



# Clear and concise report writing: guidance for occupational hygienists

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## 1. Introduction

Occupational hygiene is concerned with the Anticipation, Recognition, Evaluation and Control of health hazards in the workplace; at each of these stages, effective communication is essential.

The production of formal written reports is one of the key methods of communicating occupational hygiene information. This guidance will help occupational hygienists produce clear and effective reports to achieve the aims and objectives for which they have been produced. The aims of the guidance are to:

- Provide a basis for good practice.
- Aid the Continuing Professional Development of qualified occupational hygienists.
- Provide a study aid for the trainee occupational hygienist.

The guidance may be useful in terms of evaluation criteria by which managers or regulators may review occupational hygiene reports.

This guidance builds upon documents produced by the Institute of Occupational Hygienists (IOH) in 1994 (1) and the Australian Institute of Occupational Hygienists (AIOH) in 2006 (2) and aims to provide occupational hygienists and those who work with them, with a framework to identify what should be included in a written report. It is applicable to all occupational hygiene reports, including those dealing with risk assessment and monitoring of specific chemical, physical ergonomic and biological hazards. It provides guidance on how to; record survey activities, present hazard and risk information, communicate numerical data and document the findings and present possible recommendations or the need for additional control measures.

Although many of the principles presented in this document are applicable to other forms of written and oral communication, this work is not explicitly intended to cover letters, electronic-mail (e-mail), discussion documents, risk assessments, leaflets, posters signs etc. Whilst all of these are methods of communication which occupational hygienists may employ, they are beyond the scope of this document.

### The importance of good presentation

We live in a world where we are sold many things on the basis of presentation and image. The media, television and the internet have changed people's expectations of written communication with an increased emphasis on immediacy, and our ability to edit and change web page entries, blogs and documents. Templates and 'cut and paste' techniques have become a widely accepted method for preparing outputs and while they have brought significant advances in presentation and simplicity they also hold dangers in allowing the writer to present irrelevant, unchecked or inappropriate information. Improvements in Information Technology (IT) have increased people's expectations of what should be contained in written reports while their tolerance of poor presentation has decreased. Written communication is important for the following reasons:

- **Recording** - effective health and safety management as well as legislative compliance rely heavily on written records. In addition to this, corporate memories are poor historically and written information is essential in providing continuity.
- **Educating** – Hazard recognition and control of health risk both begin with understanding, which inevitably means that education is part of an occupational hygienist's role. Written communication via the report can be key to educating management and workers on the need for change and control.

- **Influencing** - Written communication can be an effective way of presenting arguments in order to implement actions which control potential health risks. In particular, it is effective at preventing misunderstandings as well as dealing with negative feelings and avoiding an overreaction from the intended audience.

It is important to note that a report can only be as good as the work that it is presenting. Flaws in the design or execution of the work described within the report cannot be corrected or disguised by it. At the same time good quality work needs to be presented in a good quality report in order for it to be recognised and used effectively.

The ABC of report writing is useful mnemonic:

**Alacrity:** The report that arrives 6 months after the survey occurred and when conditions and personnel may have changed will be of little use.

**Brevity:** Keep it brief and to the point.

**Clarity:** Keep it simple, avoid technical jargon, consider readership and emphasise what, if anything needs to be done to improve health and safety.

The diagram below summarises the different components which need to be considered when producing a report. Each of these is dealt with in the following sections.

**Figure 1.1 Components to be considered in an occupational hygiene report**



## 2. Aims and Objectives of a report

In order for a report to be successful it is necessary to clearly define the aims and objectives. The objectives of a report should identify the scope of the report and why it should be produced. The objectives should be clear to the author and to those requesting the report at the start of the work. The author should normally have written objectives and Terms of Reference (ToR) at the start of the work, and it is helpful to refer back to these during the report writing process.

Depending on the nature and extent of the work, the author may wish to have separate aims and objectives, where aims are the changes that the author would like to bring about as a result of the work and accumulation of data, whilst the objectives are the activities which are carried out in order to achieve these changes.

In considering the reader (see section 3) it is likely that the author may identify primary and secondary or even tertiary objectives.

- **Primary objectives** may be considered to be those which triggered the production of the report in the first place. For instance a noise survey to obtain baseline information regarding a particular area of plant or certain site tasks/activities or locations. Alternatively an air monitoring survey may have been undertaken to demonstrate the effectiveness of a new control measure.
- **Secondary objectives** are those which did not trigger the production of the report but are of interest to the manager, occupation hygienist or local workforce. For instance, the report on the survey undertaken to demonstrate the effectiveness of a new control measure may also have secondary objectives of risk communication and for training purposes. It may also be used to assist in the demonstration of legal compliance with an exposure limit or internal company procedures and rules.
- **Tertiary objectives** are those which do not directly relate to the author or the primary readership. These largely relate to potential future uses of the report. Whilst it may seem an unnecessary complication, the nature of occupational hygiene is such that the author needs to consider future readership in terms of the use of the:
  - Data by researchers for activities such as exposure modelling or epidemiological studies.
  - Report by regulatory authorities.
  - Report by design engineers or other health & safety professionals.
  - Report in future legal cases.

The objectives described above will vary depending on the individual circumstances. Some examples of typical objectives are listed below:

- Formal Risk Assessment.
- Identification of sources of exposure to physical, chemical or biological agents.
- Identification of fugitive emissions.
- Reappraisal of personal exposures, noise levels etc, following process, plant or control measure modifications.
- Demonstration of compliance with an exposure limit.
- Demonstration of compliance with legislation.
- Communicating the health hazards and risks in the workplace.
- Documenting planned actions.
- Proposing planned actions.

- Seeding ideas for planned actions.
- To reassess exposures after any planned control improvements have been implemented.
- Historical evidence and record keeping e.g. epidemiology or exposure modelling in future.

### **3. Considering the Reader**

In producing any report it is essential that the author considers the potential readership and understands what the reader requires from the report. The author should consider the following questions:

- Why does this particular reader need or want to read this report?
- What is necessary to communicate to the reader?
- How much background (to this project, workplace, sampling method etc.) will the reader need in order to understand the recommendations, conclusions and arguments made in the report?
- What does the reader already know about this or similar work?
- How wide is the reader's knowledge of the subject?
- What access to references and any cited documents will the reader have?
- What will be the reader's expected response to the report?
- What, from the writer's point of view, is the desired response to the report?
- How can the writer bridge the gap between what the reader knows already and what the writer wants (or needs) the reader to know, in order to produce the desired response.

Unfortunately there is the added complication for most occupational hygiene reports in that they are usually written for several interested parties within a workplace, with each group having different, and sometimes competing, requirements. The author will need to analyse the potential readership, their depth of occupational health and hygiene knowledge, and adjust the content and style of the report appropriately.

#### **Writing for a varied readership**

The author should consider the different types of reader. The report may be read by a range of people including; managers, employees, union representatives, regulators, occupational health practitioners and researchers. Each of these groups will have a varying degree of knowledge and interest in different parts of the report.

Even when the level of knowledge or individual readers can be identified, the requirements may be contradictory. For instance the senior manager may require brevity whilst the regulator or line manager may require copious detail. Some techniques which can be employed to try to deal with this issue are listed below:

- Use of visual communication techniques (see Section 8).
- Strategic use of appendices and summaries (see Section 9).
- Combining the report with other methods of communication. The occupational hygienist needs to be an advocate for their work and as such cannot simply rely on the publication of their report. Activities such as presentations to management, informal conversations, action plans, e-mail, close down and follow up meetings, and training sessions should all be used to supplement the message contained within a report.
- Writing two or more separate reports. This is time-consuming and requires some knowledge of the politics of an organisation and would not normally be advocated. However, this may be advisable where a large amount of information is being presented, especially to different and/or external groups or professional bodies.



#### 4. Written English

The quality of the writing within the report is essential for clear and concise communication of the findings it is describing. Occupational hygienists therefore need to be accomplished writers in order to produce effective reports. Some general points which are appropriate for occupational hygiene reports are presented below:

- **Punctuation:** Reports tend to rely heavily on punctuation and the author needs to be fully conversant with the use of colons, semicolons and bullet points etc.
- **Grammar:** In general reports should be written in the past tense using the passive voice and in the third person neuter. e.g. "samples were taken" not "I took samples". There may be exceptions to this such as recommendations being made in the future tense or in the production of an expert witness report or legal statement.
- **Jargon:** Authors should avoid the use of jargon; however this will need to be balanced with the requirements for accuracy and precision when describing various technical aspects of the work.
- **Sentences:** The sentences should be short, not more than 25 words long is a good rule of thumb. Short sentences produce a clear, easily-read style for factual material, although an occasional long sentence may also be needed at times.
- **Word Choice:** Authors should choose words carefully to try and avoid ambiguity that may give the wrong impression and draw incorrect conclusions. Careful choice of words is particularly important when drawing conclusions and making recommendations. An article by David Kudlinksi (3) describes the issues associated with the use of the wrong words in occupational hygiene reports.
- **Paragraphs:** Paragraphs should also be kept relatively short and contain unity of content i.e. they should be pertinent to one aspect of the report. Several short paragraphs, rather than long, rambling ones, will help to retain the interest and understanding of the reader. They will also help to ensure that the information contained in the short paragraphs is relevant to the subject(s) being reported and/or discussed. Misunderstandings can be potentially serious in respect of occupational hygiene reports, where workplace health protection matters and recommendations are being recorded. Clarity of reporting is vital and the report should flow consistently from beginning to end.
- **Acronyms:** Acronyms and other abbreviations can be used provided that they are defined the first time they are used in the text. In longer reports, they should be included in a glossary.
- **Units:** The presentation of units must be consistent throughout the report: e.g. use milligrammes per metre cubed ( $\text{mg}/\text{m}^{-3}$ ) or parts per million (ppm) but not both for a specific contaminant.
- **Readability:** A great deal of research has been put into the readability of various documents. One guide to help with the readability of your report can be found on website. <http://office.microsoft.com/en-us/word-help/test-your-document-s-readability-HP010148506.aspx> (accessed December 2011).

- **Plagiarism:** The use of IT has made plagiarism easier and more common than ever before. Further information on what is considered plagiarism and how it can be avoided can be found at: <http://www.plagiarism.org/index.html> (accessed December 2011).

## 5. Organisational Issues

The production of consistent good quality reports requires preparation and organisation; some points for consideration include:

- **House styles and templates:** Many companies and consultancies will have their own house styles and templates for the production of reports. A good template is one which is flexible enough to allow each report to achieve its specific aims, whilst at the same time offering good, consistent presentation as well as time savings.
- **Document control:** The use of electronic copies of documents brings clear advantages in terms of distribution, review and circulation. However, it also brings the potential for confusion and alteration of documents. A robust report numbering and traceable document management system is therefore essential. Final reports should be clearly distinguished from previous versions, for instance by using a DRAFT watermark or FINAL stamp. Final reports should be circulated in a format that is not easily manipulated e.g. Printable Document Format (PDF).
- **IT:** Word processing software is easy to use, but at the same time authors need to make a specific effort in order to make the best use of it. The use of computer generated tables of contents, lists of tables, hyperlinks and automated referencing can all speed up report production and enhance its readability. Care must be taken though to ensure that all the report recipients will be able to download/read the material contained within the report.
- **Confidentiality and Security:** Occupational hygiene reports may contain information which is confidential to individuals and/or an organisation. In the majority of cases ownership of the content of an occupational hygiene report lies with the employer or client and not with the author. The author therefore needs to use secure systems and procedures used to compile and store the information.

## 6. Quality

### Report Checking

Reviewing a report is an essential stage in the production process in order to fine tune and possibly correct the content and presentation.

The computer spell-check provides a basic level of checking on spelling and some grammar. Most software-based checking systems have limitations though. For instance, it may be set to a specific language (American or UK English) or it may not check items in capitals. It will not pick up some common transpositions (e.g. “form” for “from”) and it can actually introduce errors by incorrectly substituting words. Although useful, software is not a substitute for checking by a reader and ideally, all reports should be checked by at least one person other than the author. The checking should cover the technical content as well as the typing, grammar and presentation. For example, check that data included in the text is consistent with the data in tables and charts.

However, it must be recognised that we do not live in an ideal world and that in some cases authors have to be the sole checkers of their own work. In these circumstances the techniques may be employed to make the checking process as robust as possible.

- Revisiting and reviewing the report after a period of time (at least 24 hours and preferably longer) will improve the process of checking greatly.
- The use of a formal checklist such as the one given in Appendix I.
- Allowing sufficient time for a thorough and methodical checking process.
- Checking the report several times for different aspects e.g. one check for spelling/grammar, a further check to examine units used, and a final check for technical content & consistency.

### **Quality Assurance**

Whilst reviewing is an essential stage in the production of a report, it should be part of a broader quality assurance process rather than an end of line quality control check. A quality assurance process is likely to include some or all of the following elements:-

- Taking appropriate actions to deal with issues raised in the report review process in order to prevent similar issues being raised in future reports.
- Reviewing the structure and content of reports with other occupational hygienists at regular intervals.
- Undertaking periodic peer review of reports, preferably by occupational hygienists external to the immediate organization.
- Following up on reports to determine how effective they have been in achieving their aims and objectives and adjusting future reports accordingly. This would involve asking questions such as:
  - Was the message understood?
  - Was it acted on?
  - Where there any barriers to understanding or points that could have been better explained?

### **Draft Reports**

Issuing draft reports is useful in a number of circumstances, particularly when:

- The actions described within the report need to be agreed by consensus.
- A contribution is required on areas where the author does not have a detailed knowledge. Typically this covers items such as a process description, specific workplace areas or production levels.
- The author wishes to get approval of the report amongst the readership.

When issuing drafts it should be noted that the author of the report is the person who has ownership of its content and he/she should not be unduly influenced over its content, particularly with regard to observations, recommendations and conclusions.

Draft reports should not be used as a surrogate method for checking reports and that the author of the report. Whilst it is often useful to prepare the reader of the report by showing them a draft, the responsibility for the quality of the report rests with the author.

## **7. Presentation of Numerical information**

There are numerous methods used to present numerical information including tables, graphs, charts and line drawings. They can all provide as much, if not more information than the written prose of the report, but the format for each must be appropriate to the information that is being presented. The 'comfort' of the reader is vital throughout the report. Clarification of the general situation or of complex details is often readily acceptable to the reader if it is presented in a way which is both visually attractive and easy to use, follow and understand. It is therefore important for the report writer to decide the right place for the presentation of numerical information which has a direct bearing on the main text and is essential to the reader's understanding of the report.

If the report includes a lot of results these are best presented in tabular form. Comparisons of aspects of one item or of two different items may be best presented in bar chart form, while for both general trends, graphs are normally used. Such items may be produced either as an upright A4 sheet ('portrait' position) or turned through an angle of 90° for greater width ('landscape' position). The landscape format is very useful and easily accepted by the eye, provided that the page is turned clockwise through 90°.

All graphs, maps, histograms and drawings must be accurately recorded and consistently labelled (Table numbers, Figure numbers etc.) with titles, units, appropriate scales and legends where necessary.

In describing numerical data it is often helpful to scale the value to the appropriate standard to which is being compared. One way of doing this would be to express the exposure measurement as a percentage of the relevant exposure limit. So, for example, a measured 8 hour time-weighted average (TWA) personal exposure of 15ppm carbon monoxide could be expressed as 50% of the relevant Occupational Exposure Limit (in this instance UK-WEL). While a measurement of 45ppm would be 150% of the limit. Whilst this technique is appropriate for exposures to chemical agents, it is less useful for noise exposures.

When numerical information is included in any format, the report writer should review it, asking the following questions:

- Does it give all the required information?
- Does it reproduce faithfully the information intended?
- Does it reproduce accurately the results obtained and measurements taken?
- Is it easy to use/follow?
- Does it look attractive?

If the answer in each case is yes, the effect of the report is enhanced by the use of such items.

### **Expressing variability of results**

The issue of expressing variability in results can be problematic. Where personal exposure to chemical agents is concerned evidence suggests that the variability between two exposure measurements of one worker carried out on different days is often larger than the variation

between two different workers performing the same task on the same day. Exposures to chemical agents also tend to demonstrate a log normal distribution, whilst exposures to physical agents such as noise, vibration, and the thermal environment may have different distributions.

Clearly being able to provide some method of explaining variability is important and various statistical techniques exist including presenting some measurement of central tendency such as the arithmetic mean, the geometric mean when the distribution of values is skewed, or the inter-quartile range to give an idea of where the middle 50% of measurements lie. Measures of variability/spread may include the overall range or the standard deviation (for arithmetic means) or the geometric standard deviation (for geometric means). Values that give percentiles of the distribution (e.g. the 90<sup>th</sup>, 95<sup>th</sup>, or 99<sup>th</sup> percentile) are often employed in risk assessment or to determine the likelihood that a given worker is likely to be exposed above a limit value. Recently published guidance (Ogden, 2011) (4) can be used to determine and explain variability in exposure data.

Explaining concepts such as log normal distributions, intra and inter worker variability are not straightforward and can sometimes confuse the overall message that the report is trying to convey. Some approaches which occupational hygienists have used to try and tackle this include:

- Discussing the range of results found and indicating that other exposures may occur on other days.
- Describing the results obtained as a single snapshot.
- Relating the results to other activities that were taking place in the locality.
- Deliberately excluding a discussion of variability in order to concentrate on the main issues.

The author will need to use professional judgement in deciding which of these or any other strategy to adopt. However, if the strategy of “exclusion” is applied the author should consider all of the potential readers of the report (see section 3); after doing this it may then be prudent to include a sentence indicating why this strategy has been adopted. For further guidance there is an excellent discussion of how to handle and interpret exposure variability available online through the US Environmental Protection Agency Exposure Factors Handbook (5).

## **8. Visual communication**

### **Photographs**

Photographs can be an excellent addition to reports, but caution must be taken that they are used wisely and do not distract from the main objectives and aims of the report. Some points to consider when using photographs are given below:

- Taking and composing good photographs in a working environment requires technical and artistic skills, which have to be learnt and practised. A good occupational hygienist will realise that photography skills are likely to be an essential part of their continuing professional development.
- Informed consent for the photographs will be required from both the company and any individuals within the photographs. It is important to keep a record of the consent given and use a standard form for this where possible. Consent for use in a report does not imply consent for other purposes such as a lecture/presentation, website or promotional material.

- There may be a need to blur/pixelate faces, names, labels etc in order to preserve anonymity and/or focus attention on the chosen subject.
- Word processing and graphics software can be used to annotate photographs and enhance their effectiveness. (See Example 1 in Appendix III).
- Care should be taken when taking/choosing photographs so that they illustrate the points that are intended to be made, and in particular that they don't include images which will detract from these points. Images which contain examples of abnormal practice or illustrate other risks than those intended. For instance, an eagle eyed observer may spot the sampling pump in Example 1, Appendix III and take issue with its position. This may detract from the message that the photograph is trying to convey (See Example 2 in Appendix III).
- Most digital cameras can now be used to capture video images and the software for the capture of still images from video is freely and cheaply available e.g. Windows Live Movie Maker (<http://explore.live.com/windows-live-movie-maker?os=other> accessed December 2011). The use of video allows the user to select an individual frame which best illustrates the point they are trying to make. This is particularly useful when activities involve movement. The resultant output of still images from video is not as high quality as conventional still photography but is sufficient for the inclusion in reports.
- Cropping/framing of photographs can be used to help illustrate the message being conveyed and help focus on the area, activity or process of interest.
- Overuse of photographs can reduce their effectiveness.

### **Diagrams, maps etc.**

Advances in computer software mean that it is now much easier to draw well presented diagrams than ever before. Some points to consider when using diagrams.

- In some cases diagrams are better than photographs as they can simplify things and remove unnecessary background information.
- Simple maps or plant layouts are an easy yet accurate way of presenting workplace information and workplace parameters such as noise levels, temperature, lighting levels etc.
- The use of a good flow diagram can be a more effective way of describing industrial processes than plain text. Example 3 in Appendix III shows a flow diagram which has been annotated to incorporate details of control measures, monitoring results and recommendations on a single page.
- Use of a schematic diagram within a ventilation report greatly enhances understanding and makes future examination and testing of local exhaust ventilation (LEV) much easier. Example 4 in Appendix III shows a schematic diagram of a Local Exhaust Ventilation system. This is useful when trying to identify the position of test points on a system which cannot be depicted in one photograph.
- The use of colour can greatly enhance visual presentation. Example 5 in Appendix III shows the position of and level of noise measurements as well as colour coding them. However the author should be careful to consider the future presentation and reproducibility of the

report, which may only be possible in black and white. In addition to this approximately 10% of males and 0.5% of females have some form of colour blindness. These issues can be overcome by ensuring that colours chosen have a high level of contrast and/or through the use of an additional clue such as texture or pattern.

- Well marked maps of sampling locations are sometimes essential to interpretation of results and so someone else can repeat the survey at a later date.
- Photographs and maps etc should be consistently labelled to facilitate referencing within the text.
- The author is responsible for ensuring that they do not breach copyrights when using images and maps etc. If the report is to be a public document (rather than strictly in-house) it is important to keep a record of copyright permissions.

## **9. Typical Layout of an Occupational Hygiene Report**

The essential elements of any given report will depend on the objectives, length and nature of the report. A short 3 page document describing findings from a 30 minute site visit earlier that day will generally not require a contents page or appendices and may merge sections such as discussion, conclusions and recommendations. For longer more detailed reports which describe extensive hygiene work then a comprehensive report will be required. The exact content of a report will vary depending upon the aims and objectives, the following list gives sections should be considered for inclusion in report:

- Front Page
- Executive Summary
- Authors and Signatures
- Contents page
- Introduction
- Aims and Objectives
- Acknowledgements
- Process Description
- Description of Hazards
- Relevant Legislation
- Evaluation criteria
- Strategy and Methods of sampling and analysis
- Results
- Discussion and observations
- Conclusions
- Recommendations and suggested action plan
- Tables, Figures, maps, histograms, photographs as appropriate
- References
- Appendices
- Bibliography

The list above is intended as a guide; only large comprehensive reports describing extensive work are likely to have all of these sections. However, consideration should be given to each of these sections to determine whether they are to be included and their likely extent.

## **Front Page**

The front page or cover of a report should provide the title of the work that has been carried out e.g. "Noise survey within machining area of Widget Incorporated as well as other factual information including:

- The date of the report and dates of the survey or audit the report describes.
- The unique reference number of the report, following whatever convention is used in the author's organization.
- The name/address of the commissioning company.
- The name/address of the company that the occupational hygienist works for.
- The address/location of the site where the survey took place
- Confidentiality rating, e.g. "Internal company use only".
- Distribution list.
- The name, qualifications and signature of the person who has reviewed/approved the report.

## **Executive Summary**

An Executive Summary is an essential element all but very short reports. It is the report in miniature and should quickly and clearly describe the purpose of the work, the main conclusions and how these were reached and should also summarise the main recommendations. The drafting of the Executive Summary should be done with care and awareness as often this is the only part of the occupational hygienist's report that is read by many of those who will receive the document. Brief, accurate and clear information is required. It is best to prepare the Executive Summary when the rest of the report has been drafted, to ensure consistency with the main text.

## **Authors and Signatures**

Individual organisations will have their own rules on report signatures and control of documents. However, all reports should be at least be signed by the lead author. The author(s) should also list their job title/position as well as relevant qualifications as post nominal letters.

## **Contents Page**

Contents are useful in directing the reader to particular areas of the report and are recommended when the report is lengthy and has many sub-sections, tables, figures or appendices etc. For contents to be useful it is important to have clear and consistent page numbering throughout. Section or Paragraph numbering should be used so that it aides the reader, the type and level of numbering will vary depending upon the length and nature of the document.

## **Introduction**

The introduction section should provide some background to the work, explain why the report was commissioned, by whom, and whether any previous related reports have been written or work undertaken. It should also describe events such as incidents of ill health or complaints that have prompted the work covered in the report to be carried out. It is important to identify the scope of the report, where and when the work was carried out. Some authors will include an overview of the relevant legislation at this stage while others may choose to provide this under the process description or within a dedicated section.

## **Aims and Objectives**

Stating the aims and objectives of the work within a dedicated section is a useful practice. Not only does it clarify the nature of the work but it also provides the reader with a readily identifiable section to refer back to when considering the conclusions and recommendations in order to see if the work has achieved what it set out to do.



### **Acknowledgements**

The report should acknowledge those people who are not listed as authors but assisted in its production and/or the work that it describes.

### **Description of activities**

This section should describe the activities and/or processes being assessed. Information on the relevant conditions prevailing at the time and how representative of normal working practices these were, will also be provided here. Depending on the reader the process description may provide some basic details about the materials used, quantities, workforce, worker behaviour and general dimensions of the work areas/locations. The level of detail should relate closely to the stated objectives of the report but will also need to consider possible tertiary aims and objectives described in section 2. Overall the description should provide enough detail to reconstruct or visualise for the readers the working conditions and how the activities were performed.

### **Description of Hazards**

Depending upon the aims and objectives of a report a description of the hazards and their health effects may be required.

### **Relevant Legislation**

A summary of legislation relevant to the process, material or activity may be useful within a dedicated section. Where recent updates to legislation have taken place or where the author has identified that the reader has particularly poor understanding of the legal framework then it may be useful to provide this clearly and in summary form. Where assessing compliance with the law is part of the aims of the survey, then it should be included. Reference to the relevant legislation and associated guidance documents and information on where these can be obtained can help support this section and full details should be included in the References list at the end of the report.

### **Evaluation Criteria**

A description of how risks are being evaluated should be included. This may simply be to list the relevant industry or company standards and/or Occupational Exposure Limits. However it may also require a description of how an in house limit has been derived or what process is being used for qualitative assessments.

### **Strategy and Methods of Sampling and Analysis**

As with any description of scientific procedures a well-written methods section is essential to any report. The methods should provide enough information to enable replication of the work performed and as such should contain:

- The sampling strategy adopted and the rationale behind it.
- Description of the equipment and sampling methods used with reference to any standard sampling and analytical techniques used.
- Information on quality assurance procedures such as zeroing, calibration and use of field and laboratory blanks etc.

The section does not need to reproduce information, which is presented elsewhere in the report or in easily accessible publications which can be referenced.

### **Results**

The results section of the report will be one of the most widely read. Pages of detailed tables with many footnotes will be much harder for the reader to digest compared to simpler graphical formats (see Sections 7 & 8). The author should consider if it is best to present raw data in appendices while summarising complex numerical data in a small number of figures or tables within the main body of

the results section of the report. The results chapter should generally only be used to describe direct findings from the survey. As such the section should list measurement results as well as list appropriate contextual information such as conditions during a working activity and presence or absence of control measures. Discussion and analysis of the meaning of the generated data should be kept apart and included in a separate section.

Where personal sampling has been undertaken it is the normal convention to record the names of the individuals involved. However, there may also be circumstances where the anonymity of the workers needs to be preserved. The author will need to take appropriate action to ensure the level of anonymity required whilst maintaining as full a record of the activities as possible.

### **Discussion and Observations**

The discussion section provides the author with the opportunity to compare the results with workplace exposure limits and other relevant exposure standards etc. Comparison of results with previous surveys, with measurements made in other similar venues or with data from the scientific literature should be provided where possible. Consideration of any possible bias that may have been introduced by the timing or location of the sampling performed should also be presented. This is likely to include a discussion of things such as exposure modifiers and an account of how representative the survey was. For example, the measurement of noise levels in a plant where one-third of the machinery had been taken off-line for emergency maintenance work on the day of the survey is likely to have led to under-estimation of personal exposures. The discussion will describe the occupational hygienist's thought-processes in evaluating the risks that are being assessed and should include the interpretation of observations made on the workplace and working practices and use of the different types of control measures that may be in use. This evaluation will be performed on the basis of observations, measurement data and consideration of the control measures in place. The discussion may also provide the reader with information on the potential options for reducing worker exposure and improved control of potential health risks.

### **Conclusions**

The conclusion section presents the key information in a concise, logical and priority order. The conclusions should refer back to the aims and objectives of the work, and must address the questions or concerns that initiated the survey. The conclusions presented should be clear and concise and a great deal of attention will need to be paid to appropriate word selection. The conclusions should be readable and understandable on their own in isolation from the rest of the report.

### **Recommendations and Suggested Action Plan**

Recommendations are normally the main outputs of the report and will be one of the sections most closely read by those who commissioned the work. Where change and improvements to control measures are required they should be listed in priority order with advice on suitable timescales provided. It is important to make clear which recommendations are essential to achieve compliance and/or reduction of risk those that are desirable in terms of good practice.

In order to make the recommendations effective the author should consider presenting them in a way which makes them more useable and a good guide for further possible surveys/reports. For instance the use of an action plan, which can easily be removed or copied from the report and incorporated into the reader's management system.

### **Tables, Figures, Maps, Histograms, Photographs**

The position of these will vary depending upon the information they contain and the nature of the report. In some instances it is appropriate to give them in the preceding sections of the report.

However where this detracts from the flow of the document it is recommended that they are given a separate section or appendix. In each case they should be clearly labelled and numbered in a manner which is consistent with the rest of the report.

### **References**

A reference section should provide the reader with the details of how to access any previous studies or legislation and guidance material cited in the body of the report. A standard format for referencing should be used, there are a number of standards used such as Harvard (author and date in text) or Vancouver (numbered reference – as used in this guidance). Use of the instructions to authors of scientific journals such as the Annals of Occupational Hygiene will help here. See: [http://www.oxfordjournals.org/our\\_journals/annhyg/for\\_authors/general.html](http://www.oxfordjournals.org/our_journals/annhyg/for_authors/general.html) (accessed December 2011).

### **Appendices**

Appendices should be used selectively to adjust the style and content of the report for the intended readership. The content of the appendices will vary depending upon the intended audience. For instance if the intended audience is largely management it may be appropriate to write a short report where a lot of information is in appendices, whilst a report intended for a more technical or academic report would require much more detail within the main body of the work.

The main body of the report should be readable in its own right and should not require the reader to repeatedly move to the Appendices in order to understand the messages that the report conveys. Examples of appendices may be tables of individual data, maps, figures or photographs that were too large to include in the body of the report, relevant documents such as existing risk assessments or previous measurement data that is not available elsewhere.

### **Bibliography**

Finally a separate bibliography listing more general reading material relevant to the report contents may be appropriate in some instances.

## **10. Are there legal requirements for a report?**

There is no legislation that specifies particular components of a hygiene report in the UK, although there are some elements that would be expected given the framework of regulations dealing with workplace hazards such as COSHH, Noise at Work, Control of Asbestos and Control of Lead at Work. Data on the methods used to identify the hazard, assess the risk in terms of personal exposure and to determine if risks were adequately controlled would all be anticipated in a report produced by a competent occupational hygienist. Where personal exposure information has been collected then data that would allow identification of the worker is required under UK legislation. Where it is desirable to exclude names from reports then this requirement may be satisfied by recording the information elsewhere within the company e.g. in the form of survey record sheets.

While there is no definitive list of the type and nature of information that should be collected during an occupational hygiene survey there are clear advantages in having a core set of data that is recorded during chemical hazard monitoring. In the 1990s some attempts were made to identify what key pieces of information should be recorded in a standardized manner and further guidance can be found in the scientific literature (Lippmann et al., 1996(6); Rajan et al., 1997) (7). Recording methodology, sampling duration, type of sample, control measures in use etc allows greater comparison between surveys and over time thereby enabling greater knowledge about exposure determinants, easier manipulation of data within a database setting and the ability to pool data for

the purposes of epidemiological study. Guidance relating to the Registration, Evaluation, Authorization and restriction of Chemicals (REACH) regulations also suggests what type of sampling and contextual information should be collected in hygiene or exposure surveys.

Although not exhaustive table 10.1 provides a basic checklist of core elements that should be considered in any hygiene survey report.

**Table 10.1 List of core elements in an occupational hygiene report relating to exposure assessment**

<b>Data element</b>	<b>Detail</b>
<b><i>Sampling information</i></b>	
Details of the workplace and premises where the survey was carried out.	Site address Dates of visits
Details of the process and tasks being carried out.	Duration. Continuous or episodic. Location of the worker in relation to potential exposure sources. Indication of how working conditions influence exposure e.g. higher than average production levels.
Specific location of any measurements.	Static or personal. Sketch plan of work area.
Names of employees sampled. Job title.	
Details of hazards present, products produced or processed.	References to other documents such as data sheets
Description of tools and equipment used.	
Any other co-workers or secondary sources of exposure	Info on process/chemical they are involved in, if relevant to contaminant of interest to present study
Method of measurement and where appropriate analysis-specific published method or in-house.	Pump , tube, badge, filter, filter holder, dosimeter numbers etc.
Sampling strategy.	Method of selection of workers. Timing and duration of sampling: representative or 'worst case'.
Sampling details.	Flow rate, calibration, who collected samples, who analysed samples.
Results. Concentrations.	Details of laboratory and field blank corrections.
<b><i>Contextual information</i></b>	
Details on properties of materials	e.g. quantities of material involved; fine powder or coarse granules; percentage active pharmaceutical ingredient (API); moisture content
How materials were handled	e.g. sealed unit transfer or vigorous tipping from a height in to an open container; observations on 'careful' or 'rough' work practices

Data element	Detail
Presence and effectiveness of local control measures and procedures	Summary of controls: <ul style="list-style-type: none"> <li>• LEV (type) and other engineering controls.</li> <li>• PPE.</li> <li>• Administrative controls.</li> <li>• Suitability and effectiveness of the controls.</li> <li>• Human factors and their influence on controls.</li> </ul>
Inside/outside building.	Approximate room size in cubic meters.
Level of general ventilation.	Mechanical (info on air changes per hours (ACH) or natural.
Use of personal protective equipment.	Type, make, model, manufacturer. Duration of use. Maintenance and storage of PPE. Suitability and effectiveness.

## 11. References

1. Institute of Occupational Hygienists Report no 15 "Guidelines on Occupational Hygiene Reports" issue 1 published January 1994. (Out of Print)
2. Australian Institute of Occupational Hygienists Inc. "Guideline for writing on Occupational Hygiene Reports" published June 2006.  
See: [http://www.aioh.org.au/downloads/documents/AIOH\\_OHReportGuideline.pdf](http://www.aioh.org.au/downloads/documents/AIOH_OHReportGuideline.pdf) (accessed December 2011)
3. Article by David Kudlinski "Watch Your Language" – AIHA in 'The Synergist', published February 2010.
4. Ogden TL. (2011). 'Testing Compliance with OELs for Airborne Substances' Joint guidance published by the British Occupational Hygiene Society and the Nederlandse Vereniging voor Arbeidshygiëne (Dutch Occupational Hygiene Society).  
<http://www.bohs.org/library/technical-publications/> (accessed December 2011)
5. US Environmental Protection Agency "Exposure Factors Handbook" published August 1997.  
See: <http://www.epa.gov/ncea/efh/pdfs/efh-chapter02.pdf> (accessed December 2011).
6. Lippmann M, Gomez MR, Rawle GM. (1996) Data elements for occupational exposure databases: guidelines and recommendations for airborne hazards and noise. Applied Occupational and Environmental Hygiene. 11: 1294–1311.
7. Rajan B, Alesbury R, Carton B, Gerin M, Litske H, Marquart H, Olsen E, Scheffers T, Stamm R, Woldbaek T. (1997) European proposal for core information for storage and exchange of workplace exposure measurements on chemical agents. Applied Occupational and Environmental Hygiene. 12: 31–39.

## 12. Bibliography

"MHSC Handbook on Mine Occupational Hygiene Measurements" published in South Africa. 2007 Chapter 2. Report Writing Casper J. Badenhorst, Anglo Platinum Ltd., and Editors

Cherrie, Semple & Howie "Monitoring Health Hazards at Work" - Chapter 8 Hygiene Reports & Records and Chapter 7 Analysis of Measurement Results. 4<sup>th</sup> Edition Published 2010 ISBN-13: 978-1405159623

The Institution of Engineering and Technology - A guide to Technical Report Writing  
See: [www.theiet.org/students/resources/tech-report-writing.cfm](http://www.theiet.org/students/resources/tech-report-writing.cfm) (accessed December 2011)

## Appendix I - An example of a Checklist for reviewing an Occupational Hygiene report

Adapted from MHSC Handbook on Mine Occupational Hygiene Measurements

Section of Report	Yes	No
<b>Report Title</b>		
Does the title accurately describe the contents of the report?		
Is the title specific enough (i.e., give enough information)?		
Is the title concise enough (i.e., not give too much information)?		
Does the title enable easy electronic and manual filing, referencing and indexing?		
<b>Executive Summary/ Summary</b>		
Is it shorter than one page in length?		
Does it contain a statement of the problem if there is one		
Does it contain information on who was monitored and where?		
Does it contain a statement of the methods used?		
Does it contain the most important results relative to applicable occupational exposure or other limits?		
Does it contain a statement of the conclusion(s) if found to be necessary?		
Does it contain the essential recommendation(s)?		
<b>Introduction</b>		
Is the problem clearly stated?		
Are the aims/objectives of the survey/report clearly stated?		
Is the history/ background included, and in sufficient detail?		
Does it reflect who did it, where and how it was done, and what workers were monitored?		
Does it include a summary of the operations and/or processes conducted during the survey?		
<b>Materials and Methods</b>		
Are materials and equipment described in sufficient detail necessary?		
Are methods described in sufficient detail for repetition, if necessary?		
If a laboratory manual was used as a reference, was it paraphrased and properly cited?		
Is the laboratory utilised identified?		
Are methods of statistical analysis included here?		
Is this section free of results or discussion?		
<b>Results</b>		
Have all of the results been described in the text of the results section?		
Have only the most relevant data been selected and reported in the tables and figures?		
Have all figures and tables been cited in the text of the results section?		
Have the most effective graphical or tabular formats been chosen to present important data?		
Can all figures and tables be understood without having to refer to the text?		
Are figures properly titled and captioned (below figure)?		
Are tables properly titled and captioned (above table)?		
Where applicable, does the dependent variable appear on the vertical axis and the Independent variable on the horizontal axis?		
Are tables and figures numbered independently, and are they numbered according to the sequence in which they are cited in the text?		

Section of Report	Yes	No
Have appropriate statistics been reported, and are they correct?		
Is the results section free of methodology or interpretation?		
Is the results section well-organised?		
<b>Discussion</b>		
Have all possible conclusions been drawn from the data, i.e., have all of the implications of the data been discussed?		
Where applicable, have anomalies been reported and addressed?		
Have assumptions been identified and justified?		
Where applicable, has the relationship between these and previous findings been discussed?		
What would be the implications of non-compliance with the report in terms of potential health and legal endpoints?		
Are control measures, and the efficiency of these control measures and any deficiencies in control measures discussed in this section?		
Is compliance with legal requirements highlighted in this section?		
Is the discussion section well-organised?		
<b>Recommendations</b>		
Are preventive measures included if employee exposures require to be reduced?		
Are required sampling strategies and programmes or additional required measurements listed?		
Are required actions to improve preventive measures and the persons responsible for carrying them out recorded along with action dates?		
Is the recommendations section well-organised?		
<b>Acknowledgements</b>		
Where applicable, are persons who assisted with the survey work identified?		
Are sources of borrowed equipment and supplies identified?		
Where applicable, are contributors of donated services (i.e., reviewing and editing) identified?		
<b>Literature Cited</b>		
Do all references cited appear in the text?		
Are all citations consistently presented in the same format?		
Are citations presented in an established format, including Internet citations?		
<b>General</b>		
Is the report consistently written in the past tense?		
Have typing errors and misspellings been eliminated?		
Does the entire report exhibit stylistic consistency?		
Did the authors use citations rather than footnotes?		
Does the report include a table of contents?		
Does the report need a listing of tables and figures?		
Does the report need a list of abbreviations and acronyms or a glossary?		
Does the report have provision for the official review or signing off by the relevant person(s)?		
Is the version of the report correctly indicated? e.g. Draft or Final.		



## **Appendix II - General Rules for report writing**

1. The reader's ability to understand the content is the most important aspect.
2. Keep the report as short as possible, while including all essential information.
3. Organise for the convenience of the report user.
4. All references should be correct in all details.
5. The writing should be accurate, concise and avoid jargon.
6. The right diagram with the right labels should be in the right place for the reader.
7. Summaries should give the whole picture, in miniature.
8. Reports should be checked for technical errors, typing errors and inconsistency.
9. A report should stimulate/facilitate action.
10. Reports and the recommendations they contain should be followed up.

Adapted from: The Institution of Engineering and Technology - A guide to Technical Report writing ([www.theiet.org/students/resources/tech-report-writing.cfm](http://www.theiet.org/students/resources/tech-report-writing.cfm) accessed Oct 2011)

## Appendix III - Examples of photographs and Diagrams

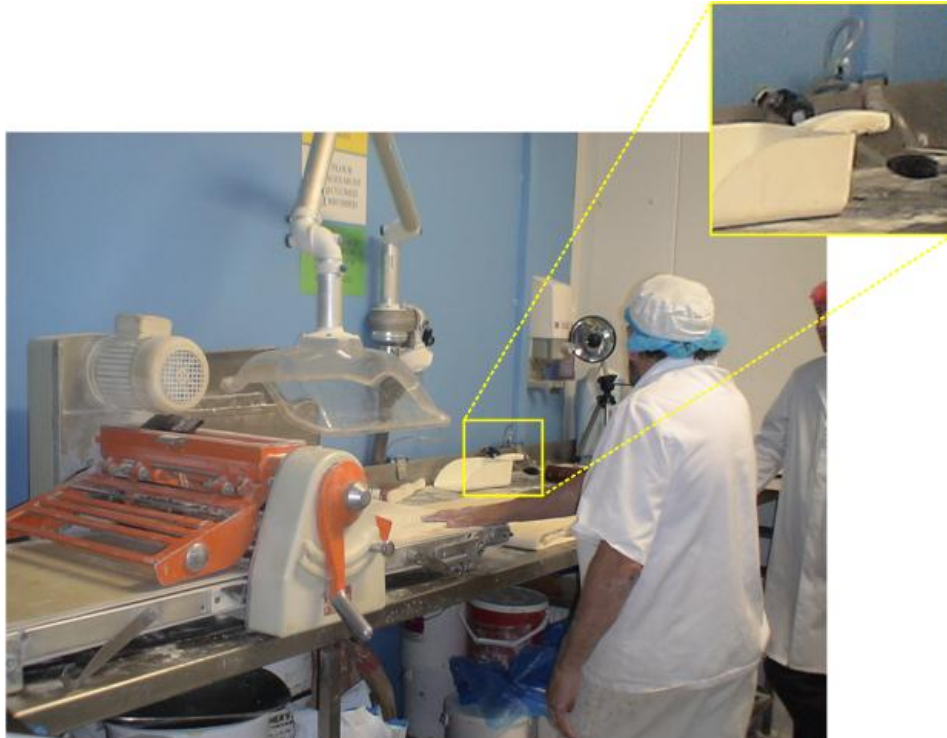
### Example 1 - Annotated Photograph

(Source: Adapted by Adrian Hirst from original Photograph by HSE)



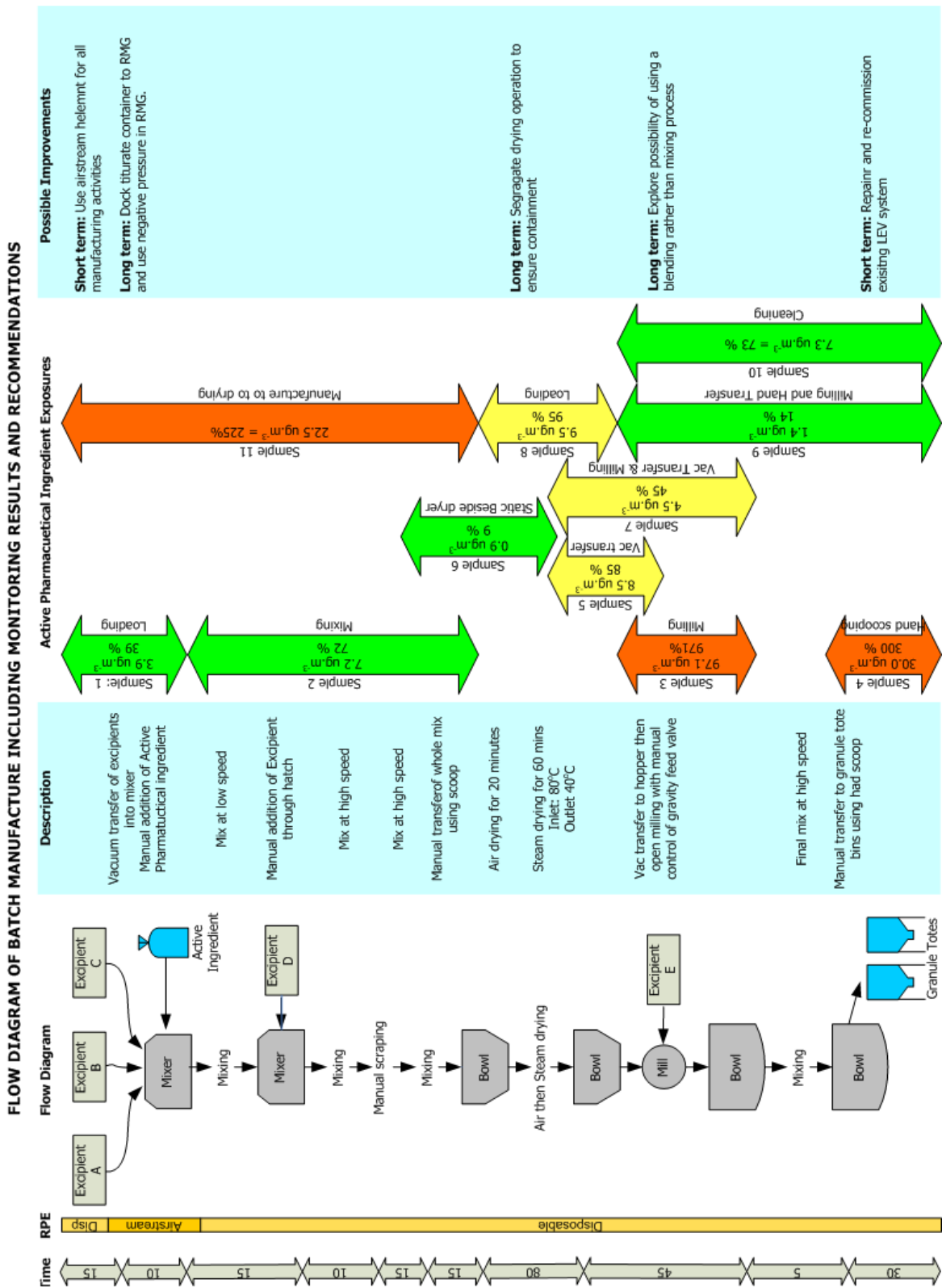
### Example 2 - Photograph highlighting something which may detract from the intended illustration.

(Source: Adapted by Adrian Hirst from original Photograph by HSE)



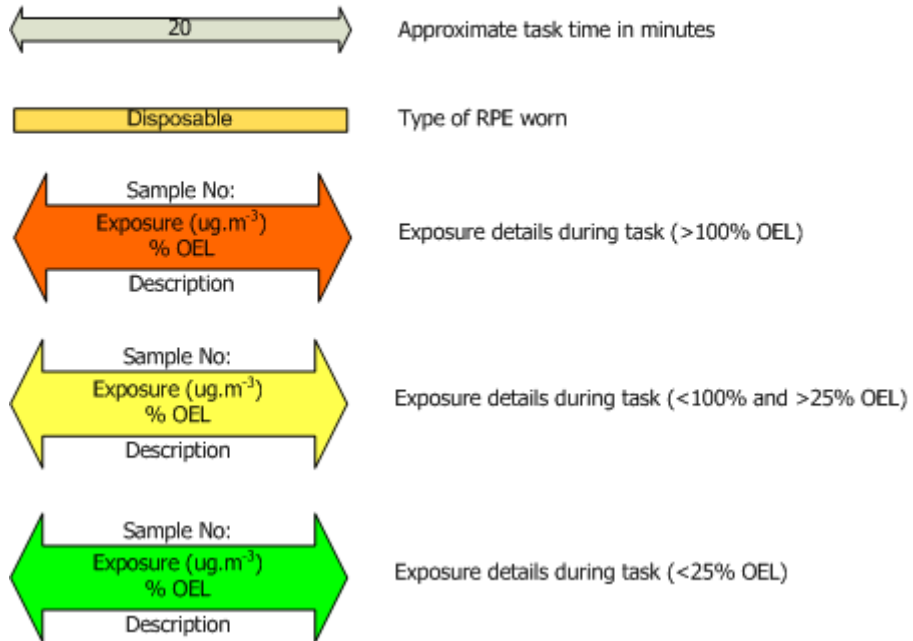
This is the same photo as in example 1. However the position of the sampling pump has been highlighted to illustrate how unintended content in a photo can detract from the intended message.

**Example 3 - Diagram of a process incorporating controls, monitoring results and recommendations**  
 (Source: Adrian Hirst)

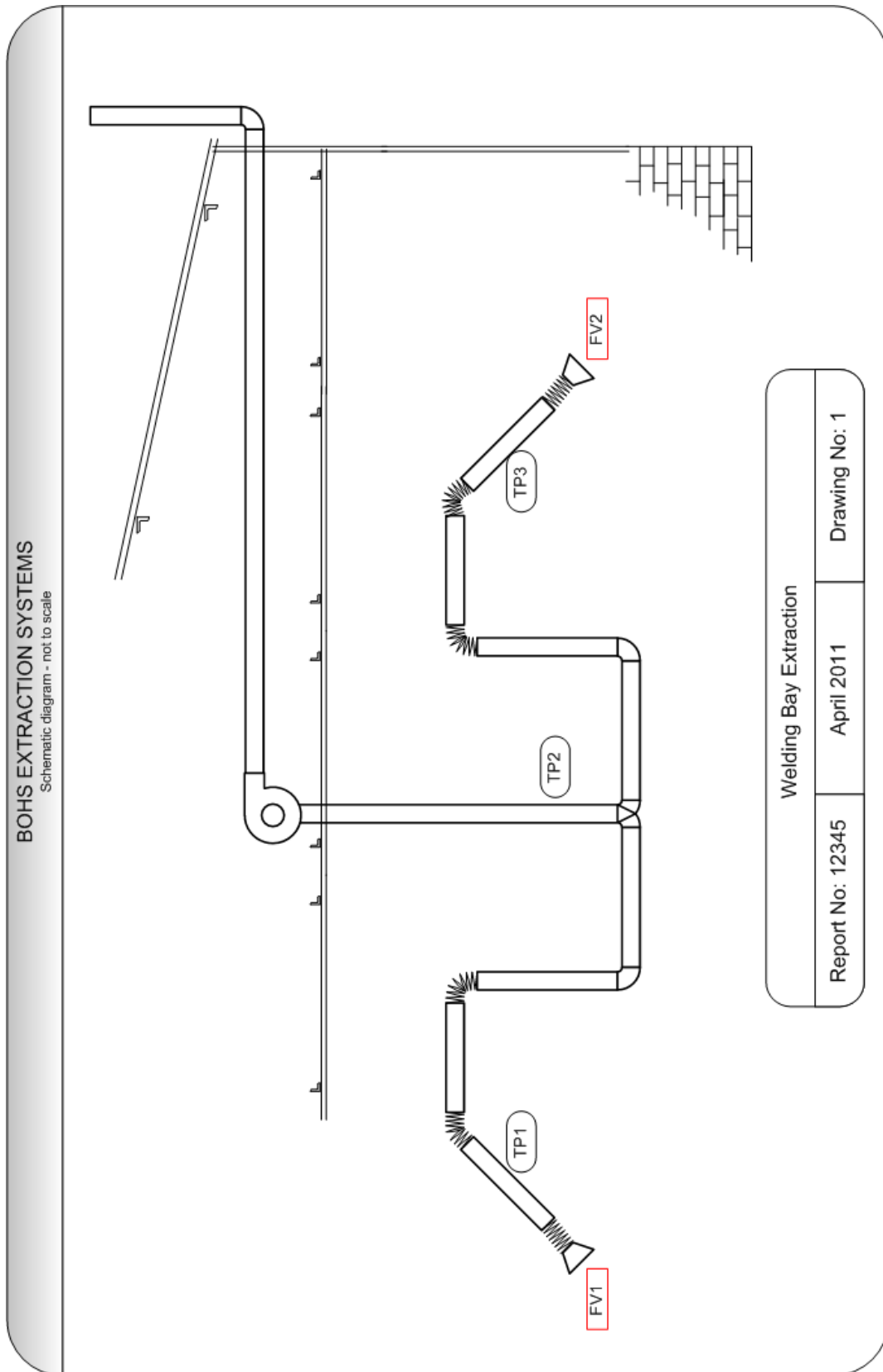


### Example 3 Continued – Key to Process Diagram

#### KEY:



Example 4 - LEV diagram (Source: Adrian Hirst)



### Example 5 - Noise Diagrams (Source: Adrian Hirst)

Diagram 1 – Noise measurements taken at operator Positions

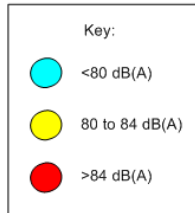
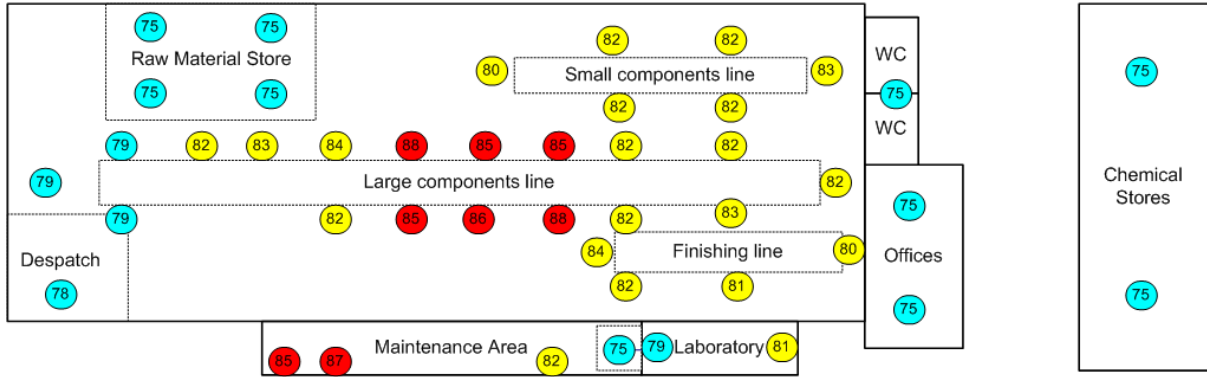
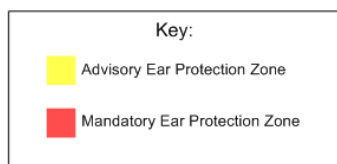
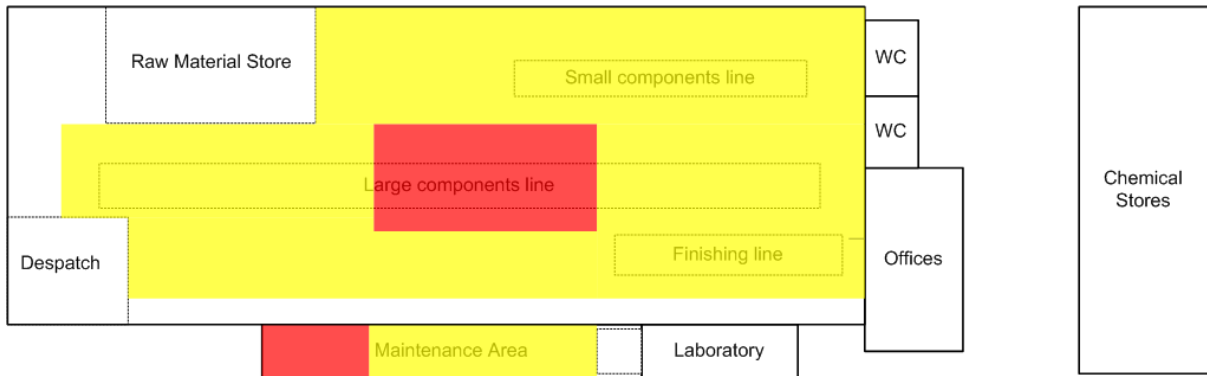


Diagram 2 – Suggested Ear Protection Zones







Pride Park, Derby, DE24 8LZ, UK  
[www.bohs.org](http://www.bohs.org)