A memo to NESPAK

AoA. Hayat Sahib,

Your learned eight point statement has been delivered to me by several sources. For the sake of the children of Pakistan I am duty bound to respond. At the outset I agree with your point of view concerning the necessity for Pakistan to start building large dams & reservoirs. The last was Tarbela dam (completed 1974 & commissioned 1976.) In all humility here is my point wise response.

1) Gen. Dr. G. S. Butt received a PhD in Geotech Engineering but he did not restrict himself to just that. In the 09 years that I was his part time assistant & student, I witnessed his deep study & command of geology, hydrology, glaciology & geophysics. Geophysics being his passion in later life. His motto was "A Book a Day". It is sad to read Mr. Mansoor Hashmi's comments that Gen. Dr. Butt involved in Construction Management role in KKH, that too of military outfits, does not qualify him as a Design Expert. Therefore his CV will not qualify with a professional institution. You have endorsed him. His statement of a 276m RCC dam is false. The ICOLD & Wikipedia show Longtan RCC at 216.5m (2009) & Gibe-III RCC in Ethiopia 243m (2015). Both RCC Gravity.
2) The Pre-Feasibility Study by MONENCO recommended CFRD. It does not include an earth core. There is no earth, sand & silt in the DBD area. Gen. Dr. Butt was very clear that rock was plentiful. Please note that CFRD concept was still under development in 1981. By 2013 there were 16 CFRDs with heights greater than 200m around the world. The Shuibuya Dam in China, which is 233 m tall was completed in 2008, and is apparently the world's highest CFRD. A number of ultra-high CFRDs between 250 & 300m height are planned for construction. Therefore the CFRD will be the preferred dam type of the future. It can make full use of local materials to reduce the transportation of construction materials to the dam site, and has high adaptability, distinct economic advantages, and an excellent capability for earthquake resistance. AECOM a world leader has constantly declared the **RCC dam a most expensive & higher risk option for DBD.**
3) You underrate CFRD dams as incapable of handling GLOF (Glacial Outburst Outfall Flood) Events. CFRD has full capability of handling Probable Maximum Flood (PMF) on +10,000 years basis. The RCC dam's spillway is within the body of the dam an inherent limitation to cater for extraordinary GLOF Events. There is no limitation on the capacity of the CFRD side spillway. Please note that Mohmand dam will be a CFRD. Its spillway flood capacity (28,000 Cumecs) will be greater than DBD design for 26,000 Cumecs. By the way Tarbela dam an Earth Core Rock- Fill (ECRD) has capacity for 46,000 Cumecs & Mangla ECRD capacity 74,000 Cumecs. Therefore kindly withdraw this remark that CFRD & ECRD dams cannot handle GLOF events or even higher flood events. Presently the catchment areas of Shyok viz Siachen area & Khodman Glacier are both showing no possibility of GLOF. The Khodman Glacier is already melted. At Kachura south of Skardu there may be a chance of sliding. In the Skardu plain area a natural slide could create flood conditions otherwise there is no other danger. Hunza GLOF potential is not great. The real problem is the energy dissipation downstream. CFRD allows a side spillway to handle any flood situation.
4) Barry Cooke (1915-2005) was a great believer in CFRD. His life sketch tells us that he was too frail to work in the last year of his life. He passed away on 21 April 2005. His motto was "**CFRD dams are inherently safe**". Therefore it is not believable that an 89 years old man on his death bed advised NESPAK to switch from CFRD to RCC. He is being unfairly quoted. There can be no record of his visiting Pakistan to assist NESPAK for DBD Feasibility Study. This reference to late Barry Cooke does not seem logical. Someone managing his consultancy misused his name.

5) The Detailed Design & Tender documents simply followed the NEAC JV Feasibility Study as per their mandate because NESPAK JV had switched to the tallest RCC in the World. Gen. Dr. Butt had passed away on 01 May 2006 after giving us his pearls of wisdom based on his lifelong work in the Karakorums. Lahmeyer was perhaps too busy working in IHK to really worry about mistakes West of the LOC. German Engineers have never out-performed on ultra-high dams because they have few large projects in their country. The Swiss built the Grand Dixence 285m (1961) as a high Concrete Gravity dam. We understand DBD RCC is at present not a Concrete Gravity dam but an Embankment RCC dam. Its weight is not enough to counteract & it is supported by massive Embankments using an arch design. We have at present an Embankment RCC & not a RCC Gravity or Concrete Gravity dam design. All RCC high dams are rigid & have low earthquake resistance. All CFRDs have high resistance to earthquakes. **Above all CFRD will cost less than half at DBD site.**
6) I am surprised that run-of-river projects are being compared with DBD. The RCC dam at Dasu could be either RCC or CFRD but the HPP pondage is merely 1.5MAF gross storage. The RCC dam design will be OK. Dasu clearly is going to be pre-DBD. It will require constant flushing of sediments through low level orifices. Due to this sediment flushing problem an RCC was considered necessary. The Pattan & Thahkot run-of-river projects will operate after DBD and could have been silt free, thanks to the sediment control at DBD but the catchments below DBD entering the Indus will bring additional sediment that requires flushing. Concerning the upstream Bunji HPP it has a smaller reservoir of 0.25 MAF. It will be a sand trap without the upstream Shyok & Skardu dams. Bunji HPP power capacity anyway seems too optimistic & be reduced. An RCC is fine for all run-of-river HPPs because of the minimum pondage. If Dasu RCC dam collapses there will be minor devastation downstream. **Why are we comparing the tallest RCC design of DBD with the RCC dams at run-of-river power plants of small reservoirs?** BTW if Dasu was not pre DBD & if DBD existed then sediment flushing would also be a smaller issue and CFRD could be an option.
7) DBD is located in an active seismic zone with the reservoir located on the Central Asian Fault-line. All that Gen. Dr. Butt conveyed in his three letters of 2004 to President Musharraf & one to WAPDA chairman was that CFRD has higher earthquake resistance compared to RCC. **Secondly he conveyed that this is not an ideal location for flood control. Save time & money. Build a safer CFRD**. Designing a 281m tall RCC (later NEAC JV reduced to 272m) including 50m below to the rock bed. A wasteful project in his opinion. The design is actually an RCC arch and not a classical RCC concrete gravity dam as noted in WAPDA literature. An RCC Arch dam has poor earthquake resistance compared to CFRD rock-fill dams. **There seems no purpose to spend more than twice the amount on the tallest RCC dam in the world when plentiful rock is available at site**.
8) I repeat that Dasu HPP has a maximum storage of 1.5 MAF which is not dangerous if there is a dam break at Dasu. Please note **AECOM Executive Summary** from a 31 May 2014 mail sent to WAPDA. Around 10 Sep 2018 they sent a four page letter to Honorable CJP. AECOM knowledge & experience of large dams is reportedly greater than those who worked on DBD studies. NESPAK is not having world class large dam & hydropower experts. It should kindly resist the temptation to bulldoze its concerned countrymen. The largest RCC dam is an existential issue.

P.S.: Your advice on limitation of education & knowledge should have been given to Gen. Dr. Butt when he was trashing on 30 June 2004 the NEAC JV Feasibility Study & the POEs who had approved the Feasibility Study. This climactic meeting took place at WAPDA House on 30 June 2004. Yes I am not an expert of large dams but neither is anybody else in NESPAK. Pakistan Paindabad.

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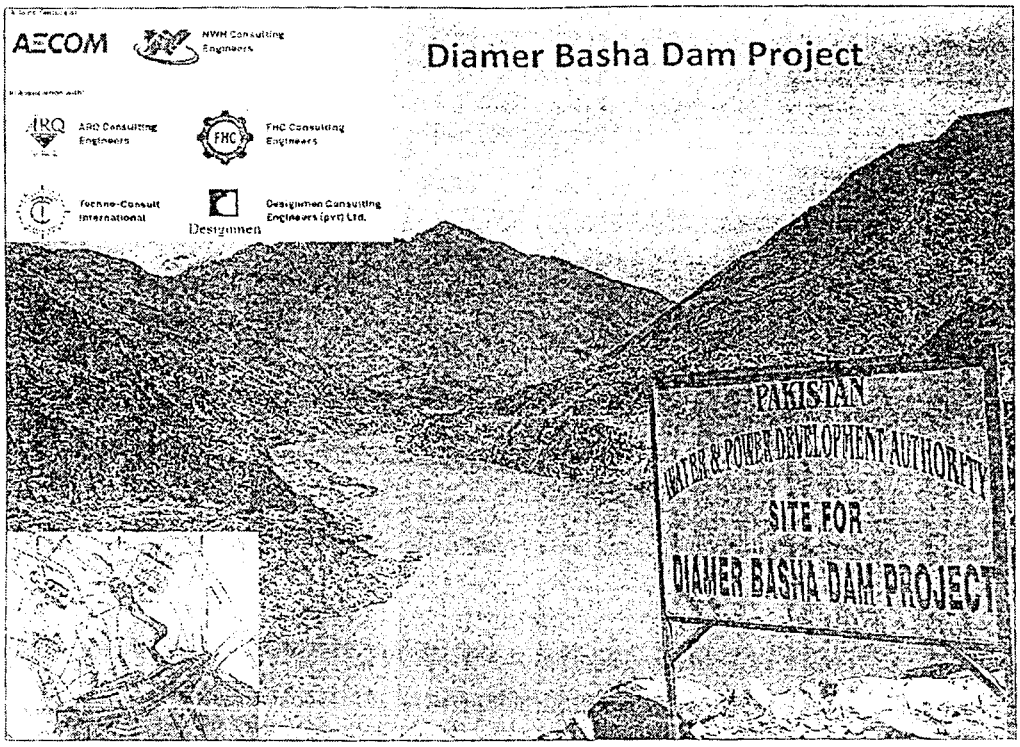
Suleman Najib Khan
www.wrdc.com.pk (April 14, 2020)



Executive summary

- AECOM wish to bring to your attention that the AECOM NWH JV is proposing an alternative solution more economical and more efficient with a potential costs saving of $4.7 billion:
  - The proposed dam alternative (Concrete Face Rockfill Dam CFRD) will allow WAPDA and the Government of Pakistan to reduce the Diamer Basha costs by ± $3b and the construction time by 1.5 years which will make the bankability of the project much more attractive,
  - Converting this time saving in energy production, the CFRD dam can gain up to $ 1.7b more than the RCC.
- The CFRD will require less infrastructure and transportation as most of the construction materials are in situ.
- By creating the Diamer Basha reservoir, this will:
  - Improve significantly the storage capacity in the Indus Basin Water System (irrigation, agriculture and environmental flow),
  - Increase useful life of downstream Tarbela reservoir by about 50 years (together with development of Dasu HPP) through trapping large amount of sediments,
  - Allow to double the total installed capacity of Dasu as planned in stage 2 (from 2,000 to 4,150MW) by regulating the river flow,
  - Enable 1,100 GWh/year of additional generation at Tarbela due to conjunctive operation of two reservoirs ($ 55M/yr).