U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

ENVIRONMENTAL ASSESSMENT RELATED TO THE CONSTRUCTION OF THE AlChemIE FACILITY 2 OLIVER SPRINGS

DOCKET NO. 50-604
ALL CHEMICAL ISOTOPE ENRICHMENT, INC.

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1.0 INTRODUCTION, SUMMARY, AND CONCLUSIONS

1.1 Introduction

The All Chemical Isotope Enrichment Company (AlChemIE) filed with the U.S. Nuclear Regulatory Commission (NRC) an application, dated November 17, 1987, for a license to construct and operate the AlChemIE Facility-2 OLIVER SPRINGS. AlChemIE intends to use the facility to enrich stable isotopes. In order to enrich stable isotopes, AlChemIE is purchasing centrifuge machines from the Department of Energy (DOE).[1] The centrifuge machines were originally designed and manufactured to enrich uranium, but AlChemIE will not use them for that purpose.

Although the enriching of stable isotopes is not ordinarily within the regulatory authority of the Commission, any equipment or device capable of enriching uranium, if intended for commercial use, must be licensed by the Commission. Since the centrifuge machines AlChemIE will obtain from the Department of Energy are capable of enriching uranium, their possession and use must be licensed. The Commission rule which governs the licensing of production facilities is 10 CFR Part 50.

This document does not address the topic of safeguards. Readers interested in that topic should refer to the safety evaluation report soon to be issued by the NRC staff.

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[1]On April 7, 1986 the Department of Energy published a notice in the Federal Register (51 FR 11811) requesting expressions of interest for participation in the Department's uranium enrichment program. AlChemIE responded to the notice, expressing an interest to use the centrifuge machines for commercial purposes, not involving the enriching of uranium, as further described herein and in their application. On December 5, 1986, AlChemIE submitted a proposal in response to the Department's announcement in the Commerce Business Daily requesting such proposals. On December 27, 1986, the Department notified AlChemIE that a minimum of 250 machines were reserved at the Portmouth, Ohio, Gaseous Centrifuge Enrichment Plant. Contract negotiations between AlChemIE and the Department have proceeded from that time, in one particular for lease arrangements for the Centrifuge Plant Demonstration Facility, located at the K-25 complex on the Federal reservation at Oak Ridge, Tennessee.

1.2 Summary

The local environment at Oliver Springs is moderately well characterized as a result of the environmental studies of the Oak Ridge Reservation. The area is being developed as an industrialized park with utilities and waste management services to support the major facility needs.

The facility will be housed in a steel-framed building with aluminum siding. The centrifuge equipment will be obtained from DOE's Portsmouth Facility. Some of these machines are contaminated with uranium. The centrifuges will be used to process various chemical compounds, some of which are considered toxic or hazardous.

AlChemIE will file for an air emissions permit with the Tennessee Department of Health and Environment (TDHE). While the feed material and processing rate information is not completely defined, the NRC used available information to perform a conservative analysis which indicates that material releases due to normal operations are expected to be environmentally acceptable.

AlChemIE waste water (primarily sanitary water) will be discharged through the existing Oliver Springs waste water treatment plant. The discharge limits will not have to be modified to accommodate the AlChemIE waste water. AlChemIE's non-hazardous and hazardous/toxic solid and liquid wastes will be transferred to appropriate existing DOE, municipal, and commercial waste management operations which already have the necessary permits.

An analysis of potential accidental releases of material from the process indicates that the off-site concentrations of toxic materials will be less than the time-weighted average threshold limit values (TWA-TLV) which have been established by the American Conference of Governmental Industrial Hygienists (ACGIH). Exposure of the population to toxic material emissions in concentrations below these limits will not result in any effects.

The NRC assessed the potential consequences of using the contaminated equipment and concluded that even under the unexpected conditions where the uranium would be released to the environment, the consequences would be minimal with a 50-year whole body equivalent dose commitment to an individual of less than 1.2E-5 mrem.

1.3 Conclusions

On the basis of the staff's evaluation of the applicant's environmental report and further independent analysis of environmental impacts of the proposed action, the staff concludes that the actions proposed will not result in any significant environmental impacts.

2.0 DESCRIPTION OF THE PROPOSED FACILITY AND OPERATIONS

AlChemIE is planning to build a new facility near Oliver Springs, Tennessee, for the enrichment of stable isotopes. The facility, a description of the isotope enrichment process, the utility requirements, and the discharges are presented in this section.

2.1 Facility

OVERVIEW

The AlChemIE Facility 2 will be a steel frame structure with aluminum siding and roof, insulation, and metal interior walls. The overall dimensions of the facility are 140 ft by 210 ft. The process area is 140 ft. by 100 ft while the assembly and maintenance area is 140 ft by 60 ft and the storage area is 140 ft by 60 ft. The roof over the assembly and maintenance area is 125 ft high while the roof over the process and storage areas is 85 ft high. The centrifuge cascades will generally be relatively small (5-10 machines) with several cascades in operation at any one time.

Figure 2.1 presents an overall perspective of the facility and identifies the various portions of the facility. The centrifuges, which are the major pieces of process equipment, are located in the process area. AlChemIE will also use this area for feed and withdrawal.

Because of the value of the product material and its toxicity in several instances, the applicant will take several precautions to confine it. The avenue for any material to leave the facility and enter the environment is the ventilation system which is discussed in the following paragraphs.

BUILDING VENTILATION SYSTEM

There will be a ventilation system in the cascade area, the main purpose of which is to maintain a vertical temperature gradient for the cascade in order to improve process efficiency. This ventilation system will recirculate

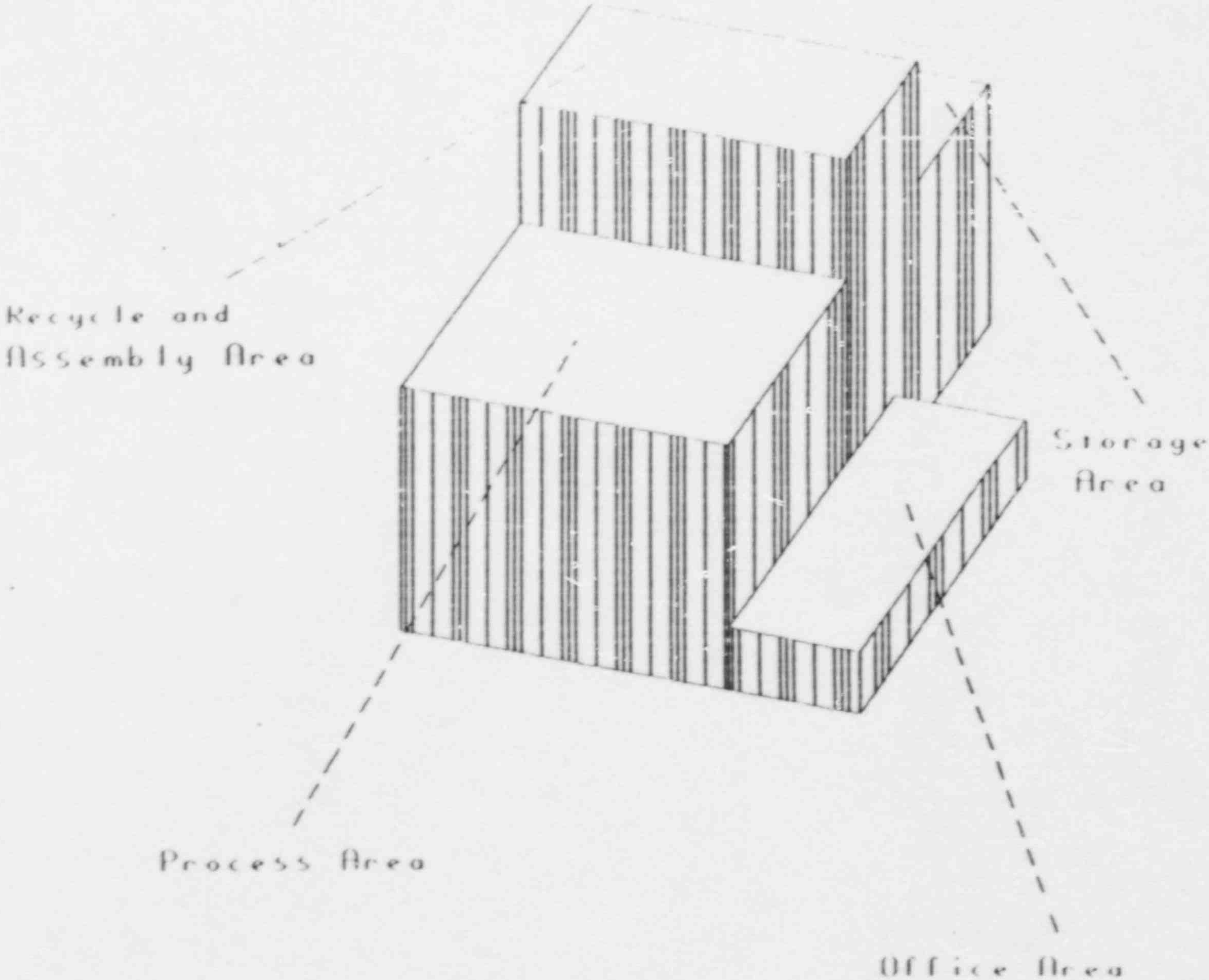

Figure 2.1 AlChemIE's Oliver Springs Facility

air, heating it as necessary, and discharging air as necessary through roof-mounted ventilators. The ventilators will be operated by an automatic control system to maintain the desired temperature profile in the cascade area. The maximum exhaust rate is projected to be 150,000 cfm, but it is expected to operate at significantly lower levels, particularly during the winter months when heat will be required to maintain the desired temperature gradient. The building operators have the ability to shut down the exhausters should that be necessary for any reason. The system maintains the cascade area at a pressure slightly above atmospheric (0.1 in. of water pressure).

The cascade area as well as other areas of the facility have roof mounted exhausters that can be activated by the operators from the control room if necessary. These will not be used for normal operations.

BUILDING DRAIN SYSTEM

The building will have no floor drain system.

2.2 Process

CENTRIFUGES

The gas centrifuge isotope enrichment process involves the rotation of a long, thin vertical cylinder about its vertical axis in an evacuated casing. The rotation at high speeds subjects the contained gases to centrifugal acceleration thousands of times greater than gravity. As a result, the heavier isotopes collect at the outer radius of the cylinder.

In the machines being used in the AlChemIE facility, the feed is introduced at the center of the rotating cylinder and two streams are produced. The first contains the concentrated light elements and is taken off at the top of the centrifuge near the center of the rotating cylinder. The second contains the concentrated heavy elements and is taken off at the bottom of the centrifuge near the outer radius of the rotating cylinder. Both streams are products.

Some of these machines have already been used for uranium separation purposes and have residual amounts of uranium contamination in them. The extent of uranium contamination in the machines has been estimated by DOE. The DOE estimates that the machines which were originally in the centrifuge building at the Portsmouth site contain, on the average, 85 grams of uranium with an average enrichment of 1.1 % U-235. The chemical form of the uranium is UO_2F_2, and is permanently fixed on the machines and piping. Processing of materials other than uranium in the centrifuge machines at the Centrifuge Plant Demonstration Facility (CPDF) at Oak Ridge has indicated that the residual uranium is not transferred to the process gas stream. The uranium is expected to remain fixed to the piping and centrifuges during AlChemIE's operation of the facility.

FEED AND REMOVAL SYSTEMS

The centrifuges process gaseous material. The feed for the centrifuge cascade is either already in the gaseous form at normal temperatures and pressures or it is converted to a gas by the application of heat from either a hot water bath or a forced hot air system.

AlChemIE will utilize portable feed carts for feed cylinders which require either heating in order to generate a feed gas or confinement because the material is toxic or hazardous. These feed carts, while not designed at the present time, may provide secondary confinement functions for feed cylinders. Feeds such as the noble gases (Ar, Kr, Ne, etc.), which are already a gas and are non-toxic, will not require feed carts.

After the material has passed through the centrifuge cascade, it is placed in product cylinders. This is accomplished by condensation, possibly with the aid of a compressor if the physical properties of the material being processed through the cascade require one. The condensation will occur in portable withdrawal carts. The carts are still being designed, but they will be similar to the portable feed carts in providing confinement capability. The material being withdrawn from the cascade will be condensed using either dry ice in isopropyl alcohol or liquid nitrogen.

PROCESS OFF-GAS SYSTEMS

Each cascade will have four process off-gas systems. These areas are the evacuation and purge systems for: (1) the cascade, (2) the feed system, (3) the product withdrawal system, and (4) the tails withdrawal system.

The cascade evacuation and purge system will establish and maintain a low pressure in the centrifuge casing. The evacuation system is used to reduce the centrifuge casing pressure from atmospheric pressure down to a level where the purge pump operates. At this point, the evacuation system is shut off and the purge system is used to further reduce and maintain the vacuum used in the process.

The evacuation and purge systems for the feed and withdrawal systems are used in combination with each other in a similar manner as the feed and withdrawal systems. The feed evacuation and purge system is used to remove air from the lines between the feed cylinder and the centrifuge before the feed is introduced into the cascade. This system is only used prior to start-up of the cascade.

The product and tails withdrawal evacuation and purge system is used to initially evacuate the cascade and the withdrawal piping The purge system may remain operational during cascade operation to remove any non-condensables that collect in the product or tail cylinders.

The discharges from all four of these evacuation and purge systems will be connected to a common discharge header for each cascade. In all the cascades except those processing xenon and krypton, the gases in this header will be treated to remove the process material. The specific method of gas treatment of the various potential process materials has not been selected at the present time, but AlChemIE has stated that it will use cold trapping, chemical trapping or mechanical trapping depending on the physical and chemical properties of the process material.

PROCESS MATERIALS

There is a wide range of feeds that AlChemIE is planning or considering for processing in its Facility 2. A list of the potential materials to be processed as well as the feed form is presented in Table 2.1. The various forms have been identified based on their vapor pressure. Some of these materials or their reaction products are toxic. For these toxic materials in particular, AlChemIE states in their environmental report that they will use material safety data sheets and other data supplied by the manufacturers of their feed chemicals to develop handling, operating, and safety procedures. These are normal industrial precautions to protect workers and the environment when handling the material.

Additional materials will be utilized in the AlChemIE enrichment process. These materials have been identified in the AlChemIE waste management plan and are: (1) absorbents for the process off-gas treatment system, (2) vacuum pump oil, (3) freon TP-35, (4) centrifuge oils, (5) nitrogen, dry ice, and isopropyl alcohol which are used for product and tails condensing.

2.3 Utilities

There are four utilities which will be used in the AlChemIE facility. These are electricity, water, natural gas, and compressed air. The demand for each of these utilities, and the capability of existing systems to provide these utilities is reviewed in this section.

The electricity is used to drive the centrifuges, the vacuum pumps, and the compressors. It will also be used to generate the small amount of heat required to raise the temperature of some of the feed cylinders. The maximum demand for electricity has been estimated by AlChemIE to be 2000 kw. The existing power system in the region is capable of delivering millions of kw to the area. This regional capacity was originally established for the support of the ORGDP operations which are now shut down.

TABLE 2.1 POTENTIAL AlChemIE FEEDS

Element Being Separated	Element or Compound	Toxic or Hazardous Properties for the Material or its Reaction Products
Ar	Ar	
B	$B(CH_3)_2I$	yes
B	BF_2I	yes
Br	CF_3Br	
C	CF_4	
C	C_3H_8	
C	$C_2H_xF_{(6-x)}$	
Cd	$Cd(CH_3)_2$	yes
Cl	CF_3Cl	
Cr	CrO_2F_2	yes
Fe	$Fe(CO)_5$	yes
Ga	$Ga(CH_3)_3$	yes
Ge	GeF_4(l)	yes
Ge	GeF_4(g)	yes
Ir	$Ir(CH_3)_3$	yes
Ir	IrF_6	yes
Kr	Kr	
Mo	MoF_5	yes
N	N_2	
Ne	Ne	
Ni	$Ni(CO)_4$	yes
O	PF_3O	
O	CO_2	
Pb	$Pb(CH_3)_4$	yes
Pt	$Pt(PCH_3)_3$	yes
Re	ReF_6	yes
Ru	$Ru(CO)_4$	yes
S	SO_3	
S	SF_6	
Sb	SbH_3	yes
Se	SeF_6	yes
Si	SiF_4	yes
Sn	SnH_4	yes
Ta	TaF_5	yes
Te	TeF_5	yes
Ti	$TiCl_4$	yes
Tl	$Tl(CH_3)_3$	yes
W	WF_6	yes
Xe	Xe	
Zn	$Zn(CH_3)_2$	yes

The primary use of water at the AlChemIE facility will be for sanitary purposes and for cooling water makeup. The maximum demand for water for the AlChemIE facility is estimated to be 5000 gallons per day primarily for sanitary water use but also for cooling water makeup. This water will be discharged through the waste water systems to be installed in the Andy Justice Industrial Park.

Natural gas will be used for space heating in the AlChemIE Oliver Springs Facility and the maximum rate of consumption will be less than 10,000 scfm.

Compressed air is used for instrumentation and control purposes. AlChemIE will have its own compressors to meet this need.

Liquid nitrogen and dry ice (CO_2) in isopropyl alcohol will be used at the facility to condense the product and tail gases after they have been removed from the cascade.

A summary of the consumption of these utilities and their planned usage is presented in Table 2.2.

2.4 Discharges

The operation of the AlChemIE facility will result in some gaseous and liquid discharges to the environment as well as some solid waste which must be managed. This section describes the estimated discharges and the estimated solid waste.

GASEOUS DISCHARGES

Some very small gaseous discharges are expected from both the building ventilation system as well as the evacuation and purge systems for the cascade. The extent of these emissions has not been estimated by AlChemIE, but the Staff believes that they will be small because the cascades operate under vacuum and because DOE experience with such facilities has demonstrated that releases are small. Furthermore, AlChemIE has stated that they will install systems to treat the discharges from the evacuation and purge systems for all cascades

TABLE 2.2 UTILITIES AND MATERIALS REQUIRED FOR AlChemIE FACILITY 2

Utility	Peak Facility Demand
Electric (kw)	2000
Water (gal/day)	5000
Compressed Air (scfm)	750
Natural Gas (scfm)	10,000
Liquid Nitrogen (lb/day)	450
Dry Ice, CO_2 (lb/day)	240

except those processing xenon and krypton. These systems will utilize cold trapping, chemical trapping or mechanical trapping systems depending on the physical and chemical characteristics of the material involved. In addition to these releases of process materials, there will be some releases of N_2 and CO_2 from the cooling of product cylinders. The maximum release rate of these two inert gases is 450 lb/day for N_2 and 240 lb/day for CO_2.

WATER DISCHARGES

The sanitary waste water from the facility will be discharged through the waste water system associated with the Andy Justice Industrial Park. The estimated quantity of sanitary water discharged from the AlChemIE 2 facility is 5000 gallons per day. This will be released to existing Oliver Springs waste water treatment systems.

The existing Oliver Springs sanitary waste treatment facility has a capacity of 1 million gallons per day. During normal operations, it currently processes 400,000 to 450,000 gallons per day. The AlChemIE discharges will be very small additions to the current system.

During periods of heavy rainfall, the existing system can be overtaxed because of water infiltration into drain piping. This problem is recognized by state authorities and Oliver Springs has a program to replace the leaking pipes.

OILS, SOLVENTS AND SOLID WASTES

In addition to these air and water discharges, there will be some oils, solvents, and solid waste generated at the facility. The oils and solvents (both water and organic solvents) will be generated as a result of operations and maintenance activities. These wastes will be handled and packaged on site as required for safe shipment to off-site waste treatment or disposal facilities.

Solid waste will also be generated at the facility as a result of failed equipment (primarily centrifuges), but also vacuum and gas handling equipment. The failed centrifuges may contain uranium as well as toxic or hazardous material contamination. In the event they are contaminated with toxic or hazardous material, they will be decontaminated. The decontaminated failed centrifuge will then be sent to DOE for classified burial, and the toxic or hazardous material removed from the equipment will be packaged for shipment to a licensed waste management contractor. All solid wastes will be transferred to existing waste management organizations which are licensed to handle the various kinds of waste generated.

Table 2.3 presents a summary of the estimates of liquid and solid waste that will be generated by AlChemIE Facility 2. The table also identifies the amount of material expected to be sent to each type of treatment or disposal site.

2.5 Administrative Controls

The AlChemIE operations will conduct isotope separation operations according to the needs of customers in the medical, industrial, and research communities. As such, the exact determination of what and when isotope separations will be conducted will depend on the status of the commercial market. To help assure that operator and public health and safety are considered during processing, AlChemIE will prepare detailed handling, operating, and safety procedures for each of the materials before actual processing is undertaken.

TABLE 2.3 AlChemIE FACILITY 2 DISCHARGES

		Projected Discharge	Destination
WATER (gallons/day)		5000	Sewer system
SOLID WASTE (lbs/yr)		1930	commercial garbage
		2980	ChemWaste
		12,300	DOE/ORGDP
		1180	scrap metal
		100	TOSCA or RCRA facility
	Subtotal	18,490	
OILS AND SOLVENTS (gal/yr)		20	commercial disposal
		300	ChemWaste
		50	TOSCA or RCRA facility
	Subtotal	370	

3.0 DESCRIPTION OF AFFECTED ENVIRONMENT

The environment surrounding the proposed AlChemIE facility at Oliver Springs, Tennessee, has been well characterized as a result of studies and investigations by DOE and their contractors concerning facilities on the nearby Oak Ridge Reservation (ORR). Detailed treatments and discussions of land use, geology, surface and ground-water hydrology, meteorology, ecology, cultural and historical resources, socioeconomics and demography, and aesthetic characteristics can be found in Loar, et al., 1980 (reference 1); MMES, 1986 (reference 2); and Union Carbide, 1979 (reference 3). An environmental report which discusses the proposed action as it affects the environment has been prepared by the EDGe Group, 1987 (reference 4).

This section briefly summarizes each aspect of the environment around the proposed ALChemIE facility. More detailed information can be obtained from the references listed above.

LAND USE

The proposed facility will be constructed at the 247 hectare (610 acre), Andy Justice Industrial Park located within the Oliver Springs city limits (Figure 3.1). The lands surrounding the facility are rural farmland or rangeland and associated low density housing. The nearest house is approximately one-half kilometer to the northeast. Approximately 2 kilometers to the southeast are residential areas of Oak Ridge. The commercial center of Oliver Springs is approximately one and one-half kilometers north. Highway 61, the major four-lane access to Oliver Springs, runs southeast from downtown Oliver Springs and passes within one-half kilometer of the proposed facility. Both sides of this highway within the Oliver Springs city limits are commercially developed. The AlChemIE Facility 2 will occupy about 8 hectares (20 acres) of land at the industrial park.

Figure 3.1 Location of the Proposed AlChemIE Facility

GEOLOGY

The site lies in the Valley and Ridge Physiographic province of East Tennessee. This province is characterized by alternating ridges and valleys aligned southwest to northeast. The ridge and valley topography is an expression of the different erosion rates of the folded and faulted Paleozoic sedimentary formations which underlay the province. The proposed ALChemie site lies in a valley underlain by shales and limestones of the Conasauga Formation. Ridges to the northwest and southeast of the site are underlain by the more resistant Knox group and Rome Formations.

CULTURAL AND HISTORICAL RESOURCES

There are 23 sites in the five county area surrounding the proposed facility which are listed in the National Register of Historic Places. No historic structures or sites requiring preservation are located near the proposed AlChemIE facility. Only one of the 23 listed historic sites are within 10 km of the facility.

DEMOGRAPHY AND SOCIOECONOMICS

The proposed facility will be located in Anderson county within the Oliver Springs city limits. The five county area (Anderson, Knox, Loudon, Morgan and Roane) had a combined 1980 population of 480,622. The largest population centers are Knoxville 40 km east and Oak Ridge 10 km northeast with 1980 populations of 183,139 and 27,662, respectively. The city of Oliver Springs had a 1980 population of 3,600. The area immediately surrounding the proposed facility is rural farmlands and rangeland with low population density.

Currently, the DOE and its contractors are the dominant force in the local economy. DOE accounts for 77 percent of the local employment in Oak Ridge and owns 63 percent of the total land area within the city limits. This area includes many of the prime industrial sites on TVA's Melton Hill and Watts Bar Lakes. The fact that DOE owns much of the land which could be developed for industry reduces the size of the potential tax bases for Anderson and Roane counties. Tax statistics show that Anderson county has the highest property tax rates in the state of Tennessee.

ECOLOGY

The ecology of the nearby DOE Oak Ridge Reservation has been studied and assessed by numerous workers. Comprehensive treatments of terrestrial and aquatic communities can be found in the references identified at the beginning of this section.

The facility at Oliver Springs will consist of buildings and paved or concrete areas within a fenced compound. The region immediately surrounding the proposed facility is primarily pasture land with fence row vegetation. The woodland communities in neighboring areas are typical of the second-growth forests that characterize this portion of East Tennessee. There are no data on terrestrial fauna specific to the Oliver Springs area; however, component species are believed to be typical of those found in similar habitats within the region. There is no evidence of species which are on either the state or federal list of threatened or endangered species.

HYDROLOGY

Poplar Creek, located less than 500 feet south of the proposed facility, is the major surface water body in the immediate area. The drainage basin comprises 136 square miles of the surrounding Cumberland Mountains and Valley and Ridge province. The stream gradient in its reach adjacent to the proposed facility is less than 2 percent, and the stream morphology is one of broad meanders that span the valley floor. Poplar Creek flows into the Clinch River approximately 10 km southwest near the ORGDP. The surface waters of the watershed are a calcium-magnesium/bicarbonate type. Hardness is generally moderate with total dissolved solids concentration usually ranging between 100 and 250 mg/l. Run-off from the facility would go into Poplar Creek. Sanitary discharges from the facility would be treated in the Oliver Springs sewage treatment facility.

Ground water in the area occurs under water table conditions but local and transient semi-confined conditions have been observed during periods of high water levels, especially in low areas. Water levels are highest during January and February and decrease to minimum levels during October and November. Depth to the water level is generally 10 meters or less except in areas of high relief. The Knox group and the Chickamauga Formation are the primary aquifers in this area of East Tennessee. Permeabilities in these units are quite high near the surface where dissolution has enlarged fractures in the dolomites and limestones. Data indicates that permeabilities decrease with depth, so that ground-water movement is restricted to the upper more weathered zones of bedrock.

Oliver Springs municipal water is supplied from Bacon Spring at the northwest base of Black Oak Ridge near highway 61 (about 8 kilometers away). Water from Bacon Spring is pumped to Oliver Springs in water mains parallel to Highway 61. The water for the AlChemIE facility will come from this main. Residential and single-family wells are common in rural areas not served by public water supplies. Many residents in the rural areas around Oliver Springs obtain their water from such wells.

METEOROLOGY

The meteorology of this area of East Tennessee is largely influenced by its topography. The prevailing winds follow the topographic trend of the ridges: daytime up-valley winds come from the southwest; nighttime down-valley winds come from the northeast. No meteorological data is available for Oliver Springs but data from the ORGDP, which has very similar topographic features, has been collected. The wind rose (Figure 3.2) based on data collected at 60 meters above ground surface at ORGDP during 1987, shows the bimodal nature of the winds at the ORGDP site. Annual and short term X/Q values were calculated using this data. It is expected that this data should be applicable to the Oliver Springs site because of the general similarity of the topographical features of the two sites, although the Oliver Springs site would be expected to be less dominated by flow from the ENE. Still the X/Q values that were calculated from the ORGDP data could be used at the site and are expected to be

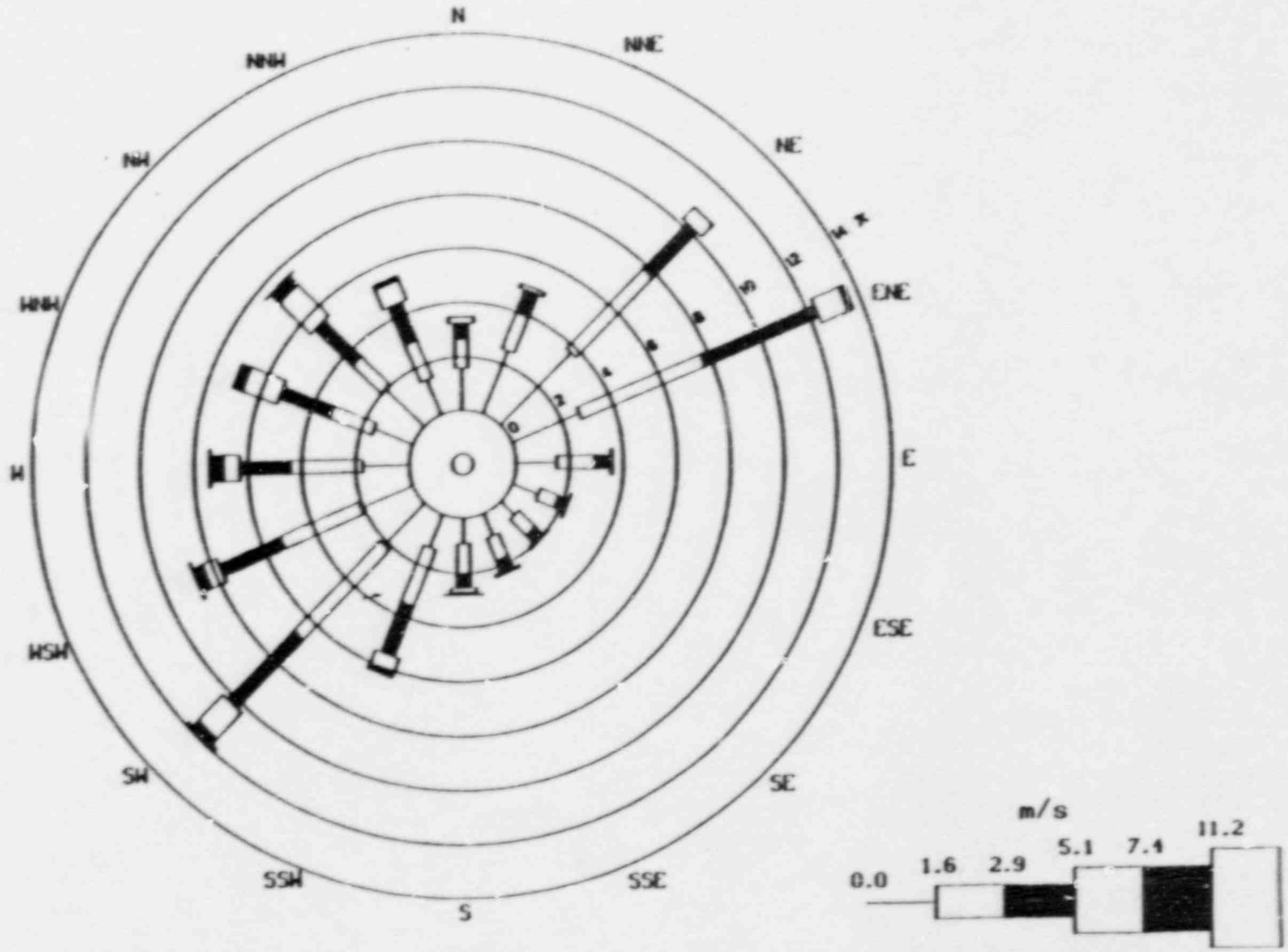

Figure 3.2
Wind Rose for the Oak Ridge Gaseous Diffusion Plant Site (Data taken at 60m during 1987)

conservative. This analyses shows insert Figure 3.2 here that maximum annual average X/Q values are predicted for the SSW to WSW direction at distances of 1 to 1.2 km and in the NE to ENE direction at distances of 0.5 to 0.6 km. The value of X/Q ranges from 3.2E-8 to 3.8E-8 sec/m^3.

4.0 ALTERNATIVES TO THE PROPOSED ACTION

There are three general alternatives to the proposed action that have been identified and are discussed in this section. These alternatives are the no action alternative and the different site alternative. The different site alternative has two variations, expansion at the CPDF site and the selection of another new site. Each of these are discussed in the following paragraphs.

The alternatives are evaluated in section 5 along with the proposed action.

4.1 The No Action Alternative

The no action alternative would result in AlChemIE not constructing the new facility at any location.

4.2 The Alternate Site

There are two variations on this alternative. The first involves the construction of additional centrifuge isotope enrichment capability at or very near the CPDF where AlChemIE is already establishing its first facility. The second involves the selection of a new construction site other than the Andy Justice Industrial Park.

5.0 THE CONSEQUENCES OF THE PROPOSED ACTION AND THE ALTERNATIVES

5.1 Consequences of the Proposed Action

5.1.1 Nonradiological Consequences

IMPACTS OF CONSTRUCTION

The proposed AlChemIE Facility will occupy about 8 hectares (20 acres) of the 247 hectare (610 acres) Andy Justice Industrial Park. Less than 3 acres of the AlChemIE site will actually be developed. The building will occupy about 0.2 hectare (0.6) acres of area and the rest of the developed area is estimated to involve less than 0.8 hectare (2 acres). The balance of the AlChemIE site would be maintained and landscaped appropriately. The fugitive dust and water run-off from the site can be readily controlled with standard construction methods.

IMPACTS OF OPERATION

NONRADIOLOGICAL CONSEQUENCES

The operation of the AlChemIE Facility 2 in Oliver Springs is expected to have a potential for impact only in a few areas. There will be no impact on local land use because the area is an industrial park, there will be no impact on subsurface water because there will be no discharges from the facility other than normal run-off. There will be no impact on cultural resources because the area of the industrial park does not contain historical sites. The demography of the area will not be impacted because no relocation of personnel will be required to either construct or operate the facility.

Socioeconomic

The operation of the AlChemIE Facility 2 will create about 50 jobs for management and skilled labor personnel. The net effect of this is expected to be a positive benefit for the local area and will offset some of the recent layoffs at the DOE site. The modest size of the construction and operating work force required for the Oliver Springs facility would not be expected to be a large burden on the local community, although some impact should be felt in a community of that size.

Air Quality

AlChemIE is planning to operate their Facility 2 in such a manner that there will be no degradation of the local air quality. AlChemIE projects no emissions from the facility other than ventilation air and some krypton and xenon when these materials are being processed. AlChemIE will apply to the Tennessee Department of Health and Environment (TDHE) for an air permit. The TDHE will issue permits with any restrictions deemed necessary to assure that the AlChemIE facility complies with the Clean Air Act requirements and does not impact the local air quality.

While no specific estimates of air emissions from the AlChemIE facility 2 were provided in the AlChemIE submittal, the staff performed a preliminary evaluation of the normal releases that might be expected from the facility in order to estimate the consequences of normal operation. The release fraction from the CPDF (mass out/mass in) was conservatively estimated based on reported information for gas centrifuge plants. DOE reports on the assessment of various uranium enrichment technologies indicated a release fraction of 6E-5 and 5E-6 for gas centrifuge plants (references 5, 6).

The release fraction for the AlChemIE operation of their facility 2 may be higher because: (1) some of the process materials have higher vapor pressure than UF_6, (2) the frequency of cylinder connections are likely to be greater because of the smaller sizes of the cylinder and the number of cascades in operation at one time.

The annual production of individual compounds at the AlChemIE facility is expected to range from a gram per year for some of the materials required for research to possibly a metric ton per year for a few isotopes for which there is large application. When comparing the ratio of expected maximum annual production to the American Conference of Governmental Industrial Hygienists (ACGIH) established Time Weighted Average Threshold Limit Value (TWA-TLV), the material which has the highest ratio is dimethylcadmium. This release of this material was examined in what was considered to be a bounding analysis of the consequences of normal releases to the atmosphere.

The maximum annual production of dimethylcadmium was estimated to be less than 5E+4 gm/yr. An assumption considered to be conservative was that the AlChemIE facility would release one part in a thousand to the atmosphere. Using this assumption, the maximum amount of dimethylcadmium released to the atmosphere in a year would be 50 grams (this corresponds to 40 grams of cadmium). To make the analysis more conservative, it was assumed that this material was processed, and therefore released over a 3-month period. This would correspond to an average release rate of about 5E-6 gm/sec. The maximum X/Q is 3.8E-8 sec/m^3 which means that the maximum cadmium concentration in the air at ground level will be 2E-13 g/m^3 which is many orders of magnitude below the ACGIH TWA-TLV for cadmium of 0.05 mg/m^3. On the basis of this analysis, the staff concludes that normal atmospheric emissions for the AlChemIE facility are expected to be of no environmental consequence.

Potential accidental releases that could result in releases to the atmosphere were also considered. For accidents, the material in storage as well as the material in process was considered. Because the cascade operates at very low pressure (on the order of a torr) the cascade will contain only a few gram-moles of material. The cylinders which are used for feed, withdrawal, and storage can contain hundreds or thousands of gram-moles of material. The potential accidents of greatest concern are considered to be those which involve the release of material from a cylinder.

The amount of material in the various cylinders which AlChemIE expects to use is tentatively identified in the Environmental Report (reference 4). This information, together with time-weighted average threshold limit values (TWA-TLV) established by the ACGIH, was used to evaluate the level of hazard associated with the various cylinders of material. The hazard index for the various cylinders was estimated by dividing the mass of material in the cylinder by the TWA-TLV. On this basis, the material that presents the greatest potential hazard to the environment is dimethylcadmium ($Cd(CH_3)_2$). Table 5.1 presents the listing of these various hazardous materials.

TABLE 5.1 HAZARD POTENTIAL FOR AlChemIE CYLINDERS

Element Being Separated	Element or Compounds	Feed Cylinder (lbs)	Feed Cylinder (gms)	ACGIH TWA TLVs (mg/m^3)	Cylinder Risk Index
Cd	$Cd(CH_3)_2$	104	4.72E+04	0.05	9.44E+05
Tl	$Tl(CH_3)_3$	97	4.40E+04	0.1	4.40E+05
Sn	SnH_4	90	4.09E+04	0.1	4.09E+05
Te	TeF_6	176	7.99E+04	0.2	4.00E+05
Se	SeF_6	141	6.40E+04	0.2	3.20E+05
Ni	$Ni(CO)_4$	142	6.45E+04	0.35	1.84E+05
Fe	$Fe(CO)_5$	156	7.08E+04	0.8	8.85E+04
Sb	SbH_3	91	4.13E+04	0.5	8.26E+04
Ta	TaF_5	512	2.32E+05	5	4.65E+04
B	BF_3	269	1.22E+05	3	4.07E+04
W	WF_6	218	9.90E+04	5	1.98E+04
Mo	MoF_6	275	1.25E+05	10	1.25E+04
S	SF_6	107	4.86E+04	6000	8.10E+00
O	CO_2	32	1.45E+04	9000	1.61E+00

Dimethylcadmium has a melting point of -4°C and a boiling point of 106°C. This means that as long as the cylinder is not heated above its boiling point, the pressure in the cylinder will be subatmospheric. In the case of the AlChemIE process, the feed cylinder is expected to be at room temperature with a cylinder pressure estimated to be about 11 psia. In an accident situation where the piping leading from the cylinder to the cascade failed, air would enter the process piping and the opening would allow the dimethylcadmium to diffuse out. Only gaseous cadmium would be released initially although the liquid material could vaporize and be released with time. In this specific analysis, it was assumed that the cylinder was primarily filled with vapor which was completely released at the time of the accident. The amount of cadmium in the vapor state of the cylinder is estimated to be 0.35 lbs (0.43 lbs of dimethylcadmium).

The volume of the room containing the centrifuges is 3.4E+4 m^3 (1.2E+6 ft^3) and assuming uniform dispersion of the material in the process room, the concentration of cadmium in the building air would be 4.7 mg/m^3. This is greater than the ACGIH TWA-TLV of 0.05 mg/m^3. (The TWA-TLV is a concentration at or below which a worker exposed for 8 hours per day for 40 hours a week should experience no ill effects.) In actuality, the concentration of the cadmium in the room will not be uniform since the gas has a density that is almost five times that of air. There will be a tendency for the cadmium vapor to concentrate in the lower levels of the room.

In the cadmium release scenario, the release of cadmium from the process building is calculated to occur with the building ventilation fans operating at their maximum rate of 71 m^3/sec (150,000 cfm). The associated release rate of cadmium is 0.33 g/sec. This will be dispersed by the local winds. The maximum concentration is expected to occur at a distance of about 1 km. At this location, the X/Q is 3.8E-8 sec/m^3 and the predicted concentration is 0.013 $\mu g/m^3$. This is well below the ACGIH TWA-TLV of 0.05 mg/m^3. The ne t residence is closer than the 1 km distance, but the concentration at thi cation is expected to be less than the calculated maximum of 0.013 $\mu g/m^3$.

An accidental release of tin hydride (SnH_4) was also calculated. Tin hydride was selected because, while it has a lower toxicity than cadmium, the material has a much higher vapor pressure (the boiling point is -52°C) and so the material will be completely released to the building atmosphere. The feed cylinders of tin hydride are estimated to contain 41,000 grams of tin hydride or 40,000 grams of tin. If this entire amount is released to the process room, the concentration of tin in the room atmosphere would be 1.2 g/m^3. This is significantly greater than estimated TWA-TLV of 0.1 mg/m^3. (The value of 0.1 was used because ACGIH does not provide a TWA-TLV for tin hydride but it does identify a TWA-TLV for organic tin compounds of 0.1 mg/m^3. Toxicology sources state that SnH_4 is more toxic than AsH_3 which has a TWA-TLV of 0.2 mg/m^3) Again, the density of this material is over four times that of air and so the tin hydride will concentrate in the lower elevations of the process building.

Assuming that the building exhaust fans are operating at the maximum rate of 71 m^3/sec (150,000 cfm) this material would be released to the environment at the rate of 84 g/sec. The maximum concentration is expected to occur at a distance of about 1 km. At this location, the X/Q is 3.8E-8 sec/m^3 and the predicted concentration is 3.1 μg/m^3. This is well below the estimated TWA-TLV of 0.1 mg/m^3. The X/Q at the nearest residence is estimated to be less than this maximum.

This accident analysis indicated that for the materials AlChemIE expects to process, no major off site impacts will result even in the event of a failure of equipment that results in the release of material from a cylinder.

Irrespective of the preceding analysis, the applicant is currently discussing with the State of Tennessee its obligations, if any, related to the small inventories of toxic chemicals it may possess and Title III - Emergency Planning and Community Right-to-Know of the Superfund Amendments and Reauthorization Act of 1986.

Water Quality

AlChemIE will discharge primarily sanitary water and this will be routed through existing Oliver Springs waste treatment systems. AlChemIE will not require its own NPDES permit to comply with the requirements of the Federal Water Pollution Control Act. The facility will be discharging to the existing Oliver Springs waste water treatment system which has an NPDES permit.

The sanitary waste water from the AlChemIE facility is not expected to contain any radiological or toxic materials and so no modification of the Oliver Springs discharge characteristics is expected.

Solid Waste and Hazardous/Toxic Wastes

The solid waste that is generated by the AlChemIE operations will be packaged as necessary and transported to approved disposal or treatment and disposal sites. This applies to the commercial trash, the hazardous and toxic waste, the uranium contaminated waste, and the scrap metal. There will be no waste disposal on the AlChemIE site.

Oils and solvents generated at the AlChemIE facility will also be sent to approved facilities for treatment or disposal. No oil or solvent disposal will occur on the AlChemIE site.

Transportation

There will be some moderate amount of shipment associated with the early stages of the Oliver Springs project. Equipment will be shipped from the DOE Portsmouth facility to the Oliver Springs site. There will be as many as 700 truck shipments over a two-year period. Of these shipments, about 170 of them will involve centrifuge rotors.

Once the facility becomes operational, there will be minimal transportation requirement for the AlChemIE operation at Oliver Springs. The maximum number of cylinder of gas processed per year is estimated to be less than 400, about 1 cylinder per day. Delivering the feed cylinders to the facility and removing the product cylinders from the facility is estimated to require on the average 1 truck trip per week or less.

5.1.2 Radiological Consequences

During normal operation, no releases of the uranium contaminating some of the centrifuges and piping is expected. This is based on previous DOE experience with uranium contamination. As a consequence, no radiological doses are projected for normal operations.

There is the unlikely event of the fixed uranium contamination (presumed to be UO_2F_2) being converted to a volatile form (possibly UF_6) and being released from the centrifuges and piping. A bounding accident involving radionuclides is the release of uranium from one contaminated centrifuge cascade over an 8-hour period. The amount of material involved is estimated as that from ten average contaminated centrifuges (850 grams of uranium at 1.1% U-235). The release rate is estimated at .029 grams/sec.

The greatest air concentrations from these releases are projected to occur at about 0.5 kilometer the facility. The maximum concentrations are calculated to be 1.1E-9 g/m^3. The breathing rate for an adult who might be exposed to accidental release is 1.2 m^3/hr. Over an 8-hour period, an adult at this point of maximum concentration would breathe in 9.6 cubic meters of air containing 1.06E-8 grams of uranium. Since there is 2.8E-4 Bq of activity associated with this material, the dose commitment to the adult breathing this air would be 1.9E-5 mrem to the red marrow, 8.8E-6 mrem to the lung, 1.2E-4 mrem to the kidney, 2.8E-4 mrem to the bone surface and 1.2E-5 mrem whole body equivalent dose. This is over six orders of magnitude less than the naturally occurring annual dose and is an insignificant dose contribution.

The exposure of off-site personnel to this concentration for 8 hours would result in an exposure level of 5.3E-4 mg-min/m^3 which is at a level where no toxicological effects would be expected (reference 7).

5.2 Consequences of the No Action Alternative

If this alternative were adopted, the full market demand for enriched stable isotopes would not be met. The development of the Andy Justice

Industrial Park would proceed at a slower pace The moderate socioeconomic benefits associated with the employment of about 50 personnel would not occur.

5.3 Consequences of Alternate Site Selection

The are two variations on this alternative. The first involves the expanded use of the CPDF where AlChemIE is building their first facility. This is not practical because there is not the available space on the DOE site for the storage and processing that the Oliver Springs site will provide.

The second variation on this alternative involves new sites other than Oliver Springs. AlChemIE has investigated other sites in the area, examining the economic and environmental aspects of the various sites. The Oliver Springs site was better characterized than the alternatives and presented no environmental liabilities relative to the other sites

6.0 LIST OF AGENCIES AND PERSONNEL CONTACTED

Roane County Executive	Kenneth E. Yager
Oak Ridge City Manager	Jeff Broughton
Oak Ridge Mayor	Roy F. Pruett
Anderson County Exec	David O. Bolling
Oliver Springs Town Administrator	Howard L. Elliott
Tennessee Department of Health and Environment Division of Air Pollution Control	V. N. Malichis
Tennessee Department of Health and Environment Division of Air Pollution Control	George R. Woods
Tennessee Department of Health and Environment Division of Water Pollution Control	Natalie Harris
Tennessee Department of Health and Environment Division of Solid Waste Management	Rick Brown

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