Reply to the points made by Hon'ble Chief Minister of Tamil Nadu to Hon'ble Prime Minister of India Thiru Narendra Modi request to intervene and advise the authorities concerned to drop the Neutrino Observatory (INO) Project in Tamil Nadu:

(A) Regarding the observations made by SEIAA, Tamil Nadu:

The letter points out two observations made by SEIAA, Tamil Nadu.

1. "*The tunneling work involves carrying out blasting in the hard and composite rock mass and requires a huge quantity of high strength explosives to break it. Further, the tunneling work involves excavation of 600000 cubic metres of Charnockite rock from the mountain."*

Reply: While the work will indeed involve blasting in the rock mass, this will be carried out with the technique called "controlled blasting method", which is quite standard these days. The excavation of 600000 cubic metres will take place over 3 years, which corresponds to only about 200-300 tons every day.

The tunneling will be carried out using "Controlled Blasting Method" which involves placing the explosives at appropriate points to get the proper shape of the tunnel. Typically there will be two or at a maximum three such explosions in a 24 hour cycle, each lasting only a few seconds. The word control is technically used to indicate that there will not be any overblasting while minimising ground vibrations. Once the tunnel has progressed about 300 metres or more, even these ground vibrations will not be felt on the surface.

The tunneling and cavern construction for INO, involving 1.91 km of tunnel and laboratory caverns, will be completed over a period of 30-36 months. The excavated quantity of rock during this period is approximately 2.3 lakh tons in weight or around 6,00,000 cubic meters of rock in volume (accounting for 20% voids). While the quantities may appear large, it amounts to removing about 200-300 tons of rock, or around ten to fifteen 20-ton lorry loads, on an average every day. Any large construction project involves this much of debris removal. Part of the excavated material, about ten percent, will be used in INO construction itself and a part of it will be temporarily stored in the area marked for the purpose, and then evacuated.

Given the demand for granite by construction industry in TN, the excavated material which belongs to the Forest Department may fetch good returns.

2. "The tunnel and cavern will be at a depth of 1000m from the top of the mountain. At the depth of 1000m, mountain rock would be under tremendous pressure and the vertical stress is expected to be greater than 270kg per sq.m. This will create problems like rock burst and roof collapse. The proposals will have to be scrutinized using Geotechnical studies for safegaurds."

Reply: There are many examples of deep underground tunnels around the world and increasingly in India and even Tamil Nadu. The problem of stress and rock bursts is well studied, and with advanced technology available now, these can be predicted and engineering solutions implemented, whether it is road tunnels, metro tunnels, or underground powerhouses. The geotechnical report for INO was done by the geotechnical engineers and scientists of GSI, who are experts in this field and have also advised the TANGEDCO in many of its underground power projects, where similar rock conditions exist.

The rock mass in Bodi West Hills is almost uniformly Charnockite (granite) which is very stable. (As an analogy, drilling a 7.5 m height tunnel at a depth of nearly 1300 m into the Bodi West Hills is just like putting a water pipe through a 3.5 metre high wall in a house. We do not expect the house to collapse while putting water mains!)

The PUSHEP project at Singara has a powerhouse which is 70 meters long and more than 22 meters wide is excavated at a depth of 550 meters. Even after 15 years no adverse conditions have been encountered. The Atal tunnel which was inaugurated recently has the highest rock overburden of 1800 meters. During its construction, the engineers were able to take care of every conceivable problem and it is operational now. The Shyamaprasad Mukherjee tunnel near Jammu has a maximum rock cover of more than 1000 meters.

Thus, the points mentioned in the above two observations by SEIAA can be taken care of by proper planning and implementation, and hence should not cause any serious concerns about the project. INO is committed to best practices during both the construction and operation phases.

(B) Tiger Corridor:

Claim: "It is pertinent to know that the site which is proposed for the neutrino project falls within the Mathikettan-Periyar Tiger Corridor as mapped by the National Tiger Conservation Authority (NTCA). The corridor has the critical function of maintaining the genetic floe, which will be destroyed by the project activities."

Reply: INO project does not involve or require any area on the surface of the hill that lies within the Tiger Corridor or even within the RF boundary. The proposed INO tunnel and cavern complex will be located deep below the tiger corridor, approximately at a depth of about 800-1300 metres below surface. The National Tiger Conservation Authority (NTCA) has already considered these factors and have communicated that they have no objection to locating INO in its present site.

The Mathiketan Periyar tiger corridor mentioned is a part of a very long corridor connecting Mathikettan National Park in the north, Periyar Tiger Sanctuary in the south and Meghamalai Sanctuary in the east. Roughly 2-3 km wide, the corridor is envisaged as a means for tigers (and other animals) to move freely between these sanctuaries. The relevant portion of the Tiger Corridor lies on the upper reaches of the BWH and the portal (tunnel entrance) lies well outside this corridor. The proposed INO tunnel and cavern complex will be located deep below the surface and hence deep below the tiger corridor, approximately at a depth of about 800 metres below surface. The caverns will be 1300 m below the tiger corridor. There will be absolutely no disturbance to the surface (and to tigers or other animals) even during the onstruction phase since vibrations due to controlled blasting fade away within a distance of about 500 m from the blasting site. Of course there will be no disturbance to the animals during the operating phase of the observatory. The tunnel portal and surface facilities are well outside the tiger corridor.

(C) Wildlife sanctuaries and Western Ghats:

Claim: "Therefore, the SEIAA referred the matter to the Ministry of Environment, Forest and Climate Change. The proposed project is located about 4.9 km from Mathikettan Shola National Park. The proposed site also falls within the Bodi Hills West Reserve Forest, which falls within the Southern Western Ghats. The Western Ghats is considered as a biodiversity hotspot harboring numerous endemic species of flora and fauna. This area also links ecologically to the eastern habitats where Srivilliputhur

Meghamalai Tiger Reserve is located and hosts tigers from the region and assista in genetic dispersal across the Western Ghats and their South-eastern projections through the Cumbum valley. Along with tigers, its co-predators, several other species of mammals including the ungulates, reptiles and amphibians move around the slopes of these hills."

Reply: The Western Ghats is indeed a bio-diversity hotspot. However, the proposed INO site comprises a small patch of land of area about 26.825 ha only at the foothills of the Bodi West Hills, and does not occupy any part of the hill itself or any reserve forest (RF) area. The project site is more than 30 km away from Srivilliputhur Meghamalai sanctuaries separated by the Cumbam valley with a highway passing in between. Hence, this project will not disturb these distant sanctuaries. The Mathikettan Sholar National Park (MSNP) lies on other side of TN Kerala border; moreover, the entire INO (surface and underground facilities) lies well outside the Eco-Sensitive Zone (ESZ) of MSNP.

INO does not occupy any part of the Reserve Forest. The horizontal access tunnel to the laboratory caverns itself is deep underground by the time the RF boundary is reached at the edge of the hill. Hence there is absolutely no disturbance to the surface flora or fauna, and no disturbance any where once the observatory is operational. There will be minimal disturbance during its construction which will be over within three years, as mentioned earlier.

The INO site is located in an area where there are no big trees; hence not even one tree will be cut d during construction. The site was selected in consultation with the District Forest Officer and the Collector of the Theni district in 2009-2010. The Project Report was prepared by TANGEDCO, an arm of the Tamil Nadu state government. The tunnel portal is in Poromboke land given free of cost by late Chief Minister Thiru M Karunanidhi and handed over during the period of late Chief Minister Thirumati J Jayalalithaa.

(D) Watershed and catchment areas:

Claim: "The area also forms a significant watershed and water catchment for river Sambal and River Kottakudi. Small streams on the west side of Bodi Hills join the Kottakudi river which joins the Periyar river before draining into the Vaigai dam. The watershed is the lifeline of local communities as it supports their livelihood and provides water for drinking and agricultural needs for five districts of Tamil Nadu."

Reply: INO will not disturb any streams or occupy the watershed/catchment areas. All surface facilities are located on the poromboke land where there are no streams. Kottagudi river is at least 20 to 30 km away on a completely different side (northern slope) of BWH, whereas the project site abuts the eastern and southeastern face of the hill. In addition, the catchment area of Periyar is more than 5,000 sq km. The area of INO land is a little more than one-quarter of a sq km; hence it will not affect the catchment area of Periyar either.

There is a stream which runs on the southern border of the INO land which absorbs the suface flow. This is not going to be touched or altered; in fact, a small bridge will be constructed over it in order to leave the flow undisturbed. It must be noted that the project proponents have assured the local people that they will not be exploiting local water resources, especially ground water. Water supply to the project is brought to the site through pipes from the pump house near the river about 19 km away. This was completed by the TWAD board of the government of Tamil Nadu in 2013 itself.

Summary:

The members of the collaboration are conscious of their obligation to preserve nature and environment. It is very clear, from the geological and ecologial reports, that INO can be constructed in an environmentally safe way and will in no way damage local flora or fauna or disturb the locals living nearby. The Observatory will only host detectors, which are like telescopes, silently observing the sky. There will be absolutely no disturbance of any kind, or any irreversible damage on the surface of the hill. We believe that, given the opportunity, INO will be a prime example of executing a project in an environmentally and ecologically sustainable way and will bring unique scientific opportunities to both Tamil Nadu in particular and India as a whole.