

**PROPOSAL FOR A PHYSICAL AGENTS (ELECTROMAGNETIC FIELDS)  
DIRECTIVE**

**REGULATORY IMPACT ASSESSMENT.**

***PURPOSE AND INTENDED EFFECT***

**Issue**

1. The Danish Presidency of the European Union introduced a proposal for a Physical Agents (Electromagnetic Fields (EMF)) Directive on 17 December 2002. It is the third in a sequence of physical agents directives that amend the European Commission's original 1993 proposal for a Physical Agents Directive covering noise, vibration, EMFs and optical radiation.

**Objectives**

2. The proposal lays down minimum health and safety requirements regarding the exposure of workers to the risks arising from EMFs and the objective is to achieve harmonisation of control regimes between Member States. It aims to achieve this by using the well accepted guidelines for restrictions on exposure that have been produced by the International Commission for Non-ionising Radiation Protection (ICNIRP). These scientifically based guidelines, which are very conservative, are designed to prevent the well understood acute effects on health that can occur at extremely high levels of exposure. What the proposal specifically does not do is address the suggested long-term effects such as carcinogenic effects for which there is no conclusive evidence.

3. The proposal places a range of duties on employers. These include the requirements to assess risk, reduce exposure, undertake health surveillance and provide information and training to workers.

**Risk assessment**

4. Electromagnetic fields (EMFs) are a form of radiation that can interact with people in a complex way that varies according to the frequency of the radiation. The symptoms of acute exposure are well defined. At low frequencies, induced currents can cause effects on the function of the central nervous system and at high frequencies there can be both whole body and localised heating leading to a rise in body temperature. These well established acute effects will only occur as a result of intense exposure and are extremely rare. They will not occur in people during their day-to-day living and should not occur at work.

5. The main international guidelines to protect against the acute effects are those published by ICNIRP and in the UK by the National Radiological Protection Board (NRPB). There is no essential difference between the two sets of guidelines for occupational exposure.

They define what are called ‘basic restrictions’ which are essentially exposure limits on induced current density or energy absorption in the body. These basic restrictions are set at a level well below that at which adverse effects might be expected. But current density and energy absorption in the body cannot be measured directly. So another set of figures are used that ICNIRP calls ‘reference levels’. These figures represent the external electromagnetic field strengths produced by the source and they can be measured.

6. If the measured field strengths are lower than the appropriate reference level it means that the basic restriction has not been exceeded and no further action is necessary. If however, they are greater than the reference level, then the basic restriction may or may not have been exceeded. In this case, further investigations need to be carried out.

7. The draft Directive diverges from this concept by requiring exposure reducing actions to be taken when the EMF level exceeds the reference levels. The values of the reference levels have become “action values” in the draft Directive. Any inappropriate actions required at the reference level would impose unnecessary costs on industry.

8. Currently there is no UK legislation specific to EMFs. The general duties to assess and control risks contained in the Health and Safety at Work etc Act 1974 and the Management of Health and Safety at Work Regulations 1999 apply. HSE expects employers to refer to NRPB’s guidelines in order to comply with these general duties when considering exposure to EMFs. As the NRPB guidelines are virtually identical to the ICNIRP occupational guidelines, those requirements of the Directive that borrow directly from the ICNIRP guidelines should not impose any additional burdens on compliant employers. Although exposure to EMFs can occur in any workplace that uses electrical equipment, the emissions of EMFs will not normally cause the basic restrictions (limit values, in the Directive’s parlance) to be exceeded. However, there are particular areas where emissions may be high enough to approach the limit values in the proposal. Such industries include those that use equipment and processes such as resistance welders, induction furnaces and dielectric heaters.

### **Options considered**

9. It is the UK view that compliance with the NRPB/ICNIRP guidelines affords sufficient protection and control to prevent any instance of ill health. If the Directive were to do no more than utilise the ICNIRP guidelines and adopt its concepts, then there should be no impact on those industries that already comply with the NRPB guidelines. However, the draft proposal contains among its requirements extensive provision for exposure reduction and health surveillance at the reference levels, which were not designed for that purpose. The reference levels are intended to be purely a marker from which to calculate whether the basic restrictions may have been exceeded – action to reduce exposure etc. is only appropriate above the basic restrictions. Any other provision would impose costs for no benefit.

10. The Government view is that negotiations should seek to amend the proposal so that it follows the ICNIRP approach more closely to ensure a minimal impact on industry. Compliance with the ICNIRP basic restrictions would ensure that there is no risk to the health and safety of workers from exposure to EMFs.

### **Information sources**

11. Information has been gained from the following organisations:
  - The Civil Aviation Authority
  - National Grid Transco (on behalf of the electricity industry)
  - MoD
  - DfT
  - DTI
  - The Maritime and Coastguard Agency
  - The Radiocommunications Agency
  - Brunel University
  - The UK Mobile Operators Association
  - The Engineering Employers Federation
  
12. Information has also been sought from individual companies as well as from technical experts within HSE.
  
13. The base year for the cost estimates is 2002, and future costs have been discounted using the Treasury's recommended 3.5% discount rate.

### ***BENEFITS***

#### **Health and safety benefits**

14. At or below the limit values set in the draft Directive, there will be no adverse health effects for workers (except possibly for some people with body implants). If workers were to be exposed at levels substantially in excess of these values, adverse health effects would be observed. At extremes, these health effects could include cardiac arrhythmias and heat stroke, and therefore the consequences would be potentially life threatening, although we are not aware of any fatalities caused by EMF exposure.
  
15. Indeed the only HSE knowledge of ill-health or injury concerns substantial EMF over-exposure as a result of very infrequent accidents or incidents. Although the Directive should have the effect of increasing awareness of the risks of over-exposure, the effect on such incidents is likely to be minimal. We are therefore unable to identify any health and safety benefits from the Directive.
  
16. Workers with particular types of body implants (both active and passive) could be at risk when exposed to EMF below the limit values. The draft Directive does not specifically mention this category of worker but in Article 4.3, it calls for "particular attention, when carrying out the risk assessment, to... any effects concerning the health and safety of workers particularly at risk". HSE currently has no information on either the proportion of workers in the affected sectors that are subject to this particular risk, the levels of exposure at which they may be affected, and the possible incidence. Consequently no attempt has been made to estimate the health benefits to workers with implants.

### **Other benefits**

17. There would be unquantifiable benefits to trade in providing a harmonised level of protection of workers to exposure to EMFs across Europe. But a harmonised level of protection would ensure that there was a 'level playing field' across the European Union in relation to the control of exposure to EMFs.

### ***COSTS***

#### **Business sectors affected**

18. Research conducted by the NRPB<sup>1</sup> has identified business sectors and industrial processes that potentially expose workers to EMF that exceed the action levels stated in the EU Directive. NRPB's coverage was limited by the amount of empirical research that the Board has been able to conduct, and therefore its list of EMF emitting equipment may not be exhaustive.

19. According to currently available information from the NRPB, the potentially affected workers are:

- Those maintaining antennae, for example in broadcasting, navigation and telecommunications
- Those working with electricity generation and distribution
- Those working with dielectric and induction heating systems
- Those working with resistance welders
- Drivers of electric locomotives
- Those involved in electro-chemical processing
- Those using diathermy, hypothermia and nuclear magnetic resonance equipment, for example in the health services
- Those using tape erasing equipment to erase data stored on tapes and other magnetic media.
- Those using crack detection equipment for the non-destructive testing of metallic components
- Those using plasma etchers in the semi-conductor business
- Those using RF sputterers to apply coatings to components used in a variety of industries
- Those using Radio Frequency Identification (RFID) equipment for identifying components and restricting personnel access
- Those working with Electronic Article Surveillance (EAS) equipment used to prevent theft from shops, libraries etc.

Data gathered from industry sources during the preparation of this RIA, combined with HSE's best estimates, has allowed HSE to develop a picture of the number of potentially affected businesses, sites and workers in a subset of the industries implied by the list above. Table 1 presents these estimates.

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<sup>1</sup> NRPB R265 and NRPB-W24

Type of equipment	Sectors	Estimated no. of businesses/ organisations	Estimated number of relevant sites	Estimated pieces of equipment	Estimated no. of workers potentially affected
Radio transmitters	Broadcast	2	1350		1550
Radio transmitters	Telecoms	5	28,000	35,000	800-1000*
Navigation masts	Marine and aeronautical navigation	36	430		500-1000
Radar installations	Air traffic control, Coastguard	27	189		500-1000
Electricity generators, transformers, pylons etc	Electricity production and distribution	125-225	173000		6000
Induction furnaces		1000-3000		3,000	9,000
Electric locomotives	Rail	30	NA	7,100	7000-14000
Dielectric heaters	Various	250-1000		500-1000	1500-10000
Physiotherapy equipment	Medical	300-700	700	3200	9000
Magnetic resonance equipment	Medical	200-500		250	1250

\* Information from the telecommunications industry indicates that none of these workers is routinely exposed to levels in excess of the draft Directive's action values

[Thus far in its investigations, HSE has been unable to estimate the number of businesses, sites and workers who would be affected in industries that use the following types of equipment:

- Electro platers
- Resistance welders
- Tape erasers
- Crack detection equipment
- Plasma etchers
- Radio Frequency Sputterers
- Radio Frequency identification
- Electronic Article Surveillance

20. Consequently, HSE's estimates represent only a partial picture of the overall compliance costs faced by businesses and other organisations in Great Britain. HSE is endeavouring to acquire more information and will provide a fuller set of costs in future versions of this RIA.

21. The use of much of the equipment referred to above is not specific to a particular industry. This applies especially to resistance welders and electroplaters. Furthermore, some businesses within a relevant SIC group will use specific types of EMF generating equipment, while others will not. This further complicates the task of estimating the number of businesses that would potentially be affected by the Directive.

22. The task of estimating the number of businesses is simplified in cases where equipment users are easily identifiable as coming from one particular industry. This is the case for the “production and distribution of electricity” industry (SIC 401) and the “transport via railways” industry (SIC 601), and we can make reasonable assumptions about the number of businesses involved using Small Business Service data. Within the electricity production and distribution industry, 125 firms (60 micro<sup>2</sup>, 25 small, 15 medium and 25 large)<sup>3</sup> would be affected (assuming all firms in this group employ workers exposed to EMF). In addition there is an unknown number of contracting firms that provide services to the electricity industry. Within the rail industry, approximately 30 companies would be affected (assuming that only the large and medium sized firms in this SIC code operate electric locomotives). Other information on the number of affected businesses (Table 1) has come directly from industry representative organisations.

### **Compliance costs to business, charities and voluntary organisations**

23. Some firms are already compliant with at least some of the measures contained in the draft Directive. This is for two reasons: Firstly, media coverage and therefore public awareness of potential problems in specific industries has, in some cases, forced all of the affected firms to conform with high industry specific standards (which generally follow NRPB or ICNIRP guidelines). In particular, this applies to the mobile telecommunications industry. Secondly, the Management of Health and Safety at Work Regulations 1999 require employers to assess risks, take measures to reduce the risks identified and provide appropriate health surveillance. The regulations do not specifically mention EMF as a potential health hazard, and consequently the level of awareness of the risk among most employers is probably low. However, the NRPB publishes EMF exposure guidelines, which, although not legally binding, currently act as a benchmark.

24. HSE has assumed that few workers in the telecom industry are exposed above the action values in the draft Directive. The impact on the industry should therefore be minimal although there may well be some requirement for action such as provision of signage.

25. The incidence of exposure to EMFs above the action values in all other affected industries is unknown, and HSE has no basis for making an assumption in this regard. There remains the issue of the extent to which the non-telecoms industries already comply with the draft Directive’s Article 4 (“Determination and assessment of risks”). HSE has assumed that between 5 and 20% of the relevant firms already conduct suitable risk assessments.

26. HSE also has no knowledge of the number of workers who might be exposed above the limit values. The draft Directive prevents exposure above the limit values, but it is not clear whether it expects exposure to be calculated once the action values have been exceeded, or whether it implies that action under Article 5.2 to reduce exposure to a minimum will be sufficient to ensure that the limit values are not exceeded. HSE has assumed the latter, and

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<sup>2</sup> Between one and nine employees (pers. comm. SBS statistical service)

<sup>3</sup> Source: Small and Medium Enterprises (SME) Statistics for the United Kingdom 2001, Small Business Service October 2002.

therefore has not costed the exposure calculations which are necessary under the NRPB and ICNIRP guidelines, and would affect employers not already complying with those guidelines.

27. Compliance costs are considered in this RIA under the following headings: Familiarisation and planning (time spent by company management understanding the Directive and discussing how to respond to it); determination and assessment of risks (Article 4 of the Directive); provisions aimed at avoiding or reducing exposure (Article 5); worker information and training (Article 6); consultation and participation of workers (Article 7); and health surveillance (Article 8).

Familiarisation and planning:

28. HSE's inability to establish with certainty the total number of companies affected by the Directive means that overall familiarisation and planning costs to UK companies can only be tentatively estimated. Assuming that familiarisation and planning requires an average of four hours of management time per business, and that the hourly cost of an appropriate manager is approximately £24<sup>4</sup>, the following range of one-off implementation costs would apply: £1.5 to £4.2 million.

Determination and Assessment of risks.

29. The Directive does not prescribe how firms should conduct EMF risk assessments. HSE has therefore made several assumptions in order to estimate compliance costs. The first assumption is that there will be numerous cases where, in the judgement of responsible and knowledgeable staff, there is no reasonable expectation that the action values will be exceeded. No further action would be required in such cases. However, where there is any doubt, some kind of additional assessment would have to be made. The least onerous type of assessment (type 1) would apply where manufacturers' information (or information from other reputable sources) is available on the EMF fields generated by the equipment in question. In theory, such assessments should only have to be conducted once. However, type 1 assessments would only be valid if the equipment was installed on a stand-alone basis (so that EMF from different pieces of equipment did not combine to create EMF of greater overall strength), and if the equipment was not dismantled for repairs and maintenance. In the latter case, assessments using measuring equipment should be conducted to ensure that the re-assembled equipment does not emit EMFs that exceed the action levels in strength. Type 1 assessments are assumed to be performed by an electrical technician on a one-off basis.

30. Type 2 assessments would become necessary where the conditions for type 1 assessments are not fulfilled, or where there are concerns about certain particular types of workers, especially those with body implants. In most cases, they would involve an electrical technician using monitoring equipment for varying lengths of time, depending on the number of measurements that have to be taken. The cost of a technician is assumed to be £14.40 per hour<sup>5</sup>. In a proportion of cases, company managers may decide to hire a consultant either because of the complexity of the assessment or because there is no in-house expertise (the likelihood in small firms). HSE has assumed that this will occur in 25% of all cases and that the

<sup>4</sup> Source: New Earnings Survey 2002. SOC124 average hourly wage rate £18.64, multiplied by 1.3 to account for non-wage labour costs.

<sup>5</sup> Source: New Earnings Survey 2002, ONS. SOC 302 average hourly wage rate £11.08 multiplied by 1.3 to include non-wage labour costs.

full cost of hiring a consultant would be £300 per day (which is set deliberately high to allow for a slight fee increase as a result of greater demand for consultant services). Type 2 assessments would have to be repeated after major repair and maintenance events, which HSE has assumed to occur every two years for some types of equipment and every five years for others (refer to table 2 for the schedule).

31. All sites operating equipment that may expose workers to EMF greater than the action values will be required to make a type 1 or type 2 assessment. Table 2 gives the assumed regularity and duration of type 1 assessments, while Table 3 gives the same information for type 2 assessments.

Type of establishment/equipment	Regularity of assessment (years)	Duration of assessment per site (average days)	Number of units of assessment (sites/pieces of equipment)
Broadcast antennae	Once only	0.125	500-1000
Resistance welders	Once only	0.03	
Electricity production and distribution	Once only	0.125	155900

Type of equipment/equipment	Regularity of assessment (years)	Duration of assessment per site (average days)	Number of units of assessment (sites/pieces of equipment)
Broadcast antennae	2	2	350
Telecommunications antennae*	2	2	0
Marine and aeronautical navigation aids	2	0.5	430
Marine and aeronautical radar	2	1	189
Electricity production and distribution	5	0.5	17100
Induction furnaces	2	0.33	1000-2000
Medical departments (MRI)	2	0.5	100-250
Electro platers	2	2	
Dielectric heaters	2	2	500-1000
Rail companies (electric locomotives)	5	0.25	7,100
Resistance welders	5	0.03	
Diathermy	5	0.5	700

\* Assumed already to be compliant with Directive

32. EMF measuring equipment will either have to be hired or purchased by the company that requires a type 2 assessment. HSE judges that the cost of hiring such equipment would be £75 per day.

33. Downtime is assumed to be negligible because equipment will have to be operating in order for measurements to be taken.

34. Costs under “determination and assessment of risks” are estimated to lie in the following ranges: First year costs (which are not one-off but which vary in subsequent years) are

between £3.7 to 4.8 million, with ten year discounted costs with a present value of £5.9 to 9.7 million.

Provisions aimed at avoiding or reducing exposure:

35. Article 5.1 requires employers to reduce risks to a minimum. It is not at all clear what this can mean beyond compliance with the basic restrictions, since it is accepted that risk is prevented with such compliance. There should, therefore, be no costs in complying with Article 5.1 for employers already compliant with the NRPB guidelines.

36. In Article 5.2, the Directive states that "...once action values...are exceeded, the employer shall devise and implement an action plan comprising technical and/or organisational methods intended to reduce exposure to a minimum". Reducing exposure to a minimum has no logical purpose where there is no associated risk and it is not clear what criteria would be used to define "minimum". For the purposes of this RIA we have assumed that it means as low as possible consistent with carrying out the work processes, though the UK would not necessarily transpose the requirement into legislation with this meaning. The estimated costs are therefore hypothetical and do not necessarily reflect what employers would be expected to do.

37. In any case, there is currently no way of producing a comprehensive estimate of industry's costs of acting to reduce worker exposure to EMF in Great Britain. This is because a) there is no reliable data on the degree to which the Directive's action value will be exceeded by the large and diverse set of businesses affected; b) for each business, there will be several technical options for reducing exposure, very few of which have been subjected to rigorous costing exercises. The range of estimated costs for Great Britain would therefore be so large as to be meaningless.

38. However, in order to gain an impression of the likely scale of the costs, it is possible to take information from industries that have produced their own preliminary estimates. The electricity generating and distribution industry is particularly concerned about the Directive's impact, and has provided HSE with initial estimates of capital and recurrent expenditure that the industry would face. HSE has not been able to verify the accuracy of the figures, and reproduces them faithfully from the electricity industry's first estimates. The electricity industry is currently refining their compliance cost estimates and consequently, the figures will probably be revised.

Table 4. Electricity industry estimated costs of complying with Article 5.2 "Actions necessary to reduce worker exposure".

		Recurring costs	One-off costs
Electric fields	Substation compounds	£2M/yr	
	Overhead line work	Cost of remedy	£1M/yr
		Cost of reduced productivity	Of order £5M/yr
Magnetic fields	Substation compounds	NGT*	£0.3M-£1.2M
		DNOs**	£20M-£130M
	SVCs		£30M
	Cable tunnels outside substations	NGT*	Estimates from <£1M/yr to >£100M/yr

		DNOs**	Not yet quantified	
	Cable tunnels under substations	NGT* and DNOs**	No method of achieving compliance yet identified	
	Live line work		Not yet quantified	
	Live jointing at low voltages		£50M/yr	
	Power stations			<£0.5M
* National Grid Transco				
** Distribution Network Operator				

39. According to Table 4, quantified one-off costs range from approximately £50.8 to 161.7 million, while annual recurring costs range from approximately £59 to 158 million. Note that certain categories of compliance actions have yet to be quantified. Furthermore, a technical solution to reducing exposure from cable tunnels under substations has yet to be identified. The ten year present value of these costs is between £559,000,000 and £1,522,000,000.

Worker information and training:

40. The Directive will require employers to “ensure that workers who are exposed to the risks from electromagnetic fields at work and/or their representatives receive information and training relating to the outcome of the risk assessment”. Although workers are only exposed to risk above the basic restrictions this provision can only make sense if it applies to workers at the action value, since a risk assessment will have to have been undertaken at that value.

41. For the purposes of the RIA HSE has assumed that information is required where the risk assessment is required, that 10 to 25% of workers from assessed workplaces will require training, that the transfer of training and information will take one half hour per year per worker and that the average full labour cost of employing such workers is £13 per hour<sup>6</sup>. Furthermore, HSE has assumed that management will provide the information and training, requiring on average five minutes per worker per year, at an average cost of £24 per hour<sup>7</sup>.

42. Costs under “worker information and training” are estimated as follows: Annual recurrent costs of between £44,000 and £163,000, with a ten year present value of between £379,000 and £1,404,000. These are implementation costs.

Consultation and participation of workers:

43. This process would be handled through existing channels, and therefore the incremental costs are assumed to be negligible.

Health surveillance:

44. Article 8 of the Directive states that “surveillance shall be appropriate where: the exposure of workers to electromagnetic fields is such that a link can be established between that exposure and an identifiable illness of harmful effects on health; it is probable that the illness

<sup>6</sup> A review of relevant SOC codes suggests that an hourly wage rate of £10 is a representative average. This figure is multiplied by 1.3 to account for non-wage labour costs.

<sup>7</sup> NES 2002, SOC 124. Hourly wage rate of £18.64 multiplied by 1.3 to account for non-wage labour costs.

or the effects occur in a worker's particular working conditions". For workers who do not have body implants, there is no empirical or experimental evidence that exposure to EMF below the limit values causes any ill-health effects. In the absence of any risk to health, it is difficult to argue that health surveillance should be provided for the vast majority of workers who are exposed to EMF below the limit values. However, article 8 also states that "In any event, workers exposed to electromagnetic fields in excess of the values referred to in article 3 [the action values] shall be entitled to appropriate health surveillance." It is not at all clear what this provision can mean, but on the assumption that some form of health surveillance of unknown purpose and form must be undertaken, HSE considers it must provide some costing, however arbitrary the assumptions.

45. On the basis that (a) many workers potentially affected by the Directive will not actually be exposed to EMFs above the action value, and (b) many of those that are will not take up their entitlement to health surveillance, HSE has assumed that between 5 and 25% of all workers potentially affected by the Directive will request health surveillance, that the health surveillance is conducted by a nurse and takes quarter of an hour per worker per year. Furthermore, HSE assumes that the cost of the consultation is £12.50 per worker<sup>8</sup> and that there will be an associated loss of output equivalent to one quarter of an hour of the average workers' wage of £13 per hour.

46. There is a very good case for providing screening for workers with body implants (regardless of the level of EMF exposure that they are likely to experience). Once identified, these workers could be targeted with advice on appropriate work practices. The generation of this advice would require in-depth risk assessments of workplaces and particular workstations. HSE has assumed that the costs of conducting the assessments and advising workers are already included in the relevant costs above.

47. Estimated costs under "health surveillance" are as follows: Annual recurrent costs in the range of £41,000 to £302,000, with a ten year present value of between £350,000 and £2,596,000.

### **Compliance costs for a 'typical' business**

48. The diversity of the businesses affected by the Directive means that a single "typical business" is impossible to identify. However, in cases where the whole of a sector is affected, a typical business is identifiable. An obvious example (for which information is available) is the electricity distribution sector. The information presented below is averaged across the fourteen distribution network operators.

	Estimated compliance cost (£)	
	One-off costs	Ten year P.V.
1. Familiarisation and planning	1,000	1,000
2. Determination and assessment of risks	315,000	315,000
3. Action to reduce exposure*	1,429,000 to 9,286,000	1,429,000 to 9,286,000
4. Worker information and training	0	16,000
5. Health Surveillance	0	91,000
TOTAL	1,745,000 to 9,602,000	1,852,000 to 9,709,000

<sup>8</sup> A consultant occupational nurse is judged to cost £250 per day and can conduct 20 quarter hour sessions per day.

\* Estimated by the electricity industry. These costs are incomplete and therefore represent a minimum under the electricity industry's assumptions

**Total implementation compliance costs**

Table 6. Summary of compliance costs (£)				
	One-off costs		10 yr PV	
	Lower estimate	Upper estimate	Lower estimate	Upper estimate
<b>Implementation costs:</b>				
Familiarisation and planning	1,500,000	4,300,000	1,500,000	4,300,000
Worker information and training	-	-	400,000	1,400,000
<i>Total implementation costs</i>	1,500,000	4,300,000	1,900,000	5,700,000
<b>Policy costs:</b>				
Determination and assessment of risks	-	-	5,900,000	9,700,000
Action to reduce exposure*	50,800,000	161,700,000	558,700,000	1,521,700,000
Health surveillance	-	-	400,000	2,600,000
<i>Total policy costs</i>	50,800,000	161,700,000	565,000,000	1,534,000,000
<b>Total Policy and Implementation costs</b>	52,300,000	166,000,000	566,900,000	1,539,700,000

\* Only includes the costs estimated by the electricity industry

49. N.b. Due to the unavailability of data, these costs do not present a complete picture of implementation and policy costs.

50. The undiscounted estimated annualised costs are in the range £65,900,000 to £178,900,000.

**Impact on small and medium sized businesses**

51. HSE contacted four small businesses and sought the views of the Engineering Employers' Federation in order to assess the potential impact of the draft Directive. One of the contacted businesses was an oil and gas company that generates electricity from by-products, while the other three businesses were engineering firms that serve niche markets for intermediate manufactured products.

52. The responses from all parties were broadly similar. The costs of risk assessment and health surveillance would not have a significant impact because they vary in proportion with firm size (as measured either by number of employees or pieces of equipment). The implementation costs associated with familiarisation and planning were not regarded as significant, and worker training, information and communication would be handled through existing channels. However, should any of the firms be required to take action to reduce workers' exposure to EMF, the implications for small businesses could be significant. The impact could be disproportionate compared with the impact on larger firms because the actions may involve substantial costs that are not directly related to firm size.

### **Competition assessment**

53. As noted in the “Business sectors affected” section, the draft Directive would affect a large variety of businesses, and therefore may have an impact on competition in numerous markets. Two of the more important and easily identifiable markets are associated with the electricity generating and broadcasting industries.

54. The electricity generating industry includes several large and many smaller companies. Although there are some geographical limits to where certain companies can sell their power, there is a clear chain of substitution that means that the definition of the market covers the whole of Great Britain. There is a small degree of market concentration, with three or four particularly large producers. However, their combined output does not exceed 50% of the market (as measured crudely by generating capacity). Some smaller firms may be affected substantially more than larger firms because the costs of actions to reduce EMF exposure are likely to contain a large proportion of fixed costs. However, this has yet to be confirmed and, in any event, the structure of the market is unlikely to be altered. New entrants will not encounter greater set-up and on-going costs than faced by companies already in the industry.

55. The broadcast industry is highly concentrated with just two major players in the market. However, both of these firms would experience very similar compliance costs and therefore neither will be affected more than the other. Market structure would not change and new entrants to the market will not bear greater costs than those already in the market. Although technological change occurs within the industry, the pace is not rapid. The Directive would not affect firms’ choices.

### **Costs to HSE**

56. HSE anticipates that the resource costs of enforcing the Directive would be absorbed in existing inspection resources.

57. The draft Directive requires HSE to report to Brussels on a five year basis. The costs of doing this are regarded as negligible.

### **Other government costs**

58. The MoD operates military radar systems and would be responsible for conducting risk assessments, personnel training and health surveillance. In the worst scenario, the MoD would also be responsible for taking action to reduce personnel exposure to EMF. HSE has been unable to establish how many radars the MoD operates and has been unable to estimate the implementation costs that the Department would face.

### **Total costs to society**

59. In the absence of quantifiable public sector costs, the total costs to society are the same as those for “businesses, charities and voluntary organisations” (which contain no transfer payments). One-off costs are in the range £52,000,000 to £166,000,000 and the ten year present value is in the range £567,000,000 to £1,540,000,000.

**ENVIRONMENTAL IMPACTS**

60. None has been identified.

**BALANCE OF COSTS AND BENEFITS**

61. Quantification of the benefits of the draft Directive has not been possible and hence the balance of costs and benefits is impossible to state quantitatively. The Directive might have the potential to reduce the risks of workers being exposed to levels of EMF greater than the limit values, although most incidents where harmful exposure occurs are as a result of accidents. The draft Directive does not address the prevention of accidents.

62. One-off costs are in the range £52,000,000 to £166,000,000 and the ten year present value is in the range £567,000,000 to £1,540,000,000.

63. Because of current information gaps, the costs estimated in this RIA are very conservative. Despite this, HSE believes that the benefits of the current draft of the Directive would be very limited and are very heavily outweighed by the costs.

**Uncertainties**

64. A large degree of uncertainty exists over much of the data used in this RIA. In most cases, the industries potentially affected by the Directive have yet to analyse its implications and consequently HSE made a large number of assumptions. Indeed, so little information is available from industries using certain types of equipment that HSE has been unable to estimate some of the relevant costs. Efforts will be made to provide estimates once more information becomes available through continued contact with businesses and their representative organisations. In the meantime, the cost estimates in this RIA should be regarded as substantially understating overall costs within Great Britain. Most importantly, with the exception of the electricity industry, the estimates do not include the currently unquantifiable policy costs that businesses and other organisations will face by taking actions to reduce worker exposure to below the draft Directive's action values [see para 34 onwards]. The effect of including these costs would be to increase overall costs dramatically.

65. On the other hand it is difficult to understand several of the Directive's provisions, which HSE has chosen to cost on the basis of assumptions as to what the drafters might have intended them to mean. Should the Directive be adopted in its current form the UK would not necessarily transpose the Directive into legislation in line with these assumptions.

**Arrangements for monitoring and evaluation**

66. The Directive, if adopted, would need to be implemented in the UK by regulations under the Health and Safety at Work etc. Act 1974. A survey to assess awareness of the amended regulations and compliance with them would be commissioned within two years of their introduction.

**Securing compliance**

67. There is already a duty under general health and safety legislation to assess and control risk. Employers should already be complying with NRPB guidelines that, for occupational exposure, are virtually the same as the ICNIRP guidelines specified in the Directive.

68. As currently drafted, the Directive is likely to make unreasonable demands on industry and hence the level of compliance with the Directive would probably be low.

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