

Milestone ahead - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites

Address C:\Documents and Settings\Administrator\Desktop\Milestone ahead.htm Go Links

FRONTLINE

Volume 23 - Issue 19 :: Sep. 23-Oct. 06, 2006
INDIA'S NATIONAL MAGAZINE
from the publishers of THE HINDU

[Contents](#)

NUCLEAR ISSUES

Milestone ahead

T. S. SUBRAMANIAN
in Chennai

The construction of the Prototype Fast Breeder Reactor at Kalpakkam is progressing at a hectic pace.

S. R. RAGHUNATHAN

Done

Start Internet


safety vessel re... ==: Bharatiya ... Milestone ahe... Recycle Bin \\nasbhavini\Pub... Desktop 3:45 PM

Milestone ahead - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites

Address C:\Documents and Settings\Administrator\Desktop\Milestone ahead.htm Go Links



THE MAIN VESSEL of the Prototype Fast Breeder Reactor under fabrication.

ON the open beachfront at Kalpakkam, about 65 km from Chennai, some 2,000 people, men and women, are engaged in the construction of a huge structure called reactor vault. Some distance away, inside a tall, massive hall, huge vessels sit on platforms. One of them, called the safety vessel, is 13.5 metres in diameter and 13.5 metres in height, and weighs 115 tonnes. Specialist welders are stitching seams inside this cavernous vessel made of stainless steel. Others are cleaning it. It is the site of the Prototype Fast Breeder Reactor (PFBR) being constructed by Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI).

"The project will reach the peak of its activity in about six months from now," said Prabhat Kumar, Project Director. "We shall cross the first major milestone of the project when we transport the safety vessel from the Site Assembly Shop [SAS] and lower it inside the reactor vault," he added.

The PFBR will be built at a cost of Rs.3,492 crores. When the reactor is commissioned, it will generate 500 Mwe of power. Prime Minister Manmohan Singh inaugurated its construction on October 23, 2004. On August 18, 2003, Anil Kakodkar, Chairman, Atomic Energy Commission, and Secretary, Department of Atomic Energy (DAE), performed the *bhoomi puja*. After the puja, he said: "We want to make a commercial success of this breeder technology. Based on this technology, we will build more reactors." The PFBR fuel will be mixed plutonium-uranium oxide. Liquid sodium is the coolant.

This is the first time that the DAE is building a commercial breeder reactor of 500 MWe capacity. The PFBR's forerunner is a small, experimental Fast Breeder Test Reactor (FBTR) of 13 MWe capacity, also located at Kalpakkam.

The Indira Gandhi Centre for Atomic Research (IGCAR) at Kalpakkam designed the PFBR. Several IGCAR teams, headed by its Director Dr. Baldev Raj, developed the crucial technology for the components of the PFBR.

BHAVINI has been exclusively set up to build breeder reactors. The DAE-run company is an amalgamation of talent from Nuclear Power Corporation of India Limited (NPCIL), the IGCAR, the Bhabha Atomic Research Centre, the Nuclear Fuel Complex and Electronic Corporation of India Limited, both located in Hyderabad, and the Heavy Water Board. S. K. Jain is the Chairman and Managing Director of both NPCIL and BHAVINI.

Done Internet

Start safety vess... :==: Bharat... Milestone ... Recycle Bin \\nasbhavini... Document1 -... Desktop 3:46 PM

Milestone ahead - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Refresh Print Mail Desktop Search

Address C:\Documents and Settings\Administrator\Desktop\Milestone ahead.htm Go Links

The construction of the PFBR is racing ahead of schedule. This despite the loss of five months of work after the tsunami of December 26, 2004, dumped water to a height of six metres inside the 24-metre-deep foundation pit. It had to be abandoned and another one of the same size was built.

Prabhat Kumar said: "We have an ambitious target. As per schedule, the reactor should go critical in September 2010. We will definitely commission it ahead of schedule. The main civil works are progressing fast." Construction to a depth of 18 m in the pit and that of a raft (foundation) 3.5 m high has been completed. On this raft will come up eight huge buildings that constitute what is called the nuclear island. Excavation is under way for the power island, which will consist of several buildings.

FIRST OF ITS KIND

Orders have been placed for most of the core components. They are under fabrication. More orders for equipment valued at Rs.1,300 crores will be placed by March 31, 2007. Premier companies such as BHEL, L&T Limited, MTAR Technologies Private Limited, Kirloskar Bros have expressed interest. "What is most satisfying to us is that most of the components have been fabricated to better specifications than envisaged. This is remarkable for the first-of-its-kind reactor in the country," Baldev Raj said.

According to Prabhat Kumar, everything in the PFBR is first of its kind. "So no previous procedures were applicable. Everything had to be developed afresh." This posed challenges in civil works and the manufacture of components. For instance, the PFBR has the largest and deepest excavated pit, which is 21m to 24m deep. It is 268m long and 216m broad. The concreting for a raft for the PFBR was done with 35,000 cubic metres of concrete.

The concreting is state of the art. Concrete batching was fully computerised and automatic data collection was deployed. Ice manufacturing plants and storage facilities were erected. Ice flakes were mixed with concrete because the temperature of the concrete had to be maintained at 19{+0} C and 23{+0} C for the perimeter wall of the nuclear island and the raft respectively. This posed a massive challenge because the work was spread over several months. First, extensive dewatering using powerful pumps had to be done from the pit because the pit was just about 500 m from the shore and water kept gushing even a few feet below ground level. The project uses the largest tower crane in the country for erection/construction work: the crane can swing loads weighing 3.5 tonnes over a distance of 70m.

The nuclear island

The PFBR is the first reactor where seven to eight buildings of the nuclear island will come up on a single raft. The nuclear island buildings are those related to the reactor. They include the reactor building, that is, the building which will house the reactor; two steam generator buildings; the control

Done Internet

Start safety vess... :==: Bharat... Milestone ... Recycle Bin \\nasbhavini... Document1 -... Desktop 3:47 PM

Milestone ahead - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Refresh Print Mail Stop

Address C:\Documents and Settings\Administrator\Desktop\Milestone ahead.htm Go Links

waste from the reactors. The reactor building will be 73m tall from the foundation. The steam generator buildings will be taller, at 85m.

Besides these eight buildings, there will be 10 buildings. Gammon India Limited is constructing them. These include the reactor vault, which is 13.8m in diameter and 17m in height. It is so big that a mock-up with lining was built before its actual construction. It has not been decided as to how many buildings will belong to the power island. Gammon India Limited is also excavating the pit for the power island and will construct the buildings.

This is the first reactor for which components are manufactured at the site itself because they are of gigantic proportions. In the SAS, situated close to the nuclear island, workers are fabricating the safety vessel, the main vessel, the inner vessel and the thermal baffles. While L&T is building the safety vessel and the main vessel, BHEL is fabricating the inner vessel and the two thermal baffles.

The safety vessel is a massive contraption, 13.5m in diameter and 13.5m in height. It is made of stainless steel called 316-LN. No vessel of this size has been built in India so far. Seventy sections were welded together to make it. The dimensions of 13.5m by 13.5m were done with an accuracy of plus or minus 8 millimetres. R.K. Sharma, site-in-charge, special project, L&T Limited, said the circumference of the safety vessel was 43m. This was achieved with an accuracy of 3mm. That is, the vessel's circumference of 43,000 mm was accomplished with an accuracy of plus or minus 3mm. This was tough indeed. When stainless steel was welded, it underwent a large amount of distortion because heat got accumulated. "We adopted this particular sequence in the safety vessel. L&T considers this a challenge because of the demands made by tolerance and distortion control," said R.K. Sharma.

The reactor building will house the reactor vault, the vessels and the baffles in a concentric manner. The outermost is the reactor vault. On the inner surface of the reactor vault is the shield of embedded cooling pipes. Inside the reactor vault is the safety vessel with thermal insulation panels bolted on the outer surface. Inside the safety vessel is the main vessel, which holds the liquid sodium. Inside the main vessel are two thermal baffles that direct the liquid sodium in the required flow pattern. Inside the thermal baffles is the inner vessel, which supports the reactor core that includes the fuel blanket. The main vessel is welded on to the roof-slabs. The main vessel, without liquid sodium, weighs 140 tonnes. The entire assembly, that is, the main vessel, the safety vessel and the inner vessel, will be engineered in such a way that they will be hanging from the top of the reactor vault. When completed, this will be a marvel of construction and engineering techniques.

While the project cost was Rs.3,492 crores, about Rs. 393 crores had been spent until March, B.S. Goyal, Director (Finance), BHAVINI, said.

Done

Start Internet

safety vess... :==: Bharat... Milestone ... Recycle Bin \\nasbhavini... Document1 -... Desktop 3:47 PM