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Mr. John W. N. Hickey, Chief, Enrichment Branch
U.S. Nuclear Regulatory Commission
Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards
Mail Stop 4-E-4
Washington, D.C. 20555

RE: Comments on NUREG-1484 (Draft Environmental Impact Statement for the proposed Claiborne Enrichment Center, Homer, Louisiana); Docket No. 70-3070-ML, ASLBP No. 91-641-02-ML, (Special Nuclear Materials License)

Dear Mr. Hickey:

The Sierra Club Legal Defense Fund, Inc. ("SCLDF"), on behalf of Citizens Against Nuclear Trash ("CANT") hereby submits the following comments on the Draft Environmental Impact Statement ("Draft EIS") for the construction and operation of the proposed Claiborne Enrichment Center ("CEC") outside of Homer, Louisiana (NUREG-1484).[1]

This Draft EIS was ostensibly prepared to assess the potential environmental impacts of the construction and operation of the proposed CEC facility. The Nuclear Regulatory Commission ("NRC") proposes to issue the applicant, Louisiana Energy Services, Ltd. ("LES"),

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[1] These comments were prepared with assistance from Dr. Arjun Makhijani, President of the Institute for Energy and Environmental Research (technical and engineering issues); Helen M. Hunt (safeguards issues); Dr. Robert T. Bullard and Dr. Kristin Shrader-Frechette (sociological and economic issues); and Dr. Farhad Atash (land use issues).

a license to construct and operate the CEC based upon this Draft EIS.

However, under the law, a license cannot be issued based on this Draft EIS, which is so grossly deficient in its discussion of the potential impacts of the proposed facility that it entirely fails to adequately describe "the environmental effects of . . . the proposed action" as required by 40 C.F.R. § 1502.16(d).

For example, there is absolutely no discussion of any impacts of the proposed facility on the two African-American communities of Forest Grove and Center Springs -- the communities closest to the proposed site. In fact, neither of these historic communities appears on any of the numerous maps included in the Draft EIS, although more distant, predominantly White communities of similar size are noted (see, e.g., p. 3-2 where the communities of Marsalis, Aycock, Lillie, Antioch, and Leton are identified). A more blatant instance of environmental racism is difficult to imagine. And all this notwithstanding the fact that in a September 1993 report the Louisiana Advisory Committee to the U.S. Commission on Civil Rights found that many "black communities [in Louisiana] are disproportionately impacted" by environmental problems, and specifically warned that "[t]he U.S. Environmental Protection Agency should monitor the communities of . . . Forest Grove and Center Springs."[2]

Yet key agencies such as the Environmental Protection Agency in Washington were not even consulted during the drafting of the EIS -- nor were the Department of Energy, the Department of State, the Department of Defense, the CIA, the National Security Council, or the Department of Transportation, each of which has expertise on a wide variety of matters pertaining to impacts of the proposed CEC facility. The NRC's failure to consult these other agencies is all the more egregious in light of the fact that the licensing of the proposed CEC facility could have significant adverse impacts on major national policy goals and programs of these agencies, such as the Department of State's goal of reducing international weapons fuel stockpiles, the Department of Energy's efforts to control international leakage of safeguards information, and the EPA's program for promoting environmental equity in government decisionmaking.

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[2] "The Battle For Environmental Justice in Louisiana . . . . . Government, Industry and the People", September 1993 at 63 (Finding 1) and 67 (Recommendation 8), attached hereto as exhibit "1".

And questions of paramount importance to neighbors of the proposed facility are not answered in the Draft EIS, such as exactly where (other than on site, next door to residents) LES intends to put the nearly 115,000 metric tons of hazardous radioactive waste that will be generated by the facility. What these neighbors know, but the Draft EIS tries to hide, is that there currently is no disposal site available for such waste.

As a consequence of these, and numerous other fundamental flaws in the Draft EIS set forth below, a revised draft EIS must be prepared for public comment pursuant to 40 C.F.R. § 1502.9(a) before any further action can be taken by the NRC on the LES license application.

1.) THE DRAFT EIS IS INADEQUATE BECAUSE THE NUCLEAR REGULATORY COMMISSION FAILED TO CONSULT WITH ALL APPROPRIATE FEDERAL AGENCIES REGARDING THE PROPOSED PROJECT, AS REQUIRED BY NEPA.

As a threshold matter, the Draft EIS is fatally flawed because it was prepared without consultation of major federal agencies that not only have expertise in the environmental issues raised by the proposed licensing of the CEC facility, but whose own policy goals and programs could be significantly and adversely affected if the CEC facility is built and operated. Accordingly, the Draft EIS should be withdrawn, submitted to all appropriate agencies for consultation, and resubmitted to the public for comment at the appropriate time.

Requirements of NEPA

NEPA, 42 U.S.C. §§ 4321 - 4370c, requires a systematic, interdisciplinary approach to assessing the environmental impacts of a proposed federal action, culminating in the preparation of a detailed environmental impact statement which is subject to public comment. See 42 U.S.C. § 4332(2)(A) & (C). An important part of NEPA's systematic and interdisciplinary approach is consultation by the agency proposing the action with other federal agencies.

Specifically, NEPA mandates that "[p]rior to making any detailed statement [of environmental impacts], the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved." 42 U.S.C. § 4332(2)(C) (emphasis added). Reflecting this NEPA mandate, NRC regulations require that:

> To the extent sufficient information is available, the draft environmental impact statement will include . . .

> an analysis of significant problems and objections raised by other Federal, State, and local agencies . . . .

10 C.F.R. § 51.71(b); see also 40 C.F.R. § 1500.5(b) (Council of Environmental Quality NEPA regulations, which are binding on all agencies, require the NRC to "emphasiz[e] interagency cooperation before the environmental impact statement is prepared, rather than submission of adversary comments on a completed document").

Adopting a systematic and interdisciplinary approach early in the course of preparing a draft environmental impact statement is essential to serve NEPA's twin goals of informed agency decisionmaking and public participation. Early consultation allows the agency in charge of the project (the NRC) to "obtain all views from interested agencies and thereby ensure an intelligent assessment of the 'significance' of the project's environmental impact." Simmans v. Grant, 370 F.Supp. 5, 19 (S.D. Tex. 1974). Early consultation also affords the public a meaningful opportunity to review and comment on the collective assessment of the project by the government. This opportunity for public comment is critical because it facilitates "'widespread discussion and consideration of the environmental risks and remedies associated with the pending project,' thereby augmenting an informed decisionmaking process." LaFlamme v. FERC, 852 F.2d 389, 398 (9th Cir. 1988), quoting Warm Springs Dam Task Force v. Gribble, 621 F.2d 1017, 1021 (9th Cir. 1980) (per curiam).

However, during the course of preparing the Draft EIS for the CEC, such consultation did not take place with all of the appropriate federal agencies. The Department of Energy, the Environmental Protection Agency headquarters in Washington, D.C., the Department of State, and the Department of Transportation -- agencies that have significant information and/or interests bearing on NEPA matters at issue in this licensing proceeding -- were not part of any consultation process in the drafting of the Draft EIS.[3]

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[3] The Draft EIS indicates that Science Applications International Corporation was the principal preparer of the Draft EIS and "relied heavily" on information submitted by the applicant, Louisiana Energy Services, with input from the NRC staff and the Louisiana Department of Environmental Quality. Draft EIS at xxviii. The only other reference to consultation with federal agencies lists the National Weather Service Station in Shreveport, Louisiana and the Region VI office of EPA, but there is no indication that the "consultation" with these latter two agencies was significant. Draft EIS at 7-1.

Department of Energy

The Department of Energy ("DOE"), an agency that has directed operations at enrichment facilities for decades, obviously should have been consulted regarding the CEC enrichment facility proposed by LES. The DOE clearly has expertise regarding a wide range of issues pertaining to such facilities. For example, had DOE been consulted, it could have provided meaningful input on the need for the proposed facility. DOE's November 1993 edition of "World Nuclear Capacity and Fuel Cycle Requirements 1992" (DOE/EIA-0436(93) at p. 28) states unequivocally that "[t]he enrichment services market is highly competitive with capacity far in excess of annual requirements." Through various tables and projections, this document makes clear that through at least the year 2010, there is no need for additional uranium enrichment capacity anywhere in the world. The availability of enriched uranium in the U.S. will also be greatly increased by its proposed importation from Russia. See discussion of State Department, below.

Furthermore, if there is no need for the facility, then the "no action" alternative, which NEPA requires to be considered (40 C.F.R. § 1502.14 (d)), emerges as the best alternative. See also, Chelsea Neighbor Association v. United States Postal Service, 389 F.Supp. 1171, 1181 (SD NY 1975) (noting that a proper NEPA analysis requires consideration of all alternatives, including "total abandonment" of the project).

In addition, DOE is currently attempting to discern whether an "agreement for cooperation" between the United States and the foreign governments who are partners in the LES partnership is required under the Atomic Energy Act ("AEA"), 42 U.S.C. § 2153, prior to licensing the proposed facility. (Congressman John D. Dingell, Chairman of the House Subcommittee on Oversight and Investigations of the Committee on Energy and Commerce has also launched an investigation of this matter; see exhibit "2", which is a letter dated October 21, 1992 from Congressman Dingell to DOE.)

The AEA requires such an agreement where classified information relating to nuclear materials production will be shared with foreign governments, and the agreement must be approved by both the Congress and the President. The AEA also specifically states that all such agreements must provide for the protection of the "environment from radioactive, chemical or thermal contamination . . . ." 42 U.S.C. § 2153e.

DOE insight on this critical environmental and national security issue is clearly relevant to the Draft EIS. Should DOE determine that such an agreement is required (as CANT believes it

is), then it is premature to proceed with the preparation of an environmental impact statement before the terms of the agreement -- including provisions pertaining to environmental protection -- are even reached.

Finally, and as discussed more fully below, DOE is currently grappling with the immense problem of permanent disposal for all of the DUF6 generated by various operations of the United States government. Clearly, comments from DOE regarding a new source (the CEC) of even more DUF6 are germane to assessing the environmental impacts of the proposed CEC facility.

Department of State

The Department of State, one of the agencies entrusted with the national security of this country, should have been consulted regarding the CEC enrichment facility proposed by LES. The Department of State clearly has expertise regarding a wide range of national security issues which come into play at facilities (especially foreign-dominated facilities[4]) which enrich uranium. (For example, the "agreement for cooperation" issue discussed above.) These national security issues must be considered as part of the draft EIS process. NRC regulations require that all effects --"environmental and other" -- of a proposed action be assessed. 10 C.F.R. § 51.71(d).

Furthermore, the Department of State has actual and/or potential access to documents relevant to the possibility that Urenco Ltd., (the foreign corporation that owns the LES partner that will have operating control of the proposed facility), may have been involved in the transfer of critical nuclear technology to Iraq. (The International Atomic Energy Agency is currently investigating this matter.) Accordingly, the Department of State may well be in a position to comment upon whether a licensee with such close ties to Urenco Ltd. is in fact qualified to operate a nuclear facility in the United States.

The Department of State is also involved in negotiating the purchase of highly enriched uranium from Russia, to be blended down into low enriched uranium, for use in U.S. nuclear reactors. This additional large supply of enriched uranium will be in direct competition with the proposed CEC.

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[4] According to attachment D of the "LES Project Financial Plan" at page 3, Urenco Investments, which will have majority operating control of the CEC, is a wholly owned subsidiary of Urenco Ltd. which in turn is owned in equal shares by the United Kingdom, the Netherlands, and West Germany.

Department of Defense, CIA, and National Security Council

The proposed licensing of the CEC also raises national security concerns, on which the U.S. defense agencies -- the Department of Defense, the CIA and National Security Council, should have been consulted, since the purpose of importing large quantities of enriched uranium is to reduce the quantity of weapons-grade uranium in Russia. The licensing of CEC, which would be a competitor for purchasers of enriched uranium, would have a direct impact on this national security objective. Thus, the Department of Defense should have been consulted before the Draft EIS was issued.

Environmental Protection Agency

The Environmental Protection Agency ("EPA") in Washington D.C., the chief agency entrusted with environmental matters in this country, should have been consulted regarding the CEC enrichment facility proposed by LES The EPA clearly has expertise regarding a wide range of environmental issues which pertain to the proposed facility, beyond the rather straightforward issue of air and water permits (which Region VI of the EPA did handle). For example, EPA headquarters just recently concluded a major study, which involved extensive public participation, on uses and effects of Hydrogen Fluoride ("HF"), including uranium hexafluoride ("UF6").[5] Those responsible for conducting this study should have been consulted about the consequences of having yet another major producer (the proposed CEC facility) of UF6 and HF in this country.

In addition, the EPA has an Office of Environmental Equity that clearly should have been consulted regarding the proposed siting of the CEC facility in the midst of two African-American communities. As noted earlier, the Louisiana Advisory Committee to the U. S. Commission on Civil Rights has published a report on the struggle for environmental equity in Louisiana, specifically noting that EPA should monitor the communities of Forest Grove and Center Springs.

Department of Transportation

Operation of the CEC may involve the manufacture and transportation of large quantities of hydrofluoric acid as a result of LES' tails disposal plan. Yet, the Draft EIS provides no indication that the NRC Staff has consulted with the federal

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[5] U.S. Environmental Protection Agency, "Hydrogen Fluoride Study, Final Report, September 1993, EPA550-R-93-001," Report to Congress, Section 112NG Clean Air Act Amendments.

Department of Transportation ("DOT") regarding potential adverse environmental risks and impacts associated with HF transportation, and ways those impacts can be minimized or avoided. The NRC should be required to consult with the DOT regarding transportation hazards associated with HF and other chemicals to be transported to or from the CEC.

In short, the Draft EIS should be withdrawn, submitted to all appropriate agencies for consultation, and resubmitted to the public for comment at the appropriate time.

2.) THE DRAFT EIS IS INCONSISTENT WITH THE UNDERLYING PURPOSE OF NEPA BECAUSE IT ENTIRELY FAILS TO FULLY AND FAIRLY IDENTIFY, DISCUSS AND WEIGH THE ENVIRONMENTAL IMPACTS OF THE PROPOSED FACILITY

Substantively, the Draft EIS is fundamentally and fatally flawed because it is inconsistent with the underlying purpose of NEPA, which is to provide decisionmakers and the public with a full and fair discussion of all environmental consequences of a proposed action, and to fairly balance the costs and benefits of the proposed action.

> [EIS's] shall provide full and fair discussion of significant environmental impacts and shall inform decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment.

40 C.F.R. § 1502.1. In describing the impacts of the proposed action, the environment to be affected must be defined and accurately described. 40 C.F.R. § 1502.15. Once the impacts and the environment to be affected by the proposed project are fully identified and discussed, an appropriate "weighing of the merits and drawbacks" -- the costs and benefits -- of the proposed action must be done. 40 C.F.R. § 1502.23. And the information provided in the course of preparing a draft EIS under these mandates must be of "high quality." 40 C.F.R. § 1500.1(b).

However, as set forth more fully below, the Draft EIS for the proposed CEC facility fails in each of these respects: numerous impacts of the proposed facility are entirely omitted from the Draft EIS, and other impacts are discussed inadequately; the environment to be affected by the proposed CEC facility is not accurately described; and many costs of the proposed project are either not considered at all or else are underestimated while purported benefits are overestimated. Given these fundamental shortcomings, "high quality" information regarding impacts of the proposed action clearly has not been provided, as required by NEPA.

In short, the information contained in the Draft EIS is so inadequate that it precludes meaningful analysis by the public. Accordingly, a revised draft EIS must be prepared for public comment pursuant to 40 C.F.R. § 1502.9(a).

The following are the most serious omissions or inadequacies in the Draft EIS discussion of environmental impacts:

A.) As discussed more fully below in section "3", one of the most serious inadequacies of the draft EIS is the failure to discuss the two communities potentially most affected by the proposed CEC, Forest Grove and Center Springs. These residential areas are next door to the site for the proposed facility -- all within a radius of two miles, and thus must be included in the description and analysis of "the affected environment."

B.) As discussed more fully below in section "4", the draft EIS does not adequately discuss the need for the proposed CEC facility.

C.) As discussed more fully below in section "5", the draft EIS does not discuss at all the nature and environmental impacts and costs of LES's proposal for ultimate disposition of the tons of depleted uranium ("DUF6") to be generated by the proposed CEC facility, i.e., the conversion of the DUF6 to triuranium oxide ("U308"). Nor does the Draft EIS indicate where LES plans to ship the U308, or what the environmental impacts and costs of disposing of it will be.

D.) The Draft EIS fails to provide any specific information regarding where LES will ship its other waste products.

The Draft EIS should identify the landfills to which its non-hazardous waste will go, and should confirm that these landfills have adequate capacity to handle the LES waste. Otherwise, waste could pile up on the LES site.

The Draft EIS should also identify where it intends to ship hazardous wastes, and should confirm that LES has contracts with hazardous waste disposal firms adequate to ensure full shipment of all hazardous wastes generated. Otherwise, hazardous wastes could pile up on site, posing unanalyzed threats to the environment, including public health and safety.

The effects of shipment of hazardous and non-hazardous wastes to offsite locations should be analyzed in the Draft EIS, including transportation and other possible releases to the environment (i.e. through incineration, leaching through landfills, etc.) This analysis should compare such possible releases with the no action

alternative. Although such possible releases may not directly affect the Claiborne Parish area, they clearly would affect the environment generally.

The Draft EIS should also identify where LES intends to ship its "low-level" radioactive waste. Currently, only one "low-level" radioactive waste dump exists which could take LES waste: the Barnwell facility in South Carolina. However, this facility is scheduled to close in June 1994, and, at this writing, it does not appear that any other dump will be sited and completed to take its place in the near future. According to the current "compact" structure, LES waste would go to a disposal site in Nebraska. However, there has been little progress in siting, much less constructing, a radioactive waste dump there. In fact, the state of Nebraska and local governments have been actively throwing up road blocks to a possible dump in that state, and it is by no means certain that any radioactive waste dump will be built there. The NRC has advised its licensees to prepare for on-site storage of radioactive waste for the foreseeable future.[6] The Draft EIS should be rewritten to reflect this uncertainty, and to indicate LES' plans for radioactive waste storage on-site should there be no disposal capacity available.

LES projects the generation of about 450 kilograms of mixed waste (both radioactive and hazardous) annually. There currently is no disposal facility for mixed waste in the U.S.(other than for the incineration of various scintillation vials and other limited waste streams). Nor are any disposal sites currently contemplated, to the best of our knowledge. The Draft EIS should identify where it intends to ship mixed waste, if it intends to do so, and should provide contractual evidence that this waste will be accepted by a licensed facility. If LES is unable to do so, the Draft EIS should reflect how LES will store mixed waste on-site and should make clear that LES must receive all necessary mixed-waste storage permits.

E.) The Draft EIS fails to adequately discuss transportation of feed and product materials.

The Draft EIS acknowledges that approximately 2 truck loads of UF6 will travel on local roads daily and thus travel through local

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[6] Proposed Rule, 10 CFR Parts 30, 40, 50, 70, and 72; RIN 3150-AE22; "Procedures and Criteria for On-Site Storage of Low-Level Radioactive Waste, Federal Register, February 2, 1993, Vol. 58, No. 20; pp. 6730--6740. This proposed rule is currently pending before the NRC Commissioners for final action.

communities. However, the communities that the trucks will travel through are not identified, although they presumably include Center Springs, Forest Grove, Homer, Minden, and others. No indication is given as to whether the road network off the Interstate highway is adequate for these large trucks. No indication is given as to the total number of miles these trucks are expected to travel, nor of an accident rate per 1,000 miles -- which would give an indication of how many accidents these trucks might experience during the lifetime of this facility. The Draft EIS should discuss any impacts that would arise should expansion of roads in this community be necessary.

These truckloads will come from (or go to) locations at least 500 miles away, according to the Draft EIS. Truck travel at such a great distance creates a significant potential for accidents. Furthor, the Draft EIS does not analyze the potential effects of this additional truck traffic on pre-existing truck traffic in the local area, specifically with regard to trucks carrying highly flammable oil from a nearby refinery.

The LES site is at the outer reaches of LES' own stated goal of 600 miles from feed suppliers and fuel fabrication locations. The closest facility is 500 miles, the next closest is 580 miles, and the next closest 1,100 miles. Thus, another site closer to either a feed supplier or fuel fabrication facility might have been more appropriate. Yet this is not discussed as an environmental cost, nor was it factored into the choice of alternate sites. The Draft EIS should have considered both additional accident impacts and relative emissions of greenhouse gases for various proposed sites for the plant.

The Draft EIS does not indicate the frequency of transportation of hazardous materials other than UF6, other than to indicate that such transportation will exist. These transportation expectations should be made explicit as they may affect road use planning and environmental concerns.

The Draft EIS does not make reference to the fact that LES contemplates bringing in partially completed or fully constructed centrifuges from Europe by air. Indeed, the Draft EIS suggests that there will little or no air traffic as a result of LES. The affect of these numerous air shipments should be analyzed.

F.) The Draft EIS fails to adequately discuss traffic and transportation impacts in general.

A review of the draft EIS at pages 2-10 and 2-11 indicates that during the five (5) year construction phase of the project, an increase of 502 to 703 daily trips to the site are projected.

During plant operations, the traffic will increase by an estimated 190 to 200 daily roundtrips. Draft EIS at 4-29. However, the draft EIS fails to identify the area to be affected by the increased traffic, or consider environmental consequences of the increased traffic, such as noise, impacts on air and water quality, safety considerations, and travel time delays.

Furthermore, the draft EIS states that the CEC will create only one additional injury per year and no fatalities as a consequence of the transportation of feed and product material. Draft EIS at 4-35. Once again, the draft EIS's data is inadequate. Feed and product material vehicles are a small fraction of the total additional traffic which will be traveling to and from the site. NRC's analysis must include data and analysis of all potential accidents involving all vehicles driven to and from the site. In addition to the feed and product vehicles, vehicles and trucks driven by construction workers, operation employees, vendors and suppliers must be included.

The Draft EIS also omits data concerning existing road conditions and existing traffic volume. It is impossible for either the NRC or the public to determine the type, condition, or capacity of the roads leading to and from the site from the data contained in the draft EIS. Therefore, neither the NRC nor the public can perform the necessary analysis to determine whether or not these roads are adequate for the projected traffic increase.

G.) The draft EIS omits information regarding and analysis of the CEC's socio-economic impact upon the region's municipal volunteer fire departments. The draft EIS states that fire protection analysis is unnecessary because LES will provide its own fire protection system. Draft EIS at 4-19. However, an on-site fire protection system does not erase other impacts that will be felt by the region's municipal volunteer fire departments. Additional fire and rescue personnel and equipment will be needed to contend with injuries which will result from the increased traffic transporting hazardous and radioactive materials to and from the site.

H.) As discussed more fully below in section "6", the draft EIS does not discuss at all the nature and environmental impacts of the actual coolant to be used at the proposed CEC facility.

I.) The Draft EIS states that the cleared site area, which includes the existing Parish Road #39 and right of way, will be under "controlled access" for isolation reasons. Draft EIS at 2-2. However, the Draft EIS omits any information concerning existing water, electric, gas, cable, and telephone lines located on existing Road #39 which will likely have to be relocated if access

to the road is to be controlled. And the Draft EIS does not address the environmental and socio-economic impacts of such a relocation upon Forest Grove and Center Springs.

J.) The draft EIS omits any information or analysis of impacts resulting from the construction of two 115 kilovolt overhead power lines, such as the condemnation of property. It also fails to provide adequate data and analysis concerning the environmental impacts of the construction, maintenance, and operation of these lines over twenty-nine (29) miles of Claiborne Parish. In fact, the Draft EIS data is so inadequate that it does not even indicate the location of these proposed power lines.

K.) As discussed more fully below in section "6", the Draft EIS erroneously states that Freon R-11 will be banned for use by the year 2000. However, Freon R-11 will be banned January 1, 1996, well before the CEC construction is completed.

L.) As discussed more fully below in section "7-C", the Draft EIS fails to address and analyze the potential conflicts between the proposed CEC facility and existing land use plans, acts, and policies.

M.) The Draft EIS completely omits discussion of the unacceptable safety risks posed by the design of the CEC, all as set out in CANT's Contentions L, M, N, and O which are attached hereto as exhibits 3, 4, 5, and 6, respectively, which are incorporated herein by reference.

N.) The data and analysis in the Draft EIS regarding flood risk is entirely inadequate. The Draft EIS (1) omits the location of the 100 year floodplain and any other floodplain; (2) omits the location of the anticipated flooding, (3) does not provide adequate data and analysis of the potential flood risk, and (4) is deceptive, contradictory, fragmented, and fails to collectively present the data and analysis needed to adequately assess the potential flood risk for the proposed facility.

The NRC did not include the location of the 100 year flood plain in its Draft EIS as it stated it would in its Summary Report on the environmental impact scoping process: "The EIS will address the CEC site environment and characteristics which will include the site relation to the floodplain." Summary Report at 12.

The Draft EIS admits that "Claiborne Lake is a man-made lake created for flood control by the damming of Bayou D'Arbonne in 1966" (Draft EIS at 3-23), thus suggesting that there have been flooding problems in this area in the past. The Draft EIS also states that "flooding can be expected near the site." (Draft EIS at

3-46) (emphasis added), but the NRC omits any definition of "near" and omits any identification of the location of the flooding it predicts will occur during hurricanes ("flooding can be expected near the site" during hurricanes). Draft EIS at 3-46. In addition, the site contains an area of wetlands which consist of soils "subject to frequent flooding." Draft EIS at 3-27. The Draft EIS also admits that flooding could occur "at the site [as] . . . a result of local intense precipitation" (Draft EIS at 4-27) (emphasis added). But because the Draft EIS is so vague on details, there is no way to tell if the flooding will occur in the area surrounding LES property; on LES property, or at the actual CEC site, and whether or not this predicted flooding is within or beyond the 100 year floodplain -- which is of significant concern since the CEC will not be flood-proofed. (Draft EIS at 2-29).

In addition to the above inadequacies, the NRC has provided inadequate flood risk related data in its Draft EIS. The NRC states that flooding from the maximum level of intense local precipitation will reach a mere 3.5 inches below the Class I structures facility yard. Draft EIS at 4-27. This maximum high is based upon historical data recorded for a mere twenty-nine (29) years, 1951-1980. Draft EIS at 3-47. The NRC's flood risk data must include the maximum high for all recorded history, including the last fourteen (14) years in order to adequately determine the true flood risk posed by precipitation.

In short, the NRC must provide the data concerning historical and existing flood risk and flood controls for the area and incorporate such into its flood risk analysis and include mitigation measures taken to prepare for the predicted flooding.

O.) The Draft EIS' discussion of potential accident scenarios at the proposed CEC is deficient because it does not evaluate all reasonably foreseeable UF6 accident scenarios.[7] Table 4.19 lists 25 "UF6 accident scenarios," as identified by the NRC in a 1984 study. Draft EIS at 4-56. The Draft EIS rules out four of these scenarios, on the ground that "[d]ue to differences in equipment and operations," they are "unlikely to occur at CEC." Id. It also claims that cylinder overheating is prevented by the design of the autoclaves, and limiting transporter fuel inventory to prevent overheating by fire immersion. Draft EIS at 4-65. This leaves 20 accident scenarios to be evaluated. But the Draft EIS does not evaluate these accidents. Instead, it evaluates a much smaller list of seven other accident scenarios, whose relationship to the accident scenarios listed in Table 4.19 is unclear. Thus, the

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[7] NEPA requires that the NRC must consider all reasonably foreseeable accidents, even low probability accidents.

Draft EIS' evaluation of accident risks is completely inadequate to inform the public as to the actual dangers posed by the proposed CEC.

P.) The Draft EIS does not address the issue of whether the CEC will be allowed to use recycled uranium as feedstock. If the license does not forbid the use of recycled uranium, the Draft EIS must evaluate the environmental impacts of processing this type of feedstock. In particular, the EIS must assess the environmental impacts of technictium-99 in airborne and waterborne emissions from the plant, and the consequent potential for environmental contamination. The Draft EIS must also consider the environmental consequences of the increased radioactivity of recycled uranium, as well as the environmental issues raised by contamination of recycled uranium with plutonium and fission products other than technitium-99. The effect of recycled uranium on decommissioning costs should also be evaluated.

All of these serious risks, which essentially pertain to the issue of nuclear proliferation, must be discussed in the Draft EIS. CANT's chief concerns stem from the fact that the advanced technical design of the enrichment cascades at the proposed CEC would render the facility particularly vulnerable to unauthorized production of highly enriched uranium, from which nuclear bombs could be fabricated. The advanced Urenco-design cascades are non-transparent and include complicated piping arrays and modern efficiency features that permit functional cascade rearrangement by simple manipulation of valve controls, as well as rapid evacuation of centrifuge equipment. A major concern is that several inside personnel could collude to illegally produce highly enriched uranium by means of a credible scenario which would leave insufficient clues for reliable detection.

Highly enriched uranium illegally produced at the Claiborne Enrichment Center could be sold on the black market or directly to terrorist groups or foreign countries, for manufacture of nuclear weapons. Such an event would be a major cost to society. The Draft EIS should be revised to discuss those risks and reliable means by which risk of significant illegal production of highly enriched uranium at the Claiborne Enrichment Center could be reduced to a low level.

Q.) And finally, the Draft EIS underestimates and ignores several costs of the proposed enrichment facility whereas it overestimates and biases given benefits. This overestimation and underestimation appears to be systematic in such a way as to bias readers in favor of the proposed enrichment plant.

For example, in the Draft EIS's cost-benefit analysis, numerous consequences were neither quantified and costed nor added to the cost-benefit -- such as the facility's health effects,[8] safety hazards, associated increases in nearby drug trafficking, and the worsening of the economic burdens on the lowest economic groups of persons living near the facility. Rather, such effects were discussed briefly and qualitatively and then excluded from the cost-benefit analysis.[9]

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[8] The Draft EIS underestimates health and safety costs and risks in numerous areas. The Draft EIS ignores the cumulative effect of radiological releases by virtue of its failure to calculate actual probabilistic estimates for this risk and instead dismissing it. (Draft EIS at 4-66). Similarly, the Draft EIS admits repeatedly that the facility may not be economical (Draft EIS at 4-75, 4-80, 4-81), yet never provides any analysis of the way that uneconomical operations typically drive plant operators to take short cuts with respect to safety. Indeed, the admissions that the plant may be uneconomical should serve as a "red flag" to anyone who believes that health and safety regulations are likely to be followed, particularly in a situation where there are no profits to fund health and safety expenditures at the facility. The admission that the plant "will continue to operate under almost any scenario" (Draft EIS at 4-82) suggests that past experience with safety violations at other U. S. nuclear facilities will be repeated at the Homer plant, and that even environmental regulations or uneconomical operations will be ignored by CEC operators. Moreover, given that the NRC will review the facility monitoring program only once each year, there is reason to believe that the Draft EIS has underestimated the actual health and safety risks likely to occur if the plant is built.

[9] The Draft EIS is replete with instances where a careful reading of the provided data suggests significant environmental costs, but the drafters of the EIS fail to properly analyze the data and recognize such costs. For example, the DEIS acknowledges that there will be large hazardous materials releases to nearby Bluegill Pond, which admittedly (Draft EIS at 3-23) flows into Cypress Creek, which flows into Beaver Creek, which flows into Lake Claiborne. There is thus a direct pathway for liquid hazardous materials to end up in Lake Claiborne, a man-made lake created for recreational, and, eventually, drinking water purposes. It is essential that this lake remain as free as possible of chemical and radioactive contaminants. Operation of the CEC, however, would entail release of a variety of contaminants. For example, operation would result in the release of approximately 3030 grams (nearly seven pounds) of hydrofluoric acid per year into Bluegill

For example, cumulative costs associated with radiological pollution, including health and safety-related effects on the workers at the facility, are not included in the cost-benefit analysis, just as various classes of catastrophic accidents are ignored both in the safety assessment and in the cost-benefit analysis. Such omissions clearly indicate that the Draft EIS is far below the standards of probabilistic risk assessment (PRA) typically employed to assess proposed facilities, and totally undercut the reliability of the Draft EIS.

Another instance of underestimation pertains to groundwater contamination. The Draft EIS notes, for example, that groundwater contamination is a possibility from the proposed plant (Draft EIS at 4-69), yet the Draft EIS provides no quantitative determination either of the groundwater risk or its associated probabilities and consequences. Nevertheless, the risk is likely to be substantial. Ninety percent of the 127 Department of Energy nuclear-related facilities have contaminated groundwater that exceeds regulatory standards by a factor of up to 1,000, and virtually every state in which a nuclear-related facility exists has criticized the federal government for not stopping health and safety deficiencies resulting from failure to obtain independent site monitoring. (Kristin Shrader-Frechette, Burying Uncertainty (University of California Press: Berkeley, 1993.) Hence current U. S. experience with nuclear facilities suggests both that the groundwater risk at the proposed CEC facility could be quite high, and consequently that the qualitative Draft EIS judgments underestimate it. Because no PRA was done, and the drafters of the EIS ignore the probabilistic groundwater risk, they draw vague, qualitative conclusions about its low magnitude and therefore appear to underestimate another real risk of the facility.

The drafters of the EIS likewise claim that "minimal" releases of radioactive waste are expected during decontamination of the facility (Draft EIS at 4-71), yet the Draft EIS provides no PRA and no quantitative determination either of this risk or its associated probabilities and consequences. Indeed, full decontamination of a facility like the CEC has never been accomplished, so positing low risks from such an action are largely hypothetical. One important indicator that the postulated decontamination risks are greater than those postulated in the Draft EIS is the fact that the Draft EIS estimates the cost of decontamination to be approximately $518

Pond. Other releases include about 178 pounds of hydrochloric acid/year; more than 26 pounds of ammonium Hydroxide/year; and a wide variety of other contaminants including uranium and lead. The negative economic impacts of such discharges on a recreational community should be examined.

million, even though other independent experts, estimating the cost of decontamination for other existing U. S. enrichment facilities, have said that the cost is either unknown or may be as high as $8 billion for one plant. (United States Congress, National Energy Strategy (Part 2), Hearings Before the Subcommittee on Energy and Commerce, House of Representatives, 102nd Congress, first session, U.S. Government Printing Office: Washington, D.C. (1991) at 194). Also, because no enrichment facility has been completely decontaminated, there are certain to be hidden, unexpected costs. These unexpected costs are likely to encourage greater risks (caused by efforts at cost control), causing decontamination costs and risks to accelerate further.

In short, given the fact that the proposed enrichment plant is likely not to be profitable, exclusion of broad classes of costs suggests that the facility may be massively uneconomical, once one calculates the social costs of inequities and environmental burdens such as those just listed.

Not only does the Draft EIS appear to underestimate the facility costs because it excludes many factors, but its cost-benefit analysis attributes benefits to the project in the face of overwhelming evidence that the proposed CEC facility cannot succeed economically, and is likely to be bankrupt before the end of its license term. As discussed more fully in the "Need" section below (Section "4"), given the lack of any growth in the commercial nuclear power industry, and the current glut of enriched uranium which will only increase with the coming importation of uranium from Russia, the CEC's economic prospects are uncertain at best. Indeed, the Draft EIS acknowledges that the plant "may not prove to be economical." (Draft EIS at 4-75.) The Draft EIS asserts that even if the plant does not prove to be economically viable, it will "likely be operated for its lifetime" because operating costs are low compared to fixed costs. The prospect that the proposed CEC facility may be hanging on by a thread, without profits to adequately fund essential safety or environmental protection measures, can hardly be considered a "benefit."

For instance, once the CEC begins to operate, the entire plant will be contaminated, and thus a huge liability for ultimate cleanup will be incurred. If LES is in marginal financial condition, who will pay for this cleanup? This question will arise whether the CEC closes early or survives the entire 30-year license terms without amassing sufficient revenues to fund cleanup. A lesson should be taken from the Portsmouth gas diffusion plant, which closed shortly after it began operating, and must now be cleaned up, without the prospect of sufficient funding from the licensee. The purpose of the Draft EIS should be to anticipate such an easily foreseeable occurrence and discuss the potential

consequences before they happen. Yet, the Draft EIS says nothing about the potential economic costs of cleanup if the CEC does not prove to be a viable enterprise. Nor does it discuss mitigative measures for avoiding this situation, such as requiring LES to set aside adequate funds for decommissioning the entire plant in advance of licensing. (See Limerick Ecology Action v. NRC, 869 F. 2d 719 (3rd Cir. 1989) (requiring consideration of mitigative measures in NRC environmental impact statements.))

Thus, not only does the Draft EIS ascribe highly questionable economic benefits to the CEC, but it fails to analyze how CEC's doubtful financial viability could turn the plant into an enormous environmental and financial liability. This failing, which by itself violates NEPA's requirement for full disclosure, is all the more egregious because, given the otherwise adverse impacts of the project on the surrounding community, a full and fair appraisal of both the lack of need for this facility and the economic risks associated with its operation would have tipped the cost-benefit analysis away from licensing of the CEC.

The Draft EIS also claims that many secondary economic effects will arise from the wages and construction associated with the facility, as a result of more money being pumped into the nearby Louisiana region (Draft EIS at 4-76 through 4-79). These secondary economic benefits are limited, however, and may even be outweighed by associated negative impacts. For instance, most of the facility-related benefits will go to the middle and not lower economic classes (Draft EIS at 4-79), crime will increase as a result of the facility (Draft EIS at 4-75), drug trafficking will increase (Draft EIS at 4-80), and property values will increase, but not in areas affected by drugs and crime (Draft EIS at 4-80). If the economic benefits of the facility cause greater social inequities, more drug trafficking, and more crime, the "hidden economy" of the underworld may divert potential secondary benefits of the facility into crime-related activities rather than into strengthening the economy. In other words, if the regional economic infrastructure cannot utilize the secondary economic benefits associated with new construction and higher employment from the CEC, then these monies could be diverted by criminal networks to create secondary economic burdens. Meanwhile, explicit and increased government expenditures will be required to deal with problems exacerbated by the CEC.

Because the additional and serious costs of drug trafficking, increased crime, exacerbated inequities, and so on, were never quantified and costed, it is clear that the Draft EIS has underestimated the social costs associated with the facility and overestimated alleged secondary economic benefits. Indeed, there may be an excess of secondary economic burdens. The presumed

positive cost-benefit ratio in the Draft EIS is the product of numerous qualitative, vague, and subjective judgments, rather than the result of a comprehensive quantitative analysis. The presence of such extreme social costs as a result of the proposed plant suggests that standard multipliers for secondary economic benefits ought not be used, as they have been in the Draft EIS, and indeed that such standards for economic consequences, in the CEC case, may actually function as divisors for secondary economic benefits.

Apart from alleged secondary consequences, many of the claimed primary economic benefits allegedly deriving from the proposed facility are highly questionable. For example, the Draft EIS asserts (without evidence and without any quantification) that "for CEC most goods and services (excluding the centrifuges and related extremely specialized equipment) can probably be procured within the state" (Draft EIS at 4-75). If builders of the facility would guarantee that particular amounts of specific kinds of goods and services will be obtained within the state, then it would be reasonable to claim these goods and services as part of the benefits of the facility. Otherwise, such benefits are purely hypothetical, particularly in the light of the educational, social, financial, and industrial problems of the region and the state, problems that could undercut their provision of goods and services.

* * *

In summary, the NRC has failed to provide the public with "high quality" information regarding the proposed project as required by 40 C.F.R. § 1500.1(b), has failed to adequately describe the affected environment as required by 40 C.F.R. § 1502.15, has provided incomplete and erroneous information regarding the affected environment, has failed to appropriately balance the costs and benefits of the proposed project, and thus has entirely failed to adequately describe the environmental effects of the proposed project as required by 40 C.F.R. § 1502.16(d). Accordingly, a revised Draft EIS must be prepared and made available for public comment pursuant to 40 C.F.R. 1502.9(a).

3.) THE DRAFT EIS IS INADEQUATE BECAUSE IT FAILS TO DISCUSS ANY IMPACTS OF THE PROPOSED FACILITY ON THE ADJACENT COMMUNITIES OF FOREST GROVE AND CENTER SPRINGS.

CANT specifically pointed out in its Contention J (attached hereto as exhibit "7", and incorporated herein by reference) that the proposed CEC facility would have negative economic and sociological impacts on the African-American communities of Forest Grove and Center Springs. CANT members in attendance at the EIS scoping meeting held in 1991 reiterated such concerns. See "Environmental Impact Statement Scoping Process Summary Report"

("Summary Report") at 16-18. In a September 1993 report, the Louisiana Advisory Committee to the U.S. Commission on Civil Rights found that many "black communities [in Louisiana] are disproportionately impacted" by environmental problems, and specifically warned that "[t]he U.S. Environmental Protection Agency should monitor the communities of . . . Forest Grove and Center Springs."[10] Yet nowhere does the Draft EIS discuss any impacts of the proposed CEC facility on these two communities, much less the disparate impacts of locating the facility in these minority communities.

Forest Grove, founded in 1866, is just 1.25 miles from the proposed site, and Center Springs, founded in 1910, is just one quarter mile from the proposed facility. To exclude these historic communities from the Draft EIS is, in and of itself, a fatal omission that renders the Draft EIS entirely useless. No meaningful analysis of the impacts of a proposed action can possibly be done if the most directly affected communities are not considered in the discussion of such impacts.

NEPA's mandate with respect to a full and fair consideration of all effects and impacts of a proposed action is broad. All direct and indirect "aesthetic, historic, cultural, economic, social [and] health" impacts must be analyzed. 40 C.F.R. § 1508.8 The "human environment" that must be considered in a NEPA review is defined "comprehensively." 40 C.F.R. § 1508.14. Accordingly, all of the direct and indirect effects of the proposed CEC facility on the communities of Forest Grove and Center Springs must be thoroughly assessed in a revised Draft EIS, including the disparate impacts of siting the proposed facility in these minority communities.

As CANT pointed out in Contention J, the siting of the proposed facility follows a national pattern of locating facilities that generate hazardous waste in communities of color -- a pattern that falls under the rubric of what has come to be described as environmental racism. The CEC facility is proposed for a state where the percentage of African-Americans is two and a half times greater than the percentage of African-Americans in the nation. The percentage of African-Americans in Claiborne Parish is four times greater than the percentage of African-Americans in the country. And the percentage of African-Americans in Forest Grove and Center Springs is 100% and 98%, respectively. See attached

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[10] "The Battle For Environmental Justice in Louisiana . . . . . Government, Industry and the People", September 1993 at 63 (Finding 1) and 67 (Recommendation 8), attached hereto as exhibit "1".

comments to this Draft EIS prepared by Dr. Robert D. Bullard at p. 6 ("Bullard comments") (exhibit "8") which CANT incorporates herein by reference.

As noted in the Bullard comments, many facility siting decisions like the CEC siting decision distribute the costs of the proposed facility in a regressive pattern, providing disproportionate benefits for individuals who fall at the upper end of the socioeconomic spectrum, while ignoring disproportionate costs on individuals who fall at the lower end of the spectrum.

In addition, the Draft EIS also fails to address many other impacts and concerns of the residents of Forest Grove and Center Springs.

A.) For instance, there is no discussion of the impacts that the proposed project will have on the property values of those who live closest to the proposed facility -- or on the habitability of such property in the event that the radioactive waste from the facility remains on site, as is the case with numerous enrichment facilities all across the United States.

B.) The NRC excluded consideration of a majority of the local communities' wells in its definition of the affected environment and in its analysis of the environmental consequences of the construction and operation of the CEC. First, the LES did not provide a more detailed survey on water usage as the NRC ordered in its Summary Report on the EIS scoping process. "The NRC will require a more detailed survey from LES on the water usage in the vicinity of the site." Summary Report at 14. A more detailed survey was required because LES indicated prior to issuance of the Summary Report that there were only 11 shallow wells in the vicinity of the proposed facility being used for household purposes, in contrast to a local resident who indicated that there were at least 40 such wells. But the Draft EIS lets LES entirely off the hook, dismissing this important matter simply by stating that "LES was not able to confirm this figure." Draft EIS at 3-33. The number of such wells is an objective fact that can and must be determined, and then analyzed in the context of the proposed project.

Secondly, the Draft EIS makes it abundantly clear that the NRC has not performed any analysis concerning the CEC's impact upon the surrounding private wells -- whatever the number of such wells may be. "LES estimates that the lowering of the shallow aquifer will not likely extend beyond CEC property boundaries and will not affect offsite wells to any significant degree (LES, 1993b and 1992h)." (Emphasis added.) Draft EIS at 4-5. It is the NRC's responsibility to make this determination; the NRC cannot merely

rely upon the unsupported conclusions made by the applicant -- much less an applicant that does not even know the number of residential wells in the first place.

C.) The draft EIS is woefully inadequate with respect to its discussion of the relocation of Parish Road #39 by the Claiborne Parish Police Jury. The draft EIS states that Parish Road #39 will be relocated from its present location to west of the proposed CEC site by the Claiborne Parish Policy Jury. Draft EIS at 2-2. However, the NRC has excluded the location of the relocated road from its description of the affected environment and omitted data and analysis concerning the environmental consequences of this relocation upon the Forest Grove and Center Springs communities. First, the NRC omits any data regarding the socio-economic impacts of this road relocation upon the Forest Grove and Center Springs communities such as the cost of construction and maintenance of the road. In fact, the NRC omits the construction costs of relocating Parish Road #39 in its cost-benefit analysis. Draft EIS at 4-81. Moreover, the draft EIS fails to identify this affected environment or provide data and analysis concerning the impacts to the environment of the clearing of timberland, grading, construction, operation, traffic, and maintenance of the relocated road, even though the NRC previously indicated that the draft EIS would address the environmental impacts of rerouting Parish Road #39. See Summary Report at 20.

Furthermore, there are two streams which cross the proposed right of way of the relocated road. The draft EIS does not include data and analysis concerning the effects of the relocation of the road upon these surface waters and any impact of the relocated road upon Bluegill Pond and its use as the site for the plant's liquid waste stream. The draft EIS so ignores the impacts of the facility upon these communities that it omits any data and analysis pertaining to a scenario under which Parish Road #39 is not relocated, i.e., whether the existing road is adequate for use by heavy trucks carrying radioactive and hazardous waste.

D.) The draft EIS erroneously depicts Claiborne Parish property (Parish Road #39) in the Forest Grove and Center Springs communities as owned by LES in Figures 2.1, 3.2, 3.13, 3.14, 3.15, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2, and 5.3. The applicant cannot own this Parish road connecting the Forest Grove and Center Springs communities unless it has been abandoned, which it has not. The new ("relocated") Parish Road #39 planned to accommodate LES would not be completely located on LES property. Therefore, the parish government must acquire this land through eminent domain. The draft EIS fails to identify or analyze the socio-economic impacts associated with the abandonment of the existing Parish Road #39 and

the acquiring of a portion of the relocated road through eminent domain.

If Claiborne Parish attempts to take land by eminent domain, additional socio-economic impacts will be suffered by the citizens of Center Springs and Forest Grove as well as all Parish taxpayers. The draft EIS fails to analyze -- or even mention -- these impacts, such as displacement, loss of property, and cost of eminent domain proceedings.

E.) The draft EIS fails to adequately discuss traffic and transportation impacts of the proposed facility on Forest Grove and Center Springs. A review of the draft EIS at pages 2-10 and 2-11 indicates that during the five (5) year construction phase of the project, an increase of 502 to 703 daily round trips to the site are projected. During plant operations, the traffic will increase by an estimated 190 to 200 daily round trips. Draft EIS at 4-29. However, the draft EIS fails to identify the area to be affected by the increased traffic, or adequately consider the environmental consequences of the increased traffic, such as increased noise, air and water quality impacts, safety considerations, and travel time delays. The NRC does not even include Parish Road #39 as part of the affected environment in its traffic analysis. Draft EIS at 3-120.

In short, the exclusion of these two communities in the Draft EIS's description of the affected environment, and omission of any analysis of impacts on the communities of Forest Grove and Center Springs makes it impossible for the public to meaningfully comment on the Draft EIS. Accordingly, a revised Draft EIS must be prepared for public comment pursuant to 40 C.F.R. § 1502.9.

4.) THE DRAFT EIS PROVIDES INADEQUATE INFORMATION AND ANALYSIS REGARDING THE NEED FOR THE PROPOSED FACILITY. AS A RESULT, ITS EVALUATION OF THE "NO ACTION" ALTERNATIVE IS FATALLY INFIRM.

One of the key considerations in an environmental impact statement on the licensing of a nuclear facility is whether it is needed. As the Appeal Board has held with respect to the need for commercial power reactors, absent a demonstrable "need" for the material to be produced, "justification for building a facility is problematical." Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), ALAB-355, 4 NRC 397, 405 (1976). See also Public Service Company of New Hampshire (Seabrook Station, Units 1 and 2), ALAB-471, 7 NRC 47, 509 n. 58 (1978), Energy Research and Development Administration, CLI-76-13, 4 NRC 67, 76-77 (1976). In this case, where the NRC admits that the economic viability of the CEC is questionable, the Draft EIS's discussion of the need for the facility -- i.e., the "no action" alternative -- is all the more

important. However, the Draft EIS' discussion of this pivotal issue is grossly deficient, uninformed and inaccurate.

The Draft EIS relies on LES-submitted materials from the pro-nuclear Energy Resources International to support its belief that there will be increased need for enrichment services. However, independent observers do not agree with this assumption, and it is contradicted by significant developments which are ignored by the Draft EIS.

According to the U.S. Department of Energy, to whom the Draft EIS was not submitted for review, there is more than enough uranium enrichment capacity presently existing to service the world's needs through at least 2010. "World Nuclear Capacity and Fuel Cycle Requirements 1993; DOE/EIA-0436(093), November 1993. Further, even this report is highly and unrealistically optimistic about the prospects of a nuclear power resurgence in the U.S. The likelihood that there will ever be another nuclear plant built is slim; the likelihood that so many will be built that they will need new enrichment services is even slimmer. Even if there is to be a large second nuclear generation, it would make sense to build ancillary facilities, such as the LES plant, after that generation is committed to. There is no sense in permitting the creation of new pollution in the United States, especially when, according to LES, they can build their enrichment facility, if one should ever be needed, much more quickly than a reactor can be built.

More reasonable projections, which are supported by numerous Wall Street analysts (Prudential, Moody's, etc., in various copyrighted documents -- for example "Nuclear Power--A Current Risk Assessment," Moody's Special Comment, April 1993), are that there will be fewer than 90 U.S. nuclear plants by the year 2000, and the pace of decommissioning will accelerate at that time. Thus, instead of a growing market (and it is our understanding that LES will be limited by its license to the U.S. domestic market), the far greater likelihood is that there will be a quickly declining market.

There is also no need to construct a new uranium enrichment facility in the United States in light of the very large quantities of low enriched uranium that will soon appear on the U.S. market as a consequence of the large-scale dismantlement of nuclear warheads from the arsenals of the United States and the former Soviet Union.

The Draft EIS contains no mention of the vitally significant fact that the United States and Russia have recently concluded a legal agreement, known as the United States-Russian HEU Agreement, whereby Russia will sell to the United States low enriched uranium which is derived from approximately 500 tons of Soviet weapons-

grade highly enriched uranium; the low enriched uranium will be suitable for use in nuclear reactor fuel. According to the agreement, the shipments of low enriched uranium from Russia to the U.S. will begin in 1994 and will be completed in about 20 years.

The quantity of low enriched uranium to be purchased by the United States from Russia (in accordance with the HEU Agreement) is equivalent to approximately two times the total quantity of enriched product that would be produced at the proposed CEC facility over its entire 30-year lifetime, were it to operate. Furthermore, U.S. stockpiles of weapons-grade highly enriched uranium are estimated at between 500 to 600 tons,[11] which would be sufficient to satisfy possible residual market need during the next two decades.

Moreover, Russia has disclosed that, contrary to prior non-Soviet estimates, the amount of weapons-grade highly enriched uranium from former Soviet Union stockpiles is about 1250 tons, two and one-half times as much as the 500-ton quantity pertinent to the U.S.-Russian HEU Agreement.[12] Purchase by the U.S. of even more enriched uranium from former Soviet weapons stockpiles than the HEU Agreement calls for is not only possible, but likely, as this would further post-Cold War efforts by the United States to stimulate extensive near-term dismantlement of the nuclear weapons arsenals of the former Soviet Union. Such additional purchases (beyond those called for in the HEU Agreement) would release even more enriched uranium into the U.S. market. Thus, quantities of enriched uranium released from dismantled U.S. and former Soviet Union nuclear weapons into the U.S. market would be sufficient to displace any previously anticipated need for operation of the CEC before the year 2015.

Thus, the costs to society of approving the proposed action would be enormous, not only because there is no need for the facility, but because operation of a new uranium enrichment facility in the United States during the coming two decades would directly compete with incentives for near-term deep reductions in U.S. and Russian nuclear weapons arsenals. With the end of the Cold War, there is worldwide anticipation that nuclear warheads can soon be dismantled on a large scale. But obstacles to marketing enriched uranium that is derived from nuclear weapons could promote

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[11] David Albright, Frans Berkhout, and William Walker, "World Inventory of Plutonium and Highly Enriched Uranium, 1992," Oxford University Press (1993) at pp. 47-53.

[12] Statement by Minister Viktor N. Mikhailov of Minatom in the October 1993 NUKEM Market Report at p. 28.

continued stockpiling of nuclear warheads that would otherwise be dismantled. Thus, marketability of weapons-derived enriched uranium must take priority over construction of a new uranium enrichment facility in the United States. In short, operation of the CEC in the near future could kill market-based incentive that is essential for near-term large-scale dismantlement of nuclear weapons arsenals.

The Draft EIS also mischaracterizes the potential affect of the proposed CEC facility on the U. S. Nuclear enrichment market, and does not characterize the no-action alternative correctly. Indeed, the statement that "The rejection of the proposed action would prevent the introduction of well proven and energy efficient technology into the USA market" (Draft EIS at 2-37), is not true. Such technology could be introduced at an appropriate time in the future.

It is also disingenuous for the Draft EIS to state that "worldwide enrichment services are expected to increase by approximately 37%" by the year 2000. None of this projected increase, as previously discussed, is very likely to take place in the United States -- the only country in which LES can sell its services, according to our understanding of the terms of its proposed license. Every projection is that a decrease in need for enrichment services will be evident by 2000. Some more optimistic scenarios may project an increase after that date, presuming new nuclear plants are built in the United States, but there is no solid evidence that any new nuclear reactors will be built; given current knowledge, the Draft EIS must reflect that reality and assume a declining, rather than expanding market.

The Draft EIS also identifies LES' current competitors as Urenco and Eurodif. This makes no sense, since Urenco is, in fact, the major stockholder in LES and likely would be the majority holder if the plant ever were built. Urenco cannot compete with itself. Eurodif, which barely sells in the U.S. market, could perhaps be a competitor. Urenco cannot.

The Draft EIS also fails to identify LES' actual major competitor -- the wholly domestic, unionized, taxpayer-created U.S. Enrichment Corporation ("USEC").

The Draft EIS also fails to acknowledge that the proposed CEC facility will compete with enrichment plants having unionized workforces (i.e., Paducah, Kentucky and Portsmouth, Ohio), in all likelihood causing job displacement and unemployment in those communities. The Draft EIS should have evaluated the socioeconomic impacts on existing enrichment plant workers, of licensing a privately, nonunionized competitor during a uranium glut.

Finally, LES would not, as the Draft EIS states, either reduce dependence on foreign enrichment services (it would increase dependence since LES is foreign dominated), help to improve the net foreign trade balance (it would hurt the balance -- since any profits ultimately would accrue to the foreign corporation Urenco), and it would retain lower-paid, less secure non-union jobs, as opposed to union jobs at USEC.

Accordingly, the Draft EIS must be withdrawn and rewritten to reflect LES' foreign domination and competition with the domestic USEC.

5.) THE DRAFT EIS IS INADEQUATE BECAUSE IT FAILS TO ADDRESS THE IMPACTS, COSTS, AND BENEFITS OF ULTIMATE DISPOSAL OF DUF6 TAILS, OR THE CUMULATIVE AND GENERIC IMPACTS OF DUF6 TAILS DISPOSAL.

The proposed CEC facility would generate 3,830 metric tons of radioactive waste (depleted uranium hexafluoride -- "DUF6") each year, which LES claims would be stored on site for 15 years. However, the Draft EIS nowhere discusses how, exactly, this dangerous waste would be stored, other than to note that it would be in cylinders. This paucity of information about the environmental impacts of storing such material on site is woefully inadequate. The environmental effects and increased accident risk associated with corrosion of cylinders over 15 or more years should be explicitly evaluated.

Further, the Draft EIS notes that, commencing 15 years after production of enriched uranium at the proposed CEC facility, the DUF6 will be converted to triuranium oxide (U3O8). Draft EIS at 2-31. However, the Draft EIS contains no information whatsoever regarding the nature and environmental impacts of the process for converting DUF6 to U3O8, or the impacts of permanently disposing of these U3O8 tails. Given this utter lack of information, it is also impossible to determine from the Draft EIS the basis for the NRC's estimate that tails disposal will cost $12.6 million/year. Draft EIS at 2-31. In any event, the NRC does not even appear to have factored the $12.6 million estimate into its cost-benefit analysis. See Draft EIS § 4.5.

Moreover, the NRC has failed to evaluate the cumulative and generic impacts of adding to the huge (and growing) national inventory of DUF6 tails, for which the U.S. government has yet to identify an acceptable means of disposal. The NRC, in consultation with the Department of Energy, should be required to evaluate these impacts before LES can be licensed to produce more DUF6.

NEPA requires an EIS to be comprehensive and assess all reasonably foreseeable, cumulative impacts of a proposed project.

This "cumulative-impacts analysis" required under NEPA must address reasonably foreseeable future actions, such as the impacts of ultimate disposal of DUF6 tails from the proposed CEC facility. 10 C.F.R. § 1508.7. The analysis must:

> consider (1) past and present actions without regard to whether they themselves triggered NEPA responsibilities and (2) future actions that are 'reasonably foreseeable,' even if they are not yet proposals and may never trigger NEPA-review requirements.

Fritiofson v. Alexander, 772 F.2D 1225, 1245 (5th Cir. 1985) (citations omitted; emphasis added.) See also Sierra Club v. Sigler, 695 F.2d 957, 970 (5th Cir. 1983) (quoting Scientists' Institute for Public Information, Inc. v. Atomic Energy Commission, 481 F.2d 1079, 1092 (D.C. Cir. 1987)). In this case, conversion to U3O8 and disposal of the enormous quantity of tails to be generated at the CEC could have significant impacts on the environment. Yet, in flagrant violation of NEPA, the Draft EIS for the CEC contains virtually no information about this aspect of the operation of the CEC.[13]

For instance, the Draft EIS does not identify or discuss the process by which LES intends to convert DUF6 to U3O8. Depending on the type of process chosen by LES, conversion of DUF6 to U3O8 could have significant adverse environmental impacts and costs. France is the only country which currently converts DUF6 to U3O8. The French process generates as a byproduct large quantities of hydrofluoric acid (HF), an extremely toxic and corrosive chemical. Given its chemical properties, long-term storage of HF could pose more severe environmental and health hazards than long-term storage of DUF6. Yet, the Draft EIS says nothing about this potentially significant environmental impact of DUF6 conversion.

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[13] While the Licensing Board has ruled that the NRC has no regulatory requirement for a concrete plan for the disposal of DUF6, the Commission does require LES to have a "plausible strategy" for tails disposition. LBP-91-41, Slip op. at 9 (December 19, 1991). As discussed above, NEPA also requires the evaluation of all reasonably foreseeable consequences of the NRC's licensing action, which includes disposition of a huge quantity of depleted uranium tails. Thus, now that LES has identified conversion to U3O8 and offsite disposal as its ultimate disposition strategy, NEPA requires the NRC to evaluate the environmental impacts of such conversion and tails disposal, and to include those impacts in its cost-benefit analysis.

Moreover, it is doubtful that the HF generated by DUF6 conversion would be marketable. The HF generated by the French process is slightly contaminated with uranium. Although the French government is able to market its HF, there is little chance that contaminated HF would be salable in the United States. See Uranium Enrichment Organization, "The Ultimate Disposition of Depleted Uranium" (Oak Ridge National Laboratories: 1990). Another reason that the marketability of HF in the United States is questionable is because there is already a large supply of HF and decreasing production of chlorofluorocarbons may slow demand. Sohneil Pulishing Co., "Chemical Profiles: Hydrofluoric Acid" (1992).

The Draft EIS also fails to identify the means for long-term storage of U3O8, or evaluate its environmental impacts. Thus, it is completely impossible to determine where the storage will take place, whether new excavation or construction is required for the storage, what type of containment is to be used for the storage, the effectiveness of containment, or the impacts of the storage facility on the surrounding environment and community. The NRC cannot ignore these reasonably foreseeable and potentially significant impacts, which would be directly caused by the licensing and operation of the CEC.

Finally, in violation of NEPA, the Draft EIS fails entirely to address the cumulative or generic impacts of LES' proposal to add over 100,000 tonnes of DUF6 tails to the existing national inventory from other uranium enrichment plants. As of 1993, the United States government and private companies have accumulated about 500,000 tonnes of DUF6, for which the government has no identifiable means of permanent disposal. This DUF6 is sitting in corroding canisters at DOE enrichment plants and other facilities. Over a year ago, the NRC Staff "recogniz[ed] that the total volume of waste to be generated for the LES Claiborne Enrichment Center is part of a much larger national inventory." Thus, the NRC stated that "LES DU tails disposition may be addressed as part of the national inventory disposal scheme." Letter from John W. N. Hickey (NRC) to W. Howard Arnold (LES) (September 22, 1992) (exhibit "9").

Yet, the Draft EIS completely fails to address critical questions regarding the generic and cumulative impacts of LES' proposed method for waste disposal.[14] For instance, it fails to discuss the national capacity to convert DUF6 to U3O8, and whether LES will compete with government facilities for that capacity. The Draft EIS also fails to identify any locations where the U3O8 will

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[14] The DEIS does not even state why the NRC Staff apparently no longer considers that disposition of the CEC tails should be addressed as part of the national inventory disposal scheme.

be disposed of, or to discuss whether such sites are limited, and whether they should be used for disposal of the existing inventory of U3O8. It also fails to consider the environmental impacts of transporting HF, the highly dangerous byproduct of DUF6 conversion to U3O8.[15]

These issues should be addressed in a generic environmental impact statement by the NRC and the DOE. At the very least, the NRC should have consulted DOE regarding the potential cumulative impacts of DUF6 generation by the CEC on the DOE's program for disposing of the national inventory. Thus, the NRC should be required to prepare a revised Draft EIS which evaluates, after consultation with the DOE, the cumulative and generic impacts of permitting LES to generate a substantial additional quantity of DUF6. Thereafter, the public can comment in a meaningful fashion regarding this aspect of the proposed facility.

6.) THE DRAFT EIS PROVIDES INADEQUATE INFORMATION AND ANALYSIS OF THE COOLANT WHICH WILL ACTUALLY BE USED AT THE PROPOSED FACILITY.

According to the draft EIS, the CEC will rely for cooling purposes on the use of trichlorofluoromethane ($CFCl_3$) (also known as "Freon R-11" or "CFC-11"), an ozone-depleting chemical which the Environmental Protection Agency has banned after January 1, 1996. However, the proposed CEC facility would not be in operation until after the date of the ban. Thus, LES must substitute a new, legal coolant for CFC-11.

Any substitute coolant chosen by LES should be identified in a revised draft EIS, with an analysis of the environmental impacts of the coolant, and a explanation of how or whether the new coolant affects other factors in the plant's design, such as centrifuge design, calculations of expected uranium emissions, and the type of lubricants that must be used. Thereafter, the public can then meaningfully comment on this important aspect of the proposed facility.

Such an analysis and explanation are required because the design of a uranium enrichment plant depends in part on the thermodynamic and other physical and chemical properties of the specific refrigerant that is used in the centrifuges. Unless the substitute refrigerant is an exact match for the relevant physical and chemical properties of CFC-11, the substitution of another

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[15] As discussed above in section "1", the NRC violated NEPA in failing to consult with the U.S. Department of Transportation regarding the environmental impacts of HF transportation.

coolant may necessitate changes in the plant's design. For instance, the rate of flow of uranium hexafluoride through each centrifuge, or alternatively, the dimensions of the centrifuge, depends in part on the thermodynamic properties of the coolant. The type of lubricant used in the cooling system also depends in part on the composition of the coolant. If the coolant and lubricants are not matched, this could cause premature deterioration of the coolant and degradation of the equipment.

The type of coolant used in the centrifuges may also affect the levels of the plant's radioactive emissions to the environment. During the enrichment process; some coolant leaks into the centrifuge chamber containing uranium hexafluoride (UF6). Some emissions of both coolant and uranium hexafluoride occur when these two materials are separated. Thus, the amount of emissions to the environment may change as a result of a change in refrigerant. In order to control increased emissions as a result of a change in refrigerants, LES may also need to change the design of the process for separating the coolant from the uranium hexafluoride. locations.

7.) THE DRAFT EIS FAILS TO PRESENT THE NATURAL AND SOCIAL SCIENCE DATA UPON WHICH THE AGENCY HAS MADE ITS REQUIRED ANALYSIS OF ENVIRONMENTAL CONSEQUENCES PURSUANT TO 40 C.F.R. §§ 1502.1, 1502.16.

The Draft EIS fails to provide the required data and corresponding inventories which would demonstrate that the NRC has made the necessary environmental analyses required pursuant to 40 C.F.R.§§ 1502.1 and 1502.16. Much of the Draft EIS is very vague, and numerous conclusions are unsupported by actual data.

The natural and social science data to be used is outlined in § 1502.16 and "[it] forms the scientific and analytic bases for the comparisons under §1502.14 (alternatives including the proposed action). 40 C.F.R. § 1502.16. This information is the basis upon which the proposed action and various alternatives to the proposed action are to be evaluated and ranked, as required pursuant to 40 C.F.R. §1502.14.

Since the information and corresponding inventories provided in NRC's Draft EIS are insufficient and at times erroneous, and the Draft EIS evaluates and discusses the effects and significance of only one alternative, meaningful analysis of the proposed action, as well as the proposed action in comparison to alternative actions, cannot be performed as required under the CEQ regulations.

The data requirements of 40 C.F.R. §1502.16, which the Draft EIS for the proposed CEC facility does not satisfy, are discussed individually in paragraphs A-F, below.

A. The Draft EIS fails to provide natural science data regarding direct and indirect effects pursuant to 40 C.F.R. § 1508.8, 1502.16.

The Draft EIS does not include adequate natural science data regarding the direct and indirect effects of the proposed CEC facility as required pursuant to 40 C.F.R. 1502.16, 1508.8. As discussed more fully above in paragraphs A through Q of section "2", the NRC has failed to provide adequate natural science data regarding the proposed CEC's direct and indirect effects.

In summary, the Draft EIS entirely omits or provides erroneous or inadequate natural science data regarding the direct and indirect effects of the project as they pertain to: (1) the Forest Grove and Center Springs communities; (2) conversion of DUF6 to U308; (3) the actual coolant to be used; (4) relocation of Parish Road #39; (4) increased traffic and vehicles transporting hazardous and radioactive materials; (5) level of service of existing transportation systems; (6) public utility relocation, and (7) power line construction, operation, and maintenance.

B. The Draft EIS fails to address social and psychological impacts of the proposed action and fails to provide social science data and analysis regarding such direct impacts pursuant to 40 C.F.R. §1508.8, 1502.6 and 1508.14.

Social science data and analysis regarding sociological and psychological impacts of a proposed action are required in an EIS. NEPA regulations define "effects" and "impacts" to include such social effects and impacts. 40 C.F.R. § 1508.8. See also 40 C.F.R. § 1508.14 ("social" impacts to be addressed in an EIS). An interdisciplinary approach to analyzing such impacts is required:

> Environmental impact statements shall be prepared using an inter-disciplinary approach which will insure the integrated use of the natural and social sciences . . . . . The disciplines of the preparers shall be appropriate to the scope and issues identified in the scoping process.

40 C.F.R. § 1502.6.

An appropriate approach to analyzing such impacts is contained in "Guidelines and Principles for Social Impact Assessment" ("Guidelines Document") published by the International Committee on Guidelines and Principles for Social Impact Assessment, dated December 14, 1993, attached as exhibit "10". This Guidelines Document provides the first comprehensive guidelines to assist EIS drafters in fulfilling their obligations under NEPA and NEPA regulations.

This Guidelines Document defines social impact assessment "in terms of efforts to assess or estimate, in advance, the social consequences that are likely to follow from specific policy actions . . . , and specific government actions (including buildings, large projects. . .), particularly in the context of the U.S. National Environmental Policy Act or NEPA." This document provides a thorough and workable methodology for conducting the social impact analysis required under the NEPA regulations.

The NRC has failed entirely to define and describe the direct social science effects of the proposed project upon the residents of Forest Grove and Center Springs, who will suffer the greatest negative environmental and psycho-social impacts. CANT's Contention J (attached as exhibit "7" and incorporated herein by reference) addressed the proposed CEC's negative economic and sociological impacts on the communities of Forest Grove and Center Springs, such as the impacts discussed more fully in paragraphs A through E of section "3," above. Nevertheless, the Draft EIS ignores these impacts. Accordingly, the NRC must revise the Draft EIS, and in doing so it should utilize the methodology set forth in the Guidelines Document.

C. NRC'S Draft EIS fails to address and analyze the potential conflicts between the proposed CEC facility and existing land use plans, acts, or policies pursuant to 40 C.F.R. §1502.16.

The NRC failed to comply with CEQ regulations by inadequately identifying existing land uses in the affected area, and omitting any mention of, or data concerning, existing land use controls, comprehensive plans, or policies for the area surrounding the proposed site. The regulations provide that EIS's "shall" include discussions of:

> possible conflicts between the proposed action and the objectives of Federal, regional, State, and local . . . land use plans, policies and controls for the area concerned.

40 C.F.R. § 1502.16. The minimal analysis in the Draft EIS is

inadequate both in its description and analysis of land use in the affected area.

The description of surrounding predominate land use, according to the Draft EIS at 3-115, is forestland, agriculture, and pastureland -- with absolutely no mention of residential land use as a predominant land use even though the residential communities of Forest Grove and Center Springs sit next door to the proposed site. While the NRC has carefully recorded the number of acres dedicated to agriculture, the location of six cattle ranches, and the size of the largest cattle herd within the five mile radius of the site, it has omitted the amount of acreage dedicated to residential land use (as well as the acreage for all land uses other than agricultural[16]), the location of dwellings, the number of dwellings, and the number of human beings within a five mile radius of the site.

The analysis of environmental consequences to surrounding land use is even worse. Abandoning the five mile radius which was used in describing surrounding land use, the Draft EIS limits its analysis of environmental consequences to the area within LES's property line! Accordingly, the identification and analysis of the existing land use in the affected area is inadequate, erroneous, and incomplete.

Furthermore, the NRC has failed to identify or analyze the gas pipeline corridor as it indicated it would in the Summary Report. "The EIS will describe and assess pipeline corridors and the construction precautions and mitigation, as appropriate." Summary Report at p. 20. There is no such discussion anywhere in the Draft EIS. And figure 3.26 from the Draft EIS, which purports to depict land use in the vicinity of the CEC, fails to indicate any gas pipelines at all, when in fact there are thirty-one active oil and gas wells and four distribution pipelines located within a five mile radius of the proposed site. Draft EIS at 3-118.

Finally, the Draft EIS fails to identify any federal, state, regional, or local, zoning land use plan(s), comprehensive plan(s), or economic development plan(s) for the region. However, the town of Homer has both a comprehensive plan and zoning ordinance. To fully comply with the CEQ regulations, an analysis of potential

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[16] Unless the acreage for these other land uses and their corresponding percentages are identified, it is not possible to discern what the predominant land use is actually is, much less meaningfully comment on the NRC's analysis of land use in the affected area.

conflicts between the proposed facility and existing land uses and zoning ordinances must be performed by the NRC and included in a revised Draft EIS.

8.) THE DRAFT EIS FAILS TO PROVIDE IDENTIFICATION AND ANALYSIS OF ACTION ALTERNATIVES PURSUANT TO 40 C.F.R. § 1502.14.

The Draft EIS fails to adequately discuss reasonable alternatives to the proposed project as required under 40 C.F.R. §1502.14, and also fails to provide adequate reasons for rejecting alternatives.

> This section is the heart of the environmental impact statement. Based on the information and analysis presented in the sections on the Affected Environment (§1502.16) and the Environment Consequences (§1502.16), it should present the environmental impacts of the proposals and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmakers and the public.

40 C.F.R. § 1502.14 (emphasis added).

The draft EIS merely contains a single action alternative (the applicant's development plan) and the "no-action" alternative. The NRC's discussion of the single action and the no-action alternatives (which itself is flawed, since it is based upon incomplete and erroneous data concerning the affected environment and impacts on the affected environment, all as set forth above), fails to analyze the differences between the environmental impacts of these two alternatives and other action alternatives as required under NEPA regulations.

And there are alternatives to the proposed action. For example, the Draft EIS should have included discussions of the status of alternative non-nuclear energy sources (e.g., solar, wind, geothermal), and alternative nuclear energy sources (e.g., thorium-232 fission reactors (see Ivars Peterson, "Accelerator Route To Nuclear Energy," Science News Vol. 145 (January 1,1994) at p. 12). In addition, it should have considered the alternative of completing development of the atomic vapor laser isotope separation technology and building a plant based on it. A demonstration plant has been built at Lawrence Livermore National Laboratories, but the DOE has not done an EIS on it. Energy consumption per SWU in the atomic vapor enrichment technology is considerably lower than the proposed centrifuge plant. In light of the lack of urgency in the need to build a uranium enrichment plant, the Draft EIS should have

considered the wisdom of waiting to develop this more promising technology.

The Draft EIS should also have considered conversion of Russian highly enriched uranium to low enriched uranium as an alternative to the proposed CEC facility. As discussed above, such a program has significant benefits in the reduction of nuclear arms. Moreover, it would not have one of the major environmental costs associated with the proposed CEC facility -- generation of large quantities of DUF6.

In addition to omitting a discussion of action alternatives, the NRC omitted adequate discussion of the reasons for eliminating all other action alternatives. Under 40 C.F.R. § 1502.14, the NRC is required to:

> Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.

40 C.F.R. §1502.14 (emphasis added). The NRC merely states that "The no-action alternative is the only alternative considered in the Draft EIS." Draft EIS at xviii. This clearly does not constitute the required discussion of the reasons for all other alternatives being eliminated.

And finally, because the Draft EIS does not include an action alternative other than LES' development plant, the Draft EIS obviously does not adequately describe the environmental effects of all reasonable alternatives, as also required under the NEPA regulations. An EIS must provide "the environmental effects of alternatives . . . . The comparisons under §1502.14 will be based upon this discussion." 40 C.F.R. §1502.16(d).

In short, the NRC has not complied with the NEPA regulations[17], and therefore the Draft EIS must be revised to include a complete and accurate description and analysis of the environmental effects of alternatives, as well as a description of the reasons for eliminating such alternatives.

9.) THE DRAFT EIS INADEQUATELY DISCUSSES ALTERNATIVE SITES FOR THE PROPOSED ACTION

The criteria used by the NRC Staff for the regional screening of potential uranium enrichment facility sites are so irrational,

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[17] Council on Environmental Quality, 40 C.F.R. §§ 1500-1508.

arbitrary, and improper as to completely undermine the credibility of the NRC's site selection process. It is all too clear that, rather than designing objective and reasonable criteria for the purpose of assisting a choice among genuine alternatives, the NRC chose the site first and then selected an arbitrary set of criteria that would lead inevitably to that choice.

First, the 600 mile radius as a site selection criteria is completely arbitrary. There are no supporting studies or data to indicate why this odd number was selected. If a goal is to reduce transportation accidents, certainly a lesser distance would make more sense. Few people would consider more than 500 miles "near expected major feed suppliers and product receivers," especially when most product receivers are well over 1,000 miles away.

It appears that the 600 mile radius must have been chosen after the fact, since the most likely reasons LES decided to locate in Louisiana are that it is a non-union state and it happens to be represented by Sen. Bennett Johnston of Louisiana, whose former chief of staff, Charles McBride, was LES' lobbyist. There is indeed no reason whatsoever to believe that LES ever looked at sites outside Louisiana, and Figure 2.10 acknowledges that only northern Louisiana was included in the final study area.

Furthermore, it seems that a siting criterion of a "right-to-work" state, which would ensure a non-union workforce, is improper and discriminatory. While it may be acceptable for a private business to explicitly choose to operate in a non-union state, it is not acceptable for a business which relies upon a federal license for its operations to require a non-union workforce. Further, it is well-known that manufacturing unions are, on the whole, composed disproportionately of minorities. A "right-to-work" requirement thus is inherently discriminatory. Finally, it is disingenuous for the Draft EIS to state that LES "requires a source of workers who are capable of operating the plant efficiently and safely" and then establish a siting criterion which discourages employment of members of the Oil, Chemical and Atomic Workers union (OCAW) who may be the only people in the country so qualified. There is no way this can be looked upon as a "benefit" in the Draft EIS.

The Draft EIS also rules out the entire state of North Carolina as a potential site, based on the estimated peak acceleration of earthquakes in excess of 0.49%. Draft EIS at 2-46. However, the Draft EIS does not explain why this earthquake risk would be unacceptable for a uranium enrichment facility, and yet was considered acceptable for a much more dangerous and earthquake-vulnerable type of facility, the Shearon Harris nuclear power

plant. It appears that earthquake risk is only a factor when the NRC is seeking a reason to avoid considering a genuine alternative.

Another siting criterion on page 2-43 of the Draft EIS identifies Northern Louisiana as desirable because it is located in the Louisiana Power & Light service area, noting that LP&L is an LES partner. In fact, however, officials of LP&L have testified in public hearings in Baton Rouge that LP&L intends to leave the partnership if and when a construction permit is granted. Thus, LP&L will not be an LES partner during any meaningful time period, and thus, this is not a valid siting criterion.

Furthermore, Northern Louisiana is at the very edge of the "attractive" zone, for transportation of feed and product material. This cannot be considered a siting plus, as many other potential sites are far better for transport considerations.

And although LES would likely appreciate the numerous tax breaks that would come their way by siting in Louisiana, the Draft EIS fails to discuss other possible tax breaks in other locations.

Beyond these peculiarities, it is abundantly clear that the discussion of alternative sites in the Draft EIS is inadequate. The Draft EIS screening process found three potential sites (LeSage, Prison, Emerson) suitable for detailed analysis (Draft EIS at pp. 2-50 through 2-56). However, all three qualified sites were located within the same Louisiana community, with two sites located less than 5 miles from each other (Draft EIS at p. 2-51). Thus, it is specious to suggest that these locations are different alternative sites, when, in fact, they are nothing more than different places within the same site that will be affected by the proposed action.

Furthermore, the Draft EIS blatantly admits that "the staff and LES analyzed only the LeSage site in detail. If the impacts at the site were unacceptable, alternative sites would have been considered in greater detail" (Draft EIS at 2-55). Thus, assuming that the three locations actually constitute "alternative sites," still only one of them was analyzed to the degree necessary to determine its ultimate acceptability. This means that alternative sites were not analyzed in detail and compared for ultimate acceptability as required under NEPA. Thus, a revised draft EIS which adequately considers and discusses alternative sites must be prepared for public comment.

10.) THE DRAFT EIS IS INADEQUATE BECAUSE THE NRC OMITTED INCLUSION OF THE SCOPE DETERMINED IN THE SCOPING PROCESS PURSUANT TO 40 C.F.R. § 1502.9.

As discussed more fully above, the NRC's omittance of the many issues determined to be within the scope of the Draft EIS and to be analyzed in depth in the Draft EIS pursuant to 40 C.F.R. § 1501.7(a)(2) violates the CEQ regulations which require that:

> Draft environmental impact statements shall be prepared in accordance with the scope decided upon in the scoping process. The lead agency shall work with the cooperating agencies and shall obtain comments as required in part 1503 of this chapter.

40 C.F.R. §1502.9(a) (emphasis added).

The NRC has either omitted or inadequately addressed numerous significant issues previously determined by the NRC to be included in the Draft EIS and contained in the Environmental Impact Statement Scoping Process Summary Report, November 1991. Therefore, a revised draft EIS must be prepared to include in depth analysis of all the issues contained in the NRC's Summary Report.

11.) THE DRAFT EIS IS SO INADEQUATE THAT IT PRECLUDES MEANINGFUL ANALYSIS. ACCORDINGLY, A REVISED DRAFT EIS MUST BE PREPARED FOR PUBLIC COMMENT PURSUANT TO 40 C.F.R. § 1502.9(a).

For all of the foregoing reasons, and pursuant to 40 C.F.R. § 1502.9(a), the Draft EIS is fatally flawed, and must be revised:

> If a draft statement is so inadequate as to preclude meaningful analysis, the agency shall prepare and circulate a revised draft . . . .

Due to the inadequate, erroneous, and incomplete data gathered and inventoried in the preparation of the Draft EIS; the fragmented, insufficient, and sometimes lacking analysis in the Draft EIS; and the failure of the NRC to provide evidence supporting its analysis and conclusions, the current draft of the EIS utterly precludes meaningful analysis by the public of several potential environmental impacts of the proposed CEC facility.

Thus, the NRC must prepare and submit a revised Draft EIS for circulation, review, and comment pursuant to 40 C.F.R. § 1502.9 in order to afford the public an opportunity to meaningfully analyze the potential impacts of the proposed CEC facility.

Very truly yours,

Nathalie M. Walker

Nathalie M. Walker

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The Battle for Environmental Justice in Louisiana..... Government, Industry, and the People

Louisiana Advisory Committee to the
U.S. Commission on Civil Rights

September 1993

A report of the Louisiana Advisory Committee to the United States Commission on Civil Rights prepared for the information and consideration of the Commission. This report will be considered by the Commission and the Commission will make public its reaction. The findings and recommendations of the report should not be attributed to the Commission but only to the Louisiana Advisory Committee.

8. Findings and Recommendations

The following findings and recommendations are submitted under the provision of section 703.(2)(1) of the Commission's regulations, empowering the Advisory Committee to initiate and forward advice and recommendations to the Commission upon matters that the State Committee has studied. The Louisiana Advisory Committee concludes and recommends the following actions:

Louisiana Environmental Laws and Rulemaking

Finding 1: The Advisory Committee finds that black communities in the corridor between Baton Rouge and New Orleans are disproportionately impacted by the present State and local government systems for permitting and expansion of hazardous waste and chemical facilities. These communities are most often located in rural and unincorporated areas, and residents are of low socioeconomic status with limited political influence. Some residents of these communities complain that they are excluded from the local and State siting and permitting decisionmaking affecting their communities. Communities found to be affected include but are not limited to Revilletown, Sunrise, Morrisonville, Wallace, Alsen, Forest Grove, Center Springs, and Willow Springs. Residents of these communities complained of adverse health effects and quality of life issues such as safety, noise, and traffic associated with living in and around such facilities. Two communities, Revilletown and Sunrise, were dismantled by voluntary buyout programs, and one community, Morrisonville, was relocated.

This finding is further supported by the following facts: a U.S. Environmental Protection Agency report, *Toxics Release Inventory and Emissions Reductions 1987-1990 in the Lower Mississippi River Industrial Corridor,* concludes that many of the facilities emitting large amounts of chemicals are located in areas with predominately minority population. Populations within 2 miles of facilities releasing 90 percent of total industrial corridor releases feature a higher proportion of minorities than the State average. The report also concluded that several historically black rural communities have been bought out by chemical or petroleum refining facilities to create plant buffers. Although racial discrimination in targeting of black communities for industrial and hazardous waste facilities is denied, State officials and industry acknowledge that black communities in Louisiana are disproportionately impacted by such facilities. In spite of the disproportionate impact upon certain communities, the State and local governments have failed to establish regulations or safeguards to ensure such communities are reasonably protected from a high concentration of hazardous waste and industrial facilities and risks associated with living in and around such facilities.

Recommendation 1: The Advisory Committee recommends that the Louisiana Department of Environmental Quality develop comprehensive State regulations to balance environmental costs and benefits along with the social, economic, and aesthetic values of the affected communities as called for by the Louisiana Supreme Court in the case *Save Ourselves v. Louisiana Environmental Control Commission* (IT decision).

The Advisory Committee further recommends that, similar to other States cited in this report, the State and local governments adopt regulations specifying setback distances or buffer zones from residences, churches, and schools to ensure reasonable distances from industrial and hazardous waste facilities. Consideration should be given to including a buffer zone in all original construction plans and obtaining the services of an independent and professional planner to assist in examining the environmental consequences of sitting and permitting decisions.

siting decisions and special attention be paid to communities most affected by hazardous waste emitted by industries. As a good faith effort, the Louisiana Chemical Association should expand on the Responsible Care Program initiatives to address environmental equity, and affirm its commitment to nondiscrimination in the management of plant facilities.

Federal Laws and Rulemaking

Finding 8: The Advisory Committee takes note of the studies across the country that show that industrial and hazardous waste facilities are located disproportionately in minority communities and that the residents face more hazards than the rest of the population. Based upon studies and reports from environmental groups, civil rights groups, and government agencies, legitimate claims are made that racial minorities are distinctly disadvantaged by many factors, including discrimination, income, inadequate health care, low quality housing, limited access to government, and lack of political empowerment. Louisiana is an example of this phenomenon.

Significant reform in environmental laws and structural reform in the U.S. Environmental Protection Agency's policymaking framework is being studied by the U.S. Environmental Protection Agency to promote equitable sharing of burdens and benefits of environmental protection. Although significant efforts are underway to merge equity into Federal policymaking, enforcement authorities and procedures have not yet been established to implement and ensure compliance with environmental equity policies by private, local, State, and Federal entities. Moreover, final decisions have not yet been made on how equity measures will be coordinated with the U.S. Environmental Protection Agency's civil rights enforcement efforts.

Recommendation 8: The Advisory Committee concurs with the U.S. Environmental Protection Agency's recommendations in the 1992 report, *Environmental Equity Report: Reducing Risk for All Communities*. The Advisory Committee particularly supports the report's recommendation that the U.S. Environmental Protection Agency should review and, where appropriate, revise its permit, grant, monitoring, and enforcement procedures to address high concentrations of risk in racial minority communities.

In this effort, the U.S. Environmental Protection Agency should assess Louisiana's permit and siting practices at the State and local parish levels to ensure that decisions are free from inequities and discrimination. Strategies should be developed that will target environmental equity enforcement under the civil rights statutes administered by the U.S. Environmental Protection Agency, and to assess the process by which the U.S. Environmental Protection Agency enforces the environmental laws and how the agency's external civil rights compliance program will be implemented in conjunction with equity initiatives. The U.S. Environmental Protection Agency should monitor the communities of Alsen, Wallace, Forest Grove, Center Springs, and Willow Springs to ensure that siting decisions in those communities are in compliance with EPA equity and civil rights standards.

Finding 9: As early as 1973 in a report on Federal civil rights enforcement, the U.S. Commission on Civil Rights faulted EPA for its lack of enforcement under Title VI. The Commission found that EPA:

> ...has not developed policy relating to exclusionary zoning or the employment practices of recipients; and has not fully determined that Title VI implications of its programs, aside from the construction grant program.[1]

The Advisory Committee also concurs with the U.S. Commission on Civil Rights report, *Enforcement of Equal Employment and*

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1 U.S. Commission on Civil Rights, *The Federal Civil Rights Enforcement Effort, A Reassessment* (January 1973), p. 289.

U.S. House of Representatives
Subcommittee on Oversight and Investigations
of the
Committee on Energy and Commerce
Washington, DC 20515-6115

October 21, 1992

The Honorable James D. Watkins,
Admiral, USN, Retired
Secretary of Energy
Department of Energy
Forrestal Building
1000 Independance Avenue, S.W.
Washington, D.C. 20585

Dear Admiral Watkins:

As you are well aware, URENCO is an international uranium enrichment consortium that proposes to build and operate a commercial centrifuge uranium enrichment facility in the United States. Pursuant to its responsibilities under Rules X and XI of the Rules of the U.S. House of Representatives, the Subcommittee on Oversight and Investigations has been conducting for some time an inquiry relative to the Department of Energy's (DOE) reported determination that it will be permissible to transfer Restricted Data to URENCO without a bilateral agreement authorizing such transfer. The Subcommittee is monitoring compliance with the Atomic Energy Act and attempting to assess whether URENCO's involvement with the proposed enrichment facility presents a problem from the standpoint of national security and nuclear proliferation.

On January 24, 1992, the Subcommittee staff was briefed, at my request, on the URENCO issue. The briefing was conducted by George L. McFadden, Jr., Director of the Office of Security Affairs, and Mark Schroeder, Deputy General Counsel for Energy Resources and Legislation. Other DOE officials also participated. Mr. Schroeder was added to the briefing team specifically because the Subcommittee staff had made it plain to the Department that the Subcommittee was particularly concerned about the legal issues the URENCO matter raised. The information supplied at this briefing was, like all information supplied to Federal investigators in the course of an official inquiry, subject to the responsibilities and penalties of Title 18 of The U.S. Code.

Recent revelations have raised the most serious concerns about the truthfulness of the representations made to the Subcommittee during this briefing and in its aftermath.

At the January 24 briefing, Mr. Schroeder told the Subcommittee staff categorically that no written legal opinions or documents had been prepared by the DOE General Counsel's office to support the DOE's determination that a bilateral agreement for cooperation would not be required. He said that necessary legal advice had been rendered orally to the Secretary and Deputy Secretary. Mr. Schroeder also told the staff that the DOE's determination was never put in writing. When the Minority staff counsel expressed surprise that an attorney would not memorialize such a decision in any way, Mr. Schroeder further volunteered that such an occurrence was not unusual at DOE.

Interestingly, similar claims may have been made to General McFadden. The General has told Subcommittee staff that when he requested documents to prepare himself for the briefing, he was told by the Office of General Counsel that no documents were available.

When Mr. Schroeder was telephoned by the Subcommittee staff on January 27, 1992, he further indicated that the communication of the DOE's determination to the State Department occurred orally and was never reduced to writing.

It is thus with considerable consternation that the Subcommittee has learned that Mr. Schroeder's statements to the Subcommittee staff were untrue and that Mr. Schroeder may have known that his statements were untrue at the time he made them.

In May 1992 -- over three months after Mr. Schroeder met with staff and so emphatically denied the existence of the legal opinions or analyses -- the Subcommittee learned, not from the DOE but from other sources, that legal opinions had in fact been prepared by the DOE. Only after the State Department notified the DOE that it had transmitted URENCO documents mentioning DOE's legal opinions to the Subcommittee did Eric J. Fygi, Acting General Counsel of DOE, suddenly transmit a stack of draft legal memoranda on the URENCO matter, amounting to some 23 different items. Had the Subcommittee not learned of the existence of these documents from other sources, one may reasonably infer that the DOE would have continued to pretend that the documents did not exist. That DOE's attempted deception was a deliberate decision is further suggested by the great speed with which DOE was able to gather and send the documents once it knew that others had disclosed their existence -- locating, identifying, and transmitting in a matter of only a few days the documents

whose very existence it had previously denied. Moreover, the Acting General Counsel's transmittal letter implicitly acknowledges that the DOE transmittal was prompted by the State Department's actions and admits, in striking contradiction to Mr. Schroeder's statements at the January 24 meeting, that DOE had indeed prepared legal analyses.

> "I have been advised that, in its May 4, 1992 response [the letter was actually dated May 1] to your request of February 19, 1992, the Department of State has provided the Subcommittee some documents that include reference to preliminary drafts of legal analyses prepared in this office. These materials were prepared early in the process whereby this Department and the Department of State considered legal questions ... this office did prepare drafts of material through which it weighed certain of the preliminary legal analysis prepared in the Department of State."

Unfortunately, the Acting General Counsel fails to explain why the analyses were not previously provided to the Subcommittee or why the Deputy General Counsel for Energy Resources and Legislation, i.e., Mr. Schroeder, untruthfully told Subcommittee staff that such analyses did not exist.

This omission is particularly troublesome given that review of the documents indicates that Mr. Schroeder was personally involved in the creation of some of them. For example, a copy of a memorandum on the subject, "Legal Requirements for Access by URENCO, Ltd. to Operating Data Generated by the Louisiana Energy Services Uranium Enrichment Plant", was transmitted from "M. Schroeder, GC-10", to Chuck Oleszycki on January 24, 1990. The transmittal included a handwritten comment (that appears to be signed "MCS") which specifies that "in addition to the first Holifield reference (the one at p. 43 of Committee Report), there are three other page references (highlighted in red [on] pages 9 & 13), which we need."

A different version of a memorandum on the same legal subject is attached to a transmittal note dated January 15, 1991 from "Mark C. Schroeder, GC-10", to Eric Fygi, Marc Johnston, Tom Todd, and Chuck Oleszycki, which includes the remarks "Re: Urenco Restricted Data" and "Let me have your comments, if any, on the attached."

Yet another document, a note for "Mark Schroeder" from Deputy General Counsel Fygi, dated January 4, 1991, consists of seven typed pages of very specific and detailed comments and advice on the "Draft Urenco Opinion." In this memorandum,

Mr. Fygi suggests specific sentences to insert or delete, recommends the addition of certain material in footnotes, frets that "the reader does not see the plain words of section 144 until he or she reaches page 8," discusses the merits of some of the contentions advanced, advises that the use of adjectives be pared back, and, generally, makes manifest that he has gone over the manuscript with a fine tooth comb to advise and guide Mr. Schroeder.

Review of the DOE and State Department documents establishes that the DOE legal analyses were transmitted to the State Department and reviewed by State Department personnel.

Finally, documents obtained by the Subcommittee establish strong reason to believe that the DOE has not, even now, produced all the documents relevant to the development of the URENCO legal opinion.

In recent weeks, Mr. Schroeder has proffered to staff, during a September 18, 1992 meeting on another matter, the claim that his January 24 representations were "misconstrued." At a second unrelated meeting on October 2, 1992, the Minority Counsel invited Mr. Schroeder to explain in what way he had been "misconstrued". Mr. Schroeder replied, "I think that was clarified in the correspondence." The correspondence that the Subcommittee has received from the Department provides no explanation whatsoever. Under the circumstances, these explanations are wholly inadequate.

I am also troubled by how recent revelations may bear on the correspondence which you and I exchanged subsequent to the January 24 meeting in which Subcommittee staff were misinformed that the DOE had prepared no legal analyses relative to the URENCO issue. You will recall that I wrote you on February 6, 1992, shortly after the meeting, expressing my surprise and concern that the Department would reach an interpretation on an important issue under the Atomic Energy Act "without a formal legal opinion or any decisional memoranda." You replied that you were "wholly satisfied" that the Department is "faithfully serving the objectives of the Atomic Energy Act." You also asserted that even "to suggest that such a formality is required to repatriate information already well-known to the recipient strikes me as illogical, if not absurd." At the same time, you declined to provide a chronology of the DOE's decisionmaking regarding URENCO on the grounds that it "is not possible to reconstruct with any confidence ... the events ...."

Needless to say, the recent turn of events can only cause me the greatest possible concern. Accordingly, I request that you respond fully and truthfully to the following questions and requests for information.

(1) Please explain how, why, and at whose initiative or direction Deputy General Counsel Schroeder misinformed the staff that no legal analyses existed when, quite obviously, they did.

(2) With whom did Mr. Schroeder meet or talk in preparation for his briefing of Subcommittee staff?

(3) Was Deputy General Counsel Fygi aware of the plan to misinform Subcommittee staff that no written legal analyses existed?

(4) Please list the names and job titles of all persons involved in researching and drafting the legal analyses.

(5) Please list the names and job titles of all persons who reviewed the legal analyses.

(6) As to each legal analysis, please state whether the Deputy General Counsel for Energy Resources and Legislation (a) assisted in its preparation, (b) reviewed it, (c) saw it, or (d) was informed as to its existence.

(7) Please explain why and by whom General McFadden was misinformed that no documents were available for his review.

(8) Please state precisely when you became aware of the existence of the documents. Were you aware of their existence at the time of your letters to me? If you were, had you read the analyses at the time of your letters to me? Is there any aspect of the Department's assertions to the Subcommittee that you would like to revise or correct in light of the now-acknowledged existence of these documents? For example, do you still believe that even "to suggest" the need for the legal formality is "illogical, if not absurd"?

(9) What procedures does the Department have in place to ensure that information supplied to Congressional Committees is truthful or accurate? What information is supplied to Departmental employees and officials

participating in Congressional briefings relative to their legal duty to provide truthful information? What improvements are contemplated to ensure that an incident such as this does not recur?

(10) What direction are you supplying to the Inspector General in regards to this matter?

In addition, please review carefully your records for any and all items containing, discussing or in any way relating to the URENCO legal analysis and the communication of this information to the State Department. Please include these documents with your response, which will be appreciated and expected by the close of business, Friday, November 6, 1992.

The Subcommittee staff will be contacting the DOE to request interviews with DOE personnel in connection with this inquiry. Your cooperation in this regard will be greatly appreciated.

If you have any questions about this matter, please contact Subcommittee investigators Jeffrey C. Crater or Jeffrey L. Hodges at 225-3365, or Subcommittee Counsel Janina A. Jaruzelski at 225-4441.

Sincerely,

John D. Dingell
Chairman
Subcommittee on
Oversight and Investigations

cc: The Honorable Thomas J. Bliley, Jr.
Ranking Republican Member
Subcommittee on Oversight and Investigations

The Honorable Lawrence S. Eagleburger
Acting Secretary of State
Department of State

The Honorable Ivan Selin
Chairman
Nuclear Regulatory Commission

The Honorable John C. Layton
Inspector General
Department of Energy

The ER violates NEPA because it does not contain an adequate discussion of alternatives to the proposed action.

BASIS: NEPA, as implemented by 10 C.F.R. § 51.54, requires that environmental reports must include, inter alia, a discussion of "alternatives available for reducing or avoiding adverse environmental effects." LES' ER fails to satisfy this requirement in the critical respect that it does not discuss the no-action alternative. Given the signficant environmental costs of this project and the fact that LES has not demonstrated a need for the facility, this alternative should have been analyzed in detail.[40]

L. Online Enrichment Monitoring

In order to provide reasonable assurance that gas centrifuge equipment at the CEC is not unlawfully diverted to the production of highly enriched uranium (HEU), the applicant's fundamental nuclear material control (FNMC) plan should require continuous or frequent online enrichment monitoring for all cascades. To ensure the effectiveness of such monitoring, the plan should stipulate minimum process pipe inner diameters of 110 millimeters or greater at all potential measurement points.[41] The current

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40 See Contention J, which is incorporated by reference herein.

41 Minimum process pipe inner diameter should be 110 mm if uranium hexafluoride gas pressure in the pipe is relatively high, as at the Capenhurst plant in the United Kingdom. See T.W. Packer, "Continuous Monitoring of Variations in the U_{235} Enrichment of Uranium in the Header Pipework of a Centrifuge Enrichment Plant," Proceedings of the 13th ESARDA Symposium on Safeguards and Nuclear Material Management, 14-16 May 1991. Attachment 15. (This article and all other articles referenced in the following four safeguards contentions are attached and incorporated by reference into this contention.) Minimum process pipe inner diameters must be larger than 110 mm for pipes in which the uranium hexafluoride gas pressure is moderate or low. For example, if the gas pressure were one-

design of the CEC does not meet these specifications.[42]

BASIS: On December 17, 1990, the NRC published a proposed rule setting forth "new performance-based material control and accounting requirements" to be applied to enrichment facilities.[43] 55 Fed. Reg. 51,726. Pursuant to proposed § 74.33(c)(5)(i), material control and accounting systems for uranium enrichment facilities must include a "detection program, independent of production", that provides "high assurance" of "detection of any production of uranium enriched to 10 percent or more in the U_{235} isotope in any product stream." NRC Draft Regulatory Guide DG-5002, which describes methods acceptable to the NRC for achieving the performance objectives in 10 C.F.R. § 74.33, specifies that

> The licensee should have a program for monitoring the isotopic composition of product and tail streams, independent of operations, that provides high assurance of timely detection of any production of uranium enriched to 10 percent or more in the isotope U-235. .... [A]n extensive program for the centrifuge technology would be appropriate because of the ease of reconfiguring the machines to produce higher enrichments in a short period of time. The program can use nondestructive assay with fixed detectors, portable detectors, or UF_6 samples taken and analyzed for U-235 concentration.

(continued)
half that in a typical corresponding pipe at the Capenhurst plant, then the minimum process pipe inner diameter should be the square root of two times 110 mm, or 155 mm.

42 The safeguards issues addressed in the following four contentions will also be raised in CANT's comments to the Commission regarding the proposed standards for the CEC.

43 The Commission has directed that if this proposed rule is not final by the time of licensing of the CEC, the CEC license is to be amended, as necessary, to conform to the regulations. Notice of Receipt of Application for License, etc., 56 Fed. Reg. 23,310, 23,313 (May 21, 1990).

Reg. Guide DG-5002, § 1.2.

For several reasons, the most practical and effective means of meeting this requirement is to employ frequent or continuous use of fixed detectors for monitoring gas enrichment in all product, waste, and dump pipes, rather than the more established practice of occasional intermittent use of portable detectors.[44] First, continuous or frequent enrichment monitoring allows more constant and comprehensive surveillance over the uranium enrichment process than does occasional intermittent enrichment monitoring. Second, detection of HEU production by portable detectors can be evaded too easily. Because HEU gas could be removed from a centrifuge cascade in a very short time upon a decision to terminate use of the cascade (or a portion of the cascade) for HEU production, it would be possible for plant production personnel to take actions so that HEU production would not be detected by means of a portable detector technique; indeed, the high visibility of inspectors carrying detectors would serve as a signal to production personnel to promptly cease HEU production. Extensive sampling of process gas would not be a practical alternative to online enrichment monitoring, because it would involve excessive risk of leakage of air into the pipes.[45]

For all online enrichment monitoring techniques presently known, it is well established that effectiveness of monitoring

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44 See Packer, Attachment 15.

45 Communications: Trevor Packer, Harwell Lab, United Kingdom and Ben Dekker, URENCO, Netherlands, to Helen M. Hunt at ESARDA meeting, May 16, 1991.

requires that at measurement points there be at least a moderately high ratio (i.e., at least 1:1) of the amount of U_{235} in the gas to the amount of U_{235} in the pipe deposit.[46] The most practical means of assuring that this condition exists throughout the life of the enrichment equipment is to install process pipe sections at potential measurement points which are of a large diameter, i.e., greater than 110 mm inner diameter.[47] Actual recommended pipe diameter at a potential measurement point would depend on gas pressure in the pipe.[48] Proposed pipe diameters in the CEC design, however, are significantly smaller. According to URENCO representative Peter LeRoy, the planned pipe inner diameter for the CEC is 3.07 inches, which is about 78 mm.[49] At this pipe diameter, the uranium deposit that would build up on the pipe wall would, within months or a few years, dominate the online enrichment measurements. Because of associated large measurement uncertainties, online enrichment measurements would then not be capable of reliably determining whether low enriched or highly enriched uranium hexafluoride gas is present in a pipe. The CEC design should therefore be modified to increase the pipe

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46 Helen M. Hunt, "Effective Go/No Go Enrichment Measures," 13th ESARDA Symposium on Safeguards and Nuclear Material Management (May 14-16, 1991) at 363-64. Attachment 16. See also Packer, Attachment 15.

47 Communications: Trevor Packer, Harwell Lab, UK, and Ben Dekker, Urenco, Netherlands, to Helen M. Hunt at ESARDA meeting, May 16, 1991.

48 See note 41, supra.

49 Telephone communication: Peter LeRoy, LES, to Helen M. Hunt, June 11, 1991.

size at measurement points to a degree that will permit adequate enrichment monitoring.

M. Monitoring of Sampling Ports, Process Valves, and Flanges

In order to preclude or detect production of HEU by a batch recycling scheme involving misuse of sampling ports, process valves, and/or flanges, the applicant's FNMC plan should require effective monitoring by reliable technical means which accurately keep track of employee access to these process connection locations.

BASIS: Compliance with proposed 10 C.F.R. § 74.33(c)(5)(i) requires effective monitoring of all product streams. Production of HEU by a batch recycling scheme involving introduction of feed and withdrawal of product through sampling and process valve ports is a credible scenario in a gas centrifuge enrichment plant. Misuse of other process valves (not having ports) could be a component of such a scenario. Onsite production of HEU could be carried out discretely by as few as one or two production employees. For this reason, NRC Draft Regulatory Guide DG-5002, § 12.2, "Monitoring Program for Clandestine Enrichment Scenarios," requires the applicant's FNMC plan to address, inter alia, "Sampling ports and frequency of sampling to be used for monitoring of product streams," and "The use of tamper-indicating seals on process valves and flanges." Use of seals has been only partly reliable, however, because it has been possible for plant production personnel to remove seals from valve ports -- in order

1771 ESARDA Proceedings

CONTINUOUS MONITORING OF VARIATIONS IN THE ^{235}U ENRICHMENT OF URANIUM IN THE HEADER PIPEWORK OF A CENTRIFUGE ENRICHMENT PLANT

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Abstract

Non-destructive assay equipment, based on gamma-ray spectrometry and X-ray fluorescence analysis has previously been developed for confirming the presence of low enriched uranium in the header pipework of UF_6 gas centrifuge enrichment plants. However inspections can only be carried out occasionally on a limited number of pipes.

With the development of centrifuge enrichment technology it has been suggested that more frequent, or ideally, continuous measurements should be made in order to improve safeguards assurance between inspections.

For this purpose we have developed non-destructive assay equipment based on continuous gamma-ray spectrometry and X-ray transmission measurements. This equipment is suitable for detecting significant changes in the ^{235}U enrichment of uranium in the header pipework of new centrifuge enrichment plants.

Results are given in this paper of continuous measurements made in the laboratory and also on header pipework of a centrifuge enrichment plant at Capenhurst.

1. Introduction

Since the establishment of the Hexapartite Safeguards Project in November 1980, research has been conducted in several countries, including the UK, to develop techniques that could be incorporated into a non-destructive assay instrument that was capable of confirming the presence of low enriched uranium (LEU) in cascade header pipework of a UF_6 gas centrifuge enrichment plant on a rapid 'Go/No-Go', basis. The techniques reported are based on gamma-ray spectroscopy and X-ray fluorescence analysis /1/2/. The development has been complicated by the presence of comparatively large masses of uranium deposited on the pipework, especially on some of the earlier centrifuges.

With the development of centrifuge enrichment technology it has been suggested that on new plant the main header pipework should be continuously monitored to improve safeguards assurance between inspections. Although this type of equipment would be more expensive to install than the transportable system already developed, it would require less effort by both Operators and Inspectors to carry out the necessary inspections.

2. Comparison of off-line and on-line techniques

Where possible the techniques developed for the off-line NDA ^{235}U enrichment monitor, which is used for safeguarding centrifuge enrichment plants at Capenhurst, have been incorporated in the on-line instrument. Both instruments check that the enrichment of the UF_6 gas in the pipe being safeguarded is consistent with being LEU (less than 20%), by measuring the number of 185.72 keV gamma-rays emitted from the UF_6 gas, which is proportional to its enrichment and pressure. As 185.72 keV gamma-rays are also emitted from any uranium that may be deposited on the pipework, it is necessary when inspecting some pipes, especially those on older enrichment plants which may have comparatively large masses of deposited uranium on them, to establish the number of gamma-rays emitted only by the UF_6 gas/2/. A method, known as the "two geometry technique", developed for separating gamma-rays emitted from the UF_6 gas from those emitted from any deposited uranium, has been shown to be suitable for use in both off-line and on-line instruments/1/3/. It was combined with an X-ray fluorescence UF_6 gas pressure measurement in the off-line gauge to confirm that the enrichment of the UF_6 gas in product pipes in the centrifuge enrichment plant at Capenhurst was consistent with being LEU/1/2/. As the on-line instrument incorporates low resolution scintillation counters, rather than the more expensive high resolution liquid nitrogen cooled germanium detector used in the off-line instrument, it is not possible to use the X-ray fluorescence technique to measure the UF_6 gas pressure. Therefore an X-ray transmission technique has been developed, which is capable of detecting changes in UF_6 gas pressure of less than 1 torr in the header pipework in centrifuges at Capenhurst/3/. This is combined with the gamma-ray measurement to check continuously for any changes in the ^{235}U content, and hence the enrichment of the UF_6 gas in product, feed, waste and dump header pipes at Capenhurst.

Attachment 15

3. The electronic detection system

The electronic system, which was originally developed at Harwell for use in the mineral industry, uses standard ECB-bus microprocessors and peripherals in conjunction with a specially designed nuclear pulse ADC (256 channels per detector)/4/. Gain stabilisation of the NaI(Tl) scintillation counters, based on the measurement of the 88 keV gamma-rays which are emitted by a ^{109}Cd source, is maintained by the microprocessor in the slave units, each of which may control up to six detectors. The master computer controls the acquisition of data and the setting up of appropriate regions of interest for each of the four detectors. It also calculates the results and compares the measurements with previous values which are kept in an appropriate constants file.

Normally two hourly measurements are made and daily averages calculated. The results are printed out and can also be displayed on the monitor of the computer. A photograph of the four detector assemblies, special electronic system, master computer and printer being used in the service corridor at Capenhurst is shown in Fig 1.

4. Choice of detectors

It was considered both expensive and impractical to install permanently several high resolution liquid nitrogen cooled semi-conductor detectors on even all header product pipes. As it is suggested that for some centrifuge plants it may even be necessary to monitor also, feed, waste and dump pipes, it was agreed that only low resolution scintillation detectors would be acceptable for continuous monitoring.

Laboratory measurements showed that scintillation detectors fitted with NaI(Tl) crystals 75mm in diameter and 25mm thick were sufficiently sensitive and could be adequately shielded and permanently installed without causing undue interference to the Operators.

Initially three detectors were mounted on a product header pipe. One detector measured transmitted X and gamma-rays from a ^{109}Cd source, the other two measured 185.72 keV gamma-rays. One detector was uncollimated and the other was collimated, in order to investigate the possibility of using the "two geometry technique" to separate gamma-rays

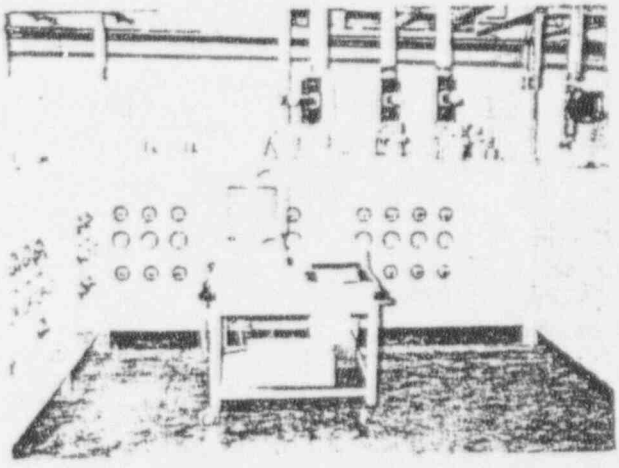


Fig 1 The monitor installed on an enrichment plant at Capenhurst

emitted from ^{235}U in the UF_6 gas from those emitted from any deposited uranium/1/.

These trials showed that there was relatively little deposit on the header pipes in the latest design of centrifuge for which this development is aimed. Interest has therefore been concentrated on investigating ways of reducing the overall cost of the equipment while maintaining acceptable performance.

Therefore later measurements have used a single detector fitted with a 50mm diameter crystal to measure both 185.72 keV gamma-rays for determining the mass of ^{235}U in the pipe and the transmitted X and gamma-rays to detect changes in UF_6 gas pressure.

5. Choice of source for the transmission gauge

Header pipes in the Capenhurst centrifuge enrichment plants are made of aluminium, the product, waste and dump pipes have internal diameters of 110mm with 5mm thick walls, while the feed pipe has a 4mm thick wall but is only 72mm in diameter. Therefore any X or gamma-ray used for the transmission gauge must be able to penetrate 10mm of aluminium while being relatively highly absorbed by a few mg/cm^2 of uranium. (Path of UF_6 gas across 110mm pipe at pressure of 10 torr = 1.1 mg/cm^2). Table 1 gives the energy of gamma-rays emitted by radio-isotope sources that

Table 1 Choice of source for transmission gauge

Source	Half Life yrs	Gamma-ray Energy keV	Abundance	Mass Absorption Coefficient cm^2/g U	Mass Absorption Coefficient cm^2/g Al	Fraction Transmitted(%) by Al Pipe with wall 4mm	Fraction Transmitted(%) by Al Pipe with wall 5mm	Fraction Absorbed(%) by 1 torr UF_6 Gas pipe diameter(mm) 55	75	110
^{57}Co	0.74	122	0.855	3.5	0.15	72	67	0.02	0.03	0.04
^{241}Am	433	59.6	0.852	6.4	0.27	56	49	0.04	0.05	0.08
^{109}Cd	1.26	88	0.038	3.3	0.20	65	58	0.02	0.03	0.04
^{109}Cd	1.26	25	0.17	74.0	2.0	1.5	.50	0.40	0.55	0.80
^{109}Cd	1.26	22	1.00	96.0	2.8	.24	.05	0.50	0.70	1.00

were considered for this application and their relative abundance and the mass absorption coefficients for aluminium and uranium for the X and gamma-rays emitted. It also gives the relative intensities of radiation transmitted through aluminium pipes with 4 and 5mm thick walls and also the percentage absorbed by UF_6 gas at a pressure of 1 torr. It is seen that ^{109}Cd is the optimum source as it emits AgK X-rays whose energies 22 and 25 keV are just above the U1 absorption edges. It is seen that a change in UF_6 gas pressure of 1 torr in the largest diameter pipe (110mm i.d.) will reduce the transmitted intensity of AgK X-rays by approximately 1%, in addition approximately 0.1% of them will be transmitted through an aluminium pipe with walls 5mm thick. Table 2 gives the calculated and measured intensities of X and gamma-rays emitted by ^{109}Cd that are transmitted through pipes of different size, where it is seen that there is relatively good agreement between the two values. The advantage of using a thinner walled pipe should be noted, although at Capenhurst this advantage is accompanied by a lower sensitivity due to the smaller UF_6 path length across the pipe. A graph of the channel countrates obtained from X and gamma-rays emitted from ^{109}Cd that have been transmitted through an aluminium pipe with 5mm thick walls is given in Fig 2. It is seen that although the intensity of transmitted 88 keV gamma-rays is much higher than the AgK X-rays, it is still possible to separate them using low resolution detectors.

6. Results

6.1 With a multi-detector system

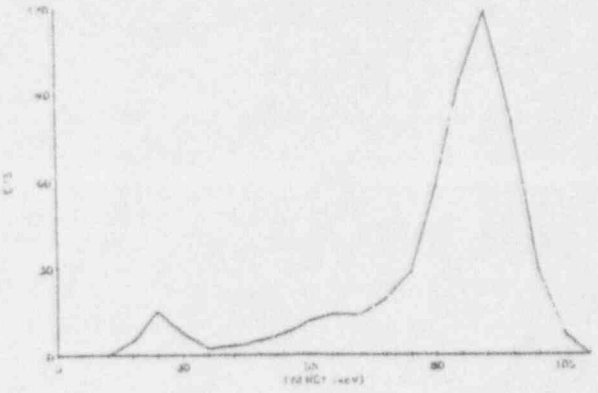
These measurements were made with three scintillation detectors, two fitted with 75mm diameter NaI(Tl) crystals detecting 185.72 keV gamma-rays, one being uncollimated the other fitted with a 30mm wide collimator. This allowed for the investigation of the "two geometry technique", which separates 185.72 keV gamma-rays emitted from ^{235}U in the UF_6 gas from those emitted from any deposited uranium. The third detector was fitted with a 50mm diameter NaI(Tl) crystal and detected transmitted AgK X-rays and 88 keV gamma-rays which were emitted from a ^{109}Cd source with an activity of 22MBq.

As there were no suitable sources of UF_6 gas available at Harwell, the gamma-ray spectrometers were approximately calibrated using samples of uranium that had been deposited onto filter papers. The transmission gauge was calibrated using aluminium filters.

The assembly was mounted on a header product pipe at Capenhurst and two hourly measurements made between September 1989 and January 1990/3/. The results obtained during two periods when the UF_6 gas was temporarily removed from the pipe are shown in Fig 3. It is seen that when the UF_6 gas was present, the net countrates obtained with the uncollimated and collimated detectors in the 185.72 keV gamma-ray channel were approximately 3.0 and 0.6c/s respectively. The errors due to counting statistics (95%c.l.) were approximately 0.1c/s for both detectors when using a 7200 second measurement time. Both countrates reduced to approximately zero when

Table 2 Comparison of the relative transmitted intensities of radiation emitted from ^{109}Cd.

Transmitted Radiation	Relative Transmitted Intensity Calculated		Measured	
	Aluminium Wall Thickness (mm)			
	4	5	4	5
22 keV X-rays	.08	.02	.11	.05
25 keV-X-rays	.08	.03		
88 keV-gamma-rays	1.1	1.0	1.1	1.0
88/22+25	7.0	20	10	20



AgK X-rays 22,25 keV, 88 keV gamma-rays

Fig 2 Transmission spectrum obtained when measuring aluminium pipes with 5mm thick walls

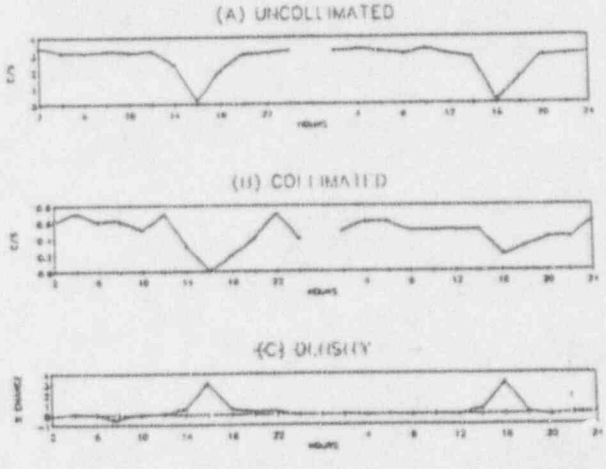


Fig 3 Results of plant measurements made with the multi-detector system during two periods when the UF_6 gas was temporarily removed

the UF_6 gas was temporarily removed from the pipe, showing that there was only a relatively small mass of uranium deposited on the pipes. At the same time that the UF_6 gas was removed from the pipe the density gauge reading increased by approximately 3% relative. However if the increase in the density reading, reduction in UF_6 gas pressure, had been accompanied by the gamma-ray countrate either being unaltered, or even increased, then an increase in the enrichment of the UF_6 gas would have been suspected and further investigation may have been needed to resolve the anomaly.

During this period of continuous measurement only three significant increases in the density readings occurred, indicating a reduction in UF_6 gas pressure. They were all accompanied by a large reduction(over 95%) in the gamma-ray count confirming the loss of UF_6 gas. There were no significant increases in the gamma-ray measurements during the same period so that it was possible to confirm that this centrifuge was only producing LEU gas during this period.

6.2. With a single detector system

The mass of uranium deposits on the pipes of the latest design of centrifuge have been shown to be comparatively small/3/. It was therefore decided that there was no necessity to make gamma-ray measurements with a collimated detector in order to separate gamma-rays that were emitted from the UF_6 gas from those emitted from the deposited uranium. Furthermore, if it was found to be possible to make the uncollimated gamma-ray and transmission measurement with the same detector, it would result in a considerable reduction in the capital cost of the system.

The original reason for not using a single detector was the possibility of 'double peaks' produced from the relatively high number of transmitted 88 keV gamma-rays from the ^{109}Cd source not being resolved from the 185.72 keV gamma-rays emitted from ^{235}U. The magnitude of this interference is shown in Fig 4, where the spectra obtained from a pipe,110 mm in diameter, containing 0.5mg/cm^2 of 3% enriched uranium, equivalent to a UF_6 gas pressure of approximately 13 torr, is shown when measured without a ^{109}Cd source. Also shown are the spectra obtained with two ^{109}Cd sources of different activity measured without uranium. As the pulse doubling effect is a function of the square of the 88 keV countrate the interference is much greater for the higher activity source (30MBq). The error introduced using the smaller source (10MBq), an acceptable activity for this application, is comparatively small (equivalent to the counts obtained from UF_6 gas at a pressure of approximately 2 torr of 3% enriched UF_6 gas). This error can be allowed for by subtracting a fraction of the number of detected 88 keV gamma-ray counts from the 185.72 keV reading. Sources of ^{109}Cd with activities of approximately 5MBq were installed in the two detector systems that were to be used on the

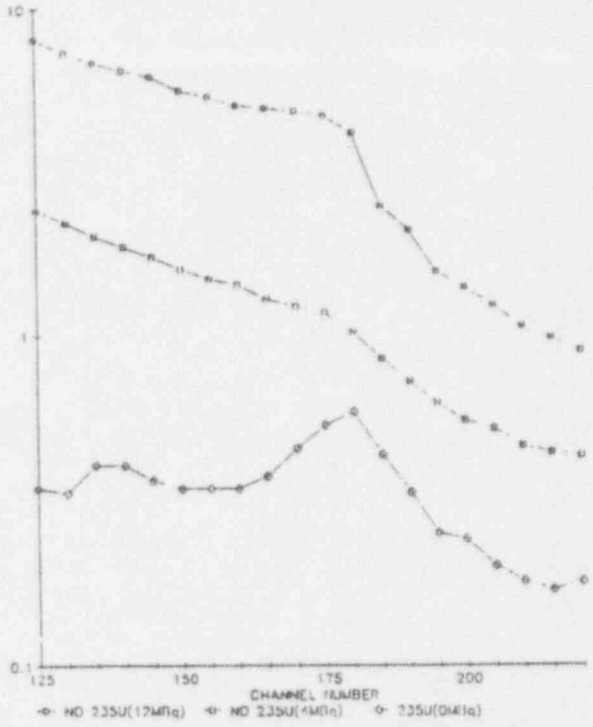


Fig 4 Interference in the ^{235}U 185.72 keV gamma-ray channels(163-192) due to 88 keV gamma-ray "double peaks" from ^{109}Cd sources with different activities

product and waste pipes and sources with activities of 10MBq in the feed and dump pipe systems.

Measurements were made on empty pipes at Harwell when the net countrates obtained in the 185.72 keV gamma-ray peaks were corrected by subtracting approximately 6 x 10^{-8} times the square of the 88 keV gamma-ray countrates. The results of two hourly measurements of corrected 185.72 keV gamma and relative AgK X-ray counts made in the laboratory over a period of 5 days for the 4 detectors are shown in Fig 5. The errors due to counting statistics (95% c.l.) were approximately 0.08 c/s for the 185.72 keV gamma-ray measurements

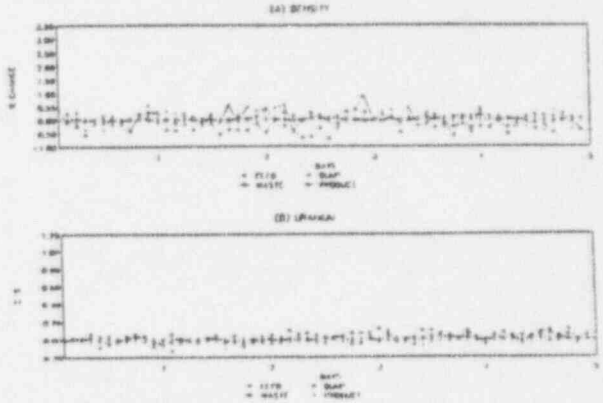


Fig 5 Results obtained in the laboratory when measuring empty pipes

and between 0.3 and 0.12 % relative for the AgK X-ray measurements depending on the activity of the ^{109}Cd source that was incorporated. It is seen that the percentage variations in the density readings are generally within ± 0.5%.

The equipment was then installed on header pipework at Capenhurst, two hourly measurements made and daily averages calculated. Corrections for dead time losses, the decay of the ^{109}Cd source and for unresolved 88 keV 'double peaks' on the gamma-ray measurement were made. A plot of variations in the transmission density and uranium gamma-ray measurements during two periods when the UF_6 gas was temporarily removed from the pipes is shown in Fig 6. It is seen that when the UF_6 gas was removed the transmission density gauge readings on the product, waste and dump pipes increased by approximately 3% relative. The corresponding increase in the smaller diameter, thinner walled, feed pipe was slightly smaller. There was a corresponding reduction in the gamma-ray reading on the product pipe of approximately 1c/s, one third of that obtained on the original gauge. This is due to the smaller diameter detectors used, 50mm in diameter instead of 75mm, in order to reduce the cost and also the weight of the lead shielding required. There were corresponding smaller reductions in the gamma-ray counts obtained with the other detectors, being consistent with that expected according to their pipe diameters, pressures and enrichments. The daily average readings of both density and

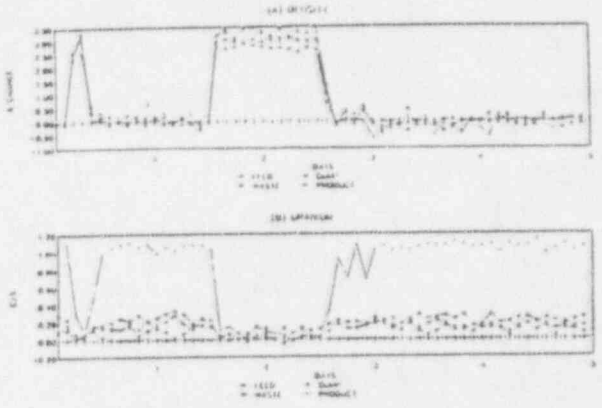


Fig 6 On-line two hourly results obtained during the time that the UF_6 gas was temporarily removed from the pipes. Periods identified by high transmitted counts (low density) and low ^{235}U counts

uranium over the period 6/12/90 to 10/3/91 for the product pipe are given in Fig 7. The periods when the UF_6 gas was temporarily removed from the pipe are clearly identified by increases in the transmitted countrates, indicating a reduction in UF_6 gas pressure and a reduction in the number of detected uranium gamma-rays. The times when the enrichment of the UF_6 gas in the product pipe was temporarily increased, and then decreased, by

Table 3 Print of time when UF_6 gas was temporarily removed from the pipes.

Run started at 9.40 6/12/90 Run time = 7200s

FEED			DUMP			WASTE			PRODUCT		
S	D	U	S	D	U	S	D	U	S	D	U
0.6	-0.08	-0.08	0.9	-0.33	0.06	0.8	-0.06	0.00	0.8	-0.08	-0.02
0.4	0.02	0.01	-0.4	-0.21	0.02	-1.6	-0.12	-0.00	1.5	-0.04	0.03
2.2	2.33	-0.15	1.5	2.34	-0.15	4.3	2.36	-0.09	1.5	2.30	-0.76
3.6	2.59	-0.12	1.4	2.99	-0.20	4.3	3.39	-0.05	1.2	3.14	-0.98
3.2	0.35	-0.00	1.3	0.32	-0.07	-0.8	0.40	0.00	1.3	-0.00	-0.58
1.0	0.10	-0.03	0.3	0.07	-0.05	-1.1	0.14	-0.08	0.2	-0.01	-0.09
2.7	0.03	-0.02	-0.9	-0.37	-0.02	-1.6	0.20	0.01	2.0	-0.04	-0.01
1.6	0.08	-0.04	1.2	-0.26	0.03	-2.2	-0.01	0.01	1.2	0.16	0.02
2.1	0.01	-0.01	1.2	-0.03	0.00	-1.3	-0.13	0.07	1.5	-0.24	0.04
2.4	0.07	-0.04	-0.1	-0.06	0.06	-1.9	0.16	-0.07	0.4	-0.08	-0.01
1.3	0.01	0.05	-0.5	-0.11	0.00	-2.2	-0.14	-0.01	2.0	0.00	0.02
1.8	0.13	0.01	0.1	-0.07	0.03	-2.4	-0.05	0.02	1.3	0.01	-0.08
Averages:											
1.9	0.47	-0.04	0.5	0.36	-0.02	-0.5	0.50	-0.02	1.2	0.43	-0.20

S, D and U are the differences between the measured and constant file values of standard, relative density (%) and ^{235}U respectively.

N.B. All daily average density readings are positive and all uranium readings are negative with respect to the constant file values observed during normal operation. This confirms that UF_6 gas had been removed during these measurements.
(The times that the gas was removed can be obtained from the individual two hourly values.)

20% relative without significant change in the UF_6 gas pressures, are also clearly visible.

There were small systematic variations in the density readings (up to 0.8%) during the 3 months of measurements, possibly due to instrumental drift or to small errors in the decay correction used for the ^{109}Cd source due to small impurities in the sources. Therefore an alternative method of correcting the density gauge measurements was used, namely by taking the ratio of detected AgK X-ray to 88 keV gamma-ray intensities. This automatically corrects for the decay of the ^{109}Cd source as well as for dead time losses. This method was found to give small systematic errors as can be seen in Fig 7. As there are no significant systematic errors on the ^{235}U determination, it appears that the correction used for correcting the 185.72 keV gamma-ray readings for 88 keV gamma-ray interference is adequate for this application.

6.3 Presentation of results

The results obtained are compared with previous values kept in an appropriate constants file. Variations from these values are at present saved as files on a two hourly and daily average basis and printed out as shown in Table 3. They can also be displayed across the screen of the PC. The chosen one of the four density or uranium readings is selected from the keyboard. Provided that an Inspector was confident that the equipment was working satisfactorily, (by checking the relative counts in the standard channels), he need only be concerned if the pressure of the UF_6 gas in the pipes decreased significantly, (by at least a factor of 2), while at the same time the uranium counts remained the same or increased. These rare occasions are probably the only time that the results need to be printed out from the data files. This approach will be more relevant if one PC and printer is used to measure continuously the four pipes on several cascades. Alternatively the files could be printed out on demand during routine inspections.

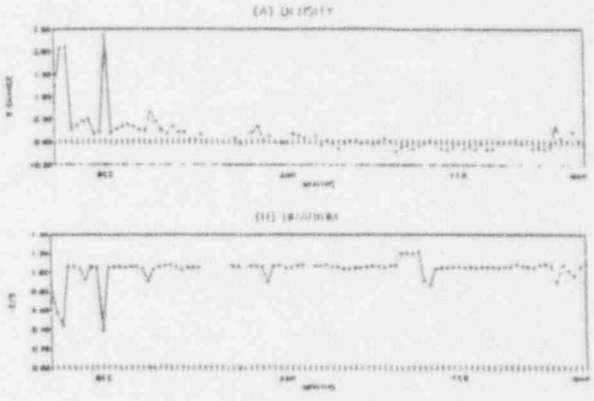


Fig 7 Daily average on-line results obtained from product pipe. Periods when UF_6 gas was removed for less than a day identified by high transmitted counts (low density) and low ^{235}U counts. Periods of 20% higher and 20% lower ^{235}U enrichments identified by corresponding changes in ^{235}U counts without significant change in the transmission density measurement

7. Conclusions

Continuous monitoring of at least one header pipe of a cascade at Capenhurst has been carried out in two periods between September 1989 and January 1990 and between December 1990 and March 1991. During these periods the UF_6 gas pressure measurement has been significantly reduced on less than 10 occasions. On each occasion the uranium countrate also reduced, almost to zero, confirming the Operators' records that the UF_6 gas had been temporarily removed.

If an inspector had access to these results, it would have been possible for him to have monitored this centrifuge, 24 hours a day, for the period of six months for which these measurements were made. Although the initial capital cost of this type of automated monitoring equipment is comparatively high, it is suggested that the cost would soon be recovered by the saving of Operator and Inspector time.

8. Acknowledgements

The author would like to record his thanks to M R Wormald of AEA Technology for providing and programming the detection equipment. Thanks are also given to K Connor and M Eastell of British Nuclear Fuels and G Preece of AEA Technology for their help in making the measurements and presenting the results.

Thanks are also given to the UK Department of Energy who funded this work through the UK Safeguards Programme.

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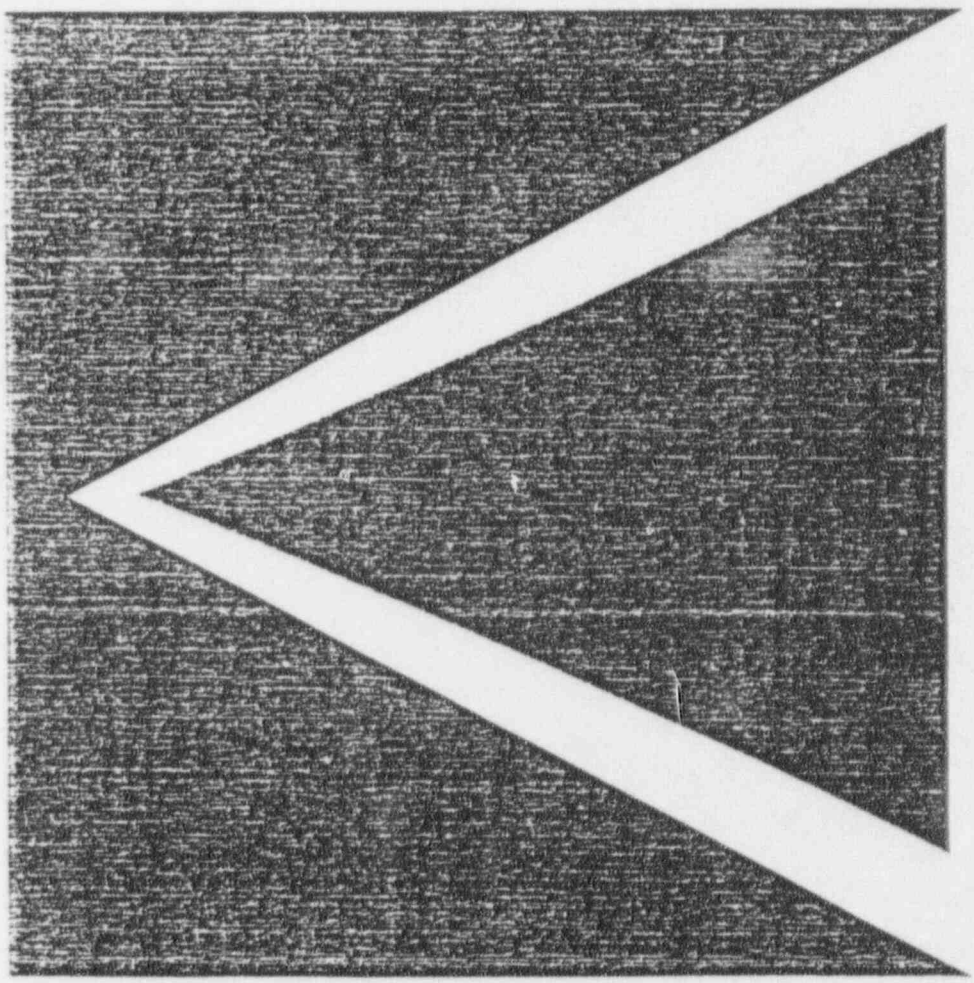

Attachment 16

EFFECTIVE GO/NO GO ENRICHMENT MEASUREMENTS

Helen M. Hunt
Consultant; Princeton, New Jersey, USA

1. Abstract

A simple plumbing bypass modification would eliminate excessive systematic error and improve precision for uranium hexafluoride gas enrichment measurements at centrifuge enrichment plants having small-diameter cascade pipes. Present gas enrichment measurements on typical small-diameter product pipes are indeterminate, because overwhelming systematic errors and large statistical errors result from the high deposit-to-gas ratios. The bypass would essentially eliminate the deposit from measurements. The intended purpose of go/no go measurements is to confirm that the enrichment of randomly selected product streams is ≤20%. The Hexapartite Safeguards Project participants agreed by consensus in 1983 on the importance of go/no go measurements.

2. Introduction

Large-scale commercial enrichment of uranium by gas centrifuge technology, which is commercially highly sensitive, began and dramatically expanded in several European countries during the 1970's. For proprietary reasons, technology holders had strong objections to permitting access of IAEA (International Atomic Energy Agency) inspectors into production areas, called "cascade halls". This resistance constituted a serious problem in safeguarding large-scale gas centrifuge enrichment plants; indeed, for large-capacity plants measurement uncertainties implied that materials accountancy procedures alone were not adequate to provide assurance that significant quantities of highly enriched uranium (HEU) were not being produced.

Consequently, international safeguards inspectorates (the IAEA and EURATOM) and technology holders (Australia, Japan, the U.S.A., and Troika - comprising the F.R.G., the Netherlands, and the U.K.) engaged in the Hexapartite Safeguards Project from 1980-83, which consisted of joint discussions for the purpose of reaching consensus on effective and efficient means for safeguarding commercial gas centrifuge enrichment plants. Principal conclusions of the Hexapartite Project and follow-up discussions, reached by consensus, were that: (1) In cascade areas there should be limited frequency unannounced inspections (LFUA inspections), of short duration, and (2) Inspectors should have the right to perform so-called "go/no go" measurements - defined as fairly quick non-destructive assay measurements on cascade-to-header product connection pipes, capable of discriminating between low enriched and highly enriched uranium hexafluoride gas in the pipes.

There was Hexapartite Project consensus that in order to verify absence of production of HEU it could be necessary to perform go/no go measurements. Hexapartite Project participants recognized various possible means of producing HEU that would probably not be detected through LFUA visual inspections. For example, cascade flows could be adjusted to yield higher enrichment than declared, batches could be recycled through a unit cascade to yield progressively higher enrichment, or a cascade that includes increased separative capacity added after the initial verification inspections could be dedicated to HEU production. Since the inspectors must allow the operator up to two hours before gaining access to a cascade hall, visual evidence such as portable feed and withdrawal stations could be confidently removed from a cascade area before entry of inspectors. Consideration of such weaknesses led to Hexapartite Project

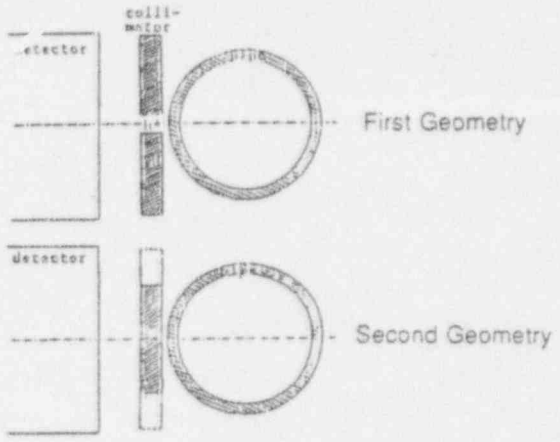

Figure 1. In the two-geometry technique, two collimators having different relative efficiencies for detecting U-235 in the gas vs in the deposit are used separately for obtaining two distinct measurements on cascade-to-header product pipes. (Source: reference 2.)

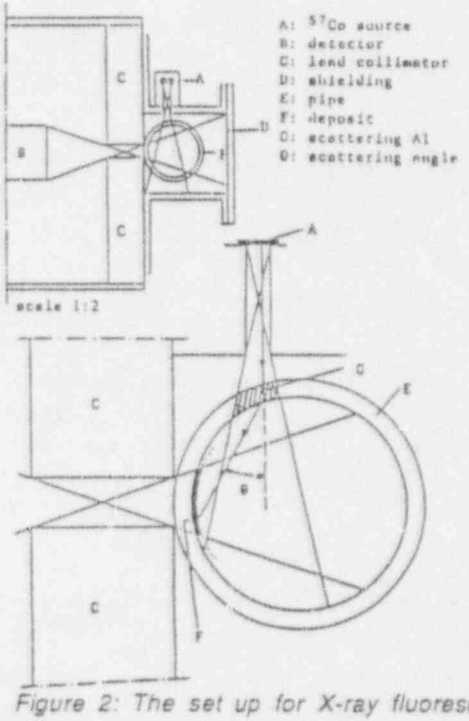

Figure 2: The set up for X-ray fluorescence measurements to determine the total uranium in the gas. The bottom diagram illustrates the possibility of detection of uranium K X-rays emitted from the deposit following stimulation by Compton scattered photons of high enough energy. (Source: reference 7.)

scattered Co-57 photons contribute to the count). In principle the measurement is proportional to the total uranium in the gas. The X-ray fluorescence measurement set-up is illustrated in Figure 2.

The Impact of Deposits on Measurement Errors

High U-235 deposit-to-gas ratios magnify the distortion effect on calculated gas enrichment of any error in the ratio of collimator deposit efficiencies. Indeed, the error magnification is proportional to the deposit, as shown in equation (A3) in the appendix. In practice, at the URENCO facility in the Netherlands, with actual gas enrichment of about 4% U-235, even careful selection and positioning of collimators for application of the two-geometry method has resulted in relative errors of ±200-300% in calculated gas enrichment, for pipes having high uranium deposit-to-gas ratio /8/. This corresponds to an error in calculated gas enrichment of about ±8-12% U-235. With the same deposit, if the uranium gas were highly enriched rather low enriched, the systematic error in calculated gas enrichment would likewise be at least ± 8-12% U-235, (as indicated in the appendix). The presence of systematic errors that are typically of roughly this magnitude obviously renders discrimination between ≤5% and 20% enriched uranium hexafluoride gas extremely unreliable.

For situations where the expected magnitude of relative systematic error is less than about 100%, further analysis is required. The calculated gas enrichment can be expressed in the form

$$\text{Calc Gas Enr} = c_1 R_1 - c_2 R_2 \qquad (1)$$

where R_1 and R_2 are the measured 185.7 keV count rates for the two geometries and the coefficients c_1 and c_2 are constants obtained by dividing formula (A2) in the appendix by an overall coefficient for total uranium determination with the X-ray fluorescence measurement. As shown in formula (A2), the coefficients are derived from estimated collimator efficiencies and efficiency ratios. Estimated efficiencies rather than true efficiencies are utilized for go/no go measurements, because true efficiencies are not independently known by the IAEA, and

having no or very little uranium deposit. Between measurements, the gas would flow through the normal pipe. If necessary, bypass pipes could be ocassionally removed to be stripped of deposit, to assure that they remain low-deposit pipes.

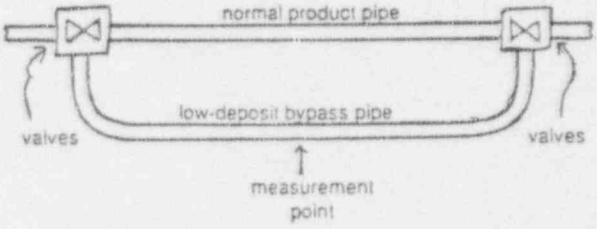

Figure 3. Schematic view of proposed bypass plumbing modification for cascade-to-header product pipes; this modification would greatly reduce calibration and statistical errors, because the bypass pipe would include very little uranium deposit.

It is logical to consider whether a bypass modification for one cascade-to-header product pipe could be used to obtain accurate calibrations for all identical cascade-to-header pipes. This problem is described in the appendix. An essential issue is that the literature indicates substantial uncertainty on the question of whether correct calibration for actual cascade-to-header product pipes is substantially independent of possible nonuniformities in actual uranium deposit. Very limited experiments have produced conflicting indications /14/. Many measurements on actual cascade pipes would be needed to investigate the issue of whether initially "identical" pipes are really identical for calibration purposes. Further, it would be necessary to demonstrate that the declared collimator gas efficiencies ratio is quite accurate--to within 3%. This might pose a problem, because in the past discrepancies of 7% and 14% were found between gas efficiencies at Almelo and at the IAEA Seibersdorf Test Loop /15/. In addition, in order to calibrate normal pipes "identical" to the bypass pipe, it would be necessary for the length of the measurements to be very long, in order to reduce statistical errors to very low levels. A relevant question is this: To what extent would the IAEA observe these verifications and calibrations?

As outlined earlier, without bypass constructions, even if systematic errors in the U-235 measurements were practically eliminated, a large proportion of measurements would take so long (more than six or eight hours) that the capability of such measurements to detect rapidly disappearing evidence of HEU production would be dubious. There is now no assurance that even diligent larger-scale research would result in near elimination of systematic U-235 measurement errors, even with the use of several bypass constructions for calibrations. Moreover, the requisite research (having uncertain results) would take a long time, perhaps years.

Effective go/no go enrichment measurements are rendered especially vital by the protection pipe deposits would afford in concealing production of HEU. Indeed, if a plant operator starts HEU production in a cascade with pipes that already have a moderately heavy deposit of low enriched uranium, the rate of increase of U-235 in the deposit is slow, because the rate of new deposition is very slow (roughly a few per cent per year) /16/. Eventually when the deposit contains enough U-235 that inspection measurements might reveal the enrichment of the deposit to be suspiciously high, the operator can move his HEU production from that cascade to another cascade having lower deposit enrichment, and he can clean out the pipes of the previous HEU cascade. Thus, in the absence of definitive gas enrichment measurements on randomly selected cascade-to-header product pipes, pipe deposits would serve to prevent detection of HEU production.

5. Conclusion

This paper identifies a practical and highly effective solution to the lingering important problem of excessive errors and consequent indeterminate results in enrichment measurements on high-deposit small-diameter cascade-to-header product pipes in gas centrifuge enrichment plants. The proposed solution involves a simple bypass plumbing construction for every cascade-to-header product pipe. This method would promote the most effective and efficient international inspections, because it would minimize the magnitude of errors and the number of necessary measurements. Moreover, because

G_a = calculated U-235 gas activity assuming error in ratio of collimator deposit efficiencies but no other errors in calibration or measurement

G = actual U-235 gas activity

D = actual U-235 deposit activity

a = relative error in ratio of collimator deposit efficiencies

k, c are constants for a particular cascade pipe (or category of identical pipes) and pair of collimators. These constants depend on actual collimator efficiencies, or efficiency ratios. For example, for some pipes at the URENCO plant in the Netherlands, k=-1.6 and c=1.3, as calculated from reference 2, tables 2 & 3.

When error in the estimated collimator deposit efficiencies is large, it would typically cause most of the systematic error in calculated gas enrichment. In such cases equation (A3) implies that the systematic error in calculated gas enrichment, as percent U-235, is approximately directly proportional to the amount of U-235 deposit. Equivalently, the relative error in calculated gas enrichment is directly proportional to the deposit-to-gas ratio. (In reality, the uranium deposit builds up very slowly.) As a realistic example, suppose that the U-235 deposit-to-gas ratio D/G were 10 if the actual gas enrichment were 4%, that a= ±15% and represents the only measurement error, that k=-1.6 and c=1.3; then for a fixed U-235 deposit, the error in calculated gas enrichment would be ±8-12% U-235, independent of the actual gas enrichment.

If it were demonstrated that in practice inaccuracies in estimated collimator gas efficiencies are indeed nearly always small enough so as not to cause substantial errors in calculated gas enrichment, then whenever the gas enrichment is known for a pipe of high or moderately high U-235 deposit-to-gas ratio, equations (A1) could be used for calibration. Specifically, if the estimated gas efficiencies e_{1g} and e_{2g} are known to be reasonably accurate, then knowledge of G would yield a reasonably accurate value for the calibration coefficient e_{1d}/e_{2d}, the ratio of deposit efficiencies. Indeed,

$$\frac{e_{1d}}{e_{2d}} \approx \frac{R_1 - e_{1g}G}{R_2 - e_{2g}G} \qquad \text{(A4)}$$

where we assume that, by means of very long measurement times, the count rates R_1 and R_2 do not include significant statistical errors.

Let us estimate the magnitude of the relative error in (A4), assuming first that there are no errors in either R_1 or R_2. Let Δ_e be the relative error in e_{1g}/e_{2g} and let Δ_G be the relative error in G. Assume both errors are fairly small, so that we can omit their product in estimating the error in (A4). Then the magnitude of the relative error in (A4) lies approximately between the magnitudes of the two values of $(\Delta_e + \Delta_G)(e_{ig}G)/(R_i - e_{ig}G)$ for i=1,2. We have $e_{1g}/e_{1d} = 1.5$ and $e_{2g}/e_{2d} = .82$ for some high-deposit pipes at Almelo /17/. In this case, substituting $R_i = e_{id}D + e_{ig}G$, we find that the magnitude of the relative error in (A4) is very roughly the absolute value of $1.1(\Delta_e+\Delta_G)(G/D)$. For example, if $\Delta_e = \Delta_G = .03$, errors in (A4) are small: for a U-235 deposit-to-gas ratio D/G of 10, the relative error magnitude is only about .007, while for D/G = 5 the relative error magnitude is still only about .013.

But in reality, especially for small-diameter pipes, there could be significant systematic errors in the count rates if the measurement equipment is positioned just slightly differently for the calibration determination than for actual go/no go measurements. The resulting relative error in (A4) would be greater than the sum of the magnitudes of the relative errors in R_1 and R_2 if the two count rate errors have opposite signs. For example, if the relative errors in R_1 and R_2 are .01 and -.01, the corresponding error in (A4) would have magnitude more than .02. When combined with a relative error magnitude of .01 attributable to deviations in the calibration inputs e_{1g}, e_{2g}, and in G, the magnitude of the resulting relative error in (A4) could be more than .03.

size at measurement points to a degree that will permit adequate enrichment monitoring.

M. Monitoring of Sampling Ports, Process Valves, and Flanges

In order to preclude or detect production of HEU by a batch recycling scheme involving misuse of sampling ports, process valves, and/or flanges, the applicant's FNMC plan should require effective monitoring by reliable technical means which accurately keep track of employee access to these process connection locations.

BASIS: Compliance with proposed 10 C.F.R. § 74.33(c)(5)(i) requires effective monitoring of all product streams. Production of HEU by a batch recycling scheme involving introduction of feed and withdrawal of product through sampling and process valve ports is a credible scenario in a gas centrifuge enrichment plant. Misuse of other process valves (not having ports) could be a component of such a scenario. Onsite production of HEU could be carried out discretely by as few as one or two production employees. For this reason, NRC Draft Regulatory Guide DG-5002, § 12.2, "Monitoring Program for Clandestine Enrichment Scenarios," requires the applicant's FNMC plan to address, inter alia, "Sampling ports and frequency of sampling to be used for monitoring of product streams," and "The use of tamper-indicating seals on process valves and flanges." Use of seals has been only partly reliable, however, because it has been possible for plant production personnel to remove seals from valve ports -- in order

to perform process monitoring -- without promptly replacing seals in a verifiable manner.

Monitoring of such HEU production by human surveillance would not be reliable. It would be difficult to detect and assure the reporting of small feed and withdrawal containers that would serve as "possible indicators of unauthorized production." DG-5002, § 11.3. Hidden in the forest of tens of thousands of centrifuges, they might not be seen by an individual who walks the halls. Moreover, individuals walking huge deserted cascade halls, listening and looking for signs of criminal production activity, could be in great personal danger if such activity were discovered. Fearing bodily harm to themselves or loved ones, cascade hall security guards would be strongly motivated not to report such anomalies. Online enrichment monitoring to defeat such a scenario would not be practical, because of the very great number of detectors that would have to be employed.

This scenario could be defeated, however, by the use of reliable tamper-proofed monitoring devices for sampling ports, process valves, and flanges. Reliable valve monitors, which could be used for these process connection locations, are under development at Sandia National Laboratories and should be available in 1992-93.[50] With a complete set of tamperproofed monitors for process connection locations, utilized with authenticated transmission of data to a central computer, it would be a simple

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50 Telephone communication: Cecil Sonnier, Sandia National Laboratories, to Helen M. Hunt, July, 1991.

matter to reliably keep track of times for employee access to process connection locations, and to compare cumulative access times with data in the applicant's FNMC plan.[51]

N. Centrifuge Cell Walls

In order to assure that safeguards can be implemented effectively, opaque walls around small cells of centrifuges should be expressly prohibited during CEC's entire license term.

BASIS: In a recent technical safeguards paper, several Japanese safeguards experts expressed concern that for economic reasons, future cascade designs will incorporate a cell type arrangement of centrifuges, pursuant to which each cell, containing a number of centrifuges, would be surrounded by an opaque wall.[52] Opaque walls would severely reduce the visibility of centrifuges, thus providing a means to conceal an unauthorized reconnection of centrifuges.[53] Specifically, centrifuges ini-

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51 Id.

52 Hideo Nishimua & Tsuyoshi Okamoto, "Effectiveness of Safeguards in a Centrifuge Enrichment Plant," 1990 Institute of Nuclear Materials Management Proceedings, at 522. Attachment 17.

53 Id. As noted by Nishimura and Okamoto,

> . . . for economic reasons the plant designer [of future gas centrifuge enrichment plants] is expected to apply a cell type arrangement to the construction of a cascade, in which one cell contains a number of centrifuges. In this case, a cell seems to be a black box into which an inspector cannot make access. A built-in arrangement might be technically possible, by which the piping can be switched from the normal arrangement to the other without being detected.

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tially connected entirely in parallel (as part of a stage) could be reconnected to incorporate series connections. The new unauthorized arrangement would include several enrichment stages.

If such a cell were functionally isolated by closing certain valves, without detection, it could be used as a clandestine dedicated HEU cascade. If the cell contained many dozens of centrifuges, it could incorporate sufficiently many enrichment stages (15 to 25) to produce 90% enriched uranium without batch recycling. Even with only a few dozen centrifuges, by batch recycling the cell could produce a bomb quantity of 90% HEU within a year. Indeed, the capacity of each URENCO TC12 centrifuge is about 40 kg SWU/year.[54] The total capacity of a cell containing three dozen TC12 centrifuges would be about 1,500 kg SWU/year. If low enriched (3%) feed were used, only 40-100 kg SWU/year (depending on process details) would be needed to produce a kilogram of 90% HEU. Thus, such a dedicated cell could clandestinely produce 15-35 kg of 90% HEU per year.

This scenario should be precluded by requiring that centrifuge cell walls, including supplemental and replacement walls installed during the life of the CEC, be transparent.

O. Design for effective IAEA inspections

Pursuant to the Hexapartite Agreement, the NRC should require that plant hardware design in every CEC cascade be con-

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54 According to Table 4.3-2 of the CEC SAR, total capacity of the LES plant would be about 1.5-1.7 million kg SWU/year, and the plant would contain 40,000 centrifuges; thus, the capacity of each centrifuge would be about 40 kg SWU/year.

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EFFECTIVENESS OF SAFEGUARDS IN A CENTRIFUGE ENRICHMENT PLANT

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ABSTRACT

The HEXAPARTITE project concluded that a limited frequency unannounced access (LFUA) inspection should be carried out as a basic safeguards approach in a centrifuge type enrichment plant already in existence, under construction, or firmly planned at that time. Application of this approach to a large scale, future commercial enrichment plant, however, should be fully investigated because the plant will have a larger capability of enriching uranium 235 and have more sensitive information from the commercial and non-proliferation viewpoints. A methodology for safeguards design and evaluation was developed. According to this methodology, firstly a mathematical model for the enriching process was established and computerized on the basis of published documents. Using this centrifuge cascade simulation codes, operations not related to the HEU production were analyzed to avoid false alarms, and theoretically possible scenarios for producing uranium with a higher enrichment were analyzed using a model centrifuge enrichment plant. Then the major anomalies were indicated and the LFUA approach was examined for the plant.

1. INTRODUCTION

A centrifuge enrichment plant consists of a UF_6 handling area and a cascade area. The former area includes a UF_6 gas feed station and the recovery equipment for product and tail UF_6 gases. $^{235}UF_6$ is enriched in a cascade of centrifuges at the latter area. Such centrifuge technology is one of the major technologies used to produce enriched uranium. If so intended, it could even produce highly enriched uranium (HEU). It is also an advanced technology which should be protected against any misuse or proliferation because it includes sensitive information and commercial know-how. It is considered, therefore, that the cascade area is an especially important area from the viewpoint of safeguards.

It is not easy to establish an effective and efficient safeguards system for an enrichment plant that uses such advanced technology. The HEXAPARTITE project [1] tackled this problem and concluded that a limited frequency unannounced access (LFUA) inspection should be carried out as a basic safeguards approach in a centrifuge type enrichment plant already in existence, under construction, or firmly planned at that time. This LFUA approach might be used for a large scale, future commercial enrichment plant. Application of the LFUA approach to such a plant, however, should be fully investigated because the plant will have a larger capability of enriching uranium 235 and have more sensitive information from the commercial and non-proliferation viewpoints.

In order to investigate a safeguards approach for a commercial enrichment plant, the authors have developed a methodology for safeguards design and evaluation. The first step to be carried out in this methodology is to have a mathematical model, which can accurately simulate a dynamic behavior of the enriching process of a centrifuge cascade, without disclosing sensitive information. For this purpose the authors developed such a mathematical model and the corresponding computer codes [2] on the basis of published documents [3, 4, 5] and, using this centrifuge cascade simulation codes, carried out some demonstration analyses with regard to normal operations of the plant. [6]

The second step in the methodology is to devise measures to avoid false alarms beforehand in designing a safeguards approach. In this context, the methodology proposes to analyze normal operations including a transient one, as well as accidental operations such as a misoperation to a valve and a malfunction of a centrifuge, other than the intentional operations for HEU production, in details enough to differentiate false indications from true anomalies. Then, the final step is to design a reliable, effective and efficient safeguards approach which could detect the true anomalies without false decisions.

In this paper, the methodology for safeguards design and evaluation, which has been outlined above, is applied to a model centrifuge plant. Only HEU production scenarios and the related normal or accidental operations are taken up. Therefore the cascade area is a main concern. Firstly, analyses are carried out over the operations not related to the HEU production and, secondly, theoretically possible scenarios for producing uranium with an enrichment higher than the declared one are analyzed and the major anomalies are indicated. Then the LFUA approach is examined for the plant.

2. MODEL PLANT

As a model centrifuge enrichment plant, a commercial type plant with the capacity of 800 tonSWU/y was designed in accordance with a procedure presented in the report [2]. Characteristics of the plant are as follows:

- Design characteristics of a UF_6 gas centrifuge

Attachment 17

Separative power : 7 kgSWU/y
Separation factor : 1.27
Holding time : 73 sec
Throughput : 0.98 tonU/y

- Characteristics of a unit cascade
  Separative work : 20 tonSWU/y
  Enrichment for feed : 0.711 %
  for product : 3.345 %
  for tail : 0.219 %
  Flow rate for feed : 26.19 tonU/y
  for product : 4.13 tonU/y
  for tail : 22.06 tonU/y
  Number of stages for enriching section : 13
  for stripping section : 9
- Operation unit and total separative work
  One operation unit : five unit cascades
  = 100 tonSWU/y
  The plant : eight operation units
  (40 unit cascades) = 800 tonSWU/y

The total number of centrifuges in a unit cascade is 2865 and the number of centrifuges for each stage is illustrated proportionally in a block size in Fig. 1.

3. PROCESS SIMULATION

A mathematical model and the corresponding computer simulation codes were developed as a tool to analyze a plant operation not related to HEU production as well as an HEU production scenario in a model centrifuge enrichment plant. [2] This simulation method makes it possible to simulate a transient operation of the cascade by solving time-dependent equations with regard to flow rate and concentration. A change of product enrichment is precisely calculated taking into account a change of feed flow rate at each enriching and stripping stage of cascade. By assuming side-streams both at enriched and depleted flow paths, the method also makes it possible to simulate a restructured cascade with a recycle flow between stages or with a connecting pipe between cascade headers. Because of this capability, it becomes possible to analyze various scenarios of producing HEU.

Two computer codes were developed: CCS-I and CCS-II codes. The CCS-I code is a generalized computer program to simulate a dynamic behavior of a cascade which is under the normal operation or is engaged in the HEU production. On the contrary, the CCS-II code is used for the analysis of a restructured, hierarchical cascade. Both computer codes solve the same difference equations. The equations, however, are based on a theory which can be applied to the isotope separation of binary gas mixtures. Therefore, there is a limitation because of the existence of uranium 234 if it is intended to accurately simulate the cascade that produces HEU with a very high enrichment.

4. OPERATIONS NOT RELATED TO HEU PRODUCTION

4.1 False Alarm Possibilities

In the LFUA approach, a product enrichment is measured at a header pipe to detect an anomaly which would indicate an HEU production. The problem is whether or not the enrichment becomes higher due to some innocent causes and as a result it is recognized as the anomaly. The following situations should be investigated:

a. Deviations from the normal operation which include transient operations such as a start-up, a shut-down and a change of material with one enrichment to another and operations in which the product flow is recycled due to some safety reasons;
b. Misoperations due to human errors which include an operation with a reduced or increased feed flow rate; and
c. Malfunctions of equipment, instruments, devices or systems including a mechanical failure of centrifuges and a power supply failure.

These operations are discussed below.

4.2 Start-up Operation

Fig. 2 shows the changes of the enrichment at a product header pipe and the average enrichment, which is the enrichment of the product recovered at the cold trap, as well as the accumulated amount of product, at a start-up operation where the feed flow rate is linearly increased until reaching the designed flow rate at 120 minutes after the feed starts. The product enrichment reaches its maximum value at 150 minutes after the start-up and gradually decreases to the designed one, while the product with higher enrichment is homogenized at the product cold trap.

This fact shows that if an enrichment monitor for safeguards purposes is designed only to detect an enrichment higher than the declared one at a header pipe, it may produce a false alarm.

4.3 Recycled Flow

Due to the failure of centrifuges in a unit cascade or other safety reasons, the product flow might be recycled to their feed stage depending on the design. Fig. 3 shows, for this case, an increase in the enrichment at the product header pipe with the ultimate enrichment being 2.4 times as much as that of the normal operation. One major characteristic in this case is that no enriched uranium is produced from the process except when the cascades are returned to the normal operation. This case, however, would be very rare even if it could happen.

4.4 A Change of Feed Flow Rate

Due to misoperations or some other reasons, feed flow rate might be changed, i.e. increased or decreased. If the feed flow rate is increased, then the product enrichment is decreased and the amount of product is enlarged. On the contrary, if the feed flow rate is decreased, the enrichment is increased and the amount is reduced. The maximum enrichment the product reaches is about 4%. The characteristic of this operation is that the situation is returned to the normal one sooner or later because the process indicator installed shows an abnormal flow rate which results in an action of the operator for remedies of the process.

4.5 Other Operations

Feed material may be changed from natural uranium to the uranium recovered from spent fuel. If the feed flow rate is not changed the product enrichment gradually increases until reaching a new equilibrium.

Other operations to be considered are shut-down operation, centrifuge failure and power failure. These operations do not show any increase of the product enrichment.

5. OPERATIONS RELATED TO HEU PRODUCTION

5.1 Technical Means for HEU Production

The followings are the well-recognized technical means for the production of enriched uranium with an enrichment higher than the declared one when the facility equipment declared as only for a peaceful purpose is used:

(1) To change the piping arrangement within/between cascades including the construction of a hierarchical cascade or a cascade with more stages and the setting up of a reflux path for recycling the gas flow.
(2) To refeed the product to the cascade.
(3) To manipulate the feed flow rate, i.e. decrease it or make it pulsate, and
(4) To change the parameters affecting the separative work, such as the cut and the rotating speed of a centrifuge, including the replacement of the centrifuge by an advanced one.

These technical means are discussed in the following subsections.

5.2 Changes of the Piping Arrangement

A typical means to produce HEU by changing the piping arrangement is to construct a hierarchical cascade by connecting a product header line of a group of unit cascades with a feeding line of another group of unit cascades. By doing so, the product from the lower group of cascades is further enriched in the upper group of cascades. An example is a hierarchical cascade which consists of seven operational units for the lower group of cascades and one operational unit for the upper group of cascades. In a start-up operation of this cascade, the average product enrichment reaches a value far larger than 20% at its peak and the significant amount of HEU, i.e. 25 kg-U235 contained in HEU with more than 20% enrichment, could be accumulated in about 50 hours after the start-up.

It is technically possible to construct a new cascade that can produce HEU as a product by completely changing the piping arrangement. The time required to accumulate the significant amount of HEU becomes shorter than in the case of the hierarchical cascade. Technical difficulties accompanied with this technical means, however, would be much greater.

If a part of a product flow from a stage is recycled to a lower stage through a side line, the product enrichment at the top stage becomes higher. A special case in which all of the product flow f the top stage is led to the feed stage has been discussed in the section 4.3 and the result is that the product enrichment may reach 2.4 times as large as the designed enrichment at its maximum. If the recycle line is closed and the product line is opened to recovery process, a product with higher enrichment is obtained. The product enrichment, however, will soon decrease because the process returns to the normal operation. Therefore the procedure must be repeated again if a product with the same level of enrichment is to be produced.

Major characteristic of the three technical means mentioned above is that the changes of piping arrangement would need tremendous efforts in completely removing UF_6 gas from the process, shutting down the centrifuges, reversing the pressure to normal, dismantling the piping system and replacing it by a new one, vacuuming the process, starting up the centrifuges and feeding the gas to the system. If the piping arrangement is returned back to the normal arrangement in order to avoid the detection of such changes, the same procedure should be repeated again. All of these events are recognized as anomalies. Another characteristic is that if the extent to which the piping arrangement is changed is limited to a small area, it needs much time to produce the significant amount of HEU although the efforts are reduced.

5.3 Refeeding the Product

It would be the easiest scenario to use the product as a feed to obtain much higher enrichment. If the flow rate is fixed to the designed one, the enrichment obtained as a product gradually increases after a feed of low enriched product starts and reaches about 15% at the second cycle and becomes far greater than 20% at the third cycle. Major anomaly is uranium with a higher enrichment in the header pipes for feed and product.

5.4 Reduced Feed Flow and a Periodic Cycled Operation

As discussed in the section 4.4, reduced feed flow produces a higher enrichment but it is slightly higher than the designed enrichment.

As discussed in the section 4.2, the start-up operation produces uranium with an enrichment higher than the declared one as a transient phenomenon. One of the potential technical means to produce HEU is to use this fact more systematically, i.e. to change the feed flow rate periodically. An example is that the feed flow rate is linearly increased from zero to the designed flow rate, then linearly decreased to zero and is kept to zero for some time and the whole scheme is repeated. It is shown that the average enrichment becomes the highest in the first cycle, gradually decreases in the following cycles approaching to the designed enrichment. This means that when the feeding cycle is repeated the feed flow rate becomes larger than the withdrawal flow rate (product plus tail) resulting in the gradual increase of the total inlet flow rate over the cascade and consequently reducing the average enrichment of the product. It is said that the

characteristics of this scen. ɔ heavily depend on the feed flow rate pattern and the number of feed cycles. There may be an optimal combination of these two parameters.

5.5 Changes of the Cut and the Rotating Speed of a Centrifuge

One of the methods to change the separative power is to change the cut of the centrifuges from the designed one to another at all stages or at a part of them. Fig. 4 gives a result of the analysis with regard to the effect of a change of the cut on the product enrichment. In general, the product enrichment becomes higher if a value of the cut decreases. This tendency is specifically intensified if the cut is changed only at the enriching section. Since the amount of product decreases in accordance with the decrease of a value of the cut, it is natural to consider that there is an optimal point from the viewpoint of a diverter. There is, however, a technical difficulty in setting up the cut at a proper value. On top of that, HEU could not be produced only by manipulating the cut because the productivity becomes low if a higher enrichment is attempted to obtain. A specific anomaly is a big change in the inlet flow at a cascade stage even if the feed flow rate to the cascade is not altered.

If the rotating speed of a centrifuge is increased, the product enrichment is enhanced, but the safety would be greatly deteriorated. A specific anomaly is an increase in the electric power consumption. If the current centrifuge is replaced by an advanced one, higher enrichment is obtained as a product. Efforts needed for the replacement, however, might be at the same level as that of the changes of piping arrangement.

5.6 A Combined Scenario

If more than one technical means are simultaneously applied for the production of HEU, the time to be required for the accumulation of the significant amount of HEU may be reduced. An example is a scenario combining the refeeding of product with the pulsation of feed flow rate. In this case it is sufficient to refeed the product only once to obtain more than 20% enrichment.

6. SAFEGUARDS APPROACH

If activities aimed at producing HEU would take place, they create anomalies depending on the scenario adopted, for example: the feed flow rate is changed; the total inlet flow rate which is the sum of feed flow rates at all stages is changed; the enrichment of product or both of product and feed are changed; the size and weight of a feed cylinder is not the same as a usual one; radiation background in the cascade area is increased; radiation background outside the cascade area is intensified; additional equipment is installed for a feed of low enriched uranium (LEU) and recoveries of HEU and/or the tail with rather a high enrichment; there exist abnormal arrangements of piping between centrifuges/headers of cascades and abnormal sounds in the cascade hall; separative work is increased; the electric power consumed is increased; and the total working rs are substantially increased.

Places of anomalies and/or places for their detection are as follows: headers of feed, product and/or tail; piping between cascades; the cascade hall; an inlet flow path at an arbitrary stage of a cascade; the autoclave station at the feed line; sampling lines at the process; UF_6 handling facility; feed/product storage area; control room; and operational record and accounting record and report.

Taking into account the detection measures against each anomaly generated by each of the HEU production scenarios, a potential safeguards approach can be established. The LFUA approach was agreed as an effective and efficient safeguards approach in the HEXAPARTITE project. This approach could be a favorable one for a future commercial enrichment plant because it can detect an HEU production by a non-destructive assay (NDA) at the product header pipe if the HEU production is attempted without any changes of the piping arrangement and because it can detect changes of the piping arrangement by visiting the cascade hall if such changes are attempted. A few points to be considered are as follows:

As discussed in the section 4, some anomalies may be generated by a normal, transient operation or a misoperation. Uranium with an enrichment higher than the designed one may be produced as a result of such operations. This fact should be taken into account if the product enrichment is continuously monitored using NDA at the product header pipe, and the anomaly should be carefully analyzed so as to distinguish a false anomaly from a true one caused by an intentional activity for HEU production. On the other hand, if the approach only permits the enrichment measurements at a time when an inspector visits the plant, the inspector could avoid a period of transient operation for his NDA measurements. In this case, however, the timing of the plant visits by inspectors would be a crucial parameter.

Frequencies and timing of the visits by inspectors depend on the time required for the accumulation of the significant amount of HEU and for the preparation for and concealment of this accumulation. The theoretical approach discussed in this paper can predict the time for the accumulation, but it is difficult to estimate the time for preparation and concealment. Applying some C/S devices or radiation monitors would be a possible solution to avoid frequent visits from inspectors.

7. DISCUSSION

In order to avoid the disclosure of sensitive information, rather a cautious approach has been adopted in this paper. Further discussions on this approach are as follows:

(a) A mathematical model to describe the process has been developed on the basis of published theories and data, without including classified information. Such a model would contribute not only to provide the inspectorates with a tool to analyze

the process but also to provide the public with transparency on a ...t in which an advanced technology is used;

(b) If there are technical parameters that can be easily modified depending on the progress of development of technologies, a sensitivity analysis should be carried out to evaluate the effect of such progress on the safeguards approach/procedure to be adopted and, if appropriate, to modify them;

(c) If appropriate, experts from the countries of technology holders could guarantee the degree of accuracy of the model; and

(d) Reliable, effective and efficient safeguards could be designed using such model.

A centrifuge in a future commercial enrichment plant will have a greater separative power, which brings in the following effects: since the numbers of stages and centrifuges in a unit cascade are reduced, the total length of pipes is shortened resulting in a reduced effort for the changes of piping arrangement; in-process inventory of UF_6 gas in a centrifuge reduces and electric power consumption also decreases; and since the cascade would need maintenance, workers will enter into the cascade hall and work there. Another effect is that for economical reasons the plant designer is expected to apply a cell type arrangement to the construction of cascade, in which one cell contains a number of centrifuges. In this case a cell seems to be a black box into which an inspector cannot make access. A built-in arrangement might be technically possible, by which the piping can be switched from the normal arrangement to the other without being detected.

There are other parameters that affect the safeguards for the future commercial enrichment plant. These are the enrichment of product uranium and the sizes of a unit cascade and the plant. A variety of enrichments would be required, which would necessitate a more careful analysis for safeguards design. On the other hand, the size of a unit cascade would be decided on the basis of operational and economical requirements and the size of the plant, which could be expanded with relative easiness if needs arise, would depend on a predicted balance between supply and demand for the future.

8. CONCLUDING REMARKS

In designing a safeguards approach for a nuclear plant in which an advanced technology is used, there are difficulties because sensitive information might not be disclosed. Lack of key information could lead to low transparency on the plant and to low reliability in the safeguards including possible misjudgements in conducting safeguards activities. In order to solve this problem the authors have developed a methodology, in which a mathematical model to describe the key process should be developed first, unintentional and intentional operations of the process are to be analyzed using this model, and a reliable, effective and efficient safeguards approach should be established taking into consideration both anomalies generated by unintentional and intentional operations.

This methodology has been applied to a model centrifuge enrichment plant with a commercial size. A mathematical model that can simulate a dynamical behavior of cascades has been developed. Transient operations and potential misoperations have been analyzed as well as technical means to produce uranium with a higher enrichment than the declared one. Then the LFUA approach has been examined. The mathematical model, which has been developed, is a relatively simple one but it has a capability of analyzing a variety of cascades aimed at HEU production. In order to enhance this capability, however, the following points should be investigated:

(1) To incorporate the mathematical model into a whole system that has the capability of simulating flows and inventories of feed, product and tail along with their corresponding enrichments all over the plant.

(2) To develop a calculation method that can predict as precisely as possible a relationship between the feed flow to a centrifuge and the separative power especially in a case of small flow rate, although it would be difficult to theoretically predict such relationship because of a complex gas dynamics.

Although the analyses of unintentional and intentional operations are not necessarily thorough, our results indicate that the transient phenomenon accompanied with normal process operations or misoperations should be taken into account when an alarm level is set up to detect an anomaly in an enrichment measurement at a cascade header. It is noted, however, that the alarm level could be set to be low if the anomalies, which may be generated as a result, are easily resolved.

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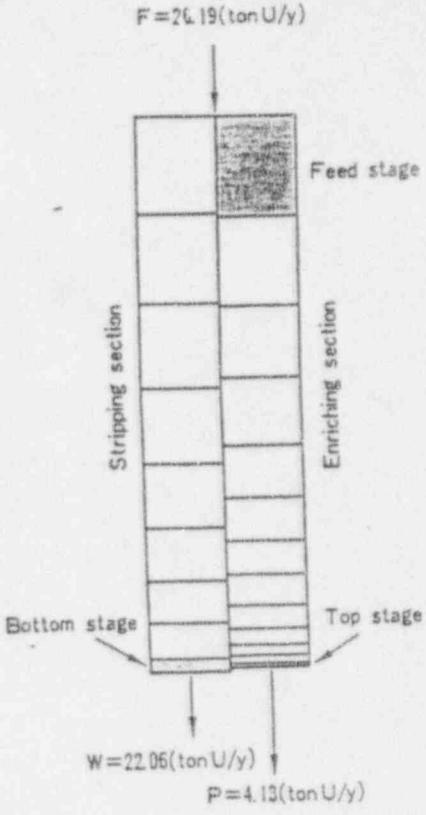

Fig. 1 A unit cascade composed of model UF_6 gas centrifuges. The number of centrifuges for each stage is proportional to a block size illustrated and the total number of centrifuges is 2865.

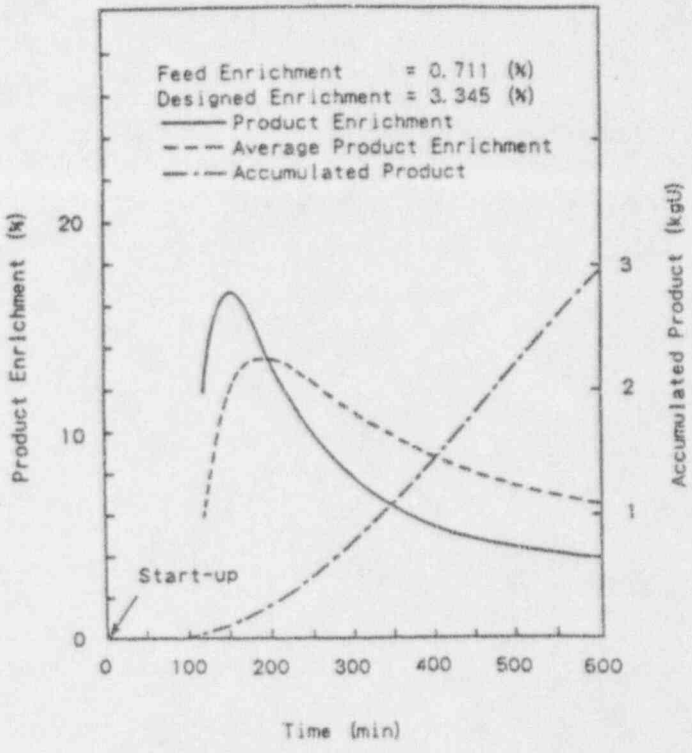

Fig. 2 Product enrichment at a cascade header pipe, average product enrichment at the cold trap and accumulated amount of product, at a start-up operation where the feed flow rate is linearly increased until reaching the designed flow rate at 120 minutes after the feed starts.

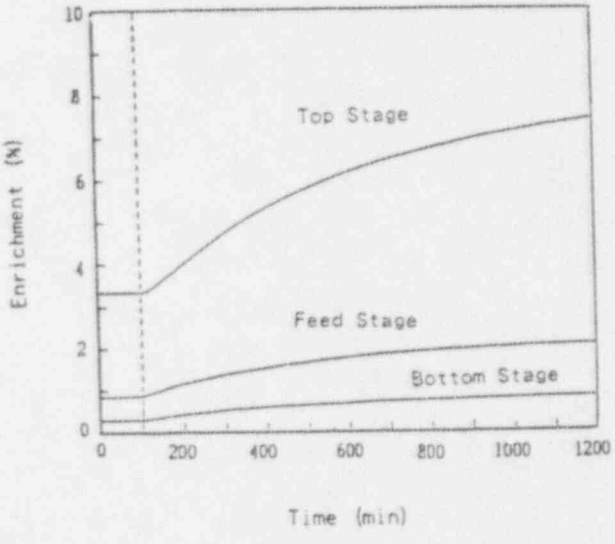

Fig. 3 Enrichments at the top stage, feed stage and the bottom stage in a case where the product flow is recycled to the feed stage.

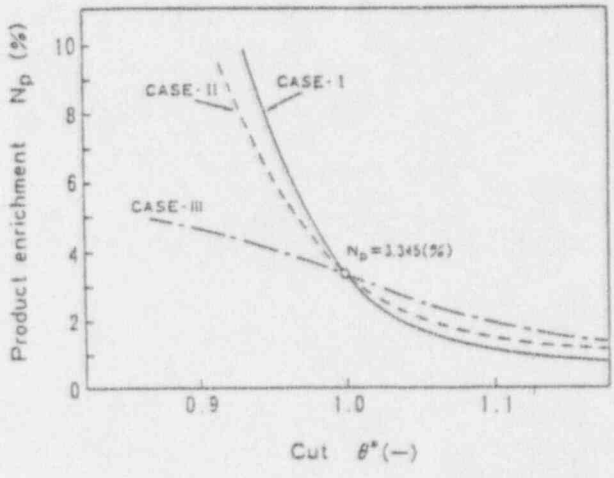

Fig. 4 Effect of the cut regulation on the product enrichment in cases of the cut being changed at all stages, CASE-I, at stages in the enriching section, CASE-II, and at stages in the stripping section, CASE-III.

tially connected entirely in parallel (as part of a stage) could be reconnected to incorporate series connections. The new unauthorized arrangement would include several enrichment stages.

If such a cell were functionally isolated by closing certain valves, without detection, it could be used as a clandestine dedicated HEU cascade. If the cell contained many dozens of centrifuges, it could incorporate sufficiently many enrichment stages (15 to 25) to produce 90% enriched uranium without batch recycling. Even with only a few dozen centrifuges, by batch recycling the cell could produce a bomb quantity of 90% HEU within a year. Indeed, the capacity of each URENCO TC12 centrifuge is about 40 kg SWU/year.[54] The total capacity of a cell containing three dozen TC12 centrifuges would be about 1,500 kg SWU/year. If low enriched (3%) feed were used, only 40-100 kg SWU/year (depending on process details) would be needed to produce a kilogram of 90% HEU. Thus, such a dedicated cell could clandestinely produce 15-35 kg of 90% HEU per year.

This scenario should be precluded by requiring that centrifuge cell walls, including supplemental and replacement walls installed during the life of the CEC, be transparent.

O. Design for effective IAEA inspections

Pursuant to the Hexapartite Agreement, the NRC should require that plant hardware design in every CEC cascade be con-

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54 According to Table 4.3-2 of the CEC SAR, total capacity of the LES plant would be about 1.5-1.7 million kg SWU/year, and the plant would contain 40,000 centrifuges; thus, the capacity of each centrifuge would be about 40 kg SWU/year.

ducive to effective online gas enrichment monitoring by the International Atomic Energy Agency (IAEA).

BASIS: The United States has agreed to inspections by the IAEA on its commercial nuclear facilities. See 10 C.F.R. Part 75. In the early 1980's, the United States, along with Australia, Japan, Germany, the Netherlands, and the United Kingdom, participated with EURATOM and the IAEA in the international "Hexapartite Safeguards Project," for the purpose of reaching consensus on effective and efficient means for international safeguarding of commercial gas centrifuge plants, in a manner protective of licensees' proprietary information regarding production technology. The participants agreed that visual inspections alone were insufficient to detect HEU production; and that online enrichment measurements, capable of discriminating between low enriched and highly enriched uranium hexafluoride gas in the pipes, are necessary to verify that no HEU is produced.[55] As described in Contention L, effective online enrichment monitoring (over the life of the enrichment equipment) requires that pipe sections at measurement points have a minimum inner diameter of 110 mm or greater, depending on gas pressure. This hardware specification, and any other hardware design features necessary to the implementation of effective and efficient IAEA safeguards, should be mandated by the NRC.

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55 D.W. Swindle, "Realities of Verifying the Absence of Highly Enriched Uranium (HEU) in Gas Centrifuge Enrichment Plants," paper presented at the 1990 March Meeting of the American Physical Society. Attachment 18. See also Hunt, Attachment 16.

MARTIN MARIETTA

K/ITP-327

REALITIES OF VERIFYING THE ABSENCE OF HIGHLY ENRICHED URANIUM (HEU) IN GAS CENTRIFUGE ENRICHMENT PLANTS

D. W. Swindle

Presented at the
1990 March Meeting of the
American Physical Society

Anaheim, California

March 12-16, 1990

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Attachment 18

March 1990 K/ITP-327

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CONTENTS

REALITIES OF VERIFYING THE ABSENCE OF HIGHLY ENRICHED URANIUM (HEU) IN GAS CENTRIFUGE ENRICHMENT PLANTS*

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ABSTRACT

Over a two and one-half year period beginning in 1981, representatives of six countries (United States, United Kingdom, Federal Republic of Germany, Australia, The Netherlands, and Japan) and the inspectorate organizations of the International Atomic Energy Agency and EURATOM developed and agreed to a technically sound approach for verifying the absence of highly enriched uranium (HEU) in gas centrifuge enrichment plants. This effort, known as the Hexapartite Safeguards Project (HSP), led to the first international concensus on techniques and requirements for effective verification of the absence of weapons-grade nuclear materials production. Since that agreement, research and development has continued on the radiation detection technology-based technique that technically confirms the HSP goal is achievable. However, the realities of achieving the HSP goal of effective technical verification have not yet been fully attained. Issues such as design and operating conditions unique to each gas centrifuge plant, concern about the potential for sensitive technology disclosures, and on-site support requirements have hindered full implementation and operator support of the HSP agreement. In future arms control treaties that may limit or monitor fissile material production, the negotiators must recognize and account for the realities and practicalities in verifying the absence of HEU production. This paper will describe the experiences and realities of trying to achieve the goal of developing and implementing an effective approach for verifying the absence of HEU production.

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†Operating contractor of the Oak Ridge National Laboratory, the Oak Ridge Gaseous Diffusion Plant, the Y-12 Plant, and the Paducah Gaseous Diffusion Plant for the U.S. Department of Energy.

INTRODUCTION

Over a two and one-half year period beginning in 1981, representatives from six countries, which included the United States, United Kingdom, Federal Republic of Germany, Australia, The Netherlands, and Japan, together with the inspectorate organizations of the International Atomic Energy Agency (IAEA) and EURATOM, developed and agreed to a technically sound and effective approach for verifying the absence of highly enriched uranium (HEU) in gas centrifuge enrichment plants. This effort, known as the Hexapartite Safeguards Project (HSP), led to the first international concensus on techniques and requirements for effective verification of the absence of weapons-grade nuclear materials production. Since that agreement, research and development has continued on the radiation detection technology-based technique that technically confirms the HSP goals are achievable. Issues such as design and operating conditions unique to each gas centrifuge plant, concern about the potential for sensitive technology disclosures, and on-site support requirements have hindered full implementation and operator support of agreements reached during the HSP negotiations. In future arms control treaties that may limit or monitor fissile material production, negotiators must recognize and account for these realities and practicalities in verifying the absence of HEU production.

In this paper, the experience and realities of trying to achieve the goal of developing and implementing an effective approach for verifying the absence of HEU production will be discussed. Addressed first will be some background information that includes a description of the availability of uranium enrichment technology, the technology's appropriateness for HEU production, and a summary of U.S. and international efforts to date on developing an effective verification approach. Following the discussion of background information, specific details of the verification approach will be described including functional descriptions of the verification activities and the technologies used in the verificatio approach. Practical aspects of implementing the agreed-to verificatio. approach will then be summarized, followed by a current report on the status of the implementation effort in countries that currently have gas centrifuge plants subject to the internationally agreed-to verification approach.

BACKGROUND

In order to understand the difficulties as well as the practicalities of verifying that a gas centrifuge plant is not producing HEU, it is important to first put into perspective both the availability of uranium enrichment technologies and the attractiveness of the gas centrifuge technology in enriched uranium production. Currently, there are thirteen countries which have openly acknowledged that they have operating uranium enrichment production or pilot plants or are conducting uranium isotope separation research. These countries are Argentina, Brazil, China, Federal Republic of Germany, France, India, Japan, The Netherlands, Pakistan, South Africa, U.S.S.R., United Kingdom, and the United States. Of these thirteen countries, nine operate gas centrifuge facilities, five

operate gaseous diffusion facilities, five are nuclear weapons states, five have not yet signed the nuclear nonproliferation treaty (NPT), eight are actively pursuing the development of laser isotope separation technology, and two of these countries are developing ion or chemical enrichment technology for uranium isotope separation. As illustrated by these statistics, the predominant separation technology that has been adopted by the countries identified is the gas centrifuge.

Gas centrifuge technology has emerged as the uranium isotope technology of choice. Why? First, it is ideally suited for uranium isotope separation and consequently HEU production. The gas centrifuge technology has a high separation factor. This high separation factor, using typical values, implies that the uranium hexafluoride (UF_6) produced as product from the gas centrifuge is at least 20% richer in ^{235}U isotope contained than the feed UF_6 originally input to the gas centrifuge. By comparison, in a gaseous diffusion converter, the product is generally less than 1% richer in ^{235}U isotope than its feed material per separation unit. Gas centrifuges also have a small in-process uranium inventory that makes them an attractive choice for uranium isotope separation. By comparison, the in-process cascade inventory in a 1000 tonne separative work unit (SWU) per year gas centrifuge plant is on the order of about 0.2 tonne of uranium as gaseous UF_6 as compared with several hundred tons of UF_6 inventory per 1000 tonne SWU/year gaseous diffusion plant. This is very important both in terms of economic investment in the facility as well as addressing the concern of nuclear criticality when producing HEU. Another factor important to the technology of choice selection is that gas centrifuges have a short equilibrium time. This is particularly important in HEU production in that the time required for the separation process to reach equilibrium and therefore produce the desired product assay is relatively short. Gas centrifuge equilibrium can be reached in about one day for an ideal HEU cascade in contrast to several months for HEU production equilibrium in a gaseous diffusion cascade or several years for chemical exchange processes. Another factor that makes gas centrifuges attractive for uranium isotope production is that gas centrifuges have low energy consumption rates. Typically, a gas centrifuge will consume ~100 kWh/SWU, which is equivalent to about 3% or 4% of the electrical energy consumed per SWU produced by a gaseous diffusion facility.

In understanding why gas centrifuge technology has emerged as the uranium isotope separation technology of choice in the 20th century, one must also recognize that most of the basic materials and technology required are currently available to moderately developed countries. In addition, it is recognized that the engineering or technical complexity of this technology is "moderate" in comparison to the technical complexity of the laser isotope separation process which involves many more scientific disciplines, as well as engineering details, to work out complex thermodynamics, operations, and materials compatability needs. Finally, gas centrifuge technology can be deployed in small-scale operating units that can be expanded over time as capacity needs change using add-on modules.

A view of the gas centrifuges located at the Almelo Gaseous Centrifuge Enrichment Plant in The Netherlands is shown in Fig. 1.

The U.S. efforts to ensure that an effective regime for verifying the absence of HEU production in gas centrifuge enrichment plants began for international safeguards purposes in 1978. At that time, the U.S. Enrichment Safeguards Program was established. This multiorganizational policy, programmatic, and technical group involved many U.S. Government agencies, including the U.S. Department of Energy, the Arms Control and Disarmament Agency, the U.S. Department of State, and five U.S. Department of Energy contractors working as a team to solve the conflicting and contrasting policy, programmatic, and technical issues. The purpose of the U.S. Enrichment Safeguards Program was to design, develop, evaluate, and implement an effective international safeguards verification approach in gas centrifuge enrichment plants. This program was active was from 1978 to 1985, which corresponded to the design and construction period for the Portsmouth Gas Centrifuge Enrichment Plant located in Portsmouth, Ohio. The direct funding for the U.S. Enrichment Safeguards Program for Department of Energy contractors during this period exceeded $21 million. The cost excluded U.S. Government Agency costs.

Serious international efforts to establish an effective regime for verifying the absence of HEU production in gas centrifuge enrichment plants began in 1980. This serious effort resulted in the establishment of the HSP which was started in November 1980 and concluded in 1983. The participants in the HSP included Australia, Federal Republic of Germany, Japan, The Netherlands, United Kingdom, and the United States and the inspectorates of the IAEA and EURATOM. The goal of the HSP that was born with a sense of cooperation and urgency was "...to develop, within two years, an adequate technical basis of technical experience and information which can be used by the IAEA, EURATOM, and the State involved in the evaluation of various safeguards approaches and the possible development of arrangements for the direct implementation for an effective and efficient safeguards system to specific facilities."

In undertaking this goal, the participants recognized four objectives that had to be achieved and balanced to develop an effective verification strategy approach for verifying the absence of HEU in gas centrifuge plants. These objectives are:

1. Maximize safeguards (verification) effectiveness,
2. Minimize the risk of acquiring sensitive information and technology by the inspectorate,
3. Minimize the intrusiveness and cost to facility operators, and
4. Minimize inspectorate resource requirements to carry out the verification.

The primary assessment resulting from the HSP was a political consensus that the detection of HEU production was of greater relevance than the detection of low enriched uranium (LEU) diversion. The key conclusions agreed to and adopted in the HSP included the following:

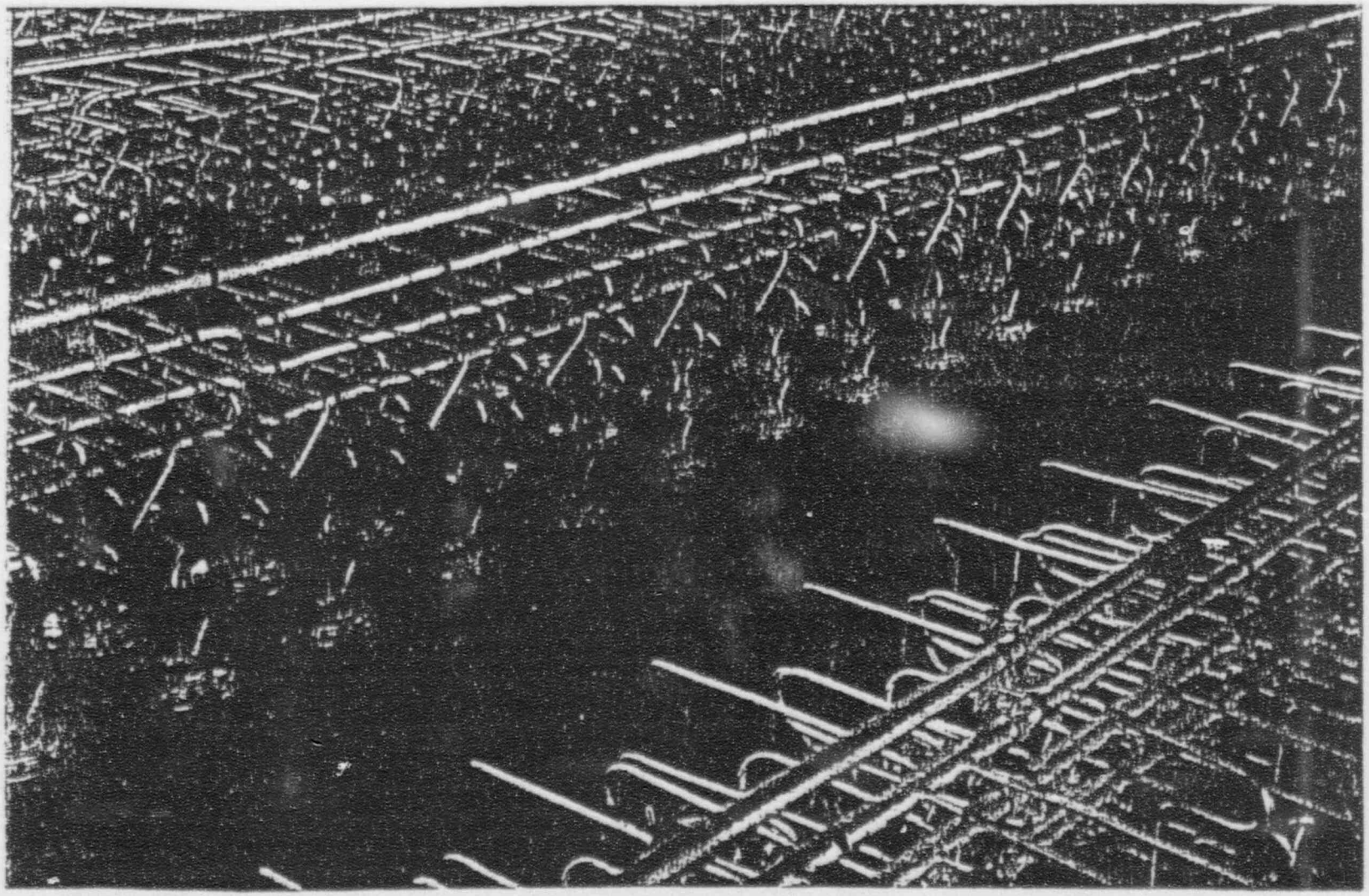

Fig. 1. Centrifuge Cascades at the Almelo Gas Centrifuge Enrichment Plant.

1. Inspector access to cascades halls of the gas centrifuge enrichment plants must be among the safeguards measures,
2. Technology holders agreed that it was necessary to adopt the "limited-frequency unannounced-access" (LFUA) strategy concept (i.e., on-site inspections of limited frequency and duration without prior announcement) in order to have an effective inspection/verification regime,
3. These LFUA inspections would need to occur randomly between four to twelve times per year for facilities up to 1000 tonne SWU/year to achieve a high degree of assurance that there was an absence of HEU production.
4. For routine inspections that did not involve cascade hall access, inspection frequencies between 12 and 15 times a year for facilities up to 1000 tonne SWU/year would be necessary.

The HSP participants also acknowledged that the LFUA inspections could occur during the routine inspection of the plants. It was agreed, however, that the plant operator would have to provide access to the cascade halls at his site within 2 h of the request for access to conduct an LFUA inspection. This 2-h timeframe was considered necessary to give the operator sufficient time to take steps to ensure that no sensitive information could be obtained inadvertently by the inspectorate when inside the cascade hall. This 2-h timeframe also was considered the limit whereby there would not be sufficient time for the operator to remove all evidence of any illegal activity without a high probability of being detected.

DESCRIPTION OF THE VERIFICATION APPROACH

Components of the gas centrifuge technology verification approach that has been internationally adopted include two very important elements: nuclear materials accountability verifications and LFUA strategy inspections. The purpose of nuclear materials accountability verifications are to verify the absence of LEU diversion by verifying nuclear material flows and inventories normally associated with routine operation of a LEU production facility. The purpose of LFUA strategy inspections, as agreed to in the HSP, is to verify the absence of HEU production by conducting nondestructive assay (NDA) measurements and visual inspections inside the gas centrifuge plants cascade halls. Because the key focus of this paper is on verifying the absence of HEU production, I will focus the remaining aspects of this discussion strictly on those aspects of the LFUA strategy inspections important in verifying the absence of HEU production.

The function of the cascade area or LFUA verification activities are simply to verify operations as declared and to verify that the design of the plant as declared by the State or facility operator is as stated. In verifying operations as declared, the inspectorate is verifying with high statistical confidence, that all nuclear materials flows and operations are as declared and that the plant is in fact only producing LEU for civil purposes. Also in verifying plant designs as declared, the inspectorate is confirming that the cascades, which are the basic operating units of the gas centrifuge plants, are connected as so stated and that any sampling points where nuclear material could be introduced or withdrawn from the cascades are also as declared.

HSP verification activities include visual observations, NDA measurements, sampling and use of tamper-indicating seals. The NDA measurements conducted inside the cascade halls have become known as LFUA strategy cascade header pipe measurements because the NDA measurements are conducted on the main header pipes that supply UF_6 feed and withdraw UF_6 product and tails from the cascades.

During visual observation inside cascade areas, the inspectorate is conducting visual checks of safeguards-relevant plant features. The function of this activity is to visually verify the process operations as declared and to verify design information as provided to the inspectorate.

In Fig. 2, the centrifuge cascades located at the Gronau, Federal Republic of Germany gas centrifuge enrichment plant, you can see the repetitiveness of the pipe work, the uniform engineering, and the many hundreds of identical gas centrifuge machines that are interconnected to make up the basic operating unit or cascade in the gas centrifuge facility. This visual inspection process relies on "transparency" of the facility. During visual verifications, the "transparency" of the centrifuge plant is readily evident and any discrepancies that might exist due to changes in interconnections that might be indicative of HEU production would be detectable.

The second component of verification activities inside the cascade hall involves LFUA strategy NDA cascade header pipe measurements. These measurements involve gamma ray measurements on individual cascade header pipes using portable radiation detection equipment. The objective is to statistically confirm the absence of HEU in the process gas flowing through the piping in an operating facility. This measurement approach is based on a two-phase measurement technique. The Phase 1 measurement is a passive gamma ray measurement of the total ^{235}U signal using a wide collimated geometry. The Phase 2 measurement is an X-ray fluorescence (XRF) measurement of the total uranium concentration contained in the gas and a simultaneous measurement of the total ^{235}U signal under a highly collimated geometry. The two measurements of 185.7 KeV gamma rays from the ^{235}U using the two geometries determine the amount of ^{235}U present only in the gas phase. The ratio of the gas-only ^{235}U signal to the gas-only total uranium signal results in a pressure- and deposit-independent measure of the UF_6 gas enrichment.

The detection equipment used for the cascade header pipe measurements is shown in Fig. 3. This equipment consists of (1) a portable high-purity germanium (HPGe) detector, (2) a portable battery-powered multichannel analyzer, and (3) an XRF source holder-source collimator that has been designed and/or modified for specific pipe sizes. The portable detector used to measure the gamma ray and X-ray emissions from the header pipes can be stored at room temperature and only requires liquid nitrogen cooling immediately prior to and during operation. The detector has been specially designed to include an internal graded back shield and an external graded collimator fabricated of tungsten and copper which is intrinsincally mounted on the detector to reduce extraneous background noise. The end of the external collimator is contoured to fit flush against the header pipe and can be rotated to interface with either a horizontal or a vertical pipe. The multichannel analyzer has built-in decision analysis firmware that guides the user through the measurement

PHOTO NO. K/PH-87-3610

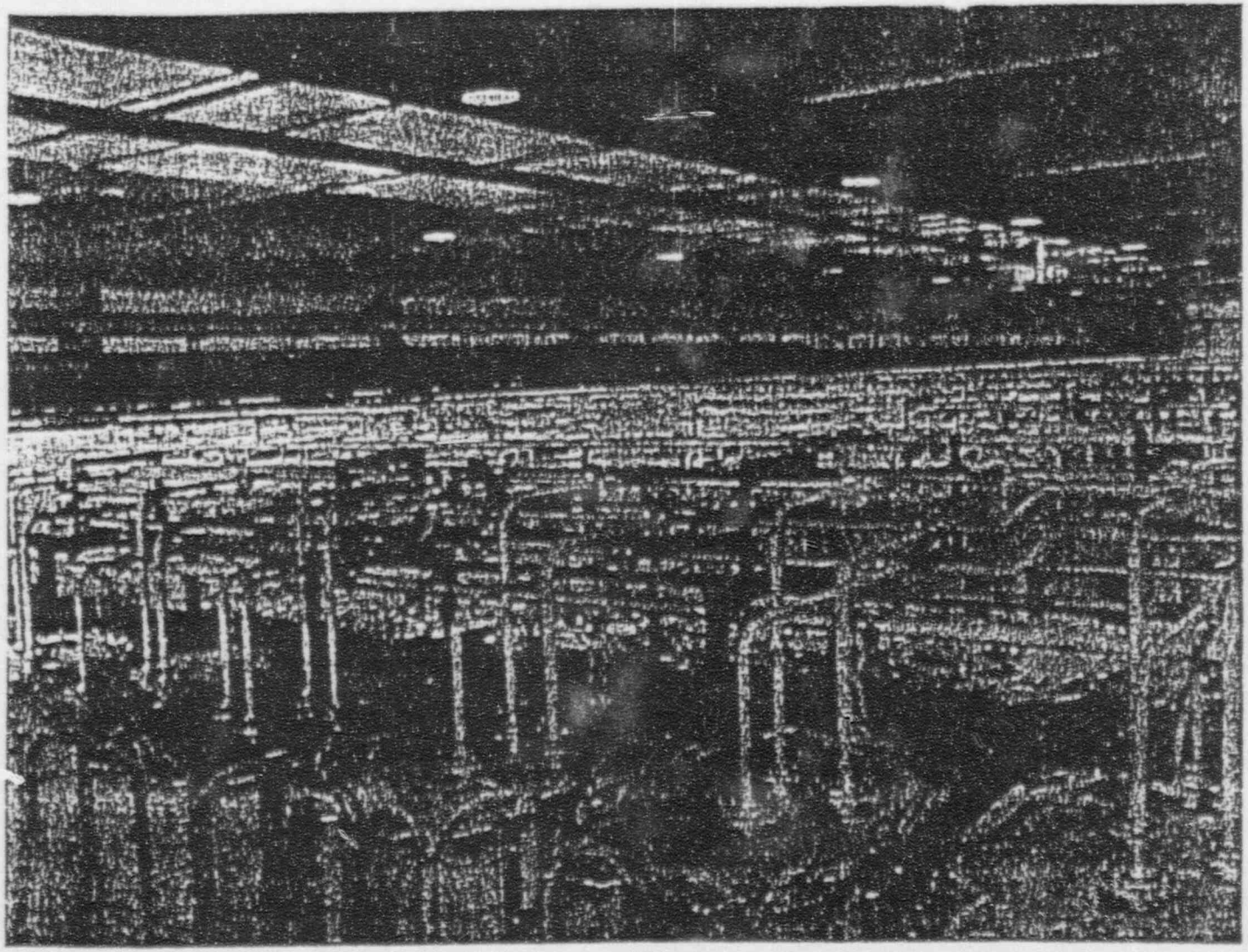

Fig. 2. Gas Centrifuge Cascades at the Gronau Gas Centrifuge Enrichment Plant.

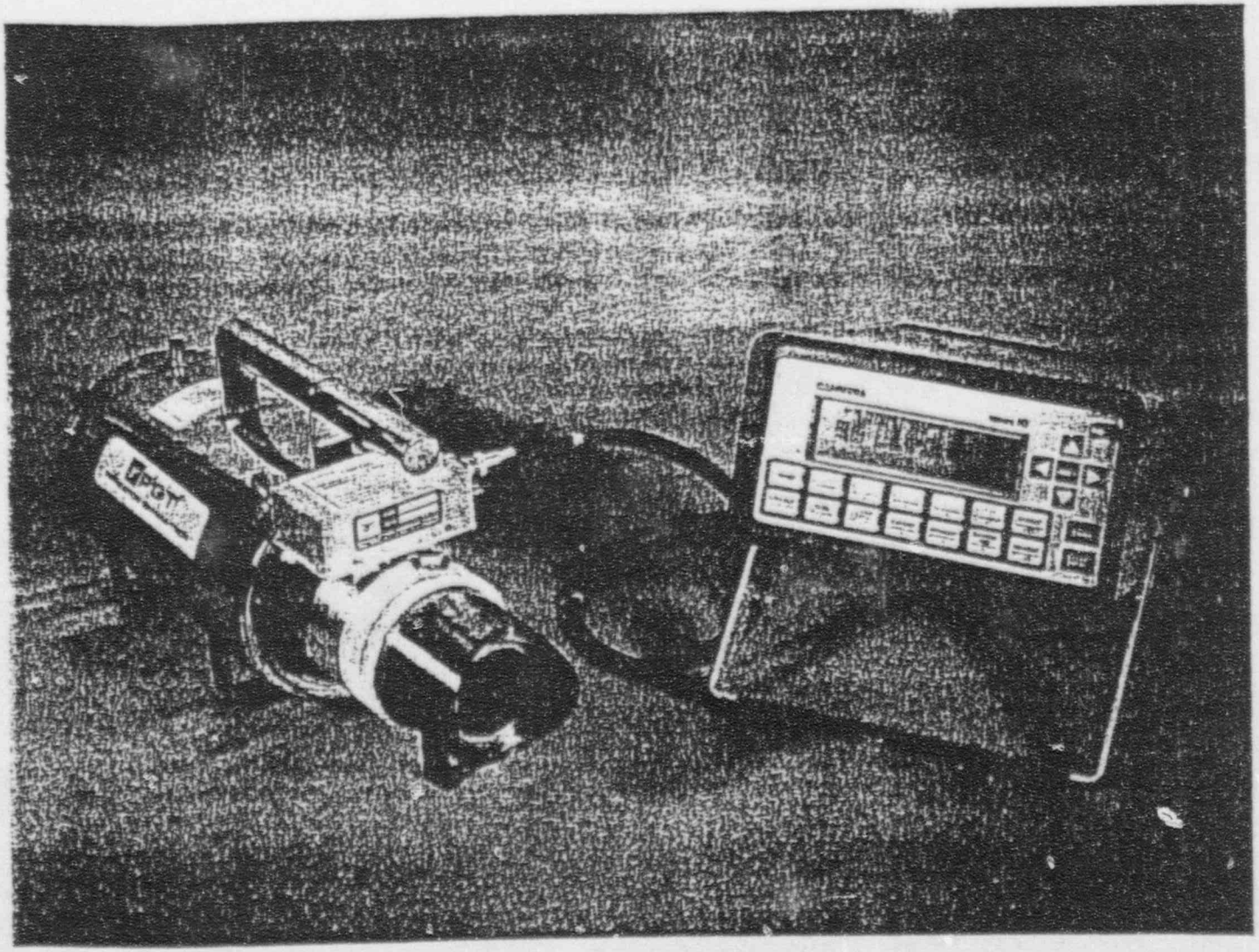

Fig. 3. High Purity Germanium Detector and Portable Analyzer used in the LFUA Strategy Measurement.

procedure, accumulates data from the detector, and provides on-the-spot analysis of the data. Besides numerous premeasurement and post-measurement activities, the intent of this highly automated approach is to make a go/no-go determination as to whether or not the process gas is above an agreed-to threshold (i.e., >20% contained ^{235}U).

The third verification activity inside the cascade hall includes sampling. In this activity, gas samples of UF_6 may be taken directly from the cascades or from vessels or pipes directly connected to and traceable from the cascades. The function of this sampling is to verify with high statistical certainty, the presence of LEU in the process gas at the time the sample was taken. The operator has a major concern with sampling; sampling can introduce light gases during the operation of making a physical connection to the cascade and thus increases the risk of disrupting or damaging process operations. Sampling has not been agreed to as a routine inspection measure. It has been acknowledged as necessary for clarification and/or resolution of anomalies that may be indicated during the visual inspections or the NDA cascade header pipe measurements.

The fourth activity that could be conducted during verification inspection inside cascade halls involves the application, verification, and placement of tamper-indicating seals on selected process piping valves and flanges, as well as any inspection equipment that is left unattended in the cascade hall area for longer term monitoring activities. The function of the placement of these tamper-indicating seals is for the inspectorate to maintain continuity of knowledge with respect to the status of the process system and/or his verification equipment's status. This can be particularly useful during plant commissioning and decommissioning activities where changes from steady-state operations are very common and the introduction of new UF_6 feed material as well as the withdrawal of UF_6 could in fact be indicators associated with HEU production.

PRACTICAL ASPECTS OF IMPLEMENTING A VERIFICATION APPROACH

There are several practical considerations that have to be recognized by the inspectorate when considering implementing a verification approach to verify the absence of HEU. Our experience to date has shown that cooperation between the host State and facility operator with the inspectorate organization is essential for successful implementation and high effectiveness in verifying the absence of HEU. As described below, the cooperation is absolutely essential because the operator has many advantages over the inspectorate as a possible diverter or producer of HEU. In addition, it is also important to have a detailed working knowledge of the design and operating parameters of the facility. In the case of IAEA safeguards, these details and operating parameters would be provided by the facility operator during the development of a design information questionnaire where steady-state operation parameters and design details (i.e., as-built conditions) are shared in a confidential manner with the inspecting authority. A third practical aspect of implementing an effective verification approach is the practicality of having "unannounced" verification inspections. The LFUA verification approach, which has been agreed to as both politically and technically, requires the adoption and implementation of "unannounced" inspections so as not to give an operator

Fig. 3. High Utility Destruction and Portable Analyzer Used in the LFUA Strategy Measurement.

sufficient time to disconnect any process equipment that may be in use for HEU production or to remove evidence of his illegal activity. The conditions agreed to in the HSP were that within 24 h of arriving in the host country, an inspector must be able to exercise the option of conducting an LFUA measurement. These 24 hours are important since any residual evidence of HEU production remaining in the plant decays to undetectable limits in about 24 hours. The issue here can be summarized as follows: as soon as an inspector arrives at an immigration point in a country, the practicality of traveling to the plant site and obtaining access within in the 24-h limit is difficult, if not impossible to achieve on an unannounced basis. For example, the border stations could be alerted for the inspector's arrival to alert the plant to cease HEU production.

An additional practical aspect of implementing a verification approach pertains to advantages. The operator has advantages as a possible illegal producer of HEU because he designed the facility; he controls the day-to-day operations; he enjoys the advantage of working in his/her own country; he knows to some detail the inspection approach that will be used; and he knows the details of his centrifuge design and their operating limits. These advantages are limited to the extent that the "cost" to misuse the centrifuges is less than it would be to build and operate a covert gas centrifuge enrichment plant. This cost includes the monetary cost of building a new covert facility or modifying an existing one to minimize the probability of detection. Cost also includes the relative risk of the inspector detecting anomalies that may be indicative of HEU production. This discussion points out the importance of a well thought-out and technically effective detection technique to maximize the probability of detecting the anomaly. Note that the operator has many options available to him to attempt the production of HEU. The method selected by an operator would depend upon the details of the verification system and the effort an operator is willing to expend to avoid detection by the inspectorate. Options available to an operator to avoid detection include cascade flow adjustment where the operator could control the cascade flows with originally installed or specially installed valving to obtain product assay levels that are higher than the declared cascade product assay. Although large quantities of HEU in a short period of time are not obtainable with this method in comparison with the others, the operator could obtain significant quantities of HEU over a long period of time using existing process support equipment with little or no physical modifications to the plant. It is important to note that visual verification inspections, which are only one component of the verification approach, cannot independently provide a high level of confidence that the plant's design basis has not changed.

The operator also has the option to reconfigure his cascades. Two basic arrangements can be used. One arrangement referred to as the parallel overwrap arrangement uses modular units of LEU cascades as building blocks for a large HEU cascade. A second arrangement is to reconfigure the centrifuge stages into one or more cascades to make a long cascade directly capable of HEU production. In both cases, physical modifications of the existing process system design would be necessary. It would be expected in the cases where reconfigurations occurred that

visual verification would have a high probability of detecting these modifications. A third option the operator has to produce HEU is to use the batch recycle approach. This approach involves recycling cascade product on a batch basis using one or more unit cascades. In this method, physical modifications to the process and support systems are not necessarily required to successfully produce HEU. An operator may elect to use portable withdrawal systems, for example, only requiring service connections to hook up the portable systems to covertly misuse a declared commercial cascade or a few machines. A fourth option available to an operator is to establish a dedicated cascade. The operator could add sufficient machine capacity after the initial verification inspections are complete. This new capacity could be dedicated to HEU production with essentially no measurable impact on the declared LEU flow. It would be difficult for the inspector to independently verify that no new cascades had been installed or to determine separative capacity as declared by the operator in cascades where centrifuges may have been replaced.

Many of those issues cited above, influenced the choice of the LFUA measurement approach to verify the absence of HEU production in the gas centrifuge enrichment plant.

Finally, as a note related to the practical aspects of implementing the verification approach, there are a number of indicators that could be associated with HEU production. One indicator includes the presence of portable feed and withdrawal equipment and/or stations in the cascade area where UF_6 can be fed to the gas centrifuge in small batches without going through the main process feed and withdrawal areas. The presence of UF_6 cylinders in the cascade area may also be indicative of HEU production. Except during the startup or shutdown of gas centrifuge machines, there is no need for UF_6 inside the cascade halls. Observing cylinders of UF_6 in operating cascade areas should be considered anomalous. Another indicator suggesting an HEU production potential involves detecting or visually observing piping reconfigurations. Finally, a radiation field indicating HEU which would be measurable during the LFUA inspection approach could be indicative of HEU production.

STATUS

Implementation of the LFUA strategy verification approach was agreed to commence fully within 1 to 2 years of the conclusion of the HSP. For many of the practical reasons cited above, the techniques have not yet been implemented. In the United Kingdom, for example, only recently in January 1990 has the equipment been adapted to the Capenhurst facility. Inspector training occurred in February and the first true in-plant inspector use is scheduled for March 1990. Likewise, 7 years after the HSP concluded, the Japanese are only now adapting and accepting the technology for use in their plant at Ningyo Togo, with calibration occurring in January 1990 and the first inspector use occuring in February 1990.

Unfortunately, the Dutch and German gas centrifuge facility operators and governments are "still investigating the technique," although it was proven feasible over 7 years ago.

SUMMARY AND CONCLUSIONS

If fully implemented, the LFUA verification approach coupled with nuclear materials accountability verification techniques offers an effective and efficient set of measures capable of verifying with high confidence the absence of HEU production in gas centrifuge enrichment plants. Implementation has been hindered by (1) delays in technology adaptation to specific plant conditions, (2) concerns by operators and owners of the technology holders over the loss of sensitive technology to the inspectorate, (3) operator reluctance to allow foreign inspectors in their operating facilities, and (4) recognition that each gas centrifuge plant is of a unique and different design, therefore requiring slightly different and unique technical solutions for each plant.

In order to have an effective verification approach that could be transferable to the arms control community and applied during nuclear materials cutoff verification inspections, a recommitment to the LFUA verification approach from the gas centrifuge technology holders and from those governments wishing to achieve high confidence levels for arms control treaties is required.

program for surveillance and maintenance of cylinders containing tails in interim storage; management and control program; and nuclear criticality safety analyses demonstrating that criticality accidents are not credible occurrences at the CEC. Id. at 2-3.

Before the CEC can receive a license, this information must be supplied to the NRC, and an opportunity must be granted to the public to respond to any new issues raised therein.

J. Inadequate Assessment of Costs Under NEPA

The Environmental Report does not adequately describe or weigh the environmental, social, and economic impacts and costs of operating the CEC. Moreover, the benefit-cost analysis fails to demonstrate that there is a need for the facility. See, e.g., Public Service Co. of New Hampshire (Seabrook Station, Units 1 and 2), ALAB-422, 6 NRC 33, 90 (1977) (in a power production plant licensing case, "need for power" is "a shorthand expression for the 'benefit' side of the cost-benefit balance which NEPA mandates"). On the whole, the costs of the project far outweigh the benefits of the proposed action.

BASIS: NEPA requires the NRC to fully assess the impacts of the proposed licensing action, and to weigh its costs and benefits. LES' Environmental Report contains a brief "benefit-cost analysis" that is improperly slanted in favor of the benefits of the project, and contains little discussion of the potentially signficant impacts and their environmental and social costs. ER § 8.0. The discussion is inadequate with respect to the following issues:

1. The ER fails to discuss the environmental impacts caused by the generation of tons of mixed radioactive waste, for which no disposal options currently exist.[27]

2. In § 8.2.2, LES claims that all effluents discharged from the plant will remain within legal limits. As discussed in Contention C, however, LES' environmental and safety analyses are inadequate in that they fail to account for severe low probability accidents which may result in discharges that exceed legal limits.[28]

3. Section 8.1.1.6 estimates the cost of decommissioning at $20 million plus $9.5 million per year for disposal of uranium tails. As discussed in Contention B, supra, LES has provided insufficient basis for this decommissioning cost estimate.[29]

4. Section 1.2 of the ER, which purports to discuss the need for the CEC, provides no such information. It briefly outlines the suppliers of enriched uranium to the United States in 1988, and provides an unexplained table of world enriched uranium needs from 1990 to 2010, but gives no current or projected information on uranium supply. This is not surprising, since it is commonly known that existing U.S. enrichment capacity is more than adequate to meet projected domestic needs through

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27 See Contentions A and B, which are incorporated by reference herein.

28 Contention C is incorporated by reference herein.

29 Contention B is incorporated by reference herein.

2010. See, e.g, GAO/RCED-89-170BR, Uranium Enrichment: Some Impacts of Proposed Legislation on DOE's Program.[30] LES vaguely states that LES should get a license without delay in order to avail itself of a "critical opening" in the uranium market that is expected to begin in 1996 "because U.S. customers have terminated their commitments for over 40 percent of their enrichment requirements scheduled to be supplied by the Department of Energy during the late 1990's." A generalized statement of LES' marketing hopes for the 1990's does not constitute a demonstration that additional enriched uranium production capacity is needed. LES should be required to evaluate existing and projected production capacity both in the U.S. and abroad, and to evaluate existing and projected enriched uranium demand in the United States.

5. The ER does not discuss the potential environmental and social impacts of improper use of the CEC for production of highly enriched uranium for nuclear weapons.[31]

6. The Environmental Report does not contain a complete or adequate assessment of the potential environmental impacts of the proposed project on ground and surface water. Groundwater is the sole source of drinking water for all of Claiborne Parish. ER § 2.5.2.4. A study prepared for LES shows that at the CEC site, the groundwater lies as close as 2.5 feet

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30 Relevant pages are appended as Attachment 10.

31 See Contentions L, M, N, and O, which are incorporated by reference herein.

below the surface. Westinghouse Environmental and Geotechnical Services, Inc., "Report of Preliminary Geotechnical Study and Environmental Evaluation, Louisiana Energy Services Uranium Enrichment Plant, Claiborne Parish, Louisiana" (August 18, 1989) at 23. There are at least 40 homes within 5 miles of the plant that use private wells for domestic water consumption. Comment by Eula Mae Malone on scoping of environmental impact statement, dated July 30, 1991.[32]

Contaminated effluent from the CEC will also be carried in Cypress Creek to Lake Claiborne, which has been designated as a potential drinking water source. In § 3.4.1.4 of the SAR, LES states that Lake Claiborne was dammed for "flood control and conservation" and that it "is not, and has never been, used as a source of public water supply. ..." To the contrary, Louisiana state law allows the Claiborne Parish Watershed District to manage the Lake for potential "municipal" use. LA REV. STAT. ANN. § 38:2863 (West 1966). In May of this year, following unusual flooding in Claiborne Parish, the Secretary of the Claiborne Watershed Commission stated that that the state Department of Transportation will not open the floodgates during high water because "Lake Claiborne is not a flood control lake."[33]

As the NRC noted in a recent letter to LES, contamination of the CEC site during its operating life is virtually inevitable.[34]

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32 Attachment 11.

33 Guardian Journal, May 16, 1991.

34 Attachment 5, Enclosure at 4.

LES also recognizes this potential. According to LES, during extended periods of low precipitation (July and/or August) groundwater may fail to support baseflow in Cypress Creek reducing the stream to standing pools of water isolated by reaches of dry bed. Under these conditions, effluent discharges into Bluegill Pond and subsequently out of the pond in a diluted state would be expected to eventually infiltrate to groundwater. The environmental report should fully evaluate the potential impacts of the proposed project on the ground and surface water in the area, and discuss the manner in which it will be kept free from contamination.[35] For instance, the holding basin, Bluegill Pond, and portions of Cypress Creek should be lined to prevent contamination of groundwater.

7. LES has not evaluated the impacts of the proposed project on wetlands located on the site, or demonstrated that it either has or does not need a permit to build on the wetlands. According to the Army Corps of Engineers, the proposed site of the CEC contains wetlands. Letter from Kenneth P. Mosley, ACE, to William Beal, Westinghouse HAZTECH, Inc., dated August 14, 1989 (Attached as Appendix H to Westinghouse Environmental and Geotechnical Services, Inc., "Report of Preliminary Geotechnical

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35 The Louisiana Geological Survey has reviewed documents prepared by LES and its consultants regarding the geologic and hydrologic data for the CEC site, and has found in to be incomplete or inadequate in numerous respects. Letter from Bradford C. Hanson, Senior Research Geologist, Louisiana Geological Survey, to Ronald D. Anderson, dated September 23, 1991. A copy of this letter is appended as Attachment 23 and is incorporated by reference herein.

Study and Environmental Evaluation, Louisiana Energy Services Uranium Enrichment Plant, Claiborne Parish, Louisiana" (August 18, 1989)).

8. In § 8.1.2.9 of the ER, LES claims that property values "may be enhanced due to the presence of the LES facility." This is inaccurate. As discussed above, both LES and the NRC consider that some contamination of the environment from the CEC is virtually a given. Moreover, CEC has the potential to become a storage facility for enormous quantities of hazardous wastes.[36] It is more likely that property values in the area will decline, due to the perception of pollution and danger from the plant. Such perception will be especially acute if the CEC becomes a waste repository for tons of toxic and radioactive waste. For instance, property values around Lake Claiborne, a retirement community touted for its pristine beauty, may be depressed when the lake becomes the receiving water for CEC's pollutants.

9. The proposed plant will also have negative economic and sociological impacts on the minority communities of Forest Grove and Cedar Springs. Forest Grove Road, which joins the two communities, must be closed in order to make way for the proposed plant, which would lie between them. If the road is closed off, it will cause hardships to families who use the road, residents who car-pool to work, school transportation, sports-related activities that involve children living in both com-

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36 See Contention A, which is incorporated herein by reference.

munities, and church services that are divided between the two communities.[37]

Moreover, the ER does not reflect consideration of the fact that the plant is to be placed "in the dead center of a rural black community consisting of over 150 families." Comment by Essie Youngblood on scoping of environmental impact statement, dated July 30, 1991.[38] The proposed siting of the CEC in a minority community follows a pattern noted in a 1987 study by the United Church of Christ, "Toxic Wastes and Race In the United States, A National Report on the Racial and Socio-Economic Characteristics of Communities With Hazardous Waste Sites."[39] The study found that "[r]ace proved to be the most significant among variables tested in association with the location of commercial hazardous waste facilities. This represented a consistent national pattern." Id. at xiii. It also found that "In communities with one commercial hazardous waste facility, the average minority percentage of the population was twice the average minority percentage of the population in communities without such facilities (24 percent vs. 12 percent)." Id. The ER does not demonstrate any attempts to avoid or mitigate the disparate impact of the proposed plant on this minority community.

K. No Discussion of No Action Alternative

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37 Statement of Roy Mardis to Claiborne Parish Police Jury, reported in The Guardian, January 18, 1990, at 3. Attachment 12.

38 Attachment 13.

39 Attachment 14, which is incorporated by reference herein.

United States General Accounting Office

GAO

Briefing Report to the Congressional Requesters

July 1989

URANIUM ENRICHMENT

Some Impacts of Proposed Legislation on DOE's Program

GAO/RCED-89-170BR

Attachment 10

Section 5

Foreign Enrichment Competition

Questions

1. What do Eurodif and Urenco currently charge European and American customers per separative work unit (SWU) of uranium? How do these prices compare with those currently charged by DOE?

2. What is the current uranium enrichment capacity of Eurodif and Urenco? How much of this capacity is uncommitted for each year through the end of calendar year 2000?

Summary Response

Currently, Urenco and Eurodif, two European producers with annual production capacities totalling over 13 million SWU, charge their partners very high SWU prices—$178 and $193, respectively, compared with DOE's $117 base price. However, these European producers are willing to sell at much lower prices to U.S. utilities to rid themselves of excess production—about 2.3 million SWU per year—and make inroads in the U.S. market. The amount of uncommitted capacity for these producers through the year 2000 depends on the terms of new contracts to be negotiated with their partnership owners within the next few years. The Soviet Union also has a large amount of uncommitted capacity and is becoming a key player in the U.S. market. Future production from China and Japan could also affect DOE sales.

Overview of Worldwide Enrichment Capacity

Between 1974 and 1985, DOE's share of the free world's enrichment market fell from 100 percent to about 47 percent because of foreign competition, rising costs, and other problems. As a result, DOE initiated a number of steps to cut costs and improve services with the objective of at least retaining its market share. For example, DOE modernized its gaseous diffusion plants and restructured its contracts with utilities. In 1988, DOE supplied about 85 percent of domestic utilities' enriched uranium requirements of about 9 million SWU, and about 50 percent of the free world's needs of about 25 million SWU.

Because of the slowdown in the construction of nuclear power plants, an oversupply of enriched uranium production capability exists throughout the world. Annual free world needs average about 25 million to 26 million SWU; DOE and its foreign competitors can produce almost 36 million SWU per year for sale to western customers. Table 5.1 shows current enrichment production capability.

Table 5.1: Current Enrichment Production Capacity

(Million SWU/year)	
Eurodif	10.8
Urenco	2.4
DOE	19.3
Soviet Union[a]	3.0
Others	0.2
Total	35.7

[a]DOE estimates that the Soviet Union's actual capacity is greater than 10 million SWU per year, of which about 3 million SWU per year has historically been offered to western customers.

Source: DOE.

Because of existing excess capacity and other factors, DOE's Sales and Marketing Manager expects the U.S. enrichment market to be the "battleground" of the 1990s. U.S. nuclear utilities represent the single largest market for enrichment services; plus, existing DOE contracts will begin to expire in the early 1990s. In addition, many public service commissions throughout the country are becoming much more cost conscious, increasingly directing utilities to buy the cheapest enrichment services available.

According to DOE, its actual production costs are now very competitive—about $70/SWU. However, this amount does not include general overhead, imputed interest, and a number of large fixed costs, including annual multimillion dollar payments to the Tennessee Valley Authority through 1994 for electricity contracted for but not needed and anticipated decommissioning and environmental cleanup costs. Also, since DOE cannot discriminate between buyers, officials say they cannot offer certain customers a discount price based on low marginal production costs. However, DOE has recently benefitted from favorable foreign exchange rates that increase its competitors' prices in the United States compared with the exchange rates that existed a few years ago.

As of April 1989, DOE's base price for both its foreign and domestic customers was $117 per SWU for the first 70 percent of a utility's total annual requirements. The remaining 30 percent of a utility's requirements is priced at $90 per SWU. In February 1989, DOE announced that its base price will increase to $122 per SWU in fiscal year 1990. Following the announcement, a DOE official told us that the increase is needed to keep pace with inflation. Further, he believed that foreign exchange rates allowed DOE to raise prices without a loss of market share.

EULA MAE MALONE

DOCKET # 70-3070 (formerly NRC Proj. # M-45)

My name is Eula Mae Malone. I live in the Center Springs community.

The following statement appears in the LES License Application, Env. Report Vol. 1, page 2.2-4.

> Of 51 individuals contacted, 40 responded with water use information. Of those that responded, 13 residences have private wells, 10 of which are currently used for domestic purposes in combination with and for gardening and livestock watering. Only 1 well is used for domestic purposes only.

I conducted my own survey and I have found ~~37~~ 40 homes within five (5) miles of the plantsite that have wells that are used for domestic purposes and that includes "DRINKING WATER".

The list of names is attached to this statement. You will note that I have been unable to include street addresses. That is because many of these homes are in out-of-the-way locations. If NRC would like to visit the ~~37~~ 40 homes, I will be glad to serve as your guide.

It appears that LES is not as well acquainted with our community as I am.

I respectfully request that my statement and the list of names be made a part of the official license application.

Attachment 11

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

JUN 25 1991

RECEIVED

JUN 28 1991

LA. DEPARTMENT OF
ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

Docket No. 70-3070

Louisiana Energy Services
ATTN: W. Howard Arnold
President
600 New Hampshire Avenue, N.W.
Suite 404
Washington, DC 20037

Gentlemen:

We have completed a detailed review of portions of your application, dated January 31, 1991, for a license for the Claiborne Enrichment Center. These portions include the topics of emergency planning, decommissioning funding, financial qualifications, liability insurance, and quality assurance, all of which appear to be logically separable from the remainder of the application. Based on this detailed review, we have prepared a list of questions and request for additional information on these topics. The list is enclosed. Your careful attention and response to these questions and request for additional information will enable us to continue our review of these topics.

We understand that you are preparing revisions to your environmental report and safety analysis report, at least in part based on our preliminary review of your application, the results of which were transmitted in my letter to you dated March 21, 1991, and discussed at a meeting on April 3, 1991. At the same time, we are continuing our detailed review of the remainder of the application. We are concerned that the timing of our subsequent questions and request for additional information may coincide with that of your revisions. Therefore, please keep us advised of your schedule for submittal of the revisions so that we may determine the most appropriate action to take on these subsequent questions and request for additional information.

If you have any questions about these matters, please contact Mr. Peter Loysen at (301) 492-0685.

Sincerely,

for

Charles J. Haughney, Chief
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety
Office of Nuclear Material Safety
and Safeguards

cc: Peter G. LeRoy
J. Michael McGarry III

Attachment 5

Enclosure

Questions and Request for Additional Information

EMERGENCY PLAN

1. Introduction

Please provide the names of the off-site emergency response organizations that you requested to comment on the emergency plan and the specific comments that were received.

2. 2.1.1.2 Nuclear Criticality

Although nuclear criticality may be an unlikely event, it is a postulated accident for emergency plan purposes, and any special emergency response measures for such an event should be included in the plan.

3. 2.2

Is section 2.2 missing, or is section 2.3 misnumbered?

4. 3.1.1 Alert and 3.1.2 Site Area Emergency

The rationale for setting a release of 1000 kilograms of UF_6 as the break point between an alert and a site area emergency should be established.

5. 3.2.1 Alert and 3.2.2 Site Area Emergency

How does a person judge a release to be more than 1 kilogram?; more than 1000 kilograms? Many of the topics in these sections may be more appropriately discussed in section 5.0, Emergency Response Measures. Regardless, a predetermined recovery practice (re-entry with appropriate respiratory protection) may not be appropriate, and should not be stipulated in the classification and notification of accidents.

6. 3.3 Information to be Communicated and Table 3-1 Alert/Site Area Emergency Report Form

What are "warning points/individuals," and what are their relationships to LES personnel having emergency response functions and to off-site response organizations (other than the State and Parish warning points shown in Figure 3-1)? Table 3-1 should have spaces for indicating the percent U-235 enrichment involved in an event and any protective actions recommended. Is the form to be completed once, or multiple times, for an event? What is the relationship of the form to the "UF_6 Release Incident Report" referred to in section 8.0, Records and Reports? Figure 3-1 suggests that LES will notify and coordinate exclusively with the NRC, the Louisiana Office of Emergency

Preparedness, and the Claiborne Parish Sheriff Department in an emergency. This would appear to be unrealistic, particularly if off-site protective actions are being recommended and other participating agencies need to coordinate their actions with LES.

7. 4.2 Facility Organization During Emergency Conditions

This section and Table 4.2-1 indicate that a large number of persons are needed to staff the CEC during emergency conditions. However, the operating shift crew can be as few as 4 to 6 persons (depending on the number of plant units extant), some of whom would not be qualified for emergency response positions. When the CEC is operating with a minimum crew, how is the facility organization during emergency conditions staffed?

8. 4.3 Local Off-Site Assistance to the CEC and 7.7 Verification of Emergency Telephone Numbers

Will the current telephone listing of all off-site response organizations be maintained as part of the emergency plan or the emergency plan implementing procedures, or both? There should be a more thorough discussion of the functions and services that each of the off-site response organizations is expected to perform or provide, the specific locations of these organizations, and how LES would communicate with them if the telephone lines are inoperative. There should also be a discussion of special training and equipment that local police and fire departments might need to deal with UF_6 releases and that local hospitals might need to deal with exposures to UF_6 reaction products. For the hospitals, some of the information is contained in letters in the Appendix; however, it should all be described systematically, either in section 4.3 or the emergency plan implementing procedures.

9. 4.4 Coordination with Participating Government Agencies

The authority of each participating agency, its expected role in an emergency, and its capabilities in terms of personnel and equipment, should be described.

10. 5.0 Emergency Response Measures

The emergency plan should include provisions by which members of the public and the media can obtain information during an emergency.

11. 5.3 Mitigating Actions

The steps involved and the time required to accomplish safe shutdown for each of the postulated accidents, especially those for which manual operations are necessary, should be discussed. The specific procedures for accomplishing safe shutdown may be described in the emergency plan implementing procedures.

12. 5.4 Protective Actions

The described on-site protective actions do not appear to be either appropriate or easily extended for off-site emergency response purposes. Modified or additional protective actions, including warning, sheltering, evacuation, surveys, and bioassays, for recommending to off-site emergency response organizations should be described.

13. 5.4.1 Personnel Evacuation and Accountability

The criteria that would be used to determine if evacuation is necessary and to determine the evacuation routes that personnel would follow should be discussed.

14. 5.4.2 Use of Protective Equipment and Supplies

The locations, types, and quantities of protective equipment and supplies, including respiratory protection equipment and protective clothing, should be detailed in the emergency plan implementing procedures.

15. 5.5.1.2 Exposure Guidelines

In addition to the guideline of 25 rems whole body radiation exposure, a guideline for uranium intake should be provided. The non-lifesaving operations appear to be the same as the lifesaving operations, and the radiation and chemical exposure guidelines are the same for both. Please explain.

16. 5.5.2 Decontamination of Personnel

The action levels for determining the need for personnel decontamination should be included in the specifications section of the license application. These levels, means for personnel decontamination, supplies, instruments, and equipment should also be specified in the emergency plan implementing procedures.

17. 6.4 Emergency Monitoring Equipment

In addition to the normally available equipment described, portable and transportable emergency equipment for monitoring, sampling, and surveying should also be described in this section and specified in the emergency plan implementing procedures.

18. 7.0 Maintenance of Radiological Contingency Preparedness Capability

The emergency plan should contain provisions for an annual audit by an independent person.

19. 7.3 Drills and Exercises

The biennial frequency for conducting emergency response exercises appears to be inconsistent with the annual frequency for participation stated in the September 26, 1990, letter to Homer Memorial Hospital. Please clarify.

20. 8.1 Records of Incidents

The stated standards for incident records maintenance are unclear. All such records related to emergencies should be maintained, including records of abnormal events, accidents, and equipment failures involved in incidents. Where contamination has occurred from incidents, records should also be maintained in a decommissioning records file.

21. Appendix

Please clarify the names of the organizations that submitted the undated LLEA Assistance Letters.

EXHIBIT I - DECOMMISSIONING FUNDING PLAN

1. Decommissioning Cost Estimate

The cost estimate is stated to have been derived from current experience at a Urenco facility in Europe, adjusted for United States differences, and additional information. This experience and information or a detailed cost estimate based on the use of a cost estimating table such as that included as Appendix F to Regulatory Guide 3.66, Standard Format and Content Guide for Financial Assurance Mechanisms Required for Decommissioning Under 10 CFR Parts 30, 40, 70, and 72, should be provided in support of the summary of decommissioning costs.

Contrary to Regulatory Guide 3.66, the summary of decommissioning costs includes credit for salvage value from the sale of potential assets. This item should be deleted from the cost estimate, or its inclusion justified. The decommissioning cost estimate does not include costs for the disposition of uranium hexafluoride tails, but it is stated that that LES intends to provide for the projected annual costs for disposal of any remaining uranium tails (projected annual costs of $9.5 million per year of tails production). Please explain why these costs are not included in the decommissioning cost estimate, how they are to be funded, and the basis for the annual costs.

The decommissioning cost estimate includes an item for restoration of contaminated ground but, based on section 11.8.1.2.1 of the Safety Analysis Report, contamination of the holding pond or land areas is not anticipated. Please explain this apparent discrepancy. Based on NRC experience at other licensed facilities, the holding pond and land areas will have to be remediated, and LES should include costs for their remediation and for disposal of contaminated soil from remediation.

2. Decommissioning Funding Mechanisms

The model documentation for financial instruments is essentially in accordance with Regulatory Guide 3.66. In section 5. of each of the trust funds, however, a statement should be added that no withdrawal from the Fund can exceed 10 percent of the outstanding balance of the Fund unless written NRC approval is attached. The Guide specifies that the executed financial instruments should be submitted with the license application. Therefore, the instruments should be completed and executed, including statements that they will become effective at the time LES takes possession of licensed material, and submitted along with the other documentation noted in Exhibits 3-5 and 3-6 of Regulatory Guide 3.66.

LIABILITY INSURANCE

1. The amount of liability insurance ($120 million proposed) to be purchased and maintained should be justified in terms of a reasonable evaluation of the risks required to be covered. LES needs not, however, provide an amount greater than the maximum amount available from commercial nuclear energy liability insurers which, at present, is $200 million.

2. If the form of liability insurance will be other than an effective facility form (non-indemnified facility) policy of nuclear energy liability insurance from American Nuclear Insurers and/or Mutual Atomic Energy Liability Underwriters, such form should be provided. The effective date for the policy should be no later than the date that LES takes possession of licensed material.

FINANCIAL QUALIFICATIONS

1. What is the projected budget beyond the venture phase (i.e., expected annual contributions and expenditures)?

2. For the construction phase, what are the projected equity contributions of each general partner and each limited partner? Documentation of the sources of funds for each partner should be provided (i.e., recent financial statements of those entities providing equity).

3. How will financing/capital costs be provided prior to start of operation of the facility?

4. What will be the source of funds if construction costs exceed the $800 million estimate indicated in the application? Are any contingency costs included in the $800 million estimate?

5. Has an underwriter been selected for the debt portion of financing? What is the anticipated interest rate payable, either absolutely or relatively compared to debt issues of analogous projects? Are there contingency plans if interest costs exceed estimates?

6. Since Section 13.2 of the Partnership Agreement states that the Management Committee shall not have the power to require a Partner to provide funds in excess of its agreed capital commitment, what would be the source of funds for safety and safeguards activities if operating costs are not fully covered by revenues during operation of the facility? Is there a procedure for requiring contributions for such necessary activities?

QUALITY ASSURANCE

1. SAR section 1.4 identifies contractors and agents employed by LES and briefly describes their responsibilities. Identify the System Class I activities performed and items supplied by these contractors and agents. Describe how LES will ensure the quality of these activities and items.

2. SAR section 10.0 commits LES to follow the guidelines (that is, the introduction, basic requirements, supplements, and appendices) of ASME NQA-1-1989. Similarly address ASME NQA-2-1989, the ASME NQA-2a-1990 Addenda, and the ASME NQA-1a Addenda, or justify not doing so. Consider adding a reference to NQA-2 in other SAR locations where only NQA-1 is now referenced.

3. SAR section 10.0 mentions the application of a graded quality program to some items that are not Quality Assurance Level 1. Consider whether a "graded QA program" is more correct and describe the program, its scope, and its elements.

4. SAR section 10.0 refers to reducing the "effectiveness of the QA Program requirements." Consider whether reducing the "QA Program commitments" is more correct.

5. The Facility Manager in SAR section 10.1.1 is shown as the CEC Manager on Tables 10.1-2 and -3. SAR section 10.1.3 refers to the "Facility Manager (or CEC Manager)." Clarify whether this is one or two positions (individuals).

6. SAR section 10.1.2 states that the Engineering and Contracts Manager is responsible for all aspects of the facility design, preparation for construction, construction, and preparation for operation. SAR section 10.1.4 states that the LES QA organization is responsible for verifying the quality of activities during design and construction. Clarify the fact that these responsibilities appear to overlap.

7. Clarify whether the LES QA organization's responsibilities for verifying quality (as specified in SAR section 10.1.4a, b, c, and f) extend beyond "activities" into the actual hardware, software, and documents. Also clarify or eliminate some duplication in sections 10.1.4c and f.

8. Identify the activities, plans, and programs occurring during the operations phase of the CEC that will be under the pertinent control of the

LES QA program. Examples include plant operation, maintenance, modifications, security, emergency planning, material control, and personnel training and qualification.

9. Identify the on-site and off-site organizational elements shown on Tables 10.1-1, -2, and -3, and describe the criteria for determining the size of the QA organization, including the inspection staff, during the construction phase and during the operations phase. Table 10.1-3 shows only inspectors and auditors reporting to the QA Manager. Clarify whether there will be QA engineers or specialists in the QA organization.

10. Clarify whether, during the construction phase and during the operations phase, QA personnel are involved in day-to-day activities involving safety. For example, do QA personnel routinely attend and participate in daily work schedule and status meetings to ensure that they are aware of work assignments throughout the plant?

11. Identify, by position title, the individual at the plant site responsible for directing and managing the site QA program during the construction phase. Briefly describe how this responsibility is met and interfaces are controlled considering the numerous organizations involved in the design and construction process.

12. Clarify the unclear first sentence of the fifth paragraph of SAR section 10.2 (Personnel performing ....).

13. Clarify what aspects of the QA program described in chapter 10 of the SAR will be applied to the fire detection/protection system for System Class I items.

14. Describe how the LES President regularly assesses the scope, status, adequacy, and regulatory compliance of the QA program during the design and construction of the CEC (in addition to the annual assessment described in section 10.18.2 of the SAR).

15. Clarify whether quality-related activities such as design, procurement, and site investigations, started before NRC acceptance of the QA program described in the SAR, are controlled by SAR QA commitments.

16. The fourth paragraph of SAR section 10.3 addresses "independent" design verification by a designer's supervisor. Provide a commitment that such verification will not result in the supervisor's review of his/her own design constraints, design input, or design work.

17. SAR section 11.1.2 addresses design responsibilities before the operations phase. Address design responsibilities in like fashion for maintenance and modifications during the operations phase.

18. Discuss the timeliness of as-built documentation throughout plant life.

19. Describe organizational responsibilities, including interfaces between design, procurement, and QA, for the control of purchased items during the operations phase.

20. Describe measures that ensure the procurement of spare and replacement parts to QA controls in effect at the time of procurement and to appropriate technical requirements.

21. Clarify whether the procurement of commercial-grade items for use as System Class I items will be in accordance with Generic Letter 89-02, or describe an alternative for NRC review.

22. The fourth paragraph of SAR section 10.7 indicates that approved vendors will be reevaluated annually. Briefly describe how this will be done. Also describe briefly how LES will determine the validity of certificates of conformance from suppliers.

23. Describe criteria for determining which processes are controlled as special processes. Also describe organizational responsibilities for qualifying special processes, equipment, and personnel during the operations phase.

24. If "inspection personnel" and "inspectors" in the second paragraph of SAR section 10.10 refer to the same individuals in the QA organization, the same term should be used.

25. Describe organizational responsibilities for establishing, implementing, and ensuring effectiveness of the program for calibration of measuring and test equipment during the operations phase.

26. Describe measures that ensure suitable training of individuals involved in special handling, preservation, storage, cleaning, packaging, and shipping of items during the operations phase.

27. Clarify whether changing the sequence of inspections, tests, and other activities involving safety requires the same controls as the original review and approval.

28. Expand upon or delete the term "when appropriate" in the first sentence of the second paragraph and the term "at the facility" in the second sentence of the third paragraph of SAR section 10.15.

29. Identify the position(s) or groups(s) within LES with authority to disposition nonconforming items.

30. Clarify that an audit plan that identifies audits to be performed and their schedules is prepared, maintained, and applied.

31. Clarify that audit team members have no responsibilities in the areas audited.

32. Describe measures that ensure that the LES QA program for operations is implemented at least 90 days before the receipt of licensed material at the plant site.

33. Since part of the CEC will be operating while part is being constructed, provide a commitment that the LES QA program for design, construction, and preoperational testing will continue simultaneously with the QA program for the operations phase while these activities are ongoing.

34. Clarify what records will be treated as QA records during the operations phase. QA records should include those such as operating logs (or equivalent), maintenance and modifications procedures and related inspection results, reportable occurrences, and other records required by license conditions.

35. Clarify whether field tests (in the third paragraph of SAR section 10.11) include pre-operational tests and post-maintenance/modifications tests to demonstrate plant operability and to identify any conditions adverse to quality/safety, as well as operational tests to verify acceptable operation.

36. Clarify that the measuring and test equipment controls described in SAR section 10.12 apply to process-related instrumentation and controls having safety significance.

DEPARTMENT OF NATURAL RESOURCES

LOUISIANA GEOLOGICAL SURVEY

University Station, Box G • Baton Rouge, Louisiana 70893-4107 • (504) 388-5320

September 23, 1991

Ronald D. Anderson
P. O. Box 72
Homer, LA 71040

Dear Mr. Anderson,

I have performed a precursory review of documents relating to the geologic and hydrologic data for Louisiana Energy Services, Uranium Enrichment Facility to be located near Homer, LA as requested in your letter dated 8-15-91 and addressed to Martha Swan, Deputy Secretary of DNR. I want to emphasize that this is a precursory review because of the time limitations on your part and my own availability. With this in mind, I offer the following observations.

Law Engineering Project No. HT-3815-90G, Task 80 - Geologic and Seismic Report. The discussion of the site geology appears detailed and thorough, but with key elements apparently overlooked.

1) Page 1: *All known geologic features such as .... mapped surface faults .... have been evaluated and documented. A field geologic survey .... was also completed.* By whom, when, and how? Someone not familiar with Louisiana geology may be at a disadvantage by not realizing the peculiarities of the region. Side-Looking Airborne Radar (SLAR) exists over all of north Louisiana; no reference was made as having utilized these data. Extensive surface faulting exists in the vicinity of Homer, LA.

2) Site location as indicated in Fig 1-3, Fig 2-1, and Fig 2-5 differs in each case with the latter figure placing the Site within the Athens Field.

3) Page 7, Physiography: The lake on the eastern edge of the proposed Facility implies a shallow water table for the area.

4) Page 7, Structure: A short discussion is offered regarding Salt Pillows, but no mention of Turtle structures (both features appear in Fig 1-3). No analysis is offered regarding implications for faulting around the perimeter of such features and whether such zones of weakness extend to the surface. If such faulting has been determined as not penetrating the surface, what procedure was used to make such a determination?

5) Page 9: The discussion of the shallow subsurface stratigraphy implies shallow permeable units (*....springs percolating from the sides of hills....; .... almost pure silt in the upper 20 feet*; numerous sand units mentioned).

6) Page 12, Boundary Fault Systems: An accurate map depicting the specific locations of the boundary fault systems relative to the proposed Facility would be more meaningful if the map scale were on the order of that used in Fig 2-1. This is particularly important regarding the Rodessa Fault System since it appears to be arcuate and present northeast of the Facility.

Attachment 23

No analysis is offered regarding the ramifications of having a large scale fault system in close proximity to the Facility.

7) The proposed Facility lies in an area of moderate aquifer recharge potential (Aquifer Recharge Atlas, Map #5, LA Geol Survey, 1988).

8) Various technical statements within the text are not referenced with respect to origin and therefore very difficult to verify factual content.

Law Engineering Project No. HT-3815-90G, Task 90 - Geotechnical Exploration Report.

1) Page 1, Report Summary: General description of surface soil conditions suggests permeable materials comprising sands and silts beneath which is approximately 20 ft. of silty clay, the latter expected to exhibit lower permeabilities.

2) Page 1: Ground Water Table will be approximately 10 ft. below the surface site grade of 326 ft.

3) Page 17, Process Area: The following observations regarding relative permeability can be derived from the various stratum descriptions: Stratum 1, 4, 5 -- high permeability; Stratum 3A, 3B -- moderate permeabilities; Stratum 2, 6 -- lower permeabilities.

4) Fig 4-6, -7, -8, -9, -10, -11, -12: Interpretational differences exist on the geologic cross sections; cross sections suggest the presence of sand channels; much more descriptive detail is a available on the boring log than is depicted on the cross sections; no attempt made to provide an analysis or interpretation of cross sections relative to the Site, contamination potential, or preventive measures; suspect the subsurface geology is more complex than indicated.

5) Subsurface soil profiles A-A' through G-G' depict specific cross sectional profiles, but no 3-dimensional interpretation; structure and isopach maps missing; potentiometric surface map missing; no attempt to define the limiting parameters within the confining units.

6) Would suggest extending the Site and Subsurface Conditions investigation beyond the confines of the proposed Facility such that local geologic parameters can be correlated to and integrated with area-wide geologic and hydrogeologic conditions. This would involve additional borings and to greater depths.

While I do not profess to be a design engineer, I offer the following observations regarding general assumptions used to compile the Design Section of the document.

Duke Engineering and Services, Inc. - Design Calculations. In reference to the Hold-Up Pond and small dam on the site:

1) What contingency plan exists should the Hold-Up Pond have insufficient capacity during a heavy rain storm? This spring was abnormally wet with considerable local flooding.

2) Pond design assumed 50% of the yard will contribute to the sediment load; applicant may wish to assume a 100% contribution and design accordingly for the extra margin of safety.

3) Suggest designing into the equation the high volume of surface water available as runoff during periods of hurricane/tropical storm passover.

4) What level of contaminants are in the sediments contained within the Hold-Up Pond? How will they be removed and disposed of? How will they be prohibited from migrating into the subsurface stratigraphic units?

5) What effect will the hydraulic head produced by the Hold-Up Pond have on the underlying stratigraphic units, ground water table, and flow direction?

6) References cited:

Rainfall Frequency Atlas of US, Tech Paper No. 40 -- Suggest using more specific, Louisiana data and avoid generalities.

Urban Hydrologic ....., 1975 -- Is there a more recent and Louisiana-specific reference?

This information is provided to you at your request as a service by the Louisiana Geological Survey (LGS). LGS does not take or imply to take a position in this matter, but acts as a disinterested third party operating upon the conviction that the best-available scientific data yields informed decisions. I hope this information is of help.

Sincerely,

Bradford C. Hanson
Sr. Research Geologist

cc Martha Swan
Dianne Curran
John Johnston

Police Jurors Listen To Protests From Residents Near Proposed Plant Site

Residents of the Forest Grove and Cedar Springs Communities crowded into the small meeting room of the Claiborne Parish Police Jury during the group's regular monthly meeting last week, to protest closing the Forest Grove Road if and when the jury is requested to do so by Louisiana Energy Services (LES).

Last year, local jurors signed a resolution agreeing to close and relocate the Forest Grove Road, when and if they are requested to do so by LES, a consortium of companies that selected a site near the communities to build a proposed uranium enrichment plant.

Roy Mardis, spokesman for Forest Grove/Cedar Springs residents, told jurors they are opposed to the road being closed. He said the road, which connects the two communities, is heavily traveled by families living on both sides.

According to Mardis, if the road is closed, it will cause hardships on families, residents who car-pool to work, sports-related activites that involve children living in both communities and church services, that are sometimes held at Center Springs and held at Forest Grove at other times. He also noted that the road is a school bus route.

Jury President W.T. "Bill" Bailey told residents that, at this time, jurors have only signed a resolution agreeing to close the road and relocate it, when and if the police jury is requested to do so by LES officials.

He said, at this time, no new route for the road has been established, but he assured residents that their "feelings will be top priority in relocating the road."

Bailey told residents that the road will probably remain open for about two more years, adding that the police jury has not yet signed a resolution to close the road, only to relocate the road if requested to do so by LES.

ing to keep the road open. We're not asking for the road to be fixed," Mardis said.

In response to a question regarding the legalities of closing the road, Assistant District Attorney Mike Ruddick explained that before the jury can close any road, it must be published three times in a local newspaper that a public hearing will be held concerning the road.

Then, after the public hearing is held and residents are allowed to voice their opinions concerning closing the road, the police jury will vote whether or not to close the road.

If the jury votes to close the road, residents will then have the option of using the court system.

"A resolution to close the road has not been passed--just a resolution to relocate the road if necessary," Bailey said, stating, "the vast majority of the people in this parish want the plant."

Mardis also said residents of the area are "not satisfied with the answers they have been getting," and said they feel they are "not being fairly represented."

Bailey said, as of yet, funding for relocating the road has not yet been established. "If and when the time comes that we need to relocate the road, we need to appoint a committee, including the road superintendent," juror of the area (District 8) and other jurors, to survey relocation possibilities, the president stated.

He also told residents that the road will be relocated before the Forest Grove Road is closed.

In other action, jurors voted to call a one-cent sales tax election for April 7 to fund garbage pick-up in rural parts of the parish, excluding Homer and Haynesville.

Currently, residents pay a one-

Please Turn To Page 3

RESIDENTS OF THE FOREST GROVE and Cedar Springs communities met with members of the Claiborne Parish Police Jury last week during the regular meeting of the jury. Residents voiced their concerns about closing the Forest Grove Road if and when

in June to locate a uranium enrichment facility in Claiborne Parish. In November of last year, LES officials announced that a site had been selected for the facility—in the Forest Grove area. Jury President W.T. "Bill" Bailey assured residents that if the road is clos-

Attachment 12

MISS ESSIE YOUNGBLOOD

July 30, 1991

DOCKET # 70-3070 (Formerly NRC Proj. # NL-45)

My name is Essie Youngblood. I live within two (2) miles of the proposed plantsite. I am a full grown senior citizen, a retired school teacher.

The purpose of this meeting is to express local environmental concerns. I consider black human beings as much a part of the environment as land, air and water. The uranium enrichment plant will be located in the dead center of a rural black community consisting of over 150 families.

I have read the Environmental Report included in the 15-volume NRC License Application and not one word is written about the fact that the plant will threaten and disrupt a rural black community that has been in existence over 100 years. To the contrary, the report goes to great length to emphasize how sparsely the area is populated.

There are many older people who live within the immediate area of the plantsite. Some of the elderly live alone or others spend the working hours alone while the young people are at work. I have read the Safety Analysis Report which is included in the Application that there is no mention of an Emergency Evacuation Plan should a Core, Oklahoma type accident occur at the Plant. The older people would be left at the mercy of the prevailing wind.

The residents of our community have never been consulted as to whether or not we wanted the plant in our midst. This fact was demonstrated when on November 12, 1989 the Police Jury passed a resolution agreeing to close or reroute Forest Grove Road. Our community was not consulted and when we (representatives from several communities) attended the police jury meeting to voice our concern, we were assured that the vast majority of the people wanted the plant, thusly revealing the fact that our community is expendable, because the establishment favors the plant.

If there is one ounce of human decency in the NRC or the IES, the IES uranium enrichment plant will not be licensed to be built in the heart of our black, minority neighborhood that is adamantly opposed to it.

I respectfully request that my statement be made a part of the IES application file.

Attachment 13

R E S O L U T I O N

WHEREAS, Louisiana Energy Services has requested the assurance of the Claiborne Parish Police Jury that the Claiborne Parish Police Jury will close and relocate, if necessary, that portion of the Parish Road situated on the LeSage property or the Emerson Property, whichever property is applicable, to accomplish the needs of Louisiana Energy Services, and

WHEREAS, it is the intention of the Claiborne Parish Police Jury to cooperate with Louisiana Energy Services to close, or relocate if necessary, the said road.

NOW, THEREFORE BE IT RESOLVED, that the Claiborne Parish Police Jury hereby agrees to do whatever is legally necessary by due process to close or relocate the said road.

Upon motion by Tommy Davidson, duly seconded by W. J. Sherman and carried, the above and foregoing resolution was duly adopted by the Claiborne Parish Police Jury in regular session convened on November 9, 1989.

* *

I, E. N. Hardy, Jr., Secretary of the Claiborne Parish Police Jury do hereby certify that the above and foregoing is a true and correct copy of a resolution adopted by the Claiborne Parish Police Jury in regular session convened on November 9,1989, at which meeting a quorum was present.

Given under my official signature and seal of office on this the 12th day of November 1990.

(S E A L)

E. N. Hardy, Jr., Secretary
Claiborne Parish Police Jury

Police Jury Changes Polling Place, Accepts Bids

At the request of election commissioners and Betty Gladney, Claiborne Parish Clerk of Court, members of the Claiborne Parish Police Jury voted to change the polling place of voters in Ward 2, Pct. 1, Gordon, from the Old Community Center there to the Fair Building in Haynesville, effective next year.

During the regular monthly meeting of the jury, Ms. Gladney, speaking on behalf of commissioners in the voting precinct, requested that the polling place be changed.

She told jurors the building has no bathroom facilities, no telephone and is completely isolated. She said commissioners have talked with voters in the precinct and the majority of voters are agreeable to moving the polling place.

She said there are numerous instances in the parish where voters residing in one precinct are casting ballots in other precincts. However, their votes are counted in the precincts where they reside.

Jack Price, juror from Haynesville, said election commissioners and other workers in Haynesville precincts are in favor of the move. "Mayor Crocker (Haynesville's mayor) said it would be fine, we'd be glad to have them," Price said.

Currently, $100 rent is paid on the building, $50 is paid for a deputy custodian and $50 is charged for rent on a portable bathroom at the facility when elections are held.

The polling place will not be changed for the Nov. 18 election and voters in Gordon will still vote in the Old Community Center.

Also during the November meeting, jurors passed a resolution at the request of Louisiana Energy Services (LES). The request was that the police jury take whatever action necessary to close or relocate the Forest Grove Road to accommodate the new uranium enrichment facility that will be constructed in the parish.

Jurors opened bids from various companies to purchase several different types of culverts and used [illegible] cars.

GUARDIAN JOURNAL 11/16/89

Police Jurors Listen To Protests From Residents Near Proposed Plant Site

Residents of the Forest Grove and Cedar Springs Communities crowded into the small meeting room of the Claiborne Parish Police Jury during the group's regular monthly meeting last week, to protest closing the Forest Grove Road if and when the jury is requested to do so by Louisiana Energy Services (LES).

Last year, local jurors signed a resolution agreeing to close and relocate the Forest Grove Road, when and if they are requested to do so by LES, a consortium of companies that selected a site near the communities to build a proposed uranium enrichment plant.

Roy Mardis, spokesman for Forest Grove/Cedar Springs residents, told jurors they are opposed to the road being closed. He said the road, which connects the two communities, is heavily traveled by families living on both sides.

According to Mardis, if the road is closed, it will cause hardships on families, residents who car-pool to work, sports-related activites that involve children living in both communities and church services, that are sometimes held at Center Springs and held at Forest Grove at other times. He also noted that the road is a school bus route.

Jury President W.T. "Bill" Bailey told residents that, at this time, jurors have only signed a resolution agreeing to close the road and relocate it, when and if the police jury is requested to do so by LES officials.

He said, at this time, no new route for the road has been established, but he assured residents that their "feelings will be top priority in relocating the road."

Bailey told residents that the road will probably remain open for about two more years, adding that the police jury has not yet signed a resolution to close the road, only to relocate the road if requested to do so by LES.

"The people of the community ing to keep the road open. We're not asking for the road to be fixed," Mardis said.

In response to a question regarding the legalities of closing the road, Assistant District Attorney Mike Ruddick explained that before the jury can close any road, it must be published three times in a local newspaper that a public hearing will be held concerning the road.

Then, after the public hearing is held and residents are allowed to voice their opinions concerning closing the road, the police jury will vote whether or not to close the road.

If the jury votes to close the road, residents will then have the option of using the court system.

"A resolution to close the road has not been passed–just a resolution to relocate the road if necessary," Bailey said, stating, "the vast majority of the people in this parish want the plant."

Mardis also said residents of the area are "not satisfied with the answers they have been getting," and said they feel they are "not being fairly represented."

Bailey said, as of yet, funding for relocating the road has not yet been established. "If and when the time comes that we need to relocate the road, we need to appoint a committee, including the road superintendent," juror of the area (District 8) and other jurors, to survey relocation possibilities, the president stated.

He also told residents that the road will be relocated before the Forest Grove Road is closed.

In other action, jurors voted to call a one cent sales tax election for April 7 to fund garbage pick-up in rural parts of the parish, excluding Homer and Haynesville.

Currently, residents pay a one-

Please Turn To Page 3

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SHREVEPORT TIMES

FRIDAY, APRIL 12, 1991

METRO

The Times

Churches reject gift from 'enemy'

Nuclear plant's checks refused by Homer congregations

By CURTIS D. HEYEN
The Times

HOMER — Two Homer area churches do not want money from an international partnership that plans to build a uranium-enrichment plant in their back yards.

Louisiana Energy Services attempted to donate $500 each to Forest Grove and Center Springs Christian Methodist Episcopal churches. But the combined congregations of about 147 people rejected the offer.

"For us to accept checks from somebody who we consider our enemy would be a conflict of interest," said Forest Grove secretary Alean Jones. "If we had cashed the checks, no sooner than they had cleared the bank they would have publicized it and said we are friends, which we are not."

Louisiana Energy Services has applied for a federal license to build and operate the uranium-enrichment plant. The Nuclear Regulatory Commission has given the document a preliminary review. The next step is announcement of how the NRC will handle the licensing process.

Timber is being cleared at the proposed plant site five miles northeast of Homer on Claiborne Parish Road 39, just off state Highway 9 — within a mile of Center Springs and two miles of Forest Grove.

The Rev. E.D. McWoodson of Minden, pastor of both churches, said he would have kept the money if it had been his decision to make.

"They do what they want," he said. "I did not have anything to do with it."

He added: "I have never in my whole life turned down a contribution to the church."

Louisiana Energy Services spokeswoman Mary Boyd said the offer was made "in the spirit of wanting to be good citizens in the parish."

The partnership has donated more than $10,000 to various Claiborne Parish groups since the plans for the plant were announced in June 1989, Boyd said. About $8,000 went to 22 community service agencies through the parish industrial development committee before Louisiana Energy Services opened its Homer offices in September, she said.

Among recipients, said Boyd: Homer High School FBLA chapter, a group of students who attended an Alabama space camp, the Claiborne Parish Fair, Desert Storm and Desert Shield support efforts, North Louisiana Uplands Film Commission, Homer American Legion post, Claiborne Academy and advertisements in school publications.

LETTERS TO THE EDITOR

Dear Editor:

What will it take for our town to see what a group of outsiders is doing to our town, families and friends. In the past 18 months or better we have witnessed how big spenders with big bucks can come into a town, and make friends fast.

On March 23, 1991, Forest Grove, Center Springs, Antioch and other churches were at Forest Grove for an evening of praise and worship to God and Christ. During this time one of our leaders took the opportunity to announce that he had two checks for Forest Grove and Center Springs for $500.00 each.

The church was full with ladies in red and men in black. To see the look on their faces when they realized that L.E.S. or L.E.A. (one in the same) had entered this place of worship in the form of a letter and checks of donations, caused a look of dismay, but God still received his praise.

Be it know Elder Edward Fuller is not speaking on behalf of Forest Grove or Center Springs concerning any L.E.S. plant issues.

On Sunday, the lesson was Freedom and Responsibility taken from 1 Corinthians 8:1-11:1 with the key verse being "take heed lest by any means this liberty of yours become a stumbling block to them that are weak" (1 Corinthians 8:9).

In our lesson we learned there is danger of causing someone to violate his or her own conscience, and any behavior which goes against the conscience is destructive.

So the strong Christian must determine not to offend another Christian by participating in that which is considered wrong by the weak Christian.

The basic lesson we needed to learn was this:

There are time when Christians must accomodate themselves to the prejudices, weaknesses and scruples of other Christians.

Paul would say "don't flaunt your freedom in the face of the saint who is young for he may be tempted to imitate you."

"It is a serious matter to sin against another Christian to do so is to sin against Christ." – Acts 9:4

It is well known that Forest Grove and Center Springs are opposed to the location of the Claiborne Enrichment Plant and for that organization (L.E.S.) to offer us a donation (brought by our Elder) was inappropriate and uncalled for.

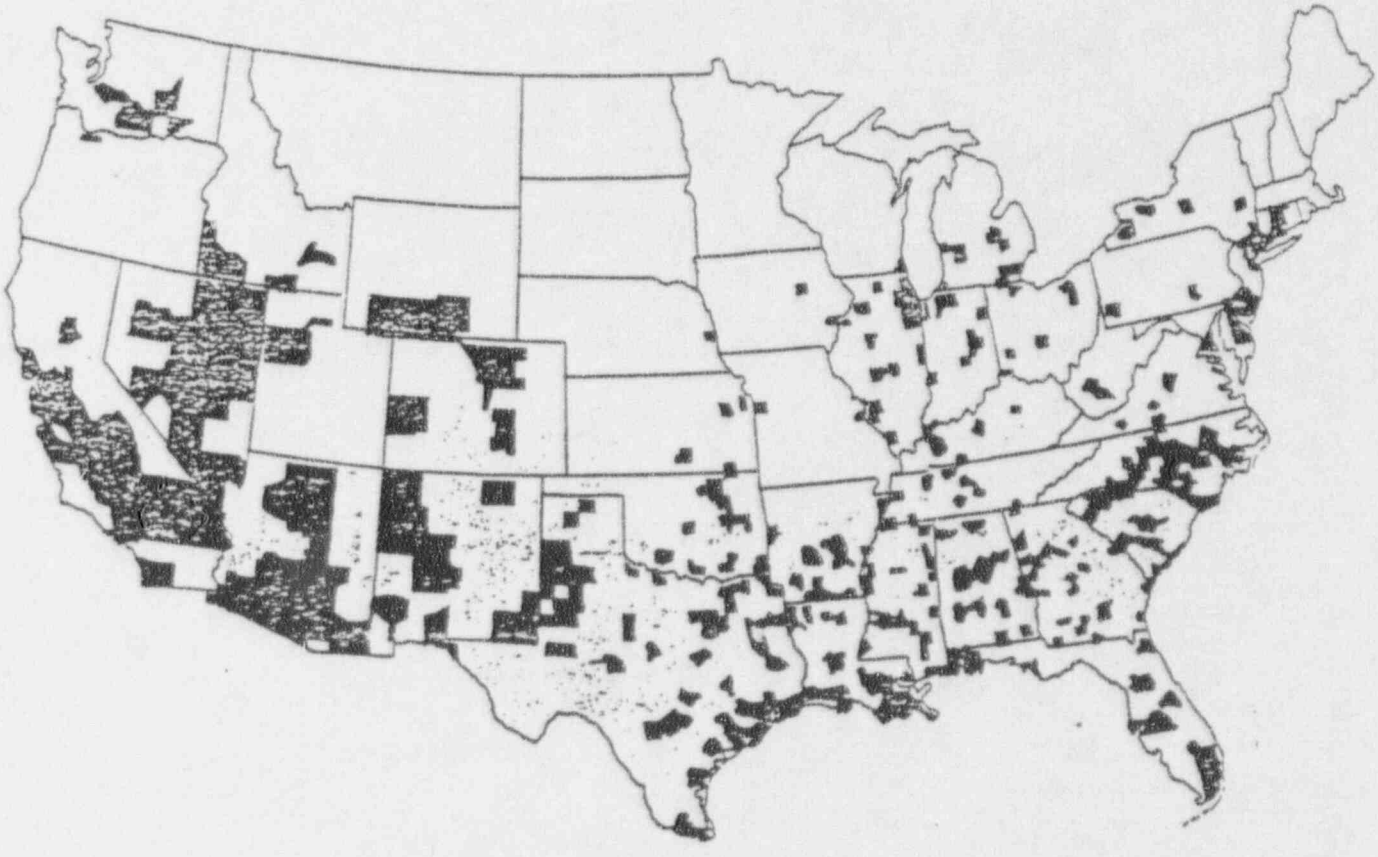
We reject the donation for it is a conflict of interest and are returning both checks.

Sincerely,
Roy Mardis

EDITORS' NOTE: Letters To The Editor do not necessarily reflect the opinions of THE GUARDIAN-JOURNAL.

TOXIC WASTES AND RACE
In The United States

A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites



COMMISSION FOR RACIAL JUSTICE
United Church of Christ

Attachment 14

Guidelines and Principles

for

Social Impact Assessment

Prepared by

The Interorganizational Committee on Guidelines

and Principles for

Social Impact Assessment

December 14, 1993

DR. ROBERT D. BULLARD
CENTER FOR AFRO-AMERICAN STUDIES
UNIVERSITY OF CALIFORNIA, LOS ANGELES
LOS ANGELES, CA 90024

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE CONSTRUCTION AND OPERATION OF CLAIBORNE ENRICHMENT CENTER, HOMER, LOUISIANA

My comments on the Draft Environmental Impact Statement for the Construction and Operation of the Clairborne Enrichment Center, Homer Louisiana will address the elements of environmental equity. Environmental equity is distilled into three broad categories: procedural, geographic, and social equity.

Procedural equity refers to the "fairness" question: the extent that governing rules, regulations, evaluation criteria, and enforcement are applied uniformly and in a nondiscriminatory way. Procedural equity might involve nonscientific and undemocratic decision making, exclusionary practices, nonrepresentativeness of samples, subjects, and opinion leaders selected in community rating and site selection scoring systems.

Geographic Equity refers to location and spatial configuration of communities and their proximity to environmental hazards, noxious facilities, and locally unwanted land uses (LULUs) such as landfills, incinerators, sewer treatment plants, lead smelters, refineries, and uranium enrichment plants. Because of their geographic and spatial configuration, some communities (i.e., rural areas, sparsely populated areas, Native American reservations, urban ghettos and barrios, the southern United States, Third World nations, etc.) are more vulnerable than others.

Social equity assesses the role of sociological factors (race, ethnicity, class, culture, life styles, political power,

organization, legal incorporation, etc.) on environmental decision making. Poor people and people of color often work in the most dangerous jobs, live in the most polluted neighborhoods, and their children are exposed to all kinds of environmental toxins on the playgrounds.

In the real world, all people, communities, and regions are not created equal. Some communities and interests are more equal than others. Unincorporated communities of color are vulnerable to a "triple jeopardy" in that they are often rural, poor, and politically powerless against industrial interests. Unequal interests and power arrangements have allowed poisons of the rich to be offered as short-term remedies for poverty of the poor. This scenario plays out in the United States, and in the proposal to site Clairborne Enrichment Center, where low-income and people of color communities are disproportionately impacted waste facilities and "risky" technologies.

Many facility siting decisions---as in the case of the proposed Clairborne Enrichment Center (CEC)---distribute the costs in a regressive pattern, while providing disproportionate benefits for individuals who fall at the upper end of the socioeconomic spectrum.[1] In the United States, race has been found to be

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[1] See Robert D. Bullard, "Solid Waste Sites and the Black Houston Community." Sociological Inquiry 53 (Spring, 1983): 273-288; United Church of Christ Commission for Racial Justice, Toxic Wastes and Race in the United States (New York: United Church of Christ, 1987); Dick Russell, "Environmental Racism." The Amicus Journal 11 (Spring, 1989): 22-32; Eric Mann, L.A.'s Lethal Air: New Strategies for Policy, Organizing, and Action (Los Angeles: Labor/Community Strategy Center, 1991); Leslie A. Nieves, "Not in Whose Backyard? Minority Population Concentrations and Noxious

independent of class in the location of municipal landfills and incinerators,[2] abandoned toxic waste dumps,[3] and cleanup of Superfund sites.[4]

Environmental racism is real. **Environmental racism refers to any policy, practice, or directive that differentially affects or disadvantages (whether intended or unintended) individuals, groups, or communities based on race or color.**[5] Environmental racism combines with public policies and industry practices to provide **benefits** for whites while shifting **costs** to people of color.[6]

Facility Sites." Paper presented at the Annual Meeting of the American Association for the Advancement of Science, Chicago (February, 1991); D. R. Wernette and L. A. Nieves, "Breathing Polluted Air: Minorities are Disproportionately Exposed." EPA Journal 18 (March/April, 1992): 16-17; Robert D. Bullard, "In Our Backyards: Minority Communities Get Most of the Dumps." EPA Journal 18 (March/April, 1992): 11-12; Bryant and Mohai, Race and the Incidence of Environmental Hazards (Boulder, CO: Westview Press, 1992), pp. 163-176.

[2] Bullard, "Solid Waste Sites and the Black Houston Community."pp. 273-288; Robert D. Bullard, Invisible Houston: The Black Experience in Boom and Bust (College Station, TX: Texas A&M University Press, 1987), chapter 6; Robert D. Bullard, "Environmental Racism and Land Use." Land Use Forum: A Journal of Law, Policy & Practice 2 (Spring, 1993): 6-11.

[3] United Church of Christ Commission for Racial Justice, Toxic Wastes and Race; Paul Mohai and Bunyan Bryant, "Environmental Racism: Reviewing the Evidence," pp. 163-176.

[4] Marianne Lavelle and Marcia Coyle, "Unequal Protection," National Law Journal, September 21, 1992, pp. S1-S2.

[5] Robert D. Bullard, Confronting Environmental Racism: Voices from the Grassroots (Boston: South End Press, 1993), chapter 1.

[6] See Commission for Racial Justice, Toxic Wastes and Race in the United States; Robert D. Bullard, ed., Confronting Environmental Racism: Voices from the Grassroots, chapter 1; Robert D. Bullard, "The Threat of Environmental Racism," Natural Resources & Environment 7 (Winter, 1993): 23-26; Bunyan Bryant and Paul

Environmental racism is reinforced by government, legal, economic, political, and military institutions.

The same forces that drive toxic waste incinerator proposals to Kettleman City and East Los Angeles (CA), Emelle (AL), Southside Chicago and Sauget (IL), and Alsen (LA) also operate in pushing proposals for low-level nuclear storage facilities or monitored retrieval storage (MRS) proposal on Native American Reservations, operate in targeting a uranium enrichment plant proposal for one of the poorest regions of the country and a regions where African Americans are significantly overrepresented in the population---the South and Clairborne Parish, Louisiana.

The southern United States is this nation's Third World where people of color, low-income, and working-class communities have become the "dumping grounds." The findings in Dumping in Dixie: Race, Class, and Environmental Quality show that African Americans in the southern states have borne a disparate burden in the siting of hazardous waste landfills and incinerators, lead smelters, petrochemical plants, and a host of other noxious facilities.[7] The

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Mohai, eds., Race and the Incidence of Environmental Hazards, pp. 163-176; Regina Austin and Michael Schill, "Black, Brown, Poor and Poisoned: Minority Grassroots Environmentalism and the Quest for Eco-Justice." The Kansas Journal of Law and Public Policy 1 (1991): 69-82; Kelly C. Colquette and Elizabeth A. Henry Robertson, "Environmental Racism: The Causes, Consequences, and Commendations." Tulane Environmental Law Journal 5 (1991): 153-207; Rachel D. Godsil, "Remedying Environmental Racism." Michigan Law Review 90 (1991): 394-427.

[7] Robert D. Bullard, Dumping in Dixie: Race, Class and Environmental Quality (Boulder: Westview Press), pp. 25-44; Robert D. Bullard, "Ecological Inequities and the New South," Black Communities under Siege," Journal of Ethnic Studies 17 (Winter 1990): 101-115.

selection of the CEC site in Clairborne Parish conforms to this pattern.

The Draft Environmental Impact Statement (DEIS) failed address many "social impacts" concerns required under the National Environmental Policy Act (NEPA) and "equity impacts" (nondiscriminatory effect) covered under Title VI of the 1964 Civil Rights Act.

Environmental justice and equity concerns have received the attention of the U.S. Civil Rights Commission. In its September, 1993 report, the Louisiana Advisory Committee to the U.S. Commission on Civil Rights reinforced what many people already knew: African American communities (along the lower Mississippi River chemical corridor) bear a disproportionate health and environmental burden from industrial pollution.[8]

Health concerns raised by residents and grass-roots activists who live in small towns such as Alsen, St. Gabriel, Geismer, Morrisonville, Wallace, and Lions (Louisiana) have not been adequately addressed by local, state, and federal agencies. Many of these unincorporated communities were established by former slaves and predate the petrochemical plants and toxic waste facilities that moved next-door.

The mission of the Nuclear Regulatory Commission (NRC) was never designed to address environmental policies and practices that

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[8] Louisiana Advisory Committee to the U.S. Commission on Civil Rights, The Battle for Justice in Louisiana. . . . Government, Industry, and the People (Kansas City: U.S. Commission on Civil Rights, Central Regional Office, September 1993).

result in unfair, unjust, and regressive outcomes. However, environmental equity concerns must be addressed if we are to have just and fair siting decisions. Without public input, the NRC and private industry such as Louisiana Energy Services (LES) are not likely to ask the questions that go to the heart of environmental injustice: What groups are most affected? Why are they affected? How can the problem be prevented?

Residents of two African American communities---Forest Grove and Center Springs---want answers as to why the nation's first privately-owned uranium enrichment plant is slated to be built so close to their communities. Forest Grove (founded just after slavery in 1866) is just 1.25 miles from the proposed CEC facility. Center Springs (founded in 1910) is just one quarter mile from the proposed facility.

Invisible Communities. There are clearly ethical, economic, and legal issues involved in the siting of the LES facility. First of all, the Clairborne Enrichment Center (CEC) is located "approximately 8 kilometer (km) (5 miles) from Homer" (p. 1--2). The CEC is also located between two African American communities of Forest Grove and Center Springs. As far as the DEIS is concerned, these two communities do not exist---they are "invisible" communities.[9] Because of their invisibility, they could not have consented to host the facility. The socioeconomic and local community characteristics of Homer were detailed in the DEIS---not

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[9] For an in-depth discussion of this phenomenon see Robert D. Bullard, Invisible Houston: The Black Experience in Boom and Bust (College Station, TX: Texas A&M University Press, 1987).

that of Forest Grove and Center Springs, communities closest to the proposed site.

Race and Class in Claiborne Parish. African Americans comprised 12 percent of the U.S. population and 30.8 percent of Louisiana's population in 1990. The racial composition of Clairborne Parish was 53.43 white, 46.09 African American, 0.16 percent American Indian, 0.07 percent Asian, 0.23 Hispanic, and 0.01 percent "other" in 1990. Because of out-migration of whites since the 1990 census, African American make up nearly half of Claiborne Parish population in 1994.

The CEC facility is proposed for a state where the percent African American is two and a half time greater than the percent African American in the nation. The percent African American in Clairborne Parish is 4 time greater than the percent African American in the country. Center Springs had approximately 100 inhabitants (99 percent African American) in 1990. The population of Forest Grove was approximately 150 (100 percent African American) in 1990.

Clairborne Parish is poorer than the surrounding parishes. According to the DEIS, the parish per capita earnings was only "about $5,800 per year. . . compared to a national average of almost $12,800" (3--108). Clairborne Parish is one of the poorest regions of the United States.

Unequal Benefits and Burdens. Should two small African American communities bear a disproportionate burden for this nation's domestic energy shortfall? The DEIS reports that the CEC

would produce about 17 percent of the estimated U.S. requirement for enrichment services in the year 2000 (p. 1--5). Too often low-income and people of color communities have borne a disproportionate burden for the nation's energy and environmental policies (costs tend to be regressive), while whites and those communities that fall at the upper end of the income spectrum receive greater benefits (jobs, increased tax base, new construction, residential amenities, etc.).

Clearly, existing Clairborne Parish residents will receive fewer economic benefits (high paying jobs and home construction) than those who relocate to the area or commute to the proposed facility. the DEIS predicts that it is unlikely that the project will get its skilled work-force from the nearby population, particularly Clairborne Parish population. Moreover, CEC staff is expected to buy homes "outside of the parish area" (p. 4--33).

The DEIS sums up the socioeconomic impact of a "no action alternative" on the proposed CEC in the following passage:

> "The socioeconomic impact of a no-action alternative is a continuation of the depressed economic conditions in this area an a likely out migration of skilled and higher income workers. This region would continue to depend on its current commercial, industrial, and agricultural base." (p. 4--74)

Given the nature of the proposed project (for some residents the CEC would bring some unacceptable risks) and work-force projections (higher-end jobs going to commuters and those who relocate outside of Clairborne Parish, the CEC facility might have the opposite effect of that predicted. The existing Clairborne Parish residents who are better educated and more skilled (and who

receive jobs at the facility) will likely move to outlying parishes. This type of out migration is fairly common and generally results in a fairly predictable pattern of "white flight." Because mobility options are greater for whites than for blacks (at every income), the project will likely accelerate the Clairborne Parish's transition from majority white to majority black.

Social Costs. Social costs include noise, public safety, mental stress, physical health, land use, and transportation impacts on nearby residents. Social costs will be localized to nearby residents (those closest to the facility such as Forest Grove and Center Springs), while benefits are more dispersed (jobs and other economic benefits) for some Clairborne and other parish residents, and the workers who relocate to the area or commute to the facility.

Property Values. Several key questions arise regarding property values and housing equity. What impact will the proposed project have on property values, especially those owners who live closest to the facility? Will the impact on property values be the same (positive or negative) for the community residents who live in Forest Grove and Center Spring compared to the property values of owners who live in Homer and other outlying areas? It is unlikely that the property values of Center Springs and Forest Grove will be enhanced by the facility. The value of their homes will likely decrease with if the facility is approved.

The DEIS identifies Clairborne Parish residents as the ones

"likely to fill the lower end of the skill and pay scale jobs" and occupy housing units where there already is "an over supply of lower quality and older homes?" (p. 3--103). Greater housing benefits are likely to accrue to commuters not existing residents. Center Springs and Forest Grove would be clear "losers" in this plan.

Labor Pool. Similarly, economic benefits (jobs and pay scale) appear to be regressive---with existing residents taking the jobs at the "lower-end of the skill and pay scale" and "an increasing number of migrants will take the jobs" at the higher-end (p. xxii). The very upper-level jobs (skilled health physicists, chemical engineers, etc.) will likely come from other parts of the United States. It is unlikely that these individuals will relocate to Center Springs, Forest Grove, or the existing communities that are closest to the proposed facility.

Clairborne Parish does not have a shortage of unskilled workers. With a dropout rate of 47 percent, "job training and employment is likely to be awarded to an available group of currently more qualified and more educated individuals. Lesser qualified individuals in the area may obtain jobs in the cafeteria, administration, and support services" (p. xxii). The CEC will not create an economic rebirth for the large number of parish residents who fall at the lower end of the economic spectrum.

Waste Disposal. The DEIS indicates that the CEC will generate non-hazardous, radioactive, hazardous, and mixed wastes. It also indicates that the wastes will be collected, inspected, volume-

reduced, and transferred to treatment facilities or disposed of at authorized waste disposal facilities. The DEIS failed to specify where the hazardous wastes, i.e., solvents, thinners, phenol mercury, sulfuric acid, lead, pesticides, etc., will be disposed (p. 2--13). Will the hazardous wastes go to the nearby licensed landfill in Monroe, LA (Ouachita Parish) where over 60 percent of the nearby residents are African Americans? Or will the wastes be shipped south to the licensed facility in Alsen, LA (Rollins Environmental Services) where over 90 percent of the community residents are African Americans?

Site Selection Process. Did anyone poll the residents of Center Springs or Forest Grove about how they felt about the CEC facility? One of the site selection criteria states, "the facility should be developed in a locale where it would be considered an asset to the community" (p. 2-39). Again, the two African American communities were defined out of the process. These two communities (located just one quarter mile and one and one-fourth mile from the proposed facility) did not give their consent to host the CEC facility. The "Homer" site score (a misnomer since the site is located some 5 miles from Homer) was derived from opinion leaders who reside outside of the two communities where the CEC facility is proposed.

One criteria used in scoring the site was "an active and cohesive community leadership to facilitate development of the site" (p. 2--50). Again, "Homer was selected because it was the highest rated community. . ." (p. 2--50). These results probably

would be a lot different if opinion leaders' views from Forest Grove and Center Springs had been used in the community scoring for site selection. There are some validity and representativeness issues involved when views were reported from a community that is 5 miles away (Homer), but no similar outreach to a community that is just one-fourth mile (Center Springs) from the property line of the proposed site.

Decontamination and Decommissioning. The CEC proposes to operate for 30 years. The phase down of the project will have regressive impact with workers at the lower-end of the skill and pay scale experience greater dislocation. Workers at the higher-end of the skill and pay scale will have more resources at their disposal to absorb the change and relocate.

Finally, "risky" technologies and "dirty" industries have followed the "path of least resistance." Poor people and people of color communities are given a false choice of "no jobs and no development" versus "risky low paying jobs and pollution." Some industries have often exploited the economic vulnerability of poor communities, poor states, and poor regions for "risky" operations. The proposed CEC facility fits this pattern.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

September 22, 1992

Docket No: 70-3070

Louisiana Energy Services, L.P.
ATTN: W. Howard Arnold
President
2121 K Street, N.W.
Suite 350
Washington, DC 20037

Gentlemen:

Since disposition of depleted uranium (DU) tails is an important decommissioning licensing issue for the proposed Claiborne Enrichment Center, the Nuclear Regulatory Commission performed an assessment of the issues involved. Our evaluation assumes that the bulk of DU tails will eventually be disposed of as a waste. We examined the acceptability of disposal of the LES enrichment plant tails, as depleted UF_4, in a licensed 10 CFR Part 61 disposal facility as suggested by LES's "Depleted Uranium Hexafluoride Management Study." We have completed our review of this proposal. Based on our analysis, we have reached the following conclusions.

The preferred chemical form for final disposition of the DU tails is U_3O_8 regardless of U-235 concentration. Even if stored tails were later further processed and depleted of U-235, the bulk of DU tails must still be disposed of. Compared with UF_4, U_3O_8 is the more stable physicochemical form and the more compatible, as regards to safety, with long-term disposition of tails. Conversion of the DUF_6 to DUF_4 for final disposition is not acceptable because its physicochemical, long-term stability is incompatible with final disposal under 10 CFR Part 61.

The Environmental Impact Statement (EIS) supporting 10 CFR Part 61 did not contemplate large volumes of DU tails. Our analysis, using methodology similar to that used for the Part 61 EIS, concludes that near-surface disposal of such large quantities of DU tails is not appropriate, both because of its potential radiological impact and its chemical toxicity. However, other disposal alternatives under 10 CFR Part 61 may be viable; e.g., deep mine disposal. Therefore, disposal options, other than near-surface disposal, must be considered for the DU tails. Disposal options must be accompanied with supporting analyses. The analyses should include funding provisions for storage, tails conversion to the oxide form, final disposition and, if applicable, transportation costs.

Your analyses should also consider an appropriate schedule for conversion and disposal. Since you are proposing to start production in phases, which may take several years, the conversion of DUF_6 to DU_3O_8, or other suitable waste form, should start 10 to 15 years after initiating production, or after generating 80,000 tons of tails, whichever is reached first.

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In summary, demonstration of viable means of DU tails ultimate disposition and provision for financial assurance are needed. It is recognized that the total volume of waste to be generated for the LES Claiborne Enrichment Center is part of a much larger national inventory. Therefore, LES DU tails disposition may be addressed as part of the national inventory disposal scheme.

We would be pleased to discuss these matters further with you after you have considered them. If you have any questions, please contact Dr. Lidia A. Roche' at (301) 504-2695.

Sincerely,

for

John W.N. Hickey, Chief
Fuel Cycle Safety Branch
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cc: Attached list

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TOXIC WASTES AND RACE IN THE UNITED STATES:

A National Report on the Racial and Socio-Economic Characteristics of Communities with Hazardous Waste Sites

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