SAFETY SCIENCE Monitor
Special Edition 1999
Safety in Action
25-28 February 1998
Safety Management
Article 13
VOL 3

DEVELOPMENT OF A STRATEGY DESIGNED FOR THE IMPLEMENTATION OF THE NSW HAZARDOUS SUBSTANCES REGULATION INTO SMALL BUSINESS

PANAYIOTIS LOULLIS
GREGOR MALICH*
CHRIS WINDER
Department of Safety Science, The University of New South Wales,
Sydney NSW 2052, Australia

ABSTRACT

The New South Wales Hazardous Substances Regulation was enacted by the NSW WorkCover Authority in July 1996 to control hazardous chemicals at work. However, small businesses have raised concern about compliance with this regulation due to its complexity, and they point out their lack of appropriate resources for developing their own hazardous substances management strategy. The Department of Safety Science at the University of New South Wales established a research project which aimed at developing an easy and cost-effective strategy for small businesses to comply with the regulation. This strategy was developed in two essential phases: (i) a review of relevant legislation and existing practices was carried out to identify the necessary extent of the strategy, (ii) based on the results of the first phase, a compliance strategy was developed using the Chemical Safety and Applied Toxicology Laboratories (CSATL) as a case study in terms of technical and organisational considerations. While absolute compliance with the regulation is desirable, organisational measures within existing resources could provide high levels of compliance at low costs when implemented thoughtfully.

1.0 INTRODUCTION

1.1 Hazardous Substances Regulation

The New South Wales Hazardous Substances Regulation (NSW HSR) was enacted by the NSW WorkCover Authority in 1996 with a two year transitional period so that employers and suppliers can introduce compliance mechanisms. It represents the State's latest legislation concerning the control of hazardous chemicals and is based on a national model and in line with ILO Convention 170 and Recommendation 177 (ILO, 1990). Accordingly, the new regulation imposes obligations on suppliers, employers, employees and retailers to deal with hazards associated with the steadily growing amount of chemicals found in workplaces. Consequently, legal requirements for identification, assessment and control of chemical substances have become more complex. Concerns have been raised by relevant businesses in general and by safety representatives in particular about development and implementation of strategies to comply with the new regulation.

There has been some criticism of the regulation (GUN, 1994), and especially small businesses claim that they do not have the human and financial resources to further develop and monitor management strategies for hazardous substances. However, most reports indicate that awareness of workplace chemical safety in Australia is poor (HOLMES, 1992; WINDER AND TURNER, 1992; LEWIS ET AL, 1993; STEWART, 1994; WINDER ET AL, 1994; PEARSON ET AL, 1995) and in need of proper control.

The NSW Hazardous Substances Regulation adopts the risk management approach of *IDENTIFY, ASSESS, CONTROL* as defined in Australian Standard AS/NZS 4360:1995 (Standards Australia, 1995). The regulation outlines a range of responsibilities, including:

Risk Management

- obligations of manufacturers and importers (suppliers), employers and employees;
- requirements for record keeping;

Identification of Hazardous Substances

- criteria for determining a hazardous substance;
- requirements for hazard communication on chemical hazards;

Assessment of the Risks of Hazardous Substances

- procedures for workplace assessment;

Control of Hazardous Substances that are a Risk to Health

- requirements for exposure control, including permissible exposure standards;
- consideration of the need for workplace monitoring;
- consideration of the need for health surveillance;
- requirements for education and training;
- systems for the emergency services.

1.2 Objectives of the Project

The Department of Safety Science at the University of New South Wales set up a research project which aimed at developing an easy and cost-effective strategy for compliance with the NSW HSR. The strategy was to be designed specifically for small businesses affected by this legislation to demonstrate the feasibility of implementing the regulation at low costs.

This article discusses some of the problems and implications of developing a hazardous substances compliance strategy for the new regulation. As an example, a compliance strategy was developed for the Chemical Safety and Applied Toxicology Laboratories (CSATL) of the Department of Safety Science. The implementation phase of the strategy was initiated in mid-1997 and is underway.

2.0 HAZARDOUS SUBSTANCES REGULATION COMPLIANCE STRATEGY

2.1 Chemicals in Laboratories

Laboratories are workplaces (SCOTT STRICOFF AND WALTERS, 1990). Although studies have shown that overall mortality rates in laboratory workers appear lower than in the general population, a number of health effects have been associated with laboratory work, including lymphomas, leukaemias, malignancies of the colon, cerebrovascular disease and prostate cancer (ALDERSON, 1986). Therefore, laboratory workers should be subject to the same occupational health and safety considerations as any other workers. There are a number of general and specific problems associated with the introduction of safe practices in chemical safety. Firstly, laboratories often contain many more chemicals than are encountered in industrial working environments; secondly, there is a wide range of possible chemical hazards that laboratory inventories can produce; thirdly, laboratory activities are extremely varied and frequently change; and lastly, there are attitudes of familiarity, indifference or ignorance on the part of many laboratory personnel to fundamentals of chemical safety. Therefore, the management of occupational health and safety in laboratory environments needs particular attention (HASKI ET AL, 1994).

2.2 CSATL Compliance Strategy

Development of a Hazardous Substances Policy

A hazardous substances policy, geared to the requirements of the CSATL, was developed. In this case, apart from the intentions and objectives, the policy defined relevant obligations and duties regarding:

- the management of CSATL;
- the Occupational Health and Safety Management Committee of the organisational unit in which the CSATL is located (the Department of Safety Science, UNSW);
- the employees and students working in the CSATL.

An appropriate draft of the policy considering the above, was developed, circulated for comment, revised and signed on the 31st January 1997. This policy emphasised not only duties regarding health and safety but, as well, the obligation of the involved parties for environmental protection. Later in 1997, the draft was adopted by the OHS Committee of the Department of Safety Science as a Department wide policy.

The policy indicated that a safety strategy was to be developed. According to the NSW HSR, this strategy would have to incorporate a number of critical elements, including:

- development of procedures for hazard communication (e.g., inventory control, development of a hazardous substances register, decanting procedures, chemicals specific training);
- development of procedures for workplace risk assessment;
- development of procedures for the control of unacceptable risks from the control of hazardous substances.

Inventory Development of the CSATL

An inventory of chemicals in the CSATL was compiled. The existing inventory contained more than 300 chemical substances, but it was out of date. The exercise of preparing an updated inventory identified a number of chemicals that were out of date, obsolete or surplus to requirements. These were discarded through the University's waste contractor. This process shortened the inventory, and assisted in reducing compliance activities.

In the updating process, all substances stored or being used in the laboratory were further categorised regarding their properties into:

- Poisons;
- Dangerous goods;
- Hazardous substances.

Apart from the categorisation process, the scope of the inventory was expanded to contain information regarding the:

- name of the chemicals;
- quantity of each chemical stored at the premises of the laboratory;
- location where the chemicals are stored;
- main hazard they may cause;
- name of the supplier of each chemical.

Even though the inventory was updated, a systematic procedure for the consequent updating of the list following any delivery of chemicals still needs to be established. The inventory was printed and placed in a file accessible for all people working in the laboratory. Further, the inventory was saved on a disc and given to the laboratory manager.

Material Safety Data Sheets (MSDS) and Register Development

CSATL already maintained a collection of MSDS, however, it only contained two MSDS. After a thorough search in the laboratory, another 12 MSDS were found. From these 14, only 7 were valid because the rest were more than five years old and could not fulfil the criteria required by the new regulation. Analysis of the inventory established that 141 chemicals were classified as hazardous substances and therefore require an MSDS.

Suppliers were then contacted to supply MSDS for (at least) the 141 hazardous substances. Even though some chemicals were produced by other suppliers, for the sake of simplicity, only three producers/suppliers were contacted (Merck, Sigma and Ajax Chemicals) to provide MSDS for all 141 chemicals. Two facts regarding the MSDS collection procedure must be noted:

- before supplying MSDS, all three companies attempted to sell CD-ROM products containing information on all their MSDS. This is unacceptable, as the NSW HSR specifies that it is the supplier's obligation to provide free of charge all MSDS that are requested. The attempt to earn money by selling CD-ROM data cannot be considered a legitimate action under the NSW HSR.
- the format of supplied MSDS was also a problem. Differences were observed in structure and in format:
  - Merck used a format which was easily readable and well-structured;
  - Ajax Chemicals MSDS were not as good as those from Merck but acceptable;
  - Sigma delivered an unsatisfactory format which challenged the reader. Furthermore, the text was printed on a bad-quality recycling paper which will not stay in a good condition for the next five years.

  These differences justify the effort needed for an international harmonisation of standard, content and format of MSDS or an electronic version free of charge.

All MSDS were compiled into a file which became the hazardous substances register. It is readily accessible for all people working in the laboratory. As for the inventory, a person with overall responsibility for the updating of the register was appointed.

Walk-through Survey of CSATL

A qualitative walk-through survey in the CSATL was carried out in early 1997. A formal checklist (designed specifically for the CSATL) and a camera were used during the workplace assessment.

A number of important failings and unsafe conditions were observed. They included:

- students carrying out experiments in the laboratory drank and ate at their workplaces despite the fact that they were informed about the relevant health risks;
- the emergency exit did not lead directly out of the building but to an adjacent office. Access to the emergency exit was partly obstructed by furnishings placed on both sites of the exit;
- absence of warning signs and of the exit/emergency signs (these signs had been ordered and were put up a few days later);
- CSATL had only one properly installed fire extinguisher, and a second was missing from a designated location (no extinguisher was located beneath the sign).
- an eye-wash facility was on site, but no-one knew where it was;
- there was no formal procedure for dissemination of safety information. As noted above, the laboratory inventory was out of date and MSDS for only a few chemicals were available;
- staff and students had not received formal training in the use of hazardous substances;
- there was no formal procedure for conducting workplace assessments, therefore assessment of risk and its control was *ad hoc*;
- there was no formal procedure for the labelling of decanted chemicals or mixed reagents, as required by the NSW HSR.

Those inappropriate attitudes, common in many laboratories, confirm that chemical safety and compliance with relevant legislation is not of primary concern. The elimination of these failings depends not only on intentions but on safety awareness of all people working in the laboratory.

Workplace Risk Assessment

In order to form a view about the feasibility of risk assessment procedures, a sample risk assessment was carried out for an experiment conducted by a PhD student. The results of this assessment make no claim to be representative of all experiments carried out in the laboratory, but they reflect tendencies for working habits and safety awareness.

The main steps of the assessment were to identify the hazardous substances used during the experiment, to obtain information about these substances (usually from the MSDS), to evaluate the exposure and the risk, to determine control measures where needed and to record the assessment. In detail, the researcher used a list of questions which were answered by the student as follows:

1. What materials are present?

   The student used during the experiment 14 substances listed below

   - Acetic Acid;
   - Aluminium Ammonium sulphate;
   - Dextran sulphate;
   - Ethylene diamine tetraacetic acid;
   - Formaldehyde.
   - Glycerol;
   - Magnesium chloride;
   - Nonidet P-40;
   - Sodium chloride;
   - Sodium dodecyl;
   - Sodium Iodate;
   - TRIS (hydroxymethyl) methylamine;
   - Triton X-100;
   - Xylene.

2. Are any of them hazardous?

   Four of the 14 substances were classified as hazardous, namely:

   - Acetic Acid;
   - Ethylene diamine tetraacetic acid;
   - Formaldehyde;
   - Xylene.

3. On average, what quantities are used?

   Apart from Xylene (about 0.5 litre for each experiment) the other chemicals were used in very small quantities.

4. How often are they used?

   Similar experiments are carried out once a week.

5. What are the likely hazards?

   - Acetic Acid: Poison (schedule 2) and Dangerous Good (class 8)
   - Formaldehyde: Poison (schedule 6) and Dangerous Good (class 3)
   - Xylene: Poison (schedule 6) and Dangerous Good (class 3)

   Detailed information concerning their hazards could be obtained from the relevant MSDS.

6. Is any substance released or emitted into the work area?

No substance was released or emitted into the work area because the whole experiment was carried out in the fume cabinet.

7. Is the student exposed to the chemical? How often and for how long?

   The student was exposed to the chemical during the experiment which took about two hours and was repeated once a week.

8. What controls are used to reduce exposure?

   - Technical equipment: biological safety cabinet
   - Personal protection: gloves and eye protection

9. What disposal procedures are used?

   Organic solvents were put in a special container collected by the university Safety and Environment unit for disposal. The remaining (nonhazardous) wastes was disposed into general rubbish or to sewer down the sink.

The questionnaire outlined above was further refined into the process flow sheet shown in Figure 1.

Q1-3 Set up the workplace assessment process

1 Who is conducting the hazardous substances assessment? — Name: ____________ Title: ____________

2 What is being assessed? — Depot: ____________ Chemical/Job: ____________

3 Has a hazardous substances register been compiled? — Yes ❑ No ❑
If No, a register must be compiled

Q4-7 Should be answered for <u>each chemical or work unit</u>

4 What substances are being assessed?

5 Has MSDS or other information about the hazardous substances been obtained? — Yes ❑ No ❑
If No, MSDS must be obtained

6 Which of these substances are hazardous?

7 Has exposure to hazardous substances in the work unit been identified? — Yes ❑ No ❑

For <u>each hazardous substance</u>: or group of hazardous substance in the work unit, find out:

Is the substance released or emitted into the work area? — Yes ❑ No ❑

Are persons exposed to the substance? — Yes ❑ No ❑

How much are people exposed to and for how long?
What control measures are used and/or proposed?
Are there any risks associated with the storage and transport of the substance? — Yes ❑ No ❑
Describe the nature of the risk for all activities with this chemical/process

Repeat 7 for the next hazardous substance

8 What is the conclusion about risks?

- Risks not significant ❑
- Risks significant but effectively controlled ❑

→ leads to: Simple and obvious assessment

- Uncertain about risks ❑

→ leads to: Seek expert help and start process again

- Risks significant **and not** adequately controlled ❑

→ leads to:

Assessment report required

Decide on controls:

Requires hazard communication	❑	Requires induction and training	❑
Requires development of safe working procedures	❑	Requires appropriate control measures	❑
Requires better storage	❑	Requires disposal procedures	❑
Requires first aid procedures	❑	Requires emergency procedures	❑
Requires ongoing monitoring	❑	Requires health surveillance	❑

Sign form below and prepare a report for action

Seek expert help and start process again

Simple and obvious assessment

Sign form below and add to register

Name of Assessor(s): ____________ ____________
Signature of Assessor(s): ____________ ____________
Date: ____________ Date for repeated assessment: ____________

Have all the work units been assessed? If not, repeat Q4-8 for the next chemical.

Figure 1: Risk Assessment Checklist

During the assessment the student gave the impression that she worked in a stereotyped manner. She was of course interested in the results of the experiment but had given little consideration to the hazards arising from the whole procedure. For example, not only was she unaware of the location of the chemicals register, she did not even know what a MSDS was. This is not intended as a criticism of the student (it might be an individual case) but a criticism of the lack of communication and appropriate training in the CSAT Laboratory.

The sample risk assessment showed that it was possible to develop procedures for qualitative assessments of risks in compliance with the NSW HSR.

3.0 DISCUSSION

The compliance strategy for the NSW Hazardous Substances Regulation is shown in Figure 2. It considers the process of managing chemical risks in the laboratory and includes:

- identifying which chemicals are present and determining which chemicals are hazardous;
- assessing each hazardous chemical to see if it is a risk to health in normal operations or other activities (such as storage, disposal);
- controlling exposures to chemicals that are risks to health.

From development and partial implementation of the strategy for compliance with the NSW HSR in the CSATL, some obstacles and deficiencies were identified.

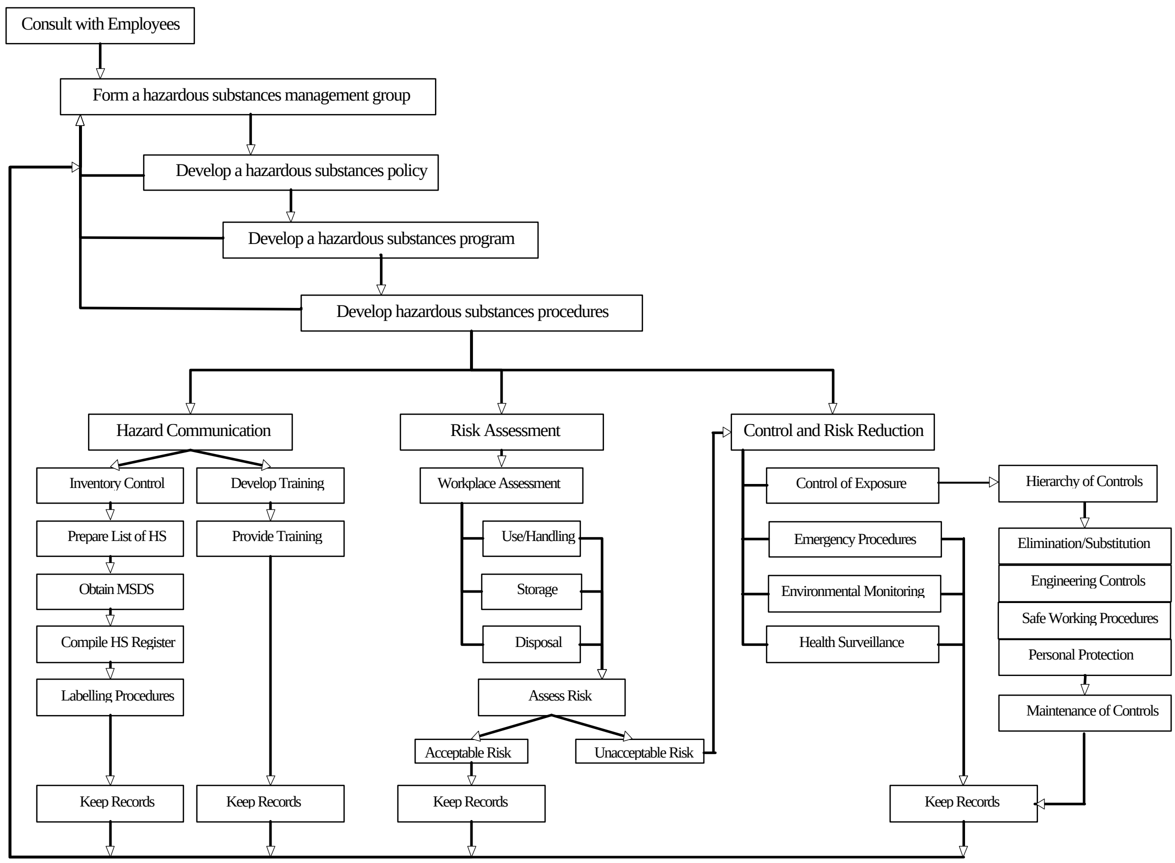

Figure 2: Hazardous Substances Regulation Compliance Strategy

Resourcing of Compliance Activities

A substantial deficiency in the laboratory was the lack of personnel that could take on responsibilities for the implementation and particularly for the review and control of the compliance strategy. The only person employed was the laboratory manager who already had a very busy work schedule. It would not be reasonable to expect from him full responsibility for safety matters as he had not been allocated additional resources to undertake compliance activities. The additional support could be based on 2-3 different alternative solutions where costs play an important factor. For example, the employment of a second person in the laboratory would be the most beneficial solution but obviously the most expensive one. A more cost effective solution with the possibility of suitable compliance is the part-time employment of a student (preferably one who already carries out experiments in the laboratory) as an assistant. This student should take responsibilities and cooperate with the laboratory manager for the implementation and review of the strategy, updating the inventory, obtaining new MSDS, updating the register, labelling of any containers and record keeping for activities concerning compliance. Alternatively, responsibility for some of these activities could be passed on to all staff and students, who would carry out compliance activities as part of their normal activities. This last option is obviously the least costly, but has other problems with regard to effectiveness and consistency.

Risk Assessment

The sample risk assessment carried out in the CSATL showed that in research laboratories of this type, where hundreds of chemicals are in use, it is not possible to carry out a qualitative assessment for every experiment or laboratory activity. In order to minimise the number of risk assessments needed it would be advisable to carry out generic assessments for groups of experiments carried out with identical working procedures. In matters of quantitative assessments, airborne concentrations of hazardous substances and monitoring, cooperation with local safety authorities (in this case, NSW WorkCover Authority) and with outside safety representatives/ specialists may be useful. Monitoring and health surveillance must be carried out when identified as necessary from a risk assessment. However, because of the nature of the experiments for which mostly small quantities of chemicals are needed, and because of the fact that students carry out their experiments not on a regular basis (exposure is not continuous), it is unlikely that monitoring and health surveillance in the CSAT-Laboratory are required.

Training

Another finding during the walk-through survey and the workplace risk assessment was the apparent poor level of safety awareness among some students. This results from the lack of specific training sessions on hazardous substances. Training for the students should be arranged periodically and should include:

- induction training for every new student who will work in the laboratory consisting of general safety information (e.g., location of first-aid box, register with MSDS, fire extinguisher, emergency exit etc.) as well as safe work practices and avoidance of unsafe work habits (such as eating in the laboratory or not using PPE). Emergency procedures must be considered during the induction training;
- subject-specific training where the student will be informed about the hazards involved with each experiment and how to avoid them;
- training related to chemical substances involved in particular experiments. When a new chemical is ordered, the user must receive information and if necessary training for the safe handling of this substance. For this, the MSDS can serve as a basis of the training session;
- review training for polishing up safety awareness and for updating knowledge due to new scientific findings or new regulatory legislation.

The Cost of Compliance

For the implementation of the NSW HSR compliance strategy, costs have played an important role. The two most important groups of costs were:

- costs associated with the time needed by the employee(s) to implement steps which do not require outside advice (safety representatives). This project showed that the steps for the development of the inventory, register and so on, can be carried out by individuals without specialised skills;

- costs arising from outside safety consultation (specialists) and from medical practitioners for the implementation of steps such as risk assessments, monitoring and health surveillance for which specific expertise and technical equipment is required. This group of costs represents the highest portion of all costs paid by small businesses as they cannot afford to organise a permanent occupational health and safety department.

The strategy for compliance with the NSW HSR has been developed especially for the needs of the CSATL. However, because it contains all the important requirements of the NSW HSR, the same strategy can be used for other small businesses as well, with minor changes due to differences among the businesses. These differences depend on the particular work carried out in each business and on the people working there (whether students or employees). For example, a laboratory which is a department of a company may have more permanent employees to take over responsibilities than a research laboratory of a university which is used mostly by students. On the other hand, such a laboratory may deal with less chemicals but larger quantities. In this case, fewer risk assessments are required, but monitoring and health surveillance might be a priority.

4.0 CONCLUSIONS

No matter in which type of business a compliance strategy must be implemented, it can be made more efficient through the use of computers, software programs and generic procedures. Compliance with any new regulation is invariably problematic. However, the development of compliance strategies for the hazardous substances regulation is not necessarily an onerous task. Often existing management and control systems can be modified to meet the obligations imposed by the regulation. If done in a comprehensive and a systematic manner compliance with the regulation can be achieved fairly painlessly. Therefore, in complying with the new regulations, supervisors and managers need to establish management and control structures which result in workplace safety, without having to rely on a traditional intransigence of workers who think they know better and don't.

REFERENCES

ALDERSON, M, *Occupational cancer*, Butterworths, London, 1986.

GUN, R, *The Worksafe model regulations for chemical safety: How much benefit?* Journal of Occupational Health and Safety - Aust NZ, 10(6): 523-528, 1994.

HASKI, R (editor), *Laboratory Safety Manual*, CCH International, Sydney, 1994.

HOLMES, N, *Allergic contact dermatitis caused by epoxy resins*, Journal of Occupational Health and Safety - Aust NZ, 7: 409-416, 1991.

ILO, *Safety in the use of chemicals at work. Convention No 170*, International Labour Organization, Geneva, 1990.

LEWIS, SM, MOORE, H, WINDER, C AND MOONEY, C, *A survey of industrial product use in the Rockdale area*, Worksafe Australia/NSW WorkCover Authority, Sydney, 1993.

PEARSON, C, GAME, W, CORBETT, C, JONES, A AND ST GEORGE, U, *Hazardous substances in the construction industry*, Journal of Occupational Health and Safety - Aust NZ, 11(5): 510-512, 1995.

SCOTT STRICOFF, R AND WALTERS, DB, *Laboratory health and safety handbook: A guide for the preparation of a Chemical Hygiene Plan*, Wiley-Interscience, New York, 1990.

STANDARDS AUSTRALIA, *Risk management. AS/NZS 4360:1995*, Standards Australia, Homebush, 1995.

STEWART, D, *Attitudes to workplace hazardous substances*, Journal of Occupational Health and Safety - Aust NZ, 10(4): 375-376, 1994.

WINDER C, MUSRY AH AND TANDON RK, *Workplace incident notification: Results of a survey of sixteen factory sites in Western Sydney*, Quality Assurance, Good Practice and Law 2: 372-385, 1994.

WINDER C AND TURNER P, *Solvent exposure and related work practices amongst spray painters in automotive body repair shops*, Annals of Occupational Hygiene 36: 384-394, 1992.