

Norfolk Vanguard & Norfolk Boreas Offshore Wind Farms

Frequently Asked Questions - updated 16th June, 2017

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1. Who is Vattenfall?

Vattenfall is a Swedish state owned energy company operating in northern Europe. We generate electricity, produce heat and distribute both through local networks. Vattenfall operates four offshore wind farms in UK waters and four onshore schemes, comprising nearly 1GW of installed capacity which feeds into the National Grid. Further information about Vattenfall can be found on our website, www.vattenfall.co.uk

2. What is Vattenfall proposing to do off the coast of Norfolk?

Vattenfall is proposing to develop two new offshore wind farms in the North Sea, off the coast of Norfolk, each having a target capacity of 1.8Giga Watts. The wind farms are called Norfolk Vanguard and Norfolk Boreas. Together the combined wind farms are expected to generate enough clean renewable electricity to meet the equivalent demand of around 2.6 million UK households.

The proposed wind farms of Norfolk Vanguard and Norfolk Boreas have been named after two ships commanded by Lord Nelson during his career. Born in Norfolk in 1758, Lord Nelson went on to become a leading figure in British naval history.

The project websites contains further information about these proposals;

<http://norfolkvanguard.vattenfall.co.uk/>

<http://norfolkboreas.vattenfall.co.uk/>

3. Why two projects?

Together, Norfolk Vanguard and Norfolk Boreas will have a combined installed capacity of 3.6GW. This represents 10% of UK household demand² and is three times greater than the planned power production of Sizewell B.

In our experience, developing adjacent or clustered projects in sequence aids the delivery of low cost renewable energy for the consumer, through:

- Shared infrastructure
- Improved knowledge of constructing and operating in the area
- Phased deployment of innovative, best-in-class technology

4. What is Vattenfall proposing to do onshore?

Vattenfall has accepted National Grid's connection offers for Norfolk Vanguard and Norfolk Boreas based on an onshore connection point at the existing 400kV Necton National Grid Substation.

Vattenfall is committed to using underground cables to bring power from the landfall to the existing grid network; this has the benefit of avoiding the landscape and visual impacts associated with overhead lines.

We are consulting with communities, landowners and other stakeholders on the most appropriate location for all the onshore infrastructure required for both projects; this includes each projects' substation location, cable corridor, cable relay station (only required if AC export cables are used) and landfall.

We will ensure that information relating to the grid connection and onshore works is updated on each the project website when decisions are made. There is a high resolution map available on the consultation pages of the websites;

<http://norfolkvanguard.vattenfall.co.uk/article/consultation-process>

<http://norfolkboreas.vattenfall.co.uk/article/consultation-process>

(and click on 'view larger map')

5. How will the projects work together?

Norfolk Vanguard and Norfolk Boreas will be the subject of separate planning applications. We began to give details of how the two projects will work together during recent drop-in exhibitions. The complete set of information boards from the **Public Drop in Exhibitions, Round 2 on March/April 2017** can be found here:

<http://norfolkvanguard.vattenfall.co.uk/article/documents>

<http://norfolkboreas.vattenfall.co.uk/article/documents>

The majority of the offshore and onshore cable corridor will be shared between both projects. Onshore construction of the projects will be coordinated as far as possible.

The plan is that cable ducts for both projects will be laid in one installation process with cables pulled through the ducts later. This coordinated approach will considerably minimise disruption to local communities.

The projects may share a landfall location, however landfall construction will be undertaken separately for each project.

If AC technology is used, each project will require a separate cable relay station. Co-location of the cable relay stations is possible, however consenting and construction would be undertaken separately.

Each project will require its own onshore substation. Where possible, these will be co-located and works coordinated in order to minimise disruption and impacts.

It is intended that one landscape strategy for both projects would be included in the consent for Norfolk Vanguard to allow planting around the substation and cable relay station (if one is required) to mature as early as possible to provide screening.

National Grid works, including an extension to the existing substation and modification of the overhead lines, will accommodate connections for both Norfolk Vanguard and Norfolk Boreas. It is expected that all National Grid works will be completed for both projects at the same time.

6. What stage are you at?

Norfolk Vanguard and Norfolk Boreas are both Nationally Significant Infrastructure Projects (NSIP) and so an Environmental Impact Assessment (EIA) is required as part of the Development Consent Order (DCO) application under the Planning Act 2008.

In October 2016, we submitted a request for an EIA Scoping Opinion on the Norfolk Vanguard project to the Planning Inspectorate.

You can view the Norfolk Vanguard related Planning Inspectorate material here:

<http://norfolkvanguard.vattenfall.co.uk/article/planning-process>

The Norfolk Boreas EIA Scoping Report was submitted to the Planning Inspectorate in May 2017. The Planning Inspectorate undertakes a formal process to consult with stakeholders on the proposed scope of the EIA. Once complete, the Planning Inspectorate will publish a formal response to Vattenfall (expected to be end of June 2017). This response will inform the scope of the EIA and subsequent Environmental Statement (ES). Vattenfall will produce a Non-Technical Summary (NTS) setting out the scope of the EIA. This will be published on the project website.

Over several weeks the projects' multidisciplinary teams have been reviewing feedback from our participatory drop-in exhibitions (just short of 800 people attended drop-ins in October, and around 830 people attended the March / April drop-ins), ongoing expert stakeholder discussions and discussions with landowners, as well as information from surveys and environmental assessments. This work continually feeds into refining the project design. In mid-June 2017, in keeping with our open and transparent approach to communication and responding to community requests to be updated as soon as project decisions are made, we publicised revisions to the project design. This was done via our third Newsletter which is sent to more than 35,000 homes within the original Norfolk Vanguard search area, letters to and meetings with key stakeholders, and website updates. The refined project proposals show one landfall zone to the south of Happisburgh village, two cable relay station zones, the underground cable corridor and a refined project substation zone located to the east of the existing National Grid and Dudgeon substations.

The results from the early environmental assessment work and an update on the locations of proposed onshore infrastructure will be made public as part of formal consultation on the Preliminary Environmental Information Report (PEIR) in October / November 2017. The next round of Drop-in Exhibitions with members of the local community will also take place around this time. Again the responses we receive in relation to that consultation will feed into the project design and our submission of a Development Consent Order (DCO) application for Norfolk Vanguard in Summer 2018. The DCO application for Norfolk Boreas is expected to be in 2019.

We anticipate a decision will be made by the Secretary of State on our Norfolk Vanguard application in 2019, and for Norfolk Boreas the following year.

More information about the programme can be viewed in the material presented at the last drop-in events.

There will be project updates between the significant milestones outlined above.

7. How will local communities, landowners, businesses and interest groups be consulted about the wind farm and electricity transmission network proposals?

We will maintain a dialogue with communities throughout the development, construction and operation phases of our projects. Vattenfall is committed to early, effective and engaging communication with the local communities where we operate. Due to the size of these projects, they are classed as Nationally Significant Infrastructure Projects (NSIP). NSIPs include the kinds of large scale facilities that support the everyday life of the country, such as major transport routes, major gas pipelines, water reservoirs and sewage treatment plants, power stations, power lines and wind farms. They require development consent under formal and strict procedures outlined in The Planning Act 2008 and need to demonstrate extensive consultation with local communities and statutory organisations prior to submitting an application and how information received from consultees has fed into the project design.

To date, we have met local people at a series of drop-in events conducted in October 2016 and March / April 2017.

We visited seven locations in the autumn of 2016, and welcomed nearly 800 people to our participative exhibitions.

Reports relating to the feedback we received during the October 2016 drop-ins can be found here: <http://norfolkvanguard.vattenfall.co.uk/article/documents>

In the Spring of 2017 we went to nine locations across Norfolk and were joined by 830 people overall. We are very happy with the level of interest shown in learning more about the projects and in contributing to the shaping of the proposals.

Reports relating to the feedback we received during the March-April 2017 drop-ins can be found here: <http://norfolkvanguard.vattenfall.co.uk/article/documents>

8. Why do you consult communities so early in the process, if there are no definite plans relating to the location of onshore infrastructure?

The Planning Act 2008 describes clearly our duty, as developers of Nationally Significant Infrastructure Project (NSIP), to consult with a range of interested parties.

See also questions 6 and 7.

Currently we are engaged in “informal pre-application consultation” with a wide range of stakeholders and with members of the local community – you can find out more about the process here:

<https://infrastructure.planninginspectorate.gov.uk/application-process/the-process/>

Sharing the steps we follow during our decision-making process to refine project proposals provides opportunities for local and national stakeholders, experts, people who are potentially impacted by the project, and people with an interest to influence our thinking, appropriately and in a timely manner. This consultation also encourages innovation and enables us to work with local people to be creative and make the most robust, sustainable and best decisions we can.

The downside is that some people will be concerned by uncertainty around whether or how they might be impacted by the proposals as they develop. We do not wish to prolong uncertainty, and can empathise with people’s concerns. However we must review and assess all the information and ideas, concerns and opportunities presented to us, and respond to them.

Before the latest revision of project proposals (June 2017), we were considering::

- Three possible landfall zones. The two, in the northern area are constrained in terms of space. Each offered space for one project deploying Alternating Current (AC) technology or two projects deploying Direct Current (DC) technology to transmit power to the National Grid.
- Seven possible cable relay station zones. Cable relay stations – one for each project – are only required should we decide that the best technology overall to deploy is AC transmission of power. There is a general preference for co-location of cable relay stations because it avoids dispersal of infrastructure over a wider area, and therefore avoids more environmental and social impacts. There may also be technical and financial arguments for this approach. If compelling reasons against co-location emerge, these will be given equal consideration.
- A zone near the existing 400KV National Grid substation, near Necton, that we were assessing for the best location to site the projects’ substations. As with the cable relay station, we are seeking to co-locate both project substations in order to avoid dispersal of infrastructure over a wider area, and reduce environmental and social impacts.

Along with the 200m-wide underground cable corridor, these were the elements of onshore infrastructure presented for consultation at the March-April 2017 drop-in events.

The June 2017 revision, taking into account recent community feedback, stakeholder and landowner input and information from technical and environmental assessments, has identified the landfall zone south of Happisburgh as our preferred landfall. Two of the seven cable relay station zones have been maintained for further assessment, and the project substation zone has been revised – it is now smaller and occupies an area to the east of the existing NG and Dudgeon

substations. These revisions have been communicated widely, via a project Newsletter, letters and our website.

We will continue to communicate locally and on our website..

9. Will AC or DC technology be used and why has this technology been selected?

A decision on the use of AC or DC technology will not be taken until after consent has been achieved as part of the detailed design and Final Investment Decision of the project. The inclusion of both transmission technology options through consent submission is required to meet full technical and economic flexibility to deliver against government targets for offshore wind cost reduction and to ensure the projects can deploy the most appropriate and advanced technology available closer to the time when construction would begin. Maintaining flexibility during the early stages of project development allows us to future-proof the projects. Whilst both technology options are being considered, only one transmission option will be developed during the final design.

10. What are the factors that influence Vattenfall's decision on whether to opt for power transmission using AC or DC?

The decision whether to adopt high-voltage direct current (HVDC) or the more common high voltage alternating current (HVAC) technology to transmit power from the wind farm site to the National Grid is a complex one, influenced by a number of variables, not least the technological and supply chain development that is possible between now and when we envisage beginning procurement and project construction in the early 2020s.

For long-distance transmission, HVDC systems can be beneficial as they cause lower electrical power losses than HVAC systems. Also the number of cables required to transmit the same electrical power are fewer and hence lower environmental impact and cost with regard to cable installation. However, the lower power losses in the cables are offset by power losses associated with the necessary conversion from HVAC to HVDC offshore and from HVDC to HVAC at the National Grid connection. HVDC systems are in their infancy - no offshore HVDC converters are operational in the UK yet and few have been deployed around the world - so the supply chain and knowledge of the technology is more limited than for HVAC.

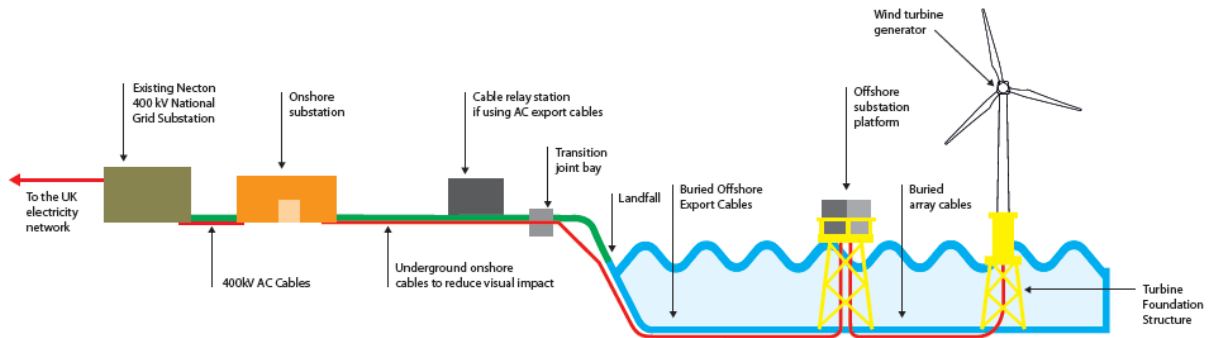
In comparison, HVAC is the standard technology utilised around the world for electrical power transmission and therefore the knowledge and supply chain, including in the UK, is better established and more competitive. This can deliver cost savings and the benefits of maturity. Although more cables are required to transmit the same power as HVDC, this does have an up-side, allowing a more resilient transmission connection should a cable failure occur, minimising the lost renewable energy to the National Grid whilst repairs are made, which can be a substantial time in the offshore environment.

All of these aspects are carefully being considered and investigated to understand the most efficient transmission technology solution. The complexity of the decision and the potential advances which could occur prior to construction are why we need to maintain flexibility over the transmission solution until post consent.

For the Norfolk Vanguard and Boreas projects, an HVAC transmission system requires a single cable relay station (for each project) near the midpoint of the distance between the project and its connection to the National Grid. This station compensates for 'charging currents' generated by the underground HVAC cables and improves the HVAC system's efficiency. The HVAC system also requires an HVAC substation located at the existing National Grid 400 kV substation near Necton. Although the amount of land required for this substation would be very similar to

that for the HVDC converter station, the buildings and equipment would be less bulky, and easier to screen with suitable siting and planting.

Regardless which option is selected Vattenfall has committed to putting all the onshore cables underground, rather than the alternative of deploying overhead cables and pylons. By deciding to underground cables, Vattenfall has taken an important decision - at our cost - determined by our desire to minimise the visual and environmental impact in the region.



11. I own land in one of the search areas, when will you speak to me?

If you need to speak to someone about land-related issues, Consents Solutions, land agents based in Norfolk, have been engaged to liaise with all landowners and occupiers to discuss route alignments, survey access, land use and landowner concerns and ultimately agree consents for all land-based infrastructure once a preferred route is selected. The primary contact will be Bob McCarthy (bobmccarthy@consentssolutions.com, 07787 783517) Ardent Management will complete a process of Land Referencing to identify all landowners and occupiers. Initial contact will be via letter with an accompanying form, it is important that landowners and occupiers provide details of all known interested parties to ensure they continue to be engaged and consulted throughout the project.

12. If my land is affected what will be required?

At the landfall site on the coast, we will require an area for jointing sub-marine cables from the offshore generators to land cables. If we use AC export cables, a cable relay station will be required close to the landfall. A Norfolk Vanguard and a second Norfolk Boreas substation, close to the existing 400kV Necton National Grid Substation will also be required. Cable easements from the coast to this substation will be needed for the underground cables.

13. Will these projects have an adverse impact on the local environment (on and offshore)?

With appropriate siting and continued consultation with relevant stakeholders, the development of offshore wind farms should have minimal impact on the local area. Any wind farm that receives consent will have gone through a rigorous planning procedure and in-depth consultation with interested bodies regarding potential impacts. Vattenfall is undertaking a number of environmental surveys. Offshore, these include bird and marine mammal surveys and surveys of the animals on the seabed. Onshore, we are collecting data on plants and animals as well as carrying out surveys to understand existing levels of traffic and noise in the area. We are using these data to undertake environmental impact assessments to fully understand the effects of our project and any mitigation required. The findings of these surveys will be presented in the Preliminary Environmental Impact Report (PEIR), which will be published in October / November 2017.

Vattenfall participates in and supports a number of independent scientific studies, led by academics in the UK and across Europe to look at any potential impact of wind developments on wildlife and habitats. Some information relating to Marine Mammals is available here:

<http://norfolkvanguard.vattenfall.co.uk/article/documents>

See the Marine Mammal information sheet.

Very recent information (published on 1st May 2017) on abundance estimates of harbour porpoise, white-beaked dolphin and minke whale in the North Sea indicate no change over the 22 years covered by the surveys with marine mammal populations apparently not adversely affected by the large scale offshore wind developments over the last ten years <https://synergy.st-andrews.ac.uk/scans3/2017/05/01/first-results-are-in/>

14. How will these schemes benefit the Norfolk economy?

The industry trade body, RenewableUK, says that more than 70,000 jobs will be created in the UK renewables industry within the next decade. Projects such as Norfolk Vanguard will contribute to the growth of an economically important industry. We will be able to provide some details about specific local benefits for Norfolk after completing our assessment of the impact of the wind farm on the local economy. We are convinced, based on our experience elsewhere, that Norfolk can expect significant benefit from this scheme.

Local businesses can register their interest in the scheme here;

<http://norfolkvanguard.vattenfall.co.uk/article/contact-us> (please complete the form under the media contact information)

15. What types of benefits and opportunities will there be associated with these projects for communities?

As a leading energy company, Vattenfall is guided by principles of sustainable development. This means we actively seek opportunities for our investments to create wider benefits and particularly to deliver solutions for people living in the areas we operate. Norfolk is a unique place with its own identity and priorities. We'd like the local experts, people who live, work and play here, to tell us what is important for Norfolk's future – its environment, people and economy. We are excited to begin a conversation with local people and stakeholders, which over the next months and years gives us a chance to explore together opportunities for bringing meaningful, lasting benefit to the local area.

Already some ideas are coming in, many associated with providing educational, skills and training opportunities for young people. While we are only at the development phase of both projects and cannot commit to making major capital investments in Norfolk until project permission is granted for Norfolk Vanguard and Norfolk Boreas, already we are providing opportunities for young

people and local businesses. We are collaborating with local skills organisations, schools and sixth form colleges to provide a flavour of the work that is entailed in developing major infrastructure projects. We are awarding local contracts where possible, for example Norfolk Wildlife Services have been contracted to undertake onshore ecological surveying.

16. The site has some fishing interests, as well as major shipping and ferry routes passing through or near to it. Will the wind farm force them to be moved?

In line with standard offshore practice, we are working on the presumption that vessels not involved in wind farm-related activities should remain 500m away from each turbine/work site during construction and commissioning. Once the cables are installed and any exclusion areas around hazards are removed, it is expected that fishing can continue within the area of the wind farm. With regard to shipping, the site has been selected to avoid potential conflicts with major shipping routes. We are undertaking extensive consultation with shipping organisations as part of the development of these projects. Any mitigation required will be discussed in detail with the relevant statutory authorities and other stakeholders during the development process.

17. Another offshore wind developer is planning to run underground cables through Norfolk too. How will you ensure that the cumulative impacts associated with these projects are minimised?

Vattenfall are progressing Norfolk Vanguard and Norfolk Boreas, in such a way as to ensure the projects are fully coherent and aligned to minimise impacts and maximise opportunities. DONG Energy is progressing Hornsea Project Three. Hornsea Project Three is a project with its own technical and environmental characteristics and constraints, and is subject to a completely separate Development Consent Order Process. Although both projects are in Norfolk, Hornsea Project Three will make landfall near Cromer, many kilometres away from where the Norfolk Vanguard and Norfolk Boreas cables will come ashore (currently zones between Bacton and south of Happisburgh are being considered) and will connect to National Grid at Norwich Main. Vattenfall and DONG teams are collaborating where there are opportunities to do so, particularly in relation to where underground cables are likely to cross, to ensure we progress the projects appropriately and sensitively.

18. What is the plan for the roads and if they are closed - how long will they stay closed for?

It will be necessary to have road closures and traffic management for periods of time in order to complete the works. Efforts will be made to avoid or minimise traffic disruption. Trenched crossing of a single-track road will require temporary road closure for a week or so. Crossing a larger road would be achieved using temporary traffic lights, trenching one lane at a time; duration is likely to be about 2 weeks. Road closures in a given locality will be sequenced so that alternative routes are available for motorists and other road users.

19. Will landfall engineering cause further instability to a changing coastline?

The Norfolk coastline is subject to natural processes and is changing, as is the case in many other dynamic coastal environments across the UK. This is not a new phenomenon. Local Authorities working with the Environment Agency in England are charged with creating, maintaining and executing coastline management plans. Vattenfall is engaging with relevant organisations regarding coastal issues.

We have also commissioned a study to investigate the impact of coastal processes on the area where we seek to bring transmission cables ashore. The purpose is to ensure that any activities we undertake do not have any negative impact on coastal realignment, and also to ensure that over the medium and long term, natural processes do not impact on our project. Planned site investigations providing detailed geological and geotechnical information will enable us to ensure that any works we undertake will not exacerbate coastal realignment processes.

20. Will electromagnetic fields (EMF) be emitted by Norfolk Vanguard and Norfolk Boreas' underground cables, cable relay stations and substations? Will the EMF impact on human and animal health?

Electromagnetic fields (EMF) are a part of the natural world: the earth has a natural static magnetic field and static electric fields are generated in the atmosphere. Electric and magnetic fields are also generated wherever electricity is transmitted or used. These occur when utilising household appliances, from electricity sent through wiring, and from sources in the built environment such as power lines and electrified railways.

Very extensive scientific research has been carried out to investigate potential for health risks from EMF¹. National² and international³ health protection bodies have developed guidelines for public EMF exposure that are set to protect health.

The underground cables, cable relay stations (if required) and substations associated with the Norfolk Vanguard and Norfolk Boreas Offshore Wind Farm grid connection will comply with the recommended government EMF guidelines set to protect public health. These guidelines are set out in a Code of Practice⁴, that was developed by the UK Government. The Code of Practice will be adhered to, to ensure that the maximum magnetic field strengths that could be generated by the proposed design are well below the guideline exposure limits, Vattenfall will provide evidence of this compliance in the projects' DCO applications.

EMF from electricity transmission has not been shown to adversely affect livestock or onshore wildlife. Some animals can sense EMF, particularly marine species such as elasmobranch fish (sharks and rays) and also some migratory birds. The potential effects of EMF on sensitive species (with mitigation if required) will be considered in the Environmental Impact Assessment where relevant.

¹ SCENIHR, "Potential health effects of exposure to electromagnetic fields (EMF)," European Commission, Luxembourg, 2015.

WHO, "Environmental Health Criteria 238. Extremely Low Frequency Fields.," WHO, 2007.

A. McKinlay, S. Allen, R. Cox, P. Dimbylow, S. Mann, C. Muirhead, R. Saunders, Z. Sienkiewicz, J. Stather and P. Wainwright, "Review of the scientific evidence for limiting exposure to electromagnetic fields (0-300 Ghz)," *Documents of the NRPB*, vol. 15, no. 3, 2004.

IARC, "IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 80 Non-ionising Radiation, Part 1: Static and Extremely Low-Frequency (ELF)," IARC Press, 2002.

² A. McKinlay, S. Allen, R. Cox, P. Dimbylow, S. Mann, C. Muirhead, R. Saunders, Z. Sienkiewicz, J. Stather and P. Wainwright, "Advice on limiting exposure to electromagnetic fields (0-300 Ghz)," *Documents of the NRPB*, vol. 15, no. 3, 2004.

Department of Health; Department for Communities and Local Government; Department of Energy and Climate Change, "Government response to the SAGE recommendations," Department of Health, 2009.

³ ICNIRP, "Guidelines for Limiting Exposures to Time-Varying Electric, Magnetic and Electromagnetic Fields (Up to 300 GHz)," *Health Physics*, vol. 74, no. 4, pp. 494-522, 1998.

ICNIRP, "Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz to 100 kHz)," *Health Physics*, vol. 99, no. 6, pp. 818-836, 2010.

European Council, "Council recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz)," OJEU L199/59, 1999/519/EC, 1999.

⁴ DECC, "Power Lines: Demonstrating compliance with EMF public exposure guidelines. A voluntary Code of Practice," Department of Energy and Climate Change, 2012.

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/37447/1256-code-practice-emf-public-exp-guidelines.pdf