

**FORM – 1A**  
**Application for Environmental Clearance for**  
**India-based Neutrino Observatory project**

**By**

**Tata Institute of Fundamental Research**  
**Mumbai 400005**

## FORM - 1 A

### 1. LAND ENVIRONMENT

- 1.1 Will the existing land use get significantly altered from the project that is not consistent with the surroundings? (Proposed land use must conform to the approved Master Plan / Development Plan of the area. Change of land use if any and the statutory approval from the competent authority are submitted). Attach Maps of (i) site location, (ii) surrounding features of the proposed site (within 500 meters) and (iii) the site (indicating levels & contours) to appropriate scales. If not available, attach only conceptual plans.

*No. The INO caverns and surrounding tunnels will be located deep underground and accessed by a 2km long tunnel. The surface facilities including the tunnel portal will be located in poramboke land not used for any planned activity. Hence there will not be any impact on land use pattern.*

*Contour map and site layout attached.*

- 1.2 List out all the major project requirements in terms of the land area, built up area, water consumption, power requirement, connectivity, community facilities, parking needs etc.

*About 26.82.5 ha of Govt. dry poramboke land in Pottipuram Village (about 1 km from T. Pudukottai hamlet), Uthamapalayam Taluk, Theni District, Tamil Nadu state. Further, the underground INO caverns and tunnels will notionally occupy about 4.62 ha. The total built up area will comprise of:*

- (a) *Underground facility: Laboratory caverns and tunnels - 20552 sq.m.  
(Notional as they are under ground and will not affect the over ground features.)*
- (b) *Over ground facility: Utility Building, Administrative - 10762 sq.m.  
Building, Detector Assembly, Guest House /hostel and housing (up to 1+ 2 floors) .*

*Provision for drawing maximum 3MW of power through 110KV double circuit line tapped form Periyar-Theni transmission line will be made. Water (maximum 340KLD) is arranged from Mullaperiyar River by TWAD Board. Own intercom exchange will be provided at INO with connectivity to BSNL exchange at Thevaram through underground fibre optic cable (voice and data communication).*

- 1.3 What are the likely impacts of the proposed activity on the existing facilities adjacent to the proposed site? (Such as open spaces, community facilities, details of the existing land use disturbance to the local ecology).

*Negligible. The project's over ground facilities are proposed in Govt. poramboke land. During the construction phase movement of men and material will be monitored and controlled to reduce the disturbance to the local ecology.*

- 1.4 Will there be any significant land disturbance resulting in erosion, subsidence & instability? (Details of soil type, slope analysis, vulnerability to subsidence, seismicity etc may be given).

*No. Major components are underground. Surface components will be arranged so as to avoid erosion or subsidence. There is no history of landslips at site.*

1.5 Will the proposal involve alteration of natural drainage systems? (Give details on a contour map showing the natural drainage near the proposed project site)

*No. Major project components are underground. Overground facilities will be planned ensuring that natural drainage is not affected.*

1.6 What are the quantities of earthwork involved in the construction activity-cutting, filling, reclamation etc. (Give details of the quantities of earthwork involved, transport of fill materials from outside the site etc.)

*Total earth work including rock involved is about 2.5 Lakhs cu.m. Most of it will be rubble stones arising from blasting of underground tunnel & caverns and will be useful for construction both within project site and for construction activities in Theni and Madurai districts. Fill materials will not be brought from outside.*

1.7 Give details regarding water supply, waste handling etc during the construction period.

*During construction, water requirement is about 5KLD. Water requirement for the first 10 years is about 180KLD and thereafter the requirement may go up to 340KLD. Permanent water supply line for 340 KLD from Mullaperiyar River has been arranged by TWAD Board.*

*Sewage generated by construction work force of about 100 (out of which about 60 may temporarily stay at site) will be low and will be disposed, well away from water bodies after proper treatment.*

1.8 Will the low lying areas & wetlands get altered? (Provide details of how low lying and wetlands are getting modified from the proposed activity)

*No. The project does not occupy or disturb low lying areas and wetlands (none in the vicinity).*

1.9 Whether construction debris & waste during construction cause health hazard? (Give quantities of various types of wastes generated during construction including the construction labour and the means of disposal)

*Construction debris generated will be mainly the products of blasting(tunneling) and this will be mostly reused in the this project and in various construction works in the neighboring districts. Efforts will be made to dispose of the debris as soon as it is generated. Sewage waste generated by construction work force of about 100 (out of which about 60 may temporarily stay at site) will be low and will be disposed, well away from water bodies after proper treatment. Leachate tests from rock samples from the area show that concentration of heavy metals such as arsenic, chromium, etc., are at below-detectable levels (see attached table).*

## 2. WATER ENVIRONMENT

- 2.1 Give the total quantity of water requirement for the proposed project with the breakup of requirements for various uses. How will the water requirement met? State the sources & quantities and furnish a water balance statement.

*During construction phase, water requirement is about 5KLD. Water requirement for the first phase of operation is about 180KLD, apart from initial filling up of lines and flushing. Full capacity operation may happen after 10 years of commissioning, which require 340KLD, (320KLD for cooling water system + 20 KLD for drinking and service water). Water for INO project has been arranged by TWAD Board from Mullaperiyar river. Local ground water will not be tapped for INO.*

*During construction, water requirement is about 5KLD only, which will be used from the water supply arranged by TWAD Board.*

- 2.2 What is the capacity (dependable flow or yield) of the proposed source of water?

*The annual realization of Mullaperiyar River is about 25TMC.*

- 2.3 What is the quality of water required, in case, the supply is not from a municipal source? (Provide physical, chemical, biological characteristics with class of water quality)

*Normal portable water is required.*

- 2.4 How much of the water requirement can be met from the recycling of treated wastewater? (Give the details of quantities, sources and usage)

*Water requirement has been optimised by adopting closed cycle cooling water system for cooling purpose. Service water will be reused for gardening after treatment.*

- 2.5 Will there be diversion of water from other users? (Please assess the impacts of the project on other existing uses and quantities of consumption)

*No.*

- 2.6 What is the incremental pollution load from wastewater generated from the proposed activity? (Give details of the quantities and composition of wastewater generated from the proposed activity)

*The INO laboratory activity will not generate any waste water. Domestic/service waste water (negligible quantity) will be reused or discharged after proper treatment.*

- 2.7 Give details of the water requirements met from water harvesting? Furnish details of the facilities created.

*The over ground facilities are located at the foot of Bodi West Hills, in low rain fall area. Water harvesting will be done, but it cannot meet the requirements to any significant extent.*

- 2.8 What would be the impact of the land use changes occurring due to the proposed project

on the runoff characteristics (quantitative as well as qualitative) of the area in the post construction phase on a long term basis? Would it aggravate the problems of flooding or water logging in any way?

*Major components of the project are under ground. The surface facilities will be so planned that will not be any impact on the run off characteristics on the area.*

- 2.9 What are the impacts of the proposal on the ground water? (Will there be tapping of ground water; give the details of ground water table, recharging capacity, and approvals obtained from competent authority, if any)

*Water for INO project is arranged by TWAD from Mullaperiyar River. Local ground water will not be tapped for INO.*

- 2.10 What precautions/measures are taken to prevent the run-off from construction activities polluting land & aquifers? (Give details of quantities and the measures taken to avoid the adverse impacts)

*Retaining walls of appropriate height will be constructed to hold the excavated tunnel muck as well as to prevent the flow of fine particles during the rainy season. Wind screens will be provided on the retaining walls to minimize dust dispersal by wind. The rock debris that is excavated will be wetted before being brought out in lorries to prevent dispersal.*

- 2.11 How is the storm water from within the site managed? (State the provisions made to avoid flooding of the area, details of the drainage facilities provided along with a site layout indication contour levels)

*INO mainly comprises of underground caverns and tunnels, seepage water from which will be pumped out. The storm water drains along the roads in the surface facilities will be constructed so as to discharge the water in the nearby streams/nallahs.*

- 2.12 Will the deployment of construction labourers particularly in the peak period lead to unsanitary conditions around the project site (Justify with proper explanation)

*A maximum of about 100 construction labourers will be deployed during the peak period. Out of this about 40 unskilled labour may be from surrounding villages. The balance will be provided with temporary housing with sanitation facilities. The sewage water will be disposed after proper treatment, well away from water bodies.*

- 2.13 What on-site facilities are provided for the collection, treatment & safe disposal of sewage? (Give details of the quantities of wastewater generation, treatment capacities with technology & facilities for recycling and disposal).

*Active sludge treatment plant of suitable capacity will be set up to treat the sewage. Untreated sewage/sullage will not be let out to the environment*

- 2.14 Give details of dual plumbing system if treated waste used is used for flushing of toilets or any other use.

*Dual plumbing is not proposed considering the low sanitation load and also availability of water through the year.*

### **3. VEGETATION**

- 3.1 Is there any threat of the project to the biodiversity? (Give a description of the local ecosystem with its unique features, if any)

*The project will not be a threat to the biodiversity. Brief description of ecosystem is attached.*

- 3.2 Will the construction involve extensive clearing or modification of vegetation? (Provide a detailed account of the trees & vegetation affected by the project)

*As INO mainly comprises of underground caverns and tunnels, extensive clearing or modification of vegetation is not involved. Over ground facilities may require minimal clearing. Extensive planting of indigenous vegetation will be done on completion of the construction work in consultation with Forest Department officials.*

- 3.3 What are the measures proposed to be taken to minimize the likely impacts on important site features (Give details of proposal for tree plantation, landscaping, creation of water bodies etc along with a layout plan to an appropriate scale.)

*The plot coverage (Plinth area) of over ground structures is less than 8000 sq.m, spread over about 23ha. Hence impact on site features will be minimal. For greening the project surroundings, appropriate local species of flora will be selected under guidance from experts*

### **4. FAUNA**

- 4.1. Is there likely to be any displacement of fauna- both terrestrial and aquatic or creation of barriers for their movement? Provide the details.

*No displacement or disturbance of any fauna due to the implementation of this project.*

- 4.2 Any direct or indirect impacts on the avifauna of the area? Provide details.

*Minimal impact as most of the construction work will take place underground.*

- 4.3 Prescribe measures such as corridors, fish ladders etc to mitigate adverse impacts on fauna.

*Not applicable*

### **5. AIR ENVIRONMENT**

- 5.1 Will the project increase atmospheric concentration of gases & result in heat islands? (Give details of background air quality levels with predicted values based on dispersion models taking into account the increased traffic generation as a result of the proposed constructions)

*Negligible impact as most construction work will take place under ground with proper ventilation. During operation of the ICAL detector the non-toxic gas mixture used is part of a closed loop gas system. The project does NOT release toxic emissions to the environment.*

- 5.2 What are the impacts on generation of dust, smoke, odorous fumes or other hazardous

gases? Give details in relation to all the meteorological parameters.

*Tunnel muck and small quantities of other waste will be stacked in the proposed muck yard till eventual disposal. The muck dump will be protected by retaining walls from runoff/slippage. Wind screens will be provided over the retaining walls to minimize dispersal of rock dust by wind. Dust from blasting will be controlled by connecting dust filters/precipitators to the exhaust stream of forced ventilation.*

*No generation of smoke except negligible exhaust from the DG sets, which run during the failure of Mains. The exhaust pipes will be provided as per prevailing norms to ensure effective dispersal/dilution of exhaust gas.*

*No odorous fumes or other hazardous gases are let out to the environment.*

- 5.3 Will the proposal create shortage of parking space for vehicles? Furnish details of the present level of transport infrastructure and measures proposed for improvement including the traffic management at the entry & exit to the project site.

*The fleet of about 50 vehicles comprising of, dumpers, tippers, material handling & transport vehicles and light vehicles can be parked within INO site during the construction phase. The panchayat road leading to the site from SH 100, will be widened for 2 lane traffic to take care of the increase in traffic during project construction.*

*During the operation phase there will be very few vehicles plying. The option to use clean electric vehicles for travel inside tunnels is being actively explored.*

- 5.4 Provide details of the movement patterns with internal roads, bicycle tracks, pedestrian pathways, footpaths etc., with areas under each category.

*Not applicable as the INO project activities will be mainly confined within own premises and the population will be below 200 residents.*

- 5.5 Will there be significant increase in traffic noise & vibrations? Give details of the sources and the measures proposed for mitigation of the above.

*Due to movement of vehicles like dumpers and tippers between tunnel portal and dump yard there will be some rise in noise and vibrations. But this will be localised within project premises and will not affect the nearby habitats (nearest one about 1.7 km away). The construction period will be between 4 to 5 years. There will be negligible vehicle movement during the operation phase.*

- 5.6 What will be the impact of DG sets & other equipment on noise levels & vibration in & ambient air quality around the project site? Provide details.

*3MW of power will be drawn through 110KV double circuit line tapped from Periyar-Theni transmission line to ensure reliable uninterrupted power supply. However 2 numbers DG sets of 500 KVA (1 W +1S) are planned. The DG sets may not be normally required to run (except for weekly test runs). The DG sets will be provided with vibration mounts and installed in acoustic enclosures, indoors. Suitable trees will be planted around the buildings housing the DG sets. Hence the impact on the noise and vibration levels and air quality will be negligible.*

## 6. AESTHETICS

- 6.1 Will the proposed constructions in any way result in the obstruction of a view, scenic amenity or landscapes? Are these considerations taken into account by the proponents?

*The height of over ground structures have been restricted to about 10 mtrs and will not obstruct appreciably the overall landscape. All buildings will be designed so as to merge with the surrounding and to improve the aesthetics.*

*The facilities will be designed as green buildings to ensure efficient use/ conservation of natural resources.*

- 6.2 Will there be any adverse impacts from new constructions on the existing structures? What are the considerations taken into account?

*No, no structures are existing in the proposed INO site or within a km of the site.*

- 6.3 Whether there are any local considerations of urban form & urban design influencing the design criteria? They may be explicitly spelt out.

*No.*

- 6.4 Are there any anthropological or archaeological sites or artifacts nearby? State if any other significant features in the vicinity of the proposed site have been considered.

*No.*

## 7. SOCIO-ECONOMIC ASPECTS

- 7.1 Will the proposal result in any changes to the demographic structure of local population? Provide the details.

*Not likely, as only about 20 families will be residing permanently at the project site. A floating population of maximum 40 persons consisting of scientists, students and officers may visit the site occasionally. The total addition of population cannot have any impact considering the current population levels in the adjacent areas.*

- 7.2 Give details of the existing social infrastructure around the proposed project.

*The project site is about 2km (by road) from T. Pudukottai and about 10km from Rasingapuram. There is a middle school in T. Pudukottai. Nearest High school is at Ramakrishnapuram, about 2 km from INO site. Nearest college is about 18 km away from site, at Uthamapalayam. Nearest govt. hospital is at Kuppanancheri patti, about 6km from INO site.*

- 7.3 Will the project cause adverse effects on local communities, disturbance to sacred sites or other cultural values? What are the safeguards proposed?

*No. There is a nearby temple, about 1-2 km away, but we will not disturb it.*



## 8. BUILDING MATERIALS

- 8.1 May involve the use of building materials with high-embodied energy. Are the construction materials produced with energy efficient processes? (Give details of energy conservation measures in the selection of building materials and their energy efficiency)

*Energy efficient processes will be adopted. Bricks will be replaced with hollow/solid cement blocks which again will extensively use byproducts of underground excavation/blasting. This will save energy required for brick baking and transport. River sand will be substituted by Crusher sand locally got from blasting, to about 80% . Concrete mix will be designed to use crusher sand and 20/40mm granite bits generated in tunnel/cavern excavation.*

- 8.2 Transport and handling of materials during construction may result in pollution, noise & public nuisance. What measures are taken to minimize the impacts?

*New and well maintained machinery/equipment will be used. Vehicles carrying loose materials (sand, debris etc.) will be properly covered during transport. Dust pollution will be brought down by wetting them through sprinklers, while dumping/storing. As most of the material handling will take place in the project site, the impact will be a localised one.*

- 8.3 Are recycled materials used in roads and structures? State the extent of savings achieved?

*Yes. Bricks will be replaced with hollow/solid cement blocks which again will extensively use byproducts of underground excavation/blasting. This will save energy required for brick baking and transport. River sand will be substituted by crusher sand locally got from blasting, by about 80%. Concrete mix will be designed to use crusher sand and 20/40mm size granite metal bits generated in tunnel/cavern excavation. Roads will be laid using byproducts from excavation.*

- 8.4 Give details of the methods of collection, segregation & disposal of the garbage generated during the operation phases of the project.

*During operation phase, small quantities of domestic waste may be generated. Waste will be segregated at source (wet/dry, biodegradable/non biodegradable) itself. Separate dust bins will be provided. Biodegradable waste will be converted to manure by composting and used for horticulture. Non-biodegradable waste will be disposed in an eco-friendly manner.*

## 9. ENERGY CONSERVATION

- 9.1 Give details of the power requirements, source of supply, backup source etc. What is the energy consumption assumed per square foot of built-up area? How have you tried to minimize energy consumption?

*Energy consumption is calculated, based on lighting, air conditioning, ventilation and equipment loads. Peak demand of 3MW is likely.*

*3MW of power will be drawn through 110KV double circuit line tapped from Periyar-Theni transmission line to ensure reliable uninterrupted power supply.*

*2 numbers of 500 KVA DG sets (1W + 1S) will be provided, to meet essential loads and minimum lighting in the event of total failure of EB power.*

*The following energy conservation measures have been adopted to minimise energy consumption.*

*(a) Energy efficient LED cluster lamps/CFL lamps / discharge lamps will be used. LED display lamps are proposed for indicating lamps in switch boards.*

*(b) Variable frequency drives/soft starters are used in large equipment.*

*(c) Electronic regulators are provided for ceiling fans.*

*(d) Energy efficient motors, chillers, blowers and other equipment will be used.*

*(d) Solar hot water system (for hostel cum guest house) and solar lighting (for small branch roads) are planned.*

*(e) Closed loop systems are adopted to conserve energy and resources.*

*(f) AC settings are kept at maximum permissible points (subject to functional requirement).*

*(g) Lighting and AC loads will be automatically switched off beyond essential duration.*

- 9.2 What type of, and capacity of, power back-up to you plan to provide?

*2 numbers of 500 KVA DG sets (1W + 1S) will be provided, to meet essential loads and minimum lighting in the event of total failure of EB power.*

- 9.3 What are the characteristics of the glass you plan to use? Provide specifications of its characteristics related to both short wave and long wave radiation?

*In over ground structures (though not significant in area), for air conditioned areas, for glass areas of exterior walls, suitable heat reflecting/insulating glass will be used to reduce heat loads. Glass specifications will be chosen accordingly.*

- 9.4 What passive solar architectural features are being used in the building? Illustrate the applications made in the proposed project.

*Court yards and roof cut outs are planned to utilize natural sun light to the best possible extent.*

- 9.5 Does the layout of streets & buildings maximize the potential for solar energy devices? Have you considered the use of street lighting, emergency lighting and solar hot water systems for use in the building complex? Substantiate with details.

*Yes. Solar hot water system (for hostel cum guest house) and solar lighting (for small branch roads) are planned.*

- 9.6 Is shading effectively used to reduce cooling/heating loads? What principles have been used to maximize the shading of Walls on the East and the West and the Roof? How much energy saving has been effected?

*Yes. Suitable trees will be planted along roads, around buildings and vacant areas in consultation with experts. Orientation of the building and sunshades will be planned so as to reduce the heat from the sun rays. Reflective coating of roofs will further reduce the heat load.*

- 9.7 Do the structures use energy-efficient space conditioning, lighting and mechanical systems? Provide technical details. Provide details of the transformers and motor efficiencies, lighting intensity and air-conditioning load assumptions? Are you using CFC and HCFC free chillers? Provide specifications.

*Yes. Dry type transformers with efficiency of 99 % at full load will be used. Motor efficiency at full load will be around 98 %.*

*Indoor lighting intensity will vary between 150 lux and 400 lux, depending on nature of work.*

*Roads will have lighting intensity of 10 to 15 lux.*

*Variable Frequency drives will be used for large loads like chillers and blowers to reduce energy consumption.*

*CFC and HCFC free chillers will be used. Refrigerant planned is R134a.*

- 9.8 What are the likely effects of the building activity in altering the micro-climates? Provide a self assessment on the likely impacts of the proposed construction on creation of heat island & inversion effects?

*No significant effect as the occupancy is very low.*

- 9.9 What are the thermal characteristics of the building envelope? (a) roof; (b) external walls; and (c) fenestration? Give details of the material used and the U-values or the R values of the individual components.

*Terrace roof provided with insulation/turfing, walls are brick wall offering insulation and fenestration protected by overhangs.*

*Material and upper limit of designed U- values shall be as follows:*

- a) R CC roof : 3.0
- b) Masonry external walls : 3.0
- c) Glass fenestration : Plain

- 9.10 What precautions & safety measures are proposed against fire hazards? Furnish details of emergency plans.

*Fire alarm systems, sprinklers and fire hydrants will be provided as per standards. Dry type transformers, oil free switch gear and heat shrinkable joints are adopted to prevent electrical fires. Fire stops, fire dampers and fire retardant coating will be provided to prevent spread of fire. Fire extinguishers (class A, B and C) will be liberally deployed. Project specific "Fire and Safety Manual" will be prepared. All personnel shall be trained in fire fighting. Mock fire drill will be conducted annually.*

*A "Disaster Manual" will be prepared. Assembly points for evacuation of personnel in the event of fire and other agencies will be earmarked and identified prominently.*

- 9.11 If you are using glass as wall material provides details and specifications including emissivity and thermal characteristics.

*For over ground structures (though not significant in area), for Air conditioned areas, for glass areas of exterior walls, suitable heat reflecting/insulating glass will be used to reduce heat loads. Glass specifications will be chosen accordingly.*

- 9.12 What is the rate of air infiltration into the building? Provide details of how you are mitigating the effects of infiltration.

*Not applicable.*

- 9.13 To what extent the non-conventional energy technologies are utilized in the overall energy consumption? Provide details of the renewable energy technologies used.

*Solar street lights and solar water heaters are proposed*

#### **10. Environment Management Plan:**

The Environment Management Plan would consist of all mitigation measures for each item wise activity to be undertaken during the construction, operation and the entire life cycle to minimize adverse environmental impacts as a result of the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations. It will state the steps to be taken in case of emergency such as accidents at the site including fire.

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Place : Mumbai



Dr. V.M. Datar  
Project Director, India based Neutrino Observatory (INO),  
and Senior Professor, INO Cell,  
Tata Institute of Fundamental Research,  
1 Homi Bhabha Road, Colaba,  
Mumbai – 400 005