



Role of scientific experts in shaping media Narratives following the Chernobyl incident

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Abstract- In the media's representation of nuclear energy, especially in substantial incidents like the “Chernobyl accident”, scientific experts play a vital and important role. The “Chernobyl disaster”, is the most terrifying nuclear accident in history, which totally changed the public and media insights on nuclear energy. Initially, the Soviet authorities tried to conceal the truth by hiding crucial information and preventing scientists from being seen by the general people. As a result, Misinformation, anxiety, unbelievable rumours and mistrust raised. However, Independent analyses, mostly as a result of the efforts of Western media and scientists, challenged the Soviet untruth and knowingly contributed to revealing the true scope of the nuclear tragedy in Chernobyl. The scientific professionals who organized the harmful reaction and later made public statements that altered the public's understanding of the disaster in the Soviet Union and all over the world are presented in this research. Also covered the function of media, especially in the West, has played in drawing attention to Chernobyl's long-term impacts on politics, the environment, and public health. This prompted the demands on worldwide for enhanced nuclear safety protocols and increased transparency. Over time, scientists' role in shaping media tales has grew, from their early restrictions in the “Soviet Union” to their growing importance in shaping public opinion around the world. The “Chernobyl disaster” showed how important it is to connect during crises in a fast, explicit, and expert-driven way. It also mentioned the need for association between governments, the media, and experts in science to ensure the consequences of trustworthy information.

Keywords: Chernobyl, Environment, Pollution, Media, Disaster, Organization, Scientific

I. Introduction

In the media's description of nuclear energy over the years, there have been certain trends and structures. In the 1950s, the media's mostly promising reporting of nuclear technology established public faith in the field. But it began to shift in the 1960s as social and environmental initiatives gained momentum. High-profile incidents like the “Chernobyl” tragedy, the "Three Mile Island" accident, and the “2011 earthquake”, “tsunami”, and “nuclear disaster that rocked Great East Japan” also had an impact on differences in media attitude. Following these events, sentiment declined again, then stabilized to some extent. The media discourse surrounding nuclear energy varies throughout countries. The media often describes nuclear energy as safer and more valuable in Asia, where governments encourage and favor it over other energy sources. For example, in the United States, nuclear energy is indeed presented in a sophisticated and complex method. Important themes in U.S. media reporting include public responsibility, trust in political and regulatory formations, evacuation measures, and the fear and anxiety that often follow nuclear accidents [1]. Radioactivity from the 1986 Chernobyl accident in Ukraine was widely discrete all over Europe. It was extremely difficult for fire-fighters to put out the flames after Reactor 4 physically burst. Among the positions of the peoples who stepped in to lessen the accident's impact were many deaths. This accident that affected the entire world was caused by a particularly dangerous type of reactor and a test that was entirely improvised [2]. The majority of those residing in the most hazardous districts of the "Soviet Union" desired to relocate or depart. About "200,000 people" who were devastated by the



disease migrated to Israel starting in 1989 in order to obtain radiation treatment and avoid areas of risk [3]. This study effort [4] offers the varying patterns of risk communication and the public's views, with an importance on risks related to ecological emergencies, public health, and technological threats. The study examines the ways in which these shifts affect public insight, policy choices, and the socialization of risk. It also highlights the benefits and difficulties of risk communication administration in the technological era. The "Chernobyl disaster" affected Europe more in the "The three former Soviet republics of Belarus, Russia, and Ukraine," with the Scandinavian nations being particularly hard hit. Numerous investigative organizations, including the "European Commission (EC), the World Health Organization (WHO), and the International Atomic Energy Agency (IAEA)", conducted in-depth studies on the accident's effects on "The Soviet republics." They decided that "the major public health risk associated to the nuclear explosion of Chernobyl" [5].

This Case Study studies the critical role that scientists have had in shaping public insights of the "Chernobyl nuclear disaster" through a detailed examination of published research materials. The studies investigate how expert views impacted the public's understanding and media coverage of the incidence which provides some viewpoint on the interaction between science, media, and public perception. The primary objectives of this case study are summarized as follows.

- To investigate how public image and comprehension of nuclear energy were impacted by expert input.
- To evaluate how specialists in the Soviet Union and Western nations shaped the story of the accident.
- This research looks at the early exclusion of professionals by the Soviet leadership and how it affected common fear and deception.
- The goal is to highlight the evolving collaboration between scientists, media, and governments in promoting transparency and public trust during nuclear crises.
- To explore the long-term effects of expert-driven media narratives on global nuclear safety regulations and public discourse.

Research questions:

1. What role did scientific experts play in shaping the media narrative following the Chernobyl incident?
2. How did the involvement or absence of expert's impact public perception?

II. Literature Survey

The Chernobyl nuclear power plant exploded "on April 26, 1986", causing the largest disaster of its sort in history in the Ukraine Soviet Socialist Republic. Throughout the Soviet Union's control, an off-site emergency plan was developed for the nuclear power plant Chernobyl. Whether an elimination strategy was part of this emergency plan is unclear, though. One of the shortcomings of the Critical strategy put into an action after the "Chernobyl" accident was that it did not include procedures for a major nuclear accident [6]. Due to the important attentions of short-lived radionuclides in the cloud of contamination, radiation measures during the first three weeks after the accident were essentially acute. The majority of these transient and enormously radioactive nuclides accrued in high absorptions on the soil and plant surfaces, clearly affecting the biota. In the meantime, it was noted that in Pripyat [7]. The area affected by Chernobyl is situated to the east of the Pre-Dnieper lowland and "Southwest of the East European Plain". It is partially located in the "Pripyat Polesye". The area is plain and experiences mild continental weather. As the event progressed, so did the radionuclides that were emitted and their physicochemical characteristics. Due to this, the fallout's radioactive content was not uniform and varied based on the fallout's direction and distance from the "Chernobyl Nuclear Power Plant (ChNPP)" [8]. In the European Community (EC), regulations pertaining to radioactivity levels the most recent being No. 2016/52 stays in effect. In Serbia, meanwhile, an authoritative manual on population safety the Rulebook on Radioactive material Content constraints in Drinking Water, Food, Animal Feeds, Drugs, General Purpose Items, Building Materials, and Other Products Put on the Market was released several years ago [9]. The IAEA report and the Atlas map provide an overview of the atmospheric circumstances (rainfall, wind direction changes) during the Chernobyl catastrophe. For modeling of the Chernobyl radioactive cloud, use the "EURAD" model and the streamlined version of the Eulerian "LRTAP" model, in that order. Show that the near-surface portion of the radioactive clouds dispersed throughout the majority of European nations till May 3, 1986, determined by the chemical transportation concept [10]. This research study [11], examines the intricate



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political environment that surrounds nuclear energy in Belarus and Ukraine, especially in the wake of the Chernobyl catastrophe. The idea focuses on how these countries have handled the difficult task of mitigating nuclear energy hazards while simultaneously satisfying the vital requirement for energy security. The degree to which local communities and civil society have participated in nuclear energy policy decision-making is examined in this article using the framework of energy democracy. Numerous research looked into how the incident at the “Chernobyl Nuclear Power Plant” affected Europe. Nevertheless, the most of these have geographically ignored the densely populated southeast of Chernobyl, which includes Iran, Turkey, Armenia, and Georgia. A thorough environmental and radiological examination was done specifically for this area in this study. For this, a Lagrangian particle dispersion model called FLEXPART was used to estimate radioactive atmospheric dispersion and ground deposition. Six simulations in total were run, and data from Turkey and Europe were used to validate the model's output [12]. National governments, with assistance from the “International Atomic Energy Agency (IAEA)”, have developed response plans to deal with nuclear accidents after the Chernobyl disaster. The emergency phase is the main emphasis of these response strategies. But according to the EU 2014 Basic Safety Standard, reaction plans also need to detail how to go from a crisis period to a period of rehabilitation and correction [13]. A number of lives were lost and significant environmental damage was caused by nuclear accidents at the “Fukushima Dai-ichi Nuclear Power Plant in Japan and the Chernobyl Nuclear Power Plant in the former Soviet Union”. These incidents were classified according to the International Nuclear and Radiological Event Scale (INES) at the highest possible level, Level 7 Major Accident. They brought about extraordinary disruptions and impacts that are abnormal [10].



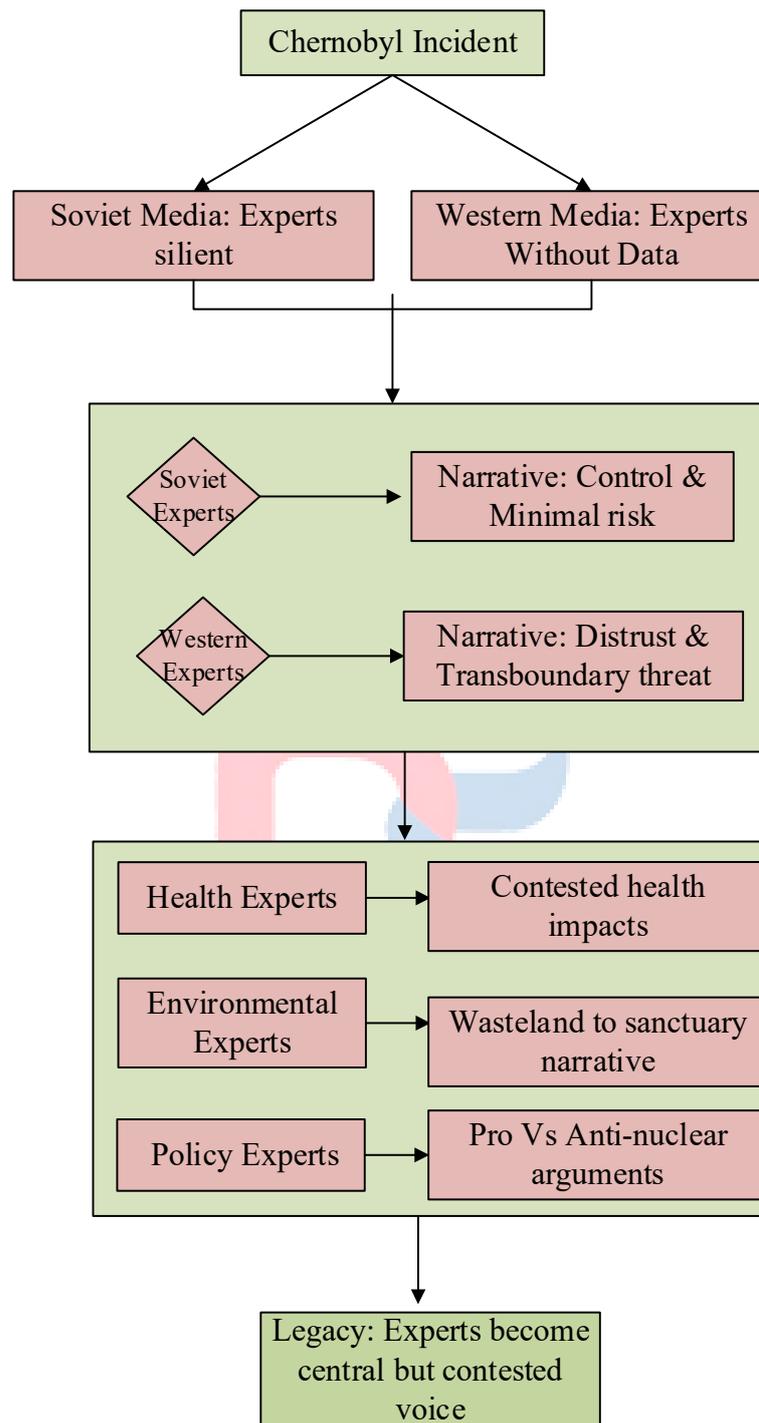


Fig.1 Flow diagram of the Case study

III. Background and Early Media Coverage

“On April 26, 1986”, a major nuclear explosion at the “Chernobyl Nuclear Power Plant” in the city of “Pripyat in northern Ukraine which was then a part of the Soviet Union” took place. This incident is known as the Chernobyl catastrophe. It is regarded as the most expensive and fatal nuclear accident in history. When an unanticipated power spike at Reactor 4 resulted in a fire and an explosion during a late-night safety test, a significant number of radioactive elements were released into the sky. These particles contaminated the environment widely and dispersed over much of Europe. More than 100,000 residents had to be evacuated from the plant's close vicinity due to heavy contamination. When the entire scope of the tragedy became apparent, the Soviet government's early downplaying of the incident's seriousness contributed to a generalized sense of panic and delayed the international reaction.

A. Data sources

The purpose of this archival study is to examine the methods used by the Soviet Union to conceal harm, inadequate management, and errors inside the nuclear sector, as well as to deflect attention away from the 1986 Chernobyl tragedy and dissemble the world community. The report particularly draws attention to the consequences of the Soviet cover-up campaign and its final failure, which is mostly attributable to the CIA and other members of the American intelligence community's efforts [14]. The primary sources of data have been examined on hematological malignancies in the post-Chernobyl era in the different regions of Ukraine with varying levels of nuclear remains and severity. According to data collected from “Ukraine's major hematological facilities between 2010 and 2017”, the prevalence of acute “myeloid leukemia”, “multiple myeloma”, and “lymphoid neoplasms” from mature B cells was higher in the most polluted areas than in the less contaminated ones [15]. This research looks at the evolution of the local flora in the Chernobyl area, which gained notoriety after the devastating nuclear disaster that happened there on April 26, 1986. In order to determine any possible long-term impacts of radiation on plant life phenomenology the study concentrates on the remotely collected “Normalized Difference Vegetation Index (NDVI)” data collected by the “Moderate Resolution Imaging Spectroradiometer (MODIS)” inside the 30 km Excluded Region, an area where all human endeavor ceased and access to the public has been banned since the incident [16]. Radiation from a massive explosion in “Reactor 4” of the “Chernobyl nuclear power plant” released a significant amount of radioactive particles on April 26, 1986. For eight days, the fire blazed, spreading radioactive smoke over Europe. The greatest amount of rainfall occurred during the night of April 28 and 29, even though the first radioactive cloud arrived in Sweden on April 27. Many distinct radioactive elements are emitted during a nuclear accident; however, the most durable radioactive particle released is cesium-137, which has a half-life of thirty years. About 5% of the total cesium fallout discharged during the accident ended up in Sweden [17]. One of the most tragic aspects of the Chernobyl nuclear accident is that an experiment intended to improve operational safety was the exact cause of the disastrous event. As a result of severe time limitations and their conviction that they understood the reactor well enough to operate it even outside of standard operating settings, the operating crew ignored critical operating restrictions and bypassed safety systems on many occasions throughout this experiment. This combined with the primary safety hazards of the RBMK class resulted in the worst reactor disaster in history [18].

B. Initial Media coverage

The media, particularly journalists, play a significant role in shaping public understanding of nuclear energy. Media platforms provide a space for various stakeholders such as “politicians”, “environmental groups”, and “scientists” to express their perspectives on the issue. Public positions on nuclear energy are both shaped by and reflected in media coverage. Journalists hold a unique position in this process, as they are part of the society they report on and draw from the similar memories of past events as a collective when discussing nuclear energy.



Fig. 2 Initial newspaper reports about Chernobyl nuclear accident

i. Soviet Media

Initially, the Soviet Union tried to downplay how serious the Chernobyl accident was when it happened in April 1986. Severe restrictions, limited data flow, and postponed formal statements were all enforced by the regime. International entities were not notified and the public was not promptly informed by the local government. Soviet officials tried to keep international media away from the site and minimized the dangers. Communication about the disaster was restricted, and local media were not permitted to report on the incident or the radioactive fallout. This aligned with the broader Soviet approach of restricting sharing of information to prevent any negative perception of the administration. Even the residents of Pripyat, a nearby town, were not informed of the seriousness of the circumstances, and they were just subsequently airlifted 36 hours after the explosion, after the radiation level had reached deadly levels. Notwithstanding these precautions, radioactivity was found in other nations most notably Sweden raising concerns around the world. Although the Soviet Union's initial attempts to control the events led to widespread suspicion and criticism, the Soviet Union was finally forced to recognize the tragedy because to the dispersion of radioactive elements and the persistent efforts of Western media [19]. The Soviet leadership consistently concealed the seriousness of the situation in reports released during the early stages of the Chernobyl accident. These accounts were marked by a lack of objectivity and frequently left out or minimized important information about the explosion's consequences. In this early media coverage, the storylines were tightly controlled by the Soviet officials, with minimal input from impartial scientific academics. Transparency was lacking in these reports, which often omitted or minimized crucial details about the event's impact. The Soviet officials tightly controlled independent scientific professionals on these early announcements. Removing scientists from the discourse was part of a larger Soviet ploy to pretend that everything was in control and well [20]. This was not only deceiving the public but also it delayed the international community's awakening to the gravity of the situation. Absence of expert involvement contributed to misinformation and misunderstanding both inside and outside the Soviet Union, which increased the Chernobyl disaster in terms of its ultimate political as well as physical consequences.

ii. Western Media

The international community recognized the actual situation of the nuclear explosion in Chernobyl was greatly aided by the efforts of Western media outlets. The nuclear meltdown was first detected far from the Soviet Union when Swedish scientists noticed elevated radiation levels and connected them to the Chernobyl area. The unanticipated increase in radiation was promptly observed by Western media, who inquired about its source and published stories about it. This external pressure ultimately forced the “Soviet Union” to open up the incident [17]. Even though the “Soviet Union” were first refused entry to the site, “Western journalists” began putting together the story from scientific data, testimonies from Soviet citizens, and satellite images. They exposed the actual scope of the explosion, the spread of the radioactivity, and the "Soviet Union's" efforts to influence the public's views. The terrible event and its consequences became more known as a result of the coverage provided by Western media like French and other countries. It forced international organizations and governments to respond, which resulted in a more well-coordinated worldwide effort to deal with the tragedy's fallout. It calls for more transparency and international cooperation in the area of nuclear safety have been triggered by the coverage. By providing independent analysis and contrasting the official claims with witness and scientific statements, Western media exposed gaps and weaknesses in the Soviet reports [21].



Fig. 3 News published in April 29, Technicians from Forsmark, Sweden checking radiation level of people exposed to fallout from nuclear incident at soviet reactor near.

IV. Role of scientific experts

Scientific experts had a significant but diverse influence on how the “Chernobyl disaster” was covered by the media. At first, scientific specialists had a restricted role in the Soviet Union since the government strictly regulated the information and controlled the independent analysis that was made available to the general population. But when the extent of the explosion became apparent, specialists from both the Soviet and Western camps started to have a greater influence on the incident.

A. Named Entity Recognition (NER)

The historical narrative of the “Chernobyl disaster” was influenced by a number of important players, who all of played vital role in shaping public perception of the accident at that point and afterward. The Chernobyl Nuclear Power Plant, the scene of the accident, became the focal point of all talks and reports because it represented the disastrous failure of Soviet nuclear power plants. The Soviet government made an effort to minimize the incident's seriousness when it first oversaw the media narrative and oversaw the catastrophe response. However, the accident came to the attention of the world when Sweden became the first nation outside

of the Soviet Union to identify increased radiation levels. Subsequently, the International Atomic Energy Agency (IAEA) produced impartial evaluations that significantly influenced the world's comprehension of the catastrophe. The Soviet version was seriously contested by Western media, Western scientists, and Western nuclear specialists who provided unbiased evaluations and accounts on the actual scope of the catastrophe. Talks about the disaster's effects on people centered on the adjacent town of Pripyat, which was most hit by radiation. Together, these organizations had an impact on how the story of Chernobyl developed, making sure that scientific evaluations were essential to comprehending the entire scope of the accident.

B. Expert Involvement

i. Soviet Scientists:

- **Valery Legasov:** Legasov was a Soviet physicist who was the “Deputy director of the Kurchatov Institute of Atomic Energy”. He became well-known as one of the key figures involved in the Chernobyl accident. He was an important participant in the government panel that looked into the accident. He organized the early effort to control the consequences and offered crucial technical evaluations. Afterwards, Legasov gained notoriety for his frank and in-depth description of the catastrophe, especially for his critiques of the “Soviet Union's” management of nuclear safety. His observations had a pivotal role in molding the Soviet and global perceptions of the catastrophe. According to reports, he committed himself in 1988, two years after the catastrophe, leaving behind tapes that expressed his worries about the structural problems in the soviet nuclear industry [22].
- **Yevgeny Velikhov:** He was a prominent Soviet physicist and a key advisor on nuclear energy to the Soviet government. He played an important role in advising the Soviet leadership on how to manage the disaster. He advocated for swift action to mitigate the spread of radiation and was involved in the decision-making process for constructing the concrete sarcophagus over Reactor 4. His involvement brought credibility to the Soviet response, as he was one of the few top scientists who were allowed to speak somewhat freely about the incident [22].
- **Anatoly Dyatlov:** Dyatlov served as the nuclear power plant's “Deputy chief engineer” while supervised the safety test that resulted in the explosion. Dyatlov's role is controversial, as he was blamed for pushing the reactor beyond its safety limits, he provided detailed technical testimony during the post-disaster investigations. His accounts highlighted the flaws in reactor design and operational protocols, which became central to understanding the causes of the disaster [23].

ii. Soviet Political Involment

- **Gorbachev:** In the years following the Chernobyl tragedy, “Mikhail Gorbachev, the General Secretary of the Communist Party of the Soviet Union”, had a complicated and changing role to perform. Initially, Gorbachev, like many other Soviet leaders, was involved in the state's efforts to control the narrative and downplay the severity of the disaster. The Soviet government, under Gorbachev's leadership, attempted to minimize the perceived impact of the explosion, restricting information and delaying public acknowledgment of the catastrophe [23], [20].
- **Boris Shcherbina:** He was a Soviet politician who led the government commission in charge of the Chernobyl response. Shcherbina worked closely with experts like Legasov to coordinate the emergency response and containment efforts. While his role was more administrative, his decisions were heavily influenced by scientific advice, and he was involved in critical actions such as the evacuation of Pripyat and the construction of the sarcophagus to contain the reactor [10].

iii. International Experts

- **Robert Gale:** He is a physician from America who specializes in bone marrow transplants. The Soviet Union recruited Gale to help cure radiation patients. His participation was extensively reported by the media, and his engagement was a part of an attempt to draw in international experience. Gale's efforts

highlighted the necessity for worldwide collaboration in responding to future calamities and helped draw attention to the disaster's devastating health effects [24].

- **Hans Blix:** During the Chernobyl accident, he served as the International Atomic Energy Agency's (IAEA) Director General. An worldwide assessment of the accident was greatly aided by Blix and the IAEA. The world community was largely informed about the actual scope of the tragedy thanks to the IAEA's findings and evaluations, which served as a contrast to the Soviet perspective. International nuclear safety procedures have been impacted for a long time by Blix's efforts in advocating for more precise and transparent reporting on nuclear events [23].
- **Liubov Kovalevska:** A Ukrainian reporter working for the “Pripyat publication Tribuna energetika [Power Engineer Tribune]” coined the phrase “state nuclear violence” before the explosion. The journalist continued by outlining the Soviet misinformation strategy and the Soviet government's attempts to conceal the facts regarding the extent and impact of the “Chernobyl disaster” [22].

V. Media Discourse Analysis

Media discourses played an important role in changing socio-political circumstances of the time and the level of information about the “Chernobyl nuclear disaster in 1986”. Soviet media initially downplayed the event's severity and concentrated more on control and repression, while Western media exposed it and regarded this incident as a demonstration of soviet totalitarianism and its failures throughout the Cold War. The increased transparency after the collapse of the Soviet Union turned attention to the human cost environmental damage and stories of disaster survivors. In the past few years Cultural depictions, such as the 2019 HBO miniseries Chernobyl, have sparked global interest in both stories highlighting both the failures of Soviet leadership and the heroism of those who risked their lives to mitigate the catastrophe. The impact of late health effects on survivors remains to be discussed. Environment remediation in the exclusion zone and the discussion about nuclear energy. The disaster has thus become an enduring symbol of government secrecy, human resilience, technological failure, and environmental impacts which, influences public discussions on nuclear power and policy.

A. Difficulties of media

At first in the reporting of the incidents, media faced challenges with accuracy because they had to cover the stories quickly and constantly, which left little opportunity for verifying correctness. It took 36 hours for the first local radio broadcasts to air, and it took 67 hours for the initial press release from the main Russian news agency, TASS. The Soviet government attempted to cover up the nuclear disaster in the early days that followed. It wasn't until Western specialists measured a radioactive cloud above Sweden that the whole magnitude of the catastrophe was made public. The degree of pollution in the surrounding areas varies greatly according on precipitation and wind direction. Some places are affected far more severely than others that are considerably closer, such the Gomel region, which is located 100 kilometres to the north. As a result, the prohibited regions are dispersed like a patchwork carpet outside the 30-kilometer zone [19]. The authorities in the Soviet Union were only forced to divulge a limited amount of information regarding the catastrophe two days after the explosion, when radiation warnings went off at a nuclear plant in Sweden. Although they did not provide any radiation data, their tone was “positive” toward containing the incident and controlling the radioactive leaks [4]. Consequently, some researchers suggest that the historical consciousness of the Chernobyl tragedy continues to impact how nuclear power is presented. It is crucial to understand, nevertheless, that individual journalistic decisions do not determine how news is framed. The way that people see the function of journalism, journalism practices, and administrative pressures all play a role in the social developing of news. The media's framing and discussion of nuclear energy are influenced by this larger context [25].

B. Sentiment Analysis



The absence of news about the incident prevented the citizens of the “Soviet Union” from reacting negatively right away. The Pripyat buildings provided a view of the flames during the incident. A number of Pripyat residents' testimonies who saw the accident have been published by Alexievich. Fearlessly, the folks saw the raging fire from the comfort of their rooftops. When they heard there was a fire, some people even drove or rode their bikes hundreds of kilometers in hopes of getting a peek. The children watched from their bikes as they cycled near to the power plant the following morning. However, a number of years later the tragedy, the individuals began to exhibit indications of psychosomatic disorders, learned helplessness, and stress disorders. Emotional mechanisms for coping like avoidance, despair, and apathetic rejection of preventative actions were used in conjunction with these. The degree of terror and worry that the victims experienced as well as the general social upheaval brought on by the area's evacuation upset them. The government's concealment of facts regarding the accident and pollution both contributed to and aggravated these problems until 1989, which led to the formation and spread of unbelievable rumors about the possible consequences of the accident. The people of Belarus, Russia, and Ukraine quickly learned about the relocation of Pripyat and Chernobyl residents [25]. The discovery of radioactive material at the Forsmark NPP, in Sweden brought the Chernobyl accident to the attention of the world. Forsmark initially thought there might be a leak in their power plant. They quickly informed the public via the radio of information such as the possible leak, the level of pollution, and the absence of any exceptional risks. When the SSI discovered that the contamination originated at Chernobyl, they told the public through the media. But the information from the SSI and the power plant made people more anxious and provoked them to take what may be considered extreme measures. People could not make sense of the information that was given to them [5].

VI. Societal Attitudes and Confidence

The general people are strongly against nuclear power in several nations. According to a 2005 survey done in 18 different nations, 53% of participants believed that the hazards associated with using nuclear power as a source of energy exceeded the benefits, while only 33% agreed. In 2014, just 20% of Europeans were in favor of using nuclear energy domestically, with 37% categorically against. Public opinions toward nuclear power have always been very mixed in the United Kingdom; at one point, just a small portion of the population favored nuclear power, making it the least desired energy source overall [26].

A. European people opinion

The Chernobyl accident, and particularly the widespread belief that the public had been misled about the disaster's repercussions, incorrect knowledge regarding the facts of the Chernobyl tragedy and its later, unknown repercussions went viral across Eastern Bloc society. The suppression of the Chernobyl incidents was met with equally severe responses from Polish society as the tragedy itself, if not more so. Eastern European societies became outraged and furious due to the stark differences between official information, underground statements and Radio Free Europe's news program. The official Rzeczpospolita newspaper published no news regarding the terrible event on April 28, 1986. On May 2, 1986, Rzeczpospolita published the first news about Chernobyl. It claimed that the pollution levels were far lower than the warning ones. The official government committee adopted the phrase "maximum security, minimum panic," but its information did not match the findings of the “Finnish” report, which indicated that the concentrations of “Iodine and caesium were around 4-5 times higher” than those in other nations. Polish statistics also differed from the “US” study, which placed “Poland” first in terms of contamination after the “Soviet countries” [27]. A massive anti-nuclear movement with over 28,000 participants emerged in 1975 to oppose the building of a “nuclear power station in Wyhl”. In the latter part of the 1970s, this movement was widespread throughout Germany. The placement of nuclear weapons in “Germany” during the “Cold War” led to a particularly strong “anti-nuclear feeling in German society”. Risks to life and safety resulted from the Soviet Union's possible preemptive strike. The German demonstrators were compelled by these circumstances to identify nuclear energy with pictures of nuclear weapons or mass murder. The Chernobyl disaster added fuel to these anti-nuclear feelings; even though it happened more than a thousand kilometers away from Germany, the nuclear waste and radiation damage it caused in the country's south greatly shocked the German people. Concerns regarding the safety of food, including dairy products, surfaced when contaminated grains were thrown out [28]. Although in 1986 just 7% of respondents believed that nuclear energy should not be used or developed because the risks involved are too great, a decade later, in , 42% concurred as shown in the Fig. 4&5. Of course, the main cause of this growing opposition to nuclear energy in Europe is the fallout from the 1986 Chernobyl nuclear accident. With 37% of



respondents in all EU member states rejecting the use of nuclear energy in their nation in 2006, the fall in support persisted over time [29].

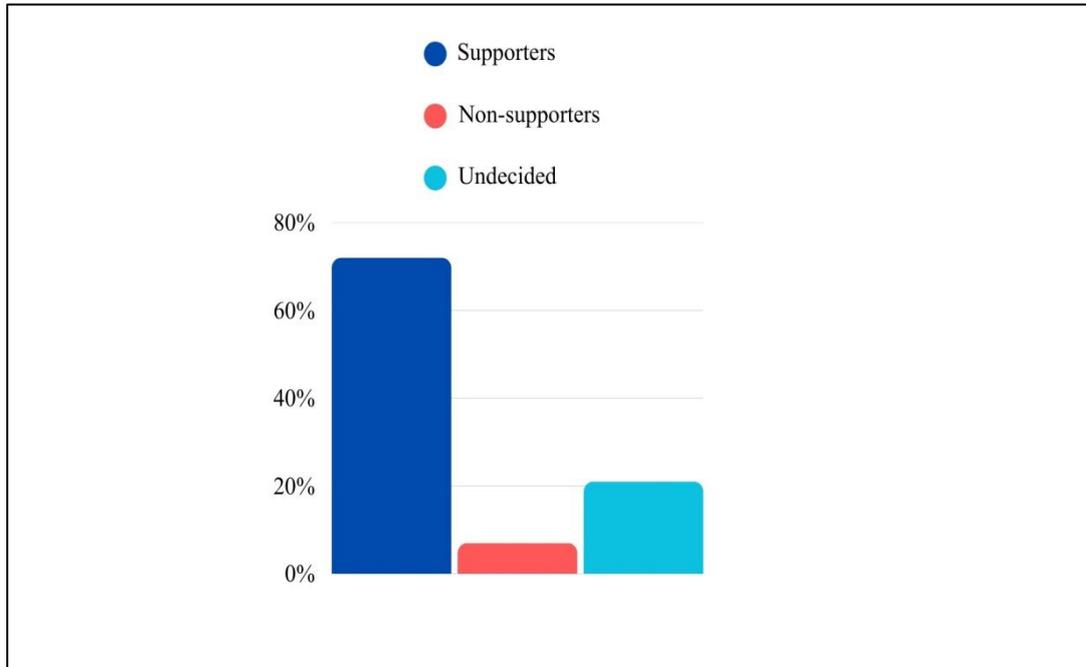


Fig. 4 Public opinion on nuclear power before Chernobyl accident

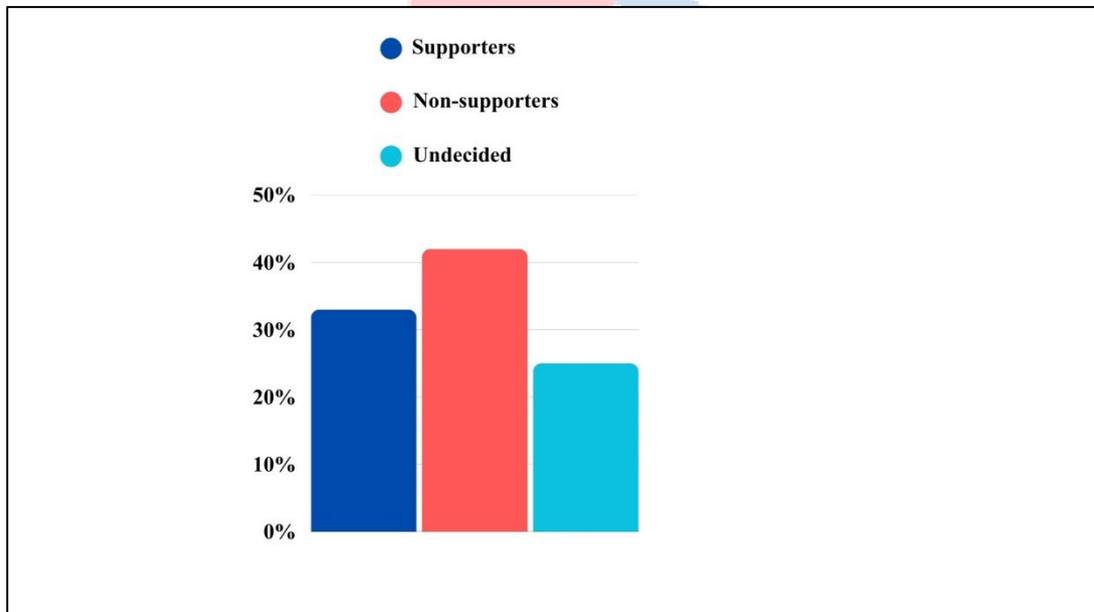


Fig. 5 Public opinion on nuclear power after Chernobyl accident

B. Other Country people opinion

Chinese people have constantly debated the question of the Chernobyl nuclear tragedy. From 2016 to 2018, people's emotions during the nuclear disaster topic were consistently low and fluctuated between negative and

neutral values. These feelings suggest that nuclear-related incidents have a comparatively negative effect on public perceptions of nuclear power, which may be connected to the news of the “Fukushima nuclear accident” [30]. Following the “Chernobyl disaster”, public enthusiasm for “nuclear energy” declined in the “United States”. Variations in energy security risk have also been demonstrated to have significant effects on support for nuclear energy use across time, extending beyond nuclear accidents. More precisely, the uncertainties and expenses surrounding energy imports have increased public support for the use of “Nuclear energy”. In fact, a record-high 77% of participants in a public opinion survey conducted in “May 2022” which is, at a period when crude oil prices above \$100 per barrel said they were in favor of using nuclear energy [31]. Few nations in the “Asia-Pacific region” had plans to generate nuclear energy prior to the Chernobyl Disaster, and the legislation that accompanied those plans were typically too vague. Following 1965, a few nations started to establish their nuclear industries, and the number of nuclear power plants worldwide increased quickly. Nevertheless, the nation-wide development rate considerably decreased as a result of the “Chernobyl incident in 1986”. Some countries have even put a temporary stop to direct nuclear power development, including “South Korea, Canada, India, Germany, and Russia”. “Japan's” development started about “1960”, and it is evident that following the “Chernobyl Disaster”, it was temporarily suspended before carrying on with its progress. Numerous nations responded to the Chernobyl disaster with emergency measures. The majority of nations that intend to pursue nuclear energy development have come to understand how critical it is to control the possibility of a radioactive and nuclear calamity [32].

VII. Long-Term Impact of Scientific Studies

Research conducted following the “Chernobyl disaster” in the three most affected republics “Ukraine, Russia, and Belarus” has shown a variety of long-term health problems linked to radiation consumption among the cleanup workforce. According to the United Nations (2010), the thyroid gland quickly absorbs and stores radioactive iodine-131 (I-131), the main fallout from the 1986 Chernobyl nuclear power plant catastrophe. I-131 was regarded as noncarcinogenic in Ukraine at the time, therefore there weren't many precautions to limit exposure. Children were given the highest doses after the accident, mostly because they had consumed milk contaminated with I-131 through the pasture-cow-milk chain. Significant rises in children's thyroid carcinoma, which is normally an uncommon occurrence, were promptly documented in “Belarus and Ukraine”, the nations most affected by reactor discharges. The effects of the Chernobyl accident on mental health are widely regarded as the most serious negative outcome. Rates of depression, anxiety, and PTSD are higher, especially among individuals who were exposed as children and particularly among those who believe there is a risk of radiation release. Decades later, psychological consequences are still a cause for concern. Thyroid cancer and other thyroid diseases in young persons exposed to radiation remain considerably higher, with no sign of a decline, in along with long-term mental health [33]. Furthermore, they have resulted in significant and ongoing disruptions to the lives of those impacted by fallout, including those who are directly affected (such as crisis and incidents respondents and recovery employees, refugees, residents of areas where dose reduction measures were implemented, and people who are indirectly affected by the contamination in less contaminated areas. Unquestionably, certain communities were negatively impacted by the radioactive fallout from nuclear accidents. One such group was the early emergency responders at Chernobyl, who experienced acute radiation syndrome [34]. Women, children or young people who had been affected to the Chernobyl nuclear plant catastrophe were asked to have their contraception experiences evaluated. The most astounding finding about this category of women is that they had a lower conception rate, as evidenced by the significantly smaller number of families, greater rates of inequality at the time of delivery, and a higher probability of needing medical aid in order to conceive [3]. It is a major catastrophic tragedy that claimed many lives and seriously damaged the environment was the nuclear accident in the former Soviet Union. The “International Nuclear and Radiological Event Scale (INES)’ gave the occurrences a maximum rating of Level 7 Major Accident. They produced exceptional disruptions and impacts that are not typical. Large amounts of “radioactive” material were discharged into the atmosphere in the first ten days following the Chernobyl accident, totaling around 14 EBq. Of this, 1.8 EBq of ^{131}I , 85 PBq of ^{90}Sr , 3 PBq of ^{239}Pu , and additional radioisotopes of plutonium, including ^{137}Cs . The “International Atomic Energy Agency's” report provided a detailed presentation of the both chemical and physical kinds of released material [10]. The radioactive pollution of water bodies and rivers

that flow through the affected areas becomes an issue in the event of a catastrophic nuclear disaster because these areas are typically used for irrigation and fishing as well as as for drinking purposes. Large portions of the “Dnieper River basin”, including the watershed of the “Pripyat River”, which is the river's right connected, became polluted in 1986 as a result of the Chernobyl accident with the long-lasting radioactive substances ^{90}Sr and ^{137}Cs , which have periods of time of roughly 30 years [35]. According to recent evaluations, wild populations may be more susceptible to radiation than laboratory populations because they are exposed to a variety of challenges in their natural surroundings. Since the liver and testes have been found to have shorter telomeres and the brain and liver have higher telomerase expression in “Chernobyl bank voles”, there is some evidence of molecular-level impairment in the Chernobyl area [36].

VIII. Comparative Analysis

Three notable nuclear disasters have happened in the past: “Fukushima in 2011, Chernobyl in 1986, and Three Mile Island in 1979”. Technical and human error were the main causes of the meltdown of the reactor core in both the “Three Mile Island” and “Chernobyl accidents”. On the other hand, the Fukushima accident was brought on by a strong earthquake that resulted in a tsunami-caused Station Black-Out (SBO) that impacted three reactors at the “Fukushima Daiichi Nuclear Power Plant”. Here we compared the Chernobyl nuclear incident with other two Three Mile Island and Fukushima Daiichi nuclear accidents.

Three-Mile Island: The catastrophe at “Three Mile Island (TMI)” Nuclear Power Plant took occurred on March 28, 1979, close to Harrisburg, Pennsylvania. The “International Nuclear and Radiological Event Scale (INES)” is a tool for educating the public about the need of taking precautions while handling nuclear and radioactive incidents. “TMI” was rated as a category 5 “accident with wider consequences” by the INES. Because of a partial meltdown in the “Unit 2 reactor”, TMI remains the worst nuclear catastrophe in US history [37].

Fukushima Daiichi: The “Fukushima nuclear accident” happened on “March 11, 2011”, at the north eastern Japanese “Fukushima Daiichi Nuclear Power Plant”. The plant's reactors suffered significant damage as a result of a strong 9.0 magnitude earthquake and ensuing tsunami, which set off explosions and a meltdown. Along with Chernobyl, the tragedy is regarded as one of the most catastrophic nuclear accidents in history. It had significant effects on the environment and human health, leading to massive evacuations and long-term worries about nuclear safety [38].

A. Experts involvement

The involvement of scientific experts in dealing with Fukushima, Three Mile Island, Chernobyl nuclear disaster has varied in speed and effectiveness. Responses are determined by factor such as government transparency, crisis management infrastructure and political environment.

In TMI the radioactive gasses were released into the environment as a consequence of a series of mistakes and equipment malfunctions that led to the tragedy. Operators brought the plant under control around 15 hours and 50 minutes after the disaster, but regrettably, the damage had already been done. The public's trust in nuclear power was severely damaged by the disaster, even though no one died as a result of it. The greatest nuclear catastrophe in American history is still regarded as having occurred at Three Mile Island [24]. The laws controlling the “nuclear power sector in the United States” were drastically changed following the partial meltdown of the “Three Mile Island (TMI) reactor in March 1979”. In response to TMI, the NRC implemented several further safety precautions for reactors. These included adjustments to the design of the control room, supplemental feedwater systems, hydrogen control technologies, and personnel training. Construction timelines and expenses were more than twice as long and nearly three times more than for nuclear reactors built before the catastrophe as a result of the more stringent safety standards put in place after the Three Mile Island tragedy [39]. A primary distinction among the nuclear catastrophes at Chernobyl and Fukushima was the shift in knowledge dissemination and distribution brought about by the growth of the Internet and social networking sites. The condition of being heavily impacted by SNS is the same in all nations, despite differences in the medium utilized and age range. Information could previously only be sent by specific organizations, such the government or a media corporation. However, these days, one person can serve as the primary source, and knowledge can be swiftly and readily shared with a large audience. False information or material laced with emotion or terror is therefore more likely to proliferate and be discussed among residents than it was previously

[40]. In Japanese financial and political organizations, positions held by men who are seen to have superior risk assessment and crisis management abilities have traditionally controlled major decision-making processes. The government minimized the "safe" radiation exposure limit and the effective radioactive danger while accompanied by pro-nuclear specialists [41]. For the most part of the catastrophe, the Japanese government and the operators of the nuclear plants, Tokyo Electric Power Company (TEPCO), made repeated attempts to set the tone and provide gatekeeping. They typically used the phrases "no immediate risk to health" and "remain calm". Japanese mainstream media has come under criticism from staff writer Hiroyuki Takahashi of a news agency for misleading facts to readers by prioritizing evidence from the government. According to him, there was no monitoring function performed by the mainstream media in Japan. Certain magazines set the agenda for readers and viewers on a wide range of topics, going much beyond simply covering the latest developments at Fukushima. For example, the New York Times covered a wide range of nuclear power-related topics in addition to accident reports and facility problems [4].

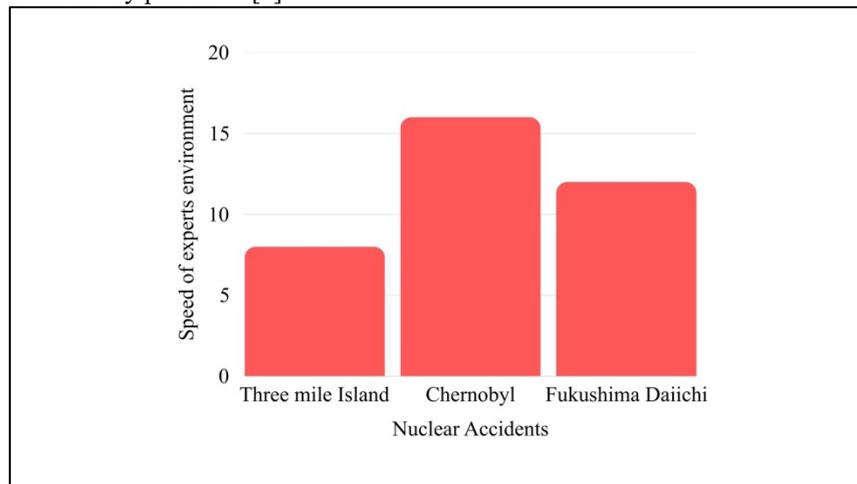


Fig. 6 Speed of Expert involvement in Nuclear disasters

Fig. 6 shows how fast experts got involved in three big nuclear accidents: Three Mile Island, Chernobyl, and Fukushima Daiichi. At TMI accident, there was a moderate delay for experts to respond. Due to confusion over severity but still the situation was controlled. On the other hand, the Chernobyl disaster had a big hold-up in getting experts there. This made things much worse because the slow response caused more damage over a wider area. For the Fukushima Daiichi accident, although serious, experts had a small delay in getting involved. But it was a quicker and coordinate response compared to other two accidents. From this analysis it is clear that Chernobyl accident had a worse and uncontrollable situation due to the downplay of the officials. This comparison highlights the significant importance of timely expert involvement in mitigating the effects of nuclear crisis.

B. Initial media response

The Three Mile Island, half nuclear reactor breakdown in 1979 was both very visible and concealed from the general public. Although it was the focus of constant media attention, its causes and effects required technical explanation. The moment unconscious radioactive substances left the site was not characterized by an explosion or fire. However, people remembered a range of unsettling sights, sounds, tastes, smells, and feeling. Between locals' sensory recollections of the catastrophe and official claims that minimal radiation had leaked from the site, public mistrust developed [42]. whereas, in 2011, during the Fukushima Daiichi nuclear plant disaster, government and utility authorities found it challenging to manage information about the accident or radiation exposure because to the widespread use of social media, the internet, and other media platforms. Due to the fact that this catastrophe happened right after a significant earthquake and tsunami that claimed lives and damaged property, risk clarification was at full speed. This was a triple-amplification event for the disclosure of risks. Some newspapers used the internet to provide greater coverage of the Fukushima disaster than previous ones. Especially for newspapers with a digital presence that were capable of publishing more extended sources with extra space for text and images, the internet brought numerous options to assist convey the narrative. The



sensationalistic reporting and excessive usage of the terms "meltdown," "catastrophe," and "radiation" in that coverage drew harsh criticism [4]. The US and Japanese governments show more transparency in handling their nuclear incidents than that of the Soviet Union did during the Chernobyl disaster. For instance, with regard to the TMI accident, confusion was not due to cover-up but rather mostly brought by misunderstanding and poor communication. The situation in the same way with the Fukushima disaster, where it was managed using minimum disruption because updated tools were present that made it easy to share information. Also, the presence of outside viewers made it easy to establish even more openness and accountability during the whole period of the crisis.

This analysis brings out the changes in communication and openness, especially as time goes by, over nuclear disasters through cases such as the ones that occurred at TMI and Fukushima Daiichi. In the case of the TMI accident, it was confusing since less had been done concerning communication. The situation at Fukushima came in at a time where media presence was required; besides the internet and social networking facilitated the exchange of information. Some of the news was considered exaggerated, but new communicative means allowed for openness and responsibility more than in previous accidents like Chernobyl, where information remained secret. Governments and outside watchers have been much more open regarding recent disasters. The reasons come down to how important good communication and trust building is during such crises to calm public fears and better how to handle a disaster like this.

C. Public perception and trust

High-profile event such as Three Mile Island (TMI) and the Fukushima disaster have shaped the public perceptions of nuclear power. While media coverage made these events visible to the public in real time, much of the actual damage was hidden from public view. Especially in the case of TMI there was no big explosion or spectacular flame. But, still Science and technology would be needed to assess the harm. TMI questioned nuclear energy's safety while making the public rely on authorities to inform them of the dangers and damages they could encounter. The public's mistrust got worse by this core tension [42]. The news narrative changed from one of "progress" to one of "runaway" and "devil's bargain." As a result, the public's initial support for nuclear power changed to one of confusion or open opposition. Recently, the public once again promoted nuclear power as a risk-risk trade-off situation since it was reconsidered as an approach to global warming [43]. Public acceptability of nuclear energy before and after the Fukushima nuclear disaster, researchers observed that public acceptance is favorably impacted by nuclear energy's perceived benefits both before and after the event. After the Fukushima nuclear tragedy, imagined risk became even more of a barrier to public acceptance. The 2011 Fukushima nuclear catastrophe greatly increased the public's perception of dangers associated with nuclear energy in China, which had a substantial negative impact. People who reside near the Tianwan NPP, which is the nearest NPP to Fukushima, were most impacted. Nuclear accidents are extremely unlikely, but when they do happen, the results can be terrible. Public acceptability is significantly and negatively impacted by perceived risk, according to studies looking at aspects influencing acceptance among the public. The public's trust decreases as risk awareness increases [44]. Large-scale demonstrations have grown more common in Japan after the Fukushima Daiichi Nuclear Power Plant disaster which was brought on by the Great East Japan Earthquake on March 11, 2011. More than 200,000 Japanese citizens participated in events against nuclear power plant restarts at their height in 2012 [45]. The Fukushima disaster in 2011 severely damaged public trust in nuclear energy and stopped the growth of nuclear energy in nations like Germany and Italy [43]. In 2010, 30.9% of respondents expressed support for nuclear energy, that declined to 26.9% in 2012. Conversely, the percentage of those opposed to nuclear energy rose from 41% in 2010 to 50.1% in 2012. These results underscore the adverse impact of the "Fukushima" disaster on public perceptions of "Nuclear power". Similar patterns were observed in surveys conducted before and after the incident among British and Japanese citizens, further illustrating the global shift in attitudes following the Fukushima catastrophe [46]. In particular, a pre-Fukushima national study carried out in China from 2002 to 2006 revealed that 80% of the people was in favor of the country's nuclear power plant construction, while fewer than 50% were in favor of building a nuclear power plant near their hometown. Public discrimination to local construction appears to have been driven by past significant commercial nuclear accidents. Sixty-two percent of respondents to a survey carried out 3 years after the Three Mile Island tragedy opposed the location of a nuclear power station within five miles of their city [47].

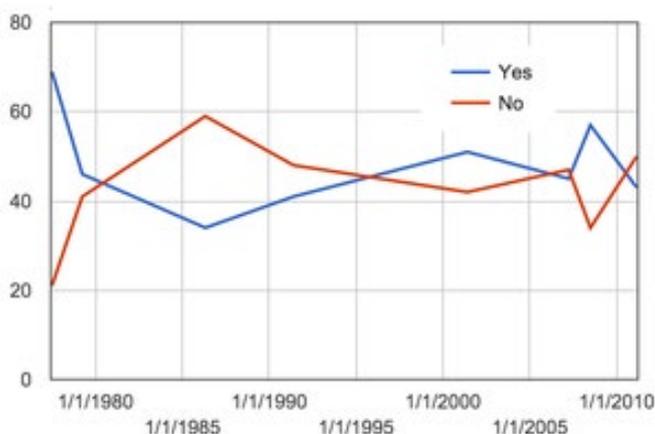


Fig. 7 Public trust in nuclear energy before and after major nuclear accidents in years such as TMI (1979), Chernobyl (1986), Fukushima (2011)

The graph in Fig. 7 represents the public trust in nuclear energy over the years before and after the major nuclear accidents. Public perceptions towards nuclear energy have largely influenced by these three catastrophic incidents. These events have caused major shifts in the people's attitudes towards the nuclear energy, which at various times favored and opposed again over the decades. Opposition to nuclear energy was much lower before TMI. After it affected the public perceptions towards nuclear power by raising opposition levels in the United States. But it was the Chernobyl disaster that caused a significant spike in anti-nuclear sentiment as the public got more aware on the risks associated with nuclear energy. Support for their initiatives had been growing over the decades particularly through the 1990s and 2000s, and peaked in 2011 after Fukushima when fears and doubts among the public erupted once again.

TABLE 1

Comparison table for Three major nuclear accidents

Aspects	Three Mile Island	Chernobyl	Fukushima
Year	March 28, 1979	April 26, 1986	March 11, 2011
Tragedy reason	Partial meltdown due to equipment failure and human error.	Reactor explosion due to design flaws and human error.	Earthquake and tsunami caused reactor coolant failure.
Initial media response	Immediate, but confusion over severity.	Delayed due to secrecy.	Quick, but information was downplayed
Government transparency	Moderate, but technical communication was unclear.	Very low, downplayed for several days.	Inconsistent, led to public criticism.
Experts involvement speed	Slight delay (within 48 hours after initial reactor malfunction)	Delayed by days due to government secrecy.	Moderate delay due to lack of communication.
International Coverage	Average, focused on nuclear safety issues.	Extensive after radiation was detected in abroad.	Widespread, long-term coverage.

Public protest	Smaller protests compared to Fukushima.	Initially limited, grew internationally later.	Widespread protests against nuclear energy.
Social media impact	No social media	No social media	Significant in spreading real-time information.
Public awareness	Moderate, unclear information caused public confusion	Low initially increased with foreign reports of radiation.	High due to international coverage.
Public trust after incident	Public trust was damaged, but restored over time with improved regulations.	Public trust was completely collapsed due to downplay and mishandling.	Public trust severely damaged, particularly on government and TEPCO.

The table 1 highlights the significant of the three major nuclear accidents had a reflective impact on global attitude towards nuclear energy. The table clearly shows how media coverage and experts involvement shaped public perception and handling of each disaster by officials. It also illustrates the cause behind each accident. Overtime there were improvements in communication and disaster management, but each accident further damaged the public trust. Many lessons were learned and safety protocols were strengthened after these incidents. The overall impact of these disasters made the world more cautious about the risk with nuclear energy.

The “Three Mile Island, Chernobyl, and Fukushima” nuclear accidents all had significant impacts, but varied in severity and consequences. Compared to other two nuclear explosion is Three Mile Island the less effect incident. Both Chernobyl and Fukushima were global crises, public response to nuclear energy shifted more dramatically after Fukushima, reflecting changes in communication and safety perceptions over time.

IX. Lessons Learned

A. Importance of Early Expert Involvement

The “Chernobyl Nuclear Disaster in 1986” offers important lessons about the need for rapid communication, openness, and professional engagement in public safety messages. Emphasizes the importance of accurate and unambiguous communication during times of crisis. Public skepticism and concern are compounded by the delay of some information. This involves working with traditional channels and social media channels to ensure that information is shared quickly and, in a manner that the general public can understand.

B. Future Crisis Management

Experts must feature early and more frequently than before in mainstream and social media platform to amplify the role experts play in shaping media messages in future. Experts should collaborate with journalists presenting concise, factual updates, debunking misinformation, and explain technological complexity without sounding too technical or baffling. It should be in understandable manner for general public. Using social media to its fullest professionals can disseminate quickly and widely, reach a variety of audiences, and encourage conscious and informed responses to emergency situations. Having open communication channels that promote trust and put the public’s need first is essential for successful crisis management.

X. Conclusion

In summary, scientific experts play an important role in influencing media stories about nuclear energy. Especially after the tragedy of Chernobyl. Information limitation of the Soviet government, including its lack of professional participation triggered distrust in public and wide spread disinformation. When the extent of the

tragedy became known, efforts by scientists from the Soviet Union and other countries had the key role to transform the perception and reaction of the public towards nuclear energy. This report also discusses scientists such as Hans Blix and Valery Legasov who were lifelines for influencing media coverage, making right judgments, and how to promote open communication. The Chernobyl disaster reminded of how professionals needed to be involved in handling crises as soon as possible. Professionals should play an active role in controlling their messages communicated through the media so as not to perpetuate false information, to disseminate actual information relevant to technology, and influence public opinion based on informed knowledge. Another lesson from this tragedy was that experience dictates that in the case of a nuclear accident, expertise, the media, and governments need to collaborate on policy matters to be open and transparent. During this sort of tragedy, there is a need for more effective crisis management, and one more lesson from the Chernobyl tragedy is early integration of scientific knowledge through conventional and social media channels. Such a strategy will help to reduce anxiety and promote resilience during the happening of technological disasters by ensuring that adequate knowledge is passed across to the population.

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