

SUMMARY PROJECT DESCRIPTION
PROPOSED KERR-McGEE AMMONIUM PERCHLORATE FACILITY
APEX, NEVADA

Prepared for

State of Nevada
Division of Environmental Protection
Capitol Complex
Carson City, Nevada 89710

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**ENVIRONMENTAL
PROTECTION**

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SUMMARY PROJECT DESCRIPTION
PROPOSED KERR-McGEE APEX AMMONIUM PERCHLORATE FACILITY

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1. PROJECT OVERVIEW

Kerr-McGee has proposed to construct an ammonium perchlorate (AP) production facility to be located just west of the intersection of I-15 and US 93. The new facility would cross blend and store AP produced on-site and also accommodate the cross-blending and storage of AP produced at the present Kerr-McGee plant located in Henderson, Nevada, so long as that plant continues to produce AP. Major project components associated with the AP production facility would include:

- o An AP production plant that would produce 40 million pounds of AP and 4 million pounds of sodium perchlorate (SP) per year; this plant would include essentially all of the process facilities described in the process description (see Section 3).
- o AP cross-blending and storage facilities, including a building where AP product would be cross blended for specific customer orders, and widely spaced paved pads where containers of AP product would be stored.
- o A buffer area of about one-half mile in width around most of the facility, which would remain undisturbed through the life of the project.
- o Ancillary facilities including offices, utilities (water, power, and gas), access roads, and fencing.

Please refer to the following enclosed plans for reference:

Drawing No. 100-GA-001: Site Location Plan

Drawing No. 100-GA-002: Site Overall Plan

Drawing No. 100-GA-003: Ammonium Perchlorate Production Plot Plan

2. PROJECT SITE

2.1 Location

The proposed site for Kerr-McGee's plant is located in Clark County's proposed Apex Heavy Industrial Use Zone, approximately 18 miles northeast of Las Vegas, Nevada. Kerr-McGee's site is about 2 miles west of the junction of US 93 and Interstate 15, in Sections 15, 16, and 17, plus portions of 8, 9, 10, 20, 21, and 22 of T18S, R63E. See the attached Site Location Plan (Drawing No. 100-GA-001) and USGS topographic maps (Dry Lake NW, Apex, and Dry Lake quadrangles, 1:24,000 scale).

2.2 Topography

The proposed site is located at the southwestern edge of Dry Lake Valley, at the southern end of the Arrow Canyon Range. Dry Lake Valley trends north-northeast and is bounded by the Dry Lake Range to the east and the Arrow Canyon Range to the west. The eastern flank of the Las Vegas Range lies near the western boundary of the proposed site.

The central portion of the proposed site where the proposed facilities will be positioned is located within an east-west trending valley at the southern end of the Arrow Canyon Range. Steep ridges, with maximum elevations of 3,106 feet and 3,385 feet occur at the northern and southern portions of the site, respectively. The central portion of the site has a low relief and consists of an eastward-sloping pediment/coalescing alluvial fan surface. Elevations in this part of the site range from about 2,600 feet on the west to about 2,200 feet on the east, and the topographic gradient across the central portion of the property is approximately 0.024 (2.4%). Most project facilities will be located at approximately the 2,300-foot level.

2.3 Geology

The general area of the proposed site is characterized by elongated north-south trending mountain ranges separated by wide valleys or basins. The mountain ranges consist generally

of uplifted bedrock blocks. Rocks exposed in the area are comprised predominantly of a thick sedimentary sequence of Paleozoic and Precambrian carbonates (primarily limestones). The valleys or basins contain unconsolidated deposits, i.e., alluvial deposits of sand, silt and gravel with some cobbles and boulders, lake bed deposits of silt and clay, and evaporite deposits of gypsum and salt.

The central part of the site overlies alluvial fan deposits which consist of:

- o Unconsolidated gravels on the steeply dipping slopes (greater than 5 degrees) derived from the carbonate ridges on the north and south ends of the site.
- o Unconsolidated silt-to-gravel-sized sediments within ephemeral channels that dissect the older alluvium.
- o Consolidated, cemented gravels of the alluvial fan on slopes less than 5 degrees.

With respect to soils, the low-relief central portion of the site is underlain principally by composed alluvium of the Colorock (very gravelly loam) - Tonopah (very gravelly sandy loam) association. The Colorock soil is shallow and well drained, while the Tonopah soil is deep and excessively drained. The shallow Colorock soil, 12 to 20 inches thick, is typically underlain by a lime-cemented caliche layer of about 22 inches in thickness.

The soil underlying the site consists predominantly of silty sand and gravel mixtures with traces of clay. The upper 6 to 18 inches of the soil is soft to firm. Below this thin mantle of surface material, the soil becomes moderately to strongly lime cemented and hard. Limestone is extensively exposed in the small hills in the southern portions of the proposed storage area south of the main drainage. In general, the limestone in the southern portion of the storage area is overlain by a few feet to possibly a few tens of feet of alluvium.

2.4 Hydrology

Average annual precipitation in the site area is approximately 4 inches, based on data for Las Vegas and Nellis Air Force Base (which feature average annual precipitation of 4.19 and 4.00 inches, respectively). Precipitation over the vicinity of the proposed site is infrequent. It usually occurs as short duration and high intensity late summer storms, with up to 2.6 inches recorded in a 24-hour period. The natural drainage paths are ephemeral in nature as they convey surface flows only in response to storm events. Intense rainfall events in the area can produce rapid runoff and flash flooding. Surface water generally drains eastward and northeastward to Dry Lake, located about three miles northeast of the project site. Dry Lake lies within Dry Lake Valley, which is a topographically closed basin.

With respect to ground water, the proposed project site is located in the Garnet hydrographic area, which includes the Dry Lake Valley basin. Minor recharge to the Dry Lake Valley basin probably occurs at the proposed site though infiltration of surface runoff into the young unconsolidated gravels on the steep slopes adjacent to the carbonate ridges located on the north, west, and south sides of the site. The alluvium underlying the proposed site probably has a wide range of transmissivities, with the finer grained, poorly sorted, or partially cemented materials having the lowest rates of transmissivity. The alluvial deposits in the proposed site area contain abundant lenses of caliche. These caliche layers reduce the potential for infiltration of surface water to recharge the ground water.

Ground water is estimated to occur at depths greater than 300 feet beneath the proposed site based on measurements at wells located on the eastern side of the site. The general direction of local ground water flow is from west to east and northeast, similar to surface drainage patterns. Ground water use is limited in the site area due to the relatively low amount in storage in the basins, the low amount of yearly recharge, and the low yield of existing wells (22 to 72 gallons/minute).

3. PROCESS DESCRIPTION

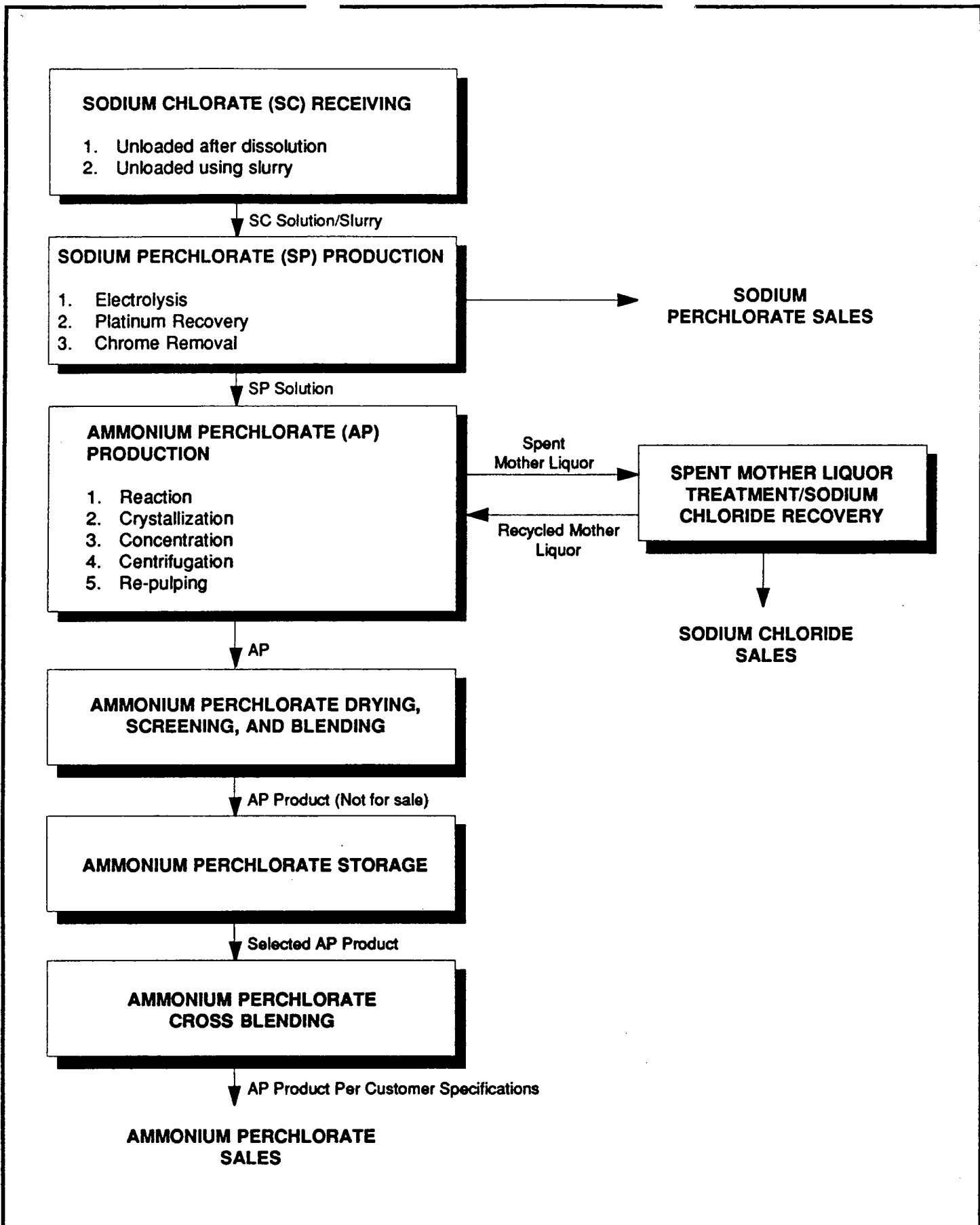
As described in Section 1, the proposed Kerr-McGee facility would produce for sale approximately 40 million pounds of ammonium perchlorate (AP) and 4 million pounds of sodium perchlorate (SP) per year. Key features in the production of these products include:

- Electrolysis of sodium chlorate solution (NaClO_3) to produce sodium perchlorate (NaClO_4).
- Reaction of sodium perchlorate with ammonia and hydrochloric acid to produce ammonium perchlorate.
- Ammonium perchlorate crystallization, drying, screening, blending and storage.
- Final cross-blending of ammonium perchlorate product prior to shipping.

The basic features of the processes to be employed are portrayed in the schematic facility process flow diagram presented as Figure 1. The basic process components are described in the following sections, with additional information about ancillary features and water use in subsequent sections.

3.1 Sodium Perchlorate Manufacturing

As stated above, sodium perchlorate (NaClO_4) is produced by electrolysis of sodium chlorate (NaClO_3). The sodium chlorate (42 million pounds per year) will be received at the proposed facility in solid form by rail or truck (primarily by rail). It will be unloaded either after dissolution (with hot water) or as a slurry (without dissolution) using a saturated solution of sodium chlorate. A two-week supply of sodium chlorate in solution will be stored on site.



From the perspective of electrolyte, the electrolysis of sodium chlorate to form sodium perchlorate is conducted on a batch basis. Starting with a nearly saturated solution of sodium chlorate (typically about 650 g/l), sodium dichromate ($\text{Na}_2\text{Cr}_2\text{O}_7$) is added to increase current efficiency, and the solution is circulated through the electrolytic cells until, after dissolution of additional sodium chlorate, the desired final concentration of sodium perchlorate (920 to 1050 g/l) is reached. Because of hydrogen gas (H_2) generation, the electrolytic cells are located outdoors. 48 million pounds of sodium perchlorate will be produced annually, of which all but 4 million pounds would be used in ammonium perchlorate manufacturing.

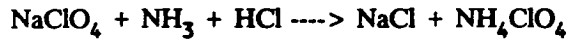
Completed batches of sodium perchlorate solution will be filtered successively to recover platinum and chrome. The first step of platinum recovery is to add hydrochloric acid to the batch to reduce the pH to approximately 5. A filter is precoated and the batch is filtered to recover platinum (which has been eroded from the electrodes) from the solution. After filtration is complete, the filter cake is washed with water, discharged to drums, and shipped off site for platinum recovery. The filtrate is stored in a temporary holding tank and then processed for chrome removal.

Chrome removal is accomplished by reduction with sulfur dioxide (SO_2), with addition of sodium hydroxide (NaOH) to permit precipitation as chromic hydroxide ($\text{Cr}(\text{OH})_3$). The chromic hydroxide precipitate is filtered as described above for platinum, with the filter cake being washed and stored in drums for off-site disposal. The filtrate is sent to intermediate storage before use in ammonium perchlorate manufacturing or sale as product.

3.2 Ammonium Perchlorate Manufacturing

Prior to the ammonium perchlorate formation reaction, residual sodium chlorate in the sodium perchlorate solution is destroyed by reaction with hydrochloric acid (HCl) and ammonia (NH_3), producing sodium chloride (NaCl) in the solution. Chlorine-containing off gas compounds are formed in side reactions and are passed through a caustic scrubber where additional sodium chloride is formed from these compounds; the scrubber liquor is recycled to the sodium chlorate destruction process.

The purified sodium perchlorate solution, ammonia, and hydrochloric acid are then metered into a jacketed, water-cooled reactor where ammonium perchlorate and sodium chloride are formed at a reaction temperature of 180 - 210°F as follows:



After reaction, the solution (mother liquor) is flash-cooled by evaporating water under vacuum, increasing the concentration of ammonium perchlorate above its saturation value and causing the ammonium perchlorate to crystallize. (Sodium chloride crystallization is minimized through control of sodium perchlorate and sodium chloride concentrations in the mother liquor.)

The resulting crystal slurry is pumped to a concentrator for mechanical separation to increase slurry solids concentration. The concentrated slurry is then fed to a centrifuge for dewatering and washing of the ammonium perchlorate crystals. The crystals are then re-pulped in a saturated ammonium perchlorate solution with low sodium chloride content. Re-pulped crystals are sent to the product finishing area.

Spent mother liquor from the centrifuge is recycled to the ammonium perchlorate crystallizer. Spent mother liquor from the crystallizer and concentrator is fed to a salt crystallizer to recover sodium chloride. A slipstream from the salt crystallizer feed is treated with soda ash (sodium carbonate, Na_2CO_3) for precipitation of the carbonates of trace impurities (i.e., iron, magnesium, calcium) and filtered for removal of these carbonate precipitates prior to entering the salt crystallizer.

The spent mother liquor that is sent to the salt crystallizer is evaporated under vacuum to increase the solids concentration; sodium chloride becomes supersaturated and crystallizes out of the solution. The crystal slurry is then sent to a concentrator and a centrifuge to dewater and wash the crystals. The centrate is returned to the salt crystallizer and the salt crystal cake is sent to a rotary calciner where the cake is dried and calcined at 1000°F to assure destruction of any residual ammonium perchlorate. The calciner off-gases are scrubbed with a caustic solution and passed through a mist eliminator prior to atmospheric

discharge. The product salt is cooled and stored for shipment.

Ammonium perchlorate product finishing will involve further drying and processing of the ammonium perchlorate crystals, depending on the product characteristics desired. Additional concentrators, centrifuges, and a flash dryer and rotary dryer are used. Exhaust gases are scrubbed to recover ammonium perchlorate dust.

Dried ammonium perchlorate crystals are screened and sized to meet product specifications. Rejects are redissolved to produce the saturated ammonium perchlorate solution referred to earlier in this section. Screened ammonium perchlorate is then blended and packed into 55-gallon drums for long-term storage in 16-ton lots at the site (generally for several months). Upon receipt of customer order, the 16-ton lots are brought to the cross-blending building where they are cross blended into larger lots per customer requirements. The screening and cross-blending building will be vented to scrubbers for recovery of ammonium perchlorate particles. Finished ammonium perchlorate product is shipped out in 5000-pound tote bins, 55-gallon drums (500 pounds), and 30-gallon drums (250 pounds).

3.3 Ancillary Features

In addition to the main process facilities directly associated with the manufacturing processes described above (and shown in the Plot Plan), ancillary features of the proposed Kerr-McGee Facility include:

- **Chemical storage facilities:**
 - **Sodium chlorate solution, 2-120,000 gallon tanks.**
 - **Sodium perchlorate solution, 2-200,000 and 1-123,000 gallon tanks.**
 - **Ammonium perchlorate (dry solid), maximum 7000 tons in containers on storage pads.**
 - **Low alkali ammonium perchlorate solution, 2-250,000 gallon tanks.**
 - **Hydrochloric acid, 2-150,000 gallon tanks.**
 - **Anhydrous ammonia (liquid), 2-40,000 gallon pressurized tanks.**

- Sulfur dioxide, stored in pressurized steel cylinders as received.
 - Sodium hydroxide solution, 50,000 gallon tank.
 - Sodium chloride (salt), 2 - 125 ton silos.
 - Hydrogen peroxide, stored in carboys and bottles as received.
 - Sodium dichromate solution in drums.
 - Sodium carbonate, 3000 pounds (in bags on pallets).
 - Tricalcium phosphate, 5000 pounds (in bags on pallets).
 - Diatomaceous earth filter pre-coat, 500-pound bags in storage bin.
- One 70 million Btu (input) boiler, with a 60 million Btu backup boiler.
 - Diesel engine powered firewater pumps, firewater pump house, and firewater tanks.
 - Fuel storage facilities (above-ground tanks):
 - Diesel, 1,500 gallon tank.
 - Propane, 1,000 gallon tank.
 - Natural gas, piped in.
 - #2 Distillate oil, 80,000 gallon tank.
 - Water softener and soft water storage tank.
 - Sodium perchlorate, ammonium perchlorate, sodium chloride, and utilities cooling towers.
 - Administration building and employee change house.
 - Chemical laboratory, warehouse, vehicle maintenance facility, and security building.
 - Rail spur, access road, truck and rail loading and unloading facilities, and parking areas.

3.4 Facility Water Uses

Table 1 presents preliminary estimates of facility water uses prepared for assistance in the sizing of water supply facilities. Actual water uses and consequent water handling, recycling, and treatment requirements could be lower. Analysis and preliminary design of recycling and treatment facilities is ongoing. The intention at the present time is to provide feasible systems that will avoid the need for effluent discharges and solar evaporation ponds, however this is still under study. In addition, feasible recycling opportunities may actually help to reduce the preliminary estimates of water requirements identified here.

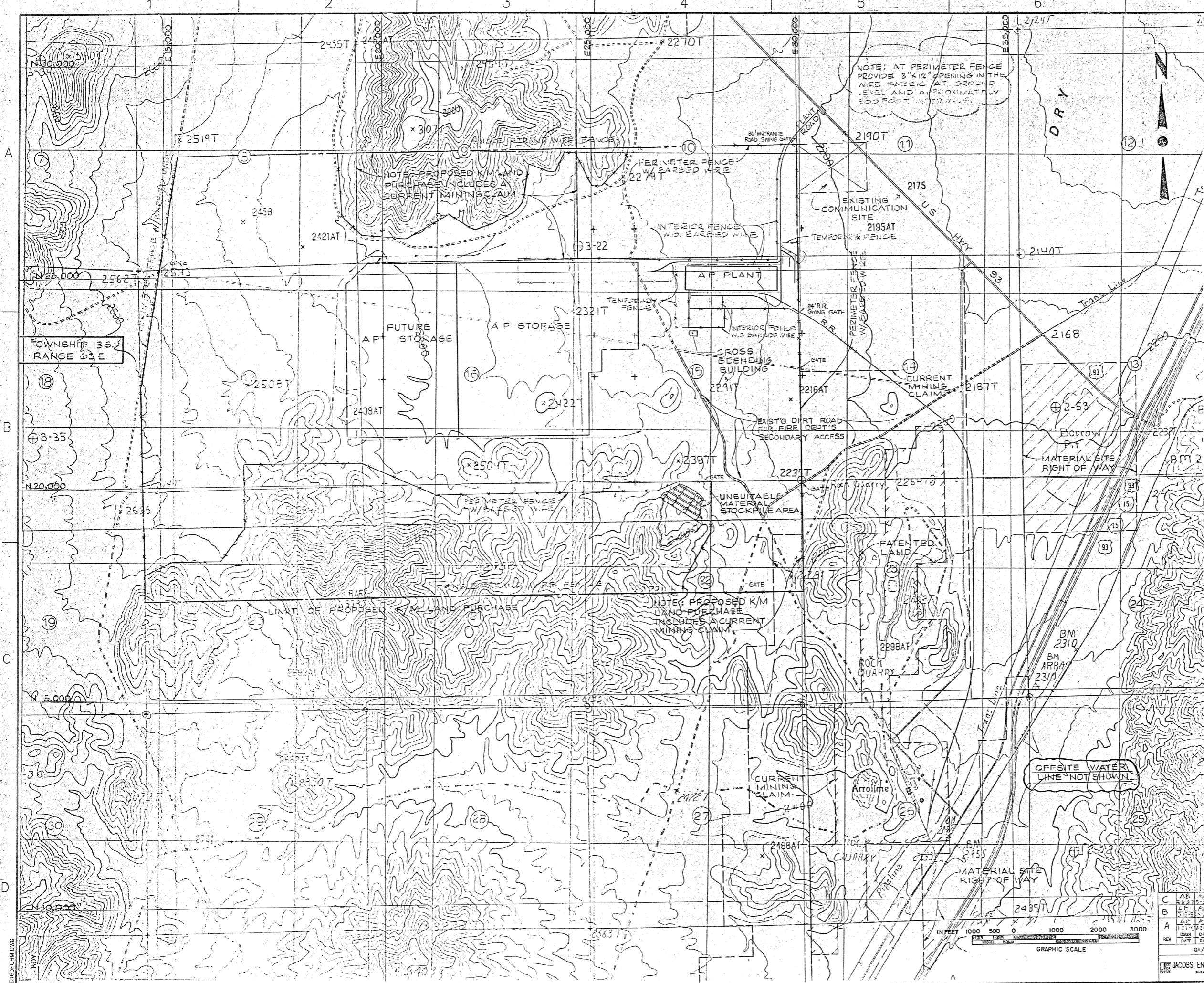
Table 1. PRELIMINARY ESTIMATE OF PROJECT WATER USES

<u>Uses</u>	<u>Amount (gal/day)</u>
<u>Raw Water</u>	
Utility Stations	72,000
Utility Area Maintenance Shop	2,200
Utilities Cooling Tower	14,400
Sodium Perchlorate Cooling Tower	72,000
Sodium Perchlorate Maintenance Shop	3,800
Ammonium Perchlorate Maintenance Shop	2,300
Ammonium Perchlorate Control Rooms/Toilets	6,500
Ammonium Perchlorate Cross-Blending Building (utility stations, scrubber, precoat mixing, toilets/breakroom, eyewash)	7,200
Firewater System	4,300
Changehouse	11,400
Ancillary Facilities (Administration Building, Laboratory, Warehouse, Vehicle Maintenance, Security Building)	1,900
Subtotal	<u>198,000</u>
<u>Soft Water</u>	
Boiler	57,600
Sodium Chlorate Unloading	18,500
Caustic Dilution	1,100
Platinum Recovery	200
Chrome Removal	500
Sodium Chlorate Destruct Scrubber	2,500
Ammonium Perchlorate Centrifuge	2,900
Seal Water System	1,500
Miscellaneous Uses	14,400
Subtotal	<u>99,200</u>
<u>Total Water Use</u>	<u>297,200</u>

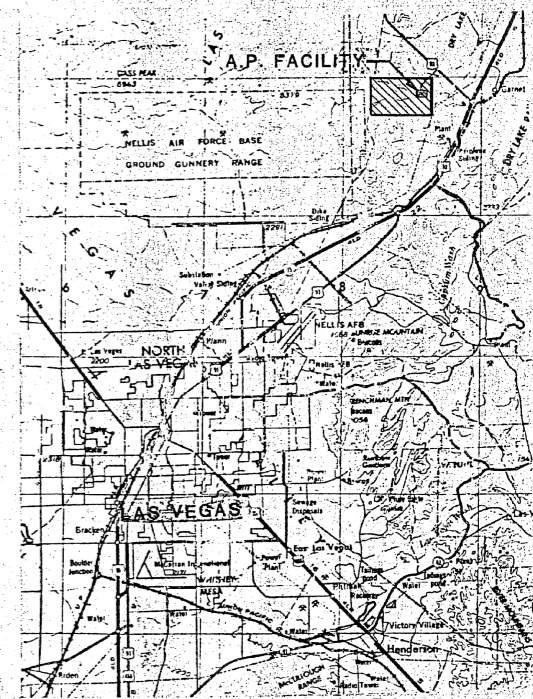
4. AMMONIUM PERCHLORATE CROSS-BLENDING AND STORAGE AREAS

Ammonium perchlorate cross blending (described in the previous section) will occur in a building located about 1000 feet directly south of the ammonium perchlorate production plant. The cross-blending building will be approximately 210 feet in length by 140 feet in width. Discharges will be limited to minor sanitary discharges (from toilets/breakroom, eyewashes) and firewater and rainfall (25-year, 24-hour storm) which would be caught in a catchment area of about 730 feet in length by 200 feet in width. The catchment area will drain into a rectangular retention pond with external dimensions of approximately 400 feet in length and 100 feet in width and a capacity of about 27,000 cubic feet. The entire catchment area and retention pond will be lined with a single hypalon liner.

The ammonium perchlorate storage area will feature 219 concrete pads, upon which drums of ammonium perchlorate would be stored as described in Section 3. These pads would be 42 feet long by 36 feet in width and would be accessed by a network of roads of 15-foot width, which would widen to 25 feet at the pads and actually divide the pads into two 18-foot wide segments. All of the pads and stored drums will be out in the open, except for three building-enclosed stacks/pads. These three light, pre-fabricated steel storage buildings would measure 74 by 74 feet (length/width) and would feature fire sprinkler systems, necessitating the construction of adjoining retention ponds for firewater containment. These retention ponds will be designed for capture of firewater and rainfall (25-year, 24-hour storm) on an approximately 190 feet by 150 feet catchment area. These retention ponds would have external dimensions of approximately 100 feet in length and 70 feet in width and capacities of about 8,000 cubic feet. The storage buildings and their associated retention ponds would be underlain by hypalon liners and concrete. The remaining parts of the catchment areas will also feature hypalon liners, overlain by earthen covers.



REFERENCE DRAWING	
DRAWING NO.	TITLE



LOCATION MAP

NOTE: PRELIMINARY DESIGN

THE EXISTING RAILROAD, UTILITIES, PATENTED LAND LINES, AND MINING CLAIM LINES SHOWN ARE NOT BASED ON ACTUAL FIELD SURVEYS. LAND CONTOUR LINES HAVE A VERTICAL ACCURACY OF PLUS/MINUS 20 FEET. (HILLS AND DEPRESSIONS ARE NOT SHOWN.) THE FINAL DESIGN AND COST ESTIMATE MAY REQUIRE ADJUSTMENTS DURING JEG'S EVALUATION OF THE TOPOGRAPHIC MAPPING AND GROUND SURVEYS OF OUR PROPOSED SITE.

NOTE: AT PROPERTY LINE AND OVER MOUNTAINOUS AREAS PROVIDE SINGLE STRAND GALVANIZED STEEL & GAGE WIRE ON STEEL POSTS SPACED AT 10 FEET. ALSO PROVIDE ENAMEL COATED STEEL METAL "PRIVATE PROPERTY, DO NOT ENTER" SIGNS APPROXIMATELY 50 FEET APART.

REV	DATE	DESCRIPTION	APPROVED
C	3-31-89	ISSUED FOR ESTIMATE	
B	3/15/89	ISSUE FOR APPROVAL	
A	1-27-87	ISSUE FOR REVIEW	

KERR MCGEE CHEMICAL CORPORATION

Km

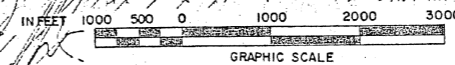
(PLANT LOCATION)

AMMONIUM PERCHLORATE FACILITY

SITE LOCATION PLAN

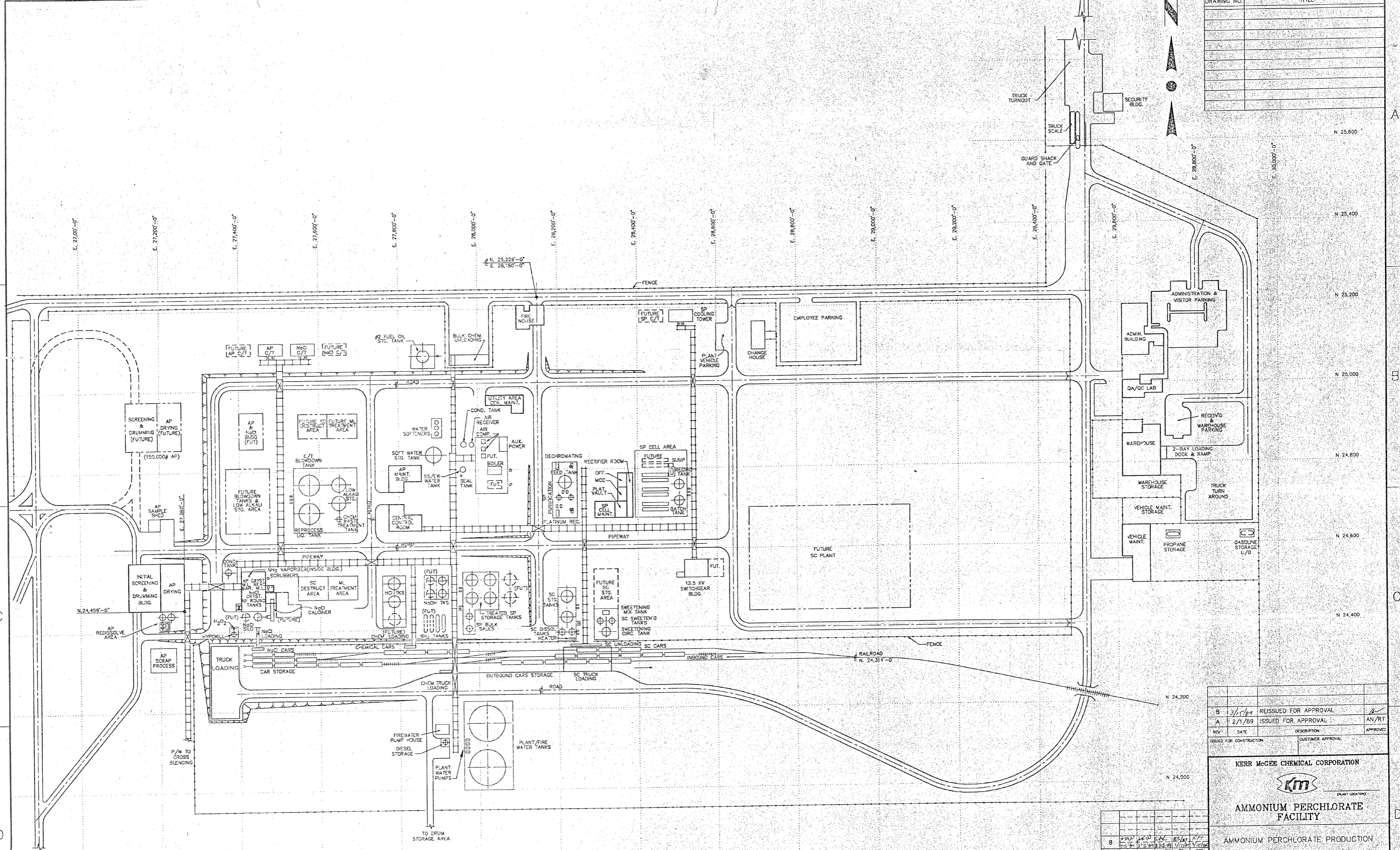
SCALE: 1" = 1000'	DATE	DRAWING NUMBER:	ISSUE
CHECKED BY:	AB	100-GA-001	REV C
APPROVED BY:		PROJECT NO. 01-D163-00	DATE

REV	DATE	CHKR	PE/PA	DEPT	DC
C	3/31/89	AB			
B	3/15/89	AB			
A	1/27/87	AB			



D163FORM.DWG

REFERENCE DRAWING	
DRAWING NO.	TITLE



REV	DATE	DESCRIPTION	APPROVED
B	3/15/89	REISSUED FOR APPROVAL	
A	2/1/89	ISSUED FOR APPROVAL	AN/RT

KERR MCGEE CHEMICAL CORPORATION

(PLANT LOCATION)

AMMONIUM PERCHLORATE FACILITY

AMMONIUM PERCHLORATE PRODUCTION PLOT PLAN

SCALE: 1" = 100'	DATE: 1-17-89	DRAWING NUMBER: 100-GA-003	REV: B
CHECKED BY: A.A. BALDOWING	DATE:	PROJECT NO: 01-0163-00	DATE: 3/1/89

NOTE:
 PLANT ELEVATION 100.00 FEET = ELEVATION 2220.00 FEET (BASED ON USGS MAPS). PLANT ELEVATIONS WILL BE REVISED BASED ON ACTUAL SURVEYS.