60	1	0	321	6	350	1.4674	0.0469	1.2671	2.9934	0.7166	13.3173	1.0291	2.09
CuCO3	61	2	128	339	6	307	1.5346	0.0501	1.0327	2.6884	0.255	10.3923	0.4845	0.96
CuCO3	62	2	128	315	6	259	1.6551	0.0786	0.7973	3.0312	0.146	9.8852	0.5678	2.01
CuCO3	63	2	128	364	6	430	1.4069	0.0688	1.07091	3.3998	0.2821	12.5933	0.5761	2.73
CuCO3	64	2	128	342	6	310	1.2582	0.0865	1.1077	2.971	0.2016	10.2847	0.4036	2.26
CuCO3	65	3	64	352	6	361	2.2009	0.051	1.2847	3.2906	0.7785	14.018	0.9786	2.38
CuCO3	66	3	64	313	6	305	1.3726	0.0485	0.947	2.9637	0.4523	12.1044	0.9459	1.85
CuCO3	67	3	64	346	6	369	0.9271	0.0487	1.2407	3.8061	0.8995	17.272	1.2716	2.5
CuCO3	68	3	64	331	6	341	1.5333	0.0573	1.2707	3.0978	0.7366	13.2097	1.0405	2.41
CuCO3	69	4	32	329	6	364	1.5113	0.0578	1.0893	2.8763	0.8036	14.47	0.9598	2.04
CuCO3	70	4	32	327	6	362	1.5213	0.0475	1.1675	2.9456	0.9803	13.8618	1.1389	2.03
CuCO3	71	4	32	330	6	347	0.8275	0.0497	1.0867	3.135	0.4964	13.6816	0.6927	2.57
CuCO3	72	4	32	342	6	374	1.5637	0.0542	1.2151	3.5063	0.9137	15.6645	1.2879	2.20
CuCO3	73	5	16	335	6	372	1.5831	NA	1.2542	**0.917**	0.9812	14.8323	1.0689	2.16
CuCO3	74	5	16	335	6	360	1.525	0.0458	1.2998	3.3714	0.7049	14.8755	0.9542	2.41
CuCO3	75	5		319	6	351	1.3967	0.0496	1.1147	3.2236	0.6029	14.445	0.8447	2.27
CuCO3	76	5	16	344	6	385	1.4849	0.0567	1.3063	3.13455	0.6915	15.0242	0.9536	2.19
CuCO3	77	6	8	320	6	350	1.4858	0.0468	1.214	3.1053	0.8092	13.8809	0.7785	2.42
CuCO3	78	6	8	339	6	372	1.5469	0.0516	1.4147	2.7977	0.883	14.7633	1.1556	2.39
CuCO3	79	6	8	339	6	375	1.5061	0.0591	1.2927	3.5749	0.8327	15.0991	1.2186	2.40
CuCO3	80	6	8	343	6	480	1.4469	0.0448	1.279	3.5775	0.7811	16.8317	0.977	2.31
CuCO3	81	7	4	326	6	353	1.4554	0.0513	1.1751	3.6513	0.6818	13.9572	0.8631	2.32
CuCO3	82	7	4	350	6	380	1.479	0.0434	1.3179	3.7768	0.7477	15.1913	0.9444	2.54
CuCO3	83	7	4	359	6	402	1.5213	0.0647	1.3176	2.9416	0.8102	17.576	1.2042	2.22
CuCO3	84	7	4	364	6	403	1.7883	0.0463	1.3064	3.3102	0.9161	15.9877	1.1483	2.32
CuCO3	85	1	0	321	26	452	1.781	0.052	1.371	3.327	0.69	15.919	1.273	2
CuCO3	86	1	0	345	26	456	1.737	0.058	1.398	3.431	1.042	15.158	1.103	2.59
CuCO3	87	1	0	347	26	475	2.072	**0.027**	1.386	3.736	0.809	18.789	1.191	2.9
CuCO3	88	1	0	337	26	443	1.65	0.049	1.271	3.524	0.567	15.21	0.878	2.80
CuCO3	89	2	128	345	**6**	284	1.4619	0.0712	0.8969	3.1924	0.1665	9.6909	0.4751	2.47
CuCO3	90	2	128	365	**6**	311	1.4499	0.0661	0.9516	3.4607	0.1585	12.1347	0.7054	2.55
CuCO3	91	2	128	319	**6**	274	1.1169	0.0621	0.9414	2.7137	0.1584	9.0967	0.341	1.65
CuCO3	92	2	128	327	**6**	291	1.3328	0.0529	0.9213	2.8554	0.2813	10.8158	0.6404	1.86
CuCO3	93	3	64	350	26	467	1.131	0.048	1.485	3.274	0.643	18.278	0.958	2.70
CuCO3	94	3	64	337	26	438	1.701	0.057	1.343	3.519	0.631	16.006	0.919	2.60
CuCO3	95	3	64	335	26	429	1.493	0.05	1.304	3.143	0.632	14.066	1.083	2.12
CuCO3	96	3	64	358	26	485	1.502	0.053	1.525	3.735	0.873	17.906	1.174	2.80
CuCO3	97	4	32	327	26	434	1.595	0.052	1.368	3.32	0.561	14.2	0.97	2.85
CuCO3	98	4	32	345	26	498	1.615	0.058	1.448	3.575	0.845	19.335	1.168	2.77
CuCO3	99	4	32	338	26	449	1.495	0.046	1.363	3.288	0.848	15.307	1.146	2.32
CuCO3	100	4	32	325	26	409	1.713	0.046	1.428	3.398	0.627	14.426	0.968	2.52
CuCO3	101	5	16	323	26	415	1.548	0.038	1.346	3.738	0.569	15.726	0.9227	2.5
CuCO3	102	5	16	336	26	446	1.767	0.039	1.324	3.663	0.764	16.66	1.056	2.54
CuCO3	103	5	16	350	26	468	1.711	0.057	1.43	3.818	0.663	16.078	1.164	2.44
CuCO3	104	5	16	365	26	532	2.041	0.053	1.671	3.329	0.93	22.402	1.437	2.79
CuCO3	105	6	8	323	26	449	1.62	0.058	1.384	3.491	0.668	16.146	1.151	3.08

Test conditions | Test data1 | Testdata1 annotations | NM_PhysChemCharact_in situ | sheet5 | sheet6 | sheet7

The following columns contain a description of the annotation that is used in the raw data files for all in-vovo work in by v
The annotation is chosen is such a way that is is useful for analysis - in this case by PROAST software, or other databa
e.g descriptions should not contain mathematical signs like %, +, -, /, \, (,). Instead of spaces to separate words, use _ (

1	subst	substance name
2	animal_nr	animal number in the experiment
3	group_nr	group designation; 1 - 7
4	dose_mg/kg	oral dose in mg/kg
5	body_wt day1	body weight at day 1 start of treatment in grams
6	autopsy_day	day number of autopsy (6 or 26)
7	body_wt	body weight at autopsy in grams
8	lung_wt	lung weight in grams
9	adrenal_wt	adrenal weight in grams
10	heart_wt	heart weight in grams
11	testis_wt	testis weight in grams
12	thymus_wt	thymus weight in grams
13	liver_wt	liver weight in grams
14	spleen_wt	spleen weight in grams
15	kidney_wt	kindney weight in grams
16	mes_LN_wt	mesenterial Lymph nodes weight in grams
17	stomach_wt	stomach weight in grams
18	brain_wt	brain weight in grams
19.00	TP	Totap Proteine in gram per Liter
20	ALB	Albumin in gram per Liter
21	ALT	Alanine aminotransferase in IU per Liter
22	AST	Aspartaat aminotransferase in IU per Liter
23	ALP	Alkalic Phosphatase in IU per Liter
24	TBIL	Total Bilirubine in umol per Liter
25	YGTX	Gamma glutamyl traferase in U per Liter
26	LDP	Lactate dehydrogenase in IU per Liter
28	CHOL	Cholesterol in mmol per Liter
29	TG	Triglycerides in mmol per Liter
30	FFA	Free Fatty Acids in mmol per Liter
31	FE	Ferro in umol per Liter
32	ZINC	Zinc in ug per deciLiter
33	GLU	Glucose in mmol per Liter
34	CR_S	Creatinine in umol per Liter
35	UREA	Urea in mmol per Liter
36	URIC	Uric Acid in umol per Liter
37	CA	Calcium in mg per deciLiter
38	CL	Chlorine in mmol per Liter
39	K	Potassium mmol per Liter
40	NA	Natrium in mmol per Liter
41	ROM	Reactive Oxygen Metabolites in U CARR ??
42	SHP	Plasmatic Thios Groups in umol per Liter
43	r_ALT_AST	ratio ALT/AST

Test conditions | Test data1 | Testdata1 annotations | NM_PhysChemCharact_in situ

Appendix 6: Eco-toxicology Test Method Description and Data Reporting Form

SUN – ECOTOXICOLOGY - TEST METHOD DESCRIPTION FORM

INFORMATION ON TEST METHOD AND PROPOSER / PARTNER			
Name of test method	Eco-Toxicology of Nanoparticles to Benthic Organisms (*Lymnaea stagnalis*) *Lymnaea stagnalis*., Acute Lethal Test (Brix et al, 2011)		
Acronym of test method			
Proposer - Organisation	Organisation Name HWU	SUN WP ID WP4	SUN Partner ID
Postal address	Heriot-Watt University Currie, Edinburgh, Eh14 4as		
Name of contact person	Professor Teresa Fernandes PhD student Valentina Ricottone		
Tel. no. of contact person			
Fax no. of contact person			
e-mail of contact person	Vr77@hw.ac.uk		

SUN WP1 STUDY DATABASE ADMIN USE ONLY	
Received (Name/Date)	
Related data record files - (Excel Templates)	
Related characterisation file(s)	
DB Entry	
Check completion (Name/Date)	

1. Study Overview	
Test Material(s):	MWCNTs_1_NP_SYN WCCo_1_NP_SYN Pigment_1_NP_SYN (OrgPig Red254) CuO_1_NP_SYN CuSO4
OECD Test Name and Number:	No OECD standard test available
Duration of the test:	96 hours
Any deviations from the standard OECD protocol? (yes or no).	N/A
Species Used (latin name):	*Lymnaea stagnalis*
Strain of test organism:	*Lymnaea stagnalis* strain Renyls
Type of Media:	OECD 203

2. Study Protocol

Mortality was assessed through aqueous exposures by monitoring the mortality in a controlled light (16h d, 8h n) and temperature (20 °C) environment, following the protocol applied by Brix et al. (2011). Briefly, juvenile snails (7-9 day old) were placed in 35ml polypropylene containers with 30ml of test medium; three replicates of 15 snails were tested for each exposure concentration. Snails were left without food 24h prior the start the experiment. Exposure was performed over 96h, mortality recorded daily and snails were not fed during the experiment. Dose-response curves and EC10 and EC50 values and corresponding 95% confidence intervals were calculated using Sigmaplot.

3. Test Vessels Used

Test vessels are 35ml polypropylene containers with 30ml of test medium. Vessels were disposed after every experiment.
Duran bottle of 100ml where used for preparing NP stocks. Upon use with nanoparticles, the glassware was washed with Decon to remove major residuals and rinsed 3 x with H_2O and distilled H_2O.

4. Deviations from the study protocol

No deviations to the general study protocol.

5. Source of Test Organism and Routine Husbandry

Lymnaea stagnalis used for these experiments are from the strain Renyls. They are cultured in OECD 203 media, pH in the range 7-8 and water hardness of 78 mg CaCo3/L, ammonia low than 2 mg/L. Snails are cultured at room temperature in a natural light regime. Snails are fed at libitum with only lettuce to avoid increasing of ammonia concentration. They are kept in a 10 L plastic tank at the density of 300ml /snail. Twice a week one third of the water is changed and all the clutches removed and placed in another tank in order to have cohorts of snails with similar age and (roughly) similar size. At 20°C and renew the water twice per week, a 3 cm adult produces 2 clutches of approx 80 eggs per week. The number of embryos per clutch increase linearly with the adult's size. Embryos hatch after 15 to 30 days at 20°C, and they need 3 months to start reach sexual maturity.

6. Source and Chemical Composition of the Test Media

OECD 203 for *Lymnaea stagnalis*

(a) Calcium chloride solution
Dissolve 11.76 g $CaCl_2.2H_2O$ in deionised water; make up to 1 litre with deionised water

(b) Magnesium sulphate solution
Dissolve 4.93 g $MgSO_4.7H_2O$ in deionised water; make up to 1 litre with deionised water

(c) Sodium bicarbonate solution
Dissolve 2.59 g $NaHCO_3$ in deionised water; make up to 1 litre with deionised water

(d) Potassium chloride solution
Dissolve 0.23 g KCl in deionised water; make up to 1 litre with deionised water

All chemicals must be of analytical grade.

The conductivity of the distilled or deionised water should not exceed 10 μScm^{-1}.

25 ml each of solutions (a) to (d) are mixed and the total volume made up to 1 litre with deionised water. The sum of the calcium and magnesium ions in this solutions is 2.5 mmol/l. The proportion Ca:Mg ions is 4:1 and Na:K ions 10:1. The acid capacity $K_{4.3}$ of this solution is 0.8 mmol/l.

Aerate the dilution water until oxygen saturation is achieved, then store it for about two days without further aeration before use.

7. Evidence That The Test Conditions Were Generally Met

In all experiments, the pH values along with the oxygen content were mostly stable. During the tests, not more than 10 percent of the control *snails* died.

8. Source and Chemical Composition of the Test Substance/Stock Dispersion

Parameter	Pigment_1_NP_SYN (OrgPig Red254)	WCCo_1_NP_SYN	CuO_1_NP_SYN	$CuSO_4*5H_2O$	MWCNTs_1_NP_SYN
Mass concentration of the stock dispersion.	0.1mg/ml	0.1mg/ml	0.08mg/ml Cu	0.0025mg/ml Cu	1mg/ml
What the material is dispersed in (e.g., ultrapure water, 10% alcohol, soil, etc.) including pre-wetting steps and use of stabilizers.	0.01g of NP in 100ml of MilliQ water	0.01g of NP in 100ml of 0.01% (wt/vol) sodium polyphosphate	0.01g of NP in 100ml of MilliQ water	0.001g of chemical in 100ml of MilliQ water	0.01g of NP in 100ml of 0.2 % SRHA 1g L^{-1}
For secondary stock made from another solution, indicate how the original was diluted.					
Sonication (including type of sionicator, energy and time) or stirring (stirring speed and time) to disperse the stock.	NPs in a 100 mL duran bottle were sonicated for 8+8 minutes with bath sonicator following Jacobsen 2010 protocol	NPs in a 100 mL duran bottle were sonicated for 8+8 minutes with bath sonicator following Jacobsen 2010 protocol	NPs in a 100 mL duran bottle were sonicated for 8+8 minutes with bath sonicator following Jacobsen 2010 protocol	Chemical in a 100 mL duran bottle was stirred for 5 minutes	NPs in a 100 mL duran bottle were sonicated for 16 minutes four times with bath sonicator following Jacobsen 2010 protocol
Storage conditions and time (if relevant).	NPs prepared on the same day of the experiment	NPs prepared on the same day of the experiment	NPs prepared on the same day of the experiment	Solution is prepared on the same day of the experiment	NPs prepared on the same day of the experiment
Media used to make any working dilutions of the stock.					
Primary particle size (indicate diameter)					
Median Particle					

size distribution by DLS.					
Any measured impurities that are relevant.					

9. Dosing of the Test Vessels

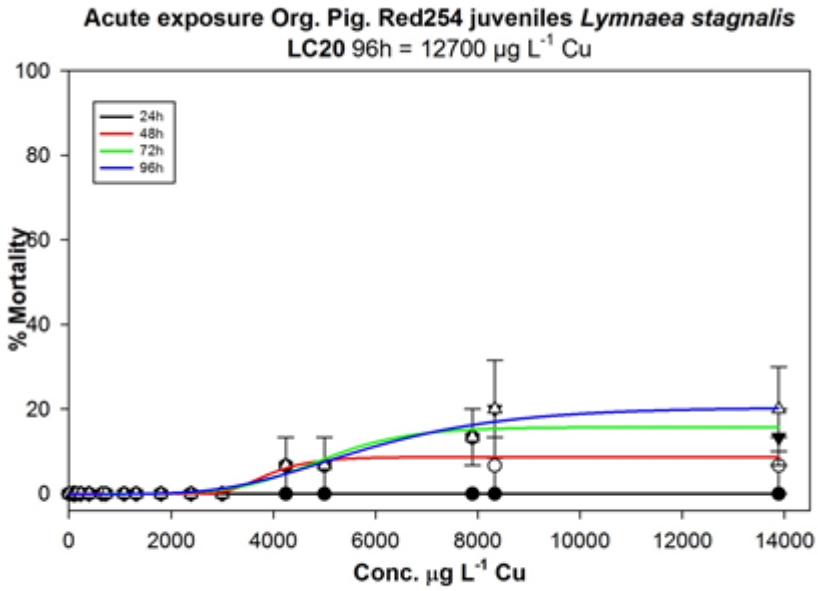
Depending the concentration of NP wanted in the test vessel, aliquote from the stock dispersion where pipetted in the test vessel containing 30 ml of media. The media was then topped up to reach the volume of 38ml.

10. Nanomaterial Concentration During the Test

No measurements were performed.

11. RESULTS

Organisms exposed to WC-Co NPs and MWCNTs in the range of concentrations investigated (0-21000 µg L-1) showed no mortality (data not reported). Exposure to Org. Pig. Red254 indicated lethal concentration values (LC20) mortality to 20% of the population at 96h of 12700 µg L^{-1} at 96h (Fig. 16) of Org. Pig. Red 254 to *L. stagnalis*.



12. Other Comments

Appendix 7: Eco-toxicology data collection template

TEST CONDITIONS *Ecotoxicology*	**Please complete the details below as far as possible f**				
	Whilst aiming to standardise EcoTox data records as far as pos				
	You can add additional items below where necessary for furth				
	In the notes area or adjacent to data tables, add annotations w				
TEST and END POINT - GENERAL INFO					
MARINA Work Package:	10				
Partner ID:	AU				
Test facility - Lab name etc:	AU				
Work conducted by:	Janeck J.Scott-Fordsmand		**email address:**	jsf@bios.au.dk	
Test / Assay End-Point short description:	Multispecies test				
(Enter full description in the covering TMDF - assay description form)					
End-Point Outcome metric (ie % viability, %cell death etc):	Total Population				
(indicate how EP is derived)	Total Population				
	Total Population				
SOP - Protocol Name - ID (see project protocol ID list):	Based on Scott-Fordsmand et al 2008, Environment International				
(or add path/link to protocol on server)					
Test start date (dd/mm/yyyy):	22/10/2013				
Test end date (dd/mm/yyyy):	19/11/2013				
TEST SUBSTANCE					
Substance name:	CuO_1_NP_PEI CuO_1_NP_PVP; CuO_1_NP_CITRATE; Cu				
CAS No:					
Standard Nanomaterial Code & Name:	NMXXX				
(See Materials list; or other standard list eg JRC)					
Highest concentration, inc units:	1280	mg Ag/kg			
DISPERSION					
Specify the standard dispersion protocol used:	none				
(or otherwise specify the dispersion technique used)					
Dispersion agent:	none				
Aids used to disperse - Y / N:	**Sonication:**	none	**Vortexing**	none	**Stiring:** no
Treatment concentration series (C) (mg/Kg):	C1	C2	C3	C4	C5

Test conditions | Raw data | Test results | Test summary | Sheet1

A	B	C	D	E	F	G	H	I	J	K
RAW DATA		Insert your results appropriate to your experimental regime								
		The replicates that are not used leave them empty (i.e. do not insert any digit)								
	Total Population									
	28 days	Species	Species	Species	Species	Species	Species	Repl7		
	Control	648	1648	461	51	20	11			
	Citrate	221	1031	404	86	15	6			
	Ascorb:	223	1621	529	51	8	8			
	PEI	743	1609	528	61	22	10			
	PYP	279	1368	486	71	19	10			
	0									
	0									
	0									
	0									
	Total Population									
	56 days	Species	Species	Species	Species	Species	Species	Repl7		
	Control	897	1423	413	19	7	107			
	Citrate	96	943	315	11	2	100			
	Ascorb:	77	888	300	7	6	81			
	PEI	820	1067	365	9	3	112			
	PYP	212	1078	426	15	3	107			
	0									
	0									
	0									
	0									
	Total Population									
	84 days	Species	Species	Species	Species	Species	Species	Repl7		
	Control	712	1538	190	1	2	48			
	Citrate	201	891	70	0	0	117			
	Ascorb:	195	1076	110	0	0	64			
	PEI	580	1152	119	0	0	51			
	PYP	142	1264	84	0	0	103			
	0									
	0									
	0									
	0									
	0									
	0	Species	Species	Species	Species	Species	Species	Repl7		
	Citrate									
	Ascorbate									
	PEI									
	PYP									
	#REF!									
	0									
	0									
	0									

TEST RESULTS

Total Population			
28 days	CuO_1_NP_PEI (	Average raw data	%
	Citrate	473.167	100.000
	Ascorbate	293.833	62.099
	PEI	406.667	85.946
	PVP	495.500	104.720
	#REF!	372.167	78.654
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	0	#DIV/0!	#DIV/0!
	0	#DIV/0!	#DIV/0!
	0	#DIV/0!	#DIV/0!
Total Population			
56 days	CuO_1_NP_PEI (	Average raw data	%
	Citrate	477.667	100.000
	Ascorbate	244.500	51.186
	PEI	226.500	47.418
	PVP	396.000	82.903
	#REF!	306.833	64.236
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	0	#DIV/0!	#DIV/0!
	0	#DIV/0!	#DIV/0!
	0	#DIV/0!	#DIV/0!
Total Population			
84 days	CuO_1_NP_PEI (	Average raw data	%
	Citrate	415.167	100.000
	Ascorbate	213.167	51.345
	PEI	240.833	58.009
	PVP	317.000	76.355
	#REF!	265.500	63.950
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	0	#DIV/0!	#DIV/0!
	0	#DIV/0!	#DIV/0!
0			
0	CuO_1_NP_PEI (	Average raw data	%
	Citrate	#DIV/0!	#DIV/0!
	Ascorbate	#DIV/0!	#DIV/0!
	PEI	#DIV/0!	#DIV/0!
	PVP	#DIV/0!	#DIV/0!
	#REF!	#DIV/0!	#DIV/0!
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	0	#DIV/0!	#DIV/0!
	0	#DIV/0!	#DIV/0!

TEST SUMMARY

CuO_1_NP_PEI CuO_1_NP_PVP; CuO_1_NP_CITRATE; CuO_1_NP_ASCORBATE

NMXXX

Based on Scott-Fordsmand et al 2008, Environment Internation

Total Populatio	Average	St Dev
NMXXX		
Citrate	473.167	633.74
Ascorb	293.833	391.062
PEI	406.667	627.323
PVP	495.500	624.643
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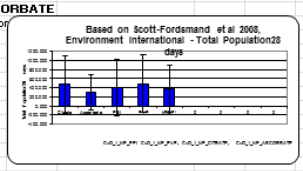

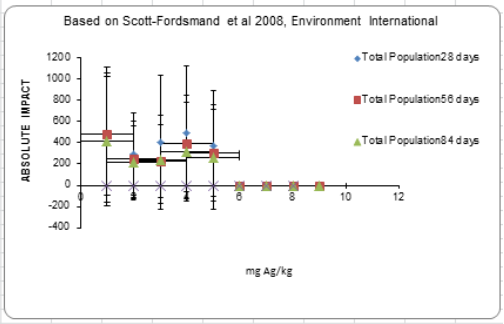

Based on Scott-Fordsmand et al 2008, Environment International - Total Population56 days

Total Populatio	Average	St Dev
NMXXX		
Citrate	477.667	573.232
Ascorb	244.500	360.315
PEI	226.500	341.557
PVP	396.000	450.744
#REF!	306.833	408.731
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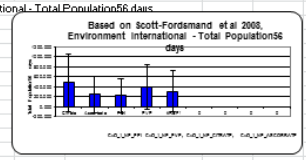

Based on Scott-Fordsmand et al 2008, Environment International - Total Population84 days

Total Populatio	Average	St Dev
NMXXX		
Citrate	415.167	612.636
Ascorb	213.167	340.655
PEI	240.833	415.69
PVP	317.000	464.184
#REF!	265.500	492.46
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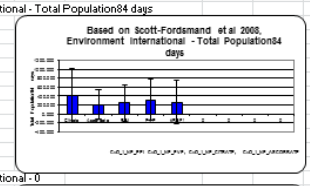

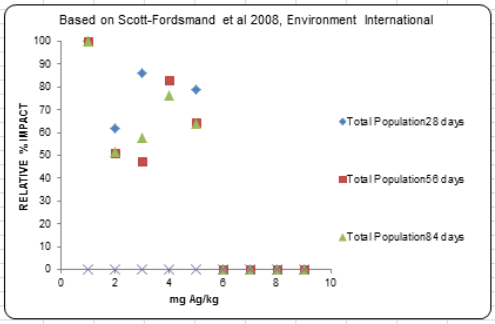

Based on Scott-Fordsmand et al 2008, Environment International - 0

0	Average	St Dev
NMXXX		
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Ascorb	#DIV/0!	#DIV/0!
PEI	#DIV/0!	#DIV/0!
PVP	#DIV/0!	#DIV/0!
#REF!	#DIV/0!	#DIV/0!
0	#DIV/0!	#DIV/0!
0	#DIV/0!	#DIV/0!
0	#DIV/0!	#DIV/0!
0	#DIV/0!	#DIV/0!