

General Recommendations for

The Testing, Calibration and Processing of Radiation Monitoring Films

Co-operating organizations

The Nuclear Energy Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- Association of Consulting Engineers
- British Electrical and Allied Manufacturers' Association*
- British Insurance (Atomic Energy) Committee
- British Mechanical Engineering Federation
- Electricity Council, the Generating Board and the Area Boards in England and Wales*
- Institution of Chemical Engineers
- Institution of Electrical Engineers
- Institution of Mechanical Engineers
- Lloyd's Register of Shipping
- Ministry of Labour (H.M. Factory Inspectorate)*
- Ministry of Power*
- Scientific Instrument Manufacturers' Association of Great Britain*
- United Kingdom Atomic Energy Authority*

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committees entrusted with the preparation of this British Standard:

- Board of Trade
- British Institute of Radiology
- British Iron and Steel Federation
- British National Committee for Non-Destructive Testing
- British Photographic Manufacturers' Association
- British Plastics Federation
- British Scientific Instrument Research Association
- Electronic Engineering Association
- Electronic Valve and Semi-conductor Manufacturers' Association
- Hospital Physicists' Association
- Institute of Physics and The Physical Society
- Ministry of Aviation
- Ministry of Defence, Navy Department
- National Physical Laboratory (D.S.I.R.)
- Radiological Protection Service

This British Standard, having been approved by the Nuclear Energy Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council on 27 May 1965

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Committee references NCE/2
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Foreword

This standard makes reference to the following British Standards:

BS 1384, *Measurements of photographic transmission density*.

BS 3664, *Film badges for personnel radiation monitoring*.

These general recommendations have been published under the authority of the Nuclear Energy Industry Standards Committee. Whilst they are not concerned with the design of film holders, they are applicable to most types of radiation monitoring films at present available (except nuclear track emulsions used for fast neutron monitoring). A useful cross-reference is to BS 3664, "*Film badges for personnel radiation monitoring*".

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

These recommendations describe those aspects which should be considered when testing, calibrating and processing radiation monitoring films, when measuring their optical (transmission) density and converting this density to the equivalent radiation dose by reference to calibration films. They are not concerned with the design of film holders (see BS 3664¹⁾) nor with assessment systems which may be used for calculating true radiation exposure from the measurements made on the films.

2 Desirable properties of radiation monitoring film

A monitoring film should possess the following properties and, if necessary, these should be confirmed before the film is used:

- a) Both fog level and base density should be low, and consistent within the batch.
- b) High sensitivity for detection of small exposures.
- c) High contrast enabling small differences in dose to be determined.
- d) Coverage of a wide exposure range ($1 : 10^5$).
- e) Stable latent image.
- f) Minimum possible radiation energy dependence.
- g) Constancy of properties between different production batches.
- h) Stable developed image.

Items c) and d) are conflicting requirements and may result in the use of separate sensitive (fast) and insensitive (slow) emulsions. These may be coated on separate film bases or on opposite sides of the same film base.

A film holder is designed to match the energy characteristics of a particular film type and, therefore, may not be suitable for use with a different film.

3 Storage prior to use

If possible the same emulsion batch should be used for a number of consecutive issue periods covering at least three months. Arrangements for suitable deliveries should be made with the manufacturer or sufficient film should be purchased at one time. In the latter case, the film should be stored in an environment having a temperature of approximately 20 °C or less, low humidity (30 to 60 per cent relative humidity) and a low radiation dose rate. For establishments which possess an enhanced radiation background, this dose rate is defined as that which will not give rise to a photographic effect in excess of that produced by 10 microroentgens/hour of high-energy gamma rays. Precautions should be taken to ensure that this dose rate cannot be raised by the inadvertent introduction of a radiation source to the vicinity of the store. Periodic checks should be made by comparing the fog level of stored film with a reference film to ensure that the radiation levels are acceptable.

Film should not be stored by the user for periods exceeding three months.

In situations where a radiation accident could affect the stock of monitoring film, a reserve batch should be stored in a more remote situation. This stock should be renewed at intervals not exceeding three months.

4 Testing radiation monitoring films

A number of tests are necessary to verify that the properties of an emulsion remain constant. These tests should be made whenever a new production batch of film is received. The manufacturer should be asked to provide information which will enable the user to recognize a new batch from the code numbers printed on the film boxes. Suggested tests are as follows:

- a) Exposure of films in the film holder to radium-226 (0.5 mm Pt filtration) or cobalt-60 gamma radiation covering a net optical density range of 0 to 3.0 to test:
 - i) the sensitivity of the film (the reciprocal of the dose required to produce a net density of 1.0 beneath the appropriate filter of the holder), and
 - ii) the shape of the dose-net density curve.

¹⁾ BS 3664, "Film badges for personnel radiation monitoring".