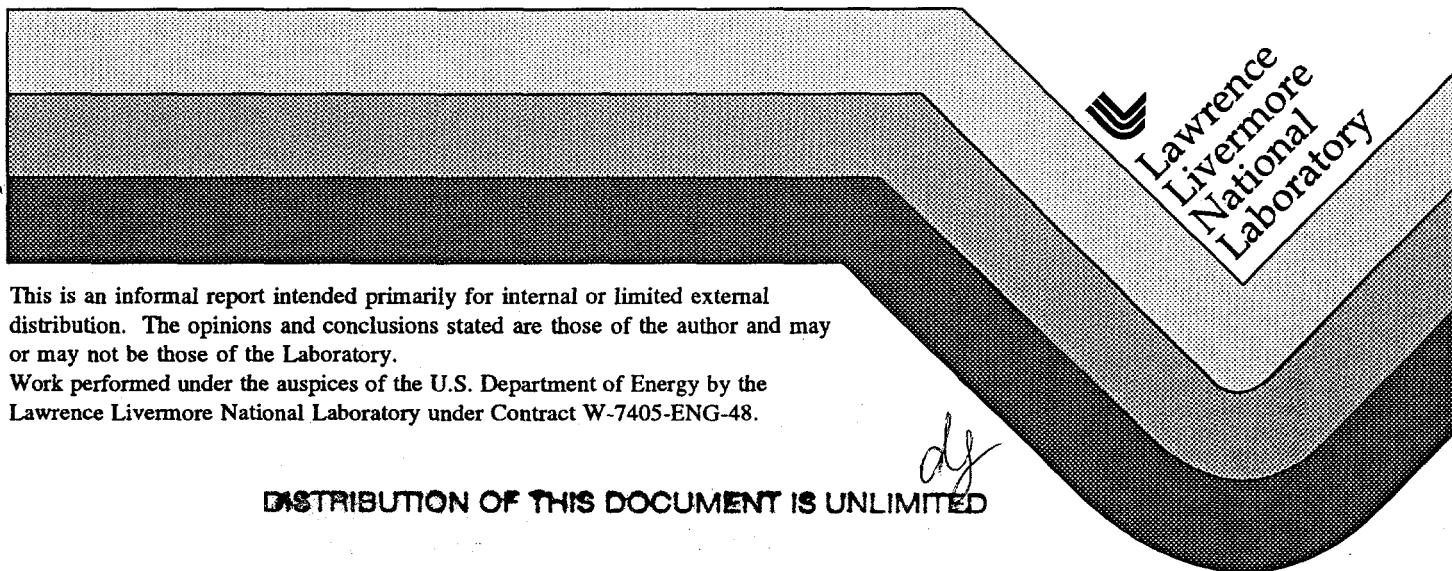


Questions on NEA Program for OMB Budget Presentation

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NUCLEAR EXPLOSIVE APPLICATIONS PROGRAM

DOCUMENT NUMBER 16697

NEA QUESTION 1

Why was the program renamed from PNE to NEA?

ANSWER

DECLASSIFICATION
STAMP ON REVERSE

We understand the program was renamed as the result of a recommendation made at the staff planning level. While DMA certainly concurred in the change, we are not sure of the exact reasoning behind it. It does seem prudent to take advantage of the formation of a new organization, such as ERDA, to redefine and also rename a program which had been on the decline for a number of years. Also, insofar as possible, it was desired to associate the program as realistically and as closely as possible with the energy responsibilities of ERDA.

NEA QUESTION 2

Why are storage cavities needed? Why can't existing caves and mines be used? Isn't a mined cavity safer for radioactive disposal?

ANSWER

In considering the need for storage cavities, we are not only concerned with U.S. needs but also with those of many other countries throughout the world which do not have geologic resources comparable to those of the U.S. and the Soviet Union. Investigation of this technology includes both cavities for storage and waste disposal.

Considering both types of cavities (storage and waste disposal), there is a serious need in the world for the capability to develop them either in salt or impermeable rock. Mines and caves might not be suitable for many of the types of storage envisioned with regard to hydrocarbons or high level radioactive wastes because their geologic makeup or location could be unsuitable. Employing nuclear explosives, we can obtain much deeper cavities than obtainable with conventional mining techniques and with less cost.

The FY 1977 effort is devoted to studies, for example, extending our detailed knowledge of the effects of storage in salt domes. If the nuclear technology develops as the initial studies predict, then a nuclear cavity might be as safe or possibly safer than the best mined cavity available.

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NEA QUESTION 3

Why can't we tolerate asymmetry between U.S. and USSR PNE capability?

ANSWER

There is presently an increasing asymmetry between the U.S. and USSR programs and capability.

There are several reasons why the U.S. should not allow this asymmetry with the Soviet Union:

Technical advice supporting our international interchanges and agreements. By Article V of the NPT, the U.S. is to ensure that "potential benefits from any peaceful applications of nuclear explosions will be made available to nonnuclear weapon States Party to the treaty." The U.S. has made commitments to support PNE through the IAEA. The expertise of that body must be based on the justification of the Nuclear Weapon States in pre-feasibility and feasibility studies and in PNE projects. The IAEA has looked to the U.S. for leadership in these types of activities. Further, the loss of a PNE capability severely curtails our ability to provide technical support to future arms control and disarmament treaty delegations on the effectiveness of PNE verification procedures as well as the ability to assess the potential degree of military advantage accruing from foreign PNE events.

PNE technology is closely associated with nuclear weapons design. Many of the more advanced weapon concepts have come as a direct result of the PNE program. Continuation of a PNE program under the constraints of a TTBT which limits weapons testing means an indirect accumulation of nuclear explosion technology benefits to the Soviet Union.

If the U.S. were to withdraw from the PNE field and leave the development of this area of technology to the Soviet Union, it could provide significant opportunities for Soviet economic and technical penetration of markets and areas of the world presently denied to them. A Soviet monopoly in this field could be used to enhance Soviet influence and to improve their posture in many areas of the developing world.



NEA QUESTION 4

Why do we need PNE execution capability to support verification capability?
Why shouldn't the money go directly to verification?

ANSWER

The retention of a capability by the U.S. to carry out an effective PNE program enhances its understanding of the requirements and problems encountered by another country in the conduct of its own program. This understanding is essential to verification. It is not reasonable to assume that the U.S. could retain a capability or understanding of a program of the scope of PNE within the lesser verification program.

All funds required in direct support of verification should be identified directly with budget items for verification to allow adequate management visibility.

NEA QUESTION 5

What is the priority of PNE research compared to other energy technology research?

ANSWER

The Administrator establishes the overall priorities within ERDA. He has seen PNE research to have sufficient priority to warrant its inclusion in the FY 1977 budget request. It should be considered independent of energy technology research because of its international implications.

Should it become necessary for the Administrator to make a determination between PNE and energy technology, a further evaluation and reexamination of the PNE proposal would be required.

NEA QUESTION 6

What is our obligation under Article V of the NPT if we determine that PNE's are not worthwhile? The recent GURC report expects "little or no use for industrial purposes" before 1990.

ANSWER

Further determination of the worth of PNE projects cannot be achieved without significant technical effort.

[REDACTED]

Any prognostication will also depend on the energy shortage, mineral shortages, etc. Recent events on the energy front have illustrated the uncertainty of such predictions. Political events can also affect the potential usefulness of PNE projects.

Article V of the NPT states:

"Each Party to the Treaty undertakes to take appropriate measures to ensure that, in accordance with this Treaty, under appropriate international observation and through appropriate international procedures, potential benefits from any peaceful applications of nuclear explosions will be made available to nonnuclear weapon States Party to the Treaty on a nondiscriminatory basis and that the charge to such Parties for the explosive devices used will be as low as possible and exclude any charge for research and development. Nonnuclear weapon States Party to the Treaty shall be able to obtain such benefits, pursuant to a special international agreement or agreements, through an appropriate international body with adequate representation of nonnuclear weapon States. Negotiations on this subject shall commence as soon as possible after the Treaty enters into force. Nonnuclear weapon States Party to the Treaty so desiring may also obtain such benefits pursuant to bilateral agreements."

If a nonnuclear weapon State believes to its satisfaction that benefits would accrue from nuclear explosive applications, it would seem that our denial of service would be a breach of the treaty obligations.

NEA QUESTION 7

What new information is available which shows that PNE's will be politically acceptable? How do you weigh the Colorado vote?

ANSWER

We have no new information with which to make a valid reassessment of the political acceptance of PNE's. There are, however, two ongoing activities of current intense interest: The Soviet Union has a vigorous PNE program and openly affirms that it has reduced to practice four applications. Of growing importance is the U.S. participation in the IAEA PNE Ad Hoc Advisory Group. Currently, the Advisory Group is preparing studies of the legal questions of employing PNE's under existing treaties, the health and safety aspects, the economics of PNE's, and preparing a technical catalog

[REDACTED]

[REDACTED]

of PNE applications. Early in 1976, additional efforts are contemplated. The objective of the Advisory Group is to support the IAEA in arriving at an international agreement on implementation of Article V of the NPT.

NEA QUESTION 8

How much has been spent to develop PNE's to date? What viable technology has resulted?

ANSWER

The AEC PNE program cost from 1961 through 1974 was \$165 million.

Significant technology has accrued not only in the PNE program but also in nuclear weapons, energy programs, earthquake phenomenology, reactor siting and containment, underground phenomenology, weather phenomenology, and radiobiology.

PNE technology in cratering, gas stimulation, device design, and engineering has been advanced. However, these PNE efforts have all been stopped short of the development required for economic application.

Major contributions to nuclear weapon design and technology have accrued from the PNE design effort and much of our understanding of underground testing phenomenology and containment has come as a direct result of the PNE program.

[REDACTED]

NUCLEAR EXPLOSIVE APPLICATIONS

Building Block from Section 4.2

A.8. Nuclear Explosive Applications

Objectives

Near-Term. (-1985):

Carry out an adequate level-of-effort research and applications program to enhance national security and support commitments which may arise under the Non-Proliferation Treaty while at the same time developing options for solving domestic energy and resource problems by the most economically and environmentally acceptable means. Continue nuclear explosion phenomenology studies of multiple explosion arrays essential to in situ mineral recovery concepts. Pursue the concepts of using nuclear-explosive-created cavities for hydrocarbon storage and radioactive waste disposal.

Mid-Term (-2000):

Continue the program as shown to be warranted as a result of experiences in the near-term including the level of effort R&D program.

Long-Term (+2000): Continue as in the mid-term.

National Energy Goals Supported

- ° Expand the domestic supply of economically recoverable energy producing raw materials.
- ° Protect and enhance the general health, safety, welfare, and environment related to energy.
- ° Perform basic supporting research and technical services related to energy.

Strategy

Reestablish and maintain a minimum viable level-of-effort program of research and experimentation sufficient to attract and retain qualified and experienced personnel and maintain an up-to-date technology in the United States to: (a) provide technical support for the U.S. Government in treaty negotiations, (b) serve as a foundation for future verification programs, (c) provide credibility and flexibility to the U.S. position on the Non-Proliferation Treaty, (d) allow the U.S. to participate in international PNE discussions and reviews, (e) enhance national security, and (f) pursue solutions to energy and resource problems.

Pursue applications to the point of demonstrating their technical, economic and environmental feasibility to private industry, the regulatory bodies, and the public. These will be applications of nuclear explosives, basically simple in nature which require few explosives, and can be demonstrated on federal lands. Applications under current study include a method of creating cavities for hydrocarbon storage and radioactive waste disposal deep enough to be safe and acceptable to the public while doing so at economic and environmental costs less than more conventional means.

Investigation of the explosion phenomenology aspects of the RIO BLANCO experiment will aid in understanding the effects of multiple explosions in various geological environments by investigation of the lack of chimney interconnection on this triple device experiment.

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

NUCLEAR EXPLOSIVE APPLICATIONS

Federal Role

A Federal role is required because of the Atomic Energy Act of 1954, as amended and the Energy Reorganization Act of 1974 which places the control of nuclear explosive technology exclusively within ERDA.

A Federal funding role is also essential to alleviate the financial risks associated with a new technology. This is especially true with respect to nuclear explosive applications which carry the additional risks and liabilities associated with nuclear explosive safety, requirements of NRC licensing, and public acceptability of products.

More importantly a Federal role is essential to maintain the Nuclear Explosive Applications program in the United States because of the national and international security implications associated with the program.

International Cooperation

Obligations of the Non-Proliferation Treaty, current studies by the International Atomic Energy Agency, and requests for U.S. assistance in international feasibility studies and discussions all dictate a high-level of international participation on the part of the U.S. PNE topics upon which the U.S. will likely be requested to provide technical advice include: Excavation Technology, Cataloguing PNE's, Economics of PNE's, Health, Safety, and Environmental Aspects of PNE's, and the Legal and Treaty Aspects of PNE's.

Technological Status and Problems

U.S. experts are currently lending technical support to the U.S. Government in current treaty negotiations, to international PNE review bodies, and for participation in international feasibility studies. Current U.S. expertise in PNE technology has been built up over the last 14 years but this capability cannot be expected to remain fresh and viable for more than a few years without further experimentation in the U.S. (The last experiment was RIO BLANCO conducted in May 1973.)

Generalized device design work and experiments have been carried out in both excavation and contained applications. Experiments in excavation and gas stimulation have reached the demonstration stage. Additional investigation of the RIO BLANCO chimney interconnection region is planned to make adjustments to the analysis codes which are used for predicting multiple explosion phenomenology.

Future applications under consideration are the feasibility of using nuclear explosive created cavities as an economical and invulnerable storage or stockpiling facility for hydrocarbons at either end of the transportation cycle, and of using such cavities for disposal of high level radioactive wastes at greater depths than would be otherwise possible by more conventional means.

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

NUCLEAR EXPLOSIVE APPLICATIONS

Technological Status and Problems (Cont)

In the case of applications to develop a resource base, uncertainties as to the exact nature, quantity and quality of resource base present a major obstacle. In addition, a deficiency in understanding the explosion phenomenology associated with multiple arrays presently inhibit exact predictions on more advanced applications.

Institutional Status and Problems

Lack of clear U.S. policy on licensing the use of PNE developed resources has resulted in expensive delays, disenchantment by industrial partners, and confusion on the part of the public.

Lack of strong and objective promotion by the Federal Government of the economic and environmental benefits of nuclear explosive applications has resulted in a void in public understanding and a reluctance to accept applications.

Past Federal funding policy requiring industry to provide 85% of field costs has resulted in a poor level of basic research and early loss of interest by industry upon failure of demonstration phase.

Environmental Status and Problems

Any sites outside the Nevada Test Site will require environmental impact statements.

Applications of nuclear explosives may prove to be less harmful environmentally than other alternatives by processing deep and low grade resources in situ.

Implementation

A level of effort research and development program will be established to provide technical support in the areas of explosion phenomenology, radioactivity transport, analysis of foreign excavation projects, storage and disposal cavities, and domestic requirements for applications which are publicly, environmentally, and economically acceptable.

In addition the level of effort R&D program will provide technical support to the U.S. Government as appropriate in treaty negotiations, in honoring Non-Proliferation Treaty (NPT) commitments, in participating in feasibility studies of foreign projects and in international studies of foreign projects and in international Peaceful Nuclear Explosives (PNE) reviews by the International Atomic Energy Agency (IAEA), Conference of the Committee on Disarmament (CCD), and bilateral PNE discussions.

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

NUCLEAR EXPLOSIVE APPLICATIONS

FISCAL YEAR

SUBUNITS - OUTPUTS/MILESTONES

75	76	77	78	79	80	81	82	83	84	85	1986- 2000	Beyond 2000
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Decision to Return to Viable Level

NUCLEAR EXPLOSIVE APPLICATIONS



Technology Support
and Applications

Note: (1) Established level-of-effort program at viable level.

(2) Experiment or demonstration of application.

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

NUCLEAR EXPLOSIVE APPLICATIONS

FINANCIAL PLAN

(Dollars in Millions)

	FY 75	FY 76	TQ	FY 77	FY 78	FY 79	FY 80	FY 81
OPERATING EXPENSES								
BA	-	-	-	4	10	8	8	8
BO	-	-	-	3	8	8	8	8
PLANT & CAPITAL EQUIPMENT*								
BA	-	-	-	-	-	-	-	-
BO	-	-	-	-	-	-	-	-

This is a level of effort program funded in the out years to maintain a staff of engineers and scientists at the design labs to support the development of new technology in this important international field. This program funding will be sufficient to provide for a field experiment at the Nevada Test Site every other year. First nuclear shot at NTS is scheduled for FY 79.

Dollars to 1985: \$67 million

* Less than \$1.0 million annually from FY77-81.

1. Fossil Energy

- b. Petroleum and Natural Gas

1. Gas and Oil Extraction

Volume I Energy Strategy
Summary of Progress Since June 30, 1975

Gas Stimulation

Further evaluation of the gas-bearing sands in the RIO BLANCO nuclear gas stimulation experiment (1973) reservoir have been initiated because of the surprisingly unfavorable results of what was expected to be one of the most promising resource bases for natural gas. This data will be compared with the data from the nearby massive hydraulic fracturing experiment expected to be completed this fiscal year.

Encl.

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

GAS AND OIL EXTRACTION

Building Block from Section 4.2

1. Fossil Energy

b. Petroleum and Natural Gas

1. Gas and Oil Extraction

Objectives

near-Term (-1985): Complete RIO BLANCO gas stimulation experiment and compare data with that of nearby massive hydraulic fracturing experiment.

National Energy Goals Supported

- ° Expand the domestic supply of economically recoverable energy producing raw materials.
- ° Protect and enhance the general health, safety, welfare, and environment related to energy.
- ° Perform basic supporting research and technical services related to energy.

Strategy

Further evaluation of the RIO BLANCO experiment is directed at advancing our understanding of tight natural gas formations as a potential resource by completing the reservoir evaluation and making a comparison of the data with the nearby hydraulic fracturing experiment.

Federal Role

A Federal role is required because of the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974 which places the control of nuclear explosive technology exclusively within ERDA.

A Federal funding role is also essential to alleviate the financial risks associated with a new technology. This is especially true with respect to nuclear explosive applications which carry the additional risks and liabilities associated with nuclear explosive safety, requirements of NRC licensing, and public acceptability of products.

International Cooperation

The International Atomic Energy Agency is soliciting U.S. support for preparing a catalogue of PNE applications.

Technological Status and Problems

Further evaluation of the gas-bearing sands in the RIO BLANCO gas stimulation experiment (1973) reservoir are planned because of the surprisingly unfavorable results of what was expected to be one of the most promising applications. This data will be compared with the data from the nearby massive hydraulic fracturing experiment expected to be completed this fiscal year. Additional investigation of the RIO BLANCO chimney interconnection region is also planned to make adjustments to the analytical codes which are used for predicting multiple explosion phenomenology.

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

GAS AND OIL EXTRACTION

Institutional Status and Problems

Lack of clear policy of the Federal Government on licensing the use of PNE developed resources has resulted in expensive delays, disenchantment by industrial partners, and confusion on the part of the public.

Lack of strong and objective promotion by the Federal Government of the economic and environmental benefits of nuclear explosive applications has resulted in a void in public understanding and a reluctance to accept applications.

Past funding policy requiring industry to carry 85% of field costs has resulted in a poor level of basic resource research and early loss of interest by industry upon failure of demonstration phase.

Environmental Status and Problems

Any sites selected off the Nevada Test Site will require environmental impact statements.

Applications of nuclear explosives may prove to be less harmful environmentally than other alternatives by processing deep and low grade resources in situ.

Implementation

The RIO BLANCO gas stimulation experiment will be brought to completion by reservoir evaluation and investigation of the chimney interconnection region.

U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

GAS AND OIL EXTRACTION

SUBUNITS - OUTPUTS/MILESTONES

FISCAL YEAR

75	76	77	78	79	80	81	82	83	84	85	1986- 2000	Beyond 2000
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GAS STIMULATION

RIO BLANCO EVALUATION



U. S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

GAS AND OIL EXTRACTION

FINANCIAL PLAN

(Dollars in Millions)

	FY 75	FY 76	TQ	FY 77	FY 78	FY 79	FY 80	FY 81
OPERATING EXPENSES								
BA	-	-	-	-	-	-	-	-
BO	2	1	.5	1	-	-	-	-
PLANT & CAPITAL EQUIPMENT								
BA	-	-	-	-	-	-	-	-
BO	-	-	-	-	-	-	-	-

The total cost and time to complete is:

Year of completion - 1977
 Federal dollars to completion - \$ 6M
 Private dollars to completion - \$ 9M
 Total dollars to completion - \$15M

All cost data are rounded to nearest million dollars.