

Fukushima in Fatehabad: What a Nuclear Accident at Delhi's Doorstep Will Mean

***Research Study Report for Takagi Fellowship
for Citizen Scientists 2014***

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Abbreviations

AEC	-	Atomic Energy Commission
AERB	-	Atomic Energy Regulatory Board
BARC	-	Bhabha Atomic Research Center
CANDU	-	CANada Deuterim Uranium type reactors
CIC	-	Central Information Commissioner
DAE	-	Department of Atomic Energy
EIA	-	Environmental Impact Assessment
GHAVP	-	Gorakhpur Haryana Anu Vidyut Pariyojna
GNPP	-	Gorakhpur Nuclear Power Project
IPPNW	-	International Physicians for Prevention of Nuclear Weapons
LOCA	-	Loss of Cooling Accident
NDMA	-	National Disaster Management Authority
NPCIL	-	Nuclear Power Corporation of India Limited
NSRA	-	Nuclear Safety Regulatory Authority
PHWR	-	Pressurised Heavy Water Reactor
PSR	-	Physicians for Social Responsibility
RTI	-	Right to Information
TEPCo	-	Tokyo Electric Power Company
UCIL	-	Uranium Corporation of India Limited

Introduction

The unprecedented triple nuclear meltdown at Fukushima, whose fallouts and human consequences continue to unfold, has evoked a wide array of questions and responses across the world. These range from the risk inherent in nuclear technology, insurmountability of nuclear accidents even in most advanced countries, and the sheer inability of their administrative structures to respond to the humanitarian impacts, additional sufferings, stigmatisation and discrimination against vulnerable sections of society like workers and immigrants, to the economic, political, and cultural limitations of modern risk societies which remain structurally in denial of these issues underpinning them.

Fukushima has forced a number of technical experts, policy makers, social scientists, artists, and activists to summarise its lessons through their own prism and come up with relevant prescriptions. In India, however, while the government remains in complete denial of Fukushima and has turned its post-Fukushima safety audit to a ridiculously complicit exercise, it has resorted to silencing and even brutal repression against independent experts and citizen groups raising questions pertaining to nuclear power and safety after Fukushima.

India is one of the few countries which continue to pursue nuclear power in the post-Fukushima world. It has one of the earliest nuclear programs with a closed nuclear cycle from uranium mining to reprocessing, and its nuclear industry remains insulated from public scrutiny as it possesses both civilian and military capabilities. In fact the Indian government's readiness to

accommodate the interests of the global nuclear lobbies – devise ways to exempt them from nuclear liability, easily granting environmental and regulatory clearances and subsidising them through various direct and indirect ways – has made it an attractive destination for newer nuclear projects. The nuclear industry worldwide, amid general and terminal financial crises, continues to pin its hopes for a ‘nuclear renaissance’ on countries like India.

India has ambitious nuclear expansion plans and its overall long-term objective remains generating 275GWe, or 25% of its energy mix, by the year 2052 from nuclear power.¹ Most recently, the government has announced setting up 10 new Pressurised Heavy Water Reactors (PHWRs) of 700 MW capacity each by 2032.²

It is in the backdrop of India’s ambitious nuclear plans that safety concerns acquire even greater significance.

I. Research Question

The present research, undertaken with the support of the *Takagi Fellowship for Citizen Scientists 2014*, is an attempt to study a hypothetical scenario of a Fukushima-like accident in India. In order to envisage such a scenario and analyse the potential implications, the study has broadly identified three key areas in which it looks at the accident in Fukushima and builds up scenarios of a similar, hypothetical disaster in Fatehabad: (a) the accident in Fukushima and continuing attempts to stem it; (b) the responses by

1 Arvind Gupta, “India’s Nuclear Energy Programme: Prospects and Challenges” *Strategic Analysis*, Vol 35, No 3, May 2011, http://www.idsa.in/strategicanalysis/35_3/IndiasNuclearEnergyProgramme_agupta

2 “Cabinet approves construction of 10 units of India’s indigenous Pressurized Heavy Water Reactors (PHWR)” *Business Standard*, May 17, 2017 http://www.business-standard.com/article/news-cm/cabinet-approves-construction-of-10-units-of-india-s-indigenous-pressurized-heavy-water-reactors-phwr-117051700997_1.html

the government and operating company to rehabilitate and compensate the affected people; and (c) safety and regulatory cultures.

This study has chosen **Fatehabad** as a hypothetical case study. The Gorakhpur Atomic Power Project, currently under construction in Fatehabad district in the Indian State of Haryana is important mainly for three reasons - (a) it is at a very short distance from Delhi and the researcher has been engaged with the local communities for almost 8 years now, (b) the Indian government is setting up 4 'indigenous' CANDU-type reactors here, and it is more likely that the construction will begin soon and proceed without external hindrances, unlike in the case of the imported reactors planned in other parts of the country, and (c) it is relatively easy to envisage a loss-of-coolant (LOCA) accident in Fatehabad due to certain site-specific issues, which have been explained later in this report.

A Fukushima-like nuclear accident in India would likely get amplified and complicated manifold by the sheer density of population. Fatehabad district has a population of more than 9,40,000 and emergency evacuation and rehabilitation in Fatehabad would be an insurmountable challenge given the bureaucratic cobweb and its unaccountability. In general, the lack of independent nuclear regulator and public experts, absence of adequate administrative emergency responses, and largely uninformed and abjectly poor people would mean that any serious accident would become unmanageable.

A case study of what would be the implications of a Fukushima-

like accident in the Indian context has been attempted, taking into account the response in Japan at various stages of the accident and its implications. The experience and lessons of the Fukushima accident - beginning from initial emergency response and evacuation, to the attempts to contain the accident and decontaminate the area, and the relief and rehabilitation of the evacuees - have also been used in this hypothetical study to analyse the potential consequences of a similar accident in Fatehabad.

II. Research Methodology

This research study is, in large part, predicated on an assessment of the documents related to the Gorakhpur Nuclear Power Project (GNPP) available on the websites of the Nuclear Power Corporation of India Limited (NPCIL) and acquired through the Right to Information Act, 2005, interviews with independent experts, including former head of India's Atomic Energy Regulatory Board (AERB) about safety of the proposed project, consultations with local administrative officials of Fatehabad District about emergency preparedness and site-specific safety challenges, as well as discussions with local activists and community leaders in villages and towns in the 30 km radius of the upcoming project.

The booklet, recently published on the fourth-year anniversary of the accident by the Fukushima Booklet Publication Committee, the report of the Citizens Commission on Nuclear Energy, and the Independent Committee's report on Fukushima, have been used as basic resource materials to build a model based on four major themes - (a) technological response to the nuclear accident, (b)

emergency response for the people, (c) evacuation and rehabilitation, and, (d) the social and psychological effects.

III. Structure of the Research Study Report

This Report has three sections:

- 1. Fukushima: An Ongoing Accident and Its Lessons**
- 2. Gorakhpur Nuclear Power Project: Danger at Delhi's Doorstep**
- 3. India: In Denial of Fukushima, Unprepared for Nuclear Disasters**

SECTION I

Fukushima: The Ongoing Accident and Its Lessons

Nuclear accidents tell us something unique about nuclear technology. Nuclear meltdowns don't have anniversaries. In almost every other kind of industrial accident, repair, reconstruction and resumption of normal life can start from the next day. In case of a nuclear accident however, the radiation spewing from damaged reactors makes any semblance of normalcy impossible for decades. In other words, effects of nuclear accidents cannot be limited in time and space, unlike other industrial accidents of the modern time.

It is more than six years of the nuclear accident in Japan, which started on 11 March 2011 with a 9.0 magnitude earthquake in the Tohoku region of the country. The earthquake caused an unprecedentedly strong tsunami that knocked off crucial cooling systems of Fukushima Dai-Ichi nuclear power station, which hosted six reactors with a total capacity of 4,696 MW.³

Subsequently, hydrogen explosions were caused in three reactors over the next week as the extremely hot and radioactive reactor fuel started melting and the Zirconium foil around the fuel rods reacted with sea water poured to cool the plant as a desperate measure. This further compounded the accident and damaged the reactor buildings.⁴

³ "Japan Earthquake & Tsunami of 2011: Facts and Information " Live Science, May 7, 2015, <http://www.livescience.com/39110-japan-2011-earthquake-tsunami-facts.html>

⁴ "Six years on, Fukushima disaster is still unfolding. Why does India refuse to heed the warning?" Kumar Sundaram, Scroll.in, 10 March 2017, <http://www.catchnews.com/international-news/six-years-on-fukushima-disaster-is-still->

As far as 250 km from the crippled nuclear plant in Fukushima, huge quantities of highly radioactive substances like Strontium, Caesium, Plutonium and radioactive Iodine were released in the atmosphere and have been found.⁵ According to rather conservative estimates of the Tokyo Electric Power Company, which operated the Fukushima plant, between 20 trillion and 40 trillion becquerels of radioactive Tritium has been leaked into the Pacific Ocean.⁶ This January, Toshiba sent the most sophisticated robot inside the building to gauge the status of the melted fuel, which died within hours.⁷

1.1 Ongoing Radioactive Contamination

Till this day, TEPCo continues to pour hundred tons of water every day to keep the crippled plant's temperature under control.⁸ 800,000 tonnes of highly contaminated water has been stored in about 1,200 massive tanks scattered around the plant area over the past six years. Almost 300 tonnes of water is leaking every day out of these tanks and threatens to contaminate the entire Pacific Ocean⁹. TEPCo has arbitrarily dumped 850 tonnes¹⁰ of this water into the sea by labelling it less contaminated. Understandably, this

[unfolding-why-does-india-refuse-to-heed-the-warning-54116.html](#)

5 “The Fukushima Disaster: a chronology” WISE International, <https://wiseinternational.org/campaign/fukushima-disaster>

6 “Japan’s TEPCO discloses extent of nuclear plant leak” Live Mint, 04 August 2013, <http://www.livemint.com/Politics/31FHymkn59aD1rrpMCl0jO/Japans-TEPCO-discloses-extent-of-nuclear-plant-leak.html>

7 “Dying robots and failing hope: Fukushima clean-up falters six years after tsunami” The Guardian, 09 March 2017, <https://www.theguardian.com/world/2017/mar/09/fukushima-nuclear-clean-up-falters-six-years-after-tsunami>

8 “Fukushima catastrophe ongoing: Leakage on a daily basis’ ” Russia Today, 07 February 2017, <https://www.rt.com/op-edge/376607-leakage-radiation-fukushima-japan/>

9 “Radioactive Water Leaks from Fukushima: What We Know” Live Science, 13 August 2013, <https://www.livescience.com/38844-fukushima-radioactive-water-leaks.html>

10 “850 tons of ‘decontaminated’ Fukushima water dumped into ocean ” Russia Today, 15 September 2015, <https://www.rt.com/news/315350-fukushima-decontaminated-water-ocean/>

has invited angry reactions from independent experts.¹¹ TEPCo started building a huge underground ice-wall costing \$320 millions¹², purportedly to prevent this daily massive leak from washing off the entire plant into the Pacific, but the ice-wall proved ineffective¹³ and had to be abandoned in September 2016.

While the TEPCo made profit from the reactors, the financial burden of the accident has been passed on to the Japanese taxpayers. The estimated cost of Fukushima clean-up is exceptionally high for any human-made disaster in history – it could take 40 years¹⁴ and about \$188 billion¹⁵. And we are talking only about the immediate plant site. The financial, ecological and social costs involved just begin to unfold.

1.2 Irreparable Humanitarian Impacts

In the aftermath of Fukushima tragedy, nearly 200,000 people lost their livelihoods and were displaced as an area of 20-km radius around the plant had to be evacuated immediately. Thousands of heart-wrenching stories of broken families and shattered lives, administrative apathy and deception, efforts by the government to find alibis to reduce and deny compensation, and the resilient spirit of the common Japanese people are part of the larger story of evacuation in Fukushima.

11 “Is it safe to dump Fukushima waste into the sea?” The Guardian, 13 April 2016, <https://www.theguardian.com/environment/2016/apr/13/is-it-safe-to-dump-fukushima-waste-into-the-sea>

12 “Japan’s \$320 Million Gamble at Fukushima: An Underground Ice Wall”, New York Times, August 29, 2016, <https://www.nytimes.com/2016/08/30/science/fukushima-daiichi-nuclear-plant-cleanup-ice-wall.html>?

13 “Fukushima ice wall failing to deliver on promise”, Nikkei Asian Review, 28 September 2016, <https://asia.nikkei.com/Tech-Science/Tech/Fukushima-ice-wall-failing-to-deliver-on-promise>

14 “Five years on, cleanup of Fukushima’s reactors remains a distant goal” The Guardian, 11 March 2016, <https://www.theguardian.com/environment/2016/mar/11/fukushima-daiichi-nuclear-reactors-decommission-cleanup-japan-tsunami-meltdown>

15 “Japan nearly doubles Fukushima disaster-related cost to \$188 billion” Reuters, 9 December 2016, <http://www.reuters.com/article/us-tepco-fukushima-costs-idUSKBN13Y047>

Till this day, around 100,000 people continue to be displaced and they face unimaginable problems in coping up with life - economic hardship with subsidies slashed as time passes¹⁶, psychological stress due to the ever-haunting fear¹⁷ of radiation-borne diseases appearing on their bodies as well as social ostracism and marginalisation.¹⁸ These immense economic, social and legal battles that the people of once sleepy towns and villages are now faced with were not their choice.

The nuclear accident has proved to be insurmountable even in a technologically advanced country like Japan. The corporation operating the reactor - the Tokyo Electric Company (TEPCo), has been found making every effort since the accident to underplay it, minimizing responsibility by using under-counting the victims, and virtually blackmailing the authorities to let it go off the hook by threatening to disrupt electricity in Tokyo. In brief, TEPCo is too big to fail and the political system in Japan has rushed to save it at the tax-payers' expense.

A worldwide reckoning that the consequences of major nuclear accidents are insurmountable and nuclear technology is inherently prone to such disasters has followed the Fukushima nuclear disaster. Besides, the nexus between the nuclear industry and the political system has also been thoroughly exposed.¹⁹

16 “Thousands of Fukushima evacuees face hardship as slash of housing subsidies nears” Japan Times, 17 January 2017, <https://www.japantimes.co.jp/news/2017/01/17/national/thousands-fukushima-evacuees-face-hardship-housing-subsidies-slashed/#.WajRktRLdzA>

17 “Psychological impact of nuclear disasters like Fukushima more damaging than the risk from radiation, experts say” The Independent, 30 July 2015, <http://www.independent.co.uk/life-style/health-and-families/health-news/psychological-impact-of-nuclear-disasters-like-fukushima-more-damaging-than-the-risk-from-radiation-10428096.html>

18 Jacobs, Robert “Social Fallout: Marginalization After the Fukushima Nuclear Meltdown” Japan Focus: The Asia-Pacific Journal, Vol. 9, Issue 28, Number 4, 11 July 2011, <http://apjjf.org/2011/9/28/Robert-Jacobs/3562/article.html>

19 “Japan's atomic disaster due to 'collusion:' panel report” Reuters, 05 July 2012, <http://www.reuters.com/article/us-japan-nuclear-report-idUSBRE8640K420120705>

1.3 Lessons from Fukushima: Various Assessments and Citizens' Perspective

Since Fukushima, many studies have been conducted to look into various impacts and implications of the nuclear accident. This includes the official report of the Fukushima Nuclear Accident Independent Investigation Commission²⁰ at the behest of the National Diet of Japan, the report jointly published by the International Physicians for the Prevention of Nuclear War (IPPNW) and Physicians for Social Responsibility (PSR) in 2016²¹, the 2013 study by SciencesPo into the disaster evacuation²² and the study conducted by Greenpeace²³ about the ecological impacts on the 5th year of the accident.

The report of the Independent Investigation Commission on the Fukushima accident, submitted to Japan's National Diet in July 2012, was a wake-up call. Calling the Fukushima accident "man-made", the report held that the "accident was the result of collusion between the government, the regulators and TEPCO... They effectively betrayed the nation's right to be safe from nuclear accidents".

In 2013, UN Special Rapporteur on Right to Health, Anand Grover published his report after visiting Fukushima and

20 "The official report of the Fukushima Nuclear Accident Independent Investigation Commission" National Diet of Japan, <http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naaic.go.jp/en/report/>

21 "5 Years Living With Fukushima Summary of the health effects of the nuclear catastrophe", IPPNW/PSR Report <http://www.psr.org/assets/pdfs/fukushima-report.pdf>

22 "Disaster Evacuation from Japan's 2011 Tsunami Disaster and the Fukushima Nuclear Accident" 13 May 2013, SciencesPo, http://www.iddri.org/Publications/Collections/Analyses/STUDY0513_RH_DEVAST%20report.pdf

23 "Radiation Reloaded: Ecological Impacts of the Fukushima Daiichi Nuclear Accident" Greenpeace International, March 2016, https://www.greenpeace.de/sites/www.greenpeace.de/files/publications/gpj-fukushima-radiation_reloaded_report_issue_040316_lr_2.pdf

unequivocally laid out the discrepancies in the official narrative of post-Fukushima responses.²⁴ While his report describes how the government in Japan colluded with the industry in a systemic denial of the affects of the accidents on common people, it also asserts that a holistic view can be only obtained by putting citizens' right to health at the centre of discourse. He scathingly criticized the Japanese government's contempt for the people's right to health. It underlined the inefficient handling of the evacuation and clean-up process and inadequate response on serious questions of health, safety and employment faced by lakhs of Fukushima evacuees who have no hopes of returning.

In March 2014, a group of civil society organisations, in consultation with local communities and independent produced a report titled "10 Lessons of Fukushima: Reducing Risks and Protecting Communities from Nuclear Disasters".²⁵ This report by Fukushima Booklet Committee is brief but comprehensive as it covers the entire range of implications and lessons starting from safety aspects to the experiences of sufferings evacuees and enormous difficulties that they face in finding a new life and claiming their compensation and reparations. The report lists 10 key lessons of Fukushima as:

1. Do not be fooled by "Nuclear Power is Safe" propaganda
2. During an emergency, the basic premise is to run away
3. Access to information and leaving records is vital
4. People affected by the disaster have the right to a comprehensive health survey and disclosure of information

24 "Report of the Special Rapporteur on the right of everyone to the enjoyment of the highest attainable standard of physical and mental health, Anand Grover, Mission to Japan (15 - 26 November 2012)" Office of the UN Human Rights Commission, http://www.ohchr.org/Documents/HRBodies/HRCouncil/RegularSession/Session23/A-HRC-23-41-Add3_en.pdf

25 "10 Lessons from Fukushima Reducing risks and protecting communities from nuclear disasters" Fukushima Booklet Committee, http://fukushimalessons.jp/assets/content/doc/Fukushima10Lessons_ENG.pdf

5. To ensure food safety and to protect agriculture, forestry and fishery industries, citizens must participate in measurement. Information disclosure is also vital
6. Complete decontamination is impossible
7. The accident cannot be brought to a conclusion unless workers are given better treatment and healthcare
8. Rebuilding the daily lives and community of those affected is essential
9. Calling for participation of those affected by the disaster in the enactment and implementation of laws that are designed to protect them
10. Taxpayers are being made to bear the compensation costs

1.4 Lessons from Fukushima

A key lesson to be drawn from Fukushima is that the accident could have easily been worse. It was nothing but sheer luck that prevented much greater levels of human population impacts and contamination. Most of the radioactive materials released went over the Pacific Ocean because of the direction of the wind during the worst phase of the accident. By another such coincidence, the water filled pool in Fukushima Daiichi plant contained the irradiated spent fuel from Unit 4. This Unit had been shut down when the accident took place and its entire fuel was inside the pool. It started heating after the cooling loop was crippled and the pool's water almost started boiling.²⁶

Minister Naoto Kan was cautioned that a fire in pool 4 could

²⁶ Richard Stone, "Near miss at Fukushima is a warning for U.S, Science 27 May 2016: Vol. 352, Issue 6289, pp. 1039-1040 <http://science.sciencemag.org/content/352/6289/1039>

require compulsory relocations out to 110–170 kilometres from the reactor site and voluntary relocations out to 200–250 kilometres.²⁷ This message, sent to the Japanese Prime Minister by Shunsuke Kondo, the chairman of Japan's Atomic Energy Commission, on 25 March 2011, meant that the people in Tokyo might have been forced to evacuate. This would have been a logistical nightmare.

The water levels in this pool had come close to below the top of the fuel rods, according to a model developed by the U.S. National Academy of Sciences.²⁸ The prevented water levels were luckily prevented from dropping further low by the water leakage from the reactor. There could have been a fire leading to the release of large amount of radioactivity if the excessive heating had generated fire.

Another lesson is that nuclear accidents of serious nature cannot be confined in time. Fukushima, as Arjun Makhijani of the Institute for Energy and Environmental Research phrased it, “is possibly the longest running, continuous industrial disaster in history”.²⁹ Radioactive contamination from such accidents might live for decades. Responses to such nuclear accidents are not just about repairing the infrastructural damage.

A crucial pointer to the complexity of the ongoing effort to deal with the Fukushima meltdowns is the recent discovery of high levels of radiation within Unit II. These levels are so high that even robotic

27 Frank N. von Hippel, Michael Schoeppner, "Reducing the Danger from Fires in Spent Fuel Pools," *Science & Global Security* 24, no. 3 (2016): 141-173, http://scienceandglobalsecurity.org/archive/2016/09/reducing_the_danger_from_fires.html

28 “Lessons Learned from the Fukushima Nuclear Accident for Improving Safety and Security of U.S. Nuclear Plants” National Academy of Sciences, Engineering and Medicine, <https://www.nap.edu/catalog/21874/lessons-learned-from-the-fukushima-nuclear-accident-for-improving-safety-and-security-of-us-nuclear-plants>

29 “Radiation Spikes At Fukushima” interview with Dr. Arjun Makhijani, *Living on Earth*, 17 February 2017, <http://www.loe.org/shows/segments.html?programID=17-P13-00007&segmentID=6>

cameras cannot operate in that environment for long.³⁰

TEPCO's early promise³¹ that it would start removing the melted fuel from these reactors by 2021 is bound to fail. As Safecast pointed out "The process of removing melted fuel debris from the damaged reactors at Fukushima Daiichi is expected to take decades, and these recent findings remind us once again that TEPCO has little grounds for optimism about the challenges of this massive and technically unprecedented project".³²

Tens of thousands of people who were evacuated from the regions surrounding Fukushima are yet to return to their homes.³³ The lesson is that the human and social impacts of nuclear accidents are also long lived. Japan's government and plant authorities would like to reduce this number soon using their callous methods³⁴. This is because of the rising financial responsibilities as well as the enormous public image-building exercise that Japan is undertaking in the wake of the upcoming 2020 Olympics games.

Japanese authorities are removing the restrictions for people to move back to areas that were earlier deemed contaminated. However, this comes with a condition that this would end housing subsidies for such evacuees.³⁵ People are moving to areas with

30 "Fukushima Daiichi NPS Prompt Report" TEPCO Holdings, 10 February 2017, http://www.tepco.co.jp/en/press/corp-com/release/2017/1375551_10469.html

31 "Mid-and-long-Term Roadmap towards the Decommissioning of Fukushima Daiichi Nuclear Power Units 1-4, TEPCO" 21 December 2011, http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/111221e10.pdf

32 "No, radiation levels at Fukushima Daiichi are not rising" Safecast Blog, 4 February 2017, <https://blog.safecast.org/2017/02/no-radiation-levels-at-fukushima-daiichi-are-not-rising/>

33 "Recovery and Reconstruction from the Great East Japan Earthquake" Japan Reconstruction Agency, http://www.reconstruction.go.jp/english/topics/Progress_to_date/index.html

34 "The 2020 Olympics, Fukushima and Trust" WISE International, 10 October 2013, <https://www.wiseinternational.org/nuclear-monitor/769/2020-olympics-fukushima-and-trust-%E2%88%92-mv-ramana>

35 "Financial crunch time looms for Fukushima's 'voluntary evacuees'" Japan Times, 7 March 2017, <https://www.japantimes.co.jp/news/2017/03/07/national/social-issues/financial-crunch-time-looms-fukushimas-voluntary-evacuees/#.Waj3HdRRLdzB>

relatively high radiation levels as a consequence.³⁶

Besides human beings, animals were also affected by the accident as evacuees in Fukushima were not allowed to take their pets with them. Many of the abandoned pets starved to death but some animals are still alive. They are trapped in the exclusion zone and are probably contaminated. Some volunteers have saved hundreds of animals in Fukushima.³⁷ On birds like barn swallows, studies have shown negative impacts.³⁸ Much like Chernobyl, forest areas around Fukushima have also been contaminated;³⁹ Fires in these abandoned forests in subsequent years have also become an additional source of risk for spread of radioactivity.

Learning from the triple meltdowns in Japan, a number of countries have moved away from nuclear power generation. The 2016 World Nuclear Industry Status Report⁴⁰ underlined this terminal and irretrievable decline of the fortunes of nuclear lobbies. The downfall has only been further exacerbated by the near-collapse of French and Japanese nuclear giants like Areva and Toshiba in recent months⁴¹ as well as decisions by countries such as Taiwan⁴² and Vietnam⁴³ to shun nuclear power and scrap nuclear

36 “Fukushima evacuees face 'forced' return as subsidies withdrawn” The Guardian, 10 March 2017, <https://www.theguardian.com/world/2017/mar/10/japan-fukushima-nuclear-disaster-evacuees-forced-return-home-radiation>

37 Japanese Animal Rescue Fund-Raiser, <https://www.gofundme.com/JapanAnimalRescue>

38 “Abundance and genetic damage of barn swallows from Fukushima” Scientific Reports 5, Article number: 9432, 02 April 2015, <https://www.nature.com/articles/srep09432>

39 Winifred A. Bird and Jane Braxton Little, “A Tale of Two Forests: Addressing Postnuclear Radiation at Chernobyl and Fukushima”, Environment and Health Perspectives,

40 World Nuclear Industry Status Report 2016, <https://www.worldnuclearreport.org/-2016-.html>

41 Green, Jim. “Nuclear Power Is In Crisis As Cost Overruns Cripple Industry Giants ” New Matilda, 26 February 2017, <https://newmatilda.com/2017/02/26/nuclear-power-is-in-crisis-as-cost-overruns-cripple-industry-giants/>

42 “Taiwan joins global anti-nuclear trend” Asia Times, 18 January 2017, <http://www.atimes.com/article/taiwan-finally-joins-anti-nuclear-movement/>

43 “Vietnam abandons plan for first nuclear power plants” Reuters, 22 November 2016, <http://www.reuters.com/article/us-vietnam-politics-nuclearpower/vietnam-abandons-plan-for-first-nuclear-power-plants-idUSKBN13H0VO>

deals.

Section II

Gorakhpur Nuclear Power Project: Danger at Delhi's Doorstep

The Nuclear Power Corporation of India Limited (NPCIL), India's state-owned nuclear operator, is setting up a huge nuclear power plant comprising of four on 'indigenous' CANDU-type heavy water reactors in Haryana, the state neighbouring New Delhi, the national capital of India. This nuclear plant would have a total capacity of 2,800 MWe, with four reactors of 700 Mwe each.

2.1 Location of Proposed Nuclear Plant

The final selection of site for the nuclear plant was approved in early 2010 after a to the villages of Gorakhpur, Kumharia & Kajal Heri in Fatehabad district by a high level land selection committee from NPCIL, comprising of engineers & managers. In the first phase, two nuclear reactors are planned. Initially, the name proposed was "Kumharia NPP" but it was later changed to Gorakhpur NPP, as most of the land to be acquired is from Gorakhpur village.

Gorakhpur is about 210 kms by road from Delhi, but the straight-line distance is just about 150 kms. Gorakhpur village has an old history and is quite big in size. Famous religious saint Baba Gorakhnath was born in this village in 11th century and the village remains a significant site of pilgrimage for the followers of his sect.

A small part of land has also been acquired from 'Kajal Heri', a beautiful village inhabited by Bishnoi community.

Gorakhpur is at a distance of 22 kms from the district headquarter Fatehabad. Fatehabad town and its surrounding villages were given the status of a district in 1997. The town houses the district headquarters and other governmental offices, besides colleges, schools and other institutions. As per the 2011 census, the Fatehabad district



has a population of 941, 522, roughly equal to the nation of Fiji.⁴⁴ Its population growth rate over the decade 2001-2011 was 16.79 %. Fatehabad has a sex ratio of 903 females for every 1000 males and a literacy rate of 69.1 %. Fatehabad has a history dating back to the 14th century, when Delhi's emperor Feroz Shah Tughlaq founded it and named it after his son Fateh Khan. The district thrives on a well-grown farming economy and the town is an important centre for agricultural trade. Most of the arable land in the district produces three crops a year and an affluent farming community is the key contributor to its rising economy. It is said to be the biggest pesticides market in Haryana. The climate of the district is of tropical type with intensively hot summer and cool winter, with a temperature of 47° in June and 2° celsius in December and January. The average rainfall of the district is 400

mm. The district is home to many small and medium sized industries, mostly catering to the local agriculture and trade.⁴⁵

2.2 Project Status

Land (1600 acres) has been acquired and preliminary work is on. Compensation amount ranging from Rs. 12,00,000 to 44,00,000 bper acre was used to effectively bribe the land owners in the area. About 1313 acres from Gorakhpur village, about 185 from Badopal village, and 3-5 acres from Kajal Heri have been acquired. The first notification to acquire the land - was issued on July 29, 2010 under Section 4 (urgency clause) of the archaic & colonial Land Acquisition Act 1894. In 2013, the Chandigarh High Court dismissed a writ petition filed by a small section of the landowners against acquisition.⁴⁶

45 " Brief Industrial Profile of Fatehabad District" MSME-Development Institute, Karnal, Haryana
http://dcmsme.gov.in/dips/har_fatehabad.pdf

46

"HC rejects petitions against nuclear plant in Haryana village" Times of India, May 17, 2013
<http://timesofindia.indiatimes.com/india/HC-rejects-petitions-against-nuclear-plant-in-Haryana-village/articleshow/20100088.cms>

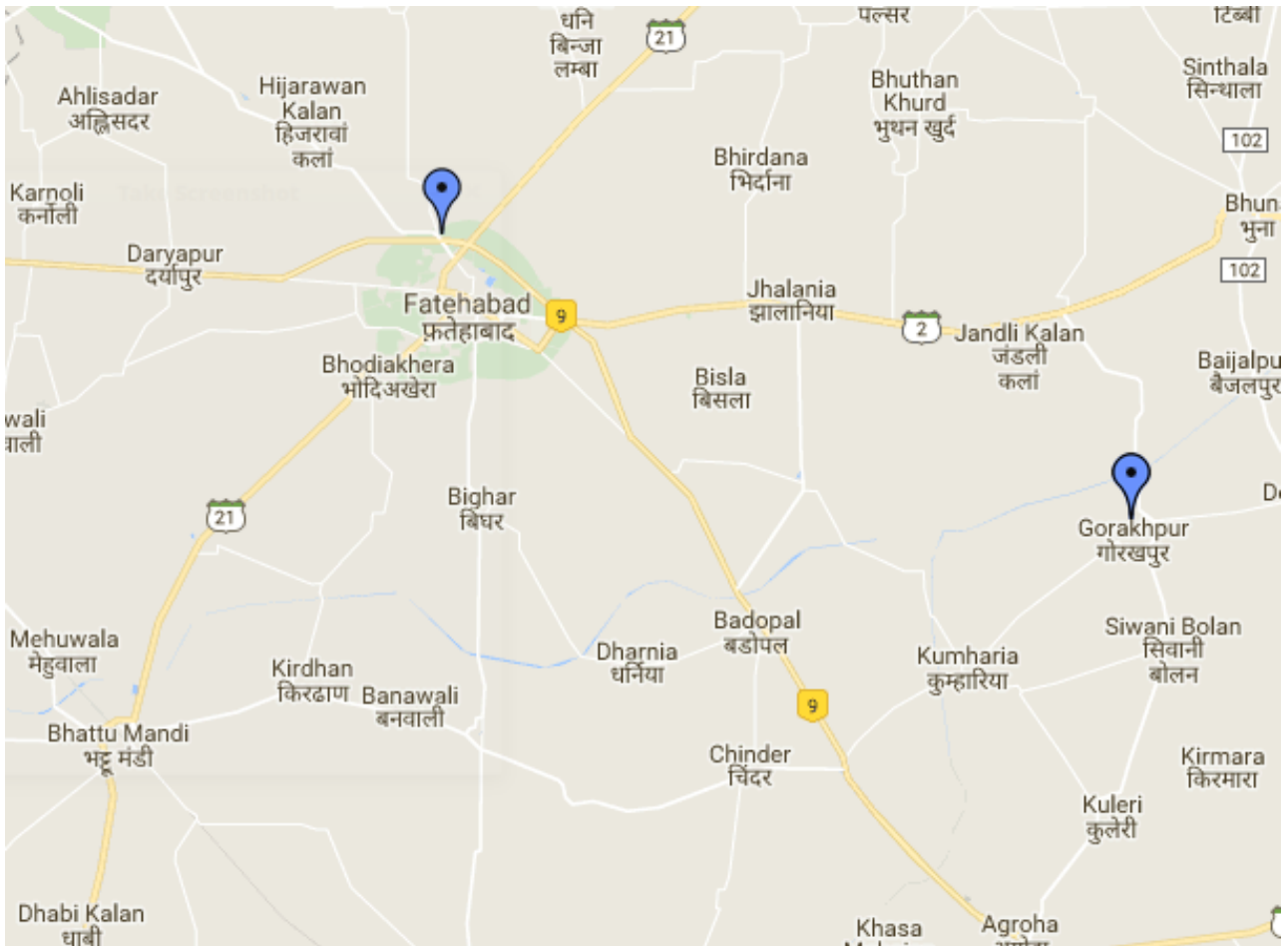


Illustration 1: location map of the proposed Gorakhpur Nuclear Power Plant

2.3 Proposed Township for the Staff of Gorakhpur NPP

In 2013, the principal bench of the National Green Tribunal ordered a stay on fencing of the 185 acres of land near Badopal village, which the NPCIL had acquired for construction of a township for the staff who would work at the proposed Gorakhpur nuclear plant. With a population of around 20,000, this village dominated by Bishnoi community had been resisting the township since its inception. The Bishnoi community has a traditional reverence for the black buck and other animals in the locality. The community leaders had moved the National Green Tribunal seeking removal of fencing as it killed several black-bucks. The Bishnoi community also

gave an ultimatum to the district administration in this regard.⁴⁷ The Wildlife Institute of India, entrusted with preparing a conservation plan for blackbucks, had told NPCIL to vacate the land acquired by it for its residential colony.⁴⁸ As of now, only pre-project activities are underway – construction of two water storage tanks with a capacity of 45.5 million litres, a few approach roads, a meteorology lab and prefab offices.



Illustration 2: A model of GNPP (Image courtesy: The Tribune)

Lacking this clearance, the construction on the site has not started even after more than 3 years of foundation-laying ceremony by the previous Prime Minister. Haryana’s Principal Secretary (Power) was quoted by the media saying that the government was suffering a financial loss of Rs 7 to 8 crore per day for the delay of the project.⁴⁹

47 “Nuclear threat to Badopal wildlife” Times of India, July 17, 2013, <http://timesofindia.indiatimes.com/home/environment/flora-fauna/Nuclear-threat-to-Badopal-wildlife/articleshow/21113136.cms>

48 “Ground Zero at Gorakhpur” The Tribune, 7 May 2017, <http://www.tribuneindia.com/news/sunday-special/perspective/ground-zero-at-gorakhpur/403248.html>

49 “Year on, construction yet to begin on Gorakhpur N-plant” 11 Jan 2015, <http://www.tribuneindia.com/news/haryana/year-on-construction-yet-to-begin-on-gorakhpur-n-plant/28814.html>

This also is a brazen violation of the norms of Atomic Energy Regulatory Board which disallow any habitation of over 10,000 people within the 'sterile' zone, 5 kms from the boundary of any nuclear plant. There are densely populated towns like Fatehabad, Ratiya and Tohana nearby where tens of thousands of people will be endangered in case of a major radioactive leak or accident. Even Hisar, a city with with a population of over 200,000, is only around 40 kilometers away.

2.4 Local Resistance Against the Project

Hoping that the nuclear project would bring jobs and development in the area and the land prices will go up, initially the villagers welcomed it. However, starting August 2010 they are strongly resisting the project, and a struggle committee of local farming community - Kisan Sangharsh Samity - was formed. It started a continuous sit-in protest in front of the mini-secretariat at Fatehabad town, which lasted more than 3 years. Both an understanding of loss of agricultural livelihood in the longer term and awareness about potential risks of having a nuclear power plant in the vicinity worked behind this resistance. In spite of a sharp increase in the offered compensation by the Haryana Government, the Kisan Sangharsh Samity kept its determination not to give land for the NPP until the end of 2013. The authorities were able to break the movement using stick and carrot policy. Besides, the villages whose land was acquired, several peripheral villages also joined the resistance after becoming aware of the unacceptable risks they will face from the nuclear plant. A number of civil society activists and independent experts from across India have visited Fatehabad to extend solidarity to the ongoing movement.

Fatehabad district has a thriving agricultural economy, and many small industries and trades centred around its agriculture contribute substantially to the district's prosperity. Wheat, mustard, rice and cotton are primary agricultural products in Fatehabad. Rich harvests in the district sustain a number of agro-based industries like rice mills, cotton ginning units, oil extraction mills etc. Vegetables are also grown, along with orchards being developed in some areas. The district is said to be the largest pesticides market in the state of Haryana.

Bhakra branch canal came in this region in early 1970s. With its plentiful water supply, it has proved to be the lifeline of the whole area. Farmers in Fatehabad district produce three crops a year in the region, despite less than 400mm annual rainfall, primarily because of this canal. Productivity of the land can be guessed from the fact that absentee landowners rent the land to tillers at the rate of Rs.30,000 - 45,000 per acre annually, compared to about Rs.20,000 in most other areas of Haryana. The green cover in Fatehabad is also much denser than other districts in Haryana or Punjab.

Another direct benefit of these lush green surroundings is the abundance of wild life in the area, compared to relatively biodiversity-barren landscapes of most of Haryana and Punjab. Large numbers of birds including a variety of Kingfishers are seen around here. The area - Bishnois being a large presence in many villages - also boasts of the presence of several hundred Black-bucks, which are seen roaming around fields and tree covered areas freely. This area deserves to be declared a people's wild-life sanctuary, in view

of its bio-diversity importance in Haryana. If the NPP is allowed to come up in this “Kashmir of Haryana” (as local activists call it), all these remnants of a beautiful landscape will be lost forever.

The proposed site being hardly 150 KMs from Delhi as-the-crow-flies, in case of any major radioactive leakage, or accident, the wind patterns will easily bring the radioactive release to the doorsteps of Delhi and NCR. Radioactive fall-out in the case of Fukushima reactor accidents were minimised because of the Pacific Ocean and the prevailing wind blowing into it. Gorakhpur in Fatehabad is surrounded by thickly populated villages & towns, Hissar being the closest large town with a population of over 200,000. The district of Fatehabad has a population of well over 8,00,000, and the wind - whichever direction it blows - will carry all that radioactive contamination into densely populated areas, including Delhi & NCR. Not a very attractive prospect for us indifferent urbanites either.

Realising these grave dangers and against the insane drive for dangerous nuclear (fission) power, many groups - both from Haryana and from elsewhere in the country, including Delhi, have got together to support and strengthen the resistance struggle lead by the farmers of Fatehabad district. A large no of discussion meetings in villages around the site, and also in many towns of Haryana, have been organised jointly - to make people aware of the extreme dangers, about various aspects of nuclear power and the imminent threat to the vibrant agro-economy of the area. Nearly 30 villages have passed resolutions opposing the proposed Gorakhpur NPP, and expressing their determination not to allow it to come up here and spoil their beautiful land. Many prominent

citizens in Fatehabad and other districts of Haryana have also joined this struggle against destructive nuclear power. In the weeks and months to come, the outcome will be decided by how many more groups and people rise up against this and resist this dangerous plant with what strength.

2.5 Grave Risks in Gorakhpur

The under-construction plant in Fatehabad poses real risk of undergoing major accident due to 3 main reasons:

1. The NPCIL has no experience in constructing and running reactors with capacity higher than 550 MWe. Gorakhpur would be first of its kind construction, a major scaling-up of the Pressurised Heavy Water designs that the NPCIL mastered by reverse-engineering CANDUs that it got from Canada in 1950s and 60s, and now calls them indigenous designs.
2. The water supply to the reactor is inadequate and in the event of an accident it would escalate the severity, potentially leading to major Loss-of-Coolant accident (LOCA) like Fukushima.
3. Regulatory and disaster response structure in Fatehabad in particular and India in general is unreliable, unaccountable and grossly unprepared to handle a nuclear emergency.

2.6 First-of-its-kind scaling up of PHWRs

The GNPP reactors would be modelled after NPCIL's existing reactors at the Kakrapar Atomic Power Station in Gujarat. In a recent interview, R K Khera, GNPP's Project Director, said that the design is technically tested at KAPS, the model can be replicated and construction can start at Gorakhpur.⁵⁰

⁵⁰ "Ground Zero at Gorakhpur" The Tribune, 7 May 2017, <http://www.tribuneindia.com/news/sunday-special/perspective/ground-zero-at-gorakhpur/403248.html>

However, the PHWR design of 550 MW capacity at Kakrapar – India’s largest operating reactor so far, has come under severe criticism after a major accident last year. The accident took place coincidentally on the 5th year anniversary of Fukushima – 11 March 2016. Actually, the accident in Kakrapar Unit-2 which led to an on-site emergency and reactor shut down, might ironically have been a result of using sub-standard equipments during the post-Fukushima safety enhancement carried out by the NPCIL.⁵¹

While the accident in KAPS was underway, Dr. A Gopalakrishnan, the former head of the Atomic Energy Regulatory Board (AERB) cautioned: ““Some reports indicate that the containment has been vented to the atmosphere at least once, if not more times , which I suspect indicates a tendency for pressure build up in that closed space due to release of hot heavy water and steam into the containment housing . If this is true, the leak is not small, but moderately large, and still continuing. No one confirms that any one has entered the containment (in protective clothing) for a quick physical assessment of the situation , perhaps it is not safe to do so because of the high radiation fields inside...all this points to the likelihood that what Kakrapar Unit-1 is undergoing is a small Loss-of-Coolant Accident (LOCA) in progress. It is most likely that one or more pressure tubes (PT) in the reactor (which contain the fuel bundles) have cracked open, leaking hot primary system heavy-water coolant into the containment housing”⁵²

51 Kumar Sundaram, “Nuclear leak in Kakrapar may be more serious than the government is telling us” Scroll, 11 March 2016, <https://scroll.in/article/805119/nuclear-leak-in-kakrapar-may-be-more-serious-than-the-government-is-telling-us>

52 “Kakrapar Nuclear Plant Is Likely Undergoing A Loss-Of-Coolant Accident: Dr. A. Gopalakrishnan” DiaNuke.org, 12 March 2016, <http://www.dianuke.org/kakrapar-nuclear-plant-likely-undergoing-loss-coolant-accident-dr-gopalakrishnan/>

The KAPS also underwent a severe accident in 2004, when the control rods were irreparably damaged during maintenance work. Another leak of heavy water, on March 11, 2011, led to a shutdown. Actually, the Unit-1 of Kakrapar reactor was commissioned in 1993 without proper testing of its Emergency Core Cooling System, which is a major source of its vulnerability.⁵³

Another 'teething trouble' than could become a reason for major potential accidents in future is the loose soil beneath the ground in Gorakhpur, with water table at 3-4 meters at the site. Although the Project Director of GNPP has told the media that the soil will be treated and the issue will be sorted, independent experts believe that rocky soil is more suitable for nuclear reactors.

2.7 Inadequate Water Supply: Invitation to Major Accidents

Gorakhpur project would consist of 4 reactors of 700MW each. This will be India's largest indigenous nuclear power project built so far. The reactor complex would require 320 cusecs of water for cooling and other purposes. But the entire project will depend for water on a small Canal, Fatehabad branch of the Bhakhra Canal, which is the main source of water for irrigation in the region. This is perhaps the only project in the world to have such limited and unreliable source of water supply. Water would pose three huge problems in Gorakhpur: the water will be inadequate even for the cooling of reactors in their normal operation; in case of an accident, the situation could be worse than even Fukushima due to non-

⁵³ T S Subramanianm, "Safety concerns", Frontline magazine, Vol 21, Issue 13, June 19-July 2, 2004
<http://www.frontline.in/static/html/fl2113/stories/20040702003809900.htm>

availability of water, and the high temperature of the discharge water from the reactor would destroy the agriculture in the downstream of the canal which dozens of villages depend use for irrigation.

A regulatory requirement of the Atomic Energy Regulatory Board (AERB) is that “if the minimum water supply required for long term heat removal from the core cannot be ensured under all circumstances, then the site shall be deemed unsuitable. Availability of adequate quantity of water to maintain the reactor under safe shutdown state for at least thirty days needs to be ensured under all circumstances.”⁵⁴

For more than 20 days in the summer of 2013, the Bhakhra Canal was closed for maintenance. The canal was almost dry and both Fatehabad town and surrounding villages are reeling under acute water crisis. When local activists raised their concerns about risks of dangerous accidents in such situations, the NPCIL officials came up with the following contradicting and unconvincing assurances in the vernacular media:

- We are researching for reactors which will consume less water
- We will take water from the western Yamuna canal. That is 200 kms away from the proposed site and if people on the other side of Haryana come to know about this plan, there will be major unrest against it.
- We will store water for one month. Even the EIA talks of only 1 week of water storage.
- In a meeting with the local activists, the District Collector

⁵⁴ Amita Bhaduri, “Fatehabad nuclear project: a Fukushima in the making?” DiaNuke.org, 28 August 2017, <http://www.dianuke.org/fatehabad-nuclear-project-fukushima-making/>

apparently said off-the-record that he will recycle the Fatehabad sewage water and supply it to the reactor!

For its enormous water requirement, this large nuclear power plant will be entirely dependent on the Bhakhra Canal, as the area has no perennial rivers or any other water-bodies like a dam or lake.

Nuclear energy consumes 400 gallons/MWh with once-through cooling and 720 gallons/MWh with wet cooling towers.⁵⁵ Coal consumes less, ranging from about 300 gallons/MWh for plants with minimal pollution controls and once-through cooling to 714 gallons/MWh for plants with advanced pollution control system and wet cooling towers. Water supply to the under construction nuclear power plant in Gorakhpur, from the Bhakhra canal is inadequate, and would have dangerous consequences in case of an accident.

The nuclear plant in Gorakhpur would take around 320 cusecs of water from the Bhakhra Branch Canal. As per the original Bhakra water sharing agreement of 1959 between Punjab and Rajasthan water is meant only for irrigation and hydel power generation. Therefore diverting a huge quantity of 320 cusecs, meant to irrigate over 130,000 acres (allocation of 2.25 cusecs per 1000 acre) for a nuclear power plant is illegal and violative of Right to life under Article 21 of the Constitution. Some other significant questions concerning water in GNPP are listed below⁵⁶:

- i. Bhakra Water Sharing Agreement 1959 between Punjab and Rajasthan restricts the use only for irrigation and generation of hydel power. It is in the opening para itself.
- ii. The allotment for irrigation in the culturable command area

⁵⁵ Bahman Zohuri, Patrick McDaniel, "Thermodynamics In Nuclear Power Plant Systems" Springer 2015, page-444

⁵⁶ Devasahayam, MG, "Haryana's Nuclear Power Plant: Inviting Disaster" DiaNuke.org, 30 December 2013, <http://www.dianuke.org/haryana-nuclear-power-plant-inviting-disaster/>

according to the Agreement is 2.25 cusecs per thousand acres

- iii. 2800 MW GNPP water requirement, to be supplied from the Fatehabad Branch is 320 cusecs. According to the allotment this quantum that can irrigate about 142, 000. Even if we take into account 30% of water that would be returned to the canal after cooling the irrigated area lost would be about 99,000 acres.
- iv. Can such a huge quantum of water be diverted for generating nuclear power, which is not provided for in the Agreement, at the cost of irrigation.
- v. In the alternative can Haryana get extra allocation to provide water for nuclear power generation? Even if Haryana gets extra water can it be conveyed to the project site?
- vi. There is contradiction in the claims of NPCIL. Passage marked in red talks of returning 50% of water to the canal while the actual quantum mentioned in the passage marked in green is only 30%. Is this not deliberate misleading?
- vii. As per nuclear experts residual water after cooling the reactor will have radiation and therefore unfit for irrigation and drinking water downstream.
- viii. Water is the most critical, but most constrained input for the nuclear plant with several adverse ramifications and effects. While other issues have been dealt with in great detail in the EIA, water issue has been dealt with in less than two pages in an almost arbitrary and dismissive manner.
- ix. Commitment letter from Government of Haryana (Annexure III)

looks abrupt and signed by an Executive Engineer referring to some decision by CM. Is it tenable and legally valid?

- x. Haryana letter is not sure about the dependability of Fatehabad Branch supply and talks of alternative supply through Sirsa Canal. This has not been dealt with properly in the EIA, leaving the critical water issue high and dry.
- xi. This is for the normal operation/reactor cooling. In case of any accident during operation huge quantum of water on a continuous basis would be required as it happened in the Fukushima case. From where will this water come.
- xii. EIA talks of 15 day closure of Fatehabad Branch once in 10 years. But as per media reports there have been frequent closures. This canal was lying closed almost for the entire month of April.
- xiii. There are reports that Gobindsagar dam itself is facing water storage problems due to sedimentation and poor rains and there have been frequent reductions in water release. Agriculture at least can adjust. But it will be disaster for a 2800 MW nuclear plant in operation. This has not been addressed at all.
- xiv. Radiation and other impacts on downstream land, farming, drinking water for human and animals have not been addressed. This is a serious flaw.

2.8 Disconcerting Absence of Any Disaster Preparedness

In 2013, the Ministry of Forest and Environmental Affairs (MoEF) awarded environmental clearance to the Gorakhpur project with several conditions, including one which requires the NPCIL to make an emergency evacuation plan at the earliest.⁵⁷

The foundation stone of the Gorakhpur nuclear power plant was laid on 13 January 2014 by the then Prime Minister Dr. Manmohan Singh. The NPCIL then estimated that construction of first phase of the plant – consisting of two reactors – would finish by the year 2021.⁵⁸ The estimated cost of the plant is Rs. 20,594 Crore. The state government has also been announcing it with pride, as it is the first Nuclear Power Plant in Haryana. While laying the foundation stone, the Prime Minister claimed that GNPP would fulfil the State’s energy needs, but the reality is that Haryana is already a power-surplus state.⁵⁹ In presence of the Chairpersons of NPCIL and AEC, the Prime Minister promised that no one will be displaced for construction of this plant. However, later, when local farmers actually refused to move away from the acquired land, they were evicted brutally by using police force.⁶⁰

Stipulations of the Atomic Energy Regulatory Board also require NPCIL to submit detailed emergency evacuation plans, but it is yet to materialise. The AERB has given a formal siting consent for the project in July 2015.

57 “Proposed Haryana nuke plant gets environment ministry’s conditional nod” Times of India, 30 December 2013, <http://timesofindia.indiatimes.com/home/environment/developmental-issues/Proposed-Haryana-nuke-plant-gets-environment-ministrys-conditional-nod/articleshow/28117870.cms>

58 “Prime Minister Dr. Manmohan Singh Lays Foundation Stone of 2800 MW Gorakhpur Haryana Anu Vidyut Pariyojana (Nuclear Power Project)”. Press Information Bureau, Government of India. 13 January 2014, <http://pib.nic.in/newsite/erelease.aspx?relid=102476>

59 “Power-surplus Haryana struggles to find buyers ” Hindustan Times, 17 October 2013, <http://www.hindustantimes.com/chandigarh/power-surplus-haryana-struggles-to-find-buyers/story-Q5A32m16tGjOm3HwbV9MIO.html>

60 “Police evict farmers from land for nuclear plant” The Tribune, 28 May 2015, <http://www.tribuneindia.com/news/haryana/community/police-evict-farmers-from-land-for-nuclear-plant/86187.html>

This is a major concern as the area around the upcoming project is densely populated, consists of hundreds of thousands of farmers with no vehicles of their own and even roads in the area might not be enough for emergency evacuation at such mammoth scale. Local activist Yashveer Arya, during an interview for this research, said - “we have been knocking at the doors of authorities for a credible evacuation plans so that people in the region could be relocated swiftly in case an accident takes place. We have to run from one bureaucracy to the other, from the district administration to the state level officials, from NPCIL office to filing Right to Information queries to the AERB. But so far, the authorities have failed to give us any such plans. All we have are empty assurances that the government can handle a nuclear accident situation. But what we know for sure is that there is no area with sparse population in the whole state or even neighbouring states where tens of thousands of people could be evacuated in case of a major catastrophic accident.”

The ‘exclusion zone’ of 1.6 KMs from the plant boundary will be outside this land acquired in Gorakhpur village. However, the local population has been traditionally using this land for grazing cattle and other common purposes and it will lose control of large parts of land in the vicinity even without formal acquisition as this land will become difficult to access. The ‘sterile zone’, an area of 5 kms as per AERB norms where artificial growth of population must not be allowed once the reactors come up, also already contains a large population, which will face adverse health impacts of the nuclear power plant and will live in constant fear of a catastrophe.

Besides, an 'Emergency Preparedness Zone' of 16 kms is also stipulated by the AERB for which an emergency evacuation plan has to be drawn by the local authorities in consultation with the NPCIL and AERB. Broadly, this zone is divided into 16 parts and in case of an accident, these segments have to be evacuated or shifted as per the circumstances. The AERB's rule is clear that emergency preparedness plans must be in place before the NPP's operation is licensed. There are 2 major kinds of emergencies - on-site and off-site.

As per the existing norms, off-site emergencies have to be handled by state authorities with technical inputs from the nuclear operator. This researcher, along with local activists and doctors, approached local authorities but they either refused to give any details at this stage or responded that the NPCIL is yet to provide them with an emergency plan.

Zones around nuclear reactors in India (as per AERB norms)	Area	Permissible population
Exclusion Zone	1.6km	
Sterilised Zone (Controlled Population Zone)	5kms	Less than 20 thousand
Emergency Preparedness Zone	16kms (Primary - 8km/secondary- 16kms, divided into 16 sectors)	Distance of population centres (>10000 persons) should be more than 10km
Environmental survey zone	30km	Distance of large population centers

		(>100000 persons) should be more than 30 km
Sources:		
1) AERB Chairman SS Bajaj's presentation at the US NRC, September 2014 - https://www.nrc.gov/docs/ML0425/ML042540084.pdf		
2) Answer in parliament by Minister of State for PMO, 1 December 2011, http://www.dae.nic.in/writereaddata/rsus1094_011211.pdf		

2.9 Nuclear Liability for Gorakhpur

In 2016, the NPCIL sought fresh bids from suppliers of equipments for Gorakhpur Nuclear Power Plant, based on new definition of suppliers laid down in the 2011 Nuclear Liability Rules. "We have gone the extra mile to address the concerns of equipment suppliers," S K Mazumder, Executive Director for contract and material management at the NPCIL was quoted in a media interview. "We now expect good support and understanding from our suppliers. We don't want to lose any more time to take the nuclear program forward."⁶¹

The NPCIL last sought bids from local equipment manufacturers for the project almost two years ago. But few component makers bid for the project then, as they felt the contract didn't provide enough safeguards against the liability law, according to Y.S. Trivedi, senior vice-president for heavy engineering at Larsen & Toubro Ltd.

⁶¹ "NPCIL seeks new bids for Gorakhpur nuclear power plant" Live Mint, 28 July 2016, <http://www.livemint.com/Industry/2rOqsVXrbrTo79k4UgbXsJ/NPCIL-seeks-new-bids-for-Gorakhpur-nuclear-power-plant.html>

Sekhar Basu, Secretary of India's Atomic Energy Commission (AEC) said that the NPCIL will introduce clauses in tender documents that will exclude component manufacturers for domestic projects from liability provisions. These companies can't be termed as suppliers as they work under "our supervision and according to our design specifications, right from design to construction and fabrication,"

This weakening of nuclear liability would mean that in case of an accident in Gorakhpur, the liability for the victims would be ridiculously limited and they would not be able to sue the suppliers directly.

2.10 Political Parties Take Turns to Support the Project which they had Labelled 'Risky'

Political parties in Haryana state have to heed to people's sentiments when they are in opposition. That is why the Bharatiya Janata Party(BJP), opposed the nuclear project when it was in opposition. But once in power, the BJP has made a complete u-turn and its Chief Minister Manoharlal Khattar started supporting the nuclear project soon after assuming power.⁶²

⁶² "CM takes U-turn, supports Gorakhpur N-plant" The Tribune, 20 December 2014, <http://www.tribuneindia.com/news/haryana/cm-takes-u-turn-supports-gorakhpur-n-plant/24392.html>

Section III

India Unprepared: in Dangerous Denial of Fukushima

Contrary to the worldwide reckoning of lessons from Fukushima, the Indian nuclear establishment remains in self-delusion. While a number of countries have decided to roll back nuclear programs after the accident in Japan, or have at least set up more stringent safety regulation, India has done no such rethink. In fact, the new regulator, Nuclear Safety Regulatory Authority(NSRA) that the Indian government has proposed to introduce after Fukushima, is more toothless, ineffective and non-independent than the existing Atomic Energy Regulatory Board(AERB) as per its former head Dr. A Gopalakrishnan.⁶³ The newly proposed Nuclear Safety Regulatory Authority (NSRA), which will replace the existing Atomic Energy Regulatory Board (AERB), also seeks to amend the RTI Act⁶⁴ and effectively deny any public scrutiny.

3.1 DAE in Denial of Fukushima

When the Fukushima accident took place, India was the first country to declare the Fukushima reactors safe, even before the Japanese government. When the situation at the nuclear site took a turn for the worse on March 14, the chief of India's nuclear establishment claimed in a press conference that no nuclear

⁶³ A Gopalakrishnan, "A nuclear regulator without teeth", DiaNuke.org, 19 September 2011, <https://www.dianuke.org/a-nuclear-regulator-without-teeth-a-gopalakrishnan/>

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Venkateshnayak, "Exempting Nuclear Safety from the Right to Information: Let's say NO!" February 8, 2012, DiaNuke.org. Available at <http://www.dianuke.org/exempting-nuclear-safety-from-the-right-to-information-lets-say-no/>

accident had occurred.

According to SK Jain, managing director of the Nuclear Power Corporation of India Limited, and Srikumar Banerjee, the then chairman of the Atomic Energy Commission, all that was happening in Fukushima was a just well-planned emergency preparedness exercise.⁶⁵ Later that year, the Department of Atomic Energy said that there was zero chance - "one in infinity" - that a nuclear accident could take place in India.⁶⁶

The mechanical denials have seeped into the entire system now. The recent Supreme Court judgment on Koodankulam also suffers from the same anachronism. Going through its 250 pages, most of which are long verbatim quotes from Atomic Energy Regulatory Board (AERB) safety manuals for pressurized heavy water reactors while the Koodankulam reactors are of an entirely different design, one can only wonder if the Fukushima accident ever happened. Justice Dipak Misra simply dismissed apprehensions of far-reaching consequences of radioactive effects as having "no basis"! The judgment says: "Nobody on the earth can predict what would happen in future and to a larger extent we have to leave it to the destiny ...apprehension is something we anticipate with anxiety or fear, a fearful anticipation, which may vary from person to person."

The truth is, Indian nuclear expansion is taking place in complete denial of the real and insurmountable risks inherent in

65 "No 'nuclear' accident in Fukushima, say Indian N-experts" India Today, 14 March 2011, <http://indiatoday.intoday.in/story/no-nuclear-accident-in-fukushima-indian-nuclear-experts/1/132416.html>

66 "AEC chief puts odds of N-plant accidents at '1-in-infinity'" The Hindu, 10 November 2011, <http://www.thehindu.com/news/national/aec-chief-puts-odds-of-nplant-accidents-at-1ininfinity/article2615375.ece>

nuclear technology, as revealed by the Fukushima disaster. Besides, every form of democratic dissent and even the government's own norms are being bulldozed by this one-dimensional nuclear obsession. In August, the DAE joined political parties in demanding exemption from the Right to Information (RTI). Interestingly, it said that its "international commitments" require strict confidentiality.

While the Indian government did initiate a safety audit process after Fukushima, it was conducted internally by NPCIL. The Atomic Energy Regulatory Board, India's nuclear regulator, is a toothless body which comes under the Atomic Energy Commission that it is actually supposed to supervise. The recommendations of the AERB's post-Fukushima review of the Koodankulam nuclear power station in Tamil Nadu were set aside to commission the reactor amid massive protests by the local community.

On August 2008, the then Minister of State in the Prime Minister's Office (PMO), V Narayanasamy's nonchalance in the Rajya Sabha said that the possible impact on the affected population is "practically insignificant". This was in his reply to a parliamentarian's question on the disaster preparedness of the Department of Atomic Energy (DAE). He expressed his confidence in the bumbling National Disaster Management Authority (NDMA), universally discredited for its abjectly inefficient handling of the recent ecological disaster in Uttarakhand. In his statement in Parliament, he quoted selectively from the conservative reports of the World Health Organization (WHO) and the United Nations Scientific Committee on the Effect of Atomic Radiation (UNSCEAR), published in February and May that year.

After Fukushima, India's Comptroller and Auditor General (CAG) has raised serious questions about nuclear safety in its 2012 report⁶⁷ on nuclear safety regulation on the lack of democratic oversight and transparency in India's nuclear sector and underlined the safety implications of such secretive safety culture.

The DAE remained silent also on the questions raised by the Parliamentary Accounts Committee (PAC) on nuclear safety in India after Fukushima.⁶⁸

After 31 years of the horrendous man-made accident in Bhopal, the victim-survivor continue to struggle for justice and reparation, for basic decontamination and cleaning, and expanding medical care beyond the arbitrarily and narrowly government-identified victims. The genetic impact of the Union Carbide disaster has been revealed in several scientific studies⁶⁹, but they have not led to any serious effort by the state or central governments.

As the world approaches the 7th year of the accident in Japan's Fukushima and the 34th year of the Chernobyl nuclear disaster in the erstwhile USSR, India must stop and think if we are in a position to deal with the a serious nuclear accident.

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CAG Report on Atomic Energy Regulatory Board (AERB), available at <http://www.dianuke.org/dianuke-documents-cag-report-on-atomic-energy-regulatory-board-aerb/>

68 M V Ramana and Suvrat Raju, "It's better to be safe than sorry", Hindustan Times, 05 February 2014, <http://www.hindustantimes.com/ht-view/it-s-better-to-be-safe-than-sorry/story-QpSS9S571iXtm6SaYaOIXK.html>

69 Rajan Patil, "Investigating genetic outcomes following 1984 Toxic Union Carbide disaster in India: epidemiological challenges", International Journal of Occupational Medicine and Environmental Health, Vol 23, Issue 4, January 2010, <https://www.degruyter.com/view/j/ijmh.2010.23.issue-4/v10001-010-0025-4/v10001-010-0025-4.xml>

While scrapping the National Disaster Management Authority (NDMA) was one of the first thing the Modi government did after assuming power, it is yet to come up with a better institution to respond to calamities and their human consequences. However, preventing and responding to a nuclear accident is a much larger issues and the imperatives go far beyond creating a new bureaucratic behemoth. And contrary to the reassurances of the nuclear engineers and nuclear industry insiders, nuclear safety is far beyond just the design safety.

3.2 Nuclear Accident: Irreversible, Long-term and Wide-ranging Consequences

The most important factor to take into consideration when building a nuclear accident scenario are its consequences, which are irreversible, long-term, genetic and essentially, unrestrained in time and space. The nuclear enthusiasts only reveal their rather ideological commitment to the technology when they ridiculously compare nuclear accidents to car accidents or any other industrial accident. In other accidents, even if the immediate physical damage and deaths might be higher, reconstruction and relief can start from the very next hour.

However, even after three decades, the 30-km zone of Chernobyl continues to host ghost cities like Pripyat which would remain uninhabitable for coming centuries. Similarly in Fukushima, once bustling cities like Namie and Futaba are now frozen in time and radiation levels remain dangerously high.

Nuclear safety is an ever-evolving challenge. Besides the immediate design safety, a country would also require a credible safety culture, an independent regulator, a responsive and reliable civic administration in general and a people-centric liability mechanism to be able to provide an adequate response. On all these counts, India comes across far more than wanting, rendering a potential nuclear accident a nightmare.

The Indian nuclear industry is completely non-transparent and unaccountable. Operating directly under the Prime Minister's office, it enjoys complete insulation from public and democratic scrutiny. Serious RTI queries are routinely rejected by deploying the 1962 vintage Atomic Energy Act evoking 'national security' clause, despite the separation of the civilian sector after the watershed moment of the Indo-US deal. In the course of Koodankulam movement, the Department of Atomic Energy (DAE) refused to part with basic documents like the Site Selection Report and the Safety Assessment Report, which are normally put in public domain all over the world. India's then Chief Information Commissioner (CIC) wrote a letter to the PM, but even that didn't work.⁷⁰

Nuclear safety regulation is another Achilles heel. India's nuclear regulator Atomic Energy Regulatory Board (AERB), which depend on the same Atomic Energy Commission (AEC) for funds and human resource that it is supposed to monitor and supervise, is a toothless and non-independent entity. The last time when its Chairman ordered a thorough safety audit of the entire sector, the report was shelved with the central government putting a 'top

⁷⁰ “Central Information Commissioner writes to PM, says don't dilute RTI act” NDTV, 29 March 2012, <http://www.ndtv.com/india-news/central-information-commissioner-writes-to-pm-says-dont-dilute-rti-act-473876>

secret' stamp on it. Dr. A K Gopalakrishnan, the former Chairman behind that enquiry, has been a vocal advocate of a strong and independent regulator since then and has proposed a moratorium on imported nuclear power plants until that happens.⁷¹ It is appalling that the Indian government chose to set aside the post-Fukushima recommendations of even this weak nuclear regulator when it came to giving green signal to the Koodankulam project in the Supreme Court. The AERB was forced to file an affidavit and call its own stipulations advisory and not mandatory. In the absence of an independent regulator, India is setting up 6 EPR-design reactors in Maharashtra's Jaitapur when the French regulator itself has raised serious objections on the design.⁷²

3.3 Liability and compensation

On the issue of liability and compensation, the Indian government has shown scant regard to the potential victims. Safeguarding the foreign suppliers from any liability has been a paramount concern. Nothing could be more absurd and ironical than the fact that since the inception of the Civil Liability for Nuclear Damage Act 2010, the government has been busy finding a way to address the concerns of the foreign suppliers who want to a complete indemnification. The clause 17(b), holding suppliers liable albeit with severe limitations, was introduced under pressure from the parliamentary opposition and civil society by a reluctant Manmohan Singh government. But Modi government has dumped the earlier BJP position on nuclear liability and has tried to create an insurance pool to channel the liability back to the exchequer and thus undermine the law.

71 Dr. A Gopalakrishnan, "Koodankulam Must Be Stopped: Dr. A Gopalakrishnan" DiaNuke.org, 19 April 2013, <http://www.dianuke.org/koodankulam-must-be-stopped-dr-a-gopalakrishnan/>

72 "French nuclear safety agency warns of Flamanville EPR meltdown risk", Mediapart, 8 June 2015, <https://www.mediapart.fr/en/journal/france/080615/french-nuclear-safety-agency-warns-flamanville-epr-meltdown-risk>

K Sujata Rao, the then secretary in the ministry of health and family welfare while deposing before the Indian parliament's standing committee on science and technology, in the matter of nuclear emergency, mentioned, "Since the response system to deal with any kind of emergency of such type, the hospitals are not well-equipped, it is natural that mortality and morbidity due to multiple burn, blasts, radiation injuries and psycho-social impact could be on very high scale and medical tackling of such a large emergency could have enough repercussions in the nearby areas of radioactive fallout..."

She suggested while setting up nuclear plants consideration may also be given to the fact that there should be hospital having trained doctors near such establishments and arrangements should also be made for free treatment of people who are affected by serious nuclear fallout."⁷³

This has been revealed in the committee's report presented to the Parliament. She confessed that Union health ministry is nowhere to meet an eventuality that may arise out of nuclear and radiological emergencies. Admittedly, there is no provision and infrastructure for health care during radiological emergencies in the country.

India's former nuclear regulator Dr. A Gopalakrishnan was also interviewed for this research, who added - "the Atomic Energy Commission needs to do a major rethink before it goes ahead with a nuclear plant which has such crucial vulnerability. Also, there must

⁷³ Quoted by Gopal Krishna, "Nuclear showdown in Delhi's neighbourhood" Intercultural Resources, 30 July 2012, <http://icrindia.co.in/mydirectory/2012/07/30/nuclear-showdown-in-delhis-neighbourhood/>

be transparency and far more stringent oversight in the safety clearance for the 700 MW PHWRs.”

3.4 Evacuation, Rehabilitation and Justice

Even less promising is the Indian government reassurance of adequate evacuation and post-accident scenario. All Indian nuclear facilities are surrounded by dense populations which have only grown further with time. In most cases, the DAE doesn't reveal the emergency preparation arrangement and when it does it comes up with ridiculous plans of relocating 50,000 people in a school premises. The mandatory emergency drills before commissioning reactors have turned out to be cruel jokes, with absurd instances like the local officials 'evacuating' a few hundred people in buses by taking them to nearby villages.⁷⁴

The experience of Bhopal accident in India, worlds largest chemical accident that happened in 1986, does not instill any confidence in evacuation and rehabilitation capacity of the Indian state, as its victims continue to struggle for medical help, rehabilitation, decontamination and compensation even after more than 30 years. When the Japanese Prime Minister visited India in 2016 to negotiate the India-Japan nuclear agreement, victim groups from Bhopal, in a collective open letter, urged - “the victims of Bhopal continue to struggle for justice, adequate compensation and proper medical, economic, social and environmental rehabilitation In our city, we have a commemorative statue of a mother and her child with “No More Bhopal, No More Hiroshima” written beneath it. And in the fifth year of the ongoing disaster in Fukushima, we can identify with the continued suffering and struggles of its

⁷⁴ Praful Bidwai, “Starting Koodankulam: When deception triumphs” DiaNuke.org, 21 July 2013, <http://www.dianuke.org/starting-koodankulam-when-deception-triumphs/>

residents.....your nuclear deal with our country will bring windfall gains to these huge corporations at the cost of the environment, labour and human rights of our people. And similar to what happened in Bhopal, there will be 1000s of Bhopal happening elsewhere in the country with much more horrendous consequences. We urge you to desist from this impending agreement during your visit to India.”

Conclusion

A Fukushima-like accident in Fatehabad would be replete with insurmountable technical, administrative and logistical difficulties given the site-specific problems like design-related issues and inadequate supply of cooling water, the lack of clarity and accountability about emergency-response mechanisms as well as the larger issues plaguing the Indian nuclear sector such as non-independence of safety regulator, limited liability and non-transparency. The government of India should conduct a widest possible consultation with all stakeholders concerned - local communities, district and state-level authorities, independent experts and civil society and environmental groups, to re-evaluate scenarios of potential accident and its consequences.