



KERR-McGEE CORPORATION

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ENVIRONMENT AND HEALTH MANAGEMENT DIVISION

December 14, 1982

HAND DELIVERED

Mr. Ralph G. Page
Uranium Licensing Branch
Division of Fuel Cycle & Material Safety, NMSS
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

ATTN: W. A. Nixon



Re: Draft Environmental Statement
(Docket No. 40-2061; NUREG-0904)

Dear Mr. Page:

Please find attached the response of Kerr-McGee Chemical Corporation to comments submitted by various governmental units to the NRC regarding the Draft Environmental Statement for the West Chicago, Illinois facility.

If you have any questions regarding this response, please let us know.

Sincerely,

W. J. Shelley, Vice-President
Nuclear Licensing & Regulation



TLB/WJS/pg

Enclosure

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RESPONSE OF KERR-McGEE CHEMICAL CORPORATION TO COMMENTS
ON NRC DRAFT ENVIRONMENTAL STATEMENT RELATED TO THE
DECOMMISSIONING OF THE RARE EARTHS FACILITY, WEST
CHICAGO, ILLINOIS (Docket No. 40-2061; NUREG-0904)

Comments on the Draft Environmental Statement (NUREG-0904) have been filed by various governmental units. In this Response, Kerr-McGee Chemical Corporation ("Kerr-McGee") considers the comments submitted by: the City of West Chicago ("City") (June 24, 1982); the Illinois Attorney General's Office ("AGO") (July 29, 1982); the Illinois Department of Nuclear Safety ("DNS") (July 27, 1982); the Illinois State Geological Survey ("ISGS") (July 29, 1982); the U.S. Environmental Protection Agency ("U.S. EPA") (July 6, 1982); the Department of the Interior ("DOI") (July 6, 1982); the Department of Agriculture, Soil Conservation Service ("DOA") (June 21, 1982); the Department of Housing and Urban Development ("HUD") (June 28, 1982); and the Low-Level Waste Licensing Branch, Division of Waste Management, Nuclear Regulatory Commission ("DWM, NRC") (May 4, 1982). The comments address four primary areas of concern: (1) assessment of alternatives and selection of a preferred alternative; (2) treatment of off-site materials located in and near West Chicago; (3) technical issues related to the West Chicago site; and (4) legal issues.

I. Assessment of Alternatives and
Selection of a Preferred Alternative

Several commenters expressed the concern that the Nuclear Regulatory Commission ("NRC") had not considered alternate disposal sites in sufficient detail, that insufficient data were available on alternate sites, that more sites should have been considered, or that NRC did not adequately supervise Kerr-McGee's search for and assessment of alternate sites.

Kerr-McGee believes that it conducted a thorough search for alternate disposal sites. It is not necessary to consider every parcel of land in the state to review a sufficient number of alternates to meet National Environmental Policy Act ("NEPA") requirements. Kerr-McGee's consideration of alternate sites began in late 1976. In July, 1977, NRC advised Kerr-McGee, at a meeting attended by representatives of the Illinois Department of Public Health ("IDPH") and Argonne National Laboratory ("ANL"), to use distance rather than a specific site for comparative cost purposes. On February 16, 1978, Kerr-McGee presented a cost comparison for a hypothetical site 125 miles from West Chicago versus the West Chicago site to NRC and ANL. In early 1979 the NRC and ANL, following the advice of the ISGS (letter, Cartwright to William Crow (NRC) dated January 11, 1979), suggested

that Kerr-McGee consider abandoned surface coal mines as alternate disposal sites in its report. On May 10, 1979, Kerr-McGee personnel met with representatives of the Illinois Environmental Protection Agency ("IEPA") to discuss disposal site criteria, after which a Kerr-McGee geologist made a field reconnaissance of Illinois coal mining areas. Kerr-McGee then sought advice from representatives of the ISGS who suggested, at a meeting on July 2, 1979, that if abandoned coal mines were not suitable for waste disposal Kerr-McGee should investigate limestone/dolomite quarries. Kerr-McGee investigated those sites and then prepared the alternate site assessment which was presented in the Stabilization Plan (Aug. 15, 1979).

Criticism of the alternative site investigation presented in the Kerr-McGee Stabilization Plan was voiced by the NRC, the IDPH, and the AGO, and was specifically directed at the investigation limit of 150 miles from West Chicago and the number of sites evaluated. In an effort to expand the investigation, Kerr-McGee scientists, in late 1979, made a state-wide visit to the major coal mining areas, 60 limestone/dolomite quarries, and 21 clay/shale quarries.

On February 14, 1980, Kerr-McGee held a meeting in St. Charles, Illinois, to solicit the cooperation of federal, state, and local government agencies in its further investigation of alternate sites. The AGO, the ISGS, the DNS, and

the IEPA were among the agencies that attended. No active participation in the site selection process was offered by the agencies in attendance. With the 150-mile distance restriction removed and the consensus that a low permeability host material was desirable, Kerr-McGee scientists then proceeded to develop site specific data for the clay/shale quarry areas. At a second meeting in St. Charles on May 20, 1980, Kerr-McGee presented all of its data, conclusions, and findings on 21 clay/shale sites. It is significant that none of the state agencies now so critical of Kerr-McGee's search attended the May 20, 1980 meeting. Kerr-McGee submitted its alternate site report, with emphasis on clay/shale quarry sites, to NRC on July 22, 1980.

The AGO argues in its comments that the DES is deficient because alternate sites were not adequately reviewed. (AGO comments p. 19.) Kerr-McGee disagrees. The consideration of alternate sites is more than adequate to fulfill the requirements of NEPA. The NRC has in several different cases considered the issue of the review of alternate sites. For example, in Boston Edison Company (Pilgrim Nuclear Generating Station, Unit 2), ALAB-479, 7 NRC 774, 779 (May 25, 1978), the Appeals Board articulated a standard for the adequacy of alternate site review:

The litmus which the courts apply--and which we must perforce use--is whether the environmental consequences of each reasonable alternative have been accorded a "hard look." We distill from the

cases a requirement that, to satisfy NEPA, an agency must go beyond mere assertions. At a minimum, it must provide a detailed, thoughtful analysis drawn from adequate data so that a reviewing body can decide on an objective basis whether the agency fairly assessed other courses of action which might realistically be substituted for the one proposed.

The review of alternative sites in the DES meets this "hard look" test. As stated in the DES (p. A-3) and noted above, "Kerr-McGee geologists and hydrologists collected and compiled information on the geology, hydrology, mineral and land-use resources, and current conditions of 3 surface coal mining areas, 60 limestone/dolomite quarries, and 21 clay/shale quarries." After a preliminary investigation, the clay/shale sites were selected as the most likely candidates for alternates. These were then examined and compared in even greater detail. The NRC staff re-evaluated the steps taken by Kerr-McGee. The evaluations in the DES go far beyond "mere assertions," provide an objective basis for review, and examine an adequate range of alternatives. As pointed out in Vermont Yankee Nuclear Power Corporation v. Natural Resources Defense Council, 435 U.S. 519, 55 L. Ed. 2d 240, 98 S. Ct. 1197, 1215-16 (1978), every possible alternative need not be examined; time and resources do not allow for it.

Specific criticism of the process for consideration of alternate sites includes the following comment by the ISGS:

Although geologic conditions at several of the proposed alternative sites appear to be suitable for waste disposal, there are large areas of the state potentially suitable for locating a site. . . . If the search for alternative sites had concentrated on identifying areas with geologic conditions potentially suitable for waste disposal, it is very likely that several areas could have been found for further exploration. (ISGS comments p. 1.)

Kerr-McGee agrees that a number of sites with geological conditions favorable for disposal of the West Chicago wastes could be found, but Kerr-McGee evaluated only those sites whose acceptability included more than geological criteria, which are only one critical factor to be considered.

The AGO commented in the same vein, that public reaction to off-site disposal should not be considered a problem. (AGO comments p. 25.) The fact is, public reaction is a problem and it would be irresponsible not to consider it. The U.S. EPA report, "Siting of Hazardous Waste Management Facilities and Public Opposition" (SW809, November, 1979) describes these problems in siting similar facilities. The existence in the United States of only three commercial low-level radioactive waste disposal facilities (some of which impose severe acceptance limitations) attests to the even greater public and government resistance when low-level radiation is involved.

The Department of Housing and Urban Development raised the question in a different way, by asking why the alternate sites are "so isolated." (HUD comments.) Urban population

density was a factor in the search for and ranking of alternative sites. As suggested in the letter from HUD, the alternative site question involves multiple factors, including the potential for public controversy and opposition to siting. However, the hazard associated with these materials is largely illusory, and any hazard that may exist will be eliminated once the disposal site is sealed, as is also suggested in the HUD letter.

Both the ISGS and the AGO commented specifically on the merits of surface coal mines for disposal of the West Chicago wastes. (ISGS comments p. 3; AGO comments pp. 21-22.) From a hydrogeological standpoint, surface coal mines are not suitable for hazardous or radioactive waste disposal without considerable site modification. After modification such mines would not be hydrogeologically superior to the West Chicago site. The Attorney General refers to the ISGS report "Hydrogeologic Considerations in Hazardous-Waste Disposal in Illinois" (Environmental Note No. 94, 1981) which identifies areas in the state most suitable for locating disposal sites. This publication considers only glacial sediments as appropriate for disposal. In the case of surface coal mines, glacial sediments have been stripped away to reach bedrock coal. Strip mines would have to be carefully backfilled and compacted to approximate the natural glacial sediment conditions discussed in Environmental Note No. 94.

The ISGS implies that mine spoil materials would be suitable for waste disposal. (ISGS comments p. 3.) Such spoil materials, typically dumped or placed with no controls or compaction, do not act as barriers to groundwater flow. (National Academy Press, "Coal Mining and Ground-Water Resources in the United States," 1981.) Such material would have to be totally reworked before it could serve as a waste disposal medium.

Both the City and the AGO suggested that more site-specific data should have been obtained for the alternate sites. (City comments p. 7, AGO comments p. 20.) Such data include "the depth and lateral extent of permeable layers, susceptibility of aquifers to contamination, hydraulic flow, proximity of shallow wells, and hydraulic connection, if any, of such wells with the . . . site." (AGO comments p. 20.) Such data are unnecessary at this stage of consideration. It must be assumed that any off-site disposal location approved by the NRC would be hydrologically suitable for disposal of low-level radioactive waste. Detailed site-specific studies, at a cost of at least \$200,000 per site and assuming Kerr-McGee had legal access, are not appropriate until a particular site is proposed for licensing action. An expenditure of \$1.2 million to thoroughly evaluate six sites is unwarranted when preliminary evaluations indicate that another solution is preferable.

The City misreads or misinterprets the DES treatment of the alternatives in at least two instances. In one, the City "contends that the DES is not adequate because alternatives to Kerr-McGee's proposed action (on-site burial) are not explored." (City comments pp. 6-7.) Kerr-McGee disagrees. Six alternatives were evaluated. In apparent contradiction of the foregoing assertion, the City states elsewhere that "A careful reading of the six alternatives discussed in the DES indicates that the one alternative for which the benefits are greater than for any of the others is Alternative IV [off-site burial]." (City comments p. 4.) Again, Kerr-McGee disagrees. The DES does not support a conclusion that Alternative IV offers greater benefits than the other alternatives. The City's Attachment 1, a chart comparing the alternatives from the City's point of view, is not supported by the DES, and the City fails to provide any data, or even to suggest specific reasons consistent with available data, to support the chart.

Other specific comments on the consideration of alternatives include the following from the ISGS:

Most of the alternative sites with shallow groundwater conditions are situated in very fine-grained materials of low hydraulic conductivity which do not in any way constitute an aquifer. Thus, although groundwater may be present at shallow depths, the low permeability of the fine-grained geologic materials limits contaminant migration and may be highly suitable for waste disposal. (ISGS comments p. 2.)

Kerr-McGee questions the wisdom of seeking disposal sites in such fine-grained media. If a disposal cell is constructed in low-permeability material, difficulties associated with preventing infiltration and the buildup of water in the cell may be severe. Subsurface leachate migration may be restricted, but migration to the surface through small permeable zones near the surface or by seepage through the cell cover will likely result in a surface leachate nuisance.

The Illinois State Geological Survey concludes:

Lastly, in Appendix A (also on page A-3), the report indicates that where excavation in clay/shale quarries reaches "unweathered, fractured shale . . . the desired permeability might not be present." It should be noted that fracturing of shale bedrock is most commonly a weathering phenomenon. Deeply weathered shale frequently resembles a homogenous clay; while below that relatively thin, highly weathered zone, the less-weathered shale is likely to be somewhat fractured to some depth. However, thick deposits of unweathered, unfractured shale in Illinois have been found to be very effective barriers to groundwater movement. (ISGS comments p. 3.)

Any shale bed in Illinois shallow enough to be considered for a waste disposal site will undoubtedly have numerous fractures, parallel to the bedding, which have resulted from geological events, i.e., burial, loading and consolidation and then gradual unloading and pressure release. At considerable depth and on a regional basis, shale beds are commonly regarded as barriers to groundwater flow. However, these generalizations cannot be applied to shallow shale beds, and

therefore they cannot automatically be considered as good candidates for waste disposal sites.

An important part of the DES' treatment of alternatives which drew a number of comments is the preference of Alternative III (temporary on-site storage) over the other five alternatives. The AGO, the City, and the U.S. EPA all commented that the consideration of Alternative III is incomplete without discussion of the environmental effects of the second phase of the on-site storage plan: exhumation, removal, and redisposal of the wastes. Kerr-McGee agrees. Since the short-term effects of the first stage of Alternative III and the burial portion of Alternative I (permanent on-site disposal) are identical, and since the DES concluded that there will be virtually no health or environmental effects once the disposal cell is closed, it is especially important to consider in detail the adverse impacts of removal.

The City suggests that the adverse economic impact of Alternative III in terms of damage, illness, and death should be considered. Kerr-McGee believes that such consideration is unnecessary in the absence of any evidence that damage, illness, or death will result from either Alternative III or Alternative I. The City's statement sensationalizes the issue and raises the possibility of misinforming or misleading the public. There are no health

or environmental risks associated with the decommissioning of the West Chicago facility or any of the proposed alternatives, including leaving the site as it stands.

II. Off-Site Materials

The AGO, the U.S. EPA, and the DNS commented on the off-site low-level radioactive materials found at some 75 locations in or near West Chicago. All agreed that the final EIS should address the disposition of these materials. Kerr-McGee concurs, and apparently the NRC has decided to address these matters in the final EIS.

The off-site low-level radioactive materials may be considered in three categories: Reed-Kepler Park, Kress Creek and small, randomly located, isolated spots. Kerr-McGee is prepared to accept the material from Reed-Kepler Park, provided that the approved acceptance of that material at the disposal site will not result in any significant delay in the execution of the Kerr-McGee preferred plan. As shown in Table F.1 of the DES (p. F-2), provision has been made in the disposal cell for up to 500,000 cubic feet of Reed-Kepler materials. The small, isolated locations contain insignificant quantities of low-level radioactive materials and are considered innocuous.

The Kress Creek materials will be considered separately from the on-site wastes and any other off-site materials because, as noted on page xii of the DES, the NRC has asked

Kerr-McGee to develop a plan for the contaminated areas in and near Kress Creek. NRC has put this request "on hold" pending further assessment of the radiological contamination in the Kress Creek area and determination of what, if any, corrective actions may be required. (Letter of R. G. Page, Chief, Uranium Fuel Licensing Branch, NRC, to J. L. Rainey, President, Kerr-McGee Chemical Corporation, June 4, 1982).

Both the AGO and the U.S. EPA commented on the volume and degree of hazard associated with the off-site materials. The suggested ratio of three to one for off-site versus on-site materials is in error. With the exception of Reed-Keppler Park and the wastewater treatment plant, the spots identified and quantified by Frigerio, et al. ("Thorium Residuals in West Chicago, Illinois," NUREG/CR-0413, ANL/ES-67, Sept. 1978) were small areas, having epicenters of one to two square feet, invariably located at roadside. Although Frigerio reported about 3.6 million cubic feet of radioactive material at Reed-Keppler Park, the report noted that approximately 2.4 million cubic feet of that material is at an isopleth of 20 microrems/hour or less. Further analysis by NRC indicates that there is about 400,000 cubic feet of material at Reed-Keppler Park to be considered for encapsulation at the site. (Letter of October 15, 1982 from Richard E. Cunningham (NRC) to Paul C. Cahill (EPA), p. 2.)

The gross overestimate of volume dominates EPA's conclusions about the off-site materials. But even if the

assumption of a 3:1 ratio were correct, EPA's conclusion that there is three times the risk of exposure and, by implication, three times the health risk, would be inaccurate. Risk is a function of the dose received and not necessarily a linear relationship with the volume of material. The risk of exposure to the Reed-Keppler materials, and thus of dose, is negligible.

Similarly, U.S. EPA's assertion, at page 2 of its comments, that doses associated with the 0.02 mrem/hr simulated isodose line "present a health risk about 100 times, or more, greater than calculated from airborne particulates originating on the facility site" is misleading and extreme. An "off-site" exposure rate of 0.02 mrem/hr does not necessarily result in a dose of 170 mrem/yr. A person would have to stand in the one dosing spot for the entire year. The off-site areas are isolated and small, and the hypothetical doses suggested by U.S. EPA could not be obtained within a few feet of these spots. In either case, the health risk to an individual is negligible, far less than 1 in 100,000 per year.

U.S. EPA suggests that the offsite materials should be moved to the disposal site "regardless of who incurs the costs." (U.S. EPA comments p. 2.) This comment is apparently based on the inaccurate assumptions as to volume and health risks. Kerr-McGee believes the offsite materials should be discussed in the context of health and environmental hazards.

In the absence of hazards, the cost of moving the materials to the Kerr-McGee site should be an important factor in considering the move--regardless of who would incur the costs.

III. Technical Issues Related to On-Site Encapsulation

A. Geology and Hydrology

A number of general and specific comments as to the suitability of the West Chicago location as a disposal site were submitted to the NRC. The AGO stated that the West Chicago site is "inappropriate" and technically "unsuitable" for disposal of the West Chicago wastes. (AGO comments pp. 12, 14.) The City asserted that the NRC's assessment of environmental impacts shows that the West Chicago site is not acceptable for disposal of the wastes. (City comments p. 11.) To the contrary, the NRC concluded in the DES that Kerr-McGee's proposed stabilization plan (Alternative I) would have "negligible" impact on air quality and would "afford adequate protection for groundwater resources at the West Chicago site." (DES p. 1-3.) Kerr-McGee believes that the site is an appropriate disposal location, because there are no significant health or environmental risks associated with the materials at the West Chicago facility as it exists today or as it will exist following on-site disposal. On-site containment of the waste will only improve the situation.

As to the general technical suitability of the site, in the context of the Argonne National Laboratory Report to which the AGO refers ("Characterization of Geohydrology and Subsurface Chemistry," 1977) (AGO comments p. 14), characteristics of the site are not adverse to on-site stabilization. In fact, several are highly favorable. These include such factors as the presence of material of low permeability at depth and the fact that radioactive elements are not migrating in the water table aquifer (ANL Report p. 67).

Specific comments were made about the geology and hydrogeology of the site. The AGO listed a number of factors cited in the Argonne National Laboratory report as "deficiencies," (AGO comments p. 14) which include:

- "Highly inhomogenous subsurface": Most of the glacial deposits which cover virtually all of Illinois are highly inhomogenous. Such a property of soil is not inherently unfavorable for waste disposal.

- "Generally water-saturated and permeable subsurface": This statement is a general characterization applicable to every area of the state. Detailed site studies performed by Kerr-McGee during the past two years have found significant amounts of subsurface materials to be of very low permeability. (Law Engineering Testing Co., "Hydrologic Studies, West Chicago Thorium Plant," August, 1981.)

- "Cation exchange capacities (the ability of subsurface materials to attenuate leachate) greater near surface

than below": This is a condition favorable to waste disposal, not a deterrent, since all strata have adequate exchange capacities. The shallow soil will capture leachate components more effectively than deeper materials. Laboratory studies, described in the Argonne National Laboratory and Law Engineering Testing Co. reports, and past site behavior have shown that radionuclides are immobile in the subsurface.

- "Hydraulic connection between shallow and deep aquifers": Presumably, this statement describes the glacial drift (shallow) and Silurian (deep) aquifers. The nature of the hydraulic connection between these aquifers was not described by ANL but merely assumed, since all naturally occurring sediments have some degree of permeability. In the area of the West Chicago site any interconnection between the shallow and deep aquifers is indirect, because continuous strata of low permeability impede the vertical flow of water. All data collected in deeper portions of the glacial drift aquifer and in the Silurian aquifer indicate that radionuclides have not migrated a substantial distance vertically. (Argonne National Laboratory, 1977, p. 56.)

- "Site-associated pollutants are in the water table and in the deeper aquifer": To the degree this is true, it is due entirely to past activities. Since the rare earths facility ceased operation in 1973, groundwater quality at the site as noted in monitoring wells has been improving steadily. (Argonne National Laboratory, 1977, p. 67.)

Other comments as to the geology and hydrogeology of the site include the AGO's reference to the following statement from the DES (p. 4-63):

Groundwater moves easily through an open network of joints and fractures within the Silurian dolomite. Little or no filtration takes place in the aquifer, resulting in widespread migration of pollution or contamination once it reaches the aquifer. (AGO comments p. 15.)

This characterization of the dolomite aquifer is less than accurate regarding solution channels and groundwater movement. Zeizel, et al. ("Ground-Water Resources of DuPage County, Illinois, 1962, p. 66) describes the Silurian dolomite aquifer in the West Chicago area as follows: "The dense shaley dolomite and shale of the basal Niagran series may have restricted development of the weathered zone with solution-enlarged openings in the upper part of the dolomite and restricted development of the permeability necessary for recharge to the underlying Alexandrian aquifer." This statement explains why natural recharge to the aquifer in the West Chicago area is about half of that noted in surrounding areas, and makes it clear that the Silurian dolomite aquifer in West Chicago is not typical--it lacks the "open network of joints and fractures" usually found in such aquifers.

The AGO also stresses the importance to water supply of the glacial drift and bedrock aquifers near the West Chicago site. (AGO comments pp. 14-17.) Kerr-McGee disagrees. In

a letter dated October 15, 1980 from Mr. Thomas M. Johnson, Illinois State Geological Survey (ISGS), to Mr. Eli Port, Radiation Safety Services, Inc., Johnson states, "While shallow groundwater in sand and gravel immediately beneath the site at depths of only 10 to 20 feet may have been affected by radionuclide as well as chemical migration, this zone does not represent a viable aquifer and is nowhere used for water supply to shallow wells. Virtually all shallow wells in the surrounding area are finished in the dolomite bedrock at depths of 80 or more feet."

Other comments on geology and hydrogeology relate to conductivity, groundwater gradient, water table levels, and subsurface permeability:

The Law Engineering report also found that hydraulic conductivities at the site are very high, within the range of values for clean sand (page 25-26). (AGO comments p. 17.)

Law Engineering did not at any time report that hydraulic conductivities at the site were "very high." The use of this phrase is editorial on the part of the AGO, and conveys an impression Law Engineering did not intend.

The net vertical gradient of groundwater beneath the site remains downward, indicative of a recharge area. (ISGS comments p. 2.)

This statement is correct as to the direction of the net vertical gradient of ground water beneath the site. Equally important, however, is the degree of permeability of materials through which the water must pass to be recharged. Numerous

site permeability tests in recent years show that although the hydraulic gradient at the site is downward, the vertical permeability is so low that on-going recharge to the bedrock aquifer is very small to insignificant. (Law Engineering Testing Co., August, 1981, Table 3.2.)

Section 5.6.2.1 (page 5-9), . . . states that "The perched, shallow water table in the glacial aquifer will be most affected. . ." This statement is not technically correct. . . . Although a "perched water table" may exist under certain conditions, such is not the case at West Chicago. (ISGS comments p. 1.)

This issue has been previously raised by the ISGS, and Kerr-McGee responded to it in a letter dated April 29, 1980 to Mr. William A. Nixon of the U.S. Nuclear Regulatory Commission. In that letter, Kerr-McGee stated, "If the water level in the glacial aquifer did not drop as the piezometric surface of the underlying dolomite aquifer was pulled down, then a 'perching' condition would in fact be established. This continues to be the Kerr-McGee interpretation of the aquifer responses over the past 30 to 50 years."

It should be recognized that "zero-discharge" is not realistically achievable; some migration of contaminants will occur from the site, albeit hopefully very limited. (ISGS comments p. 2.)

The DES recognizes that "zero-discharge" is not achievable. It states, rather, that contamination will be "essentially and effectively removed and/or isolated from groundwater recharge zones." (DES p. 5-33.) The preceding sentence in the DES points out that, "none of the current disposal or

storage alternatives would result in significant additional unavoidable adverse impact." Rather, "water quality should improve and thus result in a beneficial impact." Further, the concept of "zero-discharge" was not implied or intended in any part of the Stabilization Plan. To the contrary, the plan clearly describes the limited through-percolation nature of the system. Contaminants which migrate from the cell, by design, return to the biosphere (water table aquifer) in such small concentrations they no longer would be characterized as contaminants but as acceptable water chemistry of the aquifer.

The report bases its plan on well borings indicating groundwater depths of 8 to 18 feet. The soil maps show that some areas affected might have groundwater at or near the surface from March to June. These potentially high groundwater tables cause concern as to the suitability of this site for its intended use. (DOA comments.)

The lowest topographic point at the disposal site is in the southwest corner, where groundwater is at a very shallow depth during the wettest time of the year. In part, this is due to surface ponding as well as seasonal groundwater rise due to local recharge. For this area of the disposal site, the base of the liner will be approximately 8 feet above the highest groundwater recorded in this area. With a two-foot thick liner, the waste will be 10 feet above the highest groundwater. It is important to note that the recorded high water table conditions are affected by the presence of ponds on the disposal site, which undoubtedly contribute to the

localized high water table. Upon implementation of the Stabilization Plan, these ponds will be removed and replaced by a very low-permeability liner and cover, both of which will significantly reduce the local groundwater recharge and bring about a consistently lower water table.

The ISGS commented on percolation, to the effect that "It is obvious that subsurface materials are 'permeable' enough to have permitted extensive contamination of the dolomite aquifer from previous disposal operations at the site." (ISGS comments p. 2.) It is not correct to assume that because contamination has occurred in the past, it will necessarily result from the proposed stabilization. The proposed stabilization procedures differ from past disposal practices; it is the very nature of the plan to isolate the material from the environment. The permeability of the subsurface materials is sufficiently low that, combined with state-of-the-art technical measures to isolate the on-site materials, the possibility of contamination is remote.

Further, the ISGS ignores chemical data in Table 4.19 (DES p. 4-68) which show that five of six bedrock wells on the Kerr-McGee site have much better water quality than earlier reports would have predicted. This is strong evidence that direct downward contaminant movement did not and cannot occur. Therefore, the proposed disposal cell is not a direct threat to the bedrock aquifer. Permeabilities of

fine-grained subsurface materials beneath the site are quite low and inhibit downward movement of contamination.

The AGO questioned the basis for the assertion in section 7 of the DES (DES p. 7-2) that little impact is expected to the deep dolomite aquifer since the permeabilities of the subsurface material at the site are low. (AGO comments p. 15, n.11.) Kerr-McGee believes the DES assertion is well-founded. Zeizel, et al. (1962, p. 65) calculated a recharge rate to the bedrock aquifer from glacial sediments in the West Chicago area of 64,000 gallons per day per square mile. This equates to a vertical velocity on the order of one-half foot per year. Approximately 80 feet of sediments, of which 50 feet are clay, must be traversed to get from the water table to the bedrock aquifer. At one-half foot per year velocity, it would take about 160 years for recharge or pollutants to travel the necessary distance vertically. Since plant site operations began about 50 years ago, downward movement would be only 25 feet below the water table now, with about 55 feet to go to reach bedrock.

From a different standpoint, one could consider permeability values found at the disposal site in recent work by Law Engineering Testing Company and Soil Testing Services. (Law Engineering Testing Co., August, 1981, Table 3.2.) Ten clay samples across the site, from shallow to deep zones, gave permeability values of less than 1×10^{-8} cm/sec. Correlations show these beds are continuous across the area.

This translates into an indicated vertical velocity of approximately one-twentieth foot per year, or 10 times slower than suggested above.

A logical conclusion is that near-surface pollutants simply have not reached the bedrock aquifer by direct vertical movement. A factor supporting this interpretation is the water quality noted in bedrock wells on the disposal site within the past two years. Five of six wells show significantly better water quality than would be projected by various studies; one well, upgradient and in the southeast corner, shows lower quality more consistent with the regional geology.

B. Radiation

Several comments indicate confusion on the part of the commenters as to measurement of radiation dose, risk, and exposure:

[C]oncentrations of thorium buried or stored on a site such as West Chicago must be sufficiently low so that no person will receive an external dose in excess of ten (10) microroentgens per hour above background. Inspections in West Chicago show that this dosage is currently exceeded in some areas near the site. (City comments pp. 5-6.)

The City is confusing dose and exposure. See Kerr-McGee's response to U.S. EPA's similar misapprehension, p. 14, supra.

[I]t is impossible to protect the public from potential releases in the long run. (AGO comments p. 18.)

This statement is false and implies that all releases are harmful. Risks associated with releases must be considered.

The radiation dose assessment in section 5 (Table 5.5) is based on the population of the entire metropolitan area (7.5 million people). This appears to reduce the person-rem/year value to very low levels, but may be artificial. (DNS comment No. 2.)

Table 5.5 contains an estimate of dose (person-rem/yr) to the population of the entire metropolitan area from activities associated with disposal of the low-level radioactive wastes at the site. While this results in a very low dose--on the order of 3-4 microrem--for each individual in the metropolitan area, it also results in a greater person-rem total than would be obtained by applying the dose to the nearest individual to the smaller West Chicago population. For example, page 4-30 of the DES gives the West Chicago population as 12,444, and Table 5.5 gives a dose of less than 1 mrem for the nearest resident to the plant. If it is assumed all the approximately 12,500 people are the "nearest resident," then the total person-rem is less than 12.5, or half that listed in Table 5.5 for the metropolitan area. But all 12,500 are not the "nearest resident," so the total person-rem is far less than 12.5. In effect then, the NRC methodology can be construed as leading to an extremely low individual dose, but a higher total person-rem value results. Given the very small individual doses and total person-rem estimated, the difference is inconsequential. Further, the text (p. 5-24,

section 5.9.3) of the DES points out that the dose estimates in Table 5.5 are the 50-year dose commitments and that for all cases, collective population doses are only small fractions of background.

The City suggests that any wastes remaining in West Chicago are likely to produce an increase in radon concentration. (City comments, Attachment 3, p. 4.) This suggestion is contrary to fact; indeed, on-site encapsulation would reduce radon at the West Chicago facility essentially to background levels. Radon, as well as thoron, results from decay of daughter products of thorium that are present in the waste materials; encapsulation will not increase the quantity of thorium wastes over that already present, so it is impossible for radon and thoron production to increase. Further, the cover that will be placed over the wastes will retard the escape of the radon and thoron gases for a period sufficient to allow for decay of most of the gases within the encapsulated structure.

Finally, two other comments reveal additional factual misconceptions:

On that same page the NRC indicates that the Kerr-McGee wastes represent more than 35 times as much material as has already been accepted at one of the existing commercial facilities (Barnwell). (AGO comments p. 3, n.2.)

This statement is inaccurate. Although Kerr-McGee agrees that the Barnwell facility does not have capacity to accept all of the West Chicago materials, it is not true that those

materials comprise 35 times the quantity of materials already accepted at Barnwell. In 1979 and 1980 Barnwell accepted, respectively, 2,231,000 cubic feet and 1,961,000 cubic feet of low-level radioactive waste. (Levin, G.B., "Low-level Radioactive Waste Management in the U.S.: A Proving Ground," Nuclear News, August, 1981.) The total quantity for this two-year period alone represents 85 percent of the 4.8 million cubic feet of materials at West Chicago.

U.S. EPA suggests that less contaminated waste might be permanently disposed of on-site, and more highly radioactive waste stored temporarily on-site. (U.S. EPA comments p. 3.) This statement reveals a significant factual misconception. None of the waste at West Chicago is highly radioactive, and all of it is suitable for permanent on-site disposal.

C. Design of the Capsule

The City appended to its comments, as Attachment 2, the response of its consultant to the October, 1981 Law Engineering report, and criticized the NRC for not responding to the issues raised therein. (City comments p. 3.) Law Engineering has responded to those issues, and the letter of Dr. James L. Grant considering each of the points raised by the City's consultant is attached hereto as Attachment A.

The City commented that, in its opinion, the maximum expected frost depth has been underestimated. (City comments,

Attachment 2, pp. 5-6.) Kerr-McGee agrees that an estimate of 3.5 feet depth of frost penetration is not appropriate for design of the cell cover. Its design is based on a depth of penetration of 60 inches (5 feet). The value of 3.5 feet represents the City of West Chicago building code requirement for minimum footing depth. Footing depths are selected to ensure that footings are below the zone of significant soil volume change due to freezing and thawing. The depth of frost penetration of 2.5 meters suggested in the City's comments is not supported by temperature data reported by the City, nor by the quoted reference. Assuming the 18.5° F. temperature represents an average over a three-month period, the depth of frost penetration computed from Figure 6.2 of the City reference is about 5 feet for bare ground and 3.5 feet for sod and slight (0.15 meter) snow cover.

Several comments addressed the reliability of the proposed cell design:

How reliable is the disposal cell design? (AGO comments p. 5.)

The cell is designed to provide reliable long-term encapsulation and to help insure that failure of any component of the system would not have an impact on the overall system.

The proposed design . . . can reasonably be expected to be less reliable than in-situ naturally occurring clay. (AGO comments p. 17.)

Kerr-McGee disagrees. There are many reasons to expect the proposed disposal cell to be more reliable than a cell constructed in in-situ naturally occurring clay. Total permanent containment is not achievable. The ISGS states in the abstract of Environmental Note #94 (p. 1) that "total isolation of waste in humid areas is not possible; some migration of leachate from wastes buried in the ground will always occur." The ISGS has long cautioned against waste disposal in low-permeability deposits. Sites developed in such deposits have proven quite difficult to properly construct and as a consequence, have required more active monitoring and maintenance programs than sites developed in more permeable deposits.

How much settlement will occur within the disposal cell; over what period of time is such settlement expected to occur; to what extent will such settlement damage the cap; and how will such damage be repaired? (AGO comments pp. 5-6.)

Given the character of the waste and the fact that the waste will be placed in the cell in a compact state without significant voids, there is no reason to believe settlement will damage the cap. Settlement is related to the degree of compaction or void reduction achieved during placement of the material. With proper field control, settlement in the waste material, liner and cover can be virtually eliminated. Kerr-McGee intends to exercise particular care in the placement of materials so that subsequent settlement will not occur.

The Staff Report indicates that the perched shallow water table will be intersected by the disposal/storage site and that contaminants will be remobilized. (City comments, Attachment 4, p. 2.)

It appears the City's consultant misunderstood the DES. The DES does not say the cell will be intersected by groundwater; rather, excavations below the groundwater table will be required during construction.

What would or might be the environmental and health impacts of a disposal cell liner or cover failure, particularly in light of the abundant groundwater in the vicinity and the proximity of residences and schools? (AGO comments p. 5.)

For Alternatives I and III, failure of the cover and liner is best compared with the present day situation where neither cover nor liner are present and several ponds are in existence. There is virtually no measurable impact to the water table aquifer under these existing conditions. Hence, a stabilization plan adding a cover and liner to help isolate the wastes is not expected to create an adverse impact. Since the shallow aquifer is not utilized as a drinking water source, there would be no impact to residences and schools even in the event of a failure.

Among the six principal aquifers, the glacial drift and Silurian Dolomite aquifers are considered to be the most important shallow aquifers in the site area (AGO comments p. 15.)

The importance of the glacial drift aquifer must be questioned. The ISGS records show that this zone does not represent a viable aquifer and is not used for water supply to shallow wells.

A number of comments took the form of suggestions as to design or construction of the cell:

A capillary barrier, such as provided by a continuous, coarse-grained granular layer, is recommended under the bottom clay liner used for the base of the encapsulating clay system. (DWM, NRC comment No. 1.)

Such a barrier would complicate construction by requiring removal and replacement of in-situ clay used for the bottom liner. Kerr-McGee sees no significant benefit in the proposed capillary barrier.

Geofabrics (filter materials) should be used to segregate the sand and gravel drain in the multi-layer cover system from the overlying compacted clay (shown as soil and building rubble in Figure 5). (DWM, NRC comment No. 2.)

The use of fabric to segregate the drain has been contemplated as a possibility by Kerr-McGee. If significant construction benefits can be realized, it will be seriously considered.

The surface of the low-permeability compacted soil cap in the multi-layer cover system should be rolled smooth after compaction prior to placement of the sand and gravel drain. (DWM, NRC comment No. 3.)

The compacted low-permeability soil cap will be rolled smooth after compaction.

The clean building rubble proposed for the soil and building rubble layer (overlying the sand and gravel drain in the multi-layer cover) should not be placed at the bottom of that compacted unit. Rather, it should be placed above that unit at the base of the top soil . . . the low-permeability clay cover over the sand and gravel drain should be placed and compacted, then the rubble and topsoil can be placed with minimal compaction and equipment movement on top of the low-permeability cover. (DWM, NRC comment No. 4.)

Kerr-McGee agrees that this procedure may reduce construction difficulties. The soil and rubble zone, however, must be compacted to the same specifications as the low-permeability soil cover.

To the extent practicable, materials used for backfill among the wastes should be granular, rather than cohesive, to permit free drainage to the sand and gravel underdrain. (DWM, NRC comment No. 5.)

Kerr-McGee concurs with this suggestion.

The backfill placed in the areas of excavated settling ponds, drainage systems, buried tanks etc. must be sufficiently controlled and compacted so as to provide a suitable subgrade. (DWM, NRC comment No. 6.)

Kerr-McGee concurs and points out further that backfill should be granular except for the clay liner which will be constructed in these areas. Use of granular backfill materials will avoid creation of groundwater flow anomalies and reduce the likelihood of long-term consolidation and subsequent distortion of the clay liner.

In order for the permeability testing proposed on page 30 to be meaningful, a relationship between field density after compaction and permeability should be established. (DWM, NRC comment No. 7.)

This procedure is necessary to allow proper cell construction. A testing program to control quality of clayey materials will also be required to maintain confidence in the compaction-permeability relationship.

It should be emphasized also that the conclusion reached on p. 5-24 (that the final cover thickness should be decided on the basis of actual measurements of radon flux . . .) may change greatly the cover thickness and, hence Alternative III. (City comments, Attachment 4, p. 4.)

The DES statement is unclear and should be clarified by the NRC.

[A]nother alternative or perhaps a modification of Alternative III should be considered. That is to separate the waste in the storage/stabilization process by extent of contamination. (U.S. EPA comments p. 3.)

Separation would necessitate extra handling of materials, create voids within the disposal cell, and still not resolve the question of final waste disposition.

The AGO recommends that interim measures, such as soil cover, should be taken. (AGO comments p. 32.) Kerr-McGee believes that temporary soil cover is not a constructive step. The waste does not pose a health hazard in its current condition, so any interim measures are unnecessary. A temporary soil cover would become contaminated and would increase the total volume to be handled and disposed of.

D. Migration of Disposal Cell Constituents

Many site-specific comments are directed at the design of the disposal cell and the model used to predict migration:

[T]here are no engineered designs now known to permanently contain radioactive or chemically hazardous wastes buried in the ground. (The NRC is aware of radioactive waste migration problems occurring at Maxey Flats, Kentucky, West Valley, New York, and Sheffield, Illinois.) (AGO comments p. 17.)

Some migration of radionuclides has occurred at Maxey Flats, West Valley and Sheffield, but these sites are not comparable to the superior encapsulation design proposed for the West Chicago site.

The final statement should discuss and assess existing data mentioned in the Stabilization Plan, dated 1979 (Appendix III, p. 16), from tests of the mineralogy and ion-exchange or other sorption characteristics of the fine-grained materials to be used for liner construction as noted in Sections 3.1.2.2 and 5.6.2. (DOI comments p. 1.)

The referenced information was contained in the Law Engineering report of August 24, 1981, submitted to the NRC. Kerr-McGee agrees that this valuable information should be discussed in the final statement.

Neither the Law Report nor the Staff Report predict accurately the concentration or amount of leachates leaving the cell. (City comments, Attachment 4, p. 2.)

The rate of percolation has been greatly underestimated and the amount of waste leachate cannot be accurately estimated by their modelling procedures. (City comments, Attachment 4, p. 4.)

Since the model in this case is not very sophisticated and has not been calibrated with observations at the site, the results must be viewed as conjectural. (ISGS comments p. 2.)

[T]he calculations of predicted percolations may not accurately predict actual infiltration especially if the cover develops cracks due to unavoidable settlement of the waste or if it is affected by erosion. (ISGS comments p. 2.)

The City gives no basis for its statements. Estimates of the concentration and amount of leachate are conservative, i.e., high, and the model used is the most sophisticated model available. If an alternative model or method of predicting migration of contaminants is better, the ISGS should suggest its use. All groundwater and contaminated transport models, not just this one, are simplified. No

model is an exact duplication or representation of conditions at a specified site. The model was designed for the use to which it was put, and it yields competent, reliable estimates. Model results, fully documented and reproducible, offer the best objective and predictive assessment of this type of problem. Alternative assessment methods would be highly subjective and would surely be criticized if used in this study.

Basic features of the Law Engineering model represent, reasonably well, major physical attributes of the shallow aquifer. For example, the model assumes uniform unidirectional flow in an aquifer of constant thickness. This condition approximates quite well the actual groundwater flow at the site.

Most important are simplifications related to location and rate of waste leaching. The model's assumptions introduce several orders of magnitude of conservatism into the results. The values of other model parameters were also selected to maintain this conservatism. The ISGS fails to recognize these extremely conservative assumptions.

Field data show there is virtually no migration of radionuclides in the shallow aquifer at the site and modeling results indicate a negligible potential for radionuclide migration. In this sense, the model is confirmed by site observations.

Predicted percolation through the cover was based on an assumed intact cover. If suspected cover failure could be quantified, it could be modeled accordingly. However, as discussed in the Law Engineering Testing Co. report ("Final Report, West Chicago Thorium Plant Closure," 1981), estimates presented are conservatively large. As stated earlier, waste can be placed with proper care to virtually preclude settlement and ensure that any settlement which does occur will not be detrimental to cover integrity.

E. Post-Closure Monitoring

Other comments addressed post-closure monitoring. The AGO asks, "To what degree and for how long would the disposal site have to be restricted after stabilization?" (AGO comments p. 6.) NRC may determine that the site will remain off-limits for any period of time. The ISGS questioned the length of time proposed for monitoring:

In light of the proposed USEPA regulations requiring groundwater monitoring for twenty years after site closure, it is somewhat ludicrous to limit post-closure groundwater monitoring to five years at the Kerr-McGee site which contains both chemical and radioactive waste. (ISGS comments pp. 2-3.)

There was no intent to limit post-closure monitoring to five years. NRC licenses are ordinarily renewable on a five-year basis, so the plan expressed a minimum commitment of five years. Kerr-McGee has already commented that the license amendment should be for a term of years "sufficient to com-

plete the onsite containment work and to demonstrate through monitoring that the on-site containment cell is performing safely as anticipated" (Kerr-McGee DES comments, July 27, 1982, p. 3), and has recently sought responsibility for monitoring and security which would remain with Kerr-McGee for a period of twenty-five years after closure. (Letter from J. L. Rainey to R. E. Cunningham, October 11, 1982.) The ISGS reference to regulations, presumably under the Resource Conservation and Recovery Act, is not appropriate, because those regulations are not applicable to the West Chicago site.

It appears that the monitoring programs are designed to check disposal cell integrity immediately after construction and then change to a minimum frequency. If failure of the disposal cell would occur with time, a more complete effort would seem to be necessary at some time period; i.e., several years, after the cell is completed and closed. (DNS comment No. 4.)

Precisely what types of monitoring will be necessary after stabilization; for how long will such monitoring be necessary; who will conduct such monitoring and any remedial measures indicated by it; and who will pay for such monitoring and remedial measures? (AGO comments p. 7.)

Kerr-McGee will perform appropriate hydrogeologic monitoring necessary to properly track and assess performance of the disposal cell, as required by the NRC. Groundwater monitoring for at least five shallow wells and five bedrock wells will be continued. In addition, three cell (sump) monitoring points will be created. Monitoring of wells and inspection

of cover will be conducted quarterly for the first three years and thereafter at least annually or as required by NRC. Kerr-McGee is responsible for costs associated with monitoring and remedial work as long as the property is under Kerr-McGee ownership.

F. Cost Factors

Two comments dealt with the question of cost of stabilization. With respect to the "ambiguity" of Alternative III, the Attorney General's office stated:

[I]f Alternative III is the NRC's real preference, NRC expects Kerr-McGee to spend about \$43 million dollars in today's dollars on disposal of the wastes. (AGO comments p. 4.)

Although Kerr-McGee does not agree with the Attorney General's implication that the expense of Alternative III indicates an intent on the part of the NRC to select Alternative I while appearing to prefer Alternative III, the cost of the various alternatives should be considered, especially in light of the lack of health or environmental hazards associated with each of the alternatives. The \$43 million figure was arrived at by adding \$14 million, the estimated cost of Alternative I or the first stage of Alternative III (on-site encapsulation) and \$29 million, the estimated cost of Alternative IV (transportation to and burial at an off-site location). This estimate does not include the cost of exhuming material temporarily stored on-site or of transporting and burying

the additional volume of material which would have to be removed, or of restoring the West Chicago site after exhumation. The total cost of Alternative III would be substantially in excess of \$43 million.

The Attorney General erroneously assumes that Kerr-McGee's cost estimates are unfounded. (AGO comments pp. 30-31.) Kerr-McGee's responses to the Attorney General's specific questions are as follows:

On what basis were these particular multipliers chosen?

Multipliers were developed from cost increases between 1979 and 1981 for various goods, services and labor.

How were the labor and supervision cost figures derived? How many man-hours did Kerr-McGee assume, and at what hourly wage rate?

Labor and supervision cost figures were based on actual costs at the project and published rates for the area. Manpower tables are included in Kerr-McGee's "Preferred Remedial Action Plan" submitted to the NRC on December 11, 1981. Hourly wage rates vary by job, but were developed from current published rates effective at that time and rates paid at the project site.

What are the bases for the health physics monitoring and equipment figures? Are they based on proposals of particular contractors or sellers? What kind and quantity of equipment are contemplated?

Health physics monitoring costs were based on technician cost and cost of support equipment, taking into consideration

projected needs as well as equipment on hand. Equipment costs were based on market values for the equipment listed in Kerr-McGee's "Preferred Remedial Action Plan."

What do the hauling costs include -- truck rental fees, labor, packaging? How many trucks and what kind of packaging are contemplated?

Hauling cost estimates are based on published freight rates. The packaging estimate was based on DOT/NRC requirements for shipping these materials. Estimated numbers of truckloads are shown in Kerr-McGee's "Preferred Remedial Action Plan."

How can Kerr-McGee estimate the cost of labor, supervision, health physics monitoring, equipment, and backfill and cover at the New Douglas site when Kerr-McGee does not know exactly the extent of excavation, lining, and covering which would be necessary to properly stabilize the wastes?

Estimates for an off-site location, such as New Douglas, were based on general concepts and were compared to the amount of work necessary to carry out the on-site alternative.

Why is an \$18,000,000 "burial fee" for New Douglas included? Since the New Douglas site is privately owned, Kerr-McGee would have to purchase it. Therefore, it makes more sense to estimate the purchase price -- assuming, of course, that Kerr-McGee knows the amount of land to be purchased and its fair market value. In any case, purchase of as much as 100 acres would cost a small fraction of \$18,000,000.

The assumption that only cost of land should be considered as "burial fee" at New Douglas is erroneous. In addition to land purchase, there are costs for site surveys, data collection, public communication with local residents, engineering,

technical design, licensing, construction and completion of actual burial work.

Why aren't figures for post-stabilization monitoring and maintenance for Alternative I through IV included?

Post stabilization monitoring requirements were not defined, so estimates were not developed. However, they should be comparable among the alternatives (I, II, III, and IV). Costs for Alternative IV may be higher due to the additional work involved in monitoring a new-site location.

On what basis does Kerr-McGee add \$4,584,000 to the "direct site cost" of Alternatives I and III? What indirect costs are contemplated?

The \$4,584,000 cost in addition to on-site costs includes Kerr-McGee home office management, outside consultants, legal fees, engineering fees, etc. This percentage is based on actual cost data.

IV. Legal Issues

A. Applicability of the Uranium Mill Tailings Radiation Control Act (UMTRCA) to the Wastes at the West Chicago Site

The DES did not take a position on the applicability of the UMTRCA to the wastes at the West Chicago site. Commenters addressed this shortcoming as follows:

The Uranium Mill Tailings Radiation Control Act applies to the Kerr-McGee wastes. (AGO comments p. 8.)

The issue of whether provisions of the Uranium Mill Tailings Radiation Control Act of 1978

apply to the waste is raised, but not clarified, on p. 1-5. . . . This issue should be resolved in the final statement (DOI comments p. 1.)

Kerr-McGee agrees that Title II of the UMTRCA applies to the West Chicago wastes and that the final EIS should recognize this as well. Kerr-McGee in its July 30, 1982 comments on the DES has already made this point. There, Kerr-McGee emphasized that the West Chicago site contains significant quantities of thorium mill tailings which resulted from milling monazite ore for its thorium content. Extraction of thorium was a principal function at the former plant and not a sidestream of rare earth production, particularly after the passage of the Atomic Energy Act of 1954. Beginning at that time, the facility produced thorium nitrate under contract to the United States government. In connection with that thorium extraction project, Building no. 9 was constructed, and the disposal site was acquired in 1952 and 1955 to facilitate waste disposal from the expanded operation. The UMTRCA specifically covers "by-product material" which is defined in part as "the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." 42 U.S.C. § 2014(e). There is no question but that the large volume of thorium mill tailings present at the West Chicago site are by-product material and, as such, are directly covered by the Act.

The Kerr-McGee comments also noted that application of the UMTRCA to by-product material at the West Chicago site

is not diminished by the presence of mill tailings and process wastes generated at the site by rare earth production, rather than thorium production. Nothing in the Act or its legislative history suggests a congressional intent to exempt from UMTRCA by-product material which is commingled with other ore processing wastes. Two or more waste streams at facilities processing such ores is not uncommon. In addition, disposal of by-product material in significant volumes is not included in coverage under the Low-Level Radioactive Waste Policy Act of 1980. The NRC recognizes this in its final regulations under 10 C.F.R. Part 61, § 61.1(b):

Regulations in this part do not apply to . . . (2) disposal of uranium or thorium tailings or wastes (by-product material as defined in § 40.4(a-1)), as provided for in Part 40 of this chapter in quantities greater than 10,000 kilograms and containing more than five (5) millicuries of Radium 226. . . .

See Final Rule printed in Volume 3, Appendix F, NUREG-0945 (1982). Thus, failure to apply UMTRCA to the thorium mill tailings at the West Chicago site would result in a gap in the regulation of such wastes which Congress did not intend.

Two statements in the AGO comments merit additional comment.

[To] insure that byproduct material is disposed of in accordance with UMTRCA, all of the Kerr-McGee wastes should be disposed of in accordance with UMTRCA. (AGO comments p. 9.)

Kerr-McGee agrees that the Act applies to all wastes at the site, including ore residues generated from rare earth

processing and contaminated buildings, equipment and soil associated with thorium processing. The Act applies to these wastes because the by-product material at the site, which is directly covered by the UMTRCA, is inextricably mixed with mill tailings and process wastes from rare earth production. As a result, all of the tailings and process wastes at the site are contaminated with varying levels of low-level radioactivity. As a practical matter, the by-product and non-by-product materials cannot be separated out for different regulatory treatment. This mixture of wastes is precisely the kind of material that Congress intended to regulate under UMTRCA because of the widespread presence of relatively low levels of radionuclides dispersed through large quantities of non-radioactive waste materials. Thus, to insure proper disposal of by-product material in accordance with UMTRCA, the entirety of the tailings and process wastes is to be regulated under the Act.

As noted, the definition of "by-product material" in the Act includes "tailings or wastes" resulting from thorium or uranium milling. Since "tailings or wastes" is stated disjunctively, the Act must cover as by-product material wastes associated with thorium milling, but which do not constitute tailings. At a thorium processing plant, such wastes would include discarded, unused and contaminated process equipment, buildings and soils. This interpretation of "wastes" makes sense because the radiation hazard pre-

sented by buildings, equipment and soil contaminated by years of thorium processing is not significantly different from thorium mill tailings themselves. As Kerr-McGee noted in its July 30, 1982 comments, at pages 13-14, both the NRC and EPA have recognized this fact in environmental impact statements. Wastes associated with thorium production should be treated as "wastes" under the Act's definition of by-product material. Nothing in the Act or in the legislative history suggests that "wastes" should be interpreted narrowly to exclude the contaminated buildings, equipment and soil at the West Chicago site.

The AGO also commented on whether the UMTRCA favors on-site or off-site disposal of the West Chicago wastes:

With respect to the Kerr-McGee decommissioning, the statute itself thus appears to dictate that if another location exists at which disposal of the wastes would result in less need for long-term maintenance and monitoring than would the West Chicago location, the wastes must be disposed of at such other location. (AGO comments pp. 10-11.)

Kerr-McGee strongly disagrees with the AGO's conclusion that the language of the UMTRCA dictates removal of the West Chicago waste to off-site locations for disposal. To the contrary, no language in the Act states, either explicitly or implicitly, a preference for off-site disposal. In interpreting the Act, NRC and EPA personnel have repeatedly stated that on-site disposal is the norm contemplated by the Act and that removal and transportation of wastes would be a "worst case" option. In a letter to Congressman Stratton,

the Director of NRC's Office of Legislative Affairs stated:

Moving an entire tailings pile is an extreme worst case in that all other options would have to be evaluated and found to be unsatisfactory. A great deal of flexibility exists in terms of options to stabilize the tailings pile in place. Our licensing experience indicates that through recontouring and covering and hardening the tailings piles in place, the necessary level of assurance concerning long-term stability can be achieved at most, if not all, existing sites.

Uranium Ore Residues: Potential Hazards and Disposition, Hearings Before the Procurement and Military Nuclear Systems Subcomm. of the House Armed Services Comm. 97th Con. 1st Sess. p. 543 (June 1981).

Similarly, John B. Martin, Director, Division of Management, NRC Office of Nuclear Material Safety and Safeguards, testified before Congress, "We share EPA's view that [the tailings] should not be moved except as a last resort, and even then they shouldn't be moved very far. . . ." The Uranium Ore Residue Hearings, supra, at 155-156. On behalf of the EPA, Deputy Administrator John Hernandez testified before the subcommittee that because of the costs and potential dangers to public health, transportation of uranium mill tailings piles is a "last resort" solution. See Uranium Ore Residue Hearings, 12 Env. Rep. (BNA) p. 317 (June 1981). These concerns apply directly to the tailings and process waste located at the West Chicago site.

The legislative history of the Act does not support the AGO's interpretation that the objective of minimal long-term maintenance and monitoring of disposal sites dictates off-

site disposal. Statements by Congressional supporters of the Act indicate that minimizing long-term maintenance and monitoring is merely a goal, not a requirement, which in any event is presumed satisfied by compliance with applicable NRC licensing requirements. 124 CONG. REC. 38229 (1978) (remarks of Rep. Dingel); 124 CONG. REC. 37545 (1978) (remarks of Sen. Wallop). Kerr-McGee is not aware of any evidence which supports the AGO's suggestion that the need for long-term monitoring and maintenance would be greater for wastes stabilized on the West Chicago site than for wastes removed to another location.

B. Other Legal Issues

The City also commented on legal issues raised by the DES:

The City submits that Alternative III likewise represents the lack of resolution of a waste management problem under the jurisdiction of federal agencies; five to be specific. (City comments p. 9.)

Federal law provides that each state is responsible for providing for the availability of capacity either within or outside the State for the disposal of low-level radioactive waste such as that at the Kerr-McGee site. (City comments p. 10.)

Kerr-McGee agrees that Alternative III may only postpone resolution of the waste disposal problem, and has urged the NRC to adopt the only alternative that is without health and environmental risks, that is cost-effective, and that is a viable option--Alternative I. The City suggests that the duty of each state to provide low-level waste disposal

capacity pursuant to the federal Low-Level Radioactive Waste Policy Act of 1980 is relevant. It is not, because the statute does not include this material in its coverage and because there is no site which could accept this volume of low-level radioactive waste. Rather, as noted above, the waste is covered by Title II of UMTRCA, which imposes no duty on the state to provide a site. In any event, it will be many years before a Midwest or Illinois low-level radioactive waste site is established, and the problem of the West Chicago waste should be resolved long before then.

[The NRC] does not integrate its "Branch Technical Position for Disposal or Onsite Storage of Residual Thorium or Uranium from Past Operations. (City comments p. 5.)

Kerr-McGee's prior comments on the Branch Technical Position (Transmitted January 21, 1982 from W. J. Shelley (Kerr-McGee) to R. G. Page (NRC)) have noted that this NRC document does not apply to a uranium or thorium mill site subject to UMTRCA.

Impacts on psychological health are within the intended scope of an EIS. (City comments p. 6.)

The decision of the Court of Appeals for the District of Columbia in the PANE case cited by the City is, by its terms, not applicable to the West Chicago facts. The NRC has issued a policy statement indicating that it will require a consideration of psychological health in EIS preparation only in cases where a nuclear accident has occurred at the site under consideration. (47 Fed. Reg. 81762, July 22, 1982.) It should be noted that the United States Supreme

Court granted a petition for a writ of certiorari in NRC
v. PANE on October 29, 1982 (Nos. 81-2399 and 82-358).

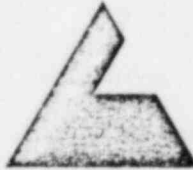
ATTACHMENT A

Response of

Law Engineering Testing Company

To

Radiation Safety Services, Inc. Comments (March 10, 1982)



LAW ENGINEERING TESTING COMPANY

geotechnical, environmental & construction materials consultants

181 INVERNESS DRIVE WEST, SUITE 100
ENGLEWOOD, COLORADO 80112
(303) 771-8641

April 8, 1982

Dr. W. J. Ganus
Kerr-McGee Corporation
Kerr-McGee Center
Oklahoma City, Oklahoma 73125

Subject: West Chicago Thorium Mill Closure
Response to Radiation Safety Services, Inc. Comments
LAW Project No. 710022

Dear Dr. Ganus:

At your request, we have reviewed the comments made by Radiation Safety Services, Inc. in their letter dated March 10, 1982. The following is an assessment of these comments.

I. In Section A of their document, Radiation Safety Services, Inc. (RSS) raise questions regarding monitoring recommendations made in our closure plan report. It is apparent from the nature of these comments that RSS did not understand the scope of our report. Therefore, we offer the following clarifications:

1. The monitoring described in the closure plan report was conceived solely as a means of verifying the performance of the disposal cell over a period of time sufficient to demonstrate proper performance, or alternatively, to detect unexpected performance. We believe that the likelihood of cell failure will decrease with time, and therefore, a finite monitoring period is appropriate.
2. The closure plan report addressed only those items of site closure related to disposal cell design, and did not treat other activities related to site closure. Those activities are addressed in other documents submitted by Kerr-McGee to the NRC. Specifically, ground and surface water monitoring was not addressed in our report. The suggestion for monitoring within the disposal cell was not intended to be a substitute for an overall site monitoring program.

3. Subjects such as long-term surveillance and maintenance are properly considered within the institutional aspects of closure. Our report did not attempt to address such items.

II. In Section B of their document, RSS make many statements concerning the bases for our design. For the most part, these statements are incorrect. The following addresses these issues:

1. RSS states that decisions regarding the disposal cell geometry were based upon computer modeling. This is not true. The disposal cell geometry was developed to achieve stated goals. The computer modeling was performed to analyze system performance.
2. The RSS discussion of modeling is somewhat confusing, and seems to imply a lack of understanding of current analytical capabilities. We know of no well-documented models which can simultaneously consider all aspects of the long-term behavior of the disposal cell. Other issues raised include:
 - a. The RSS discussion of the fate of precipitation is essentially correct.
 - b. Our analyses of percolation did include accounting for all water added to the disposal system.
 - c. We see no contradiction in runoff amounts between the percolation and erosion calculations. Average annual runoff as determined by the percolation calculations was 19 percent of incident precipitation.
 - d. The RSS discussion of the limitations of the universal soil loss equation has merit. The equation gives long-term average estimates of sheet and rill erosion. The equation does not provide estimates of gully erosion, and could not be used for such purposes, since gullying is strongly influenced by drainage patterns. We know of no way to model or compute gullying which does not require so many speculative assumptions as to render the results meaningless for this application. We have attempted to minimize locally severe erosion by providing proper site drainage and using minimum slopes

consistent with other constraints. Nevertheless, we expect that some time after construction is completed will be required to establish the grass cover, and to identify, repair and stabilize local areas of erosion. Such activities would be expected to occur during the post-construction period of active surveillance and maintenance. The universal soil loss equation was used to obtain an appraisal of the stability of the disposal cell, and is appropriate for this purpose.

- e. We cannot comment about discrepancies between our erosion estimates and "commonly accepted values for similar environments" without more information regarding these commonly accepted values.
- f. Ground water runoff refers to that portion of sub-surface water which flows into surface water bodies, and represents only a portion of percolation as we have used it in our report. Other ways in which percolation may be lost include discharge to the near-surface soils and subsequent evapotranspiration, percolation to deeper aquifers, or withdrawal by wells. In shallow ground water systems where downward infiltration is inhibited (such as is the case in the West Chicago site area), ground water runoff generally represents a substantial discharge mechanism. Therefore, the comparison between ground water runoff and computed percolation is meaningful in that it indicates the computed percolation values are realistic.
- g. RSS presents a philosophical discussion on the use of models which is not in accord with current practice or capabilities. It is difficult to respond directly to this discussion because no explanation of what additional data should be collected nor what attributes RSS considers to constitute a proper model are given. Further, there is no indication that, if such a discussion were given, such data collection and models are within current capabilities.

We know of no physical system, regardless of how simple it may be, which can be modeled without the need for simplifying assumptions. The decision which must be made in modeling is not whether to

simplify, but how to simplify. A properly-selected model will account for the basic aspects of importance to the problem being studied, and will be useable in the sense that data are available or can be collected which will allow the model to be applied. Further, the model should be simple enough to allow the results to be understood, and to allow the effects of the simplifications required to construct and to use the model to be ascertained. The transport model used for this study meets these requirements, and its use allows an appraisal of the effects of the site upon the surrounding environment. The model does adequately describe the hydrologic conditions beneath the site to the extent to which it was applied.

Complex systems require complex models only if the complexities of the system behavior must be ascertained. The selection of a model is governed as much by the types of results required as by the characteristics of the system being modeled.

- h. The comment by RSS regarding the length of record used for the percolation analyses is well-taken. Clearly, a longer record would have included more variation in climate at the site. However, the results of these analyses were not critical either to the design nor the assessment of the safety of the site. Maximum expected percolation is controlled by the cap design and not by climatic conditions. Further, the average of the data used in these analyses correspond closely to long-term climatic averages in the area.

Contrary to the statement of RSS in their comments, average percolation and erosion rates are more appropriate for assessing the long-term stability of the site than are values which occur only infrequently and for brief durations, and whose effects are included in the average values.

- i. Differences in the quality of vegetation. Computations of erosion and percolation were performed by methods both of which require semi-qualitative estimates of grass cover which will be maintained in this area. The two methods use different category headings to describe vegetation quantity. Hence,

the "fair" grass cover assumption used in the percolation analyses is roughly equivalent to the "moderate productivity" assumption used in the erosion calculations. Percolation estimates are not sensitive to the type of cover unless the site is devoid of cover.

The crop management factor used in the erosion calculations is consistent with the factor for a maintained, grassed area in the West Chicago area.

- j. The source of the depth of frost penetration used in our design is clear; it came from the stated references. The depth of 42 inches can be computed from a relation suggested by Brown (Winterkorn and Fang, Foundation Engineering Handbook, Van-Nostrand Reinhold, 1975) using design freezing index values for the coldest year in a 10-year cycle. This value also is the building code frost depth for the Chicago area for placement of footings below the depth of soil volume change. The depth of 60 inches was computed by Professor Sowers considering more extreme climatic conditions. We question the validity of the depth quoted in the RSS document.

III. In Section C, RSS states additional reservations to the plan. The following addresses the points brought out in that section.

1. Chemically Stabilized - Monitoring results indicate that ground water quality is improving in the site area. It is not clear why the question of stabilization impinges upon the results of the leachate tests.
2. Improvements in Waste Disposal and Additional Hydrologic Studies - These items are addressed adequately in the text.
3. Monitoring in the Waste Cell - This comment stems from a misunderstanding by RSS of the proposed program, and has been addressed in Section I of these responses.
4. Objectives - Again, these issues have been raised in other parts of the RSS document, and addressed previously in this response.

5. The Disposal Cell Liner - The natural clay is discontinuous at the site, and at least a portion of the liner will be constructed of compacted material. The required thickness of the liner is not related to settlement by consolidation of the glacial drift. The statement that natural liners would be better able to withstand the stresses resulting from the overlying waste is incorrect. To require that no leakage be allowed from the disposal cell is to create a situation requiring continuing maintenance for a very long period of time. Such thinking is inconsistent with the state-of-the-art in waste disposal.
6. Treatment of Collected Leachate - There are no provisions for on-site treatment and disposal of leachate, collected after cell closure. Therefore, any such leachate would be tested, and if contaminated, treated and disposed at an off-site facility.
7. Waste Compaction - The requirement stated is two-fold. First, the waste will be disposed so that no large voids will exist within the waste. The waste will be compacted during placement to preclude objectionable secondary consolidation.
8. Waste Consolidation and Future Cell Deterioration - The wastes at the site can be placed in the cell in a stable state so that cell deterioration does not occur. The consideration of compaction requirements and consolidation properly belong to the final design of the cell, and not to the conceptual design presented in our report.
9. Diffusion of Gas - The question of radon diffusion through the cap is addressed in other studies by Kerr-McGee. The question of cap breaching has been discussed in paragraph "g" above.
10. Cell Cover Slopes - The basic slope of the cell cover is 3 percent. The 1 percent value quoted (incorrectly) by RSS is presented as a minimum slope, and is intended as a lower limit on slopes in small areas of the cover such as where transitions in slope occur. This is not an inconsistency. Our conceptual design included no consideration of the ultimate use of the site. Such issues would be addressed in the custodial care requirements for the site.

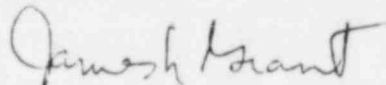
Kerr-McGee Corporation
April 8, 1982
Page Seven

11. Vegetation Control - Vegetation control is an issue which will be addressed in the custodial care requirements for the site. The consideration of such issues was beyond the scope of the conceptual design study.

We believe the above items adequately address the points raised in the RSS document. Please contact us should you have any questions regarding our responses.

Very truly yours,

LAW ENGINEERING TESTING COMPANY



James L. Grant, Ph.D.
Chief Hydrologist

JLG:cf