

**TITLE:** SUPERVISION BY THE CLIENT OF SITE RADIOGRAPHY CONTRACTORS (WHY AND HOW?)

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**1 Why should a client take an interest in work conducted on their site by site radiography contractors?**

**i Background**

<sup>(1)</sup>A contractor arrived at an industrial premises around midday to carry out a number of radiographs on a boiler vessel and associated equipment using a 300 GBq (8 Ci) <sup>192</sup>Ir source in a remote exposure container. The radiographer was instructed that he could not perform any radiography until after 1700 hrs. During the afternoon the radiographer was seen dismantling some of his equipment and, upon questioning, it transpired that he had ignored the instructions and performed two radiographs. Three welding contractors were working inside the boiler at the time and were exposed as a result of the radiographer's work. Staff in the boiler house at the time reported that they did not see any warning signs, barriers or exposure warning lights or hear any audible warnings.

**ii Risks associated with inadequate supervision of site radiography contractors**

The above is an extract from the an entry in the <sup>(1)</sup> Ionising Radiations Incident Database (IRID) maintained by NRPB for NRPB, the Health and Safety Executive and the Environment Agency. It demonstrates that poor working practices by a site radiography contractor could affect not only the radiographer but the client's own staff or others working in the area. The results of poor working practices can on rare occasions lead to high doses to individuals. The public have also been placed at risk when radiography sources have been left unknowingly on site and picked up. <sup>(2)</sup> In 1984, a family died from exposure to a radiography source after it was picked up by a family member. Site radiography is one of the few occasions that a high activity source is used in an area which can be accessed by others. Inadequate supervision of site radiography contractors could lead to;

- the setting up of an overly large demarcated work area which the radiographers cannot control and others might enter
- the risk of others not involved in the radiography remaining in the area when radiography commences
- theft or loss of a radiography container (source) if the radiographers do not adequately supervise their equipment
- the loss of a radiography source and it remaining on site after the radiographers have left
- exposure of members of the public or other workers if barriers demarcating the work area have not been correctly set
- loss of working time due to lack of emergency equipment to recover a source which fails to be retracted to its shielded position (hence higher outage costs)

The consequences of the above for a client can be significant in terms of the time to investigate the incident, potential injury to staff and the company's reputation (both for the radiography and client company – the public are more likely to associate incidents with the client company rather than the radiography contractor.

Experience has shown that where a client takes an active role in supervising site radiography contractors, the contractors have generally been diligent in following safe working practices.

### **iii Is the client responsible for the radiographer's work?**

Whilst the radiography company is responsible for carrying out the work in a safe manner, the client is responsible for the welfare of its own employees and other visitors/ contractors on the site. In the UK it is recognised that the client cannot simply delegate safety to its contractors and there remains on the client a duty of care to all workers on its site. Hence there is a duty on the client to use "competent" contractors to do the work. This becomes more complex when a client has contracted maintenance work to a main contractor who then appoints the radiographers; the client is then "distanced" from the work.

The prime responsibility for safety for any contracted out work rests with the contracting company but the client still retains overall safety responsibility for persons on its site.

## **2 What should a client do to supervise site radiography contractors?**

### **i Communication**

Under UK legislation<sup>(3)</sup> there is a requirement for employers to co-operate on health and safety matters. Whether the client has organised the radiography itself or a main contractor has organised the work, all parties should communicate to identify where the radiography will take place, which personnel are permitted access during radiography and who (the client or main contractor) will take responsibility for supervising the site radiography contractors (the radiography company has the prime responsibility for ensuring the safe working practices of its staff). The client requires an effective means of informing personnel on site that radiography will be taking place and what actions they need to take (i.e. stay away from the area!).

### **ii Planning for radiography**

Prior to the radiographers coming onto the site, certain information must be provided.

**Training** It is important that the client ensures that the radiographers employed to undertake the work have been adequately trained. The radiography company should be able to provide details of the training a radiographer has received (radiography techniques, interpretation of radiographs etc) and confirm that radiation safety training formed part of the training scheme. The importance of this extends beyond radiation safety since the client will wish to reassure themselves that the radiographers are competent to carry out radiography and that faults, e.g. in high pressure vessels, will be detected.

Whilst the above focuses on the radiographer's training needs, the client or main contractor who may be dealing with the radiographers will also need to consider training their site radiography co-ordinators (i.e. those who will liaise with the radiography contractors). This training has been provided by the NRPB to the main power generators in the UK for several years.

**Supervisor** The radiographer who leads the team should be an appointed Radiation Protection Supervisor (RPS). The RPS is a person within the radiography company who has been formally appointed to supervise the radiography work and ensure that the local rules (safety procedures) are adhered to. The client company should check who will actually be carrying out the radiography and receive confirmation that this person is a RPS.

**Safety Adviser** Within the UK, radiography companies appoint radiation specialists who can advise on radiation protection matters (the Radiation Protection Adviser [RPA] – equivalent to the Qualified Expert referenced in the <sup>(4)</sup>Basic Safety Standards). In the event of an incident during radiography, the radiographers may consult with their RPA to provide further advice and possibly assist to resolve the incident. A client company should know in advance the name of the radiography company's RPA (this may be an individual or organisation).

Procedures	The radiographers are required to work in accordance with their local rules. These rules set out the safety procedures to be followed, the names of responsible persons (e.g. the RPS and RPA) and must include contingency plans to cover accident situations. The client should have a copy of these rules to satisfy themselves that adequate contingency plans are available and any involvement that they may have, e.g. prevention of access to the radiography area in the event of an incident.
Risks	The radiography company is obliged to carry out a risk assessment to cover their work on the client's site, a copy of which should be provided to the client. The client will also need to consider the risks in the area where the work will take place (e.g. will the radiographers be working in a confined space and what actions do they need to take to protect themselves). Both parties should discuss their respective risk assessments to ensure that hazards arising from the client's work and radiographer's work are identified and effectively dealt with.
Notifications:	In the UK, the Health and Safety Executive (HSE) require prior notification 28 days before radiography takes place, although the HSE may permit a shorter notification time under certain circumstances. Other countries may have similar arrangements.
Radiography	<p>The location where the work will take place will already have been identified by the client. The radiography company will have estimated the area required to be demarcated and means of demarcating the work area (referred to as the controlled area in the UK; at the point dose rates are less than <math>7.5 \mu\text{Sv h}^{-1}</math> or less than <math>1 \mu\text{Sv h}^{-1}</math> for areas outside of the company's control). Access routes into the area should also have been identified (this would also be addressed within the risk assessment). Lifts leading into the area may require to be temporarily taken out of service or doors locked to prevent unauthorised access. Also consideration must be given to other areas outside of the client's control, e.g. public footpaths adjoining the company's premises, to ensure that the work area does not impinge on these areas; additional collimation/ shielding may be required.</p> <p>The positioning and type of warning signals should be discussed. In the event that it is not practicable to position pre-exposure/ exposure warning lights close to the barrier demarcating the work area, alternative arrangements must be put in place. It is also prudent to check at this stage how the warning signals will be used and compare this with the conditions written in their local rules. Often the pre-exposure signal is used when the radiography <b>session</b> starts and the exposure warning signals are left on for the duration of the session. Good practice indicates that pre-exposure/ exposure warning signals should be provided for <b>each</b> exposure.</p> <p>When the radiographers are carrying out the work, the barriers demarcating the work area need to be kept under surveillance. This would prove difficult if, for instance, the radiographers are working within a boiler and the demarcated area extends outside of the boiler. The client therefore needs to check who will be patrolling the barriers to prevent unauthorised access. The client may carry out this function providing that the person undertaking this duty has received adequate training and never enters the demarcated area. On most occasions, the radiography company would be responsible for this, providing additional people as necessary but this must be agreed before hand.</p>
Equipment	The radiography company should confirm the nuclide and activity of source to be used and the type of projection container that will be used. The client may need to seek specialist advice as to the suitability of the intended

projection system and its use on their premises. The client will also need confirmation that the radiographers will bring sufficient emergency equipment with them to deal with reasonably foreseeable events (“stuck source” etc).

### iii The radiography session

**Arrival on site** The client/main contractor should have identified an area for the radiographers to park their vehicle in order for the client/ main contractor’s site radiography co-ordinator to inspect the equipment/ source that they have brought with them. A check list for this is provided in the appendix.

Initially the co-ordinator should check that the radiographers have at least two suitable radiation monitors with them. Confirmation that the monitors are working can be achieved by first asking the radiographers to show the co-ordinator the battery status of each monitor (battery check) and then requesting the radiographers to place both monitors near the radiography container (both should indicate a dose rate). **The dose rate at the surface of the container should be recorded (typically even an EMPTY container utilising depleted uranium shielding will still give rise to a dose rate of approximately 25 mSv<sup>h</sup><sup>-1</sup>).**

The co-ordinator will also want to satisfy himself/ herself that the main radiographer (RPS) is the same person as agreed previously and check that the source details/ projection system do not differ from the details previously supplied by the radiography company. The source container should be locked.

Finally the co-ordinator should check that the radiographers have brought with them the emergency equipment and sufficient barriers (tape) and warning signs/ signals for the area that will be demarcated.

**Setting up** The source (in its container) should remain in the vehicle until the barriers, warning lights and warning signs have been erected. Once the co-ordinator is satisfied that this has been done, then the projection system can be brought into the work area – the client may wish to do this under a permit-to-work system whereby control of the work area is handed formally over to the radiographers, and other permits for that area are either cancelled or temporarily suspended (i.e. no one else should be working in that area).

**Radiography** Prior to work commencing, the co-ordinator may wish to check that the barriers have been set correctly and request that the radiographers carry out a test exposure (without a collimator, if appropriate, to simulate the worst case condition). Dose rates should be less than 7.5  $\mu\text{Sv h}^{-1}$  at the barrier. Once satisfied, the co-ordinator can confirm that the radiographers can start the work.

**Finishing** Once the work has been completed and before the barriers/ warning systems are removed, a dose rate measurement should be made on the side of the container (locked, with all projection tubes/ cables removed) and this compared against the initial result made when the radiographers came on site. If the dose rate is lower, it is possible that the source is NOT in the container.

### iii Accidents

The main role of the co-ordinator in the event of an accident is to implement their role in the agreed contingency plans. This may, for example, involve alerting security personnel or others on the site that an incident has taken place and keep them away from the area. The client’s co-ordinator must not attempt to directly assist the radiographers in a source recovery! However

the radiographers may need other materials to assist them in their recovery. The client can assist in providing these resources. In the event of an incident, the radiographers have their own contingency plans to follow and, can contact a RPA for further advice.

## REFERENCES

- 1 S Walker, J R Croft, G O Thomas and C R Williams; IRID: Ionising Radiations Incident Database, "First review of cases reported and operation of the database"; 1999; NRPB, Chilton, Didcot, Oxon. OX11 0RQ, ISBN 0 85951 436 6
- 2 Safety Series Report No.7, "Lessons learned from accidents in industrial radiography"; IAEA, Vienna, ISBN 92-0-103098-3
- 3 The Ionising Radiations Regulations 1999, Statutory Instrument No. 3232, The Stationary Office Limited, London. ISBN 0-11-085614-7
- 4 Council Directive 96/29/EURATOM of 13 May 1996, No L 159/1, Official Journal of the European Communities

## APPENDIX

### **Information for Site Owners in respect of Industrial Radiograph Contractors who bring Source(s) of Ionising Radiation onto their Site**

Industrial radiography involves the inspection of components (e.g. pipes and pressure vessels) to determine if cracks or other defects are present and is described in detail in the NRPB "Radiation at Work" leaflet entitled "Industrial Radiography". The source of ionising radiation will be a sealed radiation source or an x-ray set. Both types of source require strictly controlled procedures to ensure that they do not present a hazard to the radiographers using them or to other persons on the site. An important part of these procedures is the maintenance of a barrier at a suitable distance from the source, intended to ensure that no-one other than the contractors' staff can enter the so-called 'Controlled Area' within the barrier.

These notes are provided by the NRPB, as your RPA, to help you ensure that safe working practices are implemented and maintained by an Industrial Radiography Contractor working on your site. If any of your findings cause concern you should seek further advice from your RPA.

#### **(I) PRIOR TO COMMENCEMENT OF WORK**

In order to fulfil your Company's responsibilities under the Ionising Radiations Regulations 1999, discussions should be held with the contractor's employers to ensure the health and safety of employees and other persons. In particular Regulation 15 requires each employer to exchange information in order to meet this objective.

The following matters must be discussed and relevant information exchanged:

- 1 Name and address of contractor including 24 hour telephone number (for cases of emergency).
- 2 Name of Radiation Protection Supervisor who will be on site, and the name of the contractor's Radiation Protection Adviser. **If a correctly appointed RPS will not be present on site, the work should not be allowed to commence.**
- 3 Details of source(s) of ionising radiation, e.g. X or gamma, ratings, nuclide, activity, equipment details, etc as appropriate.
- 4 Confirmation that:
  - (i) notification (that the work is to be carried out) will be made by the contractor to the local Health and Safety Executive;
  - (ii) barriers will be set at positions where the dose rate does not exceed 7.5  $\mu$ Sv per hour;
  - (iii) a dose rate monitor will be used after each exposure to confirm that the source of ionising radiation has been made safe;

- (iv) at least 2 operators will be carrying out the work.
- 5 Obtain details of working procedures that will be implemented in order to ensure safe work. In particular:
- (a) Approximate location and extent of area to be barriered off.  
**CHECK THAT THIS WILL NOT PRESENT YOUR COMPANY WITH ANY PROBLEMS SUCH AS ACCESS ETC.**
  - (b) Type of barrier to be used and details of notices explaining the significance of the barriers and warning signals. Confirm that notices will be placed at all probable points of access to the barriered area.
  - (c) Warning signals to be used, (i) prior to making an exposure, and (ii) during an exposure.  
**CHECK THAT THESE SIGNALS DO NOT HAVE ANY OTHER LOCAL MEANING/ SIGNIFICANCE.**
  - (d) Proposed locations of above warning signals, in particular that the warning throughout an exposure will be clearly visible:
    - (i) at the position of the source of ionising radiation
    - (ii) at the control point
    - (iii) from all probable access points to the barriered-off area.
  - (e) Confirm that the barriered-off area will be searched prior to commencement of the work and periodically during each session, and barrier itself will be kept under surveillance to prevent persons entering the area.
  - (f) Confirm that dose rates at barriers will be checked throughout each session and barrier positions altered if necessary.
- 6 Proposed storage arrangements/facilities should be discussed and confirmed as satisfactory.

- 7 Security of source(s) of ionising radiation and methods used to prevent unauthorised tampering with the equipment should be discussed and confirmed.
- 8 Confirm, in writing, that arrangements have been made for actions to be implemented in the event of an accident, incident or occurrence (contingency plans). These details should include a description of those circumstances that might reasonably be expected to lead to a possible incident condition.

**CHECK THAT THE RADIOGRAPHERS HAVE APPROPRIATE EMERGENCY EQUIPMENT WITH THEM TO DEAL WITH SUCH AN OCCURRENCE.**

This emergency equipment for gamma radiography should include:

Audible alarm monitor  
Quartz fibre electroscope and charging device, or other integrating dosimeter  
Tongs (1 metre and 2 metre)  
Pliers  
Screwdriver  
Long-handled wire cutters  
Adjustable spanner or wrench  
Rope  
Hand lamp  
Tripod (2 metres high – to hoist an end of the projection tube to help gravity of a detached source)  
Radiation barrier (quick erect type)  
Bags of lead shot (2kg each) or  
Lead shielded semi-cylindrical tunnel  
Emergency storage container (access to)  
Pouring funnel to suit emergency storage container, for speedy placing of the source

**NOTES**

- 1 The contractor must have prepared local rules and these should cover all the above points. A request for a copy of the relevant sections of these rules will satisfy most of the above matters. **In the absence of adequate local rules the contractor should NOT be allowed to work on your site.**
- 2 Relevant employees such as those who may be in the vicinity of the work, security staff, works manager, etc should be informed of this work and the precautions being taken. These employees should be instructed to comply with the agreed arrangements and procedures for safe working.
- 3 The contractor should require confirmation that the measures in note 2 above have been implemented.
- 4 Where a contractor regularly works on your site it should only be necessary to follow the above formal procedure on the first occasion that such work is proposed. Occasional safety

audits (see para (II) below) should ensure that satisfactory working practices are being maintained.

**(II) WHILST WORK IS IN PROGRESS**

Occasional, unannounced, safety audits should be undertaken to ensure that the contractor's employees are indeed observing the agreed safe working practices. A suitable report form is attached.

**RECORD FOR INSPECTION OF SITE RADIOGRAPHY (SAFETY AUDIT)**

Name of your company and address of site

1. Contractor's name and address`	2. Name of RPS on site*	
3. Name of Contractor's RPA	4. No. of contractors on site	
5. (a) Local rules available YES/NO  <b>(b) Do they include contingency plans YES/NO**</b>  (c) Are local rules generally acceptable YES/NO**	6. Emergency equipment available  YES/NO #	
7. HSE notified of work YES/NO		8. Source(s) of radiation
9. Location of work	10. Amount of work to be done a) number of exposures b) typical exposure time c) other data	
11. TLD/film badges work by contractor's employees YES/NO	12. Dose rate monitor(s) available ** YES/NO a) number of monitors b) type  If you doubt whether the provided monitor is suitable, consult your own RPA)	
13. Use of dose rate monitor - when was it observed to be used? a) ã-radiography - after every response YES/NO b) other uses		

\* If a RPS is not present, **do not allow work to proceed.**

\*\* If local rules are inadequate or are not available, **do not allow work to proceed.**

# If inadequate emergency equipment is available, **do not allow work to proceed.**

## If a suitable radiation monitor is not available, **do not allow work to proceed.**

14. <u>DETAILS OF ARRANGEMENTS FOR RADIOGRAPHY</u>
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Sketch (show positions of radiography, barriers, warning signals, control points, etc)	
15. Pre-warning signals  Type  NO YES/	16. Warning during exposure Type YES/NO
17. Satisfactory explanatory notices YES/NO  Sufficient in number and correctly positioned YES/NO	18. Barriers patrolled or observable YES/NO
19. Beam collimation used	20. Maximum dose rates at barriers (mark position(s) on sketch, especially any positions where dose rate exceeds 7.5 $\mu\text{Sv h}^{-1}$ )
21. Other comments	22. Radiography allowed to proceed?  YES NO (give reasons)

Signed .....

Date of audit .....

\* If adequate warning signals are not provided, or are not functioning correctly, **do not allow work to proceed.**

\*\* If person undertaking this audit is NOT a classified worker, do **not** enter areas where the dose rate exceeds 7.5  $\mu\text{Sv}$  per hour. In such situations, dose rates exceeding 7.5  $\mu\text{Sv}$  per hour should be measured by the Contractor's RPS on your behalf.