

| Issue | EHS Guideline | POWERGRID SOP* | Responsible Party |
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| Terrestrial Habitat Alteration | Avoid critical habitat through use of existing utility and transport corridors for transmission and existing roads and tracks for access roads, whenever possible | <p>Minimize adverse impacts on natural environment by consciously economizing on the requirement of land for civil structures, reduction the width of the RoW, etc.</p> <p>Avoid operations in environmentally sensitive areas such as forests, wildlife reserves and biosphere reserves (ESPP 1.0)</p> <p>During route alignment all possible efforts are made to avoid the forest areas (including national park or sanctuary or to keep it to the barest minimum). Since 1998, used of forest has been reduced from approximately 6 % to 2% of RoW to 4.25% of total RoW used to date (as of March 2005) ESPP Box 4.1)</p> <p>Whenever it becomes unavoidable due to the geography of terrain or heavy cost involved, different alternative options are considered to minimize the requirement of forest area. Modern tools like GIS/GPS are used for finalization of route</p> <p>Manual stringing is used in thick forests and on slopes whenever possible. (ESPP Box 4.1)</p> <p>If the Forest is rich in wildlife, the Chief Wildlife Forest Warden also gets a detailed assessment report prepared including measures to protect the wildlife which is submitted with the application for Forest Clearance (ESPP 2.1.2)</p> <p>Wherever possible, POWERGRID uses existing paths and access roads for the movement of man and machinery. Existing roads that cannot support heavy machinery are upgraded. (ESPP 4.1.1.)</p> | POWERGRID, MoEF (Forest Department, Chief Wildlife Warden) |
| | Install transmission lines above existing vegetation to avoid land clearing | POWERGRID designs special 80 – 140 meter high towers for reducing impacts on trees, orchards, wildlife and crossing of wetlands and riverbeds. (ESPP Box 4.1) | POWERGRID |
| | Avoid construction activities during the breeding season and other sensitive seasons or times of day | Construction activities are monitored by the forest officials and all such precautions are taken by them to advise PGCIL on such activities. | <i>Forest Dep't. & POWERGRID</i> |
| | Re-vegetate disturbed areas with native plant species | Natural regeneration is allowed to specific heights and whenever required tree plantation is taken (with native species) (ESPP 2.1.2) | POWERGRID, Forest Department. |
| | Avoid clearing in riparian areas | POWERGRID designs special 80 – 140 meter high towers for reducing impacts on ... wetlands and riverbeds. (ESPP Box 4.1) | POWERGRID |
| ROW maintenance | Implement integrated vegetation management through selective removal of tall-growing tree species and encouragement of low growing grasses and shrubs | The Forest Department is requested to undertake felling, pollarding and pruning of trees for electrical clearance, whenever necessary, under the advice of POWERGRID (ESPP 2.1.2) | POWERGRID, Forest Department |
| | Remove invasive plant species during routine maintenance | POWERGRID recognizes that lopping and felling of trees can open up forest canopy allowing more sunlight into the under storey where it can lead to an edge effect and allow for the proliferation of socio-phytic weeds with possible added repercussions within a semi-evergreen or evergreen biotype (as found in Northeast India and the Western Ghats) | POWERGRID / Forest Department |

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| | according to the risk | Maintaining ROW including pruning is normally in line. Apart from this sophisticated relays installed at S/s break the circuit within milliseconds. Therefore, a chance of fire is very remote. So far No forest fire has taken place in POWERGRID history. | POWERGRID |
| | Remove blowdown and other high hazard fuel accumulations | No such materials are stored in forest area nor is it permitted. | POWERGRID/ Forest dep't. |
| | Time thinning, slashing and other maintenance activities to avoid forest fire seasons | The Forest Department is requested to undertake felling, pollarding and pruning of trees for electrical clearance, whenever necessary, under the advice of POWERGRID (ESPP 2.1.2) | Forest Department / POWERGRID |
| | Disposal of maintenance slash by truck or controlled burning | Through disposal at selected area or complete removal area from forest as per advice of Forest Dept. | Forest Department/ POWERGRID |
| | Planting and managing fire resistant species within and adjacent to RoW | Part of forest management-either by planting fire resistant species or creating fire line depending upon the situation. | Forest Department. |
| | Establishing network of fuel breaks of less flammable materials or cleared land to slow progress of fires and allow fire-fighting access | One strip is left clear of vegetation to allow for maintenance of the transmission line (ESPP 2.1.2) | POWERGRID, Forest Department |
| Prevention of Avian and Bat Collisions and Electrocutions | Aligning transmission corridors to avoid critical habitats (e.g. nesting grounds, heronries, rookeries, bat foraging corridors, and migration corridors) | If the Forest is rich in wildlife, the Chief Wildlife Warden also gets a detailed assessment report prepared including measures to protect the wildlife which is submitted with the application for Forest Clearance (ESPP 2.1.2) | POWERGRID (in IEAR?) Chief Wildlife Warden, Forest Department |
| | Maintaining 1.5 meter (60-inch) spacing between energized components and grounded hardware or, where spacing is not feasible, covering energized parts and hardware | RoW width depends on line voltage. A maximum width of RoW for transmission lines on forest land and minimum clearances between conductors and trees is adhered to in route selection as specified in IS 5613 and by MoEF Guidelines At present, a width clearance of 3 meters is allowed below each conductor for the movement of tension stringing equipment. A proposal to increase the width area for 400 KV and above lines, based on the type of conductor used is under consideration with MoEF. (ESPP2.1.2) | POWERGRID, MoEF |
| | Retrofitting existing transmission or distribution systems by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents (e.g. insulated "V's"), changing the location of conductors, and / or using raptor hoods | No such incident reported from EHV lines so far nor it is required as the spacing of conductors are more than 8 to 10 meter for 400kV transmission line | POWERGRID |
| | Considering the installation of underground transmission and distribution lines in sensitive areas (e.g. critical natural habitats); | Possibility explored. May be possible in distribution System/ line but not feasible in EHV line due to exorbitant initial cost and in maintenance also. | POWERGRID |
| | Installing visibility enhancement objects such as marker balls, bird deterrents, or diverters. | These are standard accessories and installed every where. | POWERGRID |
| Aquatic Habitat Alteration | Site power transmission towers and substations to avoid critical aquatic habitat (e.g. watercourses, wetlands, and riparian areas), as well as fish spawning habitat, and critical fish over-wintering habitat | All such areas are completely avoided for S/s setting and for Transmission line also as far as possible. | POWERGRID |
| | Maintaining fish access when road | N/A | POWERGRID |

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| Electric and Magnetic Fields | <p>Evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure.</p> | <p>A study carried out by the Central Power Research Institute on POWERGRID lines reveals that the EMF about one meter above ground near a 400 kV single circuit transmission line range from 3-7.2uT in the RoW.</p> <p>Based on a review of POWERGRID designs by Power Technologies, Inc., It was found that the phase and circuit to circuit clearances are consistent with practices used in line clearances throughout the world. The values used by POWERGRID are in the middle range of those used throughout the world and are expected to provide satisfactory performance. In particular, the conductor to ground clearances meet or exceed the requirements of the National Electrical Safety Code, American National Standard Institute, C2. (ESPP 2.4.1 and Appendix XIII)</p> | POWERGRID |
| | <p>Considering siting new facilities so as to avoid or minimize exposure to the public. Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices), should be avoided;</p> | <p>For selection of the optimum route the following criteria are taken into consideration: The route does not involve any human habitation and does not affect any public utility services such as playgrounds, schools or other establishments. Alignments are generally sited 10-15 km away from major towns, whenever possible, the account for future urban expansion (ESPP 2.1.2)</p> | POWERGRID, State Forest Department and Department of Revenue |
| | <p>If EMF levels are confirmed or expected to be above the recommended exposure limits, application of engineering techniques should be considered to reduce the EMF produced by power lines, substations, or transformers. Examples of these techniques include:</p> <ul style="list-style-type: none"> o Shielding with specific metal alloys²⁰ o Burying transmission lines o Increasing height of transmission towers o Modifications to size, spacing, and configuration of conductors | <p>All designs of TL are certified within the permissible limit and possible review of design and its modification if necessary is undertaken by Engg. dep't. and type tested etc.</p> | |
| Hazardous Materials | <p>Replacing existing transformers and other electrical equipment containing PCB, and ensuring appropriate storage, decontamination, and disposal of contaminated units</p> | <p>As part a routine maintenance, transformer oil is changed every 10-15 years. The used transformer oil is categorized as hazardous waste as per Hazardous Waste (Management and Handling) Rules Used mineral oil generated at substations meets the requirements of Schedule 5 of the Rules. POWERGRID seeks authorization for disposal of hazardous waste from concern State Pollution Control Boards as and when required. The oil can be auctioned to authorized/registered re-refiners and information to the respective SPCB is submitted. (ESPP 2.1.3)</p> | POWERGRID, State Pollution Control Board |
| | <p>Prior to final disposal, retired transformers and equipment containing PCB should be stored on a concrete pad with curbs sufficient to contain the liquid contents of these</p> | <p>All such precautions are taken as per requirement. Generally the used oil is collected from transformer directly to tanker container and taken away and storage is mostly avoided due to sheer volume.</p> | POWERGRID |

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| | capable of safely transporting and disposing of hazardous waste containing PCB | | |
| | Surrounding soil exposed to PCB leakage from equipment should be assessed, and appropriate removal and / or remediation measures should be implemented | All transformers are having oil trap (concrete) or oil sump pit and possibility of ground contamination is negligible. | POWERGRID |
| Pesticides (includes herbicides and insecticides) | <p>Alternatives to Pesticide Application</p> <p>- The following alternatives to pesticides should be considered:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Provide those responsible for deciding on pesticides application with training in pest identification, weed identification, and field scouting; <input type="checkbox"/> Use mechanical weed control and / or thermal weeding; <input type="checkbox"/> Support and use beneficial organisms, such as insects, birds, mites, and microbial agents, to perform biological control of pests | No herbicides/ Pesticide/ insecticides are being used. Only manual removable is followed | POWERGRID |
| Occupational hazards from contact with live power lines during construction, maintenance, and operation activities | Only allowing trained and certified workers to install, maintain, or repair electrical equipment | <p>Check that only erection team members are allowed to stand near the tower while erection is in process and should wear safety helmet/shoes (ESPP Appendix XII, B-14)</p> <p>Ensure that supervisor and workmen engaged in the field are aware of first aid techniques (such as in case of electric shock) (ESPP- Appendix XII- General Points, A-11)</p> <p>At substations, ensure that laying of temporary cables used during construction do not cause an danger of electrocution of persons/animals' Check that no live wires are nearby (ESPP- Appendix XII, Safety Related Check List during Construction of Sub-stations- A-8, B-17)</p> | POWERGRID, Contractors |
| | Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines | Check that capacitor unit is short circuited and earthed until erection and commissioning works are completed (ESPP- Appendix XII, Safety Related Check List during Construction of Sub-stations B-38) | POWERGRID, Contractors |
| | <p>Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards. Qualified or trained employees working on transmission or distribution systems should be able to achieve the following33:</p> <ul style="list-style-type: none"> o Distinguish live parts from other parts of the electrical system o Determine the voltage of live parts o Understand the minimum approach distances outlined for specific live line voltages o Ensure proper use of special safety equipment and procedures when | All such norms are part of Standard practices and POWERGRID has developed a detailed safety manual for such activities and is being followed at each site. Dedicated safety dept. and trained personnel are deployed to supervise the compliance. | POWERGRID, Contractors |

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| | <p>even if properly trained unless:</p> <ul style="list-style-type: none"> o The worker is properly insulated from the energized part with gloves or other approved insulation; or, o The energized part is properly insulated from the worker and any other conductive object; or, o The worker is properly isolated and insulated from any other conductive object (live-line work) | | |
| | Where maintenance and operation is required within minimum setback distances, specific training, safety measures, personal safety devices, and other precautions should be defined in a health and safety plan. | -do- | POWERGRID, Contractors |
| | Workers not directly associated with power transmission and distribution activities who are operating around power lines or power substations should adhere to local legislation, standards, and guidelines relating to minimum approach distances for excavations, tools, vehicles, pruning, and other activities | Check that only erection team members are allowed to stand near the tower while erection is in process and should wear safety helmet/shoes (ESPP Appendix XII, B-14) | POWERGRID, Contractors |
| | Minimum hot stick distances may only be reduced provided that the distance remaining is greater than the distance between the energized part and a grounded surface | Being followed. | POWERGRID, Contractors |
| Occupational hazards when working at elevation during construction, maintenance, and operation activities | Testing structures for integrity prior to undertaking work | <p>Jacks and vertical supports shall be positioned such that vertical loads are distributed equally and do not exceed the capacity of jacks.</p> <p>Proper jacking arrangement is made to take the entire load of template (ESPP Appendix II, A, II.8-, 9)</p> <p>Ensure derrick, pulleys, ropes, hooks, guys and lifting tools and tackles (i.e., winch machine, chain pulley block, Trifor, D-shackle) have been checked for adequate strength/size (per copy of test certificate) before tower erection (ESPP Appendix II, B.3-6. 16-18)</p> | POWERGRID, Contractors |
| | Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers, among others | <p>Ensure that proper scaffolding arrangements are made during stringing of conductor (ESPP Appendix XII, C-6)</p> <p>Portable ladders shall not be more than 9 meters in length (ESPP, Appendix II, E-32)</p> | POWERGRID, Contractors |
| | Establishment of criteria for use of 100 percent fall protection (typically when working over 2 meters above the working surface, but sometimes extended to 7 meters, depending on the activity). The fall protection system should be appropriate for the tower structure and necessary movements, including ascent, descent, and moving from point to | All standard precautions like safety belt, helmet, mechanical ladders etc. are used for safety of such persons. | POWERGRID, Contractors |

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| | positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached. | conductors etc. are used. | Contractors |
| | Hoisting equipment should be properly rated and maintained and hoist operators properly trained; | Yes. | POWERGRID, Contractors |
| | Safety belts should be of not less than 16 millimeters (mm) (5/8 inch) two-in-one nylon or material of equivalent strength. Rope safety belts should be replaced before signs of aging or fraying of fibers become evident | Safety belt conforming to EN361, EN362, BSEN355 & EN-358 specification and tested as per EN364-1992 specification are being used in POWERGRID | POWERGRID, Contractors |
| | When operating power tools at height, workers should use a second (backup) safety strap | Yes. -do- | |
| | Signs and other obstructions should be removed from poles or structures prior to undertaking work | Yes -do- | POWERGRID, Contractors |
| | An approved tool bag should be used for raising or lowering tools or materials to workers on structures. | Yes. -do- | POWERGRID, Contractors |
| Occupational EMF exposure | Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities; | First they are tested during type test and periodic review of maintaining desired clearance and ground clearance are designed and maintained to completely avoid such incidents. | POWERGRID, Contractors |
| | Training of workers in the identification of occupational EMF levels and hazards | Yes, part of safety drill/ training | POWERGRID, Contractors |
| | Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers | Taken care of in design process. | POWERGRID, Contractors |
| | Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE). | All design parameters have been certified by PTI, USA and field testing has also been carried out by CPRI, Hyderabad. Exposure level is well with in the prescribed international limits. | POWERGRID, Contractors |
| | Personal exposure monitoring equipment should be set to warn of exposure levels that are below occupational exposure reference levels (e.g. 50 percent). Action plans to address occupational exposure may include limiting exposure time through work rotation, increasing the | No such incident reported so far. | POWERGRID, Contractors |

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| | surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment | (ESPP, Appendix XII, C24) Check that anti-climbing devices and danger plates are provided in the tower after erection, working area of tower has been demarcated during erection (ESPP, Annex XII, B.12, 13) | |
| | Grounding conducting objects (e.g. fences or other metallic structures) installed near power lines, to prevent shock. | Obviously Yes as it is part of our project. | POWERGRID, Contractors |
| Electromagnetic Interference | Conductor bundles are created to ensure radio reception at the outside limits remains normal | Yes. -do- | POWERGRID, Contractors |
| Visual Amenity | Extensive public consultation during the planning of power line and power line right-of-way locations | Public consultation is an integral part of the process throughout the planning and execution of a project (ESPP 2.6 and Appendix XVIII) | POWERGRID Local authorities (specify) |
| | Accurate assessment of changes in property values due to power line proximity | These assessments are not done by POWERGRID but yes. | POWERGRID, Contractors |
| | Siting power lines, and designing substations, with due consideration to landscape views and important environmental and community features | Yes, part of detailed social assessment and RAP. | POWERGRID, Contractors |
| | Location of high-voltage transmission and distribution lines in less populated areas, where possible | All possible precautions are taken to avoid such area during route alignment and substation land identification process. | POWERGRID, Contractors |
| | Burying transmission or distribution lines when power must be transported through dense residential or commercial areas. | Use of tall tower or even pole tower has been practiced to minimize impact as and when required. | |
| Noise and Ozone | Locate rights-of-way away from human receptors, to the extent possible | Yes, part of route alignment process | POWERGRID, Contractors |
| | Use of noise barriers or noise canceling acoustic devices should be considered as necessary | Yes, acoustic device are installed and sound absorbing trees are planted in all of our installations to reduce the noise level further. | POWERGRID, Contractors |
| Aircraft Navigation Safety | Avoiding the siting of transmission lines and towers close to airports and outside of known flight path envelopes; | Yes | POWERGRID, Contractors |
| | Consultation with regulatory air traffic authorities prior to Installation | Ensure that permission has been obtain from Aviation Authority for erection of towers in the vicinity of flying zone and for erection of special towers, where necessary (ESPP, Appendix XII, Safety Check List during Construction of Transmission Lines) | POWERGRID, Aviation Authority |
| Environmental Monitoring | Environmental monitoring programs for this sector should be implemented to address all activities that have been identified to have potentially significant impacts on the environment during normal operations and upset conditions. | POWERGRID has a dedicated Corporate Monitoring Group to monitor entire project activities reporting to the Director (Projects). Regular monitoring of activities is carried out by at regional HQ and site on a monthly basis and by CMG on a quarterly basis. These unites oversee all environmental, social, health and safety aspects of projects. (ESPP 6.5) The Operation Service Department and has framed a guidelines/checklist for workers' safety. (ESPP 2.4) | POWERGRID, Independent Committee of Experts |
| | Environmental monitoring activities should be based on direct or indirect indicators of emissions, effluents, and | Agree but for transmission line project its applicability is almost negligible as there is no disposal of such materials in TL project. | POWERGRID, Contractors |

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| | monitored. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. | Ensure that supervisory staff from POWERGRID is available at site during construction (ESPP XII-General Points A-6) | POWERGRID |
| | Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken | Yes, part of review criteria. | POWERGRID, Contractors |
| Accident and Fatality Rates | Projects should try to reduce the number of accidents among project workers (whether directly employed or subcontracted) to a rate of zero, especially accidents that could result in lost work time, different levels of disability, or even fatalities. | Yes, POWERGRID takes all possible measures to avoid or to reduce such accidents. Under process & development. | POWERGRID, Contractors |
| | Facility rates may be benchmarked against the performance of facilities in this sector in developed countries through consultation with published sources (e.g. US Bureau of Labor Statistics and UK Health and Safety Executive) | Will be done | POWERGRID, Contractors |

*Standard Operating Procedure per ESPP 2005

Source: World Bank and POWERGRID