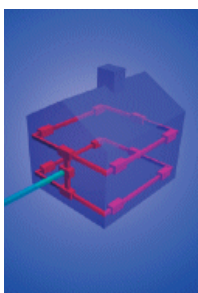


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| SAGE Group: | Distribution Working Group | | |
| Document Title: | Record of the Distribution Working Group Meeting, 13 th January 2010 | | |
| Original Author | Type | Status | Web Site Status |
| David Collier | | For Issue | Public Access |



Stakeholder Advisory Group on ELF EMFS (SAGE)



Record of the Distribution Working Group Meeting

13 January 2010



**The Hatton, 51 – 53 Hatton
Gardens, London EC1N**

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DISTRIBUTION:

Copies to - Meeting Participants

1 copy - Golder Associates (UK) Ltd

January 2010

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APPENDICES

Appendix 1 Overheads as agreed at end of meeting

1. INTRODUCTION

1.1 Nature of the Report

This document is the report of the seventh meeting of the SAGE Distribution Working Group (DWG), held on 13th January 2010.

Nothing in this report should be taken as representing a collective SAGE view. The views recorded are for the most part expressed by individual participants and even where the report indicates that an agreement has been reached, this has the status only of a working agreement for the particular meeting or work stream and should not be quoted as a SAGE view.

1.2 Attendee List

| | |
|------------------------|---|
| Andy Hood | Western Power Distribution |
| Paul Bicheno | Institution of Engineering and Technology |
| Roger Coghill | Coghill Research Laboratories |
| Stuart Conney | Department of Health |
| Caroline Hampden-White | CHILDREN with LEUKAEMIA |
| Pat Keep | Department of Health |
| Jill Meara | HPA |
| Alasdair Philips | Powerwatch |
| Graham Philips | Electromagnetic Radiation Research Trust |
| Peter Roberts | Energy Networks Association |
| John Swanson | National Grid |
| Adrian Todd | Kilmorack Community Council |

Facilitator/Technical Reporter David Collier

No apologies received

1.3 Objectives of the Meeting

The following objectives were circulated in advance and agreed on the day:

- Complete the mitigation options ranking
- Review the DWG process to date and agree future work
- Explore the need to identify thresholds for implementing mitigation
- Review the draft report to the January Main Group
- Agree January Main Group objectives in relation to DWG work
- Receive and respond to a presentation on pole-mounted transformers

1.4 Agenda

The following draft agenda for the meeting was circulated in advance and agreed on the day:

| | |
|---------|---|
| 10.00am | Agenda review Report of last meeting Actions Updates (if any) Recap of work to date / draft presentation to main meeting BREAK Remaining options ranking Thresholds for implementation / meanings for ranking categories |
| 12.45pm | LUNCH Presentation on pole-mounted transformers Objectives and reporting for January MG DWG final report BREAK Next meeting/actions Evaluation |
| 4.30pm | CLOSE |

1.5 Ground Rules

It was agreed to use the same ground rules as those used at the SAGE Main Group meeting of 14th October 2008, namely:

- All mobiles to be turned off;
- One person talks at a time;
- Issues will be dealt with under the appropriate agenda heading;
- All participants to treat each other with respect;
- Everyone present agrees to share responsibility for the wall record;
- Comments are not to be attributed in the public domain (i.e. you can report on what was said in the meeting, but not who said it). However, comments may be attributed when individuals are reporting to their own organisations;
- Participants agree to abide by the SAGE Code of Conduct.

2. REPORT FROM LAST MEETING

2.1 Acceptance of the Report

No comments were submitted to the facilitation team on the report from the meeting of 26th November 2009.

2.2 Actions from the Last Meeting

| Action | On | Progress |
|---|---------------------------------|--|
| Present short presentation on issue with regard pole-mounted transformers | Roger Coghill | Agenda item |
| To check the minimum clearance between homes and transformers | Andy Hood | See below |
| Review the DWG aims and objectives and forward comments to the facilitation team prior to the next meeting | All | No comments received |
| To assess how accurately the Government response reflected the recommendations from SAGE Phase I | John Swanson / Alasdair Philips | Summary tabled, to be circulated to all SAGE Members after Process Group |
| Identify possible candidates for peer review of the Interim Report | All | Passed to Process Group |
| More detailed information to be supplied to the facilitation team with regard to mitigation options to add to Interim Report of the DWG | All | Information provided and incorporated in JS slides |
| Detailed comments on the interim report to facilitators | All | None received |

2.3 Minimum clearance between homes and transformers

Andy hood reported on the required clearances between line conductors and buildings. They are specified in an Energy Networks Association document called ENA TS 43-8 issue 3, "Overhead Line Clearances".

All HV conductors and also bare (i.e. non-effectively insulated) LV Conductors

- Between line conductor and any object which is normally accessible = 3m (up to 33kV), 3.2m (66kV), 3.6m (132kV).
- Between line conductor and any object to which access is not required and on which a person cannot stand on or lean a ladder = 0.8m (up to 33kV), 1m (66kV), 1.4m (132kV).

Effectively Insulated LV Conductors, e.g. aerial bundled conductor (ABC):

- Vertical distance to any surface or structure that is accessible without access equipment = 3m.
- Horizontal distance to any surface of a building that is accessible without access equipment = 1m.
- Clearance to parts of a building that are not normally accessible = 0.5m.

3. UPDATES

The DWG noted that because of a family illness Nigel Westaway would not be able to facilitate this and any of the other scheduled SAGE 2 meetings. The DWG agreed that David Collier would therefore provide facilitation support but that members of the DWG would also take a more active role in defining and delivering the process. For today's event, John Swanson would lead the main technical sessions.

The current programme through to May was reviewed. No changes were recommended.

4. Meeting Format

It was agreed that John Swanson should take the meeting through the slides he had produced covering the DWG's work to date and comment as necessary. Additional slides would then be agreed as each new option was completed and would form the record of the DWG's recommendations. Some of the detailed discussion was also recorded with the slides; where we quote directly from that record, we show it in this report *in italics*.

5. Options Assessment

The slide numbers in the below refer to the overheads as agreed at end of meeting reproduced in Appendix 1.

1. **DWG Work so far (1)**
2. **DWG Work so far (2)**
3. **Framework**

No significant discussion on slides 1-3

4. Categories

The practical meaning of the ranking criteria scheme used at the last meeting was discussed. The set of categories eventually agreed is based round a traffic-light system:

| | |
|----------|--|
| “Should” | Options which DWG is confident in recommending “should” happen. Some of these (as it turned out, a majority) are already existing practice for other reasons. In this case the DWG recommendation is that they should continue but with a recognition that EMFs are also a reason for doing them, so that in future, if the other reasons change, EMFs do not get ignored. Others (as it turned out, rather few) are new measures that DWG recommends should be introduced. Where this happens, DWG is sufficiently confident it has assessed all the relevant factors to be able to make this recommendation. If, by contrast, DWG felt than an option looked promising, but that further work on the safety or cost-benefit issues was needed to determine whether it should in fact be introduced, it would be classed as “could” rather than “should”. |
| “Could” | Options which do not fall into either the “should” or “don’t” categories. In each case, this report explains the specific reasons. In many cases, however, the reasoning falls broadly into one of the following: |
| | <ul style="list-style-type: none"> • Further investigation is needed before a recommendation can be made. This could be either technical investigations (e.g. as to whether the option would have unacceptable safety consequences) or a cost-benefit analysis to determine whether the cost of introducing the option is proportionate. |
| | <ul style="list-style-type: none"> • The option cannot be generally recommended but may come into play in certain specified circumstances. |

| | |
|---------|--|
| | <ul style="list-style-type: none"> • “Consumer choice” where the option cannot be generally recommended, usually because the cost is disproportionate. However, if an interested party (for convenience described as a “consumer”) does not mind bearing the cost, then this becomes an available option. In these cases, generally speaking, the fact of DWG listing this does not change anything – the option would usually be available already – but DWG considers it helpful to list such options explicitly. |
| | <ul style="list-style-type: none"> • DWG unable to agree. There were no options in this category. |
| “Don’t” | Options which DWG is confident in recommending should not happen, either because they would not be effective, or, more usually, because the cost would be disproportionate or they would have adverse safety consequences which made them unjustifiable. |

The benefits of distinguishing between ‘weak’ and ‘strong’ recommendations was considered but ultimately not felt to be justified.

5. Loads

6. PME

7. Interconnected neutrals

8. Broken Neutrals

All agreed with minor comments.

9. Net Current Paths

There was some debate concerning a number of these options, but consensus was reached and recorded on the updated slide. In particular:

It is not worth proactively seeking out redundant cables in order to disconnect them, but a cable will normally become redundant as a result of some change to the system being made, and as part of that change, where the cable is genuinely redundant, it should be disconnected. The decision whether to remove it having disconnected it would continue to be made, as at present, on non-EMF grounds.

10. [progress slide]

11. Building Design

The main discussion here concerned retrofit options. The agreed discussion text is as follows.

In principle, if risers or plant rooms have been identified as the source of high exposures, there is an option for someone who is prepared to pay to have them moved, or retrofitted with compact designs. DWG recognises that the cost of this would normally be considerable. Further, although we use the terminology of “consumer”, in practice the person affected will often be a tenant or leaseholder rather than the building owner, and therefore less able to make decisions about changes to the building. So this option is likely to be rather limited in practice, but is still listed because it remains an option in principle.

12. [progress slide]

13. Intermediate Voltage OHLs

This was a new topic. Intermediate Voltage OHLs in this context refers to overhead lines at voltages above 400 V and below 132 kV (which was considered under SAGE Phase 1). The principal voltages in question are 11 kV, 33 kV, and 66 kV. Normally, these lines are not a significant source of exposure. They would become a possible significant source only if unusually heavily loaded. DWG identified that the commonest reason for a circuit being heavily loaded would be if it was connecting embedded generation.

Even a heavily loaded line at these voltages will produce lower EMFs than a typical high-voltage line. High-voltage lines were considered in detail in SAGE Phase 1 and similar conclusions are likely to apply. However, DWG recognised that in some respects (e.g. clearances from buildings and the ease of routing and rerouting) there could be differences. In any event DWG wished its conclusions to stand alone rather than to depend on previous work.

A recommendation on optimal phasing and balanced loads was relatively quickly agreed but there was much more discussion on potential restrictions on routing new heavily loaded intermediate-voltage lines close to homes, schools and other public spaces. A straight ‘corridor’ approach was not likely to be appropriate or acceptable but lines do pass close to houses and schools (some thought often unnecessarily). Case by case cost benefit analysis (CBA) offered a way forward but there was not enough time at the meeting to come to a consensus on exactly what might be needed. The agreed recommendation was therefore that further investigation was needed, without at this stage specifying what investigation would be required or by whom.

14. [progress slide]

15. Substation recommendation categories

16. Planning phase

The categorisation scheme was agreed.

Planning was a new topic. DWG considered that Compliance with relevant exposure limits was the only 'absolute' that could be expressed as a categorical requirement. The remaining options were not as clear cut.

Possible limits on fields produced in homes by new substations were considered. There was consensus that whether this option is recommended or not would depend on the costs and whether these were justifiable, and on any other ramifications. However, there was considerable discussion as to whether, recognising this, the DWG was in a position to advise on a field or distance criterion and whether it would be realistic to include such criteria in SAGE's 2nd Interim Report. The implications for installations in buildings where space was limited were also considered, along with the potential implications of planning changes.

Having had the benefit of this discussion, Members agreed to recommend that a cost-benefit analysis should be performed and that Government should ensure this actually happens. They noted that: *it would be possible to limit the fields that new substations produce in existing homes, schools etc. In practice, however, to allow easy widespread practical application without unreasonable case-by-case effort, any restriction could be expressed as a distance rather than a field.*

For ground-mounted substations, the DWG considered requiring the perimeter fence to enclose a larger area but decided that the parameter that affects the exposures is the distance from the equipment in the substation that produces the field. The position of the perimeter fence does not in itself have any impact.

17. Construction Phase

DWG endorsed current good practice, that new substations should have compact LV Boards and compact cables arrangements connecting the transformer to the LV Board.

Cables can be a significant source of fields and tend to concentrate at substations. Circuit routing was therefore discussed as part of this topic but it was agreed by 'clear vote' that a recommendation would not be included, recognising that substation spacing addresses it to a large extent.

18. Refurbishment

When an older substation, which may well not be particularly compact, comes to be replaced or refurbished, it was agreed that the DWG should support good practice in choosing compact designs. This was done for a variety of reasons but should now also be endorsed for EMF reasons.

DWG also recommended that components in the substation should be arranged in the lowest-exposure layout. This is not something that would be part of the planning or design considerations at present. It will often be readily achievable but where there is a significant extra cost, DWG recognised that a cost-benefit analysis would be needed.

19. Modification

This group of options apply when an existing substation is identified as the source of high exposures. After significant discussion, the following were agreed.

If the exposure were so high as to be non-compliant with the relevant exposure limits, the DNO (Distribution Network Operator) would be required to achieve compliance, at their cost, regardless of whether this was requested by consumers or not. However, in practice, all substations are compliant with the limits currently in force. Given that, DWG considered it would be difficult to force DNOs to take action where the field was high but still compliant with exposure limits. Any changes would be likely to be at the consumer's expense, but DWG felt this option should be made explicit.

The DWG therefore recommended that the DNO should consider instances of substations producing high exposures when requested and offer options for reducing the exposures at the consumer's choice and cost – where 'consumer' is used to mean the building occupier or owner or whoever is in a position to make the choice and pay for modifications if appropriate.

The trigger for the DNO performing this assessment would be when the substation produced elevated exposures in a home, school, or other similar public space. A field of 0.4 μ T should be used as a guide to when the exposure is "elevated".

A range of such modification options were considered. None could be justifiable as a general retrofit but they could be made available at the consumer's choice and cost in special cases (see slides in Appendix 1 for the details).

20. [progress slide]

21. HV Substations

It was recognised that High Voltage substations need addressing in their own right because they may throw up issues that are not adequately covered by the existing SAGE 1 work on power lines and SAGE 2 work on distribution substations. There are far fewer high voltage substations but there were a wide range of configurations and siting contexts and there is clearly a potential for exposure. However, the DWG had insufficient knowledge to say whether it was a significant issue without further work and had run out of time to gather more data. This topic would therefore have to be deferred.

22. [progress slide]

23. Training & Response

The first option under this heading was: *DNOs to investigate EMF issues when notified of them*. The agreed explanatory text was as follows.

DWG has examined and rated many options for “fixing” EMF issues. But cutting across all of these is this option which seeks to approach the issue in a different way, by ensuring that situations of elevated EMFs are taken seriously and not just dismissed or ignored. DNOs all investigate EMF issues to some extent at present. This option seeks to make sure this happens more systematically.

Given the present low volumes of EMF issues raised with DNOs, no “trigger” for the DNO to investigate is needed; DNOs are unlikely to be swamped by investigating every issue raised with them, regardless of whether the fields are in fact much elevated or not. But if the volume of issues raised increased significantly, it might be necessary to introduce a trigger to concentrate attention on more serious issues. DWG agreed to categorise this option as a ‘should’.

Practical implementation depends on the DNOs developing awareness of EMF issues by training relevant staff. DWG therefore also recommended that this should happen. Any cost benefit calculations associated with training and response should recognise that there are potential economic and reliability benefits from addressing developing faults as well as EMF benefits. The agreed text is: *EMF issues can often be indicative of network problems (such as interrupted neutrals or undesirably high currents flowing through earth connections) and it is clearly to the DNOs advantage to pick up on early signs of such problems.*

Public awareness

With respect to public awareness-raising, DWG noted that a similar recommendation had been made in SAGE Phase 1 and had been adopted by Government; the action for this now lay with HPA. There was considerable discussion about the public information option. The merits of different information dissemination methods e.g. Internet vs. leaflets, criteria for proactive distribution, and the need for awareness targets were explored. Communication was not a substitute for precaution. It was noted that some methods favoured those with ready access and experience of the Internet etc. who might already have some knowledge of the issues and be used to seeking out information. One might expect some of those most affected to be in more disadvantaged groups and therefore a more direct, proactive approach would be needed.

Whilst there was agreement that information should definitely be part of the approach to EMFs – it was placed in the ‘should’ category - Members did not reach a clear view of how this should happen and what method or methods would be best used. DWG considered that progress on this option should be monitored, by SAGE or by whatever body evolves out of SAGE.

6. Investigation of Electrical Fields around a Pole-Mounted LV Transformer

Roger Coghill gave a presentation of an electrical field strength survey he had carried out around a local pole-mounted transformer, with some observations on potential health impacts in neighbouring houses. He stressed that it was not being presented as a ‘scientific’ survey or epidemiological study, but rather as an example of apparently anomalous field strength measurements that suggested the picture was more complex than often presented, and that more attention needed to be paid to pole-mounted transformers - and indeed to electric fields generally.

The ensuing discussion concentrated on the survey methodology – Members considered a variety of potential reasons for the reported readings – and (primarily in general terms) on the conditions necessary before health impacts and field measurements can be considered potentially related.

Since the meeting, Roger has confirmed that he is happy to provide a copy of his presentation to any SAGE Member who requests one.

7. DWG Section of SAGE’s 2nd Interim Report

Good progress had already been made on the introductory sections of the DWG report to the Main Group (which would in practice probably comprise the main part of SAGE’s next report to Government).

The emerging DWG’s report structure was presented (Slide 24) and agreed by Members as the basis for the next phase of drafting. It was also agreed that John Swanson would continue as the author, supported by the facilitation team and other members of the DWG as appropriate. A good first draft was expected by mid-February for detailed DWG comment.

8. NEXT MEETING

This was the last DWG meeting of SAGE 2, and there were no actions specific to the DWG.

Appendix 1: Agreed Overheads

DWG work so far

✓ Net currents in distribution circuits



✓ Building design

✓ Intermediate voltage circuits



1/2 Final distribution substations



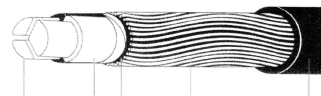
? HV substations

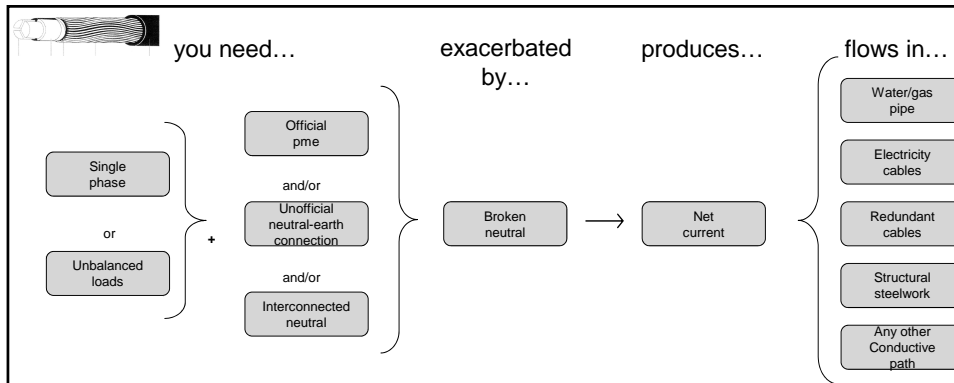
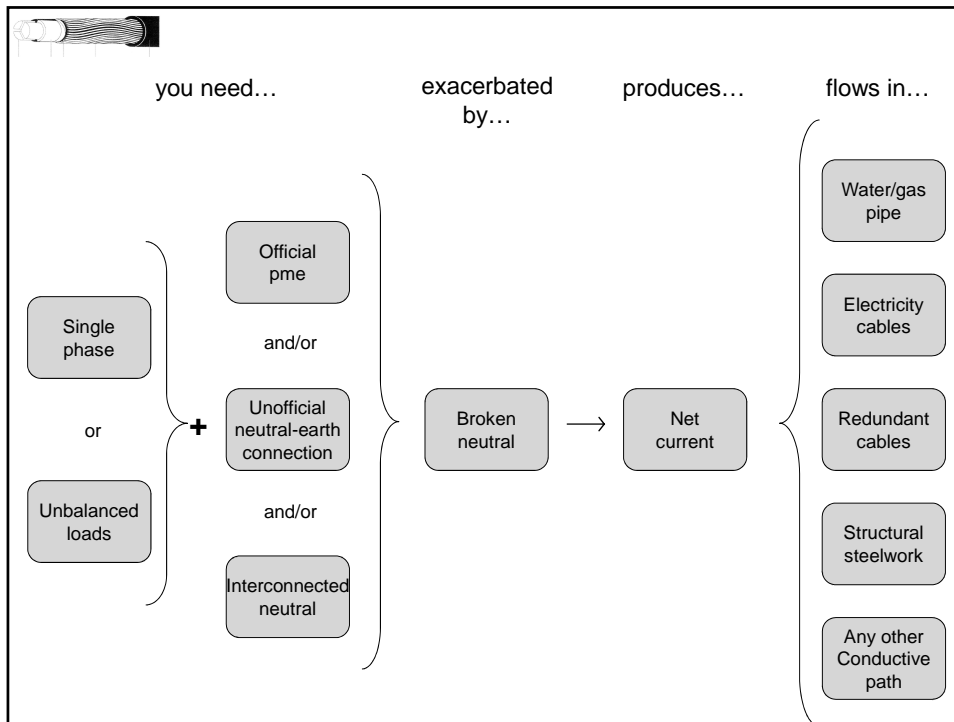


1/2 Training and Response

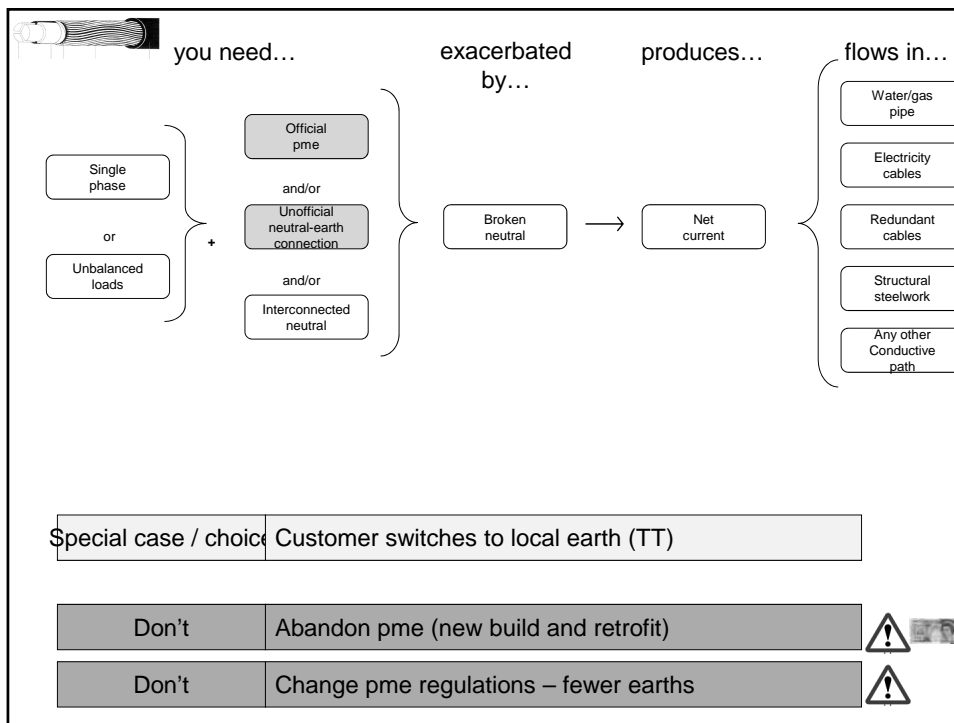
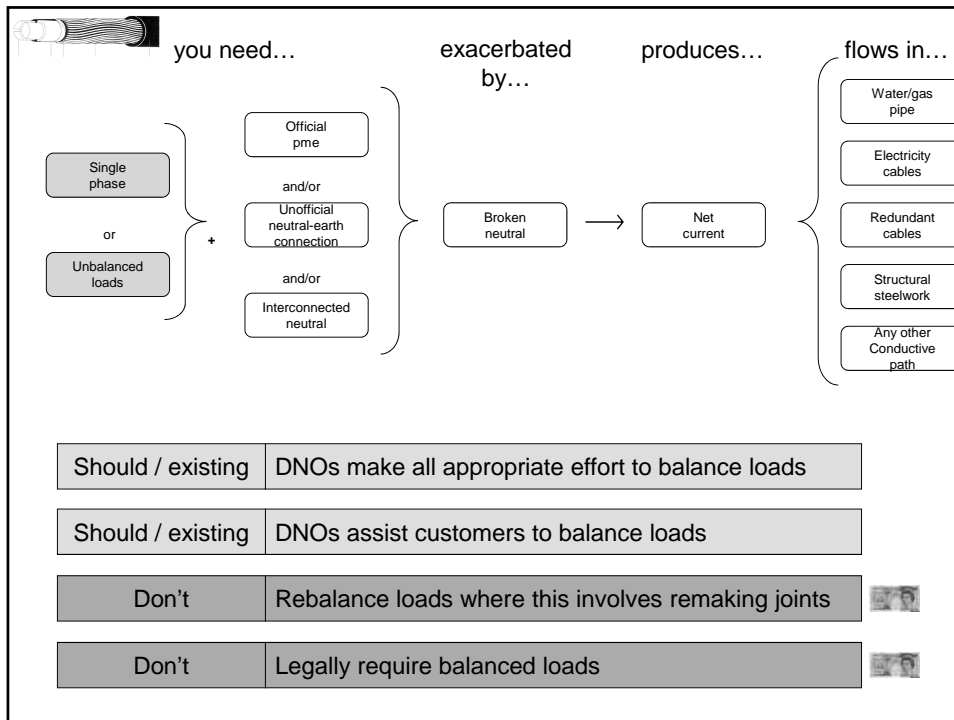
DWG work so far

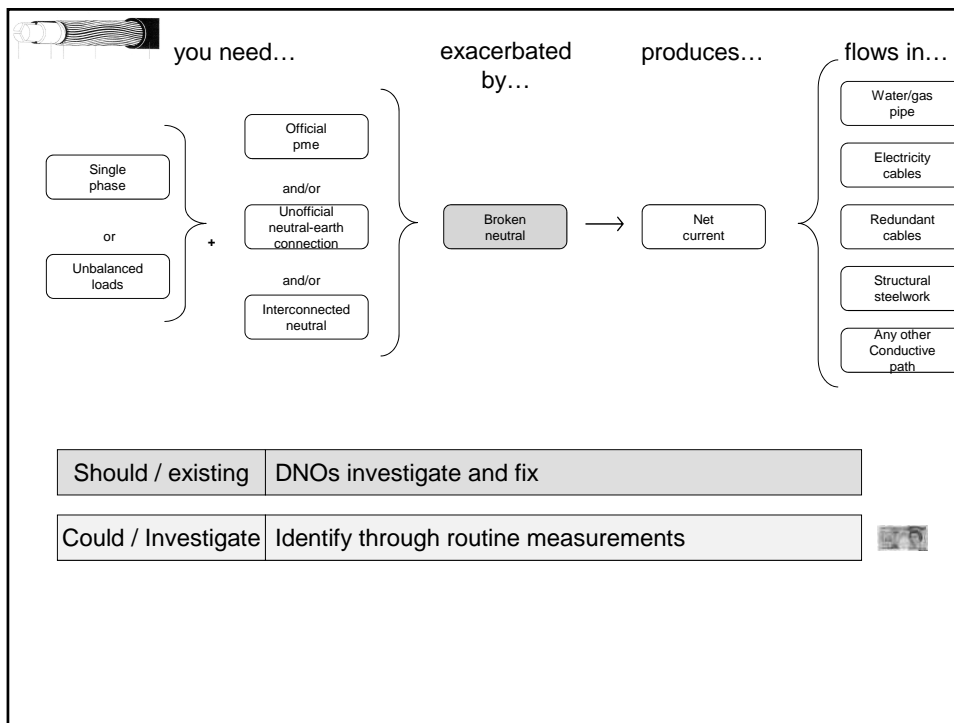
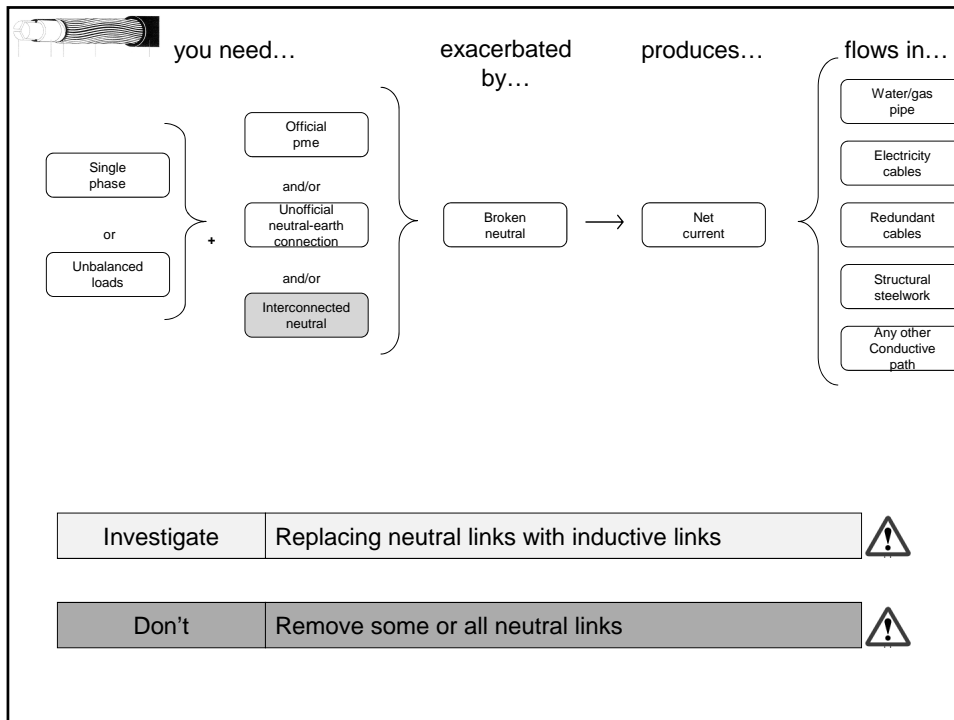
- Net currents in distribution circuits
- Building design
- Intermediate voltage circuits
- Final distribution substations
- HV substations
- Training and Response

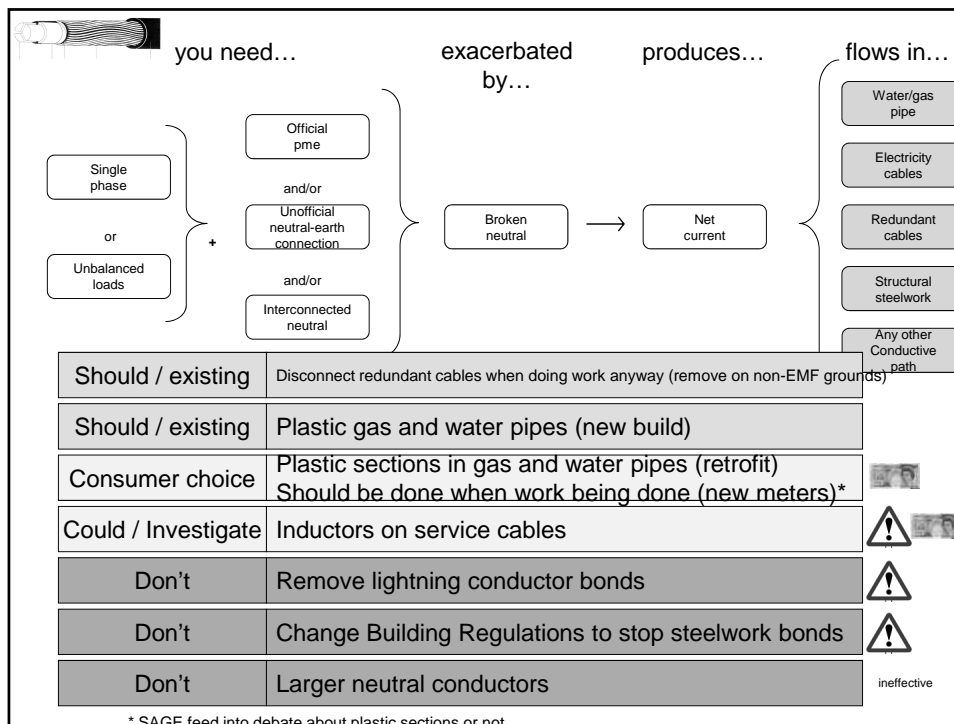




| | |
|-----------------|--|
| Should: new | |
| Should: current | |
| Could: | In special cases: DNO etc should / consumer choice |
| Could: | Further investigation needed: should happen / open |
| Could: | DWG unable to agree |
| Don't | Reject implementation / definitely don't |








DWG work so far

- Net currents in distribution circuits
- Building design
- Intermediate voltage circuits
- Final distribution substations
- HV substations
- Training and Response

Building design

| | |
|------------------------|---|
| Should / existing | Site plant rooms away from occupied areas (new build) |
| Should / existing | SNE risers in flats (new build) |
| Should / existing | Compact risers in flats (new build) |
| Building owner* choice | All of the above (retrofit)  |

* Explain who this might be

DWG work so far

- Net currents in distribution circuits
- Building design
- Intermediate voltage circuits
- Final distribution substations
- HV substations
- Training and Response





Intermediate-voltage overhead lines

- Only a significant source of field if heavily loaded
 - Probably because of embedded generation
- Heavily loaded 11 or 33 kV line still less than typical transmission line

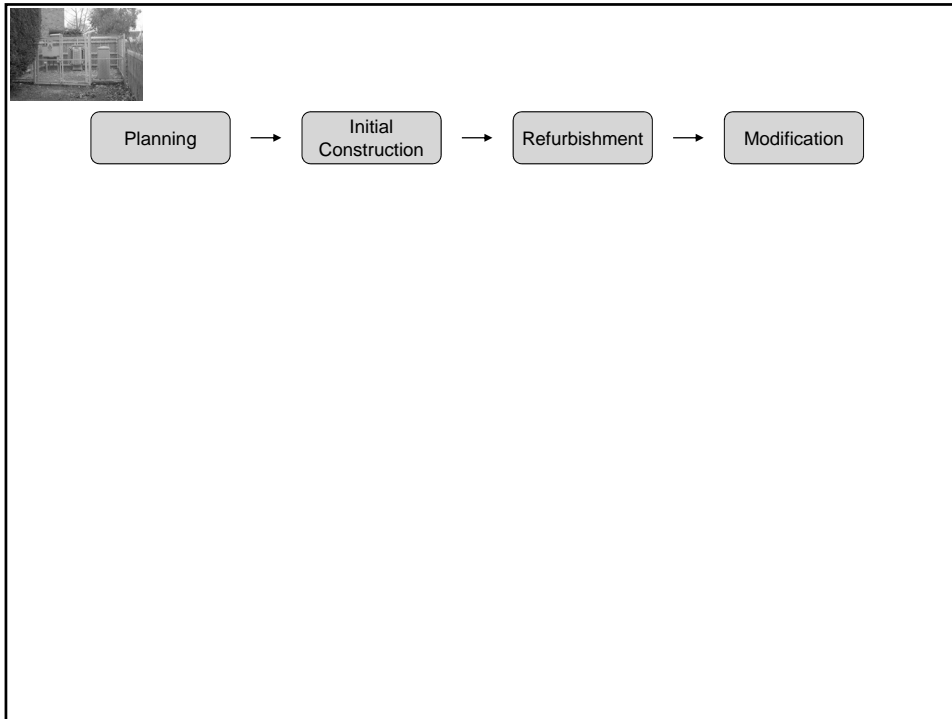
- So:

| | |
|-------------|--|
| Introduce | Optimal phasing All appropriate efforts to balance loads between circuits |
| Investigate | Routing new lines away from homes/schools/etc |

DWG work so far

- Net currents in distribution circuits
- Building design
- Intermediate voltage circuits
- Final distribution substations
- HV substations
- Training and Response





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    graph LR
      A[Planning] --> B[Initial Construction]
      B --> C[Refurbishment]
      C --> D[Modification]
  
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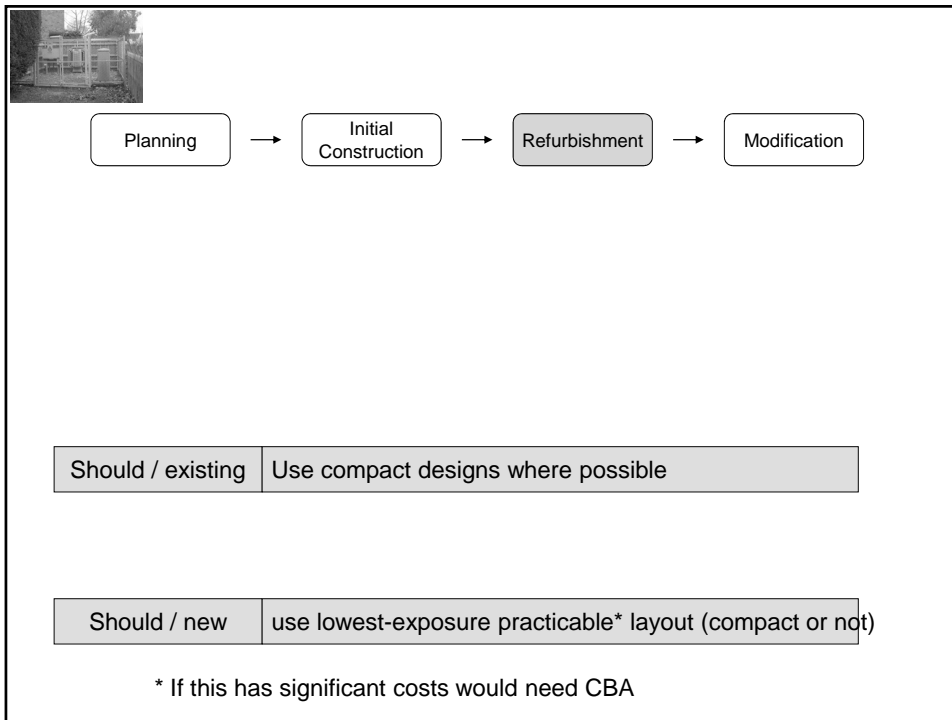
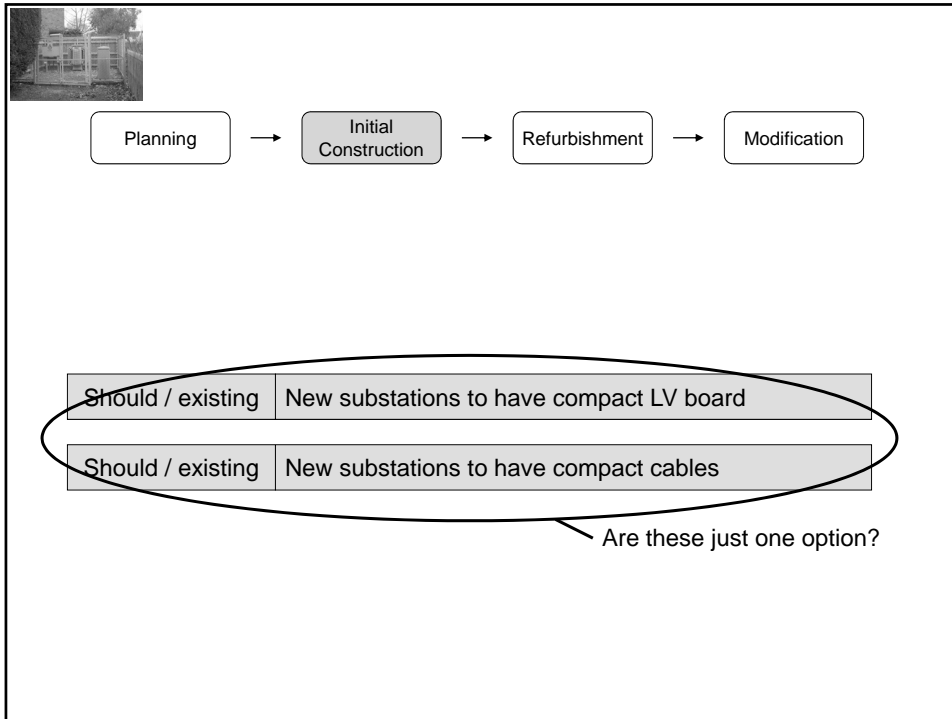
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|-------------------|-----------------------------|
| Should / existing | Comply with limits in place |
|-------------------|-----------------------------|

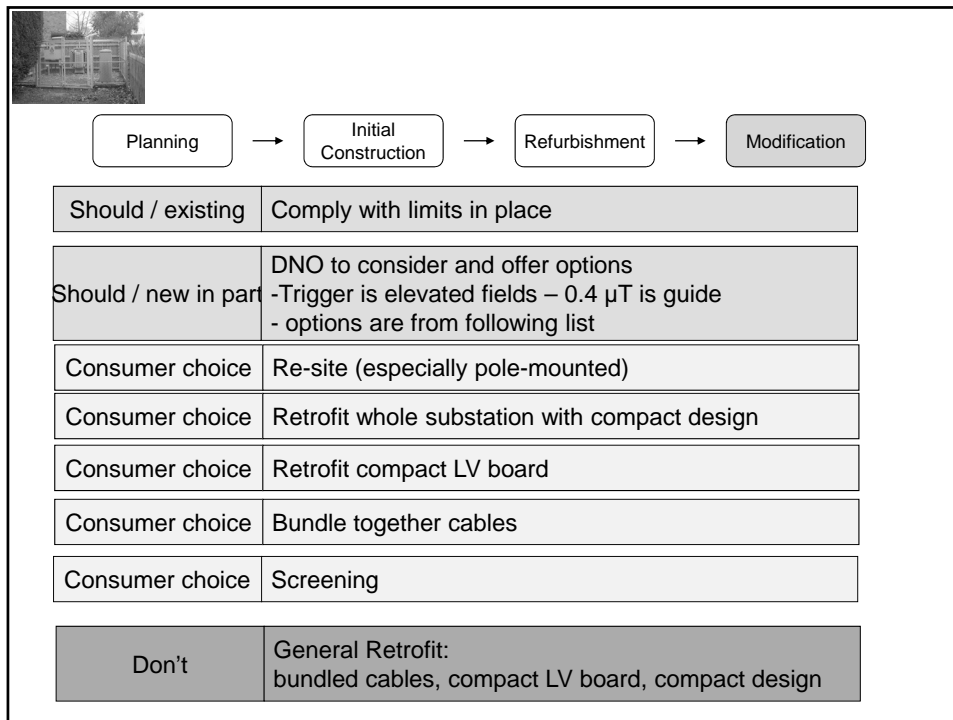
| | |
|-------------------|--|
| Should / existing | All appropriate efforts to site substations distant from homes etc |
|-------------------|--|

Investigate cost-benefit of limiting fields produced in homes etc by new substations
 - government should ensure this happens
 - so as to produce generic guidance
 - In practice, distance may be used as proxy for field

| | |
|-------|--------------------------------------|
| Don't | Perimeter fence encloses larger area |
|-------|--------------------------------------|

ineffective





DWG work so far

- Net currents in distribution circuits
- Building design
- Intermediate voltage circuits
- Final distribution substations
- HV substations
- Training and Response





HV substations (>20 kV)

- DWG ran out of time
- Needs considering as a separate issue
 - Goes beyond either lines or final distribution substations
- Recommend work is done

DWG work so far

- Net currents in distribution circuits
- Building design
- Intermediate voltage circuits
- Final distribution substations
- HV substations
- Training and Response

Training and Response

| | |
|--|---|
| | Public information <ul style="list-style-type: none">- DWG agreed on reactive information- DWG generated a range of options for proactive- SAGE 3 or equivalent should review |
| | DNO investigate EMF issues when notified <ul style="list-style-type: none">-No trigger needed with current volume- trigger needed if volume increases greatly |
| | Training and develop awareness for relevant DNO staff <ul style="list-style-type: none">-DNO aware that EMFs can be indicator for network problems |

Report structure

- Introduction
 - Distribution networks
 - Exposures
 - Mitigation options
 - Long list
 - Initial filter
 - Ranking
 - Conclusions
 - Next steps
- Introduction
 - Distribution networks
 - Exposures
 - Process followed
 - Mitigation options
 - Net currents
 - Substations
 - Etc
 - Next steps