

## co+ Impact Project: 6 Month Progress Report

### Project Description

*The co+ Impact project is a current two-year study that started on the 1<sup>st</sup> August 2014. It aims to understand the impact of carbon monoxide on the UK population in a number of environments including the home, tents, caravans and boats.*

*Currently only vague estimates for the number of individuals affected by carbon monoxide exist and these are thought to be grossly underestimated possibly due the difficulty in detecting CO poisoning, the sub-classifications of poisoning, misdiagnosis and its variable affect on individuals. The co+ Impact project therefore attempts to discern the true impact on people in the UK affected by carbon monoxide and our current state of knowledge of CO and its effects.*

### Introduction

The project overall has made positive progress in many areas including the research for the report and the population of the academic reference database. The collation of the sources is going well, utilising contacts from industry, the All-Party Parliamentary Group and charities, and there are further plans for collection from even wider resources. Multiple initiatives in CO awareness and research have been instigated in this time and will no doubt continue and orchestrate further developments.

### Report Progress

With direct reference to the objectives of the co+ Impact project outlined in the project proposal, the progress of the project is very good. Development has been made in all of the objectives with some areas naturally more progressed than others, such as the aspect that sees new research and project proposals, which will follow this project's report at near completion.

Project Objectives		
1	Source Collation	50%
2	Research Collaboration	40%
3	Project Proposals	20%
4	Exposure Limit	50%
5	Poisoning Database	40%

### Source Collation

The review of the existing research concerning CO<sup>+</sup> in the suggested environments is well underway and has coincided well with the Gas Safety Trust academic portal. Although the project specifies that the lives of the UK population in relation to CO are in examination, the research has been geographically extensive. All research into the effects of CO have been considered as the chemical processes and medical interventions will be universal. Furthermore parallels can be drawn with the statistical correlations observed in other countries and can be applied and learnt from here in the UK.

Sources have been collated from many areas including reports, conferences, academic journals and even public information films. The information is reviewed in note form, with information that is

deemed to be useful and relevant and comparative for the project recorded, including alarms and detectors, medical, leisure and domestic perspectives. Simultaneously the source is reviewed in a 5-star system for the Gas Safety Trust Carbon Monoxide Academic Reference Portal.

The collating and reading of the sources is progressing very satisfactorily, with a good portion reviewed containing relevant and interesting information that will benefit the project and the final report with yet more information out there to be collated. Additionally much networking has taken place in the past six months and contacts have provided additional source of information and been interviewed over certain aspects of carbon monoxide and alarm research. The assistance of these individuals has been paramount to the understanding of the internal process of raising CO awareness, where the project sits and where exactly it can aid development.

### **Research Area Collaboration**

Whilst it is challenging to remain objective when the areas of research are considered and see the holes in the research-frameworks of each area, some considerable ground has been covered in collaboration efforts and further tools have been put in place for future work, such as the CO sub-groups discussed below.

Firstly this study looks at research in all areas and is in communication with many of the individuals involved, with a view to collaborative area research. This has incorporated a number of meetings with heads of separate industries, all with an interest in CO, including Leigh Greenham of CoGDGM with regards to co alarm development and technology and Ben Croxford on the side of domestic CO research.

One of the largest advancements in bridging the gap between technology and medicine has been the creation of the Science and Technology group on CO (part of the All Fuels Forum), which works in tandem with the Medical sub-group, one of whose members sits on the group to form a human bridge. The two areas have different aims with regards to CO, understandably, however one of the aims of the SciTech group is to facilitate research into CO, including medical research of course, which actively promotes their involvement in wider areas of research.

The GST portal (to which the co+ Impact project was able to contribute) can be viewed as a platform for all CO information from all areas and for all those considering work in CO-related aspects, bringing together researchers from multiple areas. The portal has considerable potential to be expanded for example for use as a point of call for current and future CO research projects, not just the results of studies. The SciTech group's current bid for involvement in the portal demonstrates the collaborative and also definitive capabilities of CO research.

### **Project Proposals for Future Research Projects**

The project proposals are likely to be formulated and written following the completion of the report, and the current timescale is on track for their inclusion in the project. The co+ Impact study has already been actively involved in the bid to maintain the GST portal and create the new incident database section. This large collaborative bid has provided valuable experience in project proposal writing in preparation for the end of the project.

Additionally, some primary observations for project topics can still be made at this early stage. Firstly that there is a difference between gaps in knowledge/ research from different areas/ sub-disciplines, and gaps between research knowledge and common knowledge of those directly involved in carbon monoxide and the public.

An example of the former could be the current debate as to the effectiveness of hyperbaric oxygen therapy and when it should be used; this is an ongoing debate with much contributing research and with little chance of a swift resolution. The current medical stance in the US and the UK is that if CO poisoning is severe with high COHb levels; where long-term neurological symptoms persist following poisoning, HBO can be administered with an undetermined chance of success.

The latter however can be more readily observed in the siting of carbon monoxide alarms; numerous studies have been conducted and the conclusion of most is that CO alarms should be positioned 'just above door frame height' 1-3m away from a fuel burning appliance. There will never be a 'one size fits all' answer, as homes will vary in shape, size, and the number of detectors. However, many sources of advice to consumers will state different positions for CO alarms; suggesting they be knee height or 1m from the floor etc. Alarms provide accompanying guides for where they should be situated and a recommendation of the APPCOG 2014 inquiry is that the guides become more user-friendly, but providing easily accessible wrong information is dangerous to the public especially if installation guides do not improve.

It is areas such as these that the report is already starting to uncover differences in the information provided by sources and where it can start to make a difference to our understanding and that of the public.

### Exposure Limit

With regards to exposure limits and the impact of CO on people, a number of points have been raised that affect multiple areas including alarm manufacture, hospital treatment and data collection.

Current definitions of CO poisoning include acute and chronic which are commonly used to define a short high-impact incident in the former and a prolonged, low-level incident in the latter. Additionally the definition of acute is that the case comes to the more immediate attention of a medical examiner and in the case of chronic takes time to become detrimental and come to the attention of medical practitioners. This leaves room for a further underused definition of occult CO poisoning which covers both chronic and acute poisonings that were never diagnosed by a medical professional, even to the point of death. Despite these definitions, exposure presents as a spectrum with perhaps a chronic exposure leading to acute and then death with no definitive line between the two.

Poisoning is defined as *exposure to a harmful substance* and by this meaning anyone who has contact with CO is poisoned and could be included in statistics as an impact of CO. Currently CO poisoning is diagnosed at a COHb level of >10% with categorisations for mild and severe above this. However many people have variable symptoms at variable COHb levels even lower than 10% COHb

often in chronic exposure, whilst smokers usually reside around 4-6% COHb with no effect. Furthermore there is no clear evidence to suggest that COHb level correlates with symptoms.

The WHO indoor air guidelines suggests that 2.5% COHb levels should not be exceeded to protect the elderly, infant, those with diagnosed and latent medical issues and unborn foetuses. This is the threshold used for the activation of CO alarms under the British/EU standard; an alarm (to prevent false activation) should not activate when the ppm level and duration are not sufficient enough for the COHb level to exceed 2.5%. However, due to the undeniable effects of chronic CO exposure, some alarms are now equipped with a digital display that activates lower threshold levels (~10ppm) when they occur, and can even have their own distinguishable alarm option to alert the owner of this.

As mentioned above the clear presence the effects of chronic CO exposure and the presence of CO poisoning symptoms in studies conducted below the threshold for poisoning suggest that digital display alarms should be the only standard for CO detection and should sound at lower levels protecting the more vulnerable and cases of chronic exposure. It is clear that more research is needed into the prolonged affect of CO at lower levels and on more at-risk individuals with a view to changing definitions of exposure however this has its own ethical considerations.

### Poisoning Database

One of the more challenging objectives of the project and which has seen the most change externally is the desire to create a system for monitoring and determining the true effect of CO poisoning on the population. Understandably this would come from statistics and databases of those known to have died or to have been treated in an emergency room for example and several separate databases exist for collating such information.

One of the most directly involved charities is CO-Gas Safety and a meeting was held with the charity and Cranfield University to discuss the possibility of data sharing and expansion with the charity remaining as the main face for the project. This however was not to be possible as the charity would require financial input from the University prior to any collaborative work.

Following this, the Gas Safety Trust have included a incident database within their carbon monoxide portal that will be populated by a tendering institute with the aim of having a collaborative and thorough databases of CO poisoning cases. As the current co+ Impact study is run by Cranfield University, a party actively involved in the Carbon Monoxide Science and Technology group, the study has been actively involved in the tender bid on behalf of the entire group as a collaborative effort of multiple institutions.

Furthermore after the release of the All Part Parliamentary Carbon Monoxide Group 2014 inquiry, which suggests the need for collaborative data collection in its recommendations, Baroness Finlay has spearheaded a project collaborating Public Health England with coroners and their sample laboratories. Coroners' data has been considered a gold standard for valid CO poisoning statistics and this study (currently proposed at pilot stage) has the chance to determine the true figures for carbon monoxide poisoning for a sample population. Whether it continues and expands or identifies

issues with other data sets the project will determine the methodologies and logistical issues involved in collecting this data.

Finally a separate system to the collaborative data collection discussed above has been instigated by Cranfield University. This Incident Response process would require a high level of collaboration from many institutes and would assist the public in diagnosing carbon monoxide poisoning and then following up with thorough and comprehensive data collection of that incident.

### **Academic Portal Progress**

Much of the progress in the involvement of the project with the academic reference portal has been discussed above but to summarise, the population of the database has gone well and will continue retrospectively throughout the project, collaborating with the institution that provides the annual portal updates.

Sources from many different areas have been reviewed and this work will continue; the current literature available on the portal provides a broad analysis of the current areas related to carbon monoxide making the portal a useful instrument of research for many individuals.

Advice provided to the GST on the portal and the exchange of ideas and methods of input was beneficial to all those involved and will continue for the extent of the project.

### **Issues Faced**

A few issues have been faced in the course of this study, all of which have been overcome. Where many institutions have been happy to offer their input into the project and its proposed further actions, others have been less interested in being involved such as the data collection collaborative proposal. However in this case it has led to the proposal of several different data collaboration projects which may not have been as possible before.

Another issue occurred in the Academic Portal data collection where many of the sources recovered as citations from other articles did not relate to carbon monoxide in any field. Although it was connected to the project, the tighter timeframe for the portal made this a greater issue in this area. The problem was solved by a rapid sort of all the entries in the academic portal to check they included information pertaining to carbon monoxide in any field of research. This was a quick check and solved the issue for the immediate launch and more can be done and the quality of the sources included in the portal improved further as each remaining source is reviewed.

On-going challenges exist within the research included here for a comprehensive overview. The reviewing of the sources for the academic portal can be challenging when the field of research is not well understood, this could lead to unreliable ratings due to lack of awareness of conducting research in their field. Furthermore the articles although relating to carbon monoxide may not be relevant to the project, something that is immediately apparent however they must still be read and reviewed which takes time away from the project and its aims.

## Future Timescale

The next steps of the project will be the continued collation of sources and the reading and reviewing of information for the final report, this will include possible visits to the British and Oxford libraries for final sources not obtainable online.

Communications with those actively involved in CO has been a large part of the project so far and will continue throughout the project for the collation of sources, collaborative research and project proposals.

The final write-up of the report will likely occur in the last four months of the project followed in the review by the project proposals originating from the project. This could take some time if collaborations are to be suggested, then separate financing will have to be determined etc.

Furthermore Cranfield University has determined that from the length of the project that two 'referable' journal articles will need to be submitted following the report. This will increase the impact the report will have by reaching a significantly larger scientific audience, which may well lead to more research.

## Conclusion

The above demonstrates that the project is currently on track to reach its objectives and has outlined the methods by which this progress will continue as well what has been learnt so far. As with all good scientific research, the aims and objectives are regularly reviewed to ensure that they remain relevant and achievable.