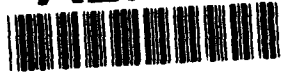


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**"The Smart Way Out"
Nuclear Energy:
Prospects for the 21st Century**

Lieutenant Colonel, AD
Peter J. DePerro
U.S. Army

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94 3 10 039

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified		1b. RESTRICTIVE MARKINGS	
2a. SECURITY CLASSIFICATION AUTHORITY N/A		3. DISTRIBUTION/AVAILABILITY OF REPORT Distribution Statement A: Approved for public release; distribution is unlimited.	
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A		4. PERFORMING ORGANIZATION REPORT NUMBER(S) NDU-ICAF-93-F2	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) NDU-ICAF-93-F2		5. MONITORING ORGANIZATION REPORT NUMBER(S) Same	
6a. NAME OF PERFORMING ORGANIZATION Industrial College of the Armed Forces	6b. OFFICE SYMBOL (if applicable) ICAF-FAP	7a. NAME OF MONITORING ORGANIZATION National Defense University	
6c. ADDRESS (City, State, and ZIP Code) Fort Lesley J. McNair Washington, D.C. 20319-6000		7b. ADDRESS (City, State, and ZIP Code) Fort Lesley J. McNair Washington, D.C. 20319-6000	
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (if applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code)		10. SOURCE OF FUNDING NUMBERS	
		PROGRAM ELEMENT NO.	PROJECT NO.
		TASK NO.	WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) "The Smart Way Out" Nuclear Energy: Prospects for the 21 st Century			
12. PERSONAL AUTHOR(S) Peter G. DePerro			
13a. TYPE OF REPORT Research	13b. TIME COVERED FROM Aug 92 to Apr 93	14. DATE OF REPORT (Year, Month, Day) April 1993	15. PAGE COUNT 31
16. SUPPLEMENTARY NOTATION			
17. COSATI CODES		18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)	
FIELD	GROUP	SUB-GROUP	
19. ABSTRACT (Continue on reverse if necessary and identify by block number) SEE ATTACHED			
20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS		21. ABSTRACT SECURITY CLASSIFICATION Unclassified	
22a. NAME OF RESPONSIBLE INDIVIDUAL Judy Clark		22b. TELEPHONE (Include Area Code) (202) 475-1889	22c. OFFICE SYMBOL ICAF-FAP

1993 EXECUTIVE RESEARCH PROJECT BY LTC PETER J. DEPERRO

"THE SMART WAY OUT"

NUCLEAR ENERGY: PROSPECTS FOR THE 21ST CENTURY

ABSTRACT

Nuclear energy can be a premier national industry with a promising future if our government and the public "wake up now and smell the coffee"! There are a number of key issues requiring action to get commercial nuclear power "back on track" (waste management, regulatory fixes, public support, safety, plant design standardization, executive leadership and government focus). Each of these issues can be resolved in favor of the industry, if only our nation has the will and common sense to take the "smart way out"! This research paper discusses the following:

- o Nuclear energy as seen hypothetically
from the year 2020
- o The "Stagnant Facts" pertaining to commercial nuclear
power - power plant construction, demand, safety,
waste management, public support
- o The prospects for our future in Nuclear Energy

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TABLE OF CONTENTS

<u>CHAPTER</u>		<u>PAGE</u>
	OVERVIEW	2
I	NUCLEAR ENERGY SEEN FROM THE YEAR 2020	3
II	THE "STAGNANT FACTS"	8
III	THE PROSPECTS FOR OUR FUTURE	15
	BIBLIOGRAPHY	22

"THE SMART WAY OUT"

NUCLEAR ENERGY: PROSPECTS FOR THE 21st CENTURY

OVERVIEW

What is the right course to take? What is the "smart way out" of the nuclear energy dilemma our nation faces today?

In this paper I will discuss:

- o Nuclear energy as seen hypothetically
from the year 2020 (Chapter I)
- o The "Stagnant Facts" pertaining to commercial nuclear
power - power plant construction, demand, safety,
waste management, public support (Chapter II)
- o The prospects for our future in Nuclear Energy
(Chapter III)

CHAPTER I - Nuclear energy seen from the year 2020

In the year 2020, the nuclear energy industry remains in decline and disarray. Its problems are many:

- o Lack of public support (environmental and safety issue)
- o Politically sensitive
- o Suffocating from regulation and licensing constraints as well as anti-nuclear activist protest
- o Waste management
- o Excessive cost

Clearly, commercial nuclear energy is an important national resource gone sour. During the early 1990's, the commercial nuclear industry in the United States found itself at a crossroads, mirroring the decline in the closely related nuclear weapons industry. The United States nuclear weapons industry "went out of business" with the fall of the former Soviet Union, no longer designing and producing nuclear weapons. The focus became dismantlement of our nuclear arsenal which has proceeded effectively. We have maintained a base nuclear force equal to that of Russia and little new output from our national weapons complex has been required.

LACK OF PUBLIC SUPPORT

In the commercial nuclear power arena, lack of public support and confidence have continued to plague the industry.

Look at the facts:

- o In 1990 - We were a nation with 110 operating reactors in over 70 plants producing 20% of the electricity in the United States (17:93,140,141).
- o In 2020 - Over half of the operating plants shut down as many licensed plants reached their design life end. With no new reactors ordered since 1978, few built in the interim years and none in planning, nuclear capacity is quickly disappearing. In 2020, nuclear power plants produce 9% of the electricity in the United States with coal use responsible for almost 75% of the total electric generation compared with 55% in 1990. Clean coal combustion technology reached commercial application in 1999 and contributed significantly to consumer satisfaction. Coal now firmly stands as the primary energy producing resource in our country.

Public confidence in nuclear energy was severely shaken by nuclear accidents/incidents at:

- o Three Mile Island, 28 Mar 1979
- o Chernobyl, 26 April 1986

- o Russellville, Arkansas, 15 Jun 1999
- o Diablo Canyon, California, 18 December 2011
- o Pilgrim Station Unit 1, 9 Jan 2017

The public appears convinced that nuclear power is not safe due to the above track record as well as safety violations made public by the Nuclear Regulatory Commission.

POLITICAL SENSITIVITY

Political sensitivity is ever present. Harmful effects of nuclear plant radiation are constantly dramatized by the anti-nuclear lobby. The members of Congress support the attitudes of their constituents in blocking plant production efforts in their respective states. The "not in my back yard" (NIMBY) syndrome remains alive and well with our nation's citizens and their lawmakers.

REGULATION AND LICENSING CONSTRAINTS/PROTEST

The licensing and construction regulating process as well as anti-nuclear activists continue to suffocate and frustrate the industry. In the licensing and construction process there are provisions for public hearings at the construction permit stage and the operating license stage. This allows lengthy legal challenges and anti-nuclear protest sentiment to succeed in

causing costly delays. Anti-nuclear activists have made a difference! A number of plants have succumbed to the same fate as the Rancho Seco Plant where anti-nuclear groups in June 1989 influenced voters of the Sacramento Municipal Utilities District to shut down the plant. This resulted in the loss of over 1200 jobs and 90 million dollars. It also marked the first time in history that an operating nuclear energy plant has been decommissioned by a public vote (9:22).

WASTE MANAGEMENT

In the year 2020 waste management remains a horror story all its own, having significantly contributed to the decline of the nuclear industry. In the late 1980's two permanent underground waste storage sites were selected by our government:

- o The Waste Isolation Pilot Project (WIPP) at Carlsbad, New Mexico designated for storage of transuranic waste (contaminated tools and equipment).
- o Yucca Mountain, Nevada Test Site designated for storage of high level waste. (9:18,19)

Both sites, although ready for operation in 2020, have yet to be given a green light for storage due to strong political and legal opposition from the states involved. Existing nuclear waste continues to be stored at nuclear weapon production facilities

and commercial power stations across the country. This is a temporary solution well past its time!

EXCESSIVE COST

The last major stumbling block to the possible resurgence of nuclear energy is excessive cost. In 2020, utilities do not develop new plant designs because plants are too expensive to purchase. As a result, nuclear plants can't provide electricity at a lower cost than that generated by coal. Obviously, the excessive cost of nuclear plants is tied to the length of time it takes to construct a plant and the legal/political battles which accompany each application for a construction permit. This represents a severe entry barrier to the industry (1:157).

BACK TO 1992

Looking back from the future, at an industry which has failed to solve its most pressing problems, can be a shocking "wake-up call" which may shed light on the "smart way out" today in 1992. Let's now examine, in some detail the present day (1992) "stagnant facts" of commercial nuclear power, with an eye toward those actions necessary to avert the tragic futuristic tale portrayed in this overview.

CHAPTER II - THE "STAGNANT FACTS" PERTAINING TO COMMERCIAL NUCLEAR POWER

POWER PLANT CONSTRUCTION

Today, 109 nuclear plants operate in the United States but incredibly, no new commercial nuclear power plants have been ordered since 1978 (3:16). There are, of course, a number of reasons why this has occurred but the fact is that our nuclear power plants are in grave trouble. Under current laws, power plants are licensed for a period of forty years, adding greater significance to a nation with no new orders for plant construction. Currently, eleven units totaling over 5 gigawatts-electric retire by 2010. Although utilities feel they can justify extensions of plant operating life for as much as twenty years, it will be difficult to obtain such a ruling from the Nuclear Regulatory Commission (16:29). Existing laws and regulations tend to suffocate the industry. As many as sixty-seven different government agencies must give permission in order to build a nuclear plant. Private citizens also stagnate the process with intervention when the utility applies for a permit to construct the plant (normally about eighteen months after the initial decision to build). Here at the construction permit hearings (which now take anywhere from three months to two years to

conclude) and again at the plant operation permit hearings, citizens and special interest groups raise issues pertaining to the community's environment, economy, health and safety, resulting in frustration and delays which cost time and money. It is clear that the Nuclear Regulatory Commission has gone out of its way to provide for public participation, complicating the licensing process immeasurably (8:152). Lengthy construction time, which is a direct result of the current licensing process has contributed heavily to the escalation of nuclear power plant costs and the industry's stagnation.

DEMAND -

Low demand for electricity certainly has contributed to the industry's stagnation. Before 1973 demand for electricity grew at an average rate of 7.0 percent a year. In the decade after the oil price hike, the average annual rate dropped to about 3.5 percent. This decrease in demand (one-half its pre-1973 rate) caused many utilities to build plants only to find they were not as urgently needed, or required at all (14:59). Additionally, this was the primary reason for the excess of generating capacity seen in the early 1980's. You don't have to be a rocket scientist to understand why utilities stopped building nuclear power plants

about this time. Since the early 1980's, we have seen economic prosperity and growth in electricity consumption. Even though these recent increases in demand have eliminated nearly all the excess capacity, and electricity shortages are a reality in parts of our nation, we still turn a cold shoulder to the construction of new nuclear plants. The U.S. Energy Information Administration projects that electricity sales in our nation will continue rising two percent annually through the year 2010. To meet this expected demand, hundreds of new electric generating plants will be needed (15:5).

SAFETY

How safe are our nuclear facilities? We know the weapons industry is fraught with risk and danger as we cope with downsizing our nuclear arsenal and dismantle thousands of warheads and munitions. We also know that weapons facilities, like the Hanford Nuclear Weapons Plant in Washington State, have serious faults including:

- o workers exposed to noxious gases
- o under reporting of occupational injuries
- o carelessness near potentially explosive waste tanks

- o not enough staff to ensure worker safety adequately during the monitoring and cleanup of tanks containing radioactive and chemical waste

A recent internal probe of worker safety also found that many employees were reluctant to report on-the-job injuries for fear that their performance evaluation would be affected (11:17). Unfortunately, when considering the safety record of the nuclear industry, one is forced to look at the Department of Defense, the Department of Energy and commercial utilities. The weapons industry is but one area of nuclear safety risk and when you combine it with our commercial nuclear industry risk, no wonder the public is scared. Has this fear contributed to the stagnation of the nuclear industry? No one factor has contributed more in my estimation.

The controversy over nuclear power plant safety really began around 1970. Many groups feared that the standard emergency core cooling system, which was designed for use if the regular cooling system failed, might not work. This failure could produce the most dreaded of nuclear accidents, a "melt down" through the foundation of the plant releasing massive amounts of radiation into the environment (14:16). Accidents have occurred and the public has paid the price in illness and death. While the precise

effects remain controversial, some critics contend that as many as 50,000 to 100,000 excess deaths occurred after accidents at the Savannah River nuclear weapons facility in 1970 and at Three Mile Island in 1979 (6:4). Fallout from Chernobyl continues to haunt the lives of many nations with the understanding that within only a few days, hundreds of millions of curies of radiation were released into the atmosphere which amounts to about one-tenth of the nuclear fission products that had been spread by all bomb tests since 1945 (6:13). The critics of the industry site other incidents such as:

- o The Peach Bottom nuclear reactors in Lancaster, Pennsylvania, shut down March 31, 1987 due to detected radiation releases. It was reported that operators were "sleeping on the job and taking drugs." The result of this incident is further reported to have affected the infant mortality rate in the Washington D.C. area because Peach Bottom is just upwind of the largest milk-producing sector of this country (6:111).

- o Atmospheric Bomb Test research reportedly indicates that children born during the bomb test years may have suffered immune system damage. An example cited is child cancer mortality, which was relatively rare in the U.S. prior to 1945, with rates of less than 20 deaths per million. This rate reportedly rose to a peak

of 80 deaths per million in 1955 in the early days of hydrogen bomb testing (6:105).

o Even Aids, Lyme disease and other immune-deficiency ailments, particularly among young people, are reportedly being linked by critics to the huge amounts of low-level radiation released since 1945.

With this kind of safety record, and the implications which follow, is it any wonder that the commercial nuclear industry suffers from stagnation?

WASTE MANAGEMENT

Waste management is indeed a horror story all its own which continues to fuel debate over the future of the nuclear industry. The waste issue haunts not only the commercial nuclear industry, but also the weapons industry and extends to other nuclear club members. The New York Times reported on 24 November 1992, that Russia continues to discharge large amounts of nuclear waste into the Arctic Ocean from nuclear weapon plants along the Ob River in addition to the many deposits made on the sea floor (13:7). The Christian Science Monitor reports that the former Soviet Union's handling of radioactive waste was frightful from the very

beginning of its nuclear program. Lake Karachay, where today one hour's exposure at the shoreline is considered fatal by physicians, is testimony to Russia's waste nightmare (20:17).

In our own nation, the Department of Energy has estimated that it will take 30 years, and cost more than \$100 billion to clean up the nuclear waste mess (4:7). In testimony before the Senate Committee on Governmental affairs, Mr. Dan W. Reicher of the Natural Resources Defense Council explained: "For over 40 years, DOE nuclear weapons facilities have been generating hazardous wastes through a variety of industrial processes and generating millions of gallons of solvents, caustics, acids, heavy metals, and nitrates; much containing radioactive materials" (19:150). Nuclear plants and weapons facilities are bulging with radioactive waste. Over stressed and about to burst at the seams, these facilities require a permanent answer to the disposition of low level, mid-level and high level nuclear waste. Long term burial in deep geological repositories appears to be the most favored solution, but political objections and community protests continue to plague the Department of Energy's attempts to come to grips with nuclear waste. Congress has designated two sites for waste storage:

- o Yucca Mountain, Nevada - High level waste repository which at the earliest could be ready in 2010.

o Carlsbad, New Mexico - The Waste Isolation Pilot Plan (WIPP) site could be operational in 1997 on a trial basis, if a current injunction in Federal Court preventing utilization, is lifted (5:57).

The jury is still out on how we will permanently deal with this dangerous and difficult issue. Here too, stagnation prevails in our attempts to get a "fix".

PUBLIC SUPPORT

Today, the Tennessee Valley Authority is the only Utility in our nation struggling to complete construction of a Nuclear Power plant (10:F1). As mentioned earlier, no other plants are on order and given the costs associated with nuclear power plant construction, nuclear power clearly has fallen out of favor. What is at the heart of this stagnate state? I submit, public support is the answer. During the early years of atomic power, the Atomic Energy Commission (AEC) did a good job of selling atomic energy. The AEC focused on educating Americans and used press releases, speeches and interviews with the news media to keep the positive aspects of atomic energy at the forefront (7:52). The acceptance of nuclear power is clearly an emotional issue in the 1990's and there is no future for nuclear power unless the public is ready to accept it. With regard to how the

American public views nuclear power, lets look at polling results from 1989 which indicate:

- o 45% think nuclear power plants are very important
- o 50% think nuclear energy should play an important role in DOE's National Energy Strategy for the future
- o 50% think nuclear energy will be important in meeting the nation's energy needs in the years ahead
- o 17% favor having a nuclear plant in their community
- o 23% oppose having a nuclear plant in their community
- o 59% undecided regards a nuclear plant in their community (1:42).

What does this tell us?

o First, there is a large percentage of the population that believes nuclear power is important and is willing to give it a chance, even if it means a power plant operating nearby.

o Second, the NIMBY (not in my back yard) syndrome is an important factor. Clearly, a large portion of the above indicated 59% undecided, would likely oppose a nuclear plant in their community when a real live facility showed up on their doorstep, given the current safety and waste management climate.

How can we influence these "undecided" to join the ranks of nuclear energy supporters? Maybe there is an opportunity here to

break the stagnation in public opinion over nuclear energy through an education and information process designed to focus on misunderstanding and the positive elements of this national dilemma (1:42).

CHAPTER III - THE PROSPECTS FOR OUR FUTURE IN NUCLEAR ENERGY

THE POSITIVE PICTURE

Nuclear energy has a positive picture to paint! It is obvious from our previous discussion that our nation will need more power plants in the near future and fueling them with coal, oil or gas leads to health, environmental, economic and political problems. The "Smart Way Out" is nuclear fuels. Bernard L. Cohn writes: "They cause no greenhouse effect, no acid rain, no pollution of the air with sulfur dioxide, nitrogen oxides, or other dangerous chemicals, no oil spills, no strain on our economy from excessive imports, no dependence on unreliable foreign sources, no risk of military ventures" (1:39).

PREREQUISITES FOR "NUCLEAR HEALTH"

The first and most important prerequisite for the future health of the commercial nuclear power industry is rising demand.

As stated earlier, the demand for electricity is projected to continue raising 2% annually through the year 2010 (15:5). Demand for electricity is a given!

In order for nuclear fuels to step to the forefront a number of other positive prerequisites must be present:

- o Existing laws and regulations must change to allow for the new construction of nuclear power plants. Combined construction and operating licenses must be legislated with no intervention allowed by a third party until after issuance of the combined license.

- o Regulatory action at the State level must provide assurances to utilities that they will receive a reasonable return on their investment.

- o The Nuclear Regulatory Commission must rule favorably on the issue of extending the operating lives of nuclear plants by as much as 20 years in order to ensure continued nuclear supply (given scientific proof that they can be safely extended).

- o New technological advances (advanced light-water power plant program, modular high temperature gas-cooled reactor program and the advanced liquid metal-cooled power plant program) must continue to be researched and developed to ensure improved safety and cost effectiveness (16:29,30).

o Rising costs of producing nuclear power must be eliminated. Government directed development of new, simpler and standard design reactors will help greatly in decreasing costs.

o The United States must learn from countries, like France, how to make nuclear power a success. There are some things we cannot change in America (our heritage, forms of political and social organization) but we can focus on a few key elements which have contributed greatly to France's success:

- national mentality toward nuclear power
- cultural values
- standardized design in nuclear facilities
- closely associated research centers, builders and utilities
- central governmental control over the nuclear power industry (2:602).

o Leadership from our new administration must be directed now to confront the "Strangle Hold" currently gripping the nation's nuclear industry. This bold leadership effort must be plainly but forcefully articulated in a national energy policy for the general public to understand. The administration's goal must be public acceptance of nuclear energy for the good of our nation's future.

o Public support must be obtained through an education and information effort which does a credible job of portraying the positive aspects of nuclear energy.

o Flawless safety standards must be maintained without the occurrence of any new accidents. We are getting better! In September 1991, the Wolf Creek nuclear plant set the current U.S. record for continuous operation by running for 487 days. Nuclear-plant operators are working to promote safer and longer runs. Operating records for safe and efficient power production can favorably influence public opinion (12:2). The nuclear industry must come to be viewed by the public and the congress as a "safe technology" industry. Passive redundant safety features must continue to be developed and advertized as the difference between "then and now".

o Waste management must be "done smart" and "done fast". Stumbling blocks must be effectively moved out of the "path to real progress". Without question, the safe, permanent disposal of nuclear waste is critical to the continued viability of the nuclear power industry. With approximately 20,000 metric tons of highly radioactive wastes temporarily stored at facilities in more than thirty states and more waste being generated each year, this most dangerous condition must be resolved now (18:8)!

CONCLUSIONS

Nuclear energy can be a premier national industry with a promising future if our government and the public "wake up now and smell the coffee"! There are a number of key issues requiring action to get nuclear power "back on track" (waste management, regulatory fixes, public support, safety, plant design standardization, executive leadership and government focus). Each of these issues can be resolved in favor of the industry, if only our nation has the will and common sense to take the "smart way out"!

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