An Investigation into Health and Safety (HS) Management in Civil Engineering Laboratories

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Abstract

Occupational accidents and diseases occur at work places at dismaying rate, which has now become a matter of great concern for all employers. The School of Engineering and Design of Brunel University in London, UK, has over the years employed a HS management system to deal effectively with all potential hazards and risk in its laboratories and other operations. However, the Civil Engineering department of this school was set up quite recently and as such, its laboratories are still in developmental stages, especially HS management. To ensure continuity of the School's HS performance success, this paper reports on a study conducted recently to examine the efficacy of the current approach used in managing HS in this new department. The method used in carrying out this study involves a critical review of the HS approach followed by a questionnaire survey of staff and undergraduate students of the department. The approach was found to be highly integrated, consisting of the incorporation of HS teaching within modules and well as following strict established HS management procedural processes during laboratory and field work. The study findings suggest, among others, that this approach is relied upon heavily by staff and students, contributing to their high level of HS awareness, knowledge and understanding amongst. The approach has also contributed to successful accreditation of the department's Civil Engineering programmes for six years running. These findings make the approach a commendable system worth recommending to other civil Engineering departments as a template for dealing with their own HS issues.

Keywords: Health and Safety; Risk Assessment; Civil Engineering Laboratory.

Introduction

The rate at which occupational accidents and diseases occur at work places in the UK is appalling. According to statistics published by Health and Safety Executive (HSE, 2005), over 1 million injuries and 2.3 million cases of ill health occur every year. Such accidents and ill health are all caused by preventable factors which could be eliminated by implementing already known available measures and methods (Alli, 2008). A key strategy by which the UK government seeks to deal with this problem is to deliberately place the responsibility for managing risks with those who own, manage and work in organisations. This constitutes the fundamental principle of UK's current framework for regulating Health and Safety (HS), introduced by *Health and Safety at Work Act 1974* and typified by the *Management of Health and Safety at Work Regulations 1999* (HSE, 2009). As with all employers, Brunel University (BU) in London, UK, is thus required to ensure that teaching, field work, laboratory work and other related operations are all undertaken safely without acceptable HS risks to students and staff. Equally important is that, all staff and students are expected to co-operate, communicate and participate fully on matters related to HS (BU Policy, 2009). These obligations take major leap in importance when it comes to laboratory and research workplaces because such settings operate in a more complex environment with inherent safety and health risks.

The School of Engineering and Design (SED) of BU, which is one of the largest and most successful Engineering and Design Schools in the UK, deals with HS in laboratories and other work places through its HS policy (SED Policy, 2009). Over the years, the school has achieved its expected HS standards largely through the implementation of HS guidelines detailed out in this policy document. However, the Civil Engineering (CE) Department of the School is a relatively new department whose laboratories were set up quite recently. For this reason, its laboratories are still in the developmental stages, with HS guidance documents on some specific laboratory operations being too general and thus requiring detailed guidelines. A review was thus carried out initially to identify more specific guidance that represents the best way to managing HS in a typical civil engineering laboratories but very little was found from the literature. Much of the available literature tends to rather focus on medical and biological laboratories (for e.g., WHO, 2004; Modicca, 2007).

Therefore, to ensure continuity of the School's successful HS performance achieved so far, it became important to carry out a study on HS management in this new laboratory for purposes of developing the most appropriate guidance required. This paper reports on such study, which offers some useful insights on the best approaches to dealing with HS in a typical CE laboratory. This could be used as a template by other universities to deal with their own HS matters. The next section of the paper discusses the methodology used in conducting this study, including the key findings of the review conducted. Nest in line is a section on primary data collection and analysis of the results obtained. The final section presents the study conclusions

Research Methodology

The research aim was addressed by first conducting a thorough literature reviews, including a review on BU and its CE department's current approach to managing HS. Following the review, primary data were collected using a semi-structured questionnaire survey of CE staff and students with regard to HS issues. The purpose of this survey was to examine the efficacy of the approach used. The results obtained from the survey were analysed quantitatively using descriptive statistics with the aid of SPSS.

An overview of the HS Management Approach Used

The main aim of any HS management system is to put in place good planning and control measures for meeting and improving required safety standards. BU seeks to achieve this through a framework that provides detailed organisational and management arrangements for dealing with HS matters. As shown in Figure 1 below, the framework is structured around the key elements set out in the HSE guidance on managing HS successfully (HSE, 1997).

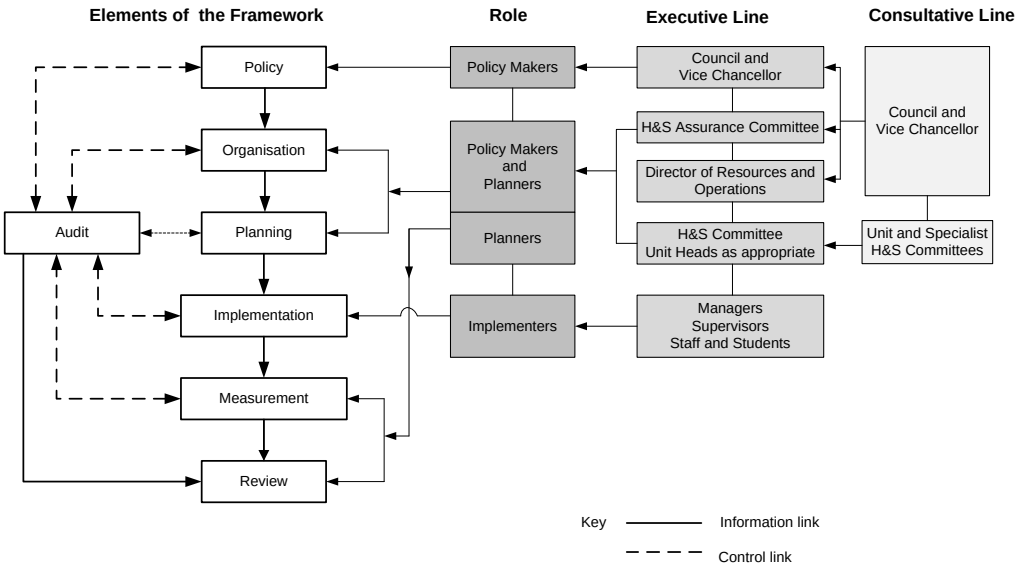

Figure 1: HS Management Structure (from Brunel, 2009)

The key elements of the framework are: Policy, Organisation, Planning, Implementation, Measurement, Audit and Review; all of which are interrelated and as such work in harmony to ensure success with HS management. HS policies, for instance, undergo continuous review and development to ensure they are continuously relevant to university activities. Review takes place at maximum intervals of three years, taking into account, relevant changes in legislation, standards or good practice. Where campus-wide University policy is insufficiently specific, Heads of Schools and Departments are responsible for ensuring the development of adequate HS policy for the particular needs of their units.

The Civil Engineering (CE) department was set up about 6 years ago and currently runs three main taught programmes: BEng/MEng in Civil Engineering, Civil Engineering with Sustainability BEng/MEng and MSc Water Engineering. Right from its inception, the department has continuously gained professional accreditation from the Joint Board of Moderators (JBM, the professional body that accredits degrees on behalf of the Institution of Civil Engineers). The JBM has always been very critical with HS management, more in particular, within the department's laboratories. Over the years, a proactive approach has been adopted for dealing with this, which can be claimed to have been effective and successful, given the successful accreditations achieved in six year running. The approach involves a variety of integrated ways running across the full spectrum of the undergraduate (BEng) course duration, as illustrated in Figure 2.

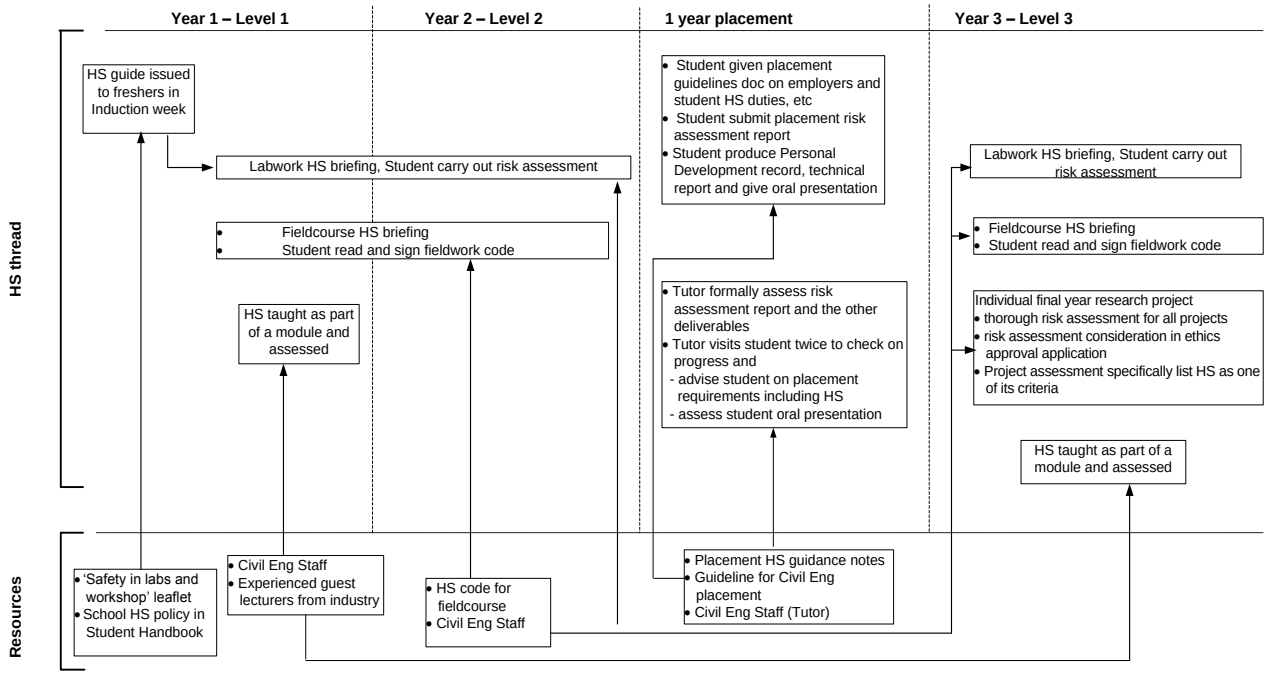

Figure 2. An integrated approach to management HS

The management of HS begins right from the recruitment stage (UKAS and open days), where awareness of this subject is promoted to students at the very outset. During induction week, all fresh students are issued with a leaflet that provides detailed guidance on safe behaviour in laboratories and workshops. Students are required to sign to confirm that they have both received and read the document.

HS is also embedded (distinctly or integrated) in the topics covered under some modules across the whole curriculum. Such modules are undertaken by all students on compulsory basis. The aim is to produce students who are not just aware of HS issues and concepts but also possess the right level of HS knowledge, competency and attitude. The subject is introduced gradually from Level One and broadened in content and complexity for the higher levels of the study (i.e., Level Two and Level Three), in accordance with the module learning outcomes. The delivery is particularly supported by guest lecturers, which include members of our Industrial Advisory Panel. In addition to these academic coverage, HS issues are also repeatedly referred to in other aspects of the course delivery, including the following situations.

1. Students are encouraged to consider and review potential HS risks at the start of all laboratory sessions and field courses. Before any field course such as surveying, residential fieldtrips and site visits are embarked on, students are introduced to the field

course study area in lectures, during which potential HS issues are discussed. They are then made to read and sign a HS Fieldwork Code of SED.

2. A central part of the one-year industrial placement, taken by those on sandwich degree programme, involves HS and risk assessment training, which is specifically assessed by personal tutors.

3. For final year individual research project, a thorough risk assessment is a key requirement that students must meet, especially for safety-critical projects. This aspect of the project is specifically assessed as HS forms one of the project marking criteria. For projects requiring ethical approval, risk assessment must be given adequate consideration as part of the approval application submissions.

Primary Data Collection and Analysis

A number of measures were taken into account in designing the questionnaire and administering it. First, the questionnaire was carefully designed and reviewed several times by the author so as to avoid any misunderstandings with its wording. Second, the questionnaire was given to one of the departmental staff to review it with regards to the clarity and relevance. Following this review, the final version of the questionnaire was personally distributed to all CE staff (both academic and technical) and to the various students' cohorts (Levels 1, 2 and 3). Two set of questionnaires of slightly different form were thus distributed to the two groups. The results obtained from the survey were analysed quantitatively using descriptive statistics with the aid of SPSS.

A total of 83 questionnaires were first distributed, and after two weeks, a reminder note was also sent out via e-mail to help maximize the response rate. Of the total questionnaires given out, only 58 were properly completed and returned, representing an overall response rate of 70% with breakdown for the different cohorts as shown in Table 1 below. Respondents' perceptions on the research questions listed in the previous section were investigated largely by asking them to rate their views on related statements using a 5-point Likert scale.

Using SPSS, the responses obtained were analysed for their mean values, yielding the results presented in Tables 2 to 5 in the sections following.

Table 1 Survey response and breakdown

Group	Sample size	Response no.	Response rate
Level 1	**35**	**27**	**77.1%**
Level 2	**23**	**19**	**82.6%**
Level 3	**14**	**7**	**50.0%**
Staff	**9**	**5**	**55.5%**
Overall Total	**83**	**58**	**70%**

Level of Awareness, Knowledge and the Importance attached to HS

As an attempt to investigate the extent to this HS management approach used has been effective, respondent were first asked to rate their level of awareness, knowledge and the importance they attach to HS risks management using a 1-5 scale (1= very low, and 5=very high). The results from the various responding groups are as presented in Table 2.

Table 2 Level of Awareness, Knowledge and Importance attached to HS management

Level of:	Level 1	Level 2	Level 3	Staff	mean
Awareness on HS risks management	3.8	3.6	3.9	4.4	3.9
Knowledge on HS risks management	3.5	3.7	3.7	4.0	3.7
Importance attached to HS risks management	3.7	3.8	4.7	5.0	4.3

As was expected, staff displayed the highest level of knowledge on HS management, followed by the Level 3 cohort, and then Level 2, with Level 1 indicating the lowest. Similar pattern goes for their perception on the importance they attach to HS risk management and their level of awareness, except that for the latter, the Level 2 cohort indicated lesser awareness level than their Level 1 counterpart, which was not to be expected as, by virtue of the duration spent on the programme, the Level 2s are ideally expected to know more about HS than the Level 1s. The possible reason could be due to the Level 1 students basing their ratings on their experience with working within other safety conscious culture/environment in the University. Overall, an average value of 3.9 was calculated for the three issues

investigated, suggesting that SS are generally highly aware of HS risks management, have good knowledge of it and also do attach much importance to it.

Respondents were next asked to rank their level of understanding on some of the key HS risk management responsibilities required during laboratory practical and field class, using the scale of 1-5 (1= lack understanding and 5 = full understanding). Table 3 shows the results obtained, which indicate a minimum mean value for the various issues investigated as 3.4. This high mean value suggests that students are well informed on some of the key HS responsibilities expected of them. The mean values for each of various groups were largely similar.

Table 3 Level of Understanding of HS Responsibilities

Level of understanding of HS responsibilities concerning:	Level 1	Level 2	Level 3	Staff	Mean
HS risk assessment in Lab/field class	3.7	3.7	4.4	4.4	4.1
Planning out work effectively to avoid risk	3.7	3.8	4.3	4.8	4.2
Communicating HS information	3.4	3.6	4.1	4.3	3.9
Monitoring and reviewing risk	3.7	3.7	4.3	4.6	4.1
Proper control of HS risk	3.4	3.8	4.6	4.5	4.1

To appreciate the impact of the HS management approach, students were asked to identify the different sources of support they often rely on to understand their HS responsibilities. They were also asked to ranked how useful they perceive those sources to be using a 1-5 scale, where 5 represents ‘Very Useful’ and 1 ‘Not Useful’. Table 4 and 5 respectively capture the various sources of support respondents rely on and their perceived usefulness. The types of supports listed were all considered useful by the respondents, with a minimum mean value of usefulness being 3.5. Advice provided by staff on HS emerged as the most frequent source of assistance students rely on, followed by HS modules taken by students during their course of study. For the ‘other’ option, few students identified appropriate signs/posters in lab as being very helpful. The high mean values from the different cohorts suggest that the existing approach well contributes to informing students of their key HS responsibilities.

Table 4 Support available for understanding HS responsibilities

Form of support	Level 1	Level 2	Level 3	Mean
Taking module on HS	96%	79%	60%	78%
Advice/briefing from staff	96%	100%	100%	99%
HS notes included in assignment hand-outs	76%	90%	57%	74%
Other	0%	11%	29%	13%

Table 5 Perceived usefulness of the support available

Form of Assistance	Level 1	Level 2	Level 3	Mean
Taking module on HS	3.7	3.8	4.0	3.8
Advice/briefing offered by staff	4.4	4.2	5.0	4.5
HS notes included in assignment handouts	3.6	3.9	4.5	4.0
Other	4.0	3.7	4.5	4.1

Conclusion and Recommendations

The study suggests that high level of HS awareness and understanding exist among staff and students. Respondents also indicated that they a good level of knowledge on this subject and do attach great importance to this subject. Students rely much on various sources of information to build their knowledge and understanding on HS matters. The sources, which most consider very helpful, are modules they take on HS, HS information they receive prior to field assignment/labwork, and advice from staff. All these sources have a drawn from a well established HS management approach deliberately designed and used by the CE department. The approach is highly integrated, consisting of the incorporation of HS teaching within modules and well as following strict established HS management procedural processes during laboratory and field work. The study findings suggest, among others, that this approach is relied upon heavily by staff and students, contributing to the positive development on HS subject as evidenced by the study findings. These findings

make the approach a commendable system worth recommending to other CE departments as a template for dealing with their own HS issues.

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