40-7580

RETURN TO 396-SS

FORM NRC-2
(7-77)
10 CFR 40

Approved by GAO
R0203

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. (Check one)
   - ☐ (a) New license
   - ☐ (b) Amendment to License No. ____
   - ☒ (c) Renewal of License No. SMB-911
   - ☐ (d) Previous License No. ____

2. NAME OF APPLICANT
   Fansteel Inc.

3. PRINCIPAL BUSINESS ADDRESS
   Number One Tantalum Place, No. Chicago, IL 60064

4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED
   Number Ten Tantalum Place, Muskogee, Oklahoma 74401

5. NAME OF PERSON TO BE CONTACTED CONCERNING THIS APPLICATION
   J.G. Duggan/M.J. Mocniak or T.S. Carlile

6. TELEPHONE NO. OF INDIVIDUAL NAMED IN ITEM 5
   (312) 689-4900 as to J.G. Duggan/M.J. Mocniak, (918)687-6303 as to T.S. Carlile

7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED
   Small percentage quantities of low-grade source material are contained in certain columbium and tantalum raw material processed by the plant. Fansteel refines these raw materials for their columbium and tantalum content only. The source materials of uranium and thorium oxides are left with the residues following processing.

8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE

(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (Including % U or Th.)	(d) MAXIMUM AMOUNT AT ANY ONE TIME (kilograms)
NATURAL URANIUM and daughters	unknown - columbium and tantalum raw material	solid - ranges from 0.05% to 0.30% U_3O_8	50,000 kilograms
URANIUM DEPLETED IN THE U-235 ISOTOPE	N/A	N/A	none
THORIUM (ISOTOPE) and daughters	unknown - columbium and tantalum raw material	solid - ranges from 0.01% to 0.60% ThO_2	100,000 kilograms

(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME (kilograms)
150,000 kilograms combined uranium and thorium

9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES
   Refer to attached information document, especially Chapter 6.

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10. LIST THE NAMES AND ATTACH A RESUME OF THE TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE OF APPLICANT'S SUPERVISORY PERSONNEL AND THE PERSON RESPONSIBLE FOR THE RADIATION SAFETY PROGRAM (OR OF APPLICANT IF AN INDIVIDUAL)
    Refer to attached information document, especially Chapter 6.

11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9. INCLUDE: (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate. The description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument).
    Refer to attached information document, especially Chapters 3 and 6.

(b) METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED IN (a) ABOVE, INCLUDING AIR SAMPLING EQUIPMENT (for film badges, specify method of calibrating and processing, or name supplier).
    Refer to attached information document, especially Chapter 3.

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11(c). VENTILATION EQUIPMENT WHICH WILL BE USED IN OPERATIONS WHICH PRODUCE DUST, FUMES, MISTS, OR GASES, INCLUDING PLAN VIEW SHOWING TYPE AND LOCATION OF HOOD AND FILTERS, MINIMUM VELOCITIES MAINTAINED AT HOOD OPENINGS AND PROCEDURES FOR TESTING SUCH EQUIPMENT

Refer to attached information document, especially Chapters 4 and 6.

12. DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 9. INCLUDE: (a) SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSION, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS

Refer to attached information document, especially Chapters 2, 3, 4, and 6.

(b) EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL

Refer to attached information document, especially Chapters 2 and 3.

(c) DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES

Refer to attached information document, especially Chapters 2, 3, 4 and 6.

13. WASTE PRODUCTS: *If none will be generated, state "None" opposite (a), below. If waste products will be generated, check here ☐ and explain on a supplemental sheet:*

(a) Quantity and type of radioactive waste that will be generated.
(b) Detailed procedures for waste disposal.

Refer to attached information document, especially Chapters 3 and 6.

14. IF PRODUCTS FOR DISTRIBUTION TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING:

(a) PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.
(b) PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.
(c) BETA AND BETA PLUS GAMMA RADIATION LEVELS (*Specify instrument used, date of calibration and calibration technique used*) AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.
(d) METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

CERTIFICATE

(This item must be completed by applicant)

15. *The applicant, and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 40, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.*

BY: J. G. Duggan
(Signature)

Dated June 27, 1986

J. G. Duggan
(Print or type name)

Vice President and General Counsel
(Title of certifying official authorized to act on behalf of the applicant)

WARNING: 18 U.S.C. Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

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TABLE OF CONTENTS

FANSTEEL INC.

MUSKOGEE, OKLAHOMA PLANT

Information Supplied
Pertaining to License Conditions
Nuclear Regulatory License SMB-911

(Note: this is attachment to Application for Source Material License)

June 27, 1986

Part 1 - License Conditions

Chapter 1. STANDARD CONDITIONS AND SPECIAL AUTHORIZATIONS

1.1 Name, Address, and Corporate Information

Fansteel Inc. — Corporate office of Licensee
Number One Tantalum Place
North Chicago, Illinois 60064

Fansteel Inc. — Plant facilities of Licensee
Number Ten Tantalum Place
Muskogee, Oklahoma 74401

Fansteel Inc. is incorporated under the laws of the State of Delaware. Its corporate office is situated at Number One Tantalum Place, North Chicago, Illinois 60064.

1.2 Site Location(s)

The plant facilities are situated in Muskogee County, Oklahoma, approximately 2-1/2 miles northeast of the City of Muskogee. The plant site contains approximately 110 acres of land. The plant site is bounded on the north by land owned by Muskogee Port Authority and used for industrial purposes, on the east by the Arkansas River, on the south by U.S. Highway 62, and on the west by State Highway 165 and an appurtenant service road.

The plant facilities include seven structures, two of which are of metal construction and the remainder of which are of masonry or brick construction. The plant facilities include chemical storage tanks, with surrounding dikes, raw material storage pads of poured concrete construction, railroad spur tracks, service roads, electrical power substations, waste treatment and storage ponds and basins. A map of the plant facilities is contained in Attachment A hereto.

1.3 License Number and Period of License

The license and period of time for which renewal is requested is SMB-911 - five years from date of renewal.

1.4 Possession Limits

The maximum quantity of source material to be possessed and used on-site in raw material, work-in-process and waste residue form is 50,000 kilograms of natural uranium and 100,000 kilograms of natural thorium.

1.5 Authorized Activities

Authorization is requested for the possession, use, storage and transfer of natural uranium and thorium and their progenies contained in the following raw materials: tantalum-columbium bearing tin slags, natural ores, beneficiated ores, synthetic ores, and waste residues. The sole activity of Fansteel in processing such raw materials is the extraction of tantalum and columbium minerals. The process for extraction of tantalum and columbium is described in Section 6.2 below.

Chapter 2. GENERAL ORGANIZATIONAL AND ADMINISTRATIVE REQUIREMENTS

2.1 Organizational Responsibilities and Authority

The Plant Radiation Safety Officer (PRSO) is the principal person responsible for establishing programs for compliance with laws and regulations affecting the manufacture and use of radioactive materials and for auditing the proper administration of the radiation safety programs. The Plant Safety Director (PSD) assists the PRSO in administration of the nuclear safety program. Refer to the Organizational Chart - Attachment B.

The PRSO and the PSD have the authority to halt any operation which either believes threatens the health or safety of personnel or the public.

The PRSO and PSD both report to the Plant Manager (PM), who is responsible for their work activities.

2.2 Personnel Education and Experience Requirements

The educational, training, and experience requirements for radiation safety officers and members of the Radiation Safety Committee are as follows:

Plant Radiation Safety Officer

Bachelor's degree in chemistry, or radiochemistry, or physics or the equivalent. Laboratory supervisory experience of 5 years minimum with special training and/or experience in radiation safety or health physics.

Plant Safety Director

Five years' industrial work experience within or relating to chemical plant operations. Attendance at OSHA and safety-oriented seminars. Experience with and/or training in proper use of applicable safety equipment. Trained in industrial first aid.

2.3 ALARA Policy

Fansteel is committed to maintaining radiation exposures and releases of radioactive materials in effluents to unrestricted areas as low as reasonably achievable (ALARA). The term "as low as reasonably achievable" takes into account the state of technology, and the economics of improvements in relation to benefits to the public health and safety, and other societal and socio-economic considerations.

This policy will be implemented by means of

a. The plant radiation safety program.

b. Monitoring of plant effluent and plant area ground water for possible radioactive materials content.

c. Continuing review of plant operations to assure that releases of radioactive materials are always maintained as low as reasonably achievable.

2.4 Safety Review Committee

Radiation safety reviews are performed on an ongoing basis by the PRSO and annually by the Plant Manager as part of the audit program.

2.5 Training

All employees who may come in contact with radioactive materials are advised of the following program before such contact:

a. Radiation safety practices as set forth in the Plant Radiation Safety Manual.

b. Employee safety instructions as set forth in Employee Safety Instructions for Handling Radioactive Materials.

Such program is conducted on a formal basis as part of the employee's on-the-job training. The PRSO and PSD are in charge of the program which is conducted by an experienced supervisor. Training measures are employed to make certain that employees understand the program. The program is repeated for all such employees on an annual basis. Records are maintained concerning the content of the program, when the program instruction was held, and who was in attendance.

2.6 Procedures

The Fansteel plant operates under a written set of Standard Operating Procedures (Procedures), all of which are evaluated by the PRSO prior to implementation. In addition, the Radiation Safety Manual provides specific requirements for radiation protection. Plant process safety audits are conducted on an annual basis by the PRSO and Plant Manager. Complete reviews of the Procedures are made concurrently with any major process change or addition.

2.7 Audits and Inspections

An audit of the Radiation Safety Program and an inspection of operations is made annually by the PRSO to determine if operations are being conducted in accordance with written procedures and satisfy applicable regulations, license conditions, and Fansteel policies. The documentation of results and corrective actions is made by the PRSO and reported to the PM. Routine inspections are part of the radiation protection program discussed in Chapter 3 below.

2.8 Records

Records required by regulations will be maintained as specified in the regulations or for 2 years when unspecified. The plant maintains a system of records pertaining to the conduct of its Radiation Safety Program including unusual operational incidents and events associated with radioactivity releases, audits and inspections, instrument calibration, employee training and retraining, personnel exposures, routine radiation surveys, and environmental surveys. These records have been regularly maintained for at least two years.

Chapter 3. RADIATION PROTECTION

3.1 Restricted Areas - Access Control

Security fences enclose the entire plant. Access to the plant is controlled by such fences and other security measures. There are no areas within the plant which are required to be restricted by reason of radiation levels. However, warning signs for radioactivity are appropriately placed on materials and operations where radioactivity exists.

Uniforms, hardhats, and safety glasses are worn by personnel having access to plant production areas. In addition to uniforms, dust masks are worn by individuals working in the milling area. Shower facilities are provided for plant personnel.

Uniforms which are used by employees in raw material handling, digestion operations, maintenance activities and waste residue monitoring, are surveyed for alpha contamination prior to release for unrestricted use. The acceptable contamination levels are as follows:

Th-nat, U-nat and Progeny	Fixed Average	Fixed Maximum	Removable Average
dpm/100 cm^2	1,000	3,000	200

3.2 Radioactivity Measurement Instrumentation

A. The following table gives the instruments used in radiation measurement and monitoring at the Muskogee plant. The manufacturer's name, instrument model number, type of radiation detected, the range, and use are also shown.

Manufacturer's Name and Model No.	Radiation Detected	Range	Use	Sensitivity
NMC Proportional Counter, PC-4	Alpha, Beta	2-600,000 cpm	Effluent and Area Monitoring	10 pCi
Canperra Proportional Counter, 2200	Alpha, Beta	2-500,000 cpm	Effluent and Area Monitoring	1 pCi
Eberline Inst. Survey Meter, E-140 (2)				
HP-270 Beta Probe	Beta & Gamma	20-60,000 cpm	Radiation Surveys	20 cpm
HP-210 Alpha Probe	Alpha			
Eberline Air Sampler	-	-	Area Air Sampling	-
Bendix Air Sampler	-	-	Area Air Sampling	-
Eberline ESP-1 with AC-3 Probe	Alpha	1-3,000,000 cpm	Radiation Survey	1 cpm

The proportional counters are calibrated weekly for detection efficiency using the standards listed in the table below. The survey meters are calibrated annually and their performance checked weekly with the standards listed below. The air samplers include rotometers for measuring flow rate which are checked against a U-tube manometer quarterly.

B. In the following table the source manufacturer, model number, radioactive nuclide, radiation detected and radiation range are given:

Calibration Sources Manufacturer and Model No.	Radioactive Nuclide	Radioactive Detected	Radiation Range
Eberline #2532	Th-230	Alpha	16K
Nuclear Measurement Corp. #6011	C-14	Beta	0.155 mev
Ludlum #10399	Th-230	Alpha	2,570 cpm
Ludlum #10400	Th-230	Alpha	25,100 cpm
Eberline #10601	Th-230	Alpha	910 cpm
Eberline #7385	Th-230	Alpha	710 cpm
Eberline #343177	Tc-99	Beta	16,450 dpm
Eberline #7789	Am-241	Alpha	18,420 dpm
Eberline #S-1668	Co-60	Beta	0.0077 uCi
Eberline #S-1114	Co-60	Beta	0.0076 uCi
Eberline #7286	Pu-239	Alpha	1,063,300 cpm
Eberline #7456	TC-99	Beta	420 cpm
Eberline #7457	TC-99	Beta	3,890 cpm
Eberline #7458	TC-99	Beta	32,500 cpm

Refer to Sectio .3(h) dealing with laboratory procedures and radioactivity m urement.

3.3 Occupational Exposure Control

Personnel exposure to radioactive material is measured by means of thermoluminescent dosimeters (TLD). All employees who work in areas where radioactive material is present wear TLD badges which are issued by the Company. The TLD badges are analyzed by an outside service specializing in radioactive measurement. The analysis is conducted on a quarterly basis. External exposures are generally a small percentage (<5%) of the limits of 10 CFR 20. Internal and external exposures are controlled through the provision of the radiation safety program.

3.4 Ventilation

The processes within the plant which could result in airborne radioactivity are controlled with the equipment and processes listed in Section 3.8 of this document. In addition, the ore dissolution area is actively ventilated mainly for the purpose of limiting chemical fumes.

3.5 Work-area Air Sampling

Representative samples for checking possible air contamination are taken weekly in the milling area at the exhausts of the ball-mill and the vibratory mill dust collectors, and in the ore dissolution area. These locations are deemed representative of possible radioactivity in air, but workers do not breathe such air because they use respirators. The air samplers sample the air for one hour while the mill is in operation.

Natural uranium and natural thorium have maximum permissible limits of 1×10^{-10} and 6×10^{-11} microcurie per milliliter, respectively. For radiation measurement in raw materials which we process, the natural thorium value of 6×10^{-11} uCi/ml is considered the maximum for all air particles.

Short-time values above this limit is considered cause for corrective action. Such values are reported to the Area Supervisor, and corrective action is taken by the Area Supervisor to correct the amount of airborne radioactivity.

3.6 Surface Contamination

For purpose of determining surface contamination, if any, smear or swipe samples are taken in the milling area and Chemical "C" Building on a weekly basis. These swipes are used primarily to detect source material spillage or leakage. Filter papers are normally used as swipes. The filter paper samples 100 cm^2 area of the surface in question. The swipe samples are then counted for gross alpha radiation in the same manner as the air and water samples. Values are reported in dpm per cm^2. These swipe samples are taken both at pre-determined locations where such "tramp" radioactivity might be expected, and also at randomly selected locations where it is not normally expected.

Values above 200 dpm/100cm^2 are reported to the Area Supervisor for corrective action by clean-up. Decontamination, if called for, is commenced immediately after radioactivity above allowable limits is found to exist.

3.7 Bioassay

A bioassay (urinanalysis) would be performed if an individual were exposed to concentrations of radioactive materials in excess of 25 percent of the permissible quarterly external exposure limits specified in 10 CFR 20. Urinanalyses would be performed by a qualified outside laboratory.

3.8 Waste Management

Attachment C hereto provides a description of the waste process flow containing natural uranium and thorium and associated daughter products. Atmospheric and liquid waste streams are discussed separately below.

Atmospheric Waste Streams

Raw materials used in processing of tantalum and columbium contain small amounts of naturally-occurring uranium and thorium (source material). Most raw material processed by Fansteel is in a form suitable for direct digestion; the materials are screened to remove tramp materials, crushed, and conveyed to an ore hopper. These operations generate some dust which is controlled by exhausting through a wet centrifugal collector. Certain other raw materials require milling prior to digestion. During milling operations raw material dust is vented to dust collectors as described below and small amounts may be released to the atmosphere.

Two types of mills are utilized, a vibratory mill and a ball mill; both are located in Chemical "A" Building. Atmospheric releases can occur in the exhaust of these mills. Exhaust associated with both the vibratory mill and the ball mill are vented to dust collectors which filter particulates prior to release to the atmosphere.

Radioactive effluents can also be released to the atmosphere during scrubbing operations. Gases from the digestion and extraction building (Chemical "C" Building) are exhausted through a common duct into a wet scrubber which in turn exhausts to the atmosphere through a vertical stack. This exhaust may contain small amounts of source material. Water discharged from the wet scrubbing operations may absorb small amounts of radioactivity as discussed in the section below.

Once the dissolution and chemical extraction processes have taken place, the product stream containing tantalum and columbium values in solution contain (virtually) no source material. Therefore the subsequent refinement processes occurring in the product stream have no potential for radioactive releases.

Liquid Waste Streams

Liquid waste containing radioactivity is generated during the dissolution and extraction process. Raw material containing source material is immersed in aqueous hydrofluoric acid. After dissolution, the resulting slurry is discharged into an extraction tank where the soluble fluorides of tantalum and columbium are preferentially extracted.

Upon completion of tantalum and columbium extraction the residues which contain the source material are transferred by pipeline to Pond 3.

Upon reaching Pond 3, the solids settle out and remain in the pond. Most radioactive residues settle in Pond 3. The supernatant is removed by surface decantation and is pumped to the lime neutralization station where it is treated with lime. Pond 3 is equipped with a French drain which pumps potential leakage from Pond 3 and nearby groundwater directly to the lime neutralization station.

Liquid effluents from the wet scrubber that scrubs digestion and extraction area gases could possibly contain small amounts of source material and are piped to the lime neutralization station along with other plant effluents.

All liquids treated at the lime neutralization station are pumped to Pond 8 and Pond 9 where precipitation of calcium fluoride occurs.

Supernatant from Pond 8 is released to Pond 9 where further settling occurs. Pond 9 supernatant is pumped to Pond 7 and then to Pond 6 for final decantation.

From Pond 6, liquid effluent is pumped through an effluent monitoring station to the Arkansas River.

Additional Storage

In the event that during the license term any of the waste residue ponds, namely, Ponds 3, 8, or 9, should become inoperative by reason of unanticipated failure, capacity limitations or otherwise, Fansteel will take all necessary steps to correct the failure, to increase pond capacity, and otherwise to meet waste residue storage license requirements.

On-Site Waste Storage - Pond 2

The waste residues produced from raw material digestion prior to September 1979 are contained in Pond 2, which is inactive. This pond has been covered with a polyvinyl chloride sheet, a polyethylene sheet, and six-to-twelve inches of soil, which supports vegetation. The purpose of the covering is to prevent wind erosion and surface water leaching of the waste residues.

Chapter 4. ENVIRONMETAL PROTECTION

4.1 Gaseous Effluents

Operations of the plant are conducted in such manner that little if any radioactive material will enter the atmosphere.

First, raw material containing radioactive elements is stored in metal drums which are located on a concrete storage pad or in a warehouse.

Second, the largest part of raw material consumed by the plant is in the form of tin slags. These require some crushing prior to being introduced to digestion. The dust generated in the crushing and conveying of the raw material to an ore hopper is controlled by exhausting with a wet centrifugal collector as described in Section 6.2. Airborne dust from this area is measured for radioactivity weekly.

Third, certain other raw materials, which are used in smaller quantities, require milling before the digestion process. The milling is carried out in a specially-constructed room in the Chemical "A" Building, this room being situated approximately 200 feet from the ore digestion area. The milling room is designed so as not to allow dust generated from milling to enter other parts of the building or otherwise to leave the room. The milled raw material is placed in ore hoppers for transfer to digestion. Dust generated from milling is controlled by means of dust collectors which filter milling exhaust. Airborne dust is measured for radioactivity weekly.

Refer to Chapter 3 above for additional information on sampling, analysis, detection, instrumentation, et al concerning control of airborne radioactive materials.

4.2 Liquid Effluent

The liquid effluent discharged from the plant at Outfall 001 is continuously sampled according to NPDES Permit #OK0001643. The effluent characteristics monitored are the pH, flow, ammonia, fluoride, total suspended solids, chemical oxygen demand, sulfate, tantalum, columbium, lead and zinc. In addition, the alpha and beta content is analyzed on a composite sample of the effluent discharged from Outfall 001.

4.3 Ground Water Monitoring

Several ground water monitoring wells are located around the perimeter of Fansteel properties. These wells access the uppermost aquifer; the available water is minimal; however, monthly samples of the stagnant water are measured for ammonia, fluoride, dissolved solids, pH, alpha and beta activity. These data are recorded and maintained as permanent records.

Chapter 5. DECOMMISSIONING PLAN

Fansteel intends to continue the operation of the plant for a substantial period of time. The plant is essential to the production of tantalum and columbium. (Fansteel, with its Muskogee and North Chicago plants, is one of two integrated producers of tantalum and columbium in the United States. Both metals have important applications in military and aerospace programs, some of which are classified for security reasons.) Fansteel has no plans to dispose of or to discontinue its tantalum and columbium business. Nonetheless, if the plant were to cease operation, Fansteel would either continue to maintain the plant under NRC license or decommission the plant in a manner that will protect the health and safety of the public and in accordance with NRC requirements then in effect.

Fansteel believes that economic methods of recovery of the valuable minerals and chemicals contained in the waste residues may be developed. On-site storage of waste residues in their present condition would allow for such recovery. While there is no economic method for such recovery at present, Fansteel continues to investigate chemical processes which would permit such recovery.

Part 2 - Descriptive Information

Chapter 6. SAFETY DEMONSTRATION

6.1 Education and Experience of Key Personnel

The resumes of personnel employed in radiation safety positions are as follows:

a. Claude Brown, Plant Radiation Safety Officer:

BS in Chemistry and Mathematics from Morehead State University, Morehead, Kentucky
Graduate work toward Chemical Engineering Degree
2-1/2 years' plutonium radiation safety experience at Monsanto Chemical Company, Miamisburgh, Ohio
9 years' plant radiation safety supervisory experience, Fansteel/Muskogee
Overall experience in process control and laboratory analyses with Fansteel and other firms - 20 years

b. Stanley McLemore, Plant Safety Director:

Graduate Northeastern State University, Tahlequah, Oklahoma, Bachelor of Arts Degree
Attended many workshops pertaining to industrial safety and health
Employed continuously by the Fansteel/Muskogee plant since 1980 with assignments in personnel administration, industrial safety and hygiene

6.2 Process Description

The plant produces tantalum and columbium products from raw materials which contain tantalum and columbium minerals. The low-grade radioactive source material which is contained in raw materials is separated from the tantalum and columbium minerals during chemical digestion of the raw materials and thereupon enters a waste stream which is directed to a waste residue pond, namely, Pond 3. The radioactive waste residues settle out in Pond 3, where most radioactive waste residues remain in semi-solid form.

The raw materials with tantalum and columbium minerals used by Fansteel comprise the following:

1. Tin slags
2. Natural ore concentrates
3. Synthetic and beneficiated concentrates which are either chemically or physically upgraded

The source materials contained in these raw materials are primarily uranium and thorium species in natural secular equilibrium with their daughter products.

The tantalum and columbium metal products are manufactured from these raw materials by means of chemical extraction and refining. Attachment D shows the process flow. Such refined products as manufactured do not contain source material. After chemical extraction of the tantalum and columbium values from the raw materials, the source material remains in the waste residues. The percentage content of the source material contained in waste residues in Pond 3 is approximately the same as the percentage content of the source material contained in the raw material before processing.

The large proportion of raw materials used by the plant is in the form of tin slags. Fansteel some years ago developed a process whereby the tin slags are handled in a moist condition with some initial crushing. These factors minimize dusting and contribute greatly in controlling the release of radioactive materials.

Tin slags are received in metal drums. The metal drums are placed on a concrete storage pad, which is adjacent to the chemical processing facilities, or in a warehouse. On occasion certain raw materials are received in burlap or fiber bags, which have a leakproof inner liner. Upon receipt these raw materials are placed in metal drums which are similarly stored on the concrete storage pad or in the warehouse.

The physical condition and constituents of raw materials other than tin slags determine whether they require milling before dissolution. If raw material milling is necessary, such is carried out in a milling room in the Chemical "A" Building; this room is situated approximately 200 feet from the digestion area.

The milling room is separated by means of walls and doors from other processing areas so as not to permit dust to migrate. This room contains two mills; a vibratory mill and a ball mill. Their operation is described below.

In the case of the vibratory mill, raw material is emptied directly from its container into a feed hopper. The raw material is then fed at a controlled rate by a screw feeder into an enclosed bucket elevator for elevation to the mill level. Material discharges from the elevator into an enclosed screw conveyor for transfer to the vibrating ball mill feed opening. This mill pulverizes the material by action of steel balls inside of a rapidly vibrating steel cylinder. Ground material discharges from the mill and falls by gravity into a classifer. The classifier centrifugally separates the material. The desired sizes are discharged into a covered digester feed hopper while the oversize material is returned via an enclosed chute to the bucket elevator feed opening. Open transfer points are ventilated through a dedicated dust collector, United States Filter Corporation "Mikro Pulsaire" Model 16S-8-30 with Nomex Bags. It has its own suction blower and bag cleaning mechanism.

In the case of the ball mill, the raw material is removed from its container and dumped into an ore lift elevator which empties into a feed hopper. It is then control fed from the hopper into the milling mechanism using a belt-type feeder. It is pulverized to the desired mesh fraction by the action of a mass of steel balls rotating inside the mill. The pulverized material is discharged from the mill in an enclosed air stream which conveys it to a classifier. Still enclosed, and working on a centrifugal principle, the classifier rejects the oversize material and returns it by gravity through a conduit to the feed end of the mill. The finer and desirable material remains in the enclosed air stream and is conveyed to a cyclone-type product collector, which in turn empties into metal drums. The air is recycled back to the discharge end of the mill for reuse in the movement of the pulverized material to the classifier. Since the mill is of an air-swept type, the positive pressure build-up inside the recycling air system is relieved through a bag-type dust collector. Fansteel has recently purchased and will install a Farr TENKAY self-cleaning cartridge-type dust collector, which Fansteel believes will provide significant improvement in dust control. The milling room procedures are conducted so as to minimize the release to the air of radioactive materials.

While the mills are in operation, access to the milling room is restricted so that only designated employees with respirators may enter for the purpose of reloading the hopper, checking the conduit airflow, and exchanging the drums under the raw material collector.

After milling, the pulverized material is placed in a storage area awaiting chemical processing. The grinding process does result in an increased surface area from which source materials could escape to plate out on nearby surfaces. It is possible that a degree of contamination could result from this release if the drums are left uncovered. Therefore procedures call for covers to be placed on the drums immediately after filling.

The raw material is transferred from the milling room in Chemical "A" or from the concrete storage pad to the Chemical "C" Building for dissolution and extraction of the tantalum and columbium. In this respect, a concrete drive ramp has been constructed connecting the three sites in order to control spillage.

The unmilled feed material is first dumped from the containers into a hopper below the ramp level which feeds a belt conveyor. The conveyor transfers the material inside the building over a sizing screen and onto a second conveyor which loads the feed hoppers. The primary conveyor discharge, crushing equipment and secondary conveyor loading and discharge are hooded and vented to a dedicated wet centrifugal dust collector. Dust entering the collector is sprayed with water and the wet dust and water particles are separated from the air stream by centrifugal force. Clean air is exhausted, the water and wet dust is discharged to a settling tank where feed material settles out and is reclaimed for reprocessing. The hoppers are then raised to the third floor level by use of a mechanical hoist. They are then placed in position on a support stand and secured to a screw feeder which is attached to a covered digestion tank. A valve between the hopper and feeder is opened and the material is fed from the hopper through the screw feeder into the acid contained in the tank. Procedures have been put into effect whereby spilling and dusting are minimized.

The dissolution process consists of immersing the raw material in aqueous hydrofluoric acid. This is carried out on a batch basis with a number of batches in process at one time. The aggregated batch amounts in process at any one time do not exceed 25,000 kilograms of raw or feed material which contains not in excess of 100 kilograms of source material.

After dissolution, the slurry is discharged into an extraction tank where the soluble fluorides of tantalum and columbium are preferentially extracted by contacting with methyl isobutyl ketone. During the batch extraction, the tantalum and columbium are separated from other constituents of the raw materials. Thus separated, the tantalum and columbium values in solution contain no radioactive materials and are further processed (refined) into semi-finished and finished tantalum and columbium products. As noted above, these semi-finished and finished tantalum and columbium products contain no source material.

Upon completion of the above extraction, the residues, which consist primarily of insoluble fluorides in which the source material is included, are discharged from the tank and transferred by pipeline to Pond 3. Water is added to the residues prior to piping in order to facilitate their flow.

Upon reacning Pond 3, the solids settle out and are retained while the supernatant (i.e., the liquid portion on top of the solids) is removed by surface decantation and pumped to the neutralization station where the supernatant is added to plant effluents and treated with lime.

Pond 3 was constructed and is operated pursuant to information supplied by Fansteel to the NRC in Fansteel's letters dated March 31, 1978; September 22, 1978; February 2, 1979; May 11, 1979; and September 20, 1979; and under the conditions set forth in NRC Amendment No. 05 dated October 22, 1979, to the above-mentioned license. All of said letters were incorporated by reference in the said Amendment. Other ponds situated at the Fansteel Muskogee plant, specifically Ponds 1, 2, 6, 7, and 8, are constructed and operated pursuant to information supplied to the NRC in the foregoing letters together with paragraph 1 of Fansteel's letter dated February 15, 1978, which was incorporated by reference in NRC license Amendment No. 04 dated July 12, 1978. The effluent control system for the plant including waste process flow is shown on Attachment C.

Pond 9 was constructed in accordance with the descriptive information set forth in Fansteel's letter to NRC dated March 4, 1983, and is operated under Amendment No. 8 to NRC license SMB-911, said Amendment being dated August 15, 1983.

The total quantity of source material contained in raw materials which are processed on an annual basis does not customarily exceed 8,000 kilograms. The amount of source material contained in raw materials which are stored on-site at a given time, does not customarily exceed 10,000 kilograms. Source materials are also contained in the waste residues, primarily in Pond 2 and Pond 3. The total amount of source material situated on-site in raw material form, in process, and in waste residues is significantly below licensed limits.

6.3 Radiation Protection

The Radiation Safety Program is carried out by means of procedures which are described below. The program is more fully described in the Radiation Safety Manual.

Radiation measuring equipment is described in Section 3.2 above.

a. Counter Surveys - This survey program is to monitor: (a) incoming raw materials, (b) weekly air samples, (c) composite water samples taken once a week, (d) contamination wipes and smears every week, (e) protective clothing, and (f) raw material shipping containers.

b. Raw Material Monitoring - Each incoming ore shipment is monitored with the Eberline Alpha Counter Meter prior to unloading the ore from the carrier. This monitoring is primarily to determine the external hazards to personnel only. The alpha probe is utilized as an aid to decontamination efforts in rapidly determining alpha contamination. It is not meant to replace the quantitative data obtained from swipe surveys.

c. Air Monitoring - Refer to Section 3.5 above.

d. Contamination Swipes - Refer to Section 3.6 above.

e. Water Sampling - A representative sample of the effluent from the sampler is taken once per week for determination of gross alpha content. A five milliliter sample is taken each time, the same being evaporated to dryness in a planchet and placed under the counter for assay. The gross alpha/beta activity of the water is reported in terms of picocuries per liter.

The Oklahoma State Department of Health has set limits of 15 pci per liter alpha activity and 50 pci per liter for beta activity on the effluent water. No determination of the specific contaminant(s) is required. If, however, the values are in excess of limits, sufficient fresh water must be released into the effluent to dilute the fluid.

f. Storage and Movement of Raw Materials - Storage and movement of the raw materials has been described in Section 6.2, Process Description.

Disposal operations pertain to processing of all raw materials as applicable. These disposal operations include:

1. Container disposal.
2. Waste water disposal.
3. Extract residue disposal.

Disposal of raw material shipping containers such as steel drums will be monitored with an alpha survey meter to insure adequate removal of radioactive materials. If the survey shows the radioactivity to be less than 200 dpm per 100 cm^2, the containers shall be released for other uses, such as storage or disposal. Containers having a radiation greater than 200 dpm per 100 cm^2 will be decontaminated by washing in a designated area until the radioactivity is less than 200 dpm per 100 cm^2. All radioactive markings or labels attached or fixed to the containers shall be removed or obliterated before disposal.

Waste water disposal from water contained in the tin slag drums, from decontamination of storage containers, and from wet milling is fed to the waste ponds, as described earlier. Here any solids settle out from the liquid, the pH of the solution is brought to within acceptable limits, and the level of any residual radioactivity would be checked as described before the effluent is discharged from the storage pond.

g. Shipment of Raw Materials - Shipments of raw materials from the plant, if any, would be made through the Plant Shipping Group in accordance with the established accounting and control procedures.

Shipping containers for such materials will comply to the limits on external radiation permitted by the Department of Transportation (DOT) regulations contained in 49 CFR, Parts 0-199. The radioactivity at the surface of each package shipped would be measured by an Alpha counter, and the results recorded in a log record.

Shipments of protective clothing from the plant for laundering purposes will be in accordance with procedures in the Radiation Safety Manual. The shipments will be monitored with an Alpha Survey Meter and those with alpha contamination of 200 dpm per 100 cm^2 or less will be released for shipment. Clothing with alpha contamination in excess of 200 dpm per 100 cm^2 will be decontaminated by spray water washing in a designated area under supervision of the Radiation Safety Group.

h. Laboratory Procedures and Radioactivity Measurement

The radiation laboratory has two stationary alpha-beta analyzers, one portable alpha counter, two ratemeters, one Bendix air sampler, two Eberline air samplers and certified radiation standards. Stationary analyzers are the Canberra Model 2200 and Nuclear Measurement Corp.'s PC-4 Alpha-Beta Counter. Portable counters consist of one Eberline ESP-1 and two Eberline E-140 ratemeters. Radiation standards are procured from NMC, NEN, Eberline, etc. The Canberra and NMC Analyzers are used to analyze air samples, surface swipe samples and water samples for alpha and beta concentration. The Eberline ESP-1 and Eberline E-140 are used for raw material and personnel monitoring.

The Canberra Model 2200 is a thin window counter with a gas flow proportional detector. The detector is surrounded by thirteen hundred pounds of lead shielding and it is self-compensating for stray cosmic radiation. The NMC PC-4 is a windowless counter with a gas flow proportional detector. The Eberline ESP-1 uses a zinc sulfide detector to analyze alpha radiation. The two Eberline E-140 ratemeters utilize a Geiger-Mueller detector.

Air samplers are used to collect air radiation samples from the milling and extraction areas. These air samplers are manufactured by Bendix and Eberline. They are calibrated quarterly with a manometer. Air samples are collected on a Gelman Type A-E glass fiber filter. Samples are taken in a central area five to six feet above the floor. Fifty cubic feet of air is drawn through the filter at a rate of about 1 CFM. Prior to analyzing the sample, background radiation on measurements are determined for the PC-4 and Model 2200. Air samples are counted for ten minutes for alpha radiation.

Radioactivity is measured in microcuries per milliliter. Efficiency is determined at calibration, and the total flow volume of air drawn through the filter is fifty cubic feet. Maximum allowable air radioactivity is 6×10^{-11} microcuries per milliliter.

Effluent and ground water samples are analyzed for alpha and beta content. Background radiation is determined by counting a blank planchet for 1000 minutes. A five milliliter water sample is evenly distributed on a ringed planchet and evaporated to dryness. A five milliliter sample is optimum to avoid excess solids associated with larger sample volumes. These evaporated samples are analyzed for one hundred minutes and corrected for background radiation.

Chapter 7. PERFORMANCE DEMONSTRATION

7.1 License History

The following data covers the issuance of license SMB-911, the renewal thereof, and the amendments thereto:

	Expiration Date
License issued January 27, 1967	Jan. 31, 1970
License renewal January 27, 1970	Jan. 31, 1975
License Amendment No. 1 dated March 17, 1971	
License Amendment No. 2 dated February 18, 1976	Jan. 31, 1980
License Amendment No. 3 dated September 23, 1976	
License Amendment No. 4 dated July 12, 1978	
License Amendment No. 5 dated October 22, 1979	
License Amendment No. 6 dated January 11, 1980	May 31, 1980
License Amendment No. 7 dated July 29, 1981	July 31, 1986
License Amendment No. 8 dated August 15, 1983	

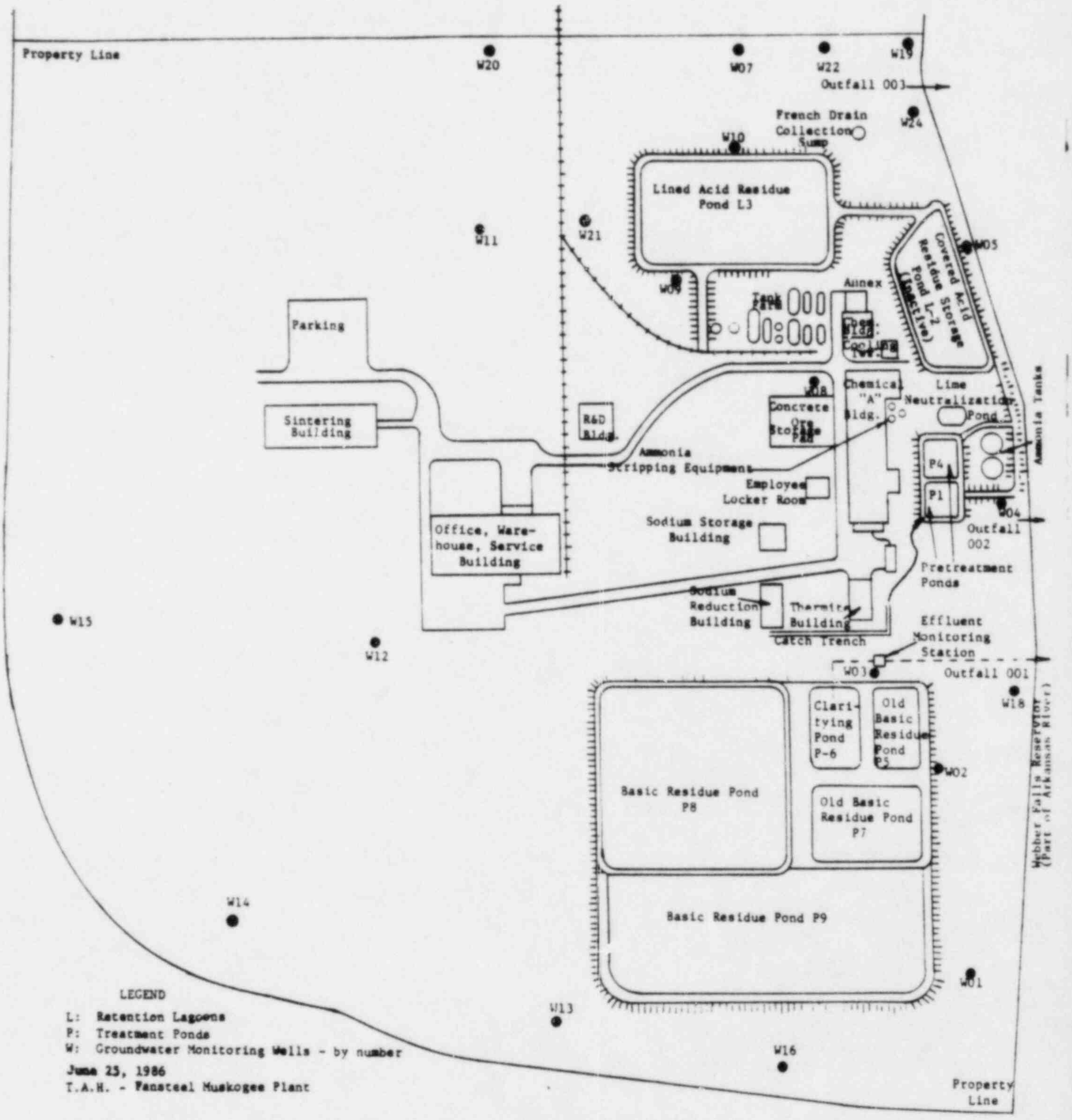
7.2 Exposure History

The risk of exposure is small, but the greatest potential for exposure occurs in the handling and milling of raw materials prior to dissolution. To minimize exposure, a wet centrifugal dust collector is operated during the loading of slags into the hoppers. Also, for the milling of most of the other raw materials a vibratory mill was installed. This unit is more compact and a more enclosed unit than the ball mill, thus minimizing the dusting.

The Chemical Operators and Maintenance personnel who work in milling and raw material handling are issued a TLD badge to determine radiation exposure. The exposure data shows that such personnel have not been exposed to doses of radiation significantly above background radiation levels.

Attachment A to Part 1
License Conditions
paragraph 1.2

PLOT OF FANSTEEL MUSKOGEE PLANT



Attachment B

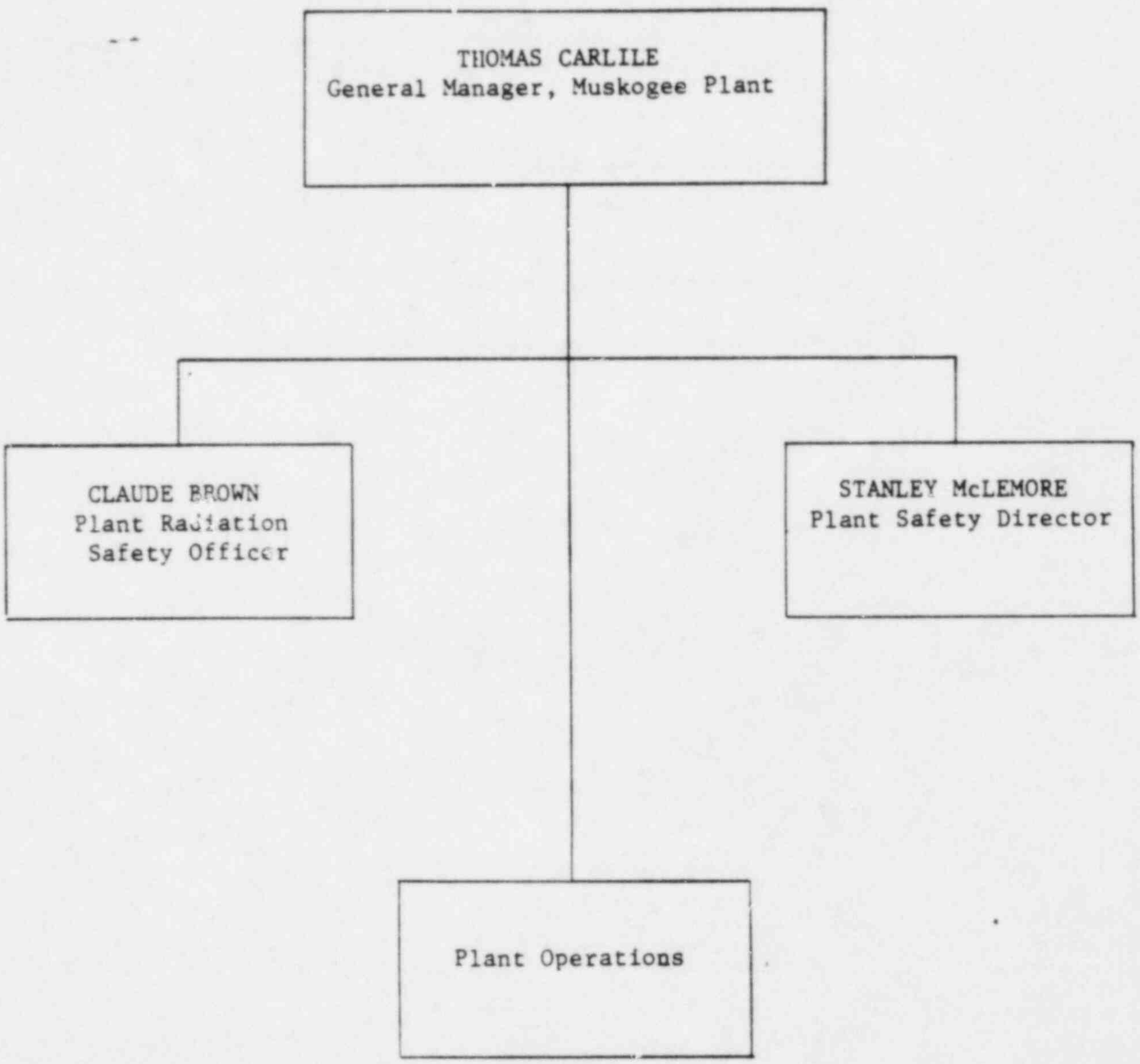
to Part 1 License Conditions

paragraph 2.1

FANSTEEL INC.

MUSKOGEE PLANT

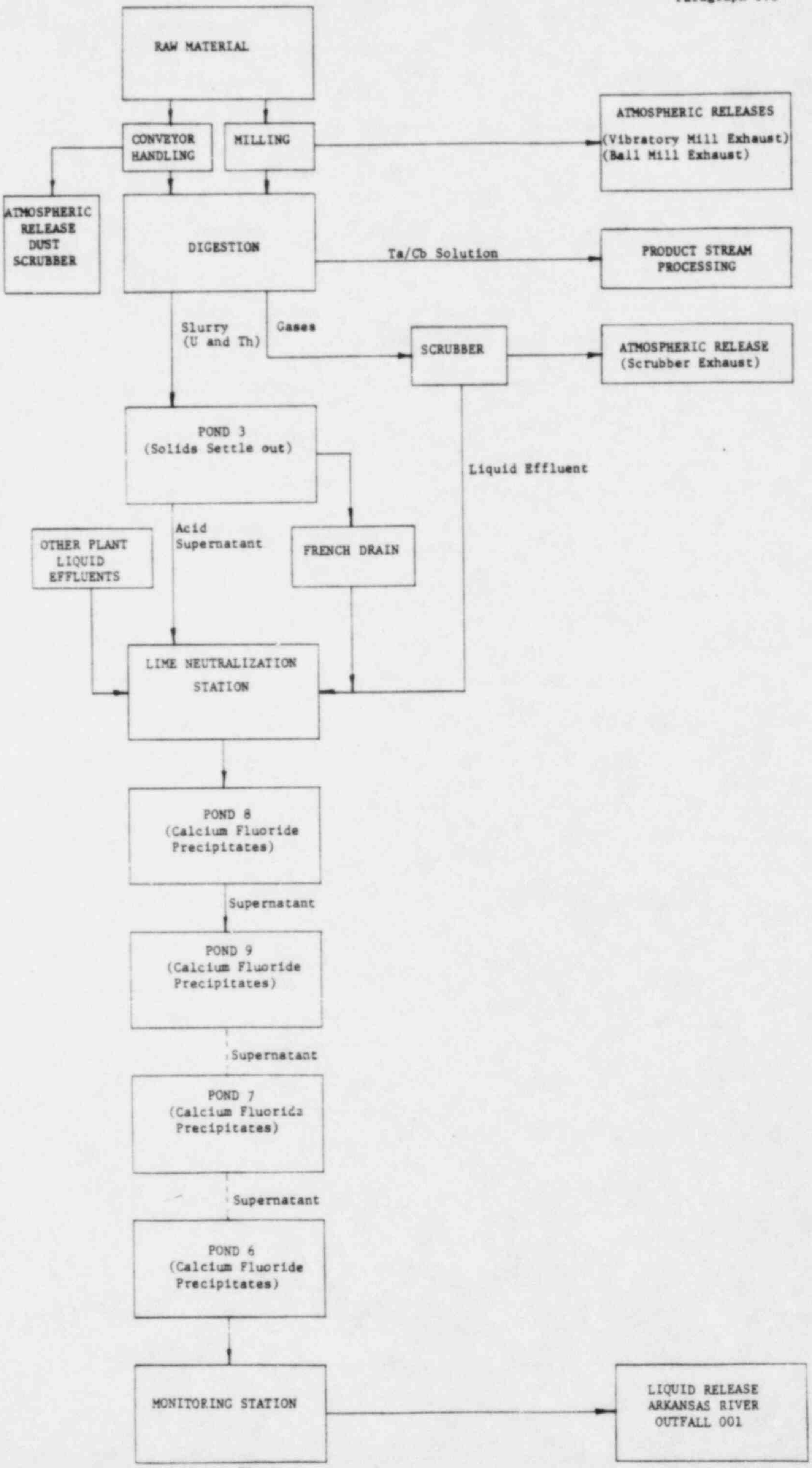
ORGANIZATIONAL CHART



WASTE PROCESS FLOW CHART

FANSTEEL MUSKOGEE PLANT

Attachment C to Part 1
License Conditions,
Paragraph 3.8

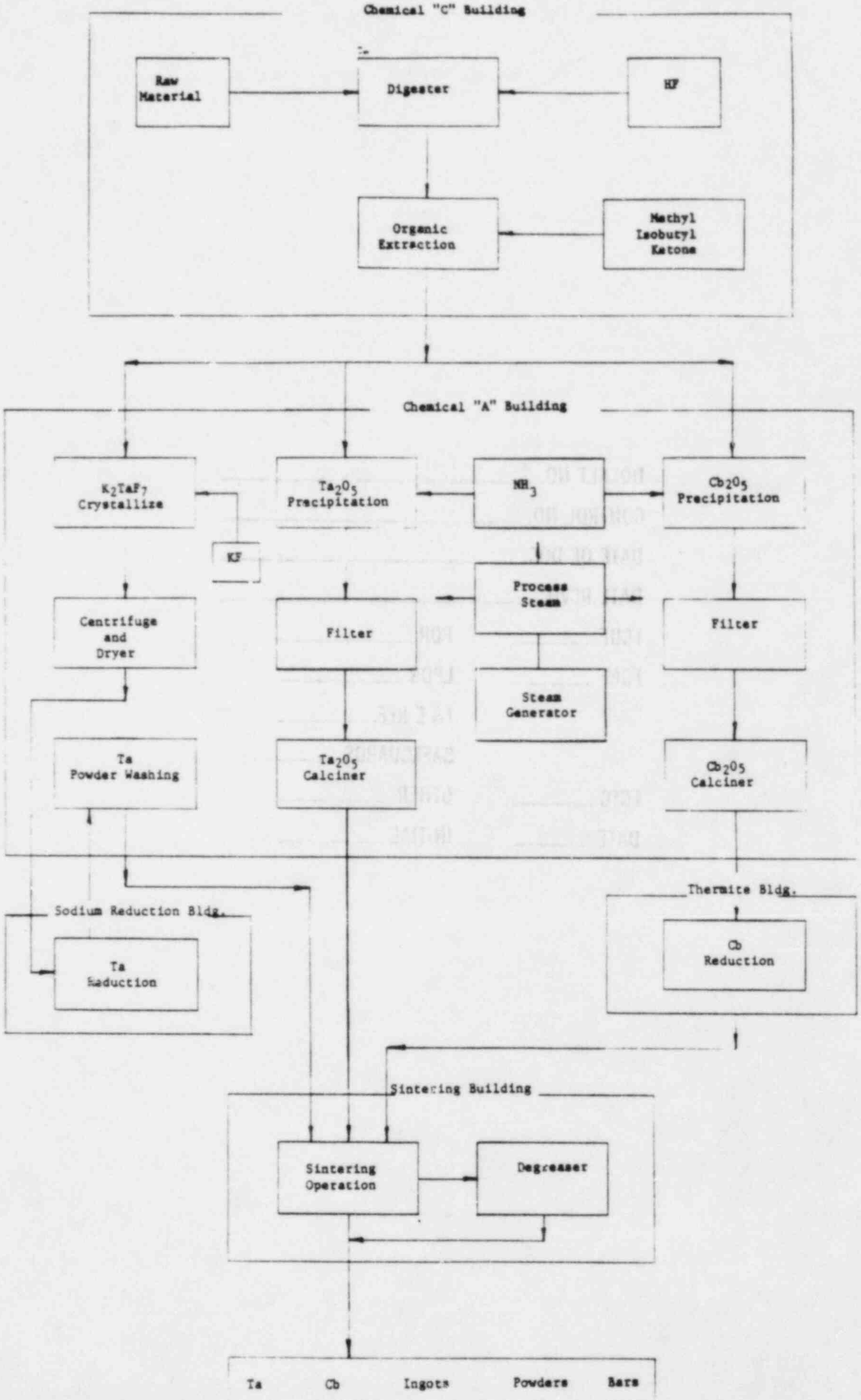


Fansteel Muskogee Plant
June 25, 1986 - T.A.H.

Process Flow Diagram for Tantalum and Columbium

Fansteel Muskogee Plant

Attachment D to Part 1
License Conditions
paragraph 6.2



Fansteel Muskogee Plant
June 9, 1986 - T.A.H.

DOCKET NO. 40-7580

CONTROL NO. 27140

DATE OF DOC. 06/27/86

DATE RCVD. 06/30/86

FCUF ✓ PDR ✓

FCAF LPDR

I & E REF. ✓

SAFEGUARDS

FCTC OTHER

DATE 6/30/86 INITIAL CEC

NUS
CORPORATION
A Halliburton Company